ASSESSING THE ACCURACY, USE, AND FRAMING OF COLLEGE NET PRICING INFORMATION

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In this dissertation, I explore questions relating to estimating and framing college net pricing. In the first study, I measure variation in actual grant aid awards for students predicted by the federal template Net Price Calculator (NPC) to receive identical aid awards. Estimated aid derived from the federal template NPC accounts for 85 percent of the variation in actual grant aid received by students. I then consider simple modifications to the federal template NPC that explain more than half of the initially unexplained variation in actual grant aid awards across all institutional sectors. The second study explores perceptions of college net pricing and the resources families use to learn about college expenses. Students and parents show substantial variation in their perceptions of college price and ability to accurately estimate likely college expenses, even when prompted to seek pricing information online. While most participants were able to estimate net price within 25 percent of NPC estimates, others were inaccurate by as much as 250 percent, or nearly $30,000. I then propose possible explanations for more or less accurate estimates that consider parent education, student grade level, previous NPC use, and online college pricing search strategies. In the third study, I explore the potential for shifts in college spending preferences when equivalent college cost scenarios are framed in different ways. I exploit disparities between net price and total price to randomly present participants with one of three

framing conditions: gain, loss, and full information. Participants are between five and six percentage points more likely to choose a college beyond their stated price preference when cost information is framed in such a way that emphasizes financial grant aid *received* as opposed to remaining costs *to be paid* or full cost information. The results of these studies suggest that clearly structured, simple to use informational resources can accurately and effectively communicate important college information. However, simply making resources available without consideration of accessibility or relevance may be insufficient. Policymakers and other hosts of college information resources should also carefully consider the ways that the presentation of college information might influence students' decisions.

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PREFACE

In the following dissertation, “Assessing the accuracy, use, and framing of college net pricing information,” I explore questions relating to estimating and framing college pricing. I include quantitative, qualitative, and behavioral aspects to consider the accuracy of pricing calculators, families’ perceptions of college pricing, and how differently presenting information might influence enrollment decisions.

My interest in college net pricing began in early 2014 at the suggestion of my academic advisor, Lindsay Page. Since then I have come to appreciate net pricing as a critical, but often overlooked, aspect of the college enrollment process. My hope is that these studies contribute to how researchers and policymakers approach efforts to make information on college net pricing more transparent.

I would like to thank Lindsay Page for her unwavering mentorship and research guidance, not only through this dissertation, but from the very beginning of my graduate studies. I’d also like to thank my dissertation committee, M. Najeeb Shafiq, Jennifer Russell, and Sera Linardi, for their advice and research assistance. And finally, a heartfelt thank you to my wife, Lauren Kokai, for her limitless love, patience, and encouragement.

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1.0 INTRODUCTION

Investment in postsecondary education is one of the most promising pathways to upward economic mobility. Those with bachelor's degrees can expect to earn around $800,000 more over the course of their lifetimes compared to those with only a high school diploma, and that is *after* fully repaying student loans (Daly & Bengali, 2014). Beyond the financial incentives, increased levels of education are associated with better health, civic engagement, and a more fulfilling work environment (Becker, 1993; Dee, 2004; Perna, 2006a).

On its face, the decision to invest in higher education is like other investment decisions; if lifetime benefits outweigh costs, it is a worthwhile investment (Becker, 1993). However, several factors complicate the decision. For example, information about price and financial aid is often unclear (Avery & Hoxby, 2004; Grodsky & Jones, 2007; Hoxby & Turner, 2013), there is frequently a lag between expenses and benefits (i.e., premium on lifetime earnings compared to not enrolling in college), and the risk that investing in college will not pay off in actual labor market returns can play an outsized role in the decision (Dynarski & Scott-Clayton, 2006; Kahneman & Tversky, 1979; Page & Scott-Clayton, 2016)

Rather than the fully-inclusive price of attendance, or sticker price, net price – the out-of-pocket price students and families pay for college after accounting for grant aid – is the best indicator of a postsecondary institution's affordability (Scott-Clayton, 2015). However, net

prices are stubbornly opaque and often remain so until after students have had to make important college choices, such as where to apply and sometimes where to enroll.

Net Price Calculators (NPCs) are online resources that provide individualized estimates of net prices to attend a given postsecondary institution. NPCs are among a suite of legislative and policy efforts intending to increase transparency in college pricing (Higher Education Opportunity Act, 2008). However, we largely lack insight into how well these tools function, if and how prospective students use them in their college search process, and the ways that presenting pricing information may influence college decisions.

1.1 THEORETICAL FOUNDATIONS

Hossler (with Braxton, & Coopersmith, 1989), Paulsen (1990), and Perna (2006) agree that both an economic model of human capital investment and a sociological model are useful for structuring research on college choice. The human capital model asserts a costs and benefits analysis drives investments in education, and the sociological model posits that personal relationships and environments shape educational aspirations and attainment. I extend this framework by incorporating research from behavioral science underlying students' college choices.

1.1.1 Human capital and postsecondary decisions

Capital – e.g., bank accounts, stock market holdings, or a business – are assets that yield income and other positive outcomes over time (Pindyck & Rubinfeld, 2013). Investments in individuals

through education, on-the-job training, or healthcare can also yield income and positive outcomes over time – this is human capital. Investments in human capital are those intended to "improve the physical and mental abilities of people" (Becker, 1962), which results in increased productivity and is rewarded with increased wages.

From an economic perspective, investment decisions are the result of a cost-benefit analysis. Individuals are presumed to be rational, and a rational individual weighs the expected costs associated with an investment decision against the expected benefits associated with that decision, then chooses the option that maximizes expected benefits (Becker, 1993; Paulsen, 2001). Thus, human capital investment models assume that individuals will invest in education as long as the expected lifetime benefits outweigh the expected costs (Becker, 1962; Becker, 1993; Ellwood & Kane, 2000).

A human capital investment model alone is insufficient for modeling college decisions. Certain conditions introduce opportunities for market failures in which the basic cost-benefit analysis breaks down, and people do not spend or invest as economic theory predicts. First, the higher education market is not perfect. Several factors, including positive spillover benefits to society, or externalities, and credit constrains create conditions that interfere with the traditional supply and demand market forces underpinning the traditional human capital investment model (Pindyck & Rubinfeld, 2013). Second, variation in social and cultural capital drives gaps in information about college costs and benefits, which influences college selection and enrollment decisions (Perna, 2006a). Third, research in psychology and behavioral economics demonstrates that actual decisions are especially likely to diverge from traditional economic models when information is complex and the decision-makers are young or inexperienced (Casey, Jones, & Somerville, 2011; Page & Scott-Clayton, 2016; Thaler & Mullainathan, 2008). For example,

even two individuals with identical estimates of their abilities and financial resources are likely to vary in their investment decisions because of differences in their personal preferences and tolerance for risk and uncertainty (Desjardins & Toutkoushian, 2005). Because of these differences, it is entirely possible that an individual with high ability decides to invest less heavily in higher education, and vice-versa.

1.1.2 Social and cultural capital

Social and cultural capital, like human capital, are resources that can be invested to improve productivity (Coleman, 1988). Social capital refers to an individual's relationships, social networks, and the ways they are connected (Morrow, 1999). Cultural capital is a related concept, and refers to the behaviors and attributes, such as language, mannerisms, or cultural interests, that shape an individual's social status (Bourdieu, 1986). Social and cultural capital facilitate access to other forms of capital, including human capital or institutional resources and supports (Coleman, 1988; Hofferth, Boisjoly, & Duncan, 1998; Lin, 2002; Morrow, 1999; Portes, 1998; R. D. Stanton-Salazar & Dornbusch, 1995).

Social and cultural capital approaches to college enrollment decisions focus on the ways demographic characteristics, such as race, income, opportunities, calculating capacities, and other resources, shape individual's access to information. Decisions based on available information – even if the information is inaccurate or incomplete – are still rational relative to that individual (Becker, 1993; Desjardins & Toutkoushian, 2005). Therefore, an individual's actions and decisions can only be understood in relation to the social context in which they were made (Bourdieu & Wacquant, 1992; Lin, 2002).

Choosing a well-matched school requires a great deal of information on expected costs and benefits associated with specific fields of study within a given institution. This is especially challenging because colleges vary substantially in terms of quality and affordability. Affordability is often uncertain until after completing financial aid applications, and the quality of a college, as measured by income potential, may not be apparent until years after completing a degree. And though a degree of uncertainty is implicit all college enrollment decisions, incomplete or inaccurate information about colleges can lead to especially poor enrollment decisions or underinvestment.

1.1.3 Behavioral science and college decisions

Social and cultural capital models advance human capital predictions about investments in higher education, but decision making consistently deviates from what economic and social models alone would predict. Often, these are complex decisions in which people act with "bounded rationality" (Simon, 1972) that are well-suited for behavioral "nudges" to promote better decisions (Thaler & Sunstein, 2008). Whereas human capital models of investment in education do not account for varying tastes for risk and uncertainty (or ambiguity), behavioral models contribute to a more complete picture of college decisions.

In the higher education decisions context, examples of behavioral principles are plentiful. For example, most students face immediate costs of attendance, but the benefits of increased income are often not realized for several years after completion, and for this reason may discount the lifetime gains associated with a college education. Furthermore, seemingly minor comparative costs can have outsized influence on behaviors. Rather than take the time to search

for financial information that is not readily available, students may choose to put it off until later, but may never get around to completing the forms (Page and Scott-Clayton, 2016).

A body of behavioral research examines how human behavior and decision making can be influenced by the way information is presented and choices are framed (Tversky & Kahneman, 1981). As financial aid award letters provide important information for enrollment decisions, it follows that variation in the layout and wording of financial aid award letters may influence the choices students make based on the information award letters provide.

Research from Avery and Hoxby (2004), Monks (2009), and Evans, Boatman, and Soliz (2018) shows how labeling types of financial aid in different ways affects student responses to aid offers. Avery and Hoxby find that students are more likely to matriculate when financial aid is labeled as a "scholarship" rather than a "grant," even though they are substantively identical in reducing net price. Relatedly, Monks finds that students are more likely to enroll at an institution when net price includes a scholarship than when an equivalent net price at the same institution does not include a scholarship. Evans and colleagues find students are less likely to select a borrowing option labeled as a "loan" than an equivalent option described as an income sharing agreement.

1.2 RESEARCH QUESTIONS

Four questions guide the first study, in which I focus on the federal template NPC. (1) To what extent do NPC-derived EFCs explain students' actual EFCs? (2) To what extent do the financial aid packages within an institution vary for first-time, full-time degree-seeking student predicted by the federal template NPC to receive identical grant aid awards? (3) What systematic factors, if

any, explain this variation? And (4) given this information, what modifications can be incorporated into the federal template NPC to reduce the unexplained variation while maintaining a tool that is simple to use?

In the second study, I use a mixed methods approach to explore the ways students and families use NPCs and other informational resources in their colleges searches. In this study, I ask: (1) To what extent do college-intending high school students and their parents accurately estimate likely college expenses? (2) How do families form estimates of net prices? (3) What resources (both in-person and online) do families use to estimate college pricing?

In the final study, I consider the ways that variations in the way college pricing information is presented might influence decisions based on that information. Specifically, I conduct an experiment investigating the extent to which college spending preferences shift when identical college cost scenarios are framed in different ways.

1.3 SUMMARY OF METHODS AND FINDINGS

To explore these research questions, I use a combination of quantitative, qualitative, and experimental research techniques. In sum, I find that resources such as NPCs provide relatively accurate estimates of likely college expenses and the students who use them are more likely to have more accurate perceptions of college prices. Furthermore, enrollment decisions may be influenced by stylistic differences in the way pricing information is presented. In the following paragraphs are abstracts of each study outlining their methods and findings.

1.3.1 Study 1. Information and accuracy in college price estimates: Assessing variation in grant aid awards explained by Net Price Calculators

Net Price Calculators (NPCs) are online tools designed to increase transparency in college pricing by presenting students with individualized estimates of net prices to attend a given postsecondary institution. The federal template NPC predicts identical aid awards for similarly-profiled students attending the same institution. Using the 2012 National Postsecondary Student Aid Survey (NPSAS:12), I use regression analysis to assess the variation in actual financial aid awards among students predicted by the federal template NPC to receive identical awards. I find that estimated aid derived from the federal template NPC accounts for 85 percent of the variation in actual grant aid received by students. I then consider modifications to the federal template NPC that include an additional upper income bracket option and indicators of both high school GPA and FAFSA filing time. These modifications explain an additional eight percentage points, or more than half, of the unexplained variation in actual grant aid awards across all institutional sectors. These findings are especially relevant as the U.S. Congress considers the Net Price Calculator Improvement Act of 2017, which would create the possibility for a universal calculator in which prospective students can enter information just once to receive net price estimates at any institution.

1.3.2 Study 2. Information and accuracy in student perceptions of college net pricing

I interview 15 student-parent dyads about their perceptions of college pricing and the resources they use to learn about college expenses. I asked participants to estimate net price to attend a given postsecondary institution, then instruct participants to use the internet to inform a second

net price estimate. I assess the accuracy of net price estimates by comparing them to estimates derived using a Net Price Calculator (NPC). Students and parents show substantial variation in their perceptions of college price and ability to accurately estimate likely college expenses, even when prompted to seek pricing information online. While most participants were able to estimate net price within 25 percent of NPC estimates, others were inaccurate by as much as 250 percent, or nearly $30,000. Students who had previously used NPCs were significantly more accurate in estimating college net prices, even when they did not use an NPC to inform their estimates. Additionally, families who expressed feeling overwhelmed by the college search and enrollment process were less likely to attempt an estimate and less accurate in the estimates they did provide. I suggest that the online resources that feature college net prices have potential to narrow income-driven gaps in college information, but more can be done to make college net prices more visible.

1.3.3 Study 3. Framing effects of financial aid on college selection

I explore the potential for shifts in college spending preferences when the equivalent college cost scenarios are framed in different ways. I solicit from participants a hypothetical maximum willingness to pay annually in out-of-pocket costs for college. Then, I exploit disparities between net price and total price to randomly present participants with one of three framing conditions: gain, loss, and full information. I find that participants are between five and six percentage points more likely to choose a college beyond their stated price preference when cost information is framed in such a way that emphasizes financial grant aid *received* as opposed to remaining costs *to be paid* or full cost information. These results are especially important as U.S. legislators consider the "Understanding the True Cost of College Act of 2017" that promotes its "Financial

Aid Shopping Sheet," as a way to simplify and standardize college cost and financial aid information.

2.0 INFORMATION AND ACCURACY IN COLLEGE NET PRICING: ASSESSING VARIATION IN GRANT AID AWARDS EXPLAINED BY COLLEGE NET PRICE CALCULATORS

For many, higher education represents one of the largest and most important investment decisions of their lifetime. On its face, the decision to invest in higher education is like other investment decisions; if lifetime benefits outweigh costs, it is a worthwhile investment (Becker, 1993). Though investment in postsecondary education remains overwhelmingly worthwhile (Autor, 2014; Bartik & Hershbein, 2018; Daly & Bengali, 2014), several factors complicate the decision. For example, information about price and financial aid is often unclear (Avery & Hoxby, 2004; Grodsky & Jones, 2007; Hoxby & Turner, 2013), there is frequently a lag between expenses and benefits (i.e., premium on lifetime earnings compared to not enrolling in college), and the risk that investing in college will not pay off in actual labor market returns can play an outsized role in the decision (Dynarski & Scott-Clayton, 2006; Kahneman & Tversky, 1979; Page & Scott-Clayton, 2016).

Rather than the fully-inclusive price of attendance, or sticker price, net price – the out-of-pocket price students and families pay for college after accounting for grant aid – is the best indicator of a postsecondary institution's affordability (Scott-Clayton, 2015). However, net prices are stubbornly opaque and often remain so until after students have had to make important college choices, such as where to apply and sometimes where to enroll.

Instead, total, or sticker prices are more visible on colleges' websites and in popular media. Though three-quarters of all full time students receive some type of grant aid (Radwin, Conzelmann, Nunnery, Austin Lacy, et al., 2018), sticker prices are generally more readily available on institutions' webpages. Additionally, media coverage of soaring college costs and runaway tuition rates, at times citing annual expenses of $55,000 or more, can create the impression that college is unaffordable.[1] Although these figures apply for a small number of institutions, average prices are usually far lower.[2] For example, in 2017-2018, the average total price for in-state students at public four-year institutions was $21,000 (Ma, Baum, Pender, & Welch, 2017). Still, such expenses make up more than a third of the median household income and, for many families, expenses are a barrier to college entry (Guzman, 2017).[3]

Fortunately, financial aid is available from federal, state, local, institutional, and other sources to assist families with college expenses. Grant aid from institutions themselves has outpaced federal and state aid in recent years, largely offsetting total cost increases within certain postsecondary sectors (Ma et al., 2017). In the past decade, average total costs at four-year private nonprofit institutions increased by approximately 25 percent, but net price has only increased by about 5 percent because of increases in grant aid (Ma et al., 2017).[4] This trend in high sticker price - high financial aid means that there is a widening gap between published college prices and after-financial aid, out-of-pocket net expenses. Given this growing difference, it is critical that students have clear information about net pricing. In 2008, the reauthorization of

[1] For example, see:
https://www.usatoday.com/story/money/personalfinance/budget-and-spending/2018/06/09/rising-cost-of-college-financial-hole/35439339/

[2] The costliest postsecondary institutions, on average, are private nonprofit four-year doctoral institutions, where the average 2017-2018 total price was $56,720 (Ma et al., 2017). Such institutions account for less than 10 percent of institutions represented in the data sample used in this study (NPSAS:12).

[3] 2016 median household income in the U.S. was $57,617.

[4] Within four-year private nonprofit institutions, total prices increased from $37,600 in 2007 to $47,000 in 2017. During this same time, net prices within this sector of institutions increased from $25,400 in 2007 to $26,700 in 2017 (in 2017 dollars).

the Higher Education Opportunity Act (HEOA) called for the U.S. Department of Education to develop Net Price Calculators (NPCs) to provide this information (HEOA, 2008).

NPCs are online tools that use student-level information to generate personalized and institution-specific estimates of grant aid and college net pricing. On average, NPCs provide better estimates of out-of-pocket prices than sticker prices, yet actual grant aid awards may vary substantially from NPC predictions (Anthony, Page, & Seldin, 2016). Especially for low-income families, even small disparities between predicted and actual aid may impact college decisions (Castleman & Page, 2016; Pallais, 2009). An NPC that severely overestimates grant aid may lead students to face unexpectedly large college net prices. Conversely, an NPC that substantially underestimates grant aid could tilt a school's applicant pool in favor of those students who are financially able to make up the predicted shortfall in grant aid, while less financially secure students may consider the school to be unaffordable and forgo even applying.

Building on prior work that relied on a more limited sample of convenience (Anthony et. al., 2016), we explore variation in actual financial aid awards for students with similar socio-demographic profiles attending the same institution. We focus on the NPC template provided by the U.S. Department of Education because it is most common among postsecondary institutions, though alternative calculators exist.[5] The federal template NPC estimates identical aid awards for first-time, full-time degree-seeking students attending the same institution with the same indicated living arrangement (on-campus, off-campus, or with family), state residency status (in- or out-of-state), and estimated Expected Family Contribution (EFC; as approximated by annual household income, household size, and number from the household in college). Using the 2012 National Postsecondary Student Aid Survey (NPSAS:12), we use regression analysis to assess the variation in actual financial aid awards among students predicted by the federal template

[5] As of January, 2017, more than 3,200 Title IV postsecondary institutions were using the federal template NPC.

NPC to receive identical awards. We then explore potential modifications to the federal template NPC to provide students with better estimates of the financial aid packages they will ultimately receive. In the modifications that we consider, we weigh carefully the trade-off between students' ability to report information accurately with the complexity that additional questions may add to the federal NPC tool.

To preview our findings, the federal template NPC estimates of grant aid account for 85 percent of the variation in actual grant aid awarded to students. We consider modifications to the federal template NPC that include an additional upper income level and indicators of high school GPA and Free Application for Federal Student Aid (FAFSA) submission timing. With these modifications, we explain an additional 8 percent of the variation in grant aid, or more than half of the initially unexplained variation in actual grant aid awards across all institutional sectors. These findings are especially relevant as Congress considers the "Net Price Calculator Improvement Act of 2017" (S.889). The legislation proposes a universal NPC that would allow prospective students to answer one set of questions to receive net price estimates at any postsecondary institution. Insights into the main drivers of variation in financial aid packages among similar students could be helpful to developing this universal calculator. The bipartisan bill was introduced in April 2017 and referred to the Committee on Health, Education, Labor, and Pensions, where it sits at the time of our writing.

2.1 BACKGROUND

The complexity involved in completing the FAFSA is well-documented (Dynarski & Scott-Clayton, 2013, 2006; Dynarski & Wiederspan, 2012). The detailed financial information

requested in the FAFSA is a major contributor to its complexity. The U.S. Department of Education uses this data to assess EFC, which determines a family's eligibility for federal student aid.[6]

In 2008, legislators introduced NPCs as an effort to increase transparency in college pricing by allowing prospective students to get individualized estimates of net prices without completing the FAFSA (Higher Education Opportunity Act, 2008). By October 29, 2011, each postsecondary institution receiving federal funding was required to have an online NPC that draws on institutional data to provide students with personalized net price estimates. Along with NPCs, the U.S. Department of Education created the College Affordability and Transparency Center and the College Scorecard websites, which make it easier for prospective college students to compare institutions by average net prices, graduation rates, and early career earnings. These resources prominently feature net pricing and links to institutions' NPCs.

Legislators introduced the bipartisan Net Price Calculator Improvement Act in April of 2017 (S.889). The legislation supports the findings of a 2012 review of NPCs by The Institute for College Access and Success (TICAS) which found that NPCs could be easier to find and use, and that net prices should be easier to compare across institutions (Cheng, 2012). The proposed legislation would require postsecondary institutions to consistently and prominently label their calculators as "Net Price Calculators" (as opposed to "Education Cost Calculator" or "Tuition Calculator," for example) and populate their calculators with data no more than two years old. The bill also allows the Secretary of Education to create a universal net price calculator that

[6] EFCs are derived from an involved assessment of family finances including household income, allowances against income, assets, family size, and the number from the family in college. Generally, the higher the EFC, the wealthier the applicant and the lower their eligibility for need-based financial aid. In contrast, an EFC of zero qualifies a student for the maximum need-based federal aid. See Appendix C for a more detailed explanation of the federal EFC methodology for dependent students.

would make it possible to complete one set of questions and receive net price estimates for any institution (S. 889, 2017).[7]

The federal template NPC and its alternatives vary substantially in terms of the scope of inputs required, but all must allow for an estimate of EFC. Typically, the level of complexity in an NPC reflects how closely it approximates the federal EFC formula through the data it requests.[8] The federal template is among the simplest, but many institutions use more complicated calculators provided by third parties such as The College Board or Ruffalo Noel Levitz. Such variety in NPCs provides an example of a potential effort-accuracy tradeoff (Johnson & Payne, 1985; Payne, Bettman, & Johnson, 1993; Tversky & Kahneman, 1974). When faced with a complex decision, individuals often turn to "rules of thumb," or heuristics, to simplify the situation. Heuristics require less effort, but may trade their efficiency for accuracy (Tversky & Kahneman, 1974).

A simple NPC, such as the federal template model, uses broad data points to estimate likely grant-based financial aid and net price instead of drawing on detailed financial information. Most alternative NPCs request more detailed student-level information. For example, The College Board's NPC includes more than 35 questions requesting such information as what income tax form the student's parent used, parents' income from interest and dividends, parents' contributions to non-taxable retirement plans, and the total amount in

[7] The legislation also requires institutions to either provide questions allowing for an estimate of veterans' education benefits or to provide information to applicants about qualifying for and accessing such benefits. We attempted to test the explanatory power of veteran status on financial aid packages, but the overwhelming share of those receiving veterans and Department of Defense education benefits are independent students and we limit our sample to only dependent students.

[8] Neither the original HEOA of 2008 nor the Net Price Calculator Improvement Act stipulate the details of how the calculator operates provided they include certain minimum requirements. Input elements must include household income, number in family, and student dependency status. Output elements must include estimates of: total cost of attendance; tuition and fees; room and board; books and supplies; other expenses; total grant aid; and net price. Additional output requirements include the percent of the first-time, full-time student cohort receiving grant aid and caveats or disclaimers associated with the estimates provided.

parents' cash, savings, and checking accounts. In theory, the advantage to more detailed calculators is that they allow for more accurate aid estimates. However, students using the calculators may not have access to the detailed information required by financial aid applications, and inaccurate data inevitably would lead to inaccurate net price estimates.[9]

The complexity of the calculator is important because the very purpose of NPCs is to increase transparency in college pricing and financial aid. Substantial research points to the complexity of the financial aid application process as a primary cause of low awareness and take-up rates of student aid (Bettinger, Long, Oreopoulos, & Sanbonmatsu, 2012; Dynarski & Scott-Clayton, 2013, 2006, 2008; Dynarski & Wiederspan, 2012; Page & Scott-Clayton, 2016). Overly complex calculators risk becoming an additional barrier to clear price information if the calculator tools themselves are too burdensome to use.

2.1.1 How the federal template NPC operates

Figure 2.1 illustrates how the federal NPC derives estimates of grant aid and net price. Panel A corresponds with answers to the nine questions in the federal template NPC. One asks if the student plans to apply for financial aid; three (age, marital status, and if the student has children) determine dependency status;[10] two determine state residency and intended living arrangements; and three (family size, number from family in college, and annual household income) approximate EFC. Conditional on the student applying for financial aid (a student who does not

[9] As an example, see the NPC for the University of Pittsburgh administered by the College Board: https://npc.collegeboard.org/student/app/pitt.

