Uncertainty and Precision in College Cost Calculators

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Abstract

As increases in college cost continue to be offset with increases in financial grant aid, net prices – the actual out-of-pocket costs students pay for college – have become the best indicator of a postsecondary institution's affordability. However, net prices are stubbornly opaque, and remain so until after students complete complex federal aid forms and receive financial aid packages. 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 first-time, full-time degree-seeking students attending the same institution with the same indicated living arrangement, residency, and estimated family contribution (EFC). 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 NPC to receive identical awards. We find that the federal template NPC accounts for 70 percent of the variation in actual grant aid received by students predicted to receive identical awards. By adding an additional upper income brackets of "$100,000-$150,000" and "above $150,000" to the NPC template, we explain an additional six percentage points of variation in aid awards overall. We find the additional upper income brackets to be most impactful within the sample of four-year private nonprofit institutions. Within this subset of institutions, this modification explains an additional 10 points of variation in financial aid awards. As students attending four-year private nonprofit institutions tend to be from relatively higher income families, on average, more accurate sorting of middle income families and upper income families is especially effective. We find that neither an indicator of academic merit (as measured by high school GPA) nor an indicator of FAFSA submission timing substantially reduces unexplained variation in financial aid awards among similar students attending the same institution.

For many, the decision to invest in higher education is one of the most costly and most important investment decisions of a lifetime. Even in a sluggish post-recession economy, investments in postsecondary education are overwhelmingly worthwhile. 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). 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, unclear cost information complicates the decision to investment in postsecondary education.

Rather than published sticker prices, net prices – the out-of-pocket costs students and families pay for college – are 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.

Published tuition rates and total costs, on the other hand, are more apparent at the outset of a student's college search. Media coverage of college tuition often paints a picture of runaway costs, citing annual expenses of $55,000 or more. Although such figures apply for certain types of institutions (i.e., private nonprofit four-year doctoral institutions), such stories conceal sizeable variation in both tuition and financial aid in college pricing.[1] Average costs are often far lower. For example, in 2017-2018, the average total cost of attendance for in-state students at public four-year was $20,770 (*Trends in College Pricing*, 2017).

In addition, news stories often fail to mention that increases in financial aid have tracked closely with increases in college costs. Average net pricing at four-year private nonprofit

[1] The average total cost of attendance at private nonprofit four-year doctoral institutions for 2017-2018 was $56,720 (*Trends in College Pricing*, 2017). Such institutions account for less than 10 percent of institutions represented in the data sample used in this study, i.e., NPSAS:12.

institutions, for example, has remained relatively stable because increases in costs were offset with increases in financial aid. In the past decade, average total costs at four-year private nonprofit institutions increased by approximately 25 percent, from $37,600 in 2007 (in 2017 dollars) to $46,950 in 2017. During this time, the average student attending a four-year private nonprofit institution received $12,250 in grant aid and tax benefits in 2007, compared to $20,210 in 2017 (in 2017 dollars). As a result, compared to total cost increases of 25 percent, net prices within this sector of institutions has only increased by about 5 percent from 2007 to 2017 (from $25,350 in 2007 to $26,740 in 2017; *Trends in College Pricing*, 2017).

This trend in high list price-high financial aid means that there is a widening gap between listed college prices and after-financial aid net expenses. Given this growing difference, it is more important than ever that students have clear information about net pricing. Net Price Calculators (NPCs) were developed to provide this information.

NPCs are online tools that use student-level information to generate personalized estimates of grant aid and college net pricing information for a specific postsecondary institution. On average, NPCs are a better indicator of actual out-of-pocket college costs than sticker prices, but actual grant aid awards may vary substantially from predicted awards (Anthony, Page, & Seldin, 2016). Especially for low-income families, even small disparities between predicted and actual aid can impact students' college decision-making (e.g., Castleman & Page, 2014; Pallais, 2009). An NPC that severely overestimates grant aid may lead students to face hardship making unexpectedly large tuition payments, leading to outsized student debt or withdrawn enrollments. Conversely, an NPC that substantially underestimates grant aid could tilt the school's applicant pool in favor of those students 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 applying.

We explore variation in actual financial aid awards for similarly-profiled students attending the same institution. Though alternative cost calculators exist, we focus on the free NPC template provided by the U.S. Department of Education because it is most common among postsecondary institutions. 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), residency (in- or out-of-state), and estimated family contribution (EFC) as approximated by family income range, 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 NPC to receive identical awards. We then identify the source of the variation and suggest modifications to the federal template NPC to provide students with better estimates of the financial aid packages they will ultimately receive.

We find that the federal template NPC accounts for 70 percent of the variation in actual grant aid awarded to students predicted to receive identical awards. With a top income bracket of "more than $100,000," the current federal template NPC does not differentiate the upper middle-income family earning just over $100,000 for whom college payments may be a substantial financial challenge from the upper income family earning many times that amount, for whom college payment is less likely to be a financial stressor. By adding an additional upper income category to the NPC template at $150,000, we more accurately differentiate middle income from upper income, and explain an additional six percentage points of variation in aid awards overall. We find the additional upper income bracket to be most impactful within the sample of four-year private nonprofit institutions. Within this set of institutions, an additional upper income bracket explains an additional 10 points of variation in financial aid awards. As students attending four-

year private nonprofit institutions tend to be from relatively higher income families, on average, more accurate sorting at the upper end of the income spectrum is especially effective. We find that neither an indicator of academic merit (as measured by high school GPA) nor an indicator of FAFSA submission timing substantially reduce unexplained variation in financial aid awards among similar students attending the same institution. These findings are especially relevant as Congress considers changes to NPCs in the "Net Price Calculator Improvement Act."

