PRICE SENSITIVITY IN STUDENT SELECTION OF COLORADO PUBLIC FOUR-YEAR HIGHER EDUCATION INSTITUTIONS

Report Presented to the Colorado Department of Higher Education

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Introduction

Augenblick, Palaich, and Associates (APA) was hired by the Colorado Department of Higher Education (CDHE) to conduct an analysis of the relationship between college admission price and student choice of institution to attend.

Founded in 1983, Augenblick, Palaich and Associates, Inc (APA) is a privately owned company with extensive experience analyzing public education systems and policies. Our mission is to help clients solve problems so they can meet student performance goals and improve the quality, effectiveness, and efficiency of our nation's public schools. We also help clients understand the fiscal, legal, and policy implications of implementing education reforms, including both short and long-term impacts. Our staff accomplish this mission using a variety of research techniques, including education data analysis, literature reviews, interviews, surveys, panel or focus group discussions, and statistical analyses. Over the past 28 years the company has worked in all 50 states serving state and federal policymakers, school and local district leaders, foundations, education advocacy organizations, and other education stakeholders.

APA agreed to investigate the following research questions:

1. What is the relationship between tuition rates and student enrollment? Are certain populations of students more or less sensitive to changes in tuition prices?

2. Who receives financial aid and what is the relationship between aid received and enrollment decisions. Does the relationship vary among different populations?

3. What determines students' enrollment decisions? Has the price sensitivity between both aid received and tuition rates changed over time? Is the price sensitivity different for different populations and institutions?

4. What are the characteristics of different populations in receiving loans and attending different types of higher education institutions?

Our analysis used data from CDHE's Student Unit Record Data System (SURDS), including data on enrollment, admissions, and financial aid.

Background

Over the last four decades, the percentage of high school graduates enrolling in college has increased from 52 percent to 66 percent, which is thought to reflect the growing economic benefits of college

degrees despite the increase in the cost of college attendance.[1] At the same time, the decision to enroll in a particular college has become far more complicated for a variety of reasons, such as the expansion of community colleges; increasing differentiation among four-year colleges; the availability of grant support from the federal government, states, and institutions; and the growth in federal student loans.

While academics have attempted to study how students make college decisions, they have run into numerous roadblocks that make it difficult to understand precisely how such decisions are made. These roadblocks mainly consist of lack of access to data and lack of exogenous variation in the factors that influence college-related decisions. For example, it has been difficult to link individual student characteristics with information about the college options available to students. It has also been difficult, if not impossible, to account for the wide variety of exogenous variables that might affect both college choice and the factors that influence college choice, such as the status of the economy, perceptions of college quality, distance from home to college, and so on.

Leslie and Brinkman study (1987)

Early studies of college going behavior were summarized in a meta-analysis by Larry Leslie and Paul Brinkman 25 years ago.[2] Based on an analysis of over 30 studies, 25 of which met criteria related to quality and comparability, Leslie and Brinkman found general agreement that enrollment in higher education declined when prices rose (defined based on tuition or tuition plus room and board), and conversely that enrollment in higher education increased when prices decreased. Reducing tuition had a greater positive effect on college enrollment than increasing tuition had a negative effect on college enrollment. For every $100 increase in the price of college attendance, the rate of enrollment of 18-24 year olds decreased by 0.75 percent, leading to a 2.2 percent decrease in total enrollment.

Leslie and Brinkman also found that tuition rates had a greater impact on college enrollment than other costs, including opportunity costs (the value of what a person might have done instead of attending college), room and board, or commuting costs. Changes in tuition rates had a greater impact on college attendance than the effect of student financial aid on reducing the net price of college attendance, and students from lower income families were more sensitive to changes in the price of college attendance than students from middle and higher income families. Finally, price changes at two-year colleges have a greater impact on student attendance than price changes at four-year colleges.