[10] Generally, a student is considered a dependent if she is under 24 years old, unmarried, and does not have any dependents of her own. The formula for federal aid is different for dependent and independent students. In this study, we focus only on dependent students.

apply is not likely receive aid financial aid), answers to these questions inform three estimates: EFC (Figure 2.1, Panel B), grant aid (Figure 2.1, Panel C), and net price (Figure 2.1, Panel D).

Figure 2.1, Panel B shows an EFC lookup table provided by the U.S. Department of Education. The federal template NPC requests family size, number from the family in college, and household income after taxes (with options ranging from "less than $30,000" to "above $99,999" in $10,000 increments).[11] Answers to these questions inform the EFC look-up table. The lookup table is populated with data from the FAFSA database to identify median EFC by annual household income (9 levels), family size (2 to 6 or more), and number in college (1 to 3 or more).

[11] Families may interpret "annual household income after taxes" differently in terms of what specific sources of income to include or exclude in this response. We conducted a sensitivity analysis incorporating varying levels of specific income sources and did not find families' income category to be sensitive to these detailed decisions. Therefore, we include only a broad measure of parents' combined income for the previous year.

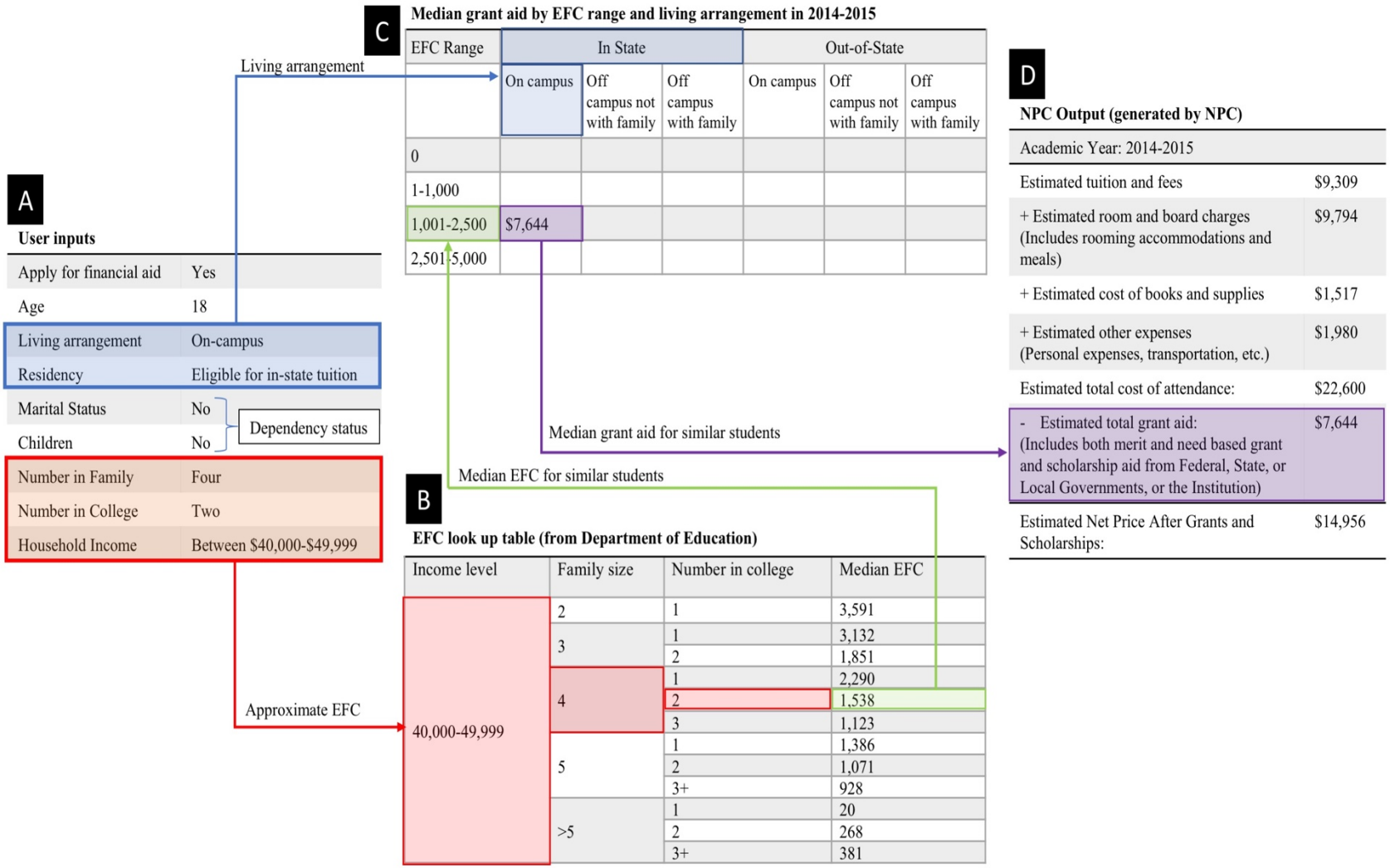

Figure 2.1 The federal template NPC process

Figure 2.1, Panel C presents a grant aid matrix. The median EFC derived using the table in Figure 2.1, Panel B is grouped into 1 of 12 EFC ranges (listed vertically in the first column in Panel C).[12] Institutions use the EFC range along with the student's state residency status and living arrangements (from Figure 2.1, Panel A) to populate grant aid estimates. Grant aid estimates are the median grant aid awards within each of 12 EFC ranges and living arrangement subgroups for a previous academic year. The federal template NPC estimates identical grant aid awards and net prices for all students within the same cells in this matrix.

Figure 2.1, Panel D lists NPC output information including total prices (itemized by tuition and fees, room and board, books and supplies, and other expenses), estimated total grant aid (including both merit and need-based grant and scholarship aid from federal, state, or local government, and the institution), and net price. Total prices may vary according to a student's state residency status and living arrangement. For example, an in-state student may face a lower tuition rate than an out-of-state-student at a public institution, and a student living off-campus with roommates may have a lower room and board estimate than a student living on campus. Net price is the total price of attendance minus estimated grant aid.

Panels B and C of Figure 2.1 are of particular interest to this study. Inaccurate EFC figures in Panel B may result in inaccurate grant aid estimates in Panel C. The cause of inaccurate EFCs may be user- or system-based. Though the single question on annual household income after taxes is drastically simpler than the financial questions on the FAFSA, a student may not have a strong sense of family income. For example, a survey of 7,000 high school seniors found that approximately one in five could not estimate their parents' annual total income (Mandell, 2008). An inaccurate estimate of family income is user error.

[12] The EFCs listed in Figure 2.1, Panel B are truncated. Comprehensive EFC ranges include (in $): 0; 1-1,000; 1,001-2,500; 2,501-5,000; 5,001-7,500; 7,501-10,000; 10,000-12,500; 12,501-15,000; 15,001-20,000; 20,001-30,000; 30,001-40,000; above 40,000.

Alternatively, inaccurate EFC binning could cause inaccurate NPC grant aid estimates. Recall that the median EFCs from the lookup table in Figure 2.1, Panel B are classified into one of 12 EFC ranges on the institutional grant aid matrix shown in Figure 2.1, Panel C. Students, especially those whose NPC-derived EFCs fall near the cut-off points, could be misclassified into an EFC range that does not correspond with the one they would be assigned using their actual EFC. This is system error.

The potential for user or system errors is important because even small differences in data inputs or EFC classification can result in substantial changes in NPC grant aid estimates. As an example, at Duquesne University, a four-year private institution in southwest Pennsylvania, shifting from an income of "$90,000 to $99,999" to "above $99,000" results in a $6,192 decline in estimated grant aid. On the other end of the income spectrum, moving from "less than $30,000" to "$30,000 to $39,999" results in a $3,000 decline in estimated grant aid. For this reason, we also examine the correspondence between actual and NPC-derived estimates of EFC.

2.1.2 Research questions

Four questions guide this study. (1) To what extent do NPC-derived EFCs explain students' actual EFCs? (2) To what extent do the financial aid packages within an institution vary for first-time, full-time degree-seeking student predicted by the federal template NPC to receive identical grant aid awards? (3) What systematic factors, if any, explain this variation? And (4) given this information, what modifications can be incorporated into the federal template NPC to reduce the unexplained variation while maintaining a tool that is simple to use?

Our study builds on prior research by Kane (1995), Stoll and Stedman (2004), and Dynarski and Scott-Clayton (2006) on exploring the sensitivity of financial aid calculations to

manipulations in its independent components. Kane notes that most of the variation in Pell grants can be explained using just a few variables. Stoll and Stedman simulate the effect of excluding items from the calculation of EFC. Dynarski and Scott-Clayton show that federal aid distribution can be reproduced using just a fraction of the information that is now collected in the FAFSA.

We expand on this line of research in two key ways. First, these studies focus on means-tested federal grant aid. We focus on all sources of grant aid, including institutional aid, which tends to be more variable, on average, especially within private institutions. This is important to consider as more than 40 percent of all grant aid – the largest portion from any source – comes from the postsecondary institutions themselves (Ma et al., 2017). Second, while the policy objective in these previous studies focused on strategically *reducing* financial aid data elements and maintaining aid distribution, we consider the possibility of strategically *increasing* data elements or modifying existing data components to improve NPC accuracy, while aiming to balance the benefit of increased accuracy with the potential of increased complexity by collecting additional information.

2.2 RESEARCH DESIGN

2.2.1 Data sources and sample

We use data from the 2012 National Postsecondary Student Aid Survey (NPSAS:12) to investigate the variation in financial aid packages among students attending the same institution who are observationally similar with respect to the data elements that govern federal template NPC estimates. NPSAS:12 is an ideal data source because it includes information corresponding

to each question on the federal template NPC, complete FAFSA information, as well as rich supplemental data on academic performance (e.g., high school GPA), family finances (e.g., adjusted gross income), and financial aid information (e.g., amount, source, and type of financial aid awards).

The full data set contains information for 111,000 students attending 1,500 institutions.[13] We apply several restrictions to achieve our analytic samples. First, we limit the sample to include only students who applied for financial aid and for whom the Department of Education has student data related to the FAFSA, resulting in 24,200 dropped observations. NPC estimates apply for first-time, full-time undergraduate students enrolled in a single institution for the full year. We limit the sample to include only these students, dropping an additional 61,600 records. We also limit the sample to include only dependent students, which reduces the sample by 11,700.[14] The final sample comprises 12,700 students attending 1,260 institutions.

Our analysis relies on measuring variation in financial aid packages for similar students attending the same institution. We include in the sample instances of a single observation within a cell on a given institution's grant aid matrix (Figure 2.1, Panel C). Where there is just one observation within an institution's grant aid matrix, there is no variation within that cell remaining to explain. As a result, this decision introduces the potential for single-observation cells to upwardly bias our findings. As such, our results represent an upper limit of the impact of the tested NPC modifications.

We conduct a parallel analysis with a more restrictive sample that eliminates instances of single observations within a given institution's grant aid matrix. This sample includes 7,600

[13] We round all four- and five-digit numbers to hundreds, and six-digit number to thousands in accordance with National Center for Education Statistics standards.

[14] NPCs function in the same way for independent students, but we do not include independent students in this analysis because of differences in the calculation of EFC.

observations within 900 institutions. While the magnitude of results differs from the larger sample, our findings and conclusions are consistent across both. We focus our presentation and discussion on the larger sample, but present findings for the more restrictive sample in Appendix A2.

The target population of NPSAS:12 consists of all students enrolled in a U.S. postsecondary school eligible to receive federal funding.[15] Additionally, note that we do not necessarily see every student aid offer a student received because students commonly receive student aid offers from more than one institution, but we only observe their enrollment in one. This should not impact our findings because NPC data is based on aid information for enrolled students and NPSAS:12 data includes only enrolled students.

2.2.2 Descriptive statistics

The average student in the sample attends an institution with an annual price of attendance of approximately $28,100 and receives $8,100 in grant aid, making the average net price $20,000 (see Table 2.1). Of the $8,100 in grant aid, federal aid such as Pell Grants account for $2,700 and institutional aid accounts for $3,400, on average. The remaining aid comes from state and outside grants and student loans. The mean FAFSA-reported EFC is $10,500, but the median EFC is only $2,600 because of the sizeable share (40%) of families in the sample are considered 0 EFC and qualify for maximum need-based federal aid.

[15] All estimates are weighted to compensate for the unequal probability of institutions and students (Radwin, Wine, Siegel, & Bryan, 2013). The variable name for the weight used in this analysis is WTA000.

Table 2.1 Descriptive statistics

	Mean (SD)	Median
Total price	28,100 (13,660)	25,500
Net price	20,000 (11,860)	18,300
EFC	10,500 (18,360)	2,600
Income	66,500 (74,100)	45,600
Total grant aid	8,100 (9,530)	5,600
Federal aid	2,700 (2,640)	2,600
State grant aid	880 (1,930)	0
Institutional grant aid	3,400 (7,200)	0
Loan aid (all sources)	$6,500 (8,400)	$5,500
N	12,690	

Source: National Postsecondary Student Aid Survey, 2012

Note. All price figures are in 2012 U.S. Dollars. Four- and five-digit figures are rounded to hundreds, and standard deviations are rounded to tens, as per NPSAS standards

Table 2.2 shows how the sample breaks down by institutional sector (public 4-year, private 4-year, public 2-year, and for-profit) and NPC type in use (federal template or an alternative). By sector, the sample is relatively balanced, with roughly 3,000 observations in each. By NPC type, however, trends emerge. Alternatives to the federal template NPCs are more common by a 10 to one margin for both private four-year institutions and for-profit institutions. Within public four-year institutions, the ratio of alternative NPCs to federal template NPCs is about two to one. In contrast, the federal template NPC is far more common within public two-year institutions.

Table 2.2 Descriptive statistics: Alternative vs federal NPC use

Sector	Alternative calculator	Federal template NPC	Full sample
Public 4-year	2,090	900	2,990
Private 4-year	2,740	250	2,990
Public 2-year	920	2,300	3,210
For-profit	3,000	290	3,290
Total	8,920	3,770	12,690

Source: National Postsecondary Student Aid Survey, 2012

2.2.3 Assessing estimated EFC accuracy

NPC grant aid estimates are derived from the EFC estimates listed in the Department of Education EFC lookup table shown in Figure 2.1, Panel B. Therefore, we begin our analysis by comparing these lookup table EFCs with true EFCs as reported in NPSAS:12. We use regression

analysis to assess the extent to which the assigned lookup table EFCs used in the federal template NPC (i.e., the median EFC within income range, family size, and number from family in college group) align with true EFCs (i.e., calculated using FAFSA data), utilizing a model of the following form:

$$FAFSA\_EFC_1 = \beta_0 + \beta_1 NPCEFC_i + e_i \tag{2.1}$$

The outcome $FAFSA\_EFC_i$ is student i's actual, FAFSA-derived EFC as recorded in the NPSAS:12 dataset. $NPCEFC_i$ is the lookup table-estimated EFC for student i. We expect true EFC to track closely with the NPC-estimated EFC. Therefore, we anticipate the β_1 coefficient to be close to one, indicating the average difference in true EFC associated with a one dollar difference in NPC-estimated EFCs.

We use the R^2 statistic associated with this regression to measure the share of a student's actual EFC that is explained using only the information used in the federal template NPC to estimate EFC. Because NPC grant aid estimates are closely linked to EFC, NPC-estimated EFCs that vary substantially from true EFCs are a likely to result in inaccurate NPC estimates.

2.2.4 Assessing NPC grant estimates

We conduct a similar regression analysis to assess the extent to which actual grant aid reported varies for students with identical NPC grant aid estimates. Two grant aid figures are central to this study: the grant aid students *actually* receive and the grand aid students *are predicted to receive* based on information used in the federal template NPC. NPSAS:12 data includes actual grant aid information but does not include NPC-estimated grant aid. Therefore, we use data requested by the federal template NPC to group students who are predicted to receive identical

grant aid awards. We then examine the variation in actual aid awards within groups of similarly-profiled students.

	State residency	In-State			Out-of-State		
	Housing option	On-campus	Off-campus	Off-campus with family	On-campus	Off-campus	Off-campus with family
EFC Range ($)	0						
	1-1,000						
	1,001-2,500						
	2,501-5,000						
	5,001-7,500						
	7,501-10,000						
	10,001-12,500						
	12,501-15,000						
	15,001-20,000						
	20,001-30,000						
	30,001-40,000						
	Above 40,000						

Figure 2.2 Panel C of Figure 2.1 in full: The existing back-end NPC table populated by institutions

Figure 2.2 shows the current grant aid matrix used by the federal template NPC. All students attending the same institution, within the same estimated EFC category (12 possible values), the same living arrangement (3 possible categories: on-campus, off-campus, or with family), and the same residency (2 possibilities: in-state or out-of-state) receive identical grant aid estimates. This yields a possible set of 72 (12x3x2) unique combinations within each of the 904 institutions included in the sample. The result is an institutional-NPC group fixed effect model, as follows:

$$Grant\ aid_{ijk} = \sum_{j=1}^{900} \sum_{k=1}^{72} \propto_{jk} I_{ijk} + \varepsilon_{ijk} \tag{2.2}$$

We express actual grant aid awarded to student *i* attending institution *j* in NPC group *k*. Our primary interest is the residual variation of actual grant aid after accounting for institution and NPC group.

Results are in terms of the R^2 value and Root Mean Square Error (RMSE) of regression analysis. The R^2 statistic quantifies the extent to which data collected by the federal template NPC explains variation in actual grant aid awards. An R^2 of 0.7, for example, indicates that the data collected by the federal template NPC explains 70 percent of the variation observed in actual financial aid awards. The RMSE measures the standard deviation of the residual variation in grant aid awards in 2012 dollars among similarly-profiled students attending the same institution.

2.2.5 Proposed measures

We then consider what additional measures might be incorporated into the federal template NPC to improve its accuracy. We assess three potential modifications to NPC data elements.

(1) Additional upper income bracket to refit EFC

Over 20 percent of the sample is clustered into the uppermost of nine income brackets, such that a family earning $100,000 annually in after-tax income is categorically identical to a family earning 10 times that amount. The median income for all families in the sample earning more than $100,000 annually is about $150,000. This parallels 2012 U.S. Census Bureau data of American family income distribution, and thus is an appropriate income level to differentiate middle-income households from upper-income households.[16] The resulting income levels include "less than $30,000" to "$99,999," as in the original NPC template, plus "100,000 to $150,000" and "above $150,000."

We follow the same procedure used in the federally-provided EFC lookup table to assign new median EFC figures by income level, family size, and number from the family in college. Then we use the new NPC EFC estimates to refit the institution-NPC group fixed effect.

(2) Indicator of academic merit

Many institutions distribute merit aid based on predictable and widely-used merit metrics (e.g., SAT or ACT scores or high school GPA).[17] We use high school GPA (HSGPA) as it is

[16] Authors' calculation using data retrieved from https://www.census.gov/data/tables/time-series/demo/income-poverty/cps-finc/finc-07.2012.html

[17] For lists of common academic benchmarks for merit scholarships, see examples compiled at: https://blog.prepscholar.com/colleges-with-full-ride-scholarships or https://www.scholarships.com/financial-aid/college-scholarships/scholarships-by-type/academic-scholarships-and-merit-scholarships/

better populated in NPSAS data compared SAT or ACT scores.[18] We choose three thresholds to mark high / low HSGPA: 2.5, 3.0, and 3.5. We code HSGPA dichotomously to indicate students with HSGPAs above (or below) these levels.

(3) Early FAFSA filing

Certain types of financial aid are awarded on a first-come first-served basis (McKinney & Novak, 2015). As a result, grant aid awards may be determined not only by *what* information the student provides on the FAFSA itself, but also by *when* the student completes FAFSA. Recall that we limit the sample to include only students who have completed the FAFSA. Of these, more than 60 percent filed within the first three months of the filing window (between January 1, 2011 and April 1, 2011). Institutions populate their NPCs with the *median* grant aid awarded to students within NPC group membership. Therefore, with more than 50 percent filing in the first three months, we use monthly intervals within this timeframe (i.e., FAFSA filed by February 1, March 1, or April 1, 2011) in our analysis and code the FAFSA timing variable dichotomously to flag and test three thresholds for "early FAFSA filers."[19] Note in 2011-2012, the FAFSA filing window began in January of 2011 and used family tax information from the previous year. As of 2016, the FAFSA filing window begins in October of a student's senior year and uses family tax information from two years earlier, or "prior-prior year."

[18] Parallel analysis using SAT and ACT scores did not result in significant changes but suffered the drawback of limiting sample size due to missing test score information. These results are available upon request.

[19] We also use individual state's 2011-2012 FAFSA filing deadlines to code early filers as those who submitted before their respective state deadline. This did not meaningfully change results.

2.2.6 Summary of proposed NPC modifications

We first suggest additional income options of "$100,000 to $150,000" and "above $150,000" to refit NPC-derived EFC estimates. We then propose indicators of high / low HSGPA and early / late FAFSA filing. Figure 2.3 incorporates these modifications into the institutional grant aid matrix presented above in Figure 2.2. The revised matrix builds on the existing 72 cell grid (12 EFC categories by 3 housing options by 2 state residency options) by adding measures of HSGPA (2 categories: high or low) and FAFSA timing (2 possibilities: early or late). The resulting matrix of 288 cells (72x2x2) represents the modified institution-NPC group fixed effect, which takes the following form:

$$Grant\ aid_{ijk} = \sum_{j=1}^{900} \sum_{k=1}^{288} \propto_{jk} I_{ijk} + \varepsilon_{ijk} \tag{2.3}$$

The revised model is analogous to Equation 2.2 with the exception of the expanded NPC group matrix.

Implementing these potential additions would be simple for both users and institutions, and does not require information that is either difficult for a user to provide or administratively burdensome for an institution to incorporate. For the overall analysis, we examine results for the full sample and also disaggregate by the type of NPC (either federal template NPC or an alternative). Results for institutions that *do not* use the federal template NPC simulate how well the federal template NPC *would* perform at these institutions.

HS GPA		High GPA												Low GPA											
FAFSA timing		Early FAFSA						Late FAFSA						Early FAFSA						Late FAFSA					
State residency		In state			Out of state			In state			Out of state			In state			Out of state			In state			Out of state		
Housing option		On	Off	Fam	On	Off	Fam	On	Off	Fam	On	Off	Fam	On	Off	Fam	On	Off	Fam	On	Off	Fam	On	Off	Fam
EFC range ($)	0																								
	1-1,000																								
	1,001-2,500																								
	2,501-5,000																								
	5,001-7,500																								
	7,501-10,000																								
	10,001-12,500																								
	12,501-15,000																								
	15,001-20,000																								

	20,001-30,000																								
	30,001-40,000																								
	>40,000																								

Figure 2.3 Proposed back-end NPC table, including proposed measures of high school GPA and FAFSA timing

2.3 RESULTS

Our findings include analyses of EFC estimates and grant aid estimates. We focus on two sets of R^2 statistics. The first R^2 statistic measures the share of variation in outcomes (EFC and grant aid, respectively) explained by the data collected in the current federal template NPC. The second set of R^2 statistics indicates the share of variation in outcomes that *would be* explained using the data we propose in our modifications. We present findings first as raw percentage point differences in the resulting R^2 statistics and second as a share of the initial unexplained variation in outcomes using the existing federal template NPC data. For example, if the current NPC model explains 70 percent of variation in outcomes and the modified NPC explains 85 percent of variation in outcomes, the difference of 15 percentage points as a share of initial unexplained variation is 50 percent. We discuss results overall across all institutions and disaggregate by institutional sectors.

We organize our findings into four sections. We first discuss results of the EFC analysis assessing the impact of an additional income bracket on NPC-derived EFC estimates. The remainder of our findings focus on grant aid awards. In the grant aid analysis, we first present results for how much variation in grant aid awards for similar students attending the same institution is explained by the current federal NPC template. Next, we review the impact of individual modifications to the federal template NPC, and last, discuss results of combinations of proposed modifications.

We present additional analyses in Appendices A1 to A3. The tables in Appendix A1 supplement our findings and discussion. Appendix A2 presents tables and figures based on the

more limited sample size in which we exclude instances of single observations of an institution-NPC group profile. Overall, results of this analysis parallel those presented here. Appendix A3 provides a more detailed explanation of the federal methodology for calculating a dependent student's EFC.

2.3.1 EFC analysis

In Table 2.3, we present results of the EFC analysis where we regress actual, FAFSA-derived EFCs on NPC-predicted EFCs. In the top row, we present results for the existing federal template NPC, and in the second row, we present results incorporating the additional income brackets of "$100,000 to $150,000" and "above $150,000."

Table 2.3 EFC analysis: Results from regression of FAFSA-derived EFC on NPC-derived EFC category

	Full sample	Public 4-year	Private 4-year	Public 2-year	For-profit
			R^2 (RMSE)		
Federal template NPC	63.3 (11,130)	61.7 (11,990)	57.0 (16,490)	70.3 (6,160)	71.5 (6,050)
High income brackets ($100,000-$150,000, >$150,000)	77.9 (8,640)	76.0 (9,500)	73.8 (12,860)	79.7 (5,090)	81.5 (4,870)
Difference in R^2 between basic and modified NPC model (pp)	14.6	14.3	16.8	9.4	10.0

Table 2.3 continued

% of remaining variation explained	40%	37%	39%	32%	35%
N	12,690	2,990	2,990	3,210	3,290

Note. R^2 quantifies the extent to which the EFC lookup table provided by the U.S. Department of Education and used in the federal template NPC model explain actual FAFSA-derived EFCs. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in EFC.

The federal template NPC explains 63 percent of variation in actual, FAFSA-derived EFCs. Using the federal template NPC calculation for EFC, no NPC-derived EFCs fall into the uppermost EFC range of "above $40,000." In reality, seven percent of actual, FAFSA-derived EFCs are in this category. By separating the top income bracket into two categories, median within-group EFCs (by income, family size, and number in college) extend to the upper range of the EFC categories, and we improve NPC-derived EFC prediction.