Background

Net Price Calculators (NPCs) are a product of a 2008 amendment to the Higher Education Opportunity Act (HEOA) of 1965. The Act called for the development of an online "net price calculator to help current and prospective students, families, and other consumers estimate the individual net price of an institution of higher education for a student." (Higher Education Opportunity Act, 2008). The U.S. Department of Education provides a free NPC template that is used most widely, but a variety of other cost calculators exist.[2] Along with NPCs, the HEOA called on the U.S. Department of Education to create 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.[3] These resources prominently feature net pricing and links to individual institutions' NPCs.

The bipartisan Net Price Calculator Improvement Act (S.889, 2017) was introduced in April 2017. The bill largely supports the findings of a 2012 review of NPCs by The Institute for College Access and Success 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

[2] As of January, 2017, more than 3,200 Title IV postsecondary institutions were using the federal template NPC.
[3] See collegecost.ed.gov/catc and collegescorecard.ed.gov for more information.

"Net Price Calculators" (as opposed to "Education Cost Calculator" or "Tuition Calculator," for example). The legislation also requires institutions either to provide questions allowing for an estimate of veterans' education benefits or to provide information to applicants about qualifying and accessing such benefits. Finally, the bill allows the Secretary of Education to create a universal net price calculator that would make it possible to complete one set of questions and receive net price estimates for any institution (S. 889, 115th Cong. 2017).

All NPCs are required to estimate individual net prices "as much as practicable," but neither the original HEOA of 2008 nor the Net Price Calculator Improvement Act stipulates the details of how the calculator operates provided they include certain minimum requirements (HEOA, 2008).[4] Different models of NPCs vary substantially in the scope of inputs required. The federal template is among the simplest, but many institutions use calculators provided by third parties such as The College Board or Ruffalo Noel Levitz. With few possible exceptions of institutions designing their own simplified calculators, non-federal template NPCs are more complex than the federal template NPC.

The complexity of the calculator is critically important because the very purpose of NPCs is to increase transparency in college pricing and financial aid, and more complexity often results in less clarity. Substantial research points to the complexity of the financial aid application process as a primary driver of low awareness and take-up rates of student aid (Bettinger, Long, Oreopoulos, & Sanbonmatsu, 2012; Dynarski & Scott-Clayton, 2013, 2006, 2008; Dynarski & Wiederspan,

[4] Input elements must include those that allow for an estimate of the student's Expected Family Contribution (EFC). These elements 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.

2012; Page & Scott-Clayton, 2016). Overly complex calculators risk becoming an additional barrier to clear cost information.

NPCs and the effort-accuracy tradeoff

The federal template NPC and its alternatives provide examples of a potential effort-accuracy tradeoff (Johnson & Payne, 1985; Payne, Bettman, & Johnson, 1993; Tversky & Kahneman, 1975). When faced with complex decisions, it is often impractical or simply too hard to evaluate every possible outcome. In these instances, we 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, 1975).

In the context of NPCs, it is possible to recreate the complex federal methodology for determining financial need – and indeed, some college cost calculators do just that. Yet, students using the calculators may not have access to the detailed information required by financial aid applications, and inaccurate data likely contributes to inaccurate net price estimates. Instead of drawing on detailed financial information, the federal template NPC prediction model uses broader, easier to access data points to estimate grant-based financial aid and net price.

The federal template calculator estimates net price using the student's dependency and residency status, family size, and approximate household income.[5] With this information, the calculator presents the user with the median aid received by similar students in a previous academic year for a particular college. Students are likely to find the federal template calculator easier to use than some of its more complex alternatives, but it is possible that its simplicity may limit its accuracy.

[5] Generally, a student is considered a dependent if she is under 24 years old, unmarried, and does not have any dependents of her own.

More complex calculators presumably trade this simplicity for increased accuracy, and many rely on the same detailed financial data (e.g., parents' investment equity, education-specific savings, and tax allowances) that informs the formula for the federal methodology to determine a family's capacity to pay for college. The primary drawback of these more detailed calculators is that students may struggle to come up with such detailed information, thus limiting the usefulness of the more complex tools. The advantage, theoretically, is that the additional detail allows for more accurate estimates of financial aid if users provide complete and accurate information.

EFC and the federal template NPC

Need-based federal aid awards depend on a student and family's ability to afford college. Generally, lower income families face greater difficulty paying for college, and are therefore eligible for larger need-based financial aid awards. The most common measure of a family's ability to pay for college is their Expected Family Contribution, or EFC. Financial aid applications forms commonly request detailed family finance information which is used in a formula to calculate a family's EFC. The formula draws from household income, allowances against income, assets, family size, and the number of family members in college.[6] Typically, the higher the EFC, the wealthier the applicant and the lower the need-based federal aid. An EFC of zero qualifies a student for the maximum need-based federal aid.

The federal template NPC includes nine questions: one of which asks if the student plans to apply for financial aid; three determine dependency status; two determine housing and residency; and three – household size, number from household in college, and annual household income after taxes – approximate EFC (See Figure 1, Section A).[7]

[6] See Appendix B for a step-by-step explanation of EFC calculation for dependent students.

[7] The family income question asks for "annual household income after taxes," and is answerable in increments of ten thousand dollars from "less than $30,000" through "above $99,999." Families may interpret this question differently in terms of what specific sources of income to include or exclude in this response. We conducted a sensitivity

The U.S. Department of Education provides a look-up table that lists median EFCs from a representative sample of financial aid applicants by household size, number from household in college, and family income level (Figure 1, Section B). Information from these tables informs individual institution's calculators.

Institutions using the federal template calculator provide the back-end data for grant aid and total cost information. Grant aid estimates are the median grant aid awards within each of 12 EFC ranges and living arrangement subgroups for a previous academic year (see Figure 1, Section C).[8] Total costs may vary according to a student's residency and living arrangements. For example, an in-state student may face a lower tuition rate 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. The following figure parallels the table institutions populate with median grant aid data for their NPCs.