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[1] "How Have College Decisions Changed Over Time? An Application of the Conditional Logit Choice Model" (Bridget Terry Long, Journal of Econometrics 121 [2004])

[2] "Student Price Response in Higher Education: The Student Demand Studies" (Larry L. Leslie and Paul T. Brinkman, Journal of Higher Education, Vol. 58, No. 2 [March/April 1987])

Kane study (1995)

In 1995, Thomas Kane undertook an analysis of college-going behavior in order to better understand the impacts of tuition and student financial aid policies. He noted that, at the time, most cross-sectional studies had found that tuition had a relatively large impact on college enrollment, particularly for students from low-income families, while the evidence from time series studies was less clear.[3] Kane's "exhaustive appraisal of the evidence on the price sensitivity of youth" concluded that states with high public tuition levels had lower college entry rates. The gap in attendance rates between students from low and high income families was greater in high tuition states than it was in low tuition states, and increases in within-state tuition rates led to lower enrollment rates and created wider gaps in college-going behavior between students from low and high income families. Finally, Kane found that when the minimum wage was raised, college enrollment rates decreased, particularly at two-year colleges; a result suggesting that students are sensitive to the opportunity cost of attending college.

Dynarski study (2003)

In 1999, Susan Dynarski examined the effects of student financial aid on college attendance and completion.[4] She showed that a $1,000 increase in grant aid raised the probability of attending college by about four percentage points and increased the number of years a student attended college by 0.16 years. The provision of financial aid raised the probability that a student will continue going to school later in life, even when financial aid was not provided.

Dynarski concluded that, from a public policy perspective, it was more efficient to provide higher level of support in the first year of college attendance than in later years, which was consistent with some financial aid programs (such as the Hope Scholarship); other financial aid programs either did not vary from year to year (such as the Pell Grant program) or provided more support after the first year of attendance (such as the Stafford loan program).

The results of this study are more credible than those of previous studies because Dynarski examines the effect of financial aid that was received in a quasi-random fashion. Specifically, she explores the effect of the elimination of college grants under the Social Security Student Benefit Program in 1982, comparing the change in enrollment rates between students who received these grants because their parents were deceased to those who would have been eligible for the grants had their parents been deceased.

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[3] "Rising Public College Tuition and College Entry: How Well Do Public Subsidies Promote Access to College" (Thomas J. Kane, Working Paper No. 5164, National Bureau of Economic Research [July 1995])

[4] "Does Aid Matter? Measuring the Effect of Student Financial Aid on College Attendance and Completion" (Susan M. Dynarski, The American Economic Review, Vol. 93, No. 1Research [1999])

Long study (2004)

A 2004 study by Bridget Terry Long examined how college costs and quality affected the decisions of people in 1972, 1982, and 1992 to attend college at all and, for those who chose to attend, where to enroll.[5] According to Long, her study was important because while many studies have estimated the impact of price on college enrollment, few evaluated how other college characteristics such as quality or distance factor into enrollment decisions, and no study examined whether the role of these factors has changed over time.

Long concluded that the impact of tuition level on the decision to attend college decreased from 1972 to 1982, and by 1992 tuition did not help at all in explaining the decision to attend college. By contrast, economic conditions, as measured by the county unemployment rate, played no role in college attendance decisions in 1972 or 1982 but were an important determinant of college going behavior in 1992. Long also found that tuition level was an important factor in choosing which college to attend, especially for students from low income families. For these students, price was as important a determinant of college choice in 1992 as it had been in 1972. Distance was not an important factor in college selection and became even less so over time, and college quality, as measured by both instructional expenditures and median SAT score, influenced the college choice decisions of students, particularly in 1992.

Finally, Long noted that the use of the conditional logistic choice model (conditional logit model) improved the ability of researchers to understand the determinants of college choice since it is able to capture the diversity of college options and prices, and is capable of modeling the relationship between individual students and schools.

Summary

Despite the progress researchers have made in the past 40 years, including the availability of more and better information, there remain significant issues that researchers are unable to overcome without studying large-scale random assignment experiments, which are very difficult to organize. A paper by Cellini in 2008 highlights some of the issues.[6] For example, traditional statistical approaches (such as ordinary least squares estimates) of the impact of aid on college-going can reveal a correlation between financial aid policies and enrollment, but these estimates can be biased because the students who choose to apply to college may be systematically different than students who do not (and are therefore omitted from the analysis). This can underestimate or overestimate the causal impact of these policies on enrollment. Cellini concludes that other statistical techniques -- such as proxy variable, fixed effects, and differences-in-differences approaches -- are replacing basic multivariate regression in some of the

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[5] See Bridget Terry Long (footnote 1).