With the additional income brackets of "$100,000 to $150,000" and "above $150,000", NPC-derived EFCs explain 78 percent of the variation observed in FAFSA-derived EFCs. Separating by institutional sectors shows that adding an additional top income bracket improves EFC explanatory power at four-year institutions, in particular. As four-year institutions tend to enroll wealthier students, it is logical that an additional upper income bracket is especially effective for this subset of institutions. These findings foreshadow our analysis of grant aid awards where we also find the additional income category to be effective in improving NPC grant aid estimates within private four-year institutions.

2.3.2 Grant aid analysis

We use Equations 2.2 and 2.3 to conduct a similar exploration of grant aid awards with potential modifications to the federal template NPC model. In Table 2.4, we present results for the individual modifications to the federal template NPC, and in Table 2.5, we present combinations of modifications including the additional upper income categories and indicators of high or low HSGPA and early or late FAFSA filing. In both tables, the top row presents the R^2 and RMSE statistics associated with the current federal template NPC. The rows below show the impact of the proposed modifications to the federal template NPC. We present the full sample in the first column and disaggregate to institutional sectors in columns two to five. Recall that the R^2 statistic reports the share of variation in grant aid awards explained by the NPC model, and the RMSE measures the standard deviation of the remaining variation in aid awards. Recall also that our results may be an upper limit of improvement based on the proposed modifications to the federal template NPC because our analysis includes single observations for a given institution-student profile, in which there is no variation in grant aid awards.

Table 2.4 Individual modifications, R^2 as share of variation in financial aid explained by NPC model

	Full sample	Public 4-year	Private 4-year	Public 2-year	For-profit
			R^2 (RMSE)		
Federal template NPC	85.1 (5,670)	85.3 (4,050)	77.8 (10,900)	77.4 (2,430)	71.2 (3,540)
High income brackets ($100,000-$150,000, >$150,000)	86.9 (5,460)	85.6 (4,200)	81.3 (10,600)	77.9 (2,430)	71.9 (3,540)
2.5 GPA	86.4 (5,790)	86.8 (4,050)	79.0 (10,940)	82.6 (2,330)	76.7 (3,450)
3.0 GPA	87.4 (5,830)	87.9 (4,100)	80.4 (10,950)	84.7 (2,300)	78.7 (3,420)
3.5 GPA	89.3 (5,490)	90.9 (3,790)	84.0 (10,780)	84.5 (2,280)	77.7 (3,470)
February 1 FAFSA	88.3 (5,500)	90.2 (3,800)	82.5 (11,090)	81.6 (2,330)	74.5 (3,520)
March 1 FAFSA	88.7 (5,560)	89.4 (4,010)	83.0 (10,760)	83.9 (2,330)	78.6 (3,360)
April 1 FAFSA	87.7 (5,720)	87.6 (4,070)	81.4 (10,710)	84.1 (2,350)	77.8 (3,440)

Table 2.4 continued

Difference in R^2 between basic and "best" modified NPC model (pp)	4.1	5.6	6.2	7.3	7.5
% of remaining variation explained	28%	38%	28%	32%	26%
N	12,690	2,990	2,990	3,210	3,290

Note. R^2 quantifies the extent to which data collected in the federal template NPC and its proposed modifications explain variation in actual grant aid awards. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in grant aid awards among similarly-profiled students. Proposed high school GPA and FAFSA timing variables are coded dichotomously to indicate high (low) high school GPA or early (late) FAFSA submission.

2.3.3 Current federal template NPC

We find that overall, the current federal template NPC explains 85 percent of the variation in actual grant aid awards received by similarly-profiled students attending the same institution. By institutional sector, the federal template NPC explains about 85 percent of variation in aid awards at public four-year institutions, 80 percent in private four-year and public two-year institutions, and 70 percent in for-profit institutions. Across all models, explanatory power is highest within public four-year institutions and lowest within for-profit institutions, with private four-year and public two-year institutions falling in between.

Overall, the standard deviation in actual grant aid awards after accounting for the federal-template NPC estimate, as indicated by RMSE, is $5,670 (see Table 2.4, first row, left column). This may be a helpful measure for prospective students to approximate high and low estimates of their expected grant aid awards. Across institutional sectors, the extent of aid awards left unexplained varies proportionally with the level of grant aid typically awarded. For example,

within the sample of private four-year institutions, where students receive relatively more grant aid, on average, one standard deviation in the spread in variance of explained grant aid is nearly $11,000. By contrast, the standard deviation of residual grant aid within public two-year institutions, where students receive relatively less grant aid, is $2,400. The modifications to the federal template NPC had a modest effect on RMSE, reducing the standard deviation of variation in aid awards by $600, on average, but the overall RMSE remains more than $5,000. We focus the remainder of our discussion on the share of variation in aid awards explained by different NPC models.

2.3.4 Individual NPC modifications

In Table 2.4, rows two through eight, we present results of the individual proposed modifications to the federal template NPC. As shown in rows three to five, we find that a measure of high school GPA is the most effective individual modification for reducing variance in grant aid awards among similar students. The most effective threshold marking high or low HSGPAs varies across institutional sectors. A HSGPA of 3.5 is more effective within public and private four-year institutions and 3.0 is more effective within public two-year and for-profit institutions. This is sensible as public and private four-year institutions tend to be more selective than public two-year and for-profit institutions, on average, so a higher HSGPA threshold may better explain aid awards within these types of institutions. Overall, an indicator for HSGPA explains an additional 28 percent of the variation in grant aid awards left unexplained by the current federal template NPC (see Table 2.4, second row from bottom).

A measure of FAFSA timing (Table 2.4, rows 6 to 8) also improved the federal NPC's grant aid explaining capacity, though to a slightly smaller degree than HSGPA. Overall, an

indicator for students submitting a FAFSA within the first two months of the filing window (in this case, by March 1) was the most effective, increasing the R^2 statistic by nearly four percentage points.

Finally, as shown in the second row of Table 2.4, we find that the addition of the upper income brackets has little effect overall but does improve explanatory power somewhat within private four-year institutions. The effect of the higher income categories echoes the EFC results presented in Table 2.3 and is consistent with students from higher income households enrolling more commonly at private four-year institutions relative to their peers from lower-income households.

2.3.5 NPC modification combinations

In Table 2.5, we present results for combinations of the three proposed modifications. All models include the additional upper income categories and combinations of three HSGPA and three FAFSA timing thresholds. As indicated in the second to last row of Table 2.5, overall and across institutional sectors, the most effective modifications to the federal template NPC model explain more than half of the variation in grant aid awards that the current federal template NPC left unexplained. Row three, column one of Table 2.5 indicates that the combination of a February 1 FAFSA filing threshold and HSGPA indicator of 3.5 most effectively improves the federal template NPC's explanatory potential, offering a nearly eight percentage point improvement over the current federal template.

Table 2.5 NPC model combinations, R^2 as share of variation in financial aid explained by NPC model

			Full sample	Public 4-year	Private 4-year	Public 2-year	For-profit
					R^2 (RMSE)		
Federal template NPC			85.1	85.3	77.8	77.4	71.2
			(5,670)	(4,050)	(10,900)	(2,430)	(3,540)
High income brackets ($100,000-150,000 & >$150,000)	February 1 FAFSA	2.5 GPA	90.9	90.8	86.6	85.9	81.2
			(5,330)	(4,050)	(10,710)	(2,260)	(3,320)
		3.0 GPA	91.6	92.3	87.3	87.1	83.5
			(5,400)	(3,950)	(10,930)	(2,310)	(3,210)
		3.5 GPA	92.7	93.5	89.9	87.7	80.7
			(5,070)	(3,870)	(10,570)	(2,200)	(3,450)
	March 1 FAFSA	2.5 GPA	90.6	90.8	85.5	88.1	84.3
			(5,610)	(4,130)	(10,960)	(2,230)	(3,170)
		3.0 GPA	91.4	91.8	86.4	89.5	87.0
			(5,680)	(4,180)	(11,030)	(2,250)	(3,020)
		3.5 GPA	92.5	93.7	88.8	89.4	83.5
			(5,390)	(3,940)	(10,870)	(2,210)	(3,350)
	FAFSA	2.5 GPA	90.0	89.2	84.7	88.5	82.1
			(5,720)	(4,230)	(10,690)	(2,220)	(3,410)
		3.0 GPA	90.7	90.4	85.7	89.1	84.8

Table 2.5 continued

	(5,810)	(4,230)	(10,750)	(2,340)	(3,290)
3.5 GPA	92.2	92.1	88.3	89.3	85.6
	(5,430)	(4,130)	(10,500)	(2,260)	(3,170)
Difference in R^2 between basic and "best" modified NPC model (pp)	7.6	8.4	12.1	12.1	15.8
% of remaining variation explained	51%	57%	55%	54%	55%
N	12,690	2,990	2,990	3,210	3,290

Note. R^2 quantifies the extent to which data collected in the federal template NPC and its proposed modifications explain variation in actual grant aid awards. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in grant aid awards among similarly-profiled students. Proposed high school GPA and FAFSA timing variables are coded dichotomously to indicate high (low) high school GPA or early (late) FAFSA submission.

By institutional sector, a February 1 FAFSA date and 3.5 HSGPA combination is most effective within private four-year institutions. For public four-year institutions (Table 2.5, 2nd column), there is virtually no difference in R^2 statistics between the February 1 and March 1 FAFSA filling dates, but the 3.5 HSGPA most effectively explains actual grant aid awards. The right-most columns in Table 2.5 show a combination of a March 1 FAFSA filing and 3.0 HSGPA threshold to be the most impactful modifications to the federal template NPC for public two-year and for-profit institutions. Improvements in explanatory power are especially pronounced within for-profit institutions, where the proposed NPC modifications offer a potential 16 percentage point improvement over the current federal template NPC in explaining variation in actual grant awards.

Figure 2.4 graphically illustrates overall results, presenting the R^2 statistic associated with the current federal template NPC ("Basic model") compared to the most effective ("Best model") of the proposed NPC modifications. With improvements in R^2 statistics ranging from 8 to 16 percentage points across all sectors, and rates of improvement between 51 and 57 percent across sectors, the proposed modifications represent a sizeable increase in NPC explaining potential over the current federal template model.

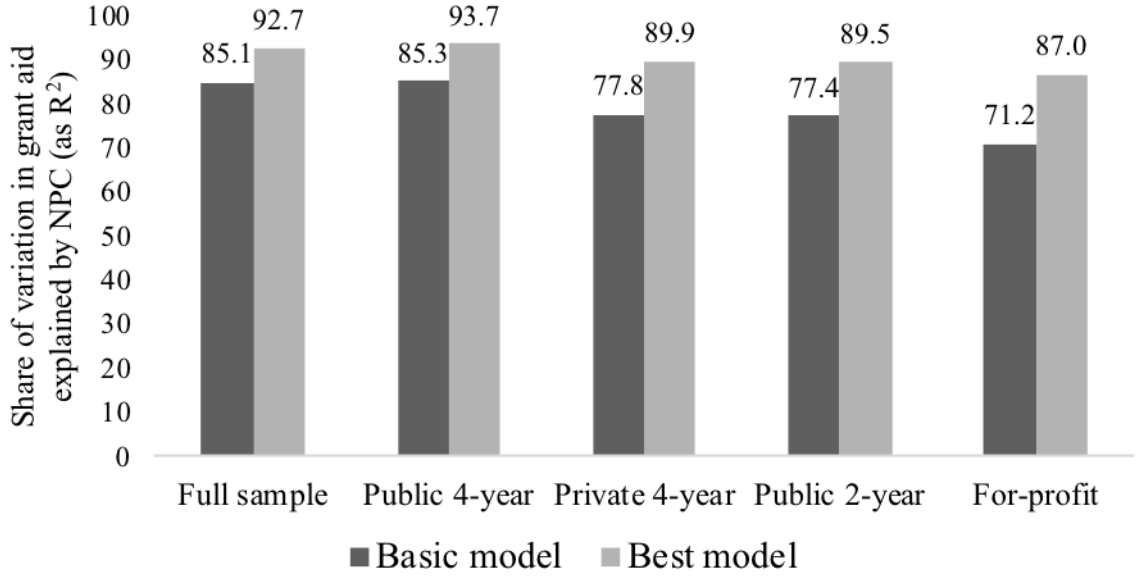

Figure 2.4 Overall results, current federal template NPC R^2 values vs "best" (highest R^2) NPC model

2.3.6 Grant aid analysis by NPC type

Table 2.6 presents parallel analysis to Table 2.5, but separates results by the type of NPC institutions use.[20] For institutions that use an alternative NPC, our results suggest how the federal template NPC and proposed modifications would perform at these institutions. We do not assess NPC type by institutional sector because of the resulting relatively small samples sizes, but recall that two-year public institutions are the only sector where the federal template NPC is most popular. Within public four-year, private four-year, and for-profit institutions, the vast majority of institution use an alternative to the federal template NPC. Therefore, we can infer that public two-year institutions have outsized influence on overall results for institutions using the federal

[20] Table A1.1 in Appendix A1 shows individual modifications to the federal template NPC by NPC type (analogous to Table 2.4).

template NPC while a combination of the remaining sectors drives overall results for institutions that use an alternative NPC. Our findings in Table 2.6 largely affirm this conclusion.

Table 2.6 Alternative vs federal template NPCs and NPC model combinations

			Alternative NPC	Federal NPC
			R^2 (RMSE)	
Federal template NPC			84.8 (6,400)	82.8 (3,500)
High income brackets ($100,000-150,000 & >$150,000)	February 1 FAFSA	2.5 GPA	90.4 (6,100)	91.7 (2,890)
		3.0 GPA	91.1 (6,140)	92.2 (3,000)
		3.5 GPA	92.5 (5,750)	91.9 (3,030)
	March 1 FAFSA	2.5 GPA	90.3 (6,310)	89.9 (3,390)
		3.0 GPA	91.2 (6,330)	90.4 (3,540)
		3.5 GPA	92.4 (6,030)	91.0 (3,400)
	April 1 FAFSA	2.5 GPA	89.6 (6,410)	89.6 (3,430)

Table 2.6 continued

3.0 GPA	90.5	89.9
	(6,420)	(3,650)
3.5 GPA	90.0	90.8
	(6,040)	(3,480)
Difference in R^2 between basic and "best" modified NPC model (pp)	7.7	9.4
% of remaining variation explained	51%	55%
N	8,920	3,770

Note. R^2 quantifies the extent to which data collected in the federal template NPC and its proposed modifications explain variation in actual grant aid awards. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in grant aid awards among similarly-profiled students. Proposed high school GPA and FAFSA timing variables are coded dichotomously to indicate high (low) high school GPA or early (late) FAFSA submission.

The second-to-last row of Table 2.6 shows the overall improvements in R^2 statistics as a share of the initial unexplained variation in grant aid awards. This rate is essentially identical for institutions that use an alternative NPC and the overall sample (as shown above in Table 2.5, also second-to-last row) – 51 percent for both – as well as for institutions using the federal template NPC and public two-year institutions – 55 percent and 54 percent, respectively. The parity in results suggests that the proposed modifications to the federal template NPC would perform equally well in institutions that do and do not currently use the federal template NPC. This may indicate that many non-federal template NPCs – especially those used by institutions awarding relatively less grant aid – may be overly complex.

2.4 DISCUSSION

The purpose of this investigation is twofold: (1) to assess the extent of variation in actual grant aid received among students predicted by the federal template NPC to receive identical grant aid awards; and (2) to identify simple modifications to the federal template NPC to reduce this variation.

We find that incorporating an additional upper income category, in combination with indicators of academic merit and FAFSA filing timing substantially improves the explanatory power of the federal template NPC across all institutional sectors. The current federal template NPC explains 85 percent of the variation in grant aid awards. Our proposed modifications to the federal template NPC explain an additional 8 percent, or more than half of the variation in grant aid awards unexplained by the current federal template model. These findings may be especially helpful should the U.S. Department of Education create a universal NPC, as outlined in the 2017 Net Price Calculator Improvement Act.

Minimizing complexity in user-provided data is central to this investigation. Our suggested modifications would require relatively simple changes to both the front- and back-facing sides of the federal template NPC. On the front-facing side, we suggest adding options for household income of "$100,000 to $150,000" and "Above $150,000" to better distinguish upper-middle and upper-income households. We also suggest introducing two questions to assess high school GPA and expected FAFSA filing time. Users could report their unweighted high school GPA on a scale of one to four, and their expected FAFSA filing time as a specific date on a calendar. On the back end, these high school GPA and FAFSA filing time measures would be translated into relatively high and low GPA values and relatively early and late FAFSA filing

dates. The resulting table, to be populated by institutions with median grant aid per student profile, would look like the revised grant aid matrix presented in Figure 2.3.

We demonstrate that with these relatively simple modifications, the federal template NPC can explain up to 90 percent of the variation in actual grant aid awards. Whether the remaining share of unexplained variation warrants the added complexity of alternative calculators is a subjective matter which may vary depending on the student and the institution in question.

Important factors for NPC developers to consider are exactly what thresholds constitute "high" or "low" high school GPAs or "early" or "late" FAFSA filing. A one-size-fits-all model might adopt the thresholds that were most effective in our overall analysis – i.e., 3.5 HSGPA and FAFSA filing within one month of the open filing window. A more targeted approach, however, would likely be more effective. One strategy is to allow for institutions to use HSGPA and FAFSA filing information best-suited to their own levels and methods of awarding financial aid. The front-facing end of the NPC would look the same, but operational thresholds of high / low HSGPA and early / late FAFSA would be specific to individual institutions. For example, an institution can select a GPA threshold in line with the merit aid they provide, or a FAFSA timing threshold in line with relevant priority deadlines for FAFSA filing.

An alternative "middle ground" approach is to provide NPC options for students to use according to the information and time they have available. Some examples of this approach include the website, collegeraptor.com and the "MyinTuition" NPC. The college search function on collegeraptor.com allows a user to indicate the amount of financial data they are prepared to provide – options include "no financial data," "I know my EFC," "limited family and financial data," and "full family and financial data" – and the extent of financial information requested adjusts accordingly.

The MyinTuition NPC is designed as a quick and simple alternative to more involved NPCs, and has been adopted by a small number of mostly private institutions (Levine, 2014).[21] This NPC requests more detailed information than the federal template NPC, including remaining mortgage balance and assets in retirement and nonretirement accounts, which may pose challenges for some users, but is still simpler than most popular NPC alternatives. Some of the institutions using the MyinTuition NPC (Dartmouth and Yale, for example), allow a choice of NPC. With this strategy, students can choose a quicker, simpler calculator for a ballpark estimate of net price or, if students want a more detailed estimate, can opt for a more involved calculator.

The MyinTuition NPC also provides a range of net price estimates (labeled "low," "best," and "high,") along with a graphic illustration of grant and loan sources as opposed to the single line-item federal NPC estimate. A modified federal template NPC may adopt a similar feature to present users with a prediction interval within which grant aid estimates are likely to vary. In our analysis of RMSE, we find that even though we decrease the share of unexplained variation in grant aid awards, the standard deviation of the residual variation in actual awards still exceeds $5,000 overall and approaches $11,000 within private four-year institutions. Providing a sector-specific estimated range of likely grant aid in addition to a specific dollar estimate may help students to make more informed college application decisions.

We used relatively simple analytic techniques to assess these modifications. Our findings suggest changes that would improve the accuracy of the federal template NPC. We chose a simple approach to align with the straightforward construction and operation of the federal template NPC. We explore additional NPC questions that are easily accessible for students and easily incorporated and customized by institutions; however, a share of variation in grant aid

[21] See https://myintuition.org/schools/ for a list of schools currently using the MyinTuition NPC.

awards to similar students remains unexplained. We recommend for future research to utilize more sophisticated modeling such as machine learning to more completely explain variation in aid awards among similar students within an institution.

NPCs are among a suite of recently-introduced online tools designed to increase information and transparency in college pricing. This information is only useful to the extent that users understand the price information they provide. For NPCs to be most useful in helping families to anticipate college prices, future research should investigate how families use NPCs, how NPCs affect families' understanding of college prices, and the ways that differences in presenting price information may influence college decisions. Greater understanding in these areas may imply additional beneficial changes to the federal template NPC.

3.0 INFORMATION AND ACCURACY IN STUDENT PERCEPTIONS OF COLLEGE NET PRICING

Postsecondary education is as important for economic vitality and upward mobility today as ever (Autor, 2014; Bartik & Hershbein, 2018). Individuals who continue their schooling beyond high school are more likely to be employed and earn higher wages than those who do not enroll in postsecondary education (Kena, Hussar, McFarland, de Brey, & Musu-Gillette, 2016; Ma, Pender, & Welch, 2016). Though college expenses are increasing, the earnings premium associated with a bachelor's degree compared to only a high school degree is increasing faster.[22] By 2020, a projected two-thirds of all employment will require some postsecondary education (Carnevale, Smith, & Strohl, 2013), and a 2016 White House report cites higher education as the "single most important investment young people can make in their futures" (Council of Economic Advisors [CEA], 2016). Given the importance of decisions about if, when, and where to enroll in college, it is critical that prospective students have clear information about college pricing.

Yet, many capable students – particularly minority students and would-be first-generation college students – lack such information and fail to enroll in postsecondary education (Hoxby & Turner, 2013), and this contributes to income-driven gaps in educational opportunities and

[22] Comparing the median, full-time full-year worker over age 25 with a bachelor's degree only to the same type of worker with just a high school degree, according to Current Population Survey's Annual Social and Economic Supplement and the Council of Economic Advisors' calculations.

economic inequality (Bailey & Dynarski, 2011; Perna, 2006). Increasing financial aid can help close this gap (Advisory Committee on Student Financial Aid [ACSFA], 2005; St. John, 2004), but a student who does not know financial aid exists or how to apply for it is unlikely to receive it. Therefore, a more fundamental explanation is that students – particularly those from lower-income families – lack quality information about college prices, financial aid, and associated benefits (Kane, 1999; Kelly & Schneider, 2011; Page & Scott-Clayton, 2016; Scott-Clayton, 2012).

In response, legislators have introduced strategies to improve information about college pricing. The College Scorecard, the Financial Aid Shopping Sheet, and Net Price Calculators (NPCs) are products of such efforts (Higher Education Opportunity Act, 2008). The College Scorecard is an online resource that provides details on key postsecondary factors including average net price, graduation rate within six years, and median salary 10 years after initial enrollment.[23, 24] The Financial Aid Shopping Sheet is a cover sheet to student financial aid award letters that standardizes and summarizes financial aid information in a way that makes it easier for students to understand and compare across institutions.[25] NPCs are online tools that use student information to generate individualized and institution-specific estimates of annual net pricing.

[23] See www.collegescorecard.ed.gov

[24] Whitehurst and Chingos (2015) highlight four flaws with Scorecard salary data. (1) Salary data only includes data for students who received federal student aid, thus omitting earnings data for a substantial number of students who did not apply for or did not receive federal aid. (2) Scorecard salary data does not account for attendance intensity (i.e., a student who attended for a full degree is not distinguishable from a student who attended for a single semester). (3) Earnings can vary substantially across programs within the same institution, but the scorecard only shows earnings at the institutional level, thus masking differences across fields of study. And (4), the Scorecard does not account for students' backgrounds upon admission, which may lead students to conflate the value added by institutions and student-level factors like academic preparedness and family income.

[25] As of September 2017, more than 3,000 postsecondary institutions have reported their commitment to adopt the Shopping Sheet. A list of those institutions can be found at: www.ed.gov/financial-aid-shopping-sheet.

Research is beginning to shed light on the accuracy and effectiveness of these tools. Hurwitz and Smith (2018) find each 20 percent difference in annual earnings reported on the College Scorecard corresponds to a five percent difference in SAT score sends received by that institution. Rosinger (2017, 2018) shows Financial Aid Shopping Sheets may result in lower student borrowing at community colleges with high loan default rates and at four-year institutions with low graduation rates. Anthony and Page (Anthony, Page, & Seldin, 2016; Anthony & Page, under review) show that the federal template NPC explains about 85 percent of variation in grant aid awards received, but the actual financial aid packages can vary substantially even for students predicted by an NPC to face the same net price.

In addition to the U.S. Department of Education's College Scorecard, Financial Aid Shopping Sheet, and NPCs, scores of websites, services for hire, books, and other resources exist to help families with their college search and enrollment. Certainly, many students and families benefit from the abundance of college-planning resources, as suggested by recent increases in postsecondary enrollment and the share of full time undergraduates receiving financial aid.[26] However, simply because resources exist does not mean that students and families have an equal chance of knowing where to find them or how to use them in their college search.

Over a decade ago, Perna (2006) argued that simply making information available without also making it accessible and relevant is insufficient, and contributes to continued inequalities in a range of college outcomes. Since then, the amount of college information available online has increased tremendously with legislative, nonprofit, and for-profit initiatives

[26] Undergraduate postsecondary enrollment increased 28 percent from 2000 to 2016 (Kena, Hussar, McFarland, de Brey, Musu-Gillette, et al., 2016) and more than 85 percent of full-time undergraduates received some kind of financial aid in the 2015-2016 academic year (Radwin, Conzelmann, Nunnery, Lacy, et al., 2018).

alike.[27] Paradoxically, more online information may expand existing gaps in information owing to disparities in income and social capital. For example, although more college information is available online than ever, access to the internet is not equal across income groups. Lower-income households are more likely to be smartphone-only internet users, meaning that certain online tasks typically reserved for larger screens, such completing complex searches or applications, or applying for financial aid, may be especially difficult for students from less affluent households.[28] In order for online college resources to decrease gaps in college information, it is critical to have a better understanding of the ways students and parents access and use this information in their college search and enrollment process.