[*Figure 2*]

The federal template NPC categorizes users on these characteristics and produces a single grant aid estimate for all students within a profile of EFC range, residency status, and living arrangement (See Figure 1, Section D). The final net price is the total cost minus the median grant aid awarded to students in the same EFC-living arrangement-residency cell. Breaking the tool down to its components shows the term "Net Price Calculator" to be a misnomer. It does not

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. With this single question, the federal template NPC drastically reduces the extensive financial questioning of the FAFSA, from which federal EFC is calculated.

[8] EFC ranges include (in $): 0; 1-1,000; 1,001-2,500; 2,501-5,000; 5,001-7,500; 7,501-10,000; 10,001-12,500; 12,501-15,000; 15,001-20,000; 20,001-30,000; 30,001-40,000; above 40,000.

actually *calculate* anything. The tool simply uses a limited set of factors to locate a student on a set of matrices.

Uncertainties in federal template NPC process

Uncertainties are present in the federal template NPC process, despite its relative simplicity. At the user level, family income and the timing of FAFSA filing are two such uncertainties. For the federal template NPC, a student enters her household size, the number from the house in college, and her household income after taxes within a $10,000 range from "below $30,000" to "above $99,999." The number of people in the household and the number in college are straightforward, but family income after taxes may not be as clear. For example, a survey of nearly 7,000 high school seniors found that about one in five could not estimate their parents' total income (Mandell, 2008). Especially for families near income category thresholds, inaccurate estimates of family income are highly possible, and would place users in inaccurate income brackets.

As an example, at a private, nonprofit institution in Pennsylvania, shifting from an income of $90,000-$99,999 to above $100,000 results in a $6,192 difference in estimated grant aid. On the other end of the income spectrum and at the same institution, moving from "less than $30,000" to $30,000-39,999 results in a $2,986 change in estimated grant aid. If we consider grant aid as a share of family income, the potential for inaccurate aid estimates because of imprecise income assessments is especially great for low-income families. Moreover, low-income parents are more likely to experience changes in their work schedules and employment status (ACS, 2005). These changes can contribute to students' uncertainty in estimating family income.

Just as small differences in estimates of family income can result in large differences in actual aid awards, small differences in the timing of financial aid applications may also lead to large differences in aid awards. This is because many non-federal forms of financial aid are

distributed on a first-come, first-served basis. Students who file their FAFSAs after priority deadlines risk losing out on financial aid money awarded to those who file FAFSAs earlier. National Postsecondary Student Aid Survey 2012 (NPSAS:12) data shows that the later a student files her FAFSA, the less likely she is to receive financial aid from non-federal sources (see Appendix, *Figure 3*). Inaccurate estimates of family income or differences in FAFSA filing timing may result in identical students (in terms of the information requested by the federal template NPC) attending the same institution receiving substantially different financial aid awards. Such scenarios motivate our research questions.

Research questions

Three questions drive this analysis. (1) 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? (2) When students predicted by the federal template NPC to receive equal aid awards receive different levels of aid, what explains that variation? And (3) Given this information, what modifications can be incorporated into the federal template NPC to reduce the unexplained variation?

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. More than 40 percent of all grant aid – the largest portion from any source – comes from the postsecondary institutions themselves (Ma, Baum, Pender, & Bell, 2015). Second, while the policy objective in these previous studies focused on strategically *reducing* financial aid data elements and maintaining aid distribution, we focus on strategically *increasing* data elements or modifying existing data components to improve NPC accuracy, aiming to balance the benefit of increased accuracy with the potential of increased complexity by collecting additional information.

Research design

Data sources and sample

We use the 2012 National Postsecondary Student Aid Survey (NPSAS:12) data to conduct a quantitative investigation of the variance in financial aid packages among observationally similar students attending the same institution. NPSAS:12 is an ideal source of information because it includes information corresponding to each question on the federal template NPC, complete FAFSA information, as well as rich supplemental data on student-level, institution-level, and financial aid information. For example, NPSAS:12 data includes information about student academic performance (e.g., GPA and SAT / ACT), family finances (e.g., adjusted gross income and total value of assets), and number of siblings in college. Student-level financial aid data consists of information including net price and classification of aid by type (e.g., loan, grant or work study) and source (i.e., federal, state, institutional, or private). At the institution-level, the data includes total enrollment figures as well as basic classifiers such as public or private, for-profit or nonprofit, and intensity of research activity.

The original data contain information for 111,057 students attending 1,482 institutions. We apply several restrictions to achieve our analytic sample. 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 Free Application for Federal Student Aid, resulting in 24,175 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 61,566 records. We also limit the sample to include only dependent students, which reduces the sample by 11,672.[9]

Second, our analysis relies on comparing the variation in financial aid packages for students attending the same institutions with the same federal template NPC inputs. Therefore, we eliminate all instances of a single observation within a given institution, EFC-range and living arrangement condition as, of course, there is no variation with a single observation. This restriction drops from the sample an additional 5,292 observations. Third, we focus our study on two-year and four-year institutions, and drop from the sample less-than-2-year institutions. After these restrictions, the sample includes 7,563 observations within 904 institutions. Of these, 2,273 observations are within 292 institutions that use the federal template NPC, and 5,290 observations are from 612 institutions that use an alternative to the federal template NPC.[10]

Descriptive statistics

The average student in the sample attends an institution with a cost of attendance of approximately $28,000 and receives about $8,000 in grant aid, making the average net price about $20,000 (see Table 1). Of the $8,000 in grant aid, federal aid such as Pell Grants account for about $3,300 and institutional aid accounts for $2,800, on average. The remaining aid comes from state and outside

[9] 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.
[10] Accurate as of 01/19/2017.

sources. Though the average FAFSA-reported EFC is $8,900, the median EFC is $0, indicating that more than half of all families in the sample qualify for maximum need-based federal aid.

[TABLE 1]

Measures

We use student living arrangement, residency, and EFC range to pool students into groups within institutions who would receive identical grant aid estimates from the federal template NPC. We use regression analysis and the resulting R^2 statistic to indicate the extent to which variation in students' financial aid packages is explained by the data elements collected through the federal NPC template and the extent to which variation is left unexplained. Where we find variation in aid awards, we then aim to identify the source(s) of that variation. Based on this analysis, we explore modifications to the federal template NPC to reduce unexplained variation in financial aid awards.