[6] "Causal Inference and Omitted Variable Bias in Financial Aid research: Assessing Solutions" (Stephanie Riegg Cellini, The Review of Higher education, Vol. 31, No. 3 [Spring 2008])

latest research. She also suggest that regression discontinuity, a non-experimental approach in which students just above and below a particular cutoff are compared, hold promise in future research.

Of the papers reviewed above, the only one that would pass the credibility bar according to Cellini is that of Dynarski (2003). However, the approach Dynarski used, in which grant aid was assumed to be assigned to students randomly, would not be possible in Colorado, because there is no similar source of variation in grant aid.   The next-best methodology we can use to study the effect of price on college choice in Colorado is the conditional logit model of Long (2004). This methodology allows us to investigate at the individual student level the relationship between the total net college price of each school a student was accepted to, and the student's final choice of college.

Methodology

As mentioned above, the preferred methodology to study the effect of price on college choice in Colorado is the conditional logit model. This methodology allows the researcher to investigate at the individual student level the relationship between the total net college price of each school a student was accepted to, and the student's final choice of college.

Data Used and Creation of Sample

The data used in this analysis was obtained from CDHE's SURDS system. We began with three datasets from CDHE, including the financial aid (FA), enrollment (ENR), undergraduate application file (UAF) datasets, as well as a cohort file that CDHE used to define a subset of appropriate students. The UAF file contains an observation for every application that was submitted to Colorado colleges, along with an indicator for whether the application was accepted, and whether the student enrolled. The FA file contains a record for every application for Financial Aid from an enrolled student at a Colorado public institution and it identifies the amount of grants, scholarships, awards, loans, and work-study received, as well as the Cost of Attendance and Adjusted Gross Income variables defined from the FAFSA. The Cohort file contains every graduating high school student in the state and is used to identify the ethnicity and gender of students.

The FA, ENR, and UAF databases were merged together and filtered in order to yield a subset of students appropriate to our analyses[7].

The dataset contained all records that met all of the following criteria:

- Students were in-state (i.e., they graduated from a Colorado high school).
- Students were in their first year at a given school.

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[7] A detailed description of our data management process appears in Appendix A.

- The term was within academic years 2004 through 2010.
- The student applied to and was accepted to at least two four-year Colorado public college or universities in a given term, and subsequently enrolled at one of these institutions. (Two-year colleges were excluded because the dataset did not contain application data and complete enrollment data for these students.)

For this set of students, we created a database that contains one record for each student for each school at which they were accepted. Each of these records contains the net price the student would have to pay at that school. For students attending a given institution, the net price is defined as the difference between the Cost of Attendance and any financial aid grants received by the student. For students accepted at a college but not attending it, the net price is the difference between the Cost of Attendance and an imputed value of financial aid grants (because financial aid data were not available under such circumstances).

Table 1 summarizes the dataset. The sample contains 72,852 records, each of which is a unique combination of a school and student. The file contains 31,259 unique students, of whom 45 percent are male, 74 percent are white, 3 percent are black, and 10 percent are Hispanic (the remaining students are either Asian, Pacific Islander, or not-classified with an ethnicity in the database). The average ACT composite score for this sample is about 24, compared to an average composite score of about 21 in 2011. Average Adjusted Gross Income (AGI) is about $75,000 per year; however, about 25 percent of the sample has income below $30,000.   Only 67 percent of the sample has AGI data, reflecting the overall percentage of students who applied for financial aid.

Among these 31,259 students, nearly three-quarters (73.6 percent) were accepted at only two institutions. (This figure does not include the students who were only accepted at one institution, who comprise the vast majority of all students and are excluded from the analysis).   Twenty percent of students in the sample were accepted at three institutions, and small numbers of students had 4, 5, 6, or 7 acceptances; one student had 10 acceptances. This distribution is important as the conditional logit model has the most descriptive power when it is comparing among a larger number of choices. An important caveat to these distributions is that students may have had other choice options that aren't reflected in the data. These missing data points would include acceptances to out-of-state or private colleges.