We shed light on this topic through a mixed methods exploration of perceptions of college expenses and the resources students and families use to form these perceptions. We conduct semi-structured interviews (please see Appendix B2 for interview protocol) with 15 student-parent dyads to explore how they know what they know about college pricing and how they estimate their likely college expenses. To better understand how students and parents think about college pricing, we use a series of questions asking students and parents to work together to estimate pricing for a given postsecondary institution. Next, we guide the participants to use the institution's NPC for the selected college to generate a student and institution specific net price estimate. We assess the accuracy of participants' pricing estimates against the NPC results.

To preview our results, we find that perceptions of likely college prices vary substantially, even after searching online for price information. Although most participants could estimate net price within 25 percent of NPC target values, others were inaccurate by as much as

[27] For examples, see nces.ed.gov/collegenavigator, bigfuture.collegeboard.org, collegeraptor.com, niche.com, collegeview.com, collegedata.com, or collegesimply.com.

[28] Income and internet use data comes from a Pew Research Center poll in 2016. For more information, see http://www.pewresearch.org/fact-tank/2017/03/22/digital-divide-persists-even-as-lower-income-americans-make-gains-in-tech-adoption/

250 percent, or nearly $30,000. Students who had previously used NPCs were significantly more accurate in estimating college net prices, even when they did not use an NPC to inform their estimates. Additionally, families who expressed feeling overwhelmed by the college search and enrollment process were less likely to attempt an estimate at all and less accurate in the estimates they did provide.

We rely on a sample of convenience, and as a result, our findings are not necessarily broadly generalizable; however, they do suggest that college-intending students and their parents, even those who share a high school and high school counselor, can have wide differences in their perceptions of college costs and knowledge of resources. We suggest that online resources that provide net pricing information effectively promote more accurate estimates of likely college expenses, but work remains to help families know the resources exist in the first place.

3.1 CONCEPTUAL FRAMEWORK

From a purely economic perspective, higher education is a straightforward investment in human capital: worthwhile investments are those in which expected benefits are likely to outweigh costs (Becker, 1993). Indeed, for most, investments in higher education are overwhelmingly worthwhile, with college graduates earning more than $800,000 in lifetime income after repaying student loans over someone with just a high school diploma (Daly & Bengali, 2014).

However, choosing a well-matched school is especially challenging because colleges vary substantially in terms of quality and affordability. Affordability is often uncertain until after completing financial aid applications, and the quality of a college, as measured by income

potential, may not be apparent until years after completing a degree. Moreover, incomplete or inaccurate information about colleges can lead to especially poor enrollment decisions or underinvestment (Hoxby & Avery, 2013; Avery, Howell, & Page, 2014). Additionally, several factors – including information barriers, credit constraints, and a complicated financial aid application process, among others – can make investments in higher education especially complicated (Dynarski & Scott-Clayton, 2008; Page & Scott-Clayton, 2016).

Social capital also influences the decision to invest in college because it facilitates access to factors such as institutional resources and supports that are helpful in college enrollment decisions (Coleman, 1988; Hofferth et al., 1998; Lin, 2002; Morrow, 1999; Portes, 1998; R. D. Stanton-Salazar & Dornbusch, 1995). For example, access to counseling in high school is a significant benefit to the college application process (Clinedinst & Koranteng, 2017), but the availability of counselors is positively related to the economic status of students in the school (Avery, Howell, & Page, 2014; Horn, Chen, & Chapman, 2003; Perna, 2006b). African American, Hispanic, and low-income students depend most on counselors for college information, but the high schools these students typically attend are less equipped to provide college-going supports (Cabrera & La Nasa, 2001; Ceja, 2001; Clinedinst & Koranteng, 2017; Avery, Howell, & Page, 2014; Perna, 2006).

With deficits in both social and financial capital, students from lower-income or non-college educated families are particularly vulnerable to inaccurate information about the expected costs (ACSFA, 2005; Grodsky & Jones, 2007; Perna, 2006b) and returns (Betts, 1996; Oreopoulos & Dunn, 2013) to investments in higher education. For example, though three-quarters of all full time students receive some type of financial grant aid (Radwin, Conzelmann, Nunnery, Lacy, et al., 2018), as many as six in 10 college-intending students rule out a college

based on the unsubsidized total price, or “sticker price,” alone (Hesel & Williams, 2010). Students from lower-income households are especially likely to overestimate the price of college and eliminate certain colleges from consideration based on sticker prices alone, which feeds into longstanding disparities in college access and completion (Bailey & Dynarski, 2011; Horn et al., 2003; Hoxby & Turner, 2015; Kelly, 2011).

Targeted interventions designed to close gaps in college information can have positive effects on college enrollment and outcomes. For example, assisting families with FAFSA completion and providing estimates of likely college grant aid results in an eight percentage point increase in completing at least two years of college (Bettinger et al., 2012). Oreopoulos and Dunn (2013) show that high school students were more likely to aspire to postsecondary education after viewing a video about the benefits and likely net prices of postsecondary education. Castleman and Page (2015; 2016) demonstrate that well-timed text messages with important college information can mitigate summer attrition for college-intending high school seniors and substantially improve the rates at which college freshmen refile for financial aid.

This study builds on research by Horn, Chen, and Chapman (2003) and Grodsky and Jones (2007) on student and parent knowledge of college pricing information and their ability to accurately estimate costs. Both studies use data from the 1999 National Household Education Survey (NHES:1999) and come to similar conclusions. Horn and colleagues assess both student and parent knowledge and find lower-income families are least knowledgeable of college costs. Grodsky and Jones focus specifically on parents’ knowledge and restrict their analysis to tuition rates for public in-state intuitions and reach a conclusion generally consistent with Horn and colleagues. Parents of lower-income households are less likely to provide estimates of tuition and are more likely to overestimate expenses when they do provide estimates.

We expand on this research in two ways. First, we specifically assess participants' knowledge of *net* prices rather than unsubsidized sticker prices. The NHES question underpinning Horn and colleagues and Grodsky and Jones asks parents for "fairly accurate estimate of the cost of one year's tuition and mandatory fees at (an in-state public / an out-of-state public / a private) college that (CHILD) might attend." Critically, the survey does not request estimates of net prices. The primary takeaway from Horn and colleagues and Grodsky and Jones relates to the ability of families from lower-income households to estimate college tuition. However, especially for lower-income families, net price is a more appropriate measure of affordability than unsubsidized tuition and fees because of the family's likely eligibility for substantial financial grant aid. Moreover, knowledge of tuition and fees alone does not accurately reflect knowledge of the living costs associated with college attendance, which often account for more than half of the total cost of college attendance (Kelchen, Hosch, & Goldrick-Rab, 2014).[29] In sum, an estimate of unsubsidized tuition and fees may not be the most useful measure of a family's perceptions of college pricing.

Second, the advantage of the studies by Horn and colleagues (2003) and Grodsky and Jones is the large and nationally representative sample on which they rely. A disadvantage, however, is that the nature of the survey does not allow for more in-depth questions that can help reveal important information about families' search processes, information sources, or reasons for misconceptions about college pricing. We conduct a mixed-methods exploration that allows an assessment of the accuracy of student and parents' net price estimates and also allows opportunities to seek more nuanced details underlying those estimates.

[29] NHES:99 includes a follow-up question asking if the provided cost estimate is inclusive of "other fees such as room and board," but the survey question itself only asks about "the cost of tuition and mandatory fees."

3.2 METHODOLOGY

We seek to: (1) assess the extent to which college-intending high school students and their parents accurately estimate likely college expenses; (2) examine the ways families form estimates of college prices; (3) study the resources (both in-person and online) families use to estimate college pricing. We use a parallel mixed-methods design in which we concurrently analyze quantitative and qualitative data, keeping the strands of data separate during analysis and synthesizing across for interpretation (Creswell & Clark, 2017).

3.2.1 Data sources

Our quantitative and qualitative data comes from transcripts of 15 interviews with college-intending high school students and their parents conducted between May 2017 and January 2018. We also use a laptop computer during the interviews and use a screen video recorder to supplement audio transcriptions. One student participant lived independently, resulting in 14 student-parent dyads and one independent student. We interviewed students and parents together because we are interested in what both know about college pricing and the resources they use. Nine students attended a private, Catholic charter school, and six attended public high schools. Of the 15 student participants, most were Black, female, high school seniors with household incomes of less than $55,000. Parent participants were also mostly Black, female, and had at least some postsecondary experience. See Table 3.1 for more demographic information about the sample.

Table 3.1 Descriptive statistics

Variable	Mean	SD
Dependent variable		
Estimate differential ($)	8,452	10,582
Estimate to target NPC ratio	1.47	0.80
Independent variables		
Race: Black	0.80	0.41
Female	0.87	0.35
Student is high school senior	0.73	0.46
Parent's education		
High school	0.21	0.42
Some college, certificate, or associate degree	0.43	0.50
Bachelor's degree or more	0.36	0.49
Household size		
2	0.20	0.41
3	0.20	0.41
4	0.20	0.38
5 or more	0.40	0.51
Low income (under $40,000 / year)	0.60	0.51
Sibling(s) in college	0.28	0.45

Table 3.1 continued

Online search strategies		
Google landing page	0.33	0.48
Specific non-university site	0.20	0.41
University webpage	0.47	0.41
Previous NPC use	0.47	0.51
Feel overwhelmed	0.33	0.49
Feel counselor is available and helpful	0.67	0.49

Note. Averages may not sum to 100 because of rounding.

We collaborated with high school teachers and counselors in and around Pittsburgh, Pennsylvania to opportunistically recruit interview participants. Participants were college-intending high school juniors and seniors and their parents or guardians. Collaborators posted flyers in classrooms and referred to us names and contact information of parents who expressed interest. We emailed, telephoned, and text messaged interested individuals to coordinate interviews and continued recruiting until 15 interviews were scheduled. Participants were each given a $30 prepaid debit card as a token of appreciation.

As the sample is moderately restrictive (i.e., college-intending high school juniors or seniors and their parents) and our claims are limited (Charmaz, 2006; Mason, 2010), a sample of 15 student-parent dyads should approach a saturation point where additional interviews yield relatively little new information (Bertaux, 1981; Morse, 1995; Seidman, 2013).

We conducted semi-structured interviews, each consisting of two parts: a card-sorting stage and a price estimating stage. For the card-sorting section, we presented each participant with a set of 12 index cards. On each card was a factor that families commonly consider in their

college enrollment decisions. These factors were inspired by a 2012 poll of 22,000 first year students, and include: cost (tuition, fees, food, and housing), availability of financial aid and scholarships, location, academic reputation, parents' advice, teacher or counselor advice, friends' advice, size (number of students), student life (social reputation), sports programs, career or major specialty, and graduation rate. [30] We asked participants to separate the cards into categories they considered more and less important to their college search. After sorting, we instructed participants to set aside their less important stack and repeat the process of sorting more and less important factors using only those cards initially placed in the more important category. Participants repeated this process until they had four or fewer factors that they considered to be more important.

We follow the card sorting with questions that probe why participants decided factors to be most important, how those factors influence their college search, and the resources they use to seek information about the factors they consider most important. For example, "How do you find what you want to know about the colleges you might be interested in?" and "I notice you put cost as more (less) important. Do you worry about paying for college? How does that affect how you look for schools?"

The purpose of the card-sorting activity is twofold. First, we are directly interested in the factors families consider most important to their college search process. Moreover, card-sorting facilitates discussion of the reasons for their priorities and allows for follow-up questions about how they learn more about the factors they consider most important and the ways those factors shape their college search (Ritchie, Lewis, Nicholls, & Ormston, 2013).

[30] The poll was conducted by Ruffalo Noel Levitz, and can be found here: https://www.ruffalonl.com/documents/shared/Papers_and_Research/2012/2012_Factors_to_Enroll.pdf

The second stage of the interviews expands on a line of price questions inspired by Kelly (2011) and consists of a series questions in which we first ask students to choose a college from a small sample of postsecondary institutions that they would be most interested in attending.[31] These institutions included: The Community College of Allegheny County, a large community college serving the Pittsburgh area; Duquesne University, a private, moderately selective university in Pittsburgh; and Slippery Rock University, a less selective state university in western Pennsylvania.[32] Each participant was from the Pittsburgh area and each of the selected institutions are likely to be familiar to college-intending high school students in this region.

We then ask students and parents to make four price estimates for their selected institution. The first question intentionally excludes contextual information about the student, family background, or itemized cost elements such as tuition, room and board, or fees. This question serves as an anchor for subsequent questions, and asks,

> *Imagine a student from Pennsylvania who applies to and is admitted to* [name of selected institution]. *How much would it cost the student each year to attend* [name of selected institution]?

The second question primes participants to think about financial aid and college costs relative to student need. This question asks:

> *Now consider a family of four from Allegheny County with an annual income of $50,000, which is a little below the middle income for Allegheny County. After receiving financial aid, how much would it cost to attend* [name of selected institution]*?*

[31] In his report, Kelly (2011) cites a survey of Virginia parents administered by Sarah Turner and colleagues as inspiration for this line of cost questions.

[32] At the time of our writing, all postsecondary institutions in this study used the federal template net price calculator. In two instances where participants had expressed interest in specific Historically Black Colleges and Universities – Hampton University in Virginia, and Lincoln University in Pennsylvania – we use these institutions instead. As both institutions also use the federal template NPC, this did not disrupt the interview protocol.

The third question specifically excludes discussion of financial aid and instead frames the question in terms of what the participant's family, specifically, "would have to pay" in order to prompt students and parents to think about their own actual net costs of attendance rather than list or sticker prices.

> *Now consider* [student's name], *How much would you have to pay for* [student's name] *to attend* [name of selected institution]*?*

The fourth question introduces the opportunity for students and parents to use online resources to adjust their previous estimates of their own net price of attendance. For the fourth question, we presented student participants with a laptop with a web browser opened to the Google homepage, and asked,

> *Again, consider* [student's name]. *How much would you have to pay for* [student's name] *to attend* [name of selected institution]. *You may use any online resources you'd like to help with your estimate.*

Last, we direct participants to the selected institution's online net price calculator, and asked participants to use the NPC to reach a final price estimate. We offered help using NPCs as needed. As participants enter requested data to use the NPC, we also observe information relating to participants' household size, income, and number in college.[33]

For each estimate, we encouraged students and parents to talk through their responses together. After each price estimate, we asked participants to explain their reasoning for their

[33] NPC estimates are only to be used as an approximation of likely grant aid awards and net price and should not be interpreted as actual financial aid awards. Each of the NPCs used in this study uses the federal template methodology, which is relatively simple to use, though alternative calculators exist. The federal template NPC estimates identical aid awards for students attending the same institution who have the same housing arrangements (on-campus, off-campus, or off-campus with family), state residency status (in-state or out-of-state), and expected family contribution (EFC) range (as approximated by household size, number from the family in college, and annual household income after taxes). Actual aid awards can vary substantially for students predicted by the federal template NPC, but overall, NPCs provide a more accurate picture of after-financial-aid out-of-pocket costs than institution's listed total costs (Anthony & Page, under review; Anthony et al., 2016).

estimates. We did not require an estimate from every participant for every question. If students or parents did not have any idea and did not want to take a guess after gentle encouragement (e.g., Are you sure you don't want to take a guess?), we simply moved to the next question. For this reason, several participants have fewer than four price estimates, but each has at least one estimate for the two questions specifically related to their own net price estimates.

A final set of open-ended questions reviews the previous sequence and participants' experience using the NPC. This set of questions probes for feedback about using the resource (e.g., Was it easy to use and understand? Do you trust the information it provides? What did you learn that you didn't know before? Would you recommend for others to use the NPC?).

3.2.2 Analysis

Our analytic strategy involves two stages. The first stage draws on the college price estimates series to explore how participants think about college pricing. Recall that each participant was asked to provide four price estimates: Two estimates for hypothetical students enrolling in a given institution (estimates 1 and 2) and two estimates specific to the family themselves (estimates 3 and 4).

We are primarily interested in estimates three and four, where participants are specifically prompted to think of their own pricing scenario. Students and parents drew from their prior knowledge and discussed the third price estimate together but did not consult any additional resources. The fourth estimate reflects how an open internet search affects net price estimates. We also observe how students and parents search for cost information online. In each case, the student was the person using the computer to search, but parents sat alongside, collaborated in the search process, and discussed search results. We are interested in the process

of the search itself (e.g., what search terms do participants use and what websites do they consult?) and the resulting net price estimate. To more clearly explain the different estimates involved in this study, we refer to the NPC net price estimate as the NPC target value throughout.

The specific NPC target values serve as a reference point for measuring the approximate accuracy of previous estimates. To be clear, we do not know the actual financial aid package a student would receive; NPC target values are only estimates based on aid awarded to similarly-profiled students in a past academic year.[34] They do, however, provide an estimate of likely net prices for a student to attend a given institution.

We use two metrics to measure the accuracy of net price estimates. First, we use the difference (in dollars) between participants' estimates of net price and the NPC target values. The selected example institutions include public and private universities and vary substantially in terms of pricing. For this reason, we also use a ratio of the estimate to NPC target value as a standardized outcome. If net price estimates are accurate, the ratio will approach one. Ratios greater than one indicate over-estimates, while ratios less than one indicate under-estimates. In some cases, estimate three (before searching online) was more accurate than estimate four (after searching online). In these instances, we use the estimate closer to the NPC target value. In other cases, participants provided an answer for *either* the third *or* fourth estimate but chose not to provide estimates for both. In these cases, we use the only estimate provided. Also, though parents and students collaborated and mostly agreed on their estimates, in some cases they did not. In these instances, we use student estimates.

[34] The U.S. Department of Education advises postsecondary institutions to use data for their NPCs that is no more than two years old. However, this is only a recommendation and some institution do not update their NPC data as often.

We use a series of single-variable OLS regressions to individually assess the relationship between a predictor and participants' NPC target values.[35] We use a parallel analysis using the estimate differential and the estimate ratio as outcomes.

The second analytic stage focuses on participants' knowledge of college pricing and the resources that inform it. We first carefully read each of the 15 interview transcripts to develop a list of emerging codes and themes focused on expected terms and concepts reflecting participants' knowledge of college costs (Corbin & Strauss, 2008). Next, we use qualitative analysis software (Dedoose) to conduct a second round of coding, using a general inductive approach in which we identify unanticipated concepts and themes (Thomas, 2006). The final analytic step combines the qualitative data with the quantitative data to identify themes associated with accurate net prices estimates.

3.3 RESULTS

As shown in Table 3.2 and Figure 3.1, students consider college pricing to be most important to their college search process. 80 percent (n=12) consider cost to be important and an equal share consider financial aid to be important. The next most-common important factors were academic major and academic reputation (at 67 percent and 40 percent, respectively), indicating that a combination of affordability and academics broadly shapes the college search of the students in the sample.

[35] The OLS regression for participants' ability to estimate net price can be expressed in the following equation:

$$Estimate\_Differential\ (Ratio) = \alpha + \beta_i X_i$$

Where *Estimate_Differential (Ratio)* is the difference (ratio) between the participant's estimated net price and the NPC target value. X_i are indicators of parent's education level, student's grade level, previous NPC use, feeling overwhelmed, and no estimate provided. β_i is the regression coefficient for the corresponding independent variable X_i.

Table 3.2 Results of card-sorting exercise

College factor	Share of students who consider the factor to be important to their college search
Cost (tuition, fees, food, and housing)	80%
Availability of financial aid and scholarships	80%
Career or major specialty	67%
Academic reputation	40%
Location	27%
Parents' advice	20%
Student life (social reputation)	20%
Teacher or counselor advice	13%
Graduation rate	13%
Sports programs	13%

Note. N=15.

Size (number of students) and friends' advice were included in the set of factors, but we do not include them here because no students considered them to be important to their college search.

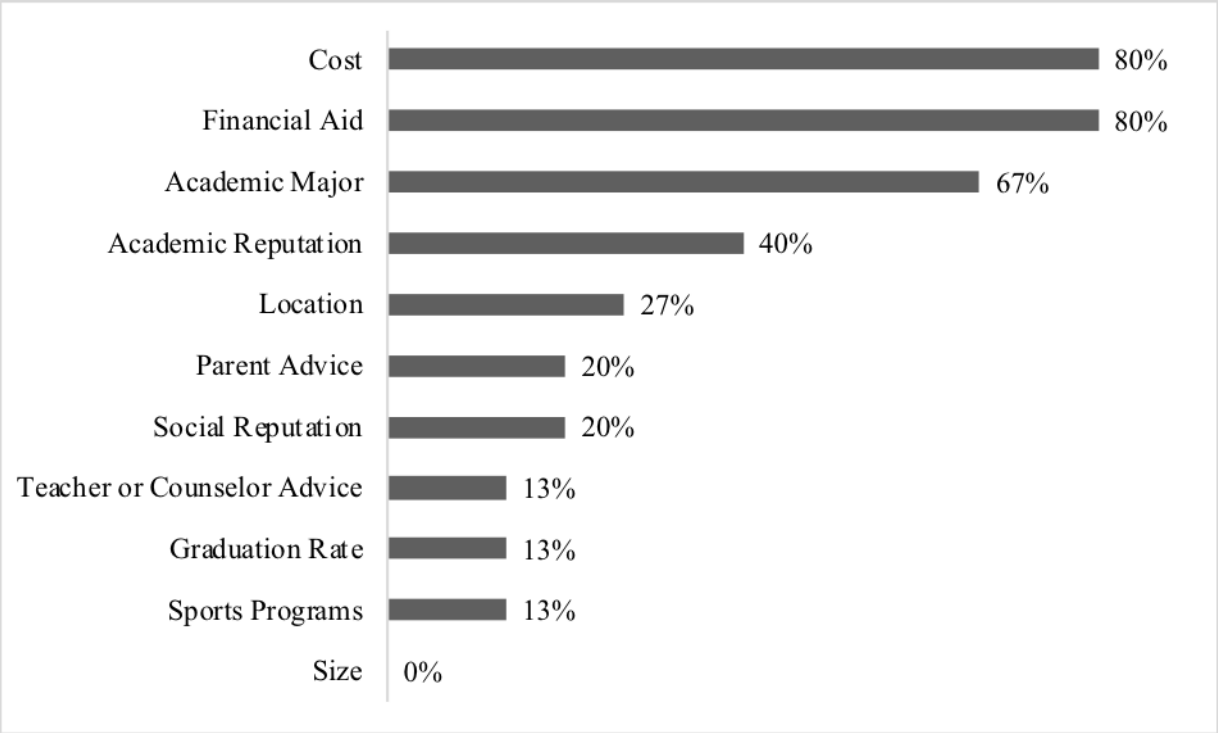

Figure 3.1 Results of college factors card-sorting activity

Despite its shared importance, perceptions of cost and financial aid vary substantially across participants. Table 3.3 shows participants' estimates, NPC target values, and estimate ratios. For example, Subject 1 (top row) reported $10,000 for both her unassisted (estimate 3, first column) and internet-assisted (estimate 4, second column) estimates. The NPC target value for Subject 1 was $10,276 (third column), and the estimate ratio was 97 percent (10,000 / 10,276; fourth column). Estimate ratios (column four) below one indicate under-estimates and ratios above one indicate over-estimates.

Table 3.3 Overall accuracy of estimates three and four relative to NPC estimates

Subject	Estimate 3 ($)	Estimate 4 ($)	NPC target value ($)	Estimate to NPC target ratio
1	10,000	**10,000**	10,276	0.97
2	5,000	**10,000**	14,200	0.70
3	350	**23,417**	22,167	1.06
4	3,000	**20,450**	13,650	1.50
5	16,000	**22,000**	22,167	0.99
6	15,000	**30,000**	22,917	1.31
7	**25,000**	47,000	22,917	1.09
8	**55,000**	60,000	25,132	2.19
9	25,000	**22,917**	22,917	1.00
10		**40,000**	14,064	2.84
11	**30,000**		22,917	1.31
12	5,000	**20,000**	15,975	1.25
13		**40,060**	32,600	1.23
14	18,000	**16,500**	14,751	1.12
15	**40,000**		11,203	3.57

Note. Estimates are of the annual net price for a student to attend a selected postsecondary institution. Estimate three is the result of student and parent conversation, but before consulting any online source. Participants were instructed to use any online resource to update their fourth estimates. The estimate nearest to the NPC target value ("best estimate") is bolded. Subjects 10, 11, 13, and 15 chose to provide just one estimate.

Consistent with previous research (Bettinger et al., 2012; Grodsky & Jones, 2007; Horn et al., 2003), overestimates were more common than underestimates, in this case by a margin of five to one. Using the internet helped most participants reach more accurate estimates, but in two cases (Table 3.3, second column, Subjects 7 and 8), internet-assisted searches resulted in less accurate perceptions of net prices. In both cases, the source for less-accurate internet searches was the institution's own webpage. We return to this topic in the discussion.