Information collected on a student's FAFSA is used to calculate the family's EFC, which is used to derive need-based federal aid awards. The federal template NPC simplifies the EFC formula by using only a broad measure of family income (annual household income after taxes), household size, and number from the household in college. Inaccurate NPC-derived EFC estimates have high potential to produce inaccurate NPC-derived grant aid estimates. A student may provide inaccurate family income information. This is user error. Alternatively, inaccurate NPC cost estimates could be the result of inaccurate EFC binning. Recall that students' EFCs are classified into one of 12 EFC ranges. Students, especially those whose NPC-derived EFCs fall near the cut-off points, could be misclassified into an EFC range that does not correspond to the one they would be assigned using their actual EFC. This is system error. Finally, inaccurate NPC estimates could be a function of the substantial range in EFCs within groups that is masked with a single median EFC figure. For this reason, our investigation includes an analysis of NPC-estimated EFCs.

Statistical models

EFCs NPC grant aid estimates are based on EFC calculations. We use regression analysis to assess the extent to which NPC-derived median EFCs align with true EFCs within institutions and living groups. We compare actual EFCs as reported in NPSAS:12 data to NPC-estimated EFCs, which are derived using a look-up table provided by the U. S. Department of Education and populated with data compiled from FAFSA applications to identify a median EFC based on the student's dependency status, number in family, number in college, and income level. We then examine the extent to which NPC-derived EFC estimates align with true EFCs within income levels, household size, and number in college, utilizing a model of the following form:

$$Actual\ EFC_i = \beta_0 + \beta_1 NPCEFC_i + e_i \quad (1)$$

The outcome $Actual\ EFC_i$ is a student's actual FAFSA-derived EFC as recorded in the NPSAS:12 dataset. $NPCEFC_i$ is the NPC-estimated EFC for student i. We expect true EFC to track closely with 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. β_0 is the intercept, and e_i is the error term.

We use the R^2 statistic associated with this regression model to measure the share of a student's actual EFC that is explained using only the information included in the federal template NPC. We investigate predictors of residual error to characterize whether the NPC estimate is systematically more accurate for certain groups of students. Because NPC grant aid estimates are closely linked to EFC, NPC-estimated EFCs varying substantially from true EFCs are a likely to result in inaccurate NPC estimates.

Grant aid We conduct a similar regression analysis to assess the extent to which actual grant aid (as indicated in NPSAS:12) varies for students with identical NPC grant aid estimates. Two grant aid figures are central to this study: the grant aid students *actually* received 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 NPCs using the federal template to group students for whom NPCs predict identical grant aid awards. We then examine the variation in actual aid awards within groups of similarly-profiled students.

The federal template NPC produces a single grant aid estimate for all students attending the same institution within an NPC group consisting of EFC category (12 possible values), living arrangement (3 possible categories: on-campus, off-campus, or with family), and residency (2 possibilities: in-state or out-of-state), yielding a possible set of 72 (12x3x2) unique combinations within each of the 904 institutions included in the sample. The result is an institutional and NPC group fixed effect model, as follows:

$$Grant\ aid_{ijk} = \beta_{0j} + \sum_{j=1}^{904} \sum_{k=1}^{72} \propto_{jk} I_{ijk} + \varepsilon_{ijk} \quad (2)$$

Within each of the 904 institutions, we use a 72-cell NPC group matrix (i.e., EFC category by living arrangement by residency, see *Figure* 2) to identify students with identical NPC-estimated grant aid awards. 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 NPC group and institution. We first use the R^2 statistic to quantify the extent to which data collected by the federal template NPC predicts variation in actual grant aid awards. We then consider what additional measures might be incorporated into the federal template NPC to improve upon the accuracy of the federal template NPC.

Results are in terms of the R^2 value and Root Mean Square Error (RMSE) of regression analysis (as in Tables 6-8). An R^2 of 70, for example, indicates that the data collected by the federal template NPC accounts for 70 percent of the variation observed in actual financial aid awards. The RMSE measures the range of remaining variation in grant aid awards among similarly-profiled students attending the same institution. Accordingly, the RMSE tracks closely with the amount of grant aid awarded by institution type.

Proposed measures

We consider three potential modifications to NPC data elements.

(1) 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). We present results based on high school GPA, as it is better populated in the NPSAS data compared to the SAT / ACT measures. High school GPA data is coded in NPSAS:12 at seven discreet levels: 1=D- to D; 2=D to C-; 3=C- to C; 4=C to B-; 5=B- to B; 6=B-A-; 7=A- to A. We repeated analysis with GPA as an indicator variable to check for nonlinear "jumps" in aid award at certain grade thresholds (e.g., GPA of 3.5 or higher), but did not find meaningful differences in results.[11] As such, we keep the GPA variable as originally coded in NPSAS:12.

(2) Early FAFSA filing

Certain types of financial aid are awarded on a first-come first-served basis. 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

[11] Parallel analysis using SAT and ACT scores did not result in significant changes. Analysis of GPA as an indicator variable and SAT or ACT scores is not shown in the appendix, but is available on request.

students who have completed FAFSAs. Of these, more than 60 percent filed their FAFSAs 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 this timeframe to flag "Early FAFSA filers" as those who filed FAFSAs between January 1, 2011 and April 1, 2011, and code a dummy variable accordingly (i.e., 1=FAFSA filed before April 1, 2011; 0=FAFSA filed April 1, 2011 or later).

(3) Additional upper income bracket

Nearly 20 percent of the sample is clustered into the uppermost income bracket, such that a family earning $100,000 annually in after-tax income is categorically identical to a family earning ten 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.[12]

This is a modification to the existing federal template NPC rather than an additional data element. We simply refit the institutional and NPC group fixed effect using the additional income categories. Improvements in R^2 values indicate that dividing this top bracket at $150,000 allows for a more accurate match of NPC-generated EFC to FAFSA-generated EFC.[13]

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

[13] Analysis of studentized residuals of the EFC analysis supports this decision, as nearly all (93%) studentized residuals of 2.5 or higher fall within this income range.