Table 2 contains the number of records for each of the 12 included institutions, as well as the percentage of students enrolled at each one and the mean net price the students would pay if enrolled. Mean net prices have only small variations across the institutions, ranging from a low of $11,573 at Western State College to a high of $16,401 at the Colorado School of Mines. However, the standard deviations of price are very large, indicating that the range of net prices paid by students within a university varies greatly. This, in turn, reflects the large variation in grants awarded to students.

Table 3 presents the distribution of the number of acceptances, by year, for students in the final sample. Over time, the number of students in the database who were accepted to two or more institutions increased slightly, from 29.8 percent in 2004 to 35.1% in 2010. This is important to note because, to the

extent that net price does affect college-going decisions, the percentage of students who might be affected is growing.

Minor issues with the Data and Sample.

A small percentage of the sample (around two percent) applied to the same institution in concurrent years, and a small number (less than 50) of first-year, first-time, in-state students are enrolled at more than one four-year public college or university in the fall semester. Both groups of students were removed from the database.

Table 1. Summary of student characteristics.

	All Students		Two or More Acceptances		Only One Acceptance	
	Number of Students	Pct.	Number of Students	Pct.	Number of Students	Pct.
All Students	96,943	100%	31,259	100%	65,684	100%
Male	45,595	47%	14,067	45%	31,528	48%
Female	51,348	53%	17,192	55%	34,156	52%
White	72,050	74%	23,444	75%	48,606	74%
Black	2,908	3%	938	3%	1,971	3%
Hispanic	9,694	10%	3,126	10%	6,568	10%
Adjusted Gross Income < $30k	20,130	21%	5,145	16%	14,985	23%
Adjusted Gross Income > $30k	42,195	44%	15,509	50%	26,686	41%
No AGI Data	34,694	36%	10,681	34%	24,013	37%

Notes:

1. "Two or more acceptances" sample includes all in-state, first-year, first-time students who were accepted to at least two Colorado four-year public colleges/universities and enrolled in one of them.

2. "Only one acceptance" sample includes all in-state, first-year, first-time students who were accepted to only one Colorado four-year public colleges/universities and enrolled in that institution.

3. Includes academic years 2004 to 2010.

4. Adjusted Gross Income is from the financial aid file. Note that this variable is missing for students who did not apply for financial aid.

Table 2. Summary of acceptances, enrollments, and price, by institution. 2004-2010.

	Number of acceptances	Percentage of total acceptances	Cost of Attendance ($)		Total Grants ($)		Net Price ($)	
			Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Adams State College	1,750	1.8	11,508	(11,536)	4,434	(3,694)	13,201	(11,500)
Colorado Mesa University	2,079	3.3	13,611	(2,940)	1,917	(2,527)	13,570	(4,797)
Colorado School of Mines	3,961	5.2	18,735	(4,613)	4,674	(4,345)	16,401	(5,229)
Colorado State University	17,803	26.2	14,289	(4,238)	3,218	(4,768)	12,327	(4,816)
Colorado State University - Pueblo	2,956	2.8	14,813	(2,280)	4,027	(3,733)	12,962	(3,801)
Fort Lewis College	2,282	3.3	12,854	(6,350)	2,103	(2,861)	13,663	(4,457)
Metropolitan State College of Denver	2,397	3.7	11,592	(2,309)	2,120	(2,965)	12,080	(3,523)
University of Colorado Denver	5,021	6.3	16,131	(5,359)	3,121	(4,151)	15,332	(5,384)
University of Colorado at Boulder	15,709	27.2	17,204	(8,070)	3,026	(4,809)	17,159	(7,456)
University of Colorado at Colorado Springs	5,213	6.8	15,456	(5,751)	3,014	(3,966)	14,365	(5,430)
University of Northern Colorado	11,115	11.2	13,641	(5,322)	2,848	(3,908)	12,541	(4,488)
Western State College	2,566	2.1	11,846	(5,031)	2,924	(3,251)	11,573	(4,023)
Total	72,852	100	15,299	(6,412)	3,138	(4,400)	14,068	(6,032)

Notes:

1. All four-year public Colorado colleges and universities included.

2. Number of acceptances, percentage of total enrollments, and price: Sample includes all in-state, first-time, first-year students who were accepted to at least two of the included institutions and enrolled in one of them.