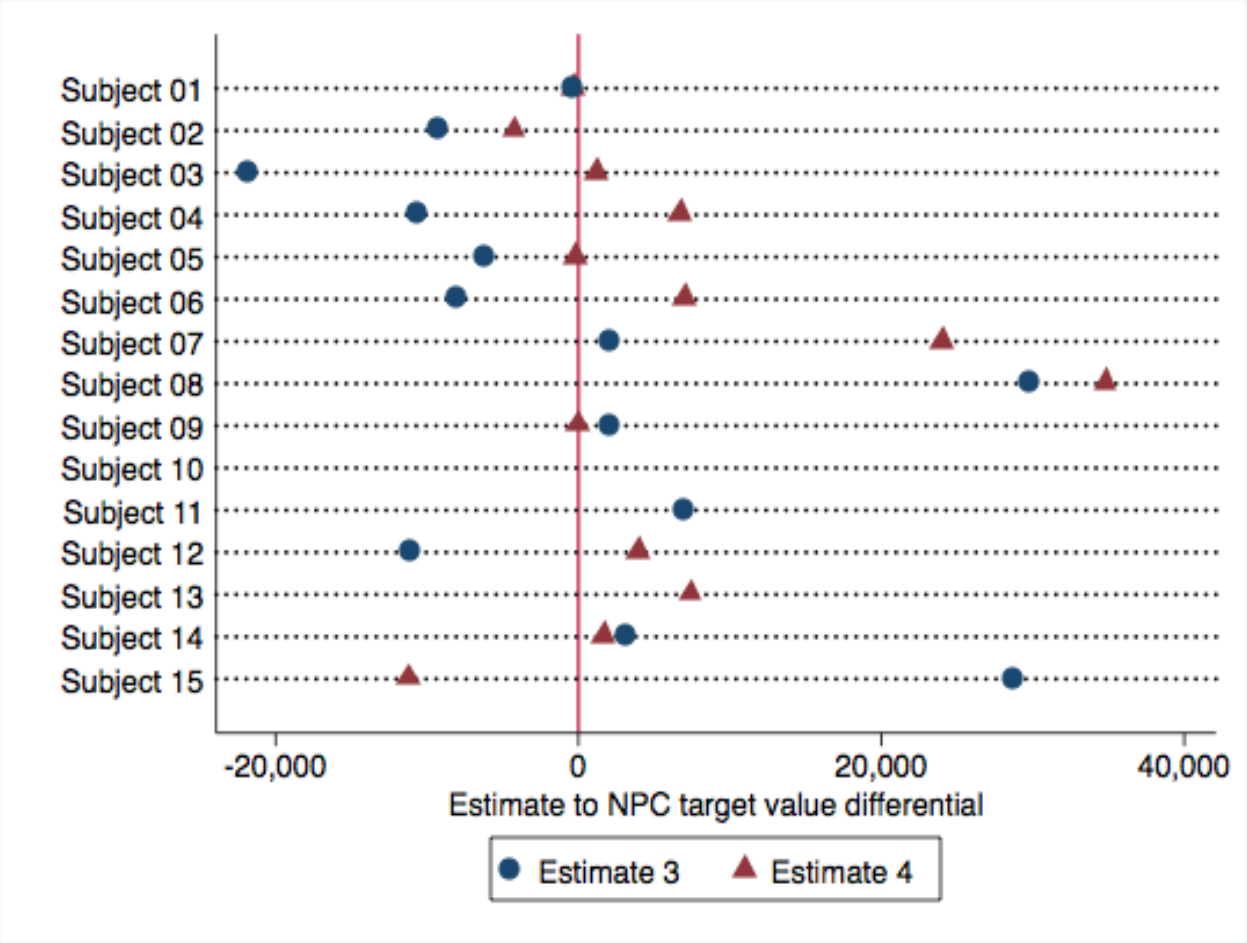

Figure 3.2 Estimate 3 and Estimate 4 differentials from NPC target value in dollars

Figure 3.2 corresponds with the data presented in Table 3.3 and shows the deviation of estimates from the NPC target value. The solid reference line at $0 indicates an exact estimate. Over-estimates fall to the right of the solid reference line and under-estimates are marked to the left of the solid reference line. Markers for estimate four (internet-assisted, red triangles) are generally nearer to the reference line than estimate three (unassisted, blue circles), showing that most participants could reach a more accurate estimate after using the internet. However, even after using the internet, nearly half (n=7) of the estimates deviated from the target value by more than $6,000.

Figure 3.3 presents the corresponding estimate to NPC target value ratios. As in Figure 3.2, Estimate 3 (blue circles) corresponds with unassisted net price estimates for a selected institution and Estimate 4 (red triangles) corresponds with internet-assisted net price estimates. Ratios approaching one indicate accurate estimates. Ratios to the right of the solid reference line are over-estimates, while those to the left of the solid reference line are underestimates. Consistent with previous research (Horn, Chen, & Chapman, 2003; Grodsky & Jones, 2007), we use a 25 percent ratio as a benchmark of relative accuracy (indicated by the dashed reference line at .75 and 1.25), and find an online resource helps most students to reach rather accurate net price estimates.

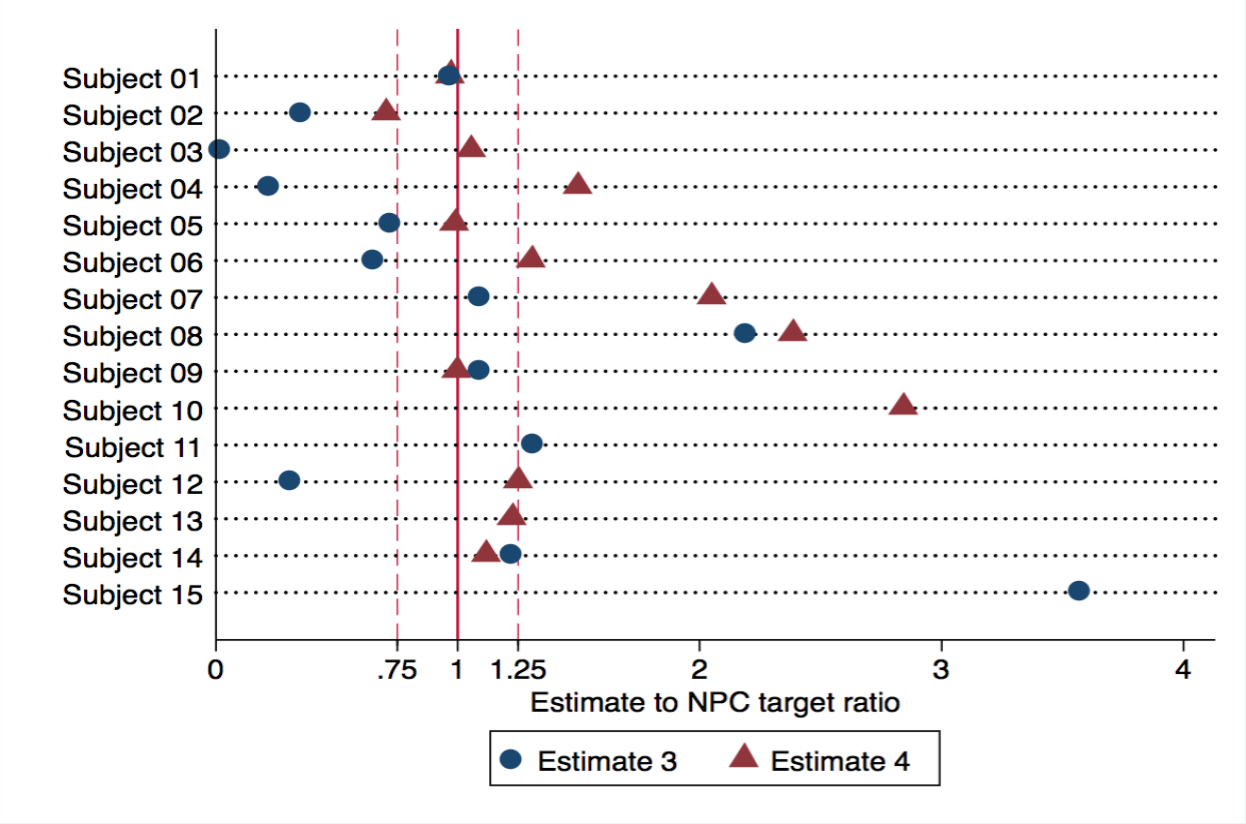

Figure 3.3 Estimate 3 and Estimate 4 to NPC target value ratios

We present regression results in Table 3.4. On the left side of Table 3.4, we present regression results of the estimate to NPC target value differential as the outcome, while on the right side of Table 3.4 we present the estimate to NPC target value ratio. Owing to the small sample size, we consider simple bivariate relationships between the outcome and each predictor, in turn.

Table 3.4 Predictors of net price estimate differential and estimate to target NPC ratio

	Dollar differential			Estimate to NPC target value ratio		
Variable	**Slope coefficient (se)**	**Intercept (se)**	**R^2**	**Slope coefficient (se)**	**Intercept (se)**	**R^2**
Parent has some college	-13,991* (5,932)	19,644 (5,306)	.30	-1.12* (0.43)	2.37*** (0.38)	.35
Student is HS senior	-9,975 (5,784)	15,767 (4,953)	.19	-0.98* (0.39)	2.20*** (0.34)	.32
Previous NPC use	-11,680* (4,670)	13,902 (3,190)	.32	-0.84* (0.35)	1.87*** (0.24)	.30
Feel overwhelmed	17,065*** (3,711)	2,763 (2,143)	.62	1.13** (0.32)	1.10*** (0.18)	.49
No estimate	12,092* (5,465)	5,227 (2,822)	.27	1.04* (0.38)	1.20*** (0.20)	.36
Targeted internet search	-9,766 (6,551)	10,410** (2,929)	.15	-0.55 (0.51)	1.59*** (0.23)	.08

Note. Results from regression of estimate differentials and estimate ratios on predictors. Standard errors in parentheses. In all regressions on the left, the outcome is the dollar differential between net price estimates and NPC target values. In all regressions on the right, outcome is the ratio of net price estimates to NPC target values. With an N of 15, power is low and results are suggestive of relationships between outcomes and predictors rather than definitive.

~p<.10. *p<.05. ** p<.01. ***p<.001

We find a positive association between parent education (defined as at least some postsecondary education compared to a high school diploma alone) and more accurate estimates by a margin of nearly $14,000, on average. Additionally, high school seniors, on average, had more accurate estimates than high school juniors. High school juniors were nearly $10,000 less accurate in their net price estimates than high school seniors. To an extent, this can be expected given that juniors are a grade level removed from college entry and may be less likely to have begun their search in earnest. Students' choice of internet resource also suggests a relationship with the accuracy of net price estimates (Table 3.4, bottom row). Though not statistically significant, participants who used targeted internet searches – as opposed to a broad Google search or the institution's own webpage – to assist in their pricing estimates were generally more accurate by nearly $10,000.[36]

We find positive associations between previous use of NPCs and accurate estimates. Additionally, participants who expressed feeling overwhelmed with the college search process were significantly less likely to provide an estimate, and significantly less accurate in the estimates they did provide. In the next section, we review each of these associations more thoroughly from a qualitative perspective.

[36] The most common search strategy was to navigate directly to the selected institution's website. Although institutions have been required to prominently post a link to their NPCs on their webpages since 2012 (Higher Education Opportunity Act, 2008), no students accessed an NPC through a university's webpage. The second common internet search approach was to use the featured information on the Google search landing page. Google search results often highlight information its search algorithms figure to be most relevant. This information is sometimes sourced directly from an institution's own website and in other instances it is from a third-party college information site such as collegedata.com or collegesimply.com. In these cases, students and parents reported price estimates before even clicking on any links after completing the initial search.

3.3.1 Previous knowledge of NPCs

Nearly half (n=7) of the students had previously used or were familiar with NPCs. The average estimate differential for this group was about $2,200. In contrast, the average estimate ratio among those who had not previously used an NPC was nearly $14,000 (Table 3.4, row 3, second column). Interestingly, students who had previously used an NPC were more accurate in their estimates even when they did not actually use an NPC to inform their estimates. Six of the seven students who had previously used an NPC reported finding the tools online on their own while independently researching college information. Only one student, Clara, who attends an urban, public charter school, specifically cited a school-related resource – a careers class at her high school – as the source of her NPC knowledge. Clara described some of the ways her career class helps with her college search as follows.

> Junior year is when we really focused on how to apply for college. What to look for in a college, how to apply for financial aid, and stuff like that. And then senior year I have a transition manager who I meet with once a week and we go over, "OK, did you apply for college? Did your transcripts and stuff get sent in? Did you get any letters back? Have you filled out your FAFSA?" and stuff like that.

In addition to a transition manager, students at Clara's school have online Naviance accounts.[37] Naviance describes itself as "a comprehensive college and career readiness solution" and lists average net price by income bracket. The net price estimate Clara found using Naviance was within $200 of the NPC target value.

[37] See www.naviance.com for more information.

3.3.2 Choosing not to provide an estimate and feeling confused or overwhelmed

Some participants (n=4) chose not to provide an estimate for either the unassisted (estimate 3) or internet-assisted (estimate 4) prompt. Additionally, a third of participants (n=5) expressed a sense of feeling overwhelmed or not knowing where to start in the search process. Families who expressed feeling overwhelmed by the college search process were less likely to even attempt to estimate net pricing, and significantly less likely to have accurate estimates when they did (Table 3.4, rows four and five). We did not press participants for reasons why they chose not to provide an estimate to minimize potential feelings of performance anxiety. However, one logical reason a student or parent may not provide a guess is that they are aware of their lack of knowledge about the topic.

One student, Siena, described feeling so overwhelmed that she was considering postponing her college search process.

> *Siena*: I was looking into a four-year straight out of high school and I was looking to major in education, secondary. But I don't really know what I want to do right now and what my process is gonna be. But that was my initial process.
>
> *Interviewer*: Did something change? You're saying that *was* the process – what's different?
>
> *Siena*: Nothing really changed. It's just the whole thing is so overwhelming so I'm over it.

A short time later, Siena described another common theme among those feeling overwhelmed with the search process: a communication barrier between students or parents and guidance counselors. When asked if she has someone like a counselor available to her for help, Siena said,

> I do. I would say that I do. My guidance counselor and other teachers that went to college. But at the same time, it's hard to understand it. If they try to explain it, it's hard to understand it because they're breaking down all this financial stuff. It's like I don't even know what you're talking about. I don't understand what you're trying to explain to me. It's all a really confusing structure to me.

Students and parents alike expressed similar sentiments of confusion around the college search and pricing process. In these cases, they know of resources that could be helpful, but the confusion brought on by the financial aid terminology may be too intimidating for a student less willing to reach out for help.

3.4 DISCUSSION

Net pricing is the best indicator of a postsecondary institution's affordability, but we lack insight into how accurately families understand and estimate net prices. In part, this is due to the individualized nature of net pricing, which makes it difficult for families to predict and difficult for researchers to study. Data on median net pricing by family income is now widely available, but substantial barriers to clear net pricing information remain. For example, students and parents might lack knowledge of where to find or how to interpret net prices. Furthermore, a single net price estimate, even broken down by income levels, may conceal substantial variation in actual net prices.

In this study, we interview 15 student-parent dyads to learn more about their perceptions of college net pricing and the resources they use to learn about college pricing. We find that with the help of an internet search, most participants were able to estimate net prices within 25

percent of NPC target values. We also find previous experience using NPCs to be significantly and positively related to students' and parents' ability to accurately estimate prices. Interestingly, participants who had previously used an NPC estimated net prices more accurately even when they did not actually use an NPC or a specific website that features net prices. This suggests that using NPCs may help to make more salient the difference between sticker prices and net prices.

Of the seven participants with estimate ratios of more than 25 percent, each used an institution's own webpage or a Google search landing page when they were provided a chance to use the internet to help with their estimate. Three of the six most accurate net price estimates came from participants who navigated to a specific online resource that features net pricing information. A number of websites highlight net pricing instead of unsubsidized sticker prices, and our results suggest that when students are aware of the websites, they have potential to help narrow information gaps.

Even the most accurate information is not helpful to prospective students who do not know where to find it and searching for accurate information in the internet-age remains a challenge. In some cases, students who *previously had* a fairly accurate sense of expected net pricing before consulting an internet search actually had substantially less accurate perceptions of pricing *after* searching online. Often, the source of inaccurate information was the university's website itself or information retrieved directly from it.

The fact that several students reported some version of inadvertently "stumbling upon" NPCs or websites that use net pricing information is encouraging because it suggests the information is reaching its target demographic (i.e., college-intending high school students and their families). But if a student is looking online for a price estimate and does not know what "net price" is, it may be unlikely they will click on a net price calculator link no matter how

prominent it is on a webpage or clearly it is labeled. For example, of the students who used a university website to find price information, no students accessed an institution's NPC via its webpage, even though the link was clearly labeled, often on the same page.

3.4.1 Limitations

We admit several limitations to this study. First, our sample size is small and one of convenience. Second, with just one coder for the interview transcripts, our coding and interview data is subject to validity concerns. Furthermore, NPC results as a benchmark for actual net pricing may be tenuous if the data behind the institution's NPC is inaccurate or outdated. For example, one NPC used in the study was still using pricing information from the 2013-2014 academic year. Additionally, we do not account for prior knowledge that a student may have had regarding the specific universities we used in our study. For instance, a student who had applied to Slippery Rock University was more likely to know net pricing information about that particular school than a similar student who had not applied to the school.

3.4.2 Implications for policy and future research

Associations between income, social capital, and net pricing information can fuel income-driven inequalities in education. For example, Desmone was interviewed in the summer going into her senior year of high school. Desmone showed relatively low awareness of college pricing and had not given much thought to her college search. Her unassisted (without internet) estimate of her net price to attend college was $350. When asked to use the internet to help with a second estimate, she Googled, "the cost to get into Slippery Rock" and used the bolded information in

the Google search landing page for her estimate of $23,417, which is the unsubsidized total price of attendance for Slippery Rock University. Her NPC target value differed by just $1,250.

Desmone used the same search technique – a broad Google query and the information featured on the search result landing page – as several other participants with far less accurate estimates. The difference is that Desmone's family earned more than $100,000 annually. Desmone would qualify for relatively little grant aid to attend a public four-year institution like Slippery Rock University. The upshot of this example is that students from higher income families may find more accurate net pricing information, even with uninformed or untargeted searches, than their peers from lower-income households who would qualify for more need-based financial aid.

Why, then, do institutions not do more to make net pricing clearer? Institutions may have different motivations for concealing or promoting their net pricing, but for some schools, anecdotal evidence suggests the answer may have more to do with public image than their ability to present more transparent pricing. In the absence of complete information, pricing is a powerful signal of quality. Some prospective students might associate high sticker prices with high quality. With this in mind, some administrators may actually enjoy a reputation for high pricing if they aspire to be recognized as an elite school. In theory, some institutions embracing a high-price high-discount tuition model can create more equitable learning environments by offering generous financial aid packages. The risk, of course, is that without accurate information about financial aid, even high-achieving students from disadvantaged backgrounds may be less likely to even consider applying (Hoxby & Avery, 2013).

Our results are generalizable only to the participants in the study, but they do indicate fertile areas for future research. We find indications that quality websites featuring net pricing

information can help to overcome barriers to college information, but we know relatively little about how prospective students find and use college information online. Considering the web-based targeting of legislative college information initiatives such as the College Scorecard and NPCs, the need for continued research in this area is clear.

4.0 FRAMING EFFECTS OF FINANCIAL AID ON COLLEGE SELECTION

Decisions about if, where, and when to enroll in college are uniquely complicated. Though investment in postsecondary education is overwhelmingly worthwhile (Autor, 2014; Bartik & Hershbein, 2018; Daly & Bengali, 2014; Goldin & Katz, 2008), the risk that it will not be can loom especially large (Dynarski & Scott-Clayton, 2006; Kahneman & Tversky, 1979). Furthermore, a complicated financial aid system (Avery & Kane, 2004; Dynarski & Scott-Clayton, 2006) and differences in expected earnings across programs even within the same institution make both the costs and returns of a postsecondary education hard to predict (Whitehurst & Chingos, 2015). More online resources for information on college cost and financial aid are available than ever, but the search process is time-intensive, partially because comparing important factors such as net price and graduation rates across institutions remains a challenge (The Institute for College Access and Success [TICAS], 2017). In addition, students from lower-income families who may be the most sensitive to college costs typically have the least access to counselors to help in navigating this process (Avery et al., 2014; Clinedinst & Koranteng, 2017; Stanton-Salazar, 1997).

In response, policymakers and educational organizations have introduced initiatives aimed at improving information for prospective students to help with college search and enrollment decisions. College affordability is a primary concern for most students and families (Callan, Doyle, & Finney, 2016; Perna, 2006a). Yet, the true cost that a family faces for a student

to attend a particular school often remains uncertain until receiving a financial aid award letter from that institution. Even then, incomplete or unclear information can lead families to struggle to decipher the award letters they receive (Kantrowitz, 2010; Rosinger, 2018; Whitsett & O'Sullivan, 2012). A review of more than 500 financial aid award letters from unique institutions by New America and uAspire found raises major concerns about misleading, confusing, or missing information in award letters. For example, six of 10 award letters in the sample did not calculate bottom line calculations of costs, and those that did had more than 20 different ways of calculating costs to students (Burd, Fishman, Keane, & Habbert, 2018). A similar review of almost 200 financial aid award letters from different postsecondary institutions by TICAS adds support to these concerns. Nearly three-quarters of the award letters did not effectively communicate basic cost information such as the total price, the delineation between aid that does and does not need to be repaid, and net price (TICAS, 2017). Both reports recommend for institutions to adopt clear and standardized terminology and layout of award letters, and specifically cite the Financial Aid Shopping Sheet as a means to achieve this goal.

The Obama administration released the Financial Aid Shopping Sheet in 2012 to simplify and standardize the financial aid information that students receive on award letters. The shopping sheet is a uniform way for postsecondary institutions to present financial aid information to prospective students. In addition to a standard format for cost and aid information, the shopping sheet provides information on a given institution's graduation rate (indicated as low, medium, or high) and loan default rate compared to national averages.[38] Students receive the shopping sheet as a cover page to the financial aid award letter sent by institutions to which they applied.

[38] As of September 2017, more than 3,000 postsecondary institutions have reported their commitment to adopt the Shopping Sheet. A list of those institutions can be found at: www.ed.gov/financial-aid-shopping-sheet.

The shopping sheet has been voluntarily adopted by more than 3,000 postsecondary institutions, but proposed legislation would mandate its use. The bipartisan Understanding the True Cost of College Act of 2017 (S.888) would require all postsecondary institutions that receive federal funding to use a standardized financial aid form.[39] The bill was introduced in April of 2017 and was referred to the Committee on Health, Education, Labor, and Pensions.

The rationale for the shopping sheet is in part grounded in a body of research that examines how human behavior and decision making can be influenced by the way information is presented and choices are framed (Tversky & Kahneman, 1981). As financial aid award letters provide important information for enrollment decisions, it follows that variation in the layout and wording of financial aid award letters may influence the choices students make based on the information award letters provide.

Research from Avery and Hoxby (2004), Monks (2009), and Evans, Boatman, and Soliz (2018) shows how labeling types of financial aid in different ways affects student responses to aid offers. Avery and Hoxby find that students are more likely to matriculate when financial aid is labeled as a "scholarship" rather than a "grant," even though they are substantively identical in reducing net price. Relatedly, Monks finds that students are more likely to enroll at an institution when net price includes a scholarship than when an equivalent net price at the same institution does not include a scholarship. Evans and colleagues find students are less likely to select a borrowing option labeled as a "loan" than an equivalent option described as an income sharing agreement.

[39] Senate Bill 888, The Understanding the True Cost of College Act of 2017, was introduced on April 7, 2017 by Senator Chuck Grassley (R-IA) and was originally cosponsored by former Senator Al Franken (D-MN). Other cosponsors include Senators Kirsten Gillibrand (D-NY), Christopher Coons (D-DE), Sheldon Whitehouse (D-RI), Warren (D-MA), Cardin (D-MD), and Smith (D-MN). For more details of the bill, see https://www.congress.gov/bill/115th-congress/senate-bill/888.

By standardizing financial aid information, the shopping sheet aims to improve information important to college decision-making in two key ways. First, it provides information on important factors such as net pricing for the specific student and institution, along with median graduation rates borrowing amounts relative to national norms. Second, as variation in the layout and wording may affect enrollment choices by selectively highlighting certain information, the shopping sheet may reduce the impact of framing effects by presenting this information in a clear and standardized way.

Rosinger (2017, 2018) sheds light on the effects of providing shopping sheet information. For example, she finds that shopping sheet information may reduce borrowing at community colleges with high loan default rates and influence students to borrow less at four-year colleges with poor graduation rates. Nevertheless, this work does not shed light on the more fundamental question of the potential effects of the framing of financial aid on college enrollment decisions.

Therefore, we explore how variation in the framing of college cost affects spending preferences. Specifically, we investigate the extent to which college spending preferences can shift when identical college cost scenarios are framed in different ways. We administer a survey to 1,400 participants in which we ask them to make hypothetical college enrollment decisions. We randomly frame college costs and financial aid to emphasize money *received* by students in the form of financial grant aid or *paid* by students in the form of remaining net price after financial aid.

We find evidence that the way cost information is presented does matter to college decisions. When costs are framed in terms of total prices and financial grant aid *received* (omitting remaining net prices *to be paid*), participants were more than five percentage points

more likely to select a college beyond their stated willingness to pay compared to participants receiving full cost information (i.e., total price, financial aid, and net price). We show that substantively meaningless changes in the way cost information is presented may significantly influence hypothetical college decisions. To help students make optimal college decisions, it is important to highlight meaningful information and to frame this information in a consistent way that makes it easy to compare across institutions.

We organize the remainder of the paper as follows. In the next section, we review selected studies of interventions designed to improve information about college decisions. In section three we discuss our study design, sample and methods. Section four includes our findings, and section five concludes with a discussion of results and policy implications.

4.1 BACKGROUND

For many, cost is a primary barrier to college entry and persistence (Callan et al., 2016; Perna & Li, 2006). Accordingly, lowering costs through financial aid and providing information about how to apply for financial aid can improve college access and completion (for reviews, see Deming & Dynarski, 2009; Dynarski & Scott-Clayton, 2013; Long, 2008; Page & Scott-Clayton, 2016). Additional research shows that students' perceptions of cost and financial aid may be as important to college outcomes as actual aid levels (Avery & Kane, 2004; Grodsky & Jones, 2007; Horn et al., 2003; Ikenberry & Hartle, 1998; Oreopoulos & Dunn, 2013; Perna, 2006b). For example, students receiving less financial aid than they anticipate are less likely to enroll at a given institution (DesJardins, Ahlburg, & McCall, 2006).