Our analysis of the federal template NPC explores the potential for combinations of these additional measures to improve NPC estimates. In the following equation, we express high school GPA and early FAFSA filing generically as $\boldsymbol{X}_{ij}$.

$$Grant\ aid_{ijk} = \beta_{0j} + \sum_{j=1}^{904}\sum_{k=1}^{72} \propto_{jk} I_{ijk} + \beta_{1j}\boldsymbol{X}_{ij} + \varepsilon_{ijk} \quad (3)$$

β_{1j} represents the relationship between each predictor that we consider, $\boldsymbol{X}_{ij}$, and actual grant aid, after accounting for the institution and NPC group to which a student belongs. If, for a given variable, the estimate of β_{1j} is non-zero and statistically significant, we interpret this as evidence that the variable (such as a student's high school GPA), is an important predictor of grant aid received.

These potential additions are simple for both users and institutions, and do not require information that is either difficult for a user to estimate or administratively burdensome for an institution to incorporate. Changes in the R^2 statistic associated with alternative models indicate the extent to which the additional measures would serve to improve the federal template.[14] For each set of models, we conduct one analysis for the full sample and disaggregate by the type of NPC (either federal template NPC or other). Results for institutions that *do not* use the federal template NPC simulate how well the federal template NPC *would* perform at these institutions.

Findings

Our findings include analyses of EFC estimates and grant aid estimates. In both, we are primarily concerned with the R^2 statistic that explains the share of variation in outcomes (EFC and grant aid, respectively) predicted by the data collected in the federal template NPC. For the grant aid analysis, we also discuss the range in remaining grant aid awarded to similarly-profiled students, as

[14] See Appendix, Table 3 for a summary model data elements and features

measured by RMSE. Last, we discuss the extent to which additional data elements – i.e., high school GPA, timely FAFSA filing, and an additional income category – affect NPC's grant aid predicting potential.

EFC analysis

EFC is a measure of a family's ability to pay for college and is central to most income-based financial aid formulas. NPC-derived EFC estimates directly inform the NPC-derived grant aid estimates. Therefore, improving the accuracy in EFC predictions is an indication of likely improvements in grant aid predictions.

We refer to the current federal template NPC as the "base model." Regressing actual, FAFSA-derived EFC on NPC-predicted EFC, as in Equation 1, shows NPC-estimated EFCs explain about two-thirds of the variation observed in FAFSA-reported EFCs (see Table 4, column 1). Of the proposed modifications to the federal template NPC model, only the additional upper income category is relevant to EFC calculation (EFC is not affected by high school GPA or FAFSA submission timing).

With the base NPC EFC calculation, no NPC-derived EFCs fall into the uppermost EFC bracket of "$40,000 or more." By separating the top income bracket into two categories ($100,000-$150,000 and above $150,000), median within-group EFCs (by income, family size, and number in college) extend to the upper range of the EFC categories. We use an additional income category to recalculate NPC-derived EFCs, recreate new fixed-effects with the new EFC grouping, and repeat the regression.[15] The difference in R^2 statistics is the additional variation in FAFSA-derived EFCs explained.

[15] NPC EFCs use a look-up table provided by the U.S. Department of Education. The look-up table lists the median EFC of a sample of early FAFSA filers by income level ("less than $30,000" to "more than $100,000" in $10,000 increments), family size (2 to 6 or more), and number in college (1 to 3 or more). This table does not include brackets corresponding with the additional income brackets in this model; however, the median NPC EFCs align

With the additional income brackets of "$100,000-$150,000" and "above $150,000," NPC-derived EFCs explains more than 80 percent of the variation observed in FAFSA-derived EFCs, which is a 20 percent improvement on the base model (Table 4, column 2). Separating by two- and four-year institutions shows adding an additional top income bracket improves EFC predictions at four-year institutions, in particular, with the R^2 statistic improving from 65 percent to 80 percent of the variation in grant aid explained. As four-year institutions tend to enroll wealthier students, it is logical that an additional upper income bracket is especially effective.

[TABLE 4]

Grant aid analysis

We use Equation 2 to conduct an analogous exploration of grant aid awards with potential modifications to the federal template NPC model. In Table 5, we summarize results of the full analysis and separate by type of NPC (federal template or other). For each institutional set, we list three R^2 values. The first R^2 statistic represents the share of actual grant aid predicted by the unaltered federal template NPC, or base model. The second R^2 statistic is the share of grant aid predicted after using the additional upper income category to refit the institution and NPC group fixed effects. And the 3rd R^2 value reflects the share of variation in grant aid awards explained with a combination of all three modifications.

The base federal template NPC accounts for 70 percent of the actual grant aid received by students predicted to receive identical grant aid awards. The alternative model incorporates a merit indicator, additional upper income level, and a measure of FAFSA timing. This model improves predicting power substantially, with gains five (for institutions using the federal template NPC,

nearly perfectly with the median FAFSA-derived EFCs (R^2=99.75) when broken down by these same factors (i.e., income, family size, and number in college). Therefore, rather than using the U.S. Department of Education of education look-up tables for the new EFC values, we use the FAFSA-derived EFCs to assign new values by the same method and incorporating the additional income bracket.

Table 5, 2nd row, 4th column) and 9 percent (for institutions using an alternative NPC, Table 5, 2nd row, last column) on the base model NPCs. Nearly all the improvements in NPC predicting potential are a result of the additional upper income bracket, particularly within four-year institutions. Measures of high school GPA and early FAFSA filing do not significantly improve the share of variation in grant aid awards predicted by the federal template NPC.