3. Cost of Attendance and Total Grants: sample includes all in-state, first-time, first-year students who were accepted to at least two of the included institutions, enrolled in one of them, and applied for financial aid.

4. Cost of Attendance is the nine-month cost of attendance as defined in the Financial Aid file. Total Grants defined as the sum of all grants, awards, and scholarships (federal, state, and institution) included in the Financial Aid file.

5. Price is defined as follows: For students who applied for financial aid, price at the enrolled institution is defined as the 9-month Cost of Attendance minus all grants, awards, and scholarships (federal, state, and institution); price at institutions the student was accepted at, but did not enroll in is predicted using the observed relationships between all student prices and Adjusted Gross Incomes at the given institution (see text for details). If financial aid was not applied for, price is defined as the 99th percentile of the observed prices (9-month Cost of Attendance minus grants) at the given institution.

6. In this table, net price does not equal mean COA minus mean total grants because the price value was recoded to remove outliers.

Table 3. Distribution of number of acceptances per included student.

Number of acceptances	All Years		2004		2005		2006		2007		2008		2009		2010	
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
1	65,684	67.8%	9,340	70.2%	9,716	69.7%	9,151	65.9%	9,478	68.1%	9,773	68.5%	9,656	66.8%	8,570	64.9%
2	22,997	23.7%	2,971	22.3%	3,137	22.5%	3,403	24.5%	3,224	23.2%	3,355	23.5%	3,516	24.3%	3,391	25.7%
3	6,593	6.8%	812	6.1%	883	6.3%	1,013	7.3%	952	6.8%	904	6.3%	1,033	7.2%	996	7.5%
4	1,366	1.4%	142	1.1%	173	1.2%	256	1.8%	212	1.5%	195	1.4%	193	1.3%	195	1.5%
5	250	0.3%	32	0.2%	28	0.2%	49	0.4%	36	0.3%	31	0.2%	40	0.3%	34	0.3%
6	43	0.0%	6	0.0%	6	0.0%	10	0.1%	3	0.0%	5	0.0%	6	0.0%	7	0.1%
7	16	0.0%	0	0.0%	2	0.0%	2	0.0%	4	0.0%	2	0.0%	3	0.0%	3	0.0%
10	1	0.0%	1	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	96,950	100.0%	13,304	100.0%	13,945	100.0%	13,884	100.0%	13,909	100.0%	14,265	100.0%	14,447	100.0%	13,196	100.0%

Notes:

1. Sample includes all in-state, first-year, first-time students who were accepted to at least one Colorado four-year public colleges/universities, and enrolled in one of those institutions.

Data Analysis

The Model

In order to model the relationship between net price and student institutional choice, we used an alternative-specific conditional logit model. Logit models allow for the comparison of multiple categorical outcomes (such as whether a student selected each of a number of schools). The logit model also is able to make comparisons at the individual level, identifying the within-student variation in prices. In this model, each student acts as her own control, thereby eliminating the need to control for any conflating variables that do not appear in the database. A model that captures within-student variation is important, because otherwise the researcher would be left to estimate the relationship between price and choice looking *across* students; across student comparisons are problematic because there are likely other characteristics that vary systematically across students that are correlated with both price and choice.

The alternative-specific conditional logit model allows for multiple alternatives and can account for alternative-specific details. Specifically, it allows us to take into account the fact that different students face different prices at different schools. This is not something a traditional multivariate regression model would accommodate. The conditional logit model yields an odds ratio, which represents the increased probability of a given outcome based on a specific increase in the independent variable. In this case, the odds ratio represents how much the probability of choosing a college changes with a $1,000 increase in price.