The U.S. Department of Education hosts a variety of resources to promote information to help with college search and selection decisions. Three such resources are the College Scorecard, Net Price Calculators (NPCs), and the Financial Aid Shopping Sheet. With their relatively recent introduction – each of these tools was launched between 2012 and 2013 – research is early in shedding light on whether and how individuals use these tools.

The College Scorecard is a website that allows users to research postsecondary institutions along several dimensions including graduation rate, average net price, and median earnings ten years after initial enrollment. Prior to the introduction of the Scorecard, graduation rates and annual net cost information were widely available, but college-specific median earnings data was not, and research suggests this additional information may affect college choices. Huntington-Klein (2016) measures college interest by Google keywords and finds that the College Scorecard is related to modest increases in searches relating to high earnings, high graduation rates, and low tuition rates. Hurwitz and Smith (2018) use data on SAT score sending behavior to estimate that each 10 percent increase in reported earnings by an institution's graduates corresponds to a 2.4 percent increase in the number of SAT score sends received by that institution, with score-send behavior among well-resourced students driving this relationship. The College Scorecard provides useful information to help students assess expected costs and benefits, but these findings suggest such tools may do little to decrease income-driven gaps in college outcomes.

Net Price Calculators (NPCs) are another online resource designed to make college costs easier to understand. NPCs use student-information about family size, income, residency, and college living arrangements to provide institution- and student-specific estimates of price of attendance, grant aid, and net price. A descriptive analysis found that while NPC estimates are a

better barometer of college prices than sticker prices, actual financial aid awards can vary substantially among students predicted by the calculators to receive identical aid (Anthony et al., 2016; Anthony & Page, under review). Furthermore, schools are advised to update cost figures annually, but some schools do not update costs as often, and may base NPC estimates on outdated pricing and aid information (Anthony et al., 2016).

The shopping sheet is designed to improve transparency in college pricing by providing a standard template for presenting key financial aid award information to prospective students. Such a standard template should make it easier for individuals to understand the details of their financial aid packages and to compare costs across institutions.[40] In addition to cost and financial aid information, which is typical of financial aid reports, the shopping sheet also includes institution-specific information about graduation rates within six years, described as "low, medium, or high," and median federal loan borrowing amounts relative to national averages.

A growing body of research indicates that informational resources such as the College Scorecard, NPCs, and the shopping sheet can influence college-related decisions by providing important, simplified information about costs, quality, and financial aid. However, the research on these tools, to date, provides less information on the question of whether and how the framing of information may influence postsecondary choices.

We shed light on this question by exploring how changes in the way cost information is presented may influence college decisions. Investments in higher education are commonly subsidized with financial aid, leading to disparities between an institution's published total price and actual net prices that students face after accounting for financial aid. A simplified equation of college costs is represented as follows:

$$\textit{TOTAL PRICE} - \textit{FINANCIAL AID} = \textit{NET PRICE}$$

[40] See https://collegecost.ed.gov/shopping_sheet.pdf

In this study, we manipulate the three elements of this pricing equation to explore how the framing of college costs affects college choice.

4.2 RESEARCH DESIGN

4.2.1 Survey design and procedure

In this study, we exploit the disparities between net price and total price to present participants with a hypothetical college choice scenario where financial aid information is presented with one of three framing conditions: gain, loss, and full information. For each condition, we include the total price and manipulate net price and financial aid. In the gain condition, we make explicit how much money the student *receives* in grant-based financial aid but exclude the out-of-pocket net price. For the loss condition, we include total price and how much the student *pays* in annual out-of-pocket net price, but do not include the financial aid amount. And in the full information condition, we present participants with the total price, grant aid, and net price (See Figure 4.1). Though the omitted pricing element varies among the three experimental conditions, the actual prices are identical across them.

Treatment condition	College prices presented in terms of:		
	Total price	Grant aid *to* student	Amount *owed* after grant aid (net price)
Gain	X	X	
Loss	X		X
Full information	X	X	X

Figure 4.1 College cost data included in gain, loss, and full information treatments

We begin by providing each participant with a list of average net prices at a sample of well-known, highly competitive public and private universities. We chose this set of schools to demonstrate the range of net prices at top colleges. With this information as a reference point and still visible on the same page, we then solicit each participant's maximum willingness to pay out-of-pocket to attend a highly selective college.[41] Here, options range from $7,500 to $30,000 (as shown in Figure 4.2).[42, 43] Within this sector of schools, this range of net prices parallels net pricing for the middle 80 percent of students.[44] This information then feeds into our experimental manipulation.

[41] The list of reference institutions is the same for all participants.

[42] Prior to choosing a college, participants read brief explanations of three college cost components: total price, financial aid, and out-of-pocket net price. We checked participants' comprehension of these terms by programming the survey so that participants could not advance to the next item until they correctly answered three multiple choice questions about these definitions.

[43] Research suggests that participants can substantially overestimate their willingness to pay in hypothetical payment scenarios (Blumenschein, Blomquist, Johannesson, Horn, & Freeman, 2008; Cummings, Harrison, & Rutström, 1995; Harrison & Rutström, 2008; List & Gallet, 2001). This is known as hypothetical bias. To reduce hypothetical bias, we introduced a follow-up certainty question asking participants if they are "probably certain" or "definitely certain" of their responses (Blumenschein et al., 2008). However, we did not find significant differences between the "probably certain" and "definitely certain" groups and retained all responses in our analysis.

[44] Authors' own calculations according to net price data for highly selective very high research activity institutions represented in the National Postsecondary Survey of Student Aid 2012 and adjusted for inflation using the Bureau of Labor Statistics CPI inflation calculator.

Name of College or University	Average Net Price (to the nearest thousand)	What is the most you would pay in out-of-pocket net price to attend an elite college?
Stanford University	$15,000	o $7,500 o $10,000 o $15,000 o $20,000 o $25,000 o $30,000
University of Michigan	$16,000	
University of Virginia	$18,000	
Yale University	$20,000	
Duke University	$25,000	
University of Chicago	$26,000	
Penn State University	$28,000	
University of Notre Dame	$29,000	
Carnegie Mellon University	$32,000	

Figure 4.2 Survey question asking maximum willingness to pay for college

We used participants' stated willingness to pay for college, defined as *C*, to vary the college pricing structures for two hypothetical colleges. The pricing structures, as shown in Figure 4.3, are consistent with a net price to total price ratio for students in the 25th percentile of net prices for highly selective, very high research activity public (College A) and private (College B) postsecondary institutions.[45]

	Payment preference	**Total price**	**Net price**	**Financial aid**	**Net price as a share of total price**
College A	*C*	1.1*C*	0.9*C*	0.2*C*	0.82
College B	*C*	2.5*C*	1.7*C*	0.8*C*	0.68

Example cost scenario with *C* = $20,000

	Payment preference	**Total price**	**Net price**	**Financial aid**	**Net price as a share of total price**

[45] We base cost figures on the average ratio of net prices to total prices at a sample of public and private, highly selective (as a combined measure of share of students accepted and median combined SAT / ACT scores), very high research activity (per 2010 Carnegie Classification) colleges and universities represented in the 2012 National Postsecondary Student Aid Survey administered by the National Center for Education Statistics. We base net prices on the 25th percentile, representing students receiving relatively more financial grant aid, and we base total prices on the 50th percentile for within this subset of institutions. We use this pricing ratio to illustrate the sizeable difference between net prices and total prices, especially for students eligible for more generous financial aid awards. Across all schools within this subset, the 25th percentile net price was $14,560 (adjusted to 2018 dollars). Total prices are the median costs in public (College A) and private (College B) schools in this highly selective sector. The average total price of public schools within this highly competitive sector is approximately 1.1 times the net price for students in the 25th percentile, or about $16,000. For private schools within this sector, the average total price is approximately 2.5 times the net price for students in the 25th percentile, or about $36,400. See *Figure 4.3*.

College A	$20,000	$22,000	$18,000	$4,000	0.82
College B	$20,000	$50,000	$34,000	$16,000	0.68

Figure 4.3 Hypothetical college cost multiplier chart

We instructed participants to presume they had already applied to and been accepted at these two institutions and now need to choose between these two options. Descriptions of the schools are identical with two exceptions. College A is described as a public school that generally ranks among the top 100 universities in the U.S., while College B is a private school that generally ranks in the top 20 universities in the U.S. We presented participants with both college options, side by side, as shown in Figure 4.4. The price figures presented in Figure 4.4 are an example based on a hypothetical payment preference (*C*) of $20,000.

Treatment Condition	**College A** is a highly competitive public university. The school is very well-regarded and generally places in the top 100 universities in the U.S. according to the most popular ranking sources. College A has a total price of $22,000	**College B** is a highly competitive private university. The school is very well-regarded and generally places in the top 20 universities in the U.S. according to the most popular college ranking sources. College B has a total price of $50,000
Gain	(and you get $4,000 in financial aid.)	(and you get $16,000 in financial aid)
Loss	[After factoring in financial aid, your annual out of pocket payment to attend College A is $18,000]	[After factoring in financial aid, your annual out of pocket payment to attend College B is $34,000]
Full	{and offers you $4,000 in financial aid, leaving $18,000 for you to pay in out of pocket net price.}	{and offers you $16,000 in financial aid, leaving $34,000 for you to pay in out of pocket net price}

Figure 4.4 Sample college selection question, prices are relative to a $20,000 payment preference

After participants made a choice, we then collected baseline demographic information including race / ethnicity, gender, income, education level, and, conditional on having attended college, educational loan borrowing behavior.

4.2.2 Sample

We used Amazon's Mechanical Turk, or MTurk, online task platform to recruit 1,400 participants to complete the survey.[46] A total sample of this size allowed us to achieve a sample of at least 400 respondents for each of the three framing conditions. We included an additional 200 participants to allow for potential incomplete or incorrectly completed surveys, though no surveys were ultimately omitted for this reason. We limited participants to those living in the U.S. and with a history of successfully completed MTurk tasks. Each participant received $0.25 for completing the survey.

[46] The primary advantage of using MTurk to collect data is that it is generally faster and less expensive and more representative of the general population than traditional sampling methods such as data collection from undergraduate students or community samples (Buhrmester, Kwang, & Gosling, 2011; Follmer, Sperling, & Suen, 2017). We paid participants $0.25 and did not allow participants to complete more than one survey. Given the low pay, lack of supervision, and anonymity, it is reasonable to question whether participants take tasks seriously. Yet, there is little evidence to suggest that data collected online is of lower quality or less reliable than data collected from in-person subject pools such as undergraduate students or enrollees from the general public (Bartneck et al., 2015; Buhrmester et al., 2011; Gosling, Vazire, Srivastava, & John, 2004; Krantz & Dalal, 2000; Paolacci, Chandler, & Ipeirotis, 2010; Rouse, 2015). Goodman and colleagues (2013) specifically recommend MTurk for behavioral decision-making research after finding similar framing effect outcomes with an MTurk sample, student sample, and a community sample.

MTurk studies are not without potential drawbacks. Some features of the MTurk platform create the potential for sampling bias. For example, if MTurk workers are willing to participate in studies for low pay, they may be atypical in their attitudes about time and money. MTurk participants have been shown to be willing to spend more time on tasks in exchange for less money than community participants, but these differences disappear when compared to an undergraduate student sample (Goodman et al., 2013). Secondly, because MTurk participants decide which of thousands of available tasks they would like to complete, there is a risk that participants will gravitate towards studies on topics they find more interesting, and have may have prior knowledge that differs from the general population (Follmer et al., 2017). In other words, a survey on college costs, such as this one, may be more attractive to workers who are implicitly interested in (and have prior knowledge of) the topic.

The average participant is in her early 30s, has at least some college education, and earns less than $60,000 annually (See Tables 4.1 and 4.2). Slightly more than half of the participants were female, and nearly three quarters of the respondents were white. More than 9 in 10 participants had at least some postsecondary education, and of those, two-thirds took out loans to pay for it.

Table 4.1 Descriptive statistics: Race / ethnicity, age, and gender

	Full sample	
Variable	**N**	**Mean**
		(sd)
Asian	1,400	0.08
Black	1,400	0.11
Hispanic	1,400	0.06
Other race	1,400	0.02
White	1,400	0.73
Female	1,400	0.56
Age	1,400	32.61
		(10.17)
If college, took out loans	920	0.69

Notes. Standard deviations (in parentheses) reported for continuous variables only.

Table 4.2 Descriptive statistics: Income, education, and willingness to pay for college

	Full sample	
Variable	**N**	**Mean**
Income		
Below $20,000	347	0.25
$20,000 - $39,999	401	0.29
$40,000 - $59,999	284	0.20
$60,000 - $79,999	172	0.12
$80,000 - $99,999	110	0.08
$100,000 and above	91	0.06
Education		
High school diploma or less	96	0.07
Some college	389	0.28
Associates / 2-yr degree	167	0.12
Bachelor's degree	554	0.39
Graduate degree	199	0.14
Maximum willingness to pay for college		
$7,500	445	0.32
$10,000	287	0.20
$15,000	270	0.19
$20,000	200	0.14
$25,000	85	0.06
$30,000	118	0.08

Note: $7,500 was by far the most frequent choice for the maximum willingness to pay for college. It is likely that participants may have chosen a lower amount if given the option, but we list $7,500 as the lowest option to more closely represent actual net pricing at highly selective institutions.

The sample was approximately evenly divided at random among the three experimental conditions. In Table 4.3, we present results from assessing baseline equivalence among experimental groups. Specifically, we present coefficients from regressions of each baseline characteristic on indicators for experimental condition, with the full information condition as the omitted category. Column 1 presents the estimated intercept from each regression, which corresponds to the average value of the outcome for those assigned to the full information condition. Columns 2 and 3 present coefficients representing differences in average outcomes for the gain and loss conditions, respectively, relative to those for the full information condition. In column 4, we report the p-value from a post-hoc comparison between the gain and loss conditions. Of all of the tests in this table, only one – income of $100,000 or more – suggests a difference in baseline characteristics between treatment conditions. Given the number of tests that we run (69), this result is to be expected and is reasonably attributable to Type I error. Taken together, we judge the results in Table 4.3 as evidence that baseline equivalence has been achieved.

Table 4.3 Assessing balance of baseline covariates in randomization

Variable	**Full information**	**Gain**	**Loss**	**Post-hoc comparison p-value**
Income				
<$20,000	0.24	-0.01	0.02	0.23
	(0.02)	(0.03)	(0.03)	
$20,000-$39,999	0.31	-0.04	-0.02	0.42

Table 4.3 continued

	(0.02)	(0.03)	(0.03)	
$40,000-$59,999	0.19	0.03	0.00	0.25
	(0.09)	(0.03)	(0.03)	
$60,000-$79,999	0.12	0.00	0.02	0.34
	(0.02)	(0.02)	(0.02)	
$80,000-$99,999	0.07	0.01	0.01	0.84
	(0.01)	(0.02)	(0.02)	
>$100,000	0.07	0.02	-0.03	**0.01**
	(0.01)	(0.02)	(0.02)	
Education				
High School or less	0.07	-0.02	0.00	0.50
	(0.01)	(0.02)	(0.02)	
Some college	0.25	0.04	0.04	0.99
	(0.02)	(0.03)	(0.03)	
Associate's / 2-year degree	0.11	0.01	0.01	0.73
	(0.01)	(0.02)	(0.02)	
Bachelor's	0.40	-0.01	-0.01	0.86
	(0.02)	(0.03)	(0.03)	
Postgraduate	0.16	-0.02	-0.04	0.28
	(0.02)	(0.02)	(0.02)	

Variable	Full information	Gain	Loss	Post-hoc comparison p-value
Max willingness to pay for college				
$7,500	0.30	0.00	0.01	0.61
	(0.02)	(0.03)	(0.03)	
$10,000	0.21	0.00	-0.01	0.80
	(0.02)	(0.03)	(0.03)	
$15,000	0.17	0.03	0.03	0.75
	(0.02)	(0.03)	(0.03)	
$20,000	0.15	-0.01	0.01	0.43
	(0.02)	(0.02)	(0.02)	
$25,000	0.06	-0.01	-0.02	0.48
	(0.01)	(0.01)	(0.01)	
$30,000	0.11	0.00	-0.02	0.21
	(0.01)	(0.02)	(0.02)	
If any college, took out loans to pay for it	0.67	0.02	0.00	0.62
	(0.02)	(0.03)	(0.03)	
Race / Ethnicity				
Asian	0.07	-0.01	0.01	0.21
	(0.01)	(0.02)	(0.02)	
Black	0.11	0.00	0.00	0.96
	(0.01)	(0.02)	(0.02)	

Hispanic	0.06	0.01	0.00	0.71
	(0.01)	(0.02)	(0.02)	
White	0.73	0.00	-0.01	0.55
	(0.02)	(0.03)	(0.03)	
Female	0.54	0.06	0.01	0.12
	(0.02)	(0.03)	(0.03)	
Age	32.68	0.37	-0.57	0.16
	(0.47)	(0.66)	(0.67)	
N	1,400			

Notes: Each cell presents parameter estimates associated with a regression of baseline covariates on an indicator for treatment conditions. Column 1 presents results from regressions of covariates on an indicator for the "full information" condition. Columns 2 and 3 present results for the "gain" and "loss" treatments, respectively, and the coefficients are relative to Column 1. Column 4 is the resulting P-value of a post-hoc equivalence test. Robust standard errors are in parentheses. Only the income variable ">$100,000" suggests a difference in treatment conditions, indicating that participants in the "gain" treatment group reported marginally higher incomes (significant at the $p<0.05$ level). As we assigned treatment conditions sequentially, it is likely this simply Type 1 error.

4.2.3 Analytic methods

To estimate the effect of the framing of financial aid information on college enrollment decisions, we fit models of the following general form:

$$COLLEGE\_B = \propto + \beta_1 Gain + \beta_2 Loss + \gamma \boldsymbol{X} + \varepsilon \qquad (4.1)$$

Here, *COLLEGE_B* is a binary variable equal to 1 if the participate selects College B as their college of choice. Recall that College B is the more expensive private institution with a net

price beyond the participant's stated maximum willingness to pay. We are primarily concerned with the extent to which the framing of costs influences the rate with which individuals opt for this more expensive option. Predictors *Gain*, and *Loss* are the framing conditions (with "full information" as the omitted category), and $\boldsymbol{X}$ is a vector of baseline covariates, including those reported in Tables 4.1 and 4.2. From this model, our primary interest is in our estimates of β_1 and β_2, which represent the impact of the gain or loss frame, respectively, on the choice of College B under the full information condition. If, for example, the β_1 coefficient is positive and statistically significant, we will interpret that to mean that financial aid information presented with a gain frame will lead an individual to be more likely to opt for College B relative to participants who receive full information. By comparing the rate with which participants choose a particular option under different framing conditions, we can assess the impact of the framing of college pricing information on college decisions, at least in the hypothetical scenario we devise. We fit all models as linear probability models, although results are unchanged when we use logistic regression specifications.

4.3 FINDINGS

We report results of fitting equation 4.1 in Table 4.4. The first column of results is based on a model with no baseline covariates, and the second column of results is based on a model with all baseline covariates included. Results show the rate of choosing College B in relation to the full information condition. We report results graphically in Figure 4.5 by comparing the rates with

which College B is the option with a total price 2.5 times the stated willingness to pay and net price 1.7 times the stated willingness to pay. The alternative, College A, has a total price of 1.1 times the stated payment preference and a net price of 0.9 times the stated payment preference.

Table 4.4 Effect of framing on choosing a college priced above stated maximum willingness to pay

	No controls	With controls
Gain treatment	0.05*	0.06*
	(0.02)	(0.02)
Loss treatment	0.01	0.02
	(0.02)	(0.02)
Intercept	0.13***	0.10
	(0.02)	(0.07)
Baseline controls		✓
R^2	0.00	0.05
N	1,400	1,400

~ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Notes. We treat the "full information" condition as the control, and represent it here as "intercept." The "gain" and "loss" effects are relative to the full information condition. Baseline controls include: income, education level, whether or not the participant took out loans to pay for college (conditional on some college attendance), stated willingness to pay for college, race indicators (Asian, Black, Hispanic, or White), gender, and age. Of these, willingness to pay for college was significantly, and positively related to a participant's likelihood of choosing the college priced above their stated maximum willingness to pay.

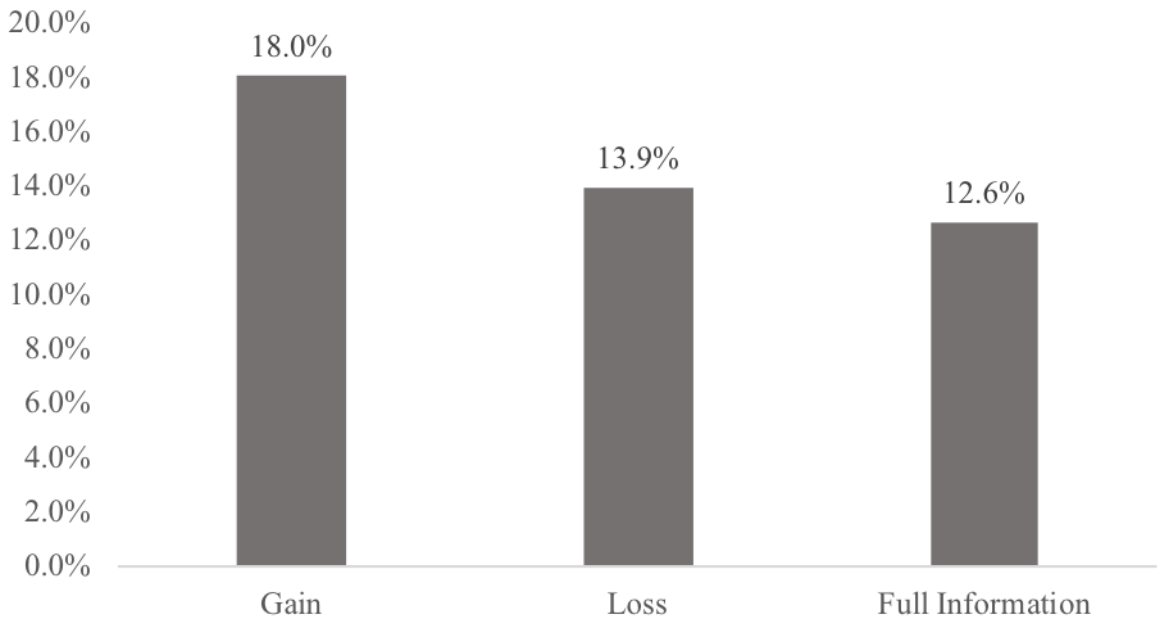

Figure 4.5 Rate of choosing College B by treatment condition

We find that under the full information condition, approximately 13 percent of individuals will select College B. Relative to this rate, individuals are no more or less likely to select College B when cost information emphasizes the remaining net price *to be paid* to the college (i.e., "loss condition"), but are five to six percentage points more likely to select College B when cost information emphasizes the financial aid *received* by the participant (i.e., "gain condition").

In context, consider a person prepared to spend $20,000 annually on college and has narrowed options down to two colleges. One has a pre-financial aid total price of $22,000, awards $4,000 in grant aid, and has a net price of $18,000 (College A). The other college option has a pre-financial aid total price of $50,000, awards $16,000 in grant aid, and has a net price of $34,000 (College B). When pricing information is framed to emphasize grant aid *received* rather

than net price *paid*, the person is significantly more likely to choose the more expensive option even though the scenarios are mathematically identical.

4.4 DISCUSSION

In efforts to improve college outcomes and expand opportunities, college information can be helpful (e.g., Avery & Kane, 2004; Hoxby & Turner, 2013), but details such as the timing, method of delivery, and duration of interventions can substantially impact their effectiveness.

We add to this research by showing that the presentation of information has the potential to influence student enrollment decisions. In our survey-based, MTurk experiment, participants were more likely to choose the enrollment option beyond their stated payment preference when costs were framed in terms of how much financial aid the student would *receive* compared to either how much was left to pay or full information.

It may be tempting to conclude that framing effects led to higher rates of "bad decisions" because College B was beyond participants' maximum payment preferences and could lead to increased student debt, but this is not necessarily the case. In fact, empirical evidence suggests that an aversion to loans – or even the word "loan" itself – could lead students to suboptimal college decisions (Boatman, Evans, & Soliz, 2018, 2017, 2014; DesJardins et al., 2006; Field, 2009). We do not assess the qualitative effects of financial aid framing (i.e., whether framing cost information is "good or bad" for student outcomes), but related student loan research does suggest the potential to use framing effects to encourage optimal borrowing behavior. For example, students enrolled in income-driven student loan repayment plans are less likely to default on their loans by virtue of protections against unaffordable payments, yet many students

do not choose this option (Findeisen & Sachs, 2016). Abraham, Filiz-Ozbay, Ozbay, and Turner (2018) show that when an income-driven repayment option is framed emphasizing the costs, take up is low; yet when an identical option is framed positively to emphasize insurance aspects, students are significantly more likely to choose the plan.

Conversely, it is possible for institutions or other interested parties to deceptively frame information, and indeed, this may be the case. Recall that a recent assessment of more than 500 financial aid award letters found that most do not include a bottom line net price or clearly distinguish between loans and grants (Burd et al., 2018; TICAS 2017). In other words, the majority of actual financial aid letters resemble this study's hypothetical "gain" condition, emphasizing the money received by students rather than the remaining amount to be paid. Among institutions with low completion rates, such practices may exacerbate the student loan default crisis by leading a prospective student to *overestimate* the quality of education and *underestimate* its true cost, resulting in a deliberate imbalance of information to the benefit of the institution and at the expense of the student. Therefore, policymakers, financial aid professionals should consider intended or unintended consequences of framing effects on college decisions. Likewise, future research should continue to explore the ways that the presentation of college information might influence students' decisions.