Table 6 presents the effectiveness of various models on improving the predicting power of the federal template NPC across all institutions (Table 6, top section), then separates results by four-year institutions (Table 6, center section) and two-year institutions (Table 6, bottom section). In Table 7, we break results down by institutional ownership, including public nonprofit institutions (Table 7, top), private nonprofit institutions (Table 7, center), and private for-profit institutions (Table 7, bottom). Finally, Table 8 further disaggregates schools by type and ownership. This table includes four-year public institutions (Table 8, top), four-year private nonprofit institutions (Table 8, center), and two-year public institutions (Table 8, bottom).

[*TABLE 5*]

High school GPA

Though institutions commonly award scholarships based on academic achievement, a measure of academic merit (high school GPA) does not meaningfully improve the federal template NPC's prediction of grant aid. The largest improvement upon the base-model R^2 statistic was within the subset of private nonprofit four-year institutions using the federal template calculator, but in no subset of institutions (e.g., 2-year public, 4-year private, etc.) did the academic merit indicator improve the R^2 statistic by more than a full percentage point across the full sample.

Timely FAFSA filing

Certain sources of financial aid are awarded on a first-come, first-served basis. We attempt to account for differences in aid awards because of FAFSA filing time with an indicator variable to identify students who submitted a FAFSA within the first three months of the FAFSA filing window. However, this did not meaningfully decrease variation in grant aid awards among similar students attending the same institution.

Additional income bracket

The median income for the for all families earning more than $100,000 annually is about $150,000. Recall that without the additional upper income category of $150,000, no observations matched into the top EFC category of "above $40,000." We use the additional top income category of $150,000 and repeat the institutional and NPC group fixed effect and find a more accurate match of NPC-generated EFC to FAFSA-generated EFC.

Including additional income brackets ("$100,000-$150,000; and "above $150,000") accounts for the largest share of gains in predictive power, accounting for nearly all of the overall improvement in R^2 values. Across all institutional sectors and NPC types, this model explains an additional six percentage points of the overall variation observed in grant aid received. Additionally, the additional income category reduces the average remaining variation in actual grant aid awards among students predicted to receive identical awards (as indicated by RMSE) by $300 (from $5,670 to $5,370).

By institutional sector, the additional income brackets are most effective within private nonprofit four-year institutions with an improvement of 10 percentage points on the base model R^2 (see Table 8, Row 4 Column 4). As these institutions are more expensive and enroll higher-income students, on average (see Table 1), an improved income-to-EFC fit at the upper end of the income spectrum explains this result.

High school GPA, early FAFSA filing, and additional income bracket

This model combines each of the proposed adjustments to the federal template NPC. We find that including a measure of high school GPA and early FAFSA timing does not significantly improve NPC predicting capacity beyond including the additional upper income category alone.

Finally, we use the RMSE to observe the average range in variation in grant aid awards left unexplained by the data collected in the federal template NPC and alternative models. On average, the remaining range in unexplained grant aid varies proportionally to the average amount of grant aid awarded within various sectors of institutions. For example, within the subsample of two-year public institutions, where students receive relatively less grant aid, the average standard deviation of the difference in grant aid is around $2,400 and only varies by about $20 across alternate models. By contrast, within four-year private nonprofit institutions, where students receive more grant aid, on average, remaining variation is $10,900, and decreases by up to $350 with additional data in the alternative NPC models.

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 can substantially improve NPC predicting power, especially within four-year institutions. We also find that a measure of academic merit and an indicator of early FAFSA timing only marginally improve the extent to which the data collected with the federal template NPC can predict grant aid awards.

These results suggest that adding an upper income bracket to the federal template NPCs of four-year institutions can be especially beneficial to middle and upper-middle income families. In this dataset, about 20 percent of families report annual incomes of $100,000 or more. By accounting for the substantial differences in incomes at the upper end of the spectrum, a modified NPC template can more accurately assign EFC, and therefore, more accurately predict grant aid.

The federal template NPC is relatively simple to use, and maintaining simplicity to minimize complexity and uncertainty in user-provided data is central to this investigation. The scope of this analysis is limited to the federal template NPC and its proposed modifications. We do not assess the accuracy of alternative, more complex calculators, so we cannot conclusively compare the precision of the simple federal template model to its more complex alternatives. Nevertheless, we demonstrate that with a relatively simple change of an additional upper income bracket, the federal template NPC can predict more than 75 percent of the variation observed in actual grant aid awards in this sample.

Whether the remaining share of unexplained variation warrants the added complexity of alternative calculators is a subjective matter which varies depending on the student and the institution in question. It is important to stress that instances of uncertainty are not eliminated – and may even be exacerbated – with more complex calculators. Even with a precise EFC and financial aid formula, user-based uncertainties, such as FAFSA filling timing and inaccurate estimates of family finances, are present. The corresponding implication is that many institutions may be using overly complex calculators without generating more precise cost estimates.

NPCs are among a suite of recently-introduced online tools designed to increase information and transparency in college pricing. However, this information is only useful to the extent that users understand the cost information they provide. We suggest that simple calculators

are most appropriate for most students, but total college costs and various forms of financial aid can still make college pricing rather complicated. For NPCs to be most useful in helping families to anticipate college costs, future research should investigate how families use NPCs, how NPCs affect families' understanding of college costs, and the ways that differences in presenting cost information may influence college decisions.