Note that we were unable to analyze the odds of students attending college at all (versus not attending) because we had no information about Colorado students who applied to a four-year public college in Colorado but were not accepted at any college or students who did not apply at all.

Calculation Method

We began by calculating the net price for the actual college a student attended. This was defined as the 9-month cost of tuition, fees, and room and board (the "list price") minus any grants, scholarships, or awards that a student received upon enrolling ("aid", which excludes loans and work-study). Unfortunately, our data only contained aid data if students actually enrolled at a school and applied for financial aid.

For the schools that a student was accepted at but did not enroll in, we imputed the net price based on the relationship between price and Adjusted Gross Income for students for whom we did have data. The imputation is performed as follows: for each institution, we regressed the net price on the AGI and two polynomial transformations of the AGI (AGI^2 and AGI^3) for those students with financial aid data. Consistent with previous research, AGI predicts price very well, with R^2 values of over 0.5, indicating that over half of the variation in net price is accounted for by student income. This relationship reflects the fact that most non-merit based aid is determined by only a few variables, one of which is AGI.

For students who did not apply for financial aid, it is not reasonable to use this predicted relationship (nor is it feasible, as we do not observe their Adjusted Gross Income). Therefore, net price for these students is defined as the 99th percentile of the net price at the given institution. The 99th percentile was used to minimize the influence of outliers in the price data.

Results

The results of the conditional logit model are displayed in Table 4. We first estimate the model using the entire sample of students in column 1, and then split the sample by several important student characteristics to explore whether the relationship between price and college choice is different for different subgroups.

The coefficient of interest is the odds-ratio on net price. This odds-ratio is interpreted as the multiple by which the probability favoring attendance at the chosen college changes with a $1,000 increase in price. Odds-ratios greater than one represent a positive relationship, while odds-ratios less than one represent a negative relationship. For example, the odds-ratio of 0.966 on price for the entire sample (column 1) implies that a $1,000 difference in price would reduce the probability of choosing to attend a particular 4-year college by 3.4 percent (1 - .966), all else equal. This effect is statistically significant, as indicated by the large z-statistic of 12.45 (and associated p-value of less than 0.01).

It is useful to compare this number to those found in Long 2004, who used nationally representative data from 1972, 1982, and 1992. A main conclusion of her study was that, among students who attended college, students have become less responsive to price over time. For example, the odds-ratios on price she found increased from 0.47 in 1972 to 0.58 in 1982, eventually reaching 0.65 in 1992. Our data from the years 2004-2010 appear to show that this trend is continuing.

Economic theory predicts that consumers are less responsive to price the more income they have (i.e., price elasticity is decreasing with income). It seems that this phenomenon is happening with the choice of college in Colorado. Columns 2 and 3 report odds ratios for students whose families make below and above $30,000 per year, respectively. Low-income students are 9.5 percent less likely to choose a college that was $1,000 more expensive, while a high-income student would be 3.3 percent *more* likely to choose a college that was $1,000 more expensive. This result likely reflects the fact that more expensive colleges are also viewed as being of better quality, and that for higher income students choosing a perceived higher quality school is more important than choosing a less expensive school.

Effects of other exogenous variables

In addition to AGI, we looked at the differential relationship between price and college choice for several other exogenous variables, including ACT scores, ethnicity, and sex. Our analysis allows us to examine whether price sensitivity varies based on these characteristics. For each subset of students, the odds ratios were statistically different from 1, indicating that price was significantly associated with

college choice. With the exception of higher income students, the odds ratios were all less than one, indicating that for every subgroup higher prices were associated with lower odds of attending.

- We found no difference between students who scored high and students who scored low on the ACT.

- We compared white to nonwhite (black and Hispanic) students. Black and Hispanic students are more responsive to price, but this may partly due to a third conflating factor, income. (Note that Asian, Native American, Pacific Islanders, and "other" races are excluded in this analysis as they represent a very small percentage of the sample.)

- We found no difference in price sensitivity between males and females.

Discussion

Our analysis suggests that Colorado students are responsive to price as they choose between public higher education institutions, although as a whole their price responsiveness is small and has lessened over time. Low income and non-white students are more sensitive to price than their counterparts.