There are several important limitations to this study. First, the context was contrived, as our study was conducted with participants recruited from Amazon MTurk rather than actual college applicants. Though MTurk data has not been shown to be less reliable than data other common subject pools, the context is still artificial (Bartneck, Duenser, Moltchanova, & Zawieska, 2015). Second, in our presentation to participants, we simplified college cost to three broad terms: total price, financial aid, and out-of-pocket net price. The college options were

thinly detailed and did not include several pieces of information that may be important in real-world college choices. For example, prospective students may consider such factors as location, graduation rates, borrowing rates, majors or concentrations, and input from their friends and family, none of which were included in the descriptions of our sample colleges.

Nonetheless, even with scant information about the hypothetical college option, our results demonstrate that the way information is presented can influence college decisions. Owing to the overwhelming number of postsecondary options and range of factors prospective students might consider, real-world enrollment decisions are almost always made with incomplete information. Given the inherent complexity of college costs and financial aid, it is important to identify what information components are *most critical* to optimal college decisions, and how to most effectively present this information to students and families. The Financial Aid Shopping Sheet is one way to do just that.

5.0 CONCLUSION

The purpose of this dissertation is to examine three aspects relating to information about college prices. Specifically, I focus on NPCs and their accuracy, usefulness, and the potential for differently framing college prices to influence college decisions. However, the results of these studies are important beyond the scope of NPCs alone.

The first study uses the federal template NPC to explore the compromise between effort and accuracy in price forecasting models. I assess variation in actual financial aid awards among students predicted by a college Net Price Calculator (NPC) to receive identical awards and suggest simple modifications to NPCs to reduce the unexplained variation in aid awards by more than half. As more colleges adopt high-sticker price high-discount pricing models, out-of-pocket expenses are increasingly difficult to predict. NPCs clarify price information by providing individualized, institution-specific college price estimates. I focus on the simple federal template NPC, though alternative, more complicated calculators are also common.

The federal template NPC and its more complicated alternatives represent an effort and accuracy tradeoff common to forecasting situations and high information spending decisions. In the context of college price prediction, a simple NPC uses easy-to-access, broad data points to estimate net price, but may sacrifice accuracy. More complicated NPCs request detailed financial information and may provide more accurate price estimates, but risk becoming too burdensome for some to use. As the U.S. Congress considers legislation to create a “universal net price

calculator" that would allow students to enter information just once to see net price information for any postsecondary institution, this paper makes an important contribution to understanding the potential to improve NPCs while maintaining a tool that is simple to use.

The second study probes deeper into whether and how students and parents actually use NPCs and net pricing in their college search and enrollment process. I find students' and parents' perceptions of net pricing varies substantially, but online resources can be helpful to reaching more accurate net price estimates. Critically, students who had previously used NPCs were significantly more accurate in estimating net prices, even when they did not actually use an NPC in their online searchers during the interview.

The final study explores how differently framing college pricing information might influence enrollment decisions. I show that people were more likely to choose an enrollment option beyond their stated payment preference when costs are framed in terms of how much financial aid the student would *receive* compared to either how much was left to pay or full information including total costs, financial aid, and net pricing. This result is especially important considering that the majority of actual financial aid letters resemble the "gain" condition used in the study that emphasizes aid received without clearly delineating remaining expenses or differentiating between aid that needs to be paid back and aid that does not.

Net pricing is not unique to higher education, but conflating net prices and maximum total price could be especially problematic if it results in an underinformed decision to forego college all together. Consider other purchases where net, out-of-pocket prices are initially uncertain, such as booking a hotel room or plane ticket, buying or renting a car, or even hailing a ride using Uber or Lyft. In each of these scenarios, net prices are uncertain at the outset, much like college net prices. The difference between these examples and college net pricing is that

buyers are likely to anticipate dynamic or uncertain pricing. I suggest for future research to study other markets where dynamic pricing is the norm to learn how to more effectively inform potential students that listed sticker prices are the maximum amount any student at a given institution pays and the share of students paying the full, listed price.

Over a decade ago, Perna (2006) argued that simply making information available without also making it accessible and relevant is insufficient, and contributes to continued inequalities in a range of college outcomes. Since then, the amount of college information available online has increased tremendously with legislative, nonprofit, and for-profit initiative alike. The results of the studies discussed in this dissertation suggest that clearly structured, simple to use informational resources can accurately and effectively communicate important college information. The internet has great equalizing potential for improving college pricing information, and websites that eschew sticker prices in favor of net prices are a step in the right direction. However, simply because resources exist does not mean that students and families have an equal chance of knowing where to find them or how to use them in their college search. Moreover, the potential for intentional or inadvertent influences of framing effects adds another dimension to Perna's argument. Indeed, simply making resources available without consideration of accessibility or relevance is still insufficient; however, policymakers and other hosts of college information resources should also carefully consider the ways that the presentation of college information might influence students' decisions.

APPENDIX A

APPENDIX TO CHAPTER 2, INFORMATION AND ACCURACY IN COLLEGE PRICE ESTIMATES: ASSESSING VARIATION IN GRANT AID AWARDS EXPLAINED BY NET PRICE CALCULATORS

A1 SUPPLEMENTARY TABLES AND FIGURES

A1.1 Alternative vs federal template NPCs and individual NPC modifications

	Alternative NPCs	Federal NPCs
	R^2 (RMSE)	
Federal template NPC	84.8 (6,360)	82.8 (3,520)
High income brackets ($100,000-$150,000, >$150,000)	86.8 (6,100)	83.1 (3,560)
2.5 GPA	85.9 (6,520)	86.4 (3,390)
3.0 GPA	87.0 (6,520)	87.0 (3,500)
3.5 GPA	89.0	88.2

Table A.1.1 continued

	(6,160)	(3,340)
February 1 FAFSA	87.8	88.4
	(6,270)	(3,110)
March 1 FAFSA	88.6	85.9
	(6,200)	(3,600)
April 1 FAFSA	87.5	85.5
	(6,350)	(3,660)
Difference in R^2 between basic and "best" modified NPC model (pp)	4.2	5.6
% of remaining variation explained	28%	33%
N	8,920	3,770

Note R^2 quantifies the extent to which data collected in the federal template NPC and its proposed modifications explain variation in actual grant aid awards. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in grant aid awards among similarly-profiled students. Proposed high school GPA and FAFSA timing variables are coded dichotomously to indicate high (low) high school GPA or early (late) FAFSA submission.

A2 CHAPTER 2 TABLES AND FIGURES, RESTRICTED SAMPLE SIZE

Table A2.1 Descriptive statistics

	Full sample	
	Mean (SD)	Median
Total price	27,800 (13,740)	25,400

Table A.2.1 continued

Net price	19,600 (12,330)	17,800
EFC	9,200 (18,700)	0
Income	58,300 (76,200)	29,000
Total grant aid	8,100 (8,700)	5,700
Federal aid	3,300 (2,620)	4,300
State aid	915 (1,970)	0
Institutional aid	2,800 (6,600)	0
N	7,650	

Source: National Postsecondary Student Aid Survey, 2012

Note. All price figures are in 2012 U.S. Dollars. Four and five-digit numbers are rounded to hundreds and standard deviations are rounded to tens, as per NPSAS guidelines.

Table A2.2 EFC analysis

	Full sample	Public 4-year	Private 4-year	Public 2-year	For-profit
			R^2 (RMSE)		
Federal template NPC	67.0 (10,800)	65.1 (11,500)	58.8 (17,900)	69.3 (5,700)	74.0 (4,900)
High income bracket ($100,000-$150,000, >$150,000)	80.7 (8,200)	78.8 (9,000)	75.6 (13,700)	77.4 (4,900)	83.8 (3,900)
Difference in R^2 between basic and "best" modified NPC model (pp)	13.7	13.7	16.8	8.1	9.8
% of remaining variation explained	42%	39%	41%	26%	38%
N	7,560	1,520	1,560	2,090	2,230

Note. R^2 quantifies the extent to which the EFC lookup table provided by the U.S. Department of Education and used in the federal template NPC model explain actual FAFSA-derived EFCs. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in EFC.

Table A2.3 Individual NPC modifications

	Full sample	Public 4-year	Private 4-year	Public 2-year	For-profit
			R^2 (RMSE)		
Federal template NPC	70.1 (5,670)	68.9 (4,050)	56.8 (10,900)	62.1 (2,430)	53.3 (3,540)
High income	75.4 (5,410)	73.2 (4,120)	66.2 (10,670)	63.4 (2,450)	56.0 (3,510)
2.5 GPA	72.6 (5,790)	72.1 (4,050)	59.1 (10,940)	70.7 (2,330)	62.1 (3,450)
3.0 GPA	74.7 (5,830)	74.4 (4,100)	61.9 (10,950)	74.4 (2,300)	65.4 (3,420)
3.5 GPA	78.5 (5,490)	80.7 (3,790)	68.8 (10,780)	74.0 (2,280)	63.8 (3,470)
February 1 FAFSA	76.4 (5,500)	79.4 (3,800)	65.9 (11,090)	69.1 (2,330)	58.6 (3,520)
March 1 FAFSA	77.3 (5,560)	77.6 (4,010)	66.8 (10,760)	72.9 (2,330)	65.2 (3,360)
April 1 FAFSA	75.3 (5,720)	74.0 (4,070)	63.7 (10,710)	73.2 (2,350)	63.9 (3,440)

Table A.2.3 continued

Difference in R^2 between basic and "best" modified NPC model (pp)	8.4	11.8	12.0	12.3	12.1
% of remaining variation explained	27%	38%	28%	32%	26%
N	7,560	1,520	1,560	2,090	2,230

Note. R^2 quantifies the extent to which data collected in the federal template NPC and its proposed modifications explain variation in actual grant aid awards. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in grant aid awards among similarly-profiled students. Proposed high school GPA and FAFSA timing variables are coded dichotomously to indicate high (low) high school GPA or early (late) FAFSA submission.

Table A2.4 NPC model combinations

			Full sample	Public 4-year	Private 4-year	Public 2-year	For-profit
			R^2 (RMSE)				
Federal template NPC			70.1 (5,670)	68.9 (4,050)	56.8 (10,900)	62.1 (2,430)	53.3 (3,540)
High income brackets ($100,000-150,000 & >$150,000)	February 1 FAFSA	2.5 GPA	82.6 (5,310)	83.1 (3,970)	75.3 (10,830)	76.8 (2,270)	69.7 (3,340)
		3.0 GPA	83.8 (5,380)	85.6 (3,890)	76.6 (11,030)	78.8 (2,310)	73.3 (3,230)
		3.5 GPA	86.1 (5,030)	88.1 (3,750)	81.2 (10,670)	79.7 (2,210)	70.1 (3,400)
	March 1 FAFSA	2.5 GPA	82.1 (5,580)	83.1 (4,030)	73.3 (11,080)	80.4 (2,230)	74.7 (3,180)
		3.0 GPA	83.6 (5,640)	84.8 (4,090)	75.1 (11,120)	82.7 (2,260)	78.9 (3,030)
		3.5 GPA	85.4 (5,380)	88.4 (3,800)	78.8 (11,040)	82.6 (2,220)	74.6 (3,280)
	April 1 FAFSA	2.5 GPA	80.8 (5,700)	78.0 (4,130)	71.7 (10,810)	81.0 (2,230)	71.0 (3,430)
		3.0 GPA	82.3	82.1	73.4	82.1	75.4

Table A.2.4 continued

	(5,780)	(4,150)	(10,850)	(2,350)	(3,310)
3.5 GPA	84.9	85.3	78.1	82.4	76.6
	(5,420)	(4,010)	(10,620)	(2,270)	(3,190)
Difference in R^2 between basic and "best" modified NPC model (pp)	16.0	19.5	24.4	20.6	25.6
% of remaining variation explained	54%	63%	56%	54%	55%
N	7,560	1,520	1,560	2,090	2,230

Note. R^2 quantifies the extent to which data collected in the federal template NPC and its proposed modifications explain variation in actual grant aid awards. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in grant aid awards among similarly-profiled students. Proposed high school GPA and FAFSA timing variables are coded dichotomously to indicate high (low) high school GPA or early (late) FAFSA submission.

Table A2.5 Alternative vs federal template NPCs and individual NPC modifications

	Alternative NPCs	Federal NPCs
	R^2 (RMSE)	
Federal template NPC	69.3 (6,360)	69.0 (3,520)
High income brackets ($100,000-$150,000, >$150,000)	75.1 (6,040)	71.7 (3,510)
2.5 GPA	71.4 (6,520)	75.5 (3,390)

Table A.2.5 continued

3.0 GPA	73.6	76.7
	(6,520)	(3,500)
3.5 GPA	77.8	78.8
	(6,160)	(3,340)
February 1 FAFSA	75.3	79.1
	(6,270)	(3,110)
March 1 FAFSA	76.9	74.6
	(6,200)	(3,600)
April 1 FAFSA	74.7	73.8
	(6,350)	(3,660)
Difference in R^2 between basic and "best" modified NPC model (pp)	8.5	10.1
% of remaining variation explained	28%	33%
N	5,290	2,270

Note. R^2 quantifies the extent to which data collected in the federal template NPC and its proposed modifications explain variation in actual grant aid awards. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in grant aid awards among similarly-profiled students. Proposed high school GPA and FAFSA timing variables are coded dichotomously to indicate high (low) high school GPA or early (late) FAFSA submission.

Table A2.6 Alternative vs federal template NPCs and NPC model combinations

			Alternative NPC	Federal NPC
			R^2 (RMSE)	
Federal template NPC			69.3 (6,360)	69.0 (3,520)
High income brackets ($100,000-150,000 & >$150,000)	February 1 FAFSA	2.5 GPA	81.7 (6,080)	85.9 (2,890)
		3.0 GPA	83.0 (6,110)	86.5 (2,990)
		3.5 GPA	85.7 (5,700)	85.9 (3,040)
	March 1 FAFSA	2.5 GPA	81.5 (6,270)	82.5 (3,390)
		3.0 GPA	83.2 (6,280)	83.3 (3,550)
		3.5 GPA	85.2 (6,010)	84.1 (3,430)
	April 1 FAFSA	2.5 GPA	80.0 (6,380)	82.2 (3,420)
		3.0 GPA	81.7	82.7

Table A.2.6 continued

		(6,390)	(3,650)
	3.5 GPA	84.6	83.7
		(6,010)	(3,500)
Difference in R^2 between basic and "best" modified NPC model (pp)		16.4	17.5
% of remaining variation explained		53%	56%
N		5,290	2,270

Note. R^2 quantifies the extent to which data collected in the federal template NPC and its proposed modifications explain variation in actual grant aid awards. RMSE (in parentheses) measures in dollars the standard deviation of the residual variation in grant aid awards among similarly-profiled students. Proposed high school GPA and FAFSA timing variables are coded dichotomously to indicate high (low) high school GPA or early (late) FAFSA submission.

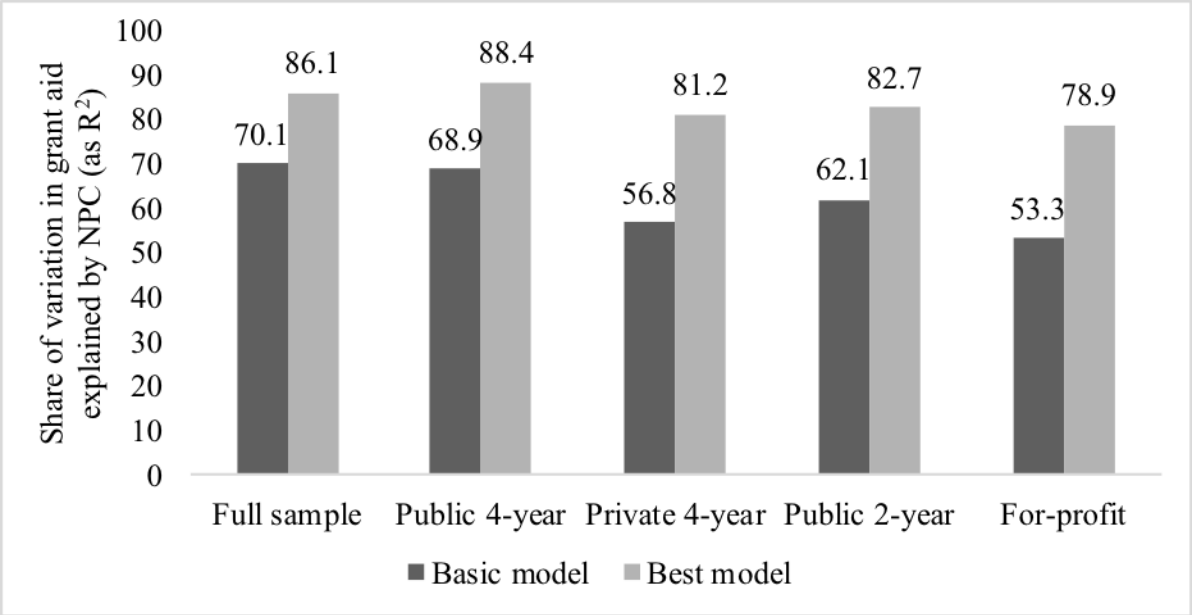

Figure A2.1 Overall results, comparing Fed. template NPC model federal template NPC

N=7,560

A3 ADDITIONAL INFORMATION ON THE FEDERAL ESTIMATED FAMILY CONTRIBUTION METHODOLOGY

For dependent students, total EFC is the sum of two separate calculations. The first is the parents' total income, which consists of the sum of total taxable earnings from both parents as well as taxed and untaxed income and benefits minus certain qualifying deductions from total income such as education credits or child support.

Next, certain allowances are deducted from the family's total income. Allowances against income include previous state and federal taxes, an employment expense allowance, a social security tax allowance and income protection allowance.[47] The social security tax allowance and the income protection allowance are both progressive rates derived from accompanying look-up tables. Parents' available income is their total income less total allowances.

The formula then addresses parents' assets, which include: cash, savings, and checking values; investments; and business net worth. Students use an additional look-up table to calculate parents' educational savings and asset protection allowance. The education savings and asset protection allowance is subtracted from the net worth to derive the parents' discretionary net worth. 12 percent of this amount is the parents' contribution from assets. The parents' available income and their contribution from assets form their adjusted available income, which is assessed at a progressive rate on an additional look-up table. Finally, this amount is divided by

[47] Up to the 2015-2016 school year, families listed tax information from the previous calendar year. Beginning with the 2016-2017 academic year, families use tax information reported two years prior to the year of enrollment. For example, a student enrolling in the fall of 2017 would use information from the family's 2015 tax returns.

the number from the household in college in the upcoming academic year to reach the parents' contribution to the cost of college.

The student's contribution formula is similar. The student's income includes taxable earnings minus certain allowances such as education credits. Additional allowances are mostly the same as those on the parents' form, but unlike their parents, students have a flat income protection allowance. Additionally, students do not have an employment expense allowance, but do include the absolute value of their parents' adjusted available income if that figure is negative. Also unlike their parents, the student's available income is assessed at 50 percent, and their assets are assessed at 20 percent rather than 12 percent. After-assessment values of available income and assets combine to make up the student's total contribution. The student's contribution and the parents' contribution are added together to reach a final EFC.

APPENDIX B

APPENDIX TO CHAPTER 3, INFORMATION AND ACCURACY IN STUDENT PERCEPTIONS OF COLLEGE NET PRICING

B1 ADDITIONAL REGRESSION MODEL

Table B1.1 Predictors of net price estimate differential and estimate to target NPC ratio

	Dollar differential			Estimate to NPC target value ratio		
Variable	**Slope coefficient (se)**	**Intercept (se)**	**R^2**	**Slope coefficient (se)**	**Intercept (se)**	**R^2**
Female	4,464	4,583	.02	0.32	1.20~	.02
	(8,249)	(7,679)		(0.62)	(0.57)	
Race: Black	-13,949*	19,611**	.30	-0.97~	2.25***	.26
	(5,940)	(5,313)		(0.45)	(0.41)	
Low income	294	8,275	.00	0.36	1.26**	.05
(Under $40,000)	(5,787)	(4,482)		(0.42)	(0.32)	

Counselor	-1,126	9,203~	.00	-0.34	1.70***	.05
available	(6,007)	(4,904)		(0.44)	(0.36)	
Sibling(s) in	3,547	7,506*	.02	0.46	1.35***	.07
college	(6,336)	(3,272)		(0.46)	(0.24)	
Household size	-146	9,008	.00	0.04	1.33~	.00
	(2,431)	(9,663)		(0.18)	(0.72)	

Note. Results from regression of estimate differentials and estimate ratios on predictors. Standard errors in parentheses. In all regressions on the left, the outcome is the dollar differential between net price estimates and NPC target values. In all regressions on the right, outcome is the ratio of net price estimates to NPC target values. With an N of 15, power is low and results are suggestive of relationships between outcomes and predictors rather than definitive.

~p<.10. *p<.05. ** p<.01. ***p<.001

B2 INTERVIEW PROTOCOL

I. *Student questions; ice-breakers, background and general college search*

1. Plans after high school

2. Have you thought much about what you might want to study in college?

Parent background, college experience, and search

3. Can you tell me more about your experience with college? Did you go yourself? Have you ever helped another child or family member with college enrollment?

4. In what ways are you involved in your child's college search process?

II. ***Card sorting***

I'm going to give you each a set of cards with different factors that you might be considering in your college search. Each of you separately sort the cards into two piles: "more important" and "less important" for choosing a school. Stack and set aside those that you considered less and important and gather the "more important" stack in front of you. Now repeat the process, sorting the cards from into more and less important categories once again. Repeat this process until you are left with just 3 or fewer cards in the "More important" category.

- Cost (tuition + food and housing)
- Availability of financial aid or scholarships
- Location
- Academic reputation
- Parents' advice
- Friends' advice
- Teachers' or counselors' advice
- Size (number of students)
- Student life (social reputation)
- Sports programs
- Career or major specialty
- Graduation rate

Let's talk through which ones you each found to be most important.

III. ***Resources – get to these questions as financial aid comes up in previous activity***

1. How do you find what you want to know about colleges you might be interested in?

2. I notice you put cost in the more (less) important stack. Do you worry about being able to pay for college? (request response from both parent and student)

a. How does that affect your search process?

b. If money were completely taken out of the picture, how do you think your college search and decision process would change?

c. Have you ruled out any colleges from your search because you think they'd be unaffordable? How do you know they'd be unaffordable?

3. I see you put financial aid as more (less) important. Can you tell me more about that? If you had a question about applying for financial aid – something like, how much financial aid will I get? Or, How much will I have to pay? – who would you talk to or where would you go to find out more information?

a. Have you had these kinds of questions? What did you find out?

IV. College cost resources activity

For the next set of questions, I'm going to ask you both to give your best guess at costs to attend a local school. Choose the one that you might be most likely to apply to: Duquesne, SRU, or CCAC

1. Imagine a student from Pennsylvania who applies to and is admitted to X. How much would it cost the student each year to attend X?

    a. How did you come up with that guess?

2. Now consider a family of four from Allegheny County with an annual income of $50,000, which is a little below the middle income for Allegheny County. After receiving financial aid, how much would it cost to attend X?
    a. Explain how you decided on this.
3. Now consider [student's name]. How much would you have to pay for [student's name] to attend X?
    a. If no idea; prompt for ideas about how they might find out. If they do not mention going online or using a computer, prompt the question – then request to elaborate and demonstrate.

Place laptop in front of student and parent with open web browser

4. Again, consider [student's name]. How much would you have to pay for [student's name] to attend X? You may use any online resources that you'd like to help with your estimate.

    Here, observe resources used. If no ideas, redirect to school NPC.
5. I've opened the browser to an online tool to help with one last estimate. Once again, consider [student's name]. Use these sites to estimate how much you would have to pay for [student's name] to attend X. If you want help using the tool, I'll be happy to assist.
    a. Had you used this site (i.e., NPC) before?
    b. If yes, how did you find out about it?
6. What did you learn that you didn't know before?
7. How could any of the online resources you used be easier to use or understand?
    a. Looking at the last estimate and the net price calculators specifically, how clearly did you feel you understood the information it provided?

b. Can you explain to me what you learned about how much it'd cost to go to X school?

c. How much do you believe this is what you'd actually end up paying if you went to X? In other words, do you believe this pricing information is true for you specifically?

8. If you were helping a friend through the college search process, what advice would you have? Would you recommend they use this site?

9. *To parent*, Do you feel any differently about paying for your child's college attendance after using these resources? How so?

10. Any questions for me?

APPENDIX C

APPENDIX TO CHAPTER 4, FRAMING EFFECTS OF FINANCIAL AID ON COLLEGE SELECTION

C1 DEPARTMENT OF EDUCATION FINANCIAL AID SHOPPING SHEET

MM / DD / YYYY

University of the United States (UUS)

Student Name, Identifier

Download

Costs in the 2018-19 year

Estimated Cost of Attendance		**$X,XXX** / yr
Tuition and fees	$ X,XXX	
Housing and meals	X,XXX	
Books and supplies	X,XXX	
Transportation	X,XXX	
Other education costs	X,XXX	

Grants and scholarships to pay for college

Total Grants and Scholarships ("Gift" Aid; no repayment needed)		**$X,XXX** / yr
Grants and scholarships from your school	$ X,XXX	
Federal Pell Grant	X,XXX	
Grants from your state	X,XXX	
Other scholarships you can use	X,XXX	

What will you pay for college

Net Costs **$X,XXX** / yr
(Cost of attendance minus total grants and scholarships)

Options to pay net costs

Work options

Work-Study (Federal, state, or institutional)	$ X,XXX

Loan Options*

Federal Perkins Loan	$ X,XXX
Federal Direct Subsidized Loan	X,XXX
Federal Direct Unsubsidized Loan	X,XXX

*Recommended amounts shown here. You may be eligible for a different amount. Contact your financial aid office.