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Tables and figures

Table 1. Descriptive statistics

	Alternative calculator N=5,290		**Federal template NPC** N=2,273		**Full sample** N=7,563	
	Mean (SD)	**Median**	**Mean (SD)**	**Median**	**Mean (SD)**	**Median**
Total cost	32,100 (13,280)	30,700	17,700 (8,610)	15,400	27,800 (13,740)	25,400
Net cost	23,000 (12,370)	22,100	11,800 (7,880)	10,100	19,600 (12,330)	17,800
EFC	10,700 (20,330)	0	5,800 (13,700)	0	9,200 (18,700)	0
Income	64,000 (82,360)	30,400	45,000 (57,210)	27,200	58,300 (76,200)	29,000
Total grant aid	9,100 (9,660)	5,900	5,900 (5,270)	5,600	8,100 (8,700)	5,700
Federal aid	3,200 (2,700)	4,100	3,500 (2,410)	4,600	3,300 (2,620)	4,300
State aid	972 (2,110)	0	782 (1,600)	0	915 (1,970)	0
Institutional aid	3,600 (7,500)	0	1,000 (3,270)	0	2,800 (6,600)	0

Table 2. Descriptive statistics: Alternative vs Federal NPC use

	Alternative calculator N=5,290		**Federal template NPC** N=2,273		**Full sample** N=7,563
Sector	N	Percent	N	Percent	N
4-year	3,800	87	571	13	4,371
2-year	1,490	47	1,702	53	3,192

Note: Percentages are rounded to nearest whole number

Table 3. Summary of existing ("Base") NPC and alternative model features

	Features	Base	GPA	Timely FAFSA	Income	GPA + Timely FAFSA + Income
Base Model Data	**Dependency**	X	X	X	X	X
	Residency	X	X	X	X	X
	Family size	X	X	X	X	X
	Number from family in college	X	X	X	X	X
	12 EFC ranges[16]	X	X	X	X	X
	9 income brackets[17]	X		X		
Proposed Modifications	**Merit aid metric**		X			X
	Timely FAFSA indicator[18]			X		X
	10 income brackets[19]				X	X

[16] 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; 15,000-20,000; 20,000-30,000; 30,000-40,000; >40,000

[17] 0-30,000; 30,001-40,000; 40,001-50,000; 50,001-60,000; 60,001-70,000; 70,001-80,000; 80,001-90,001; 90,001-100,000; >100,000

[18] Submitted by April 1, the date by which most states' priority deadlines occurred in 2011-2012 academic year. 60% of all FAFSAs in NPSAS:12 were submitted by this date.

[19] 0-30,000; 30,001-40,000; 40,001-50,000; 50,001-60,000; 60,001-70,000; 70,001-80,000; 80,001-90,000; 90,001-100,000; 100,001-150,000; >150,000

Table 4. EFC Analysis: FAFSA-derived EFC on NPC-derived EFC

			Base	Additional income bracket	Difference (pp)
Full Sample	All N=7,563	R^2 (RMSE)	67.0 (10,800)	80.7 (8,200)	13.7
	Federal template NPC	N=2,273	65.9 (8,000)	78.1 (6,400)	11.1
	Other NPCs	N=5,290	67.0 (11,700)	80.9 (8,900)	15.0
4-Year Institutions	All N=4,371		65.2 (13,200)	79.5 (10,100)	14.3
	Federal template NPC	N=571	63.3 (12,100)	79.1 (9,100)	15.8
	Other NPCs	N=3,800	65.4 (13,300)	79.5 (10,300)	14.1
2-Year Institutions	All N=3,192		70. 8 (5,300)	80.2 (4,300)	9.4
	Federal template NPC	N=1,702	68.0 (5,870)	75.8 (5,100)	7.8
	Other NPCs	N=1,490	74.9 (4,600)	86.6 (3,400)	11.7

Additional income brackets include (in $): 0-30,000; 30,001-40,000; 40,001-50,000; 50,001-60,000; 60,001-70,000; 70,001-80,000; 80,001-90,000; 90,001-100,000; 100,001-150,000; >150,000

Table 5. Summary of additional income and highest R^2 models relative to the base model

	Federal Template NPC				Alternative NPC			
	Base R^2	**Income**	**GPA + Timely FAFSA + Income**	**R^2 Difference (pp)**	**Base R^2**	**Income**	**GPA + Timely FAFSA + Income**	**R^2 Difference (pp)**
EFC Model: FAFSA-EFC vs NPC EFC	65.9	78.1	--	12.2	67	80.9	--	13.9
Grant aid: Overall	69.0	71.8	72.1	3.1	69.3	75.5	75.7	6.4
4-year institutions	68.2	72.0	72.2	4.0	67.7	74.6	74.9	7.2
2-year institutions	61.9	63.4	64.0	2.1	61.8	64.1	64.4	2.6
Public	65.9	69.3	69.8	3.9	68.7	72.2	73.2	4.5
Private not-for-profit	59.8	63.4	65.7	5.9	58.1	68.1	68.5	10.4
Private for-profit	68.6	68.7	69.1	0.5	52.1	55.6	55.8	3.7
Public 4-year	69.2	74.9	75.3	6.1	68.8	72.9	74.3	5.5
Private 4-year nonprofit	55.9	59.8	62.8	6.9	56.8	67.2	67.7	10.9
Public 2-year	61.2	62.9	63.6	2.4	64.0	65.2	66.1	2.1

Table 6. Full sample, four-year, and two-year institutions: Share of overall grant aid predicted by NPC models

			Base	GPA	Timely FAFSA	Income	GPA + Timely FAFSA + Income	Largest Difference (pp)
Full Sample	All N=7,563	R^2	70.1	70.1	70.2	75.8	75.9	5.8
		RMSE	(5,670)	(5,670)	(5,660)	(5,370)	(5,360)	
		Fed. NPC N=2,273	69 (3,520)	69 (3,530)	69.2 (3,510)	71.8 (3,510)	72.1 (3,500)	3.1
		Others N=5,290	69.3 (6,360)	69. 3 (6,350)	69.4 (6,340)	75.5 (6,000)	75.7 (5,980)	6.4
4-Year Institutions		All N=4,371	67.8 (7,200)	68 (7,190)	68 (7,180)	74.5 (6,900)	74.7 (6,870)	6.9
		Fed. NPC N=571	68.2 (5,930)	68.2 (5,940)	68.2 (5,940)	72 (6,140)	72.2 (6,150)	4.0
		Others N=3,800	67.7 (7,360)	67.8 (7,340)	67.8 (7,340)	74.6 (6,990)	74.9 (6,960)	7.2
2-Year Institutions		All N=3,192	61.9 (2,660)	61.9 (2,660)	62.4 (2,650)	63.8 (2,660)	64.3 (2,650)	2.4
		Fed. NPC N=1,702	61.9 (2,410)	61. 9 (2,410)	62.7 (2,380)	63.4 (2,430)	64 (2,410)	2.1
		Others N=1,490	61.8 (2,920)	61.9 (2,920)	62.1 (2,910)	64.1 (2,900)	64.4 (2,890)	2.6