One reason for the decline in the price sensitivity over time may be because of the increased access to financial aid. With access to financial aid, students can push costs into the future by borrowing today. This may seem a rational strategy for an 18 year old, but it is unclear whether it is in the long-run interest of the student – or of society – to incur debt, especially when college graduation rates are so low. More research is certainly needed in order to uncover the consequences of lower price sensitivity.

Correlation Versus Causation

Our analyses yielded correlational, not causal, relationships. Although we surmise that price has a causal effect on attendance, the relationship may be more complex, and other variables could be influencing the relationship. Further study is necessary to fully understand the relationship between price and attendance.

A small body of literature has estimated the *causal* effects of price on choice, such as analyses of the HOPE scholarship in Georgia. Students in other states are facing the same types of decisions as students in Colorado, and research from other states may provide important policy lessons that could be applied in Colorado.

Out of state and private schools

CDHE's datasets currently lack application and enrollment information on out-of-state and private schools. These schools comprise part of the range of choices that students face, and it is likely that many of the students in our database had additional choices not apparent in our analysis. Some students may not be in the dataset at all if they eventually chose an out-of-state school, while some may

have had more choices than is apparent from these data. An important step to improving the quality of this type of analysis would be to connect CDHE's student database with those of other states.

Additional predictive variables

Our dataset does not allow us to observe the other characteristics of schools that influence college choice.   For example, we do not have data on teacher quality, student-teacher ratios, college location, program offerings, or the quality of the match between the student and the school. Because these characteristics are associated with price, our results do not allow us to predict what the effect of *independently* raising or lowering price would be on college choice.   Further analysis could incorporate more nuanced information about the different choices offered to the student.

Estimating Net Price

Because financial aid data did not appear for schools which students did not attend, we had to impute these data based on the characteristics of students for whom this data was available. Future study could better quantify the actual net price students would have paid at institutions they did not attend.

Table 4. The effect of net price on college choice, results from alternative-specific conditional logit models: full sample of students with multiple acceptances, and heterogenous effects by income, academic ability, race, gender, and time period.

Dependent variable: Enrolled at chosen college (odds-ratios and z-statistics displayed).

Sample =	All	AGI <$30k	AGI >$30k	ACT composite <2400	ACT composite >2400	White	Black & Hispanic	Male	Female	Years 2004-07	Years 2008-10
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Odds Ratio on Net Price (per $1000)	0.966***	0.904***	1.033***	0.968***	0.965***	0.973***	0.918***	0.970***	0.963***	0.964***	0.970***
Pct. change in likelihood of attending with $,000 price increase	-3.4%	-9.6%	+3.3%	-3.2%	-3.5%	-2.7%	-8.2%	-3.0%	-3.7%	-3.6%	-3.0%
# observations	72,469	11,858	36,207	36,711	34,718	53,091	9,305	32,574	39,895	40,502	31,967
# unique students	31,106	5,086	15,492	15,577	15,064	22,949	3,878	14,090	17,016	17,349	13,757

Notes: *** p<0.01, ** p<0.05, * p<0.1

1. The full sample includes all first-time, first-year, Colorado students who were accepted to at least two four-year Colorado public colleges/universities and enrolled in one of those institutions.

2. Observations are at the student-school level; that is, there is one observation for each four-year Colorado college a student applied to and was accepted at.

3. Includes academic years 2004 through 2010.

4. Net price is defined as follows: For students who applied for financial aid, price at the enrolled institution is defined as the 9-month Cost of Attendance minus all grants, awards, and scholarships (federal, state, and institution); price at institutions the student was accepted at, but did not enroll in is predicted using the observed relationships between all student prices and Adjusted Gross Incomes at the given institution (see text for details). If financial aid was not applied for, price is defined as the 99th percentile of the observed prices (9-month Cost of Attendance minus grants) at the given institution.

5. Odds-ratios are interpreted as the multiple by which the probability favoring attendance at the chosen college is multiplied with a $1000 increase price. Odds-ratios greater than one are considered positive effects.