Other options

Family Contribution **$X,XXX** / yr
(As calculated by the institution using information reported on the FAFSA or to your institution.)

- Payment plan offered by the institution
- Parent or Graduate PLUS Loans
- American Opportunity Tax Credit *
- Military and/or National Service benefits
- Non-Federal private education loan

*Parents or students may qualify to receive up to $2,500 by claiming the American Opportunity Tax Credit on their tax return during the following calendar year.

Graduation Rate

Percentage of full-time students who graduate within 6 years

XX.X%

Low | Medium | High

Repayment Rate

Percentage of borrowers entering into repayment within 3 years of leaving school

XX.X%

X.X% National Average

This Institution

Median Borrowing

Students who borrow at UUS typically take out $X,XXX in Federal loans for their undergraduate study. The Federal loan payment over 10 years for this amount is approximately $X,XXX per month. Your borrowing may be different.

Repaying your loans

To learn about loan repayment choices and work out your Federal Loan monthly payment, go to:

http://studentaid.ed.gov/repay-loans/understand/plans

For more information and next steps:

University of the United States (UUS)
Financial Aid Office
123 Main Street
Anytown, ST 12345
Telephone: (123) 456-7890
E-mail: financialaid@uus.edu

Customized information from UUS

C2 FINANCIAL AID AND COLLEGE ENROLLMENT DECISIONS SURVEY

1. The purpose of this research is to study people's college investment choices in relation to offers of financial aid. We are surveying individuals age 18 or older and living in the U.S. from Amazon MechanicalTurk. We will ask you to complete a five-minute questionnaire. If you are willing to participate, our questionnaire will ask about your background as well as your opinion on a hypothetical college selection decision. Each participant will receive $.25 via MechanicalTurk as a token of our appreciation.

There are no foreseeable risks associated with this project. This is an entirely anonymous questionnaire, so no identifying information will be recorded. Your participation is completely voluntary, and you may choose to stop at any time.

This study is being conducted by Aaron Anthony (aaronanthony@pitt.edu) from the University of Pittsburgh.
Thank you.

2. Let's review some basic terminology about college cost.

Total price is the full cost of college and includes all tuition, fees, room and board, travel, books, and any additional expenses.

Financial aid includes both grants (that DO NOT need to be repaid) and loans (that DO need to be repaid) for students to use towards the total price of college.

Out of pocket net price is the immediate, yearly amount students pay to attend college after subtracting all financial aid from the total price.

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3. College cost information can be confusing. Let's review your understanding of the previous terms.

4. What is financial aid?

The full cost of college

The amount a student has to pay after receiving scholarships

Money from other sources that includes both grants and loans for students to use to pay for college

5. What is a college's total price?

The cost of tuition

The full cost to attend college, including tuition, fees, room and board, and any other expenses

The amount of money you can borrow to go to college

6. What is a student's out of pocket net price?

The amount a student pays to attend college after subtracting all financial aid from the total cost

The total amount of financial aid a student gets

The price to attend college, including all tuition, fees, room and board, and other expenses

7. Here's a short list of average net prices at some elite public and private colleges:

College	**Average Net Price** (to nearest thousand)
Stanford University	$15,000
University of Michigan	$16,000
University of Virginia	$18,000
Yale University	$20,000
Duke University	$25,000
University of Chicago	$26,000
Penn State University	$28,000
University of Notre Dame	$29,000
Carnegie Mellon University	$32,000

8. What is the most you would pay in annual out-of-pocket net price to attend an elite college?

7500

10000

15000

20000

25000

30000

9. How certain are you that you would pay $7500 to attend an elite college?

Probably certain

Definitely certain

16.

Suppose you are making a decision about which college to attend. Presume you have already applied and been accepted at both schools below, and now you need to make a decision about where to enroll.

Please review the profiles of the two schools below.

College A is a highly competitive public university. The school is very well-regarded and generally places in the top 100 universities in the U.S. according to the most popular ranking sources. College A has a total price of $8250 and *you get* $1500 in financial aid.	College B is a highly competitive private university. The school is very well-regarded and generally places in the top 20 universities in the U.S. according to the most popular ranking sources. College B has a total price of $18750 and *you get* $6000 in financial aid.

Which school would you choose?

College A

College B

19. In a sentence or two, explain how you made this decision

20. Indicate your age

21. Do you live in the United States?

Yes

No

22. Indicate your gender

Male

Female

23. What is your race / ethnicity?

White

Black or African American

Hispanic or Latino

Asian

Other

24. What is your highest level of education completed?

- Less than high school
- High school diploma
- Some college
- Associates or other 2-year degree
- Bachelor's degree
- Graduate degree

25. Did you take out loans to pay for college?

- Yes
- No

26. Indicate your approximate annual income.

- Below $20,000
- $20,000-$40,000
- $40,000-$60,000
- $60,000-$80,000
- $80,000-$100,000
- $100,000 +

We thank you for your time spent taking this survey.
Your response has been recorded.

Your MTurk completion code is:
41276417

BIBLIOGRAPHY

Abraham, K. G., Filiz-Ozbay, E., Ozbay, E. Y., & Turner, L. J. (2018). *Framing effects, earnings expectations, and the design of student loan repayment schemes*. Cambridge, MA: National Bureau of Economic Research.

ACSFA. (2005). *The student aid gauntlet: Final report of the special studyof simplification of need analysis and application for Title VI AID*. Washington, DC: Author.

Anthony, A. M., Page, L. C., & Seldin, A. (2016). In the right ballpark? Assessing the accuracy of net price calculators. *Journal of Student Financial Aid*, *46*(2), 25-50.

Autor, D. H. (2014). Skills, education, and the rise of earnings inequality among the "other 99 percent." *Science*, *344*(6186), 843–851.

Avery, C., Howell, J. S., & Page, L. C. (2014). *Research brief: A review of the role of college applications on students' postsecondary outcomes.* New York, NY: College Board.

Avery, C., & Hoxby, C. M. (2004). Do and should financial aid packages affect students' college choices? In *College choices: The economics of where to go, when to go, and how to pay for it* (pp. 239–302). Chicago, IL: University of Chicago Press.

Avery, C., & Kane, T. J. (2004). Student perceptions of college opportunities: The Boston COACH program. In C. M. Hoxby (Ed.), *College choices: The economics of where to go, when to go, and how to pay for it* (pp. 355–394). Chicago, IL: University of Chicago Press.

Bailey, M. J., & Dynarski, S. (2011). *Gains and gaps: Changing inequality in US college entry and completion* (No. W17633). Cambridge, MA: National Bureau of Economic Research.

Bartik, T. J., & Hershbein, B. (2018). *Degrees of poverty: The relationship between family income background and the returns to education*. Upjohn Institute Working Paper 18-284. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research. https://doi.org/10.17848/wp18-284

Bartneck, C., Duenser, A., Moltchanova, E., & Zawieska, K. (2015). Comparing the similarity of responses received from studies in Amazon's Mechanical Turk to studies conducted online and with direct recruitment. *PloS One*, *10*(4), e0121595.

Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *The Journal of*

Political Economy, *70*(5), 9–49.

Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to schooling*. New York, NY: Columbia University Press.

Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis with special references to education* (3rd ed.). Chicago, IL: University of Chicago Press.

Bertaux, D. (1981). *Biography and society: The life history approach in the social sciences* (Vol. 23). Beverly Hills, CA: Sage Publications.

Bettinger, E. P., Long, B. T., Oreopoulos, P., & Sanbonmatsu, L. (2012). The role of application assistance and information in college decisions: Results from the H&R Block FAFSA experiment. *The Quarterly Journal of Economics*, *127*(3), 1205–1242.

Betts, J. R. (1996). What do students know about wages? Evidence from a survey of undergraduates. *Journal of Human Resources*, 31(1), 27-56.

Blumenschein, K., Blomquist, G. C., Johannesson, M., Horn, N., & Freeman, P. (2008). Eliciting willingness to pay without bias: evidence from a field experiment. *The Economic Journal*, *118*(525), 114–137.

Boatman, A., Evans, B. J., & Soliz, A. (2017). Understanding loan aversion in education: Evidence from high school seniors, community college students, and adults. *AERA Open*, *3*(1), *1–16*. 2332858416683649.

Boatman, A., Evans, B., & Soliz, A. (2014). *Applying the lessons of behavioral economics to improve the federal student loan programs: Six policy recommendations*. Indianapolis, IN: Lumina Foundation.

Bourdieu, P. (1986). The forms of capital. In J. G. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241–258). New York, NY: Greenwood Press. http://doi.org/10.1002/9780470755679.ch15

Bourdieu, P., & Wacquant, L. J. D. (1992). *An invitation to reflexive sociology*. Chicago, IL: University of Chicago Press.

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*, *6*(1), 3–5.

Burd, S., Fishman, R., Keane, L., & Habbert, J. (2018). *Decoding the cost of college: The case for transparent financial aid award letters*. Washington, DC. Retrieved from https://newamerica.org/documents/2301/Decoding_the_Cost_of_College_Final_6218.pdf

Cabrera, A. F., & La Nasa, S. M. (2001). On the path to college: Three critical tasks facing America's disadvantaged. *Research in Higher Education*, *42*(2), 119–149.

Callan, P., Doyle, W. R., & Finney, J. (2016). *College affordability diagnosis*. Technical report.

Philadelphia, PA: University of Pennsylvania Institute on Research in Higher Education,.

Carnevale, A. P., Smith, N., & Strohl, J. (2013). *Recovery: Job growth and education requirements through 2020*. Washington, DC: Center on Education and the Workforce.

Casey, B. J., Jones, R. M., & Somerville, L. H. (2011). Braking and accelerating of the adolescent brain. *Journal of Research on Adolescence, 21*(1), 21–33.

Castleman, B. L., & Page, L. C. (2016). Freshman year financial aid nudges: An experiment to increase FAFSA renewal and college persistence. *Journal of Human Resources, 51*(2), 389–415.

Council of Economic Advisors. (2016, July). Investing in Higher Education: Benefits, Challenges, and the State of Student Debt. Retrieved from https://obamawhitehouse.archives.gov/sites/default/files/page/files/20160718_cea_student_debt.pdf

Ceja, M. A. (2001). *Applying, choosing, and enrolling in higher education: Understanding the college choice process of first-generation Chicana students* (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Global. (Order No. 3026250)

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Thousand Oaks, CA: Sage.

Cheng, D. (2012). *Adding it all up 2012: Are college net price calculators easy to find, use, and compare?* Washington, DC: The Institute for College Access & Success.

Clinedinst, M., & Koranteng, A. M. (2017). *State of college admission.* Retrieved from National Association for College Admission Counseling website: https://www.nacacnet.org/globalassets/documents/publications/research/soca17final.pdf

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94 (Suppl.)*, 95-120.

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. (3rd ed.). Los Angeles, CA: Sage.

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.

Cummings, R. G., Harrison, G. W., & Rutström, E. E. (1995). Homegrown values and hypothetical surveys: is the dichotomous choice approach incentive-compatible? *The American Economic Review, 85*(1), 260–266.

Daly, M. C., & Bengali, L. (2014). Is it still worth going to college? *FRBSF Economic Letter, 13*.

Dee, T. S. (2004). Are there civic returns to education? *Journal of Public Economics, 88*(9), 1697–1720.

Deming, D., & Dynarski, S. (2009). *Into college, out of poverty? Policies to increase the postsecondary attainment of the poor* (No. 15387) Cambridge, MA: National Bureau of Economic Research.

DesJardins, S. L., Ahlburg, D. A., & McCall, B. P. (2006). An integrated model of application, admission, enrollment, and financial aid. *Journal of Higher Education*, 77(3), 381–429.

Desjardins, S. L., & Toutkoushian, R. K. (2005). Are students really rational? The development of rational thought and its application to student choice. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. XX, pp. 191–240). Dordrecht, Nethlerlands: Springer.

Dynarski, S., & Scott-Clayton, J. (2013). *Financial aid policy: Lessons from research* (No. 18710). Cambridge, MA: National Bureau of Economic Research.

Dynarski, S., & Scott-Clayton, J. E. (2006). The cost of complexity in federal student aid: Lessons from optimal tax theory and behavioral economics. *National Tax Journal*, *LVIV*, 319–356. http://doi.org/10.3386/w12227

Dynarski, S., & Scott-Clayton, J. E. (2008). *Complexity and targeting in federal student aid: A quantitative analysis* (No. 13801). Cambridge, MA: National Bureau of Economic Research.

Dynarski, S., & Wiederspan, M. (2012). *Student aid simplification: Looking back and looking ahead* (No. 17834). Cambridge, MA: National Bureau of Economic Research.

Ellwood, D., & Kane, T. J. (2000). Who is getting a college education? Family background and the growing gaps in enrollment. In S. Danziger & J. Waldfogel (Eds.), *Securing the future: Investing in children from birth to college* (pp. 283–324). New York, NY: Russell Sage Foundation.

Evans, B. J., Boatman, A., & Soliz, A. (2018). Framing and labeling effects in preferences for borrowing for college: An experimental analysis. *Research in Higher Education*, 1-20. doi:10.1007/s11162-018-9518-9518-y.

Field, E. (2009). Educational debt burden and career choice: Evidence from a financial aid experiment at NYU law school. *American Economic Journal: Applied Economics*, *1*(1), 1–21.

Findeisen, S., & Sachs, D. (2016). Education and optimal dynamic taxation: The role of income-contingent student loans. *Journal of Public Economics*, *138*, 1–21.

Follmer, D. J., Sperling, R. A., & Suen, H. K. (2017). The Role of MTurk in education research: Advantages, issues, and future directions. *Educational Researcher*, 46(6), 329-334.

Goldin, C., & Katz, L. (2008). *The race between technology and education.* Cambridge, MA: Harvard College.

Goodman, J. K., Cryder, C. E., & Cheema, A. (2013). Data collection in a flat world: The strengths and weaknesses of Mechanical Turk samples. *Journal of Behavioral Decision Making*, *26*(3), 213–224.

Gosling, S. D., Vazire, S., Srivastava, S., & John, O. P. (2004). Should we trust web-based studies? A comparative analysis of six preconceptions about internet questionnaires. *American Psychologist*, *59*(2), 93.

Grodsky, E., & Jones, M. T. (2007). Real and imagined barriers to college entry: Perceptions of cost. *Social Science Research*, *36*(2), 745–766.

Guzman, G. G. (2017). Household income: 2016. *American Community Survey Briefs. US Bureau of the Census:* https://www. Census. Gov/Content/Dam/Census/Library/Publications/2017/Acs/Acsbr16-02. Pdf.

Harrison, G. W., & Rutström, E. E. (2008). Experimental evidence on the existence of hypothetical bias in value elicitation methods in C. R. Plott, & V. L. Smith (Eds.), *Handbook of experimental economics results*, *1*, 752–767. New York, NY: Elsevier Press.

Hesel, R. A., & Williams, R. C. (2010). Students and parents making judgments about college costs without complete information. *Student Poll*, *8*(1), 1-11.

Hofferth, S. L., Boisjoly, J., & Duncan, G. J. (1998). Parents' extrafamilial resources and children's school attainment. *Sociology of Education*, *71*, 246–268.

Horn, L. J., Chen, X., & Chapman, C. (2003). *Getting ready to pay for college: What students and their parents know about the cost of college tuition and what they are doing to find out (Report No. 2003030)*. Washington, DC: National Center for Education Statistics.

Hossler, D., Braxton, J., & Coopersmith, G. (1989). Understanding student college choice. In J. C. Smart (Ed), *Higher education: Handbook of theory and research*, *5*, 231–288. Dordrecht, Nethlerlands: Springer.

How Financial Aid Award Letters Fall Short. (2017). Retrieved from https://ticas.org/sites/default/files/pub_files/cost_in_translation.pdf

Hoxby, C. M., & Avery, C. (2013). The missing" one-offs": The hidden supply of high-achieving, low-income students. *Brookings Papers on Economic Activity*, *2013*(1), 1–65.

Hoxby, C., & Turner, S. (2013). Expanding college opportunities for high-achieving, low income students. *Stanford Institute for Economic Policy Research Discussion Paper*, (12-014).

Hoxby, C. M., & Turner, S. (2015). What high-achieving low-income students know about college. *American Economic Review*, *105*(5), 514–517.

Huntington-Klein, N. (2016). *The search: The effect of the college scorecard on interest in colleges*. Unpublished manuscript.

Hurwitz, M., & Smith, J. (2018). Student responsiveness to earnings data in the College Scorecard. *Economic Inquiry*, *56*(2), 1220–1243.

Ikenberry, S. O., & Hartle, T. W. (1998). *Too little knowledge is a dangerous thing: What the public thinks and knows about paying for college*. Washington, DC: American Council on Education Fulfillment Service.

John, E. P. S. (2004). *Public policy and college access: Investigating the federal and state roles in equalizing postsecondary opportunity* (Vol. 19). Portland: Ringgold, Inc.

Johnson, E. J., & Payne, J. W. (1985). Effort and accuracy in choice. *Management Science*, *31*(4), 395–414.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 1986–263.

Kane, T. J. (1995). *Rising public college tuition and college entry: How well do public subsidies promote access to college?* Cambridge, MA: National Bureau of Economic Research.

Kane, T. J. (1999). *The price of admission: Rethinking how Americans pay for college*. Washington, DC: Brookings Institution Press.

Kantrowitz, M. (2010). Survey concerning the standardization of financial aid award letters. Retrieved from Fastweb website: http://www.fastweb.com/nfs/fastweb/static/SAPA_Survey_Concerning_Standardization_of_Financial_Aid_Award_Letters.pdf.

Kelchen, R., Hosch, B. J., & Goldrick-Rab, S. (2014). *The costs of college attendance: Trends, variation, and accuracy in institutional living cost allowances*. Madison, WI: Winsconsin HOPE Lab.

Kelly, A. P. (2011). Nothing but Net: Helping Families Learn the Real Price of College. No. 10. Washington, DC: *American Enterprise Institute for Public Policy Research*.

Kelly, A. P., & Schneider, M. (2011). Filling in the blanks: How information can affect choice in higher education. Washington, DC: *American Enterprise Institute for Public Policy Research*.

Kena, G., Hussar, W., McFarland, J., de Brey, C., Musu-Gillette, L., Wang, X., Zhang, J., Rathbun, A., Wilkinson-Flicker, S., Diliberti, M., Barmer, A., Bullock Mann, F., & Dunlop Velez, E. (2016). *The Condition of Education 2016* (NCES 2016-144). Washington, DC: U.S. Department of Education, National Center for Education Statistics. Retrieved from: https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2016144

Krantz, J. H., & Dalal, R. (2000). Validity of Web-based psychological research. In M. Birnbaum (Ed.), *Psychological experiments on the internet* (pp. 35-60). San Diego, CA: Academic Press.

Levine, P. B. (2014). *Transparency in college costs*. Brookings Institution Economic Studies Working Paper, Available at: http://www.brookings.edu/research/papers/2014/11/12-transparency-in-college-costs-levine.

Lin, N. (2002). *Social capital: A theory of social structure and action*. New York, NY: Cambridge University Press.

List, J. A., & Gallet, C. A. (2001). What experimental protocol influence disparities between actual and hypothetical stated values? *Environmental and Resource Economics, 20*(3), 241–254.

Long, B. T. (2008). *What is known about the impact of financial aid? Implications for policy. An NCPR working paper*. New York, NY: National Center for Postsecondary Research.

Ma, J., Baum, S., Pender, M., & Welch, M. (2017). *Trends in college pricing*. New York, NY: College Board. Retrieved from http://trends.collegeboard.org/sites/default/files/trends-college-pricing-web-final-508-2.pdf

Ma, J., Pender, M., & Welch, M. (2016). *Education pays 2016: The benefits of higher education for individuals and society. Trends in Higher Education Series.* New York, NY: College Board.

Mason, M. (2010). Sample size and saturation in PhD studies using qualitative interviews. In *Forum qualitative Sozialforschung/Forum: qualitative social research*. 11(3). Retrieved from http://www.qualitative-research.net/index.php/fqs/article/view/1428/3028

McKinney, L., & Novak, H. (2015). FAFSA filing among first-year college students: Who files on time, who doesn't, and why does it matter? *Research in Higher Education, 56*(1), 1–28.

Morrow, V. (1999). Conceptualising social capital in relation to the well-being of children and young people: A critical review. *The Sociological Review, 47*(4), 744–765.

Morse, J. M. (1995). The significance of saturation. *Qualitative Health Research, 5*(2), 147–149.

Oreopoulos, P., & Dunn, R. (2013). Information and college access: Evidence from a randomized field experiment. *The Scandinavian Journal of Economics, 115*(1), 3–26.

Page, L. C., & Scott-Clayton, J. (2016). Improving college access in the United States: Barriers and policy responses. *Economics of Education Review, 51*, 4–22.

Pallais, A. (2009). Taking a chance on college: Is the Tennessee Education Lottery Scholarship Program a winner? *Journal of Human Resources, 44*(1), 199–222.

Paolacci, G., Chandler, J., & Ipeirotis, P. G. (2010). Running experiments on Amazon Mechanical Turk. *Judgment and Decision Making, 5*(5), 411–419.

Paulsen, M. B. (1990). *College choice: Understanding student enrollment behavior. ASHE-ERIC Higher Education Report No. 6.* Washington, DC: ERIC.

Paulsen, M. B. (2001). The economics of human capital and investment in higher education. In M. B. Paulsen & J. C. Smart (Eds.), *The Finance of Higher Education: Theory, Research, Policy, and Practice* (pp. 55–94). New York, NY: Agathon Press.

Payne, J. W., Bettman, J. R., & Johnson, E. J. (1993). *The adaptive decision maker*. Cambridge, UK: Cambridge University Press.

Perna, L. W. (2006a). Studying college access and choice: A proposed conceptual model. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (pp. 99–157). Dordrecht, Nethlerlands: Springer.

Perna, L. W. (2006b). Understanding the relationship between information about college prices and financial aid and students' college-related behaviors. *American Behavioral Scientist*, *49*(12), 1620–1635.

Perna, L. W., & Li, C. (2006). College affordability: Implications for college opportunity. *Journal of Student Financial Aid*, *36*(1), 1.

Pindyck, R. S., & Rubinfeld, D. L. (2013). *Microeconomics*. Boston, MA: Pearson.

Portes, A. (1998). Social capital: Its origins and applications in modern sociology. *Annual Review of Sociology*, *24*, 1–24.

Radwin, D., Conzelmann, J. G., Nunnery, A., Austin Lacy, T., Wu, J., Lew, S., … Siegel, P. (2018). 2015–16 National Postsecondary Student Aid Study (NPSAS:16): Student Financial Aid Estimates for 2015–16 (NCES 2018-466). Washington, DC: National Center for Education Statistics.

Radwin, D., Conzelmann, J. G., Nunnery, A., Lacy, T. A., Wu, J., Lew, S., … Siegel, P. (2018). *2015-16 National Postsecondary Student Aid Study (NPSAS: 16): Student Financial Aid Estimates for 2015-16. First Look*. NCES 2018-466. Washington, DC: National Center for Education Statistics.

Radwin, D., Wine, J., Siegel, P., & Bryan, M. (2013). *2011-12 National Postsecondary Student Aid Study (NPSAS: 12): Student Financial Aid Estimates for 2011-12. First Look*. NCES 2013-165. Washington, DC: National Center for Education Statistics.

Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (2013). *Qualitative research practice: A guide for social science students and researchers*. Thousand Oaks, CA: Sage.

Rosinger, K. (2017). Federal policy efforts to simplify college-going: An intervention in community college enrollment and borrowing. *The ANNALS of the American Academy of Political and Social Science*, *671*(1), 114–131.

Rosinger, K. (2018). Can simplifying financial aid offers impact college enrollment and borrowing? Experimental and quasi-experimental evidence. *Education Finance and Policy*, (Just Accepted), 1–55.

Rouse, S. V. (2015). A reliability analysis of Mechanical Turk data. *Computers in Human Behavior*, *43*, 304–307.

Scott-Clayton, J. (2012). *Information constraints and financial aid policy*. NBER Working Paper No. w17811. Washington, DC: National Bureau of Economic Research

Scott-Clayton, J. (2015). The role of financial aid in promoting college access and success: Research evidence and proposals for reform. *Journal of Student Financial Aid*, *45*(3), 3.

Seidman, I. (2013). *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. New York, NY: Teachers College Press.

Simon, H. A. (1972). Theories of bounded rationality. *Decision and Organization*, *1*(1), 161–176.

Stanton-Salazar, R. (1997). A social capital framework for understanding the socialization of racial minority children and youths. *Harvard Educational Review*, *67*(1), 1–41.

Stanton-Salazar, R. D., & Dornbusch, S. M. (1995). Social capital and the reproduction of inequality: Information networks among Mexican-origin high school students. *Sociology of Education*, 116–135.

Stoll, A., & Stedman, J. B. (2004). Federal student aid need analysis: Background and selected simplification issues. In *Congressional Research Service: The Library of Congress*.

Thaler, R. H., & Mullainathan, S. (2008). How behavioral economics differs from traditional economics. In D. R. Henderson (Ed.) *The Concise Encyclopedia of Economics*. Indianapolis, IN: Liberty Fund.

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. New Haven, CT: Yale University Press.

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation*, *27*(2), 237–246.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*(4157), 1124-1131. doi:10.1126/science.185.4157.1124

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science*, *211*(4481), 30.

Whitehurst, G. J., & Chingos, M. M. (2015). Deconstructing and reconstructing the College Scorecard. *Evidence Speaks Report*, *1*(4). Washington, DC: Brookings Institution Press.

Whitsett, H. C., & O'Sullivan, R. (2012). Lost without a map: A survey about students' experiences navigating the financial aid process. Philadelphia, PA: NERA Economic Consulting. Retrieved from http://www. ner a. com/publications/archive/2012/lost-without-a-map-asurvey-about-students-experiences-navigat. html.