Note: GPA indicator is coded in NPSAS:12 at seven discrete levels: 1=D- to D; 2=D to C-; 3=C- to C; 4=C to B-; 5=B-to B; 6=B-A-; 7=A- to A.
FAFSA timing is measured with a dummy variable coded as 1= FAFSA submitted before April 1, the date by which most states' priority deadlines occurred in 2011-2012 academic year.
Additional income bracket model includes (in $): 0-30,000; 30,001-40,000; 40,001-50,000; 50,001-60,000; 60,001-70,000; 70,001-80,000; 80,001-90,000; 90,001-100,000; 100,001-150,000; >150,000

Table 7. Public, private nonprofit, and private for profit: Share of overall grant aid predicted by NPC models

			Base	GPA	Timely FAFSA	Income	GPA + Timely FAFSA + Income	Largest Difference (pp)
Public	All N=3,607	R^2	67.8	67.9	68.3	71.3	71.9	4.1
		RMSE	(3,180)	(3,180)	(3,150)	(3,170)	(3,140)	
	Fed. NPC N=1,945		65.9	65.9	66.4	69.3	69.8	3.9
			(2,800)	(2,800)	(2,780)	(2,770)	(2,750)	
	Others N=1,662		68.7	69.1	69.3	72.2	73.2	6.4
			(3,590)	(3,570)	(3,560)	(3,620)	(3,550)	
Private Nonprofit	All N=1,724		58.4	58.5	58.5	67.9	68.1	9.7
			(10,370)	(10,360)	(10,360)	(10,010)	(9,980)	
	Fed. NPC N=140		59.8	60.1	60.1	63.4	65.7	5.9
			(9,700)	(9,620)	(9,720)	(9,920)	(9,740)	
	Others N=1,584		58.1	58.3	58.3	68.1	68.5	10.4
			(10,420)	(10,400)	(10,410)	(10,010)	(9,960)	
Private For-Profit	All N=2,232		53.3	53.3	53.5	56.5	56.7	3.4
			(3,540)	(3,550)	(3,540)	(3,500)	(3,490)	
	Fed. NPC N=188		68.6	68.6	69.1	68.7	69.1	0.5
			(2,690)	(2,700)	(2,680)	(2,750)	(2,750)	
	Others N=2,044		52.1	52.1	52.4	55.6	55.8	3.7
			(3,610)	(3,610)	(3,600)	(3,550)	(3,550)	

Note: GPA indicator is coded in NPSAS:12 at seven discreet levels: 1=D- to D; 2=D to C-; 3=C- to C; 4=C to B-; 5=B-to B; 6=B-A-; 7=A- to A.
FAFSA timing is measured with a dummy variable coded as 1=FAFSA submitted before April 1, the date by which most states' priority deadlines occurred in 2011-2012 academic year.
Additional income bracket model includes (in $): 0-30,000; 30,001-40,000; 40,001-50,000; 50,001-60,000; 60,001-70,000; 70,001-80,000; 80,001-90,000; 90,001-100,000; 100,001-150,000; >150,000

Table 8. Public, private nonprofit, and private for profit: Share of overall grant aid predicted by NPC models

			Base	GPA	FAFSA	Income	GPA + Timely FAFSA + Income	Largest Difference (pp)
4-Year Public Institutions	All N=1,522	R^2	68.9	69.3	69.6	73.4	74.5	5.6
		RMSE	(4,050)	(4,030)	(4,010)	(4,120)	(4,040)	
	Fed. NPC N=435		69.2	69.3	69.5	74.9	75.3	6.1
			(3,980)	(3,970)	(3,970)	(4,000)	(3,990)	
	Others N=1,087		68.8	69.4	69.7	72.9	74.3	5.5
			(4,080)	(4,040)	(4,030)	(4,160)	(4,060)	
4-Year Private Nonprofit Institutions	All N=1,559		56.8	57	57.0	66.8	67.1	10.3
			(10,900)	(10,890)	(10,890)	(10,580)	(10,550)	
	Fed. NPC N=126		55.9	57.4	56.3	59.8	62.8	6.9
			(10,190)	(10,070)	(10,200)	(10,500)	(10,260)	
	Others N=1,433		56.8	57.1	57.0	67.2	67.7	10.9
			(10,960)	(10,920)	(10,930)	(10,590)	(10,510)	
2-Year Public Institutions	All N=2,085		62.1	62.1	62.8	63.6	64.3	2.2
			(2,430)	(2,430)	(2,410)	(2,450)	(2,430)	
	Fed. NPC N=1,510		61.2	61.2	62.0	62.9	63.6	2.4
			(2,410)	(2,410)	(2,380)	(2,430)	(2,400)	
	Others N=575		64.0	64.4	64.6	65.2	66.1	2.1
			(2,480)	(2,480)	(2,470)	(2,520)	(2,490)	

Note: GPA indicator is coded in NPSAS:12 at seven discreet levels: 1=D- to D; 2=D to C-; 3=C- to C; 4=C to B-; 5=B-to B; 6=B-A-; 7=A- to A.
FAFSA timing is measured with a dummy variable coded as 1=FAFSA submitted before April 1, the date by which most states' priority deadlines occurred in 2011-2012 academic year.
Additional income bracket model includes (in $): 0-30,000; 30,001-40,000; 40,001-50,000; 50,001-60,000; 60,001-70,000; 70,001-80,000; 80,001-90,000; 90,001-100,000; 100,001-150,000; >150,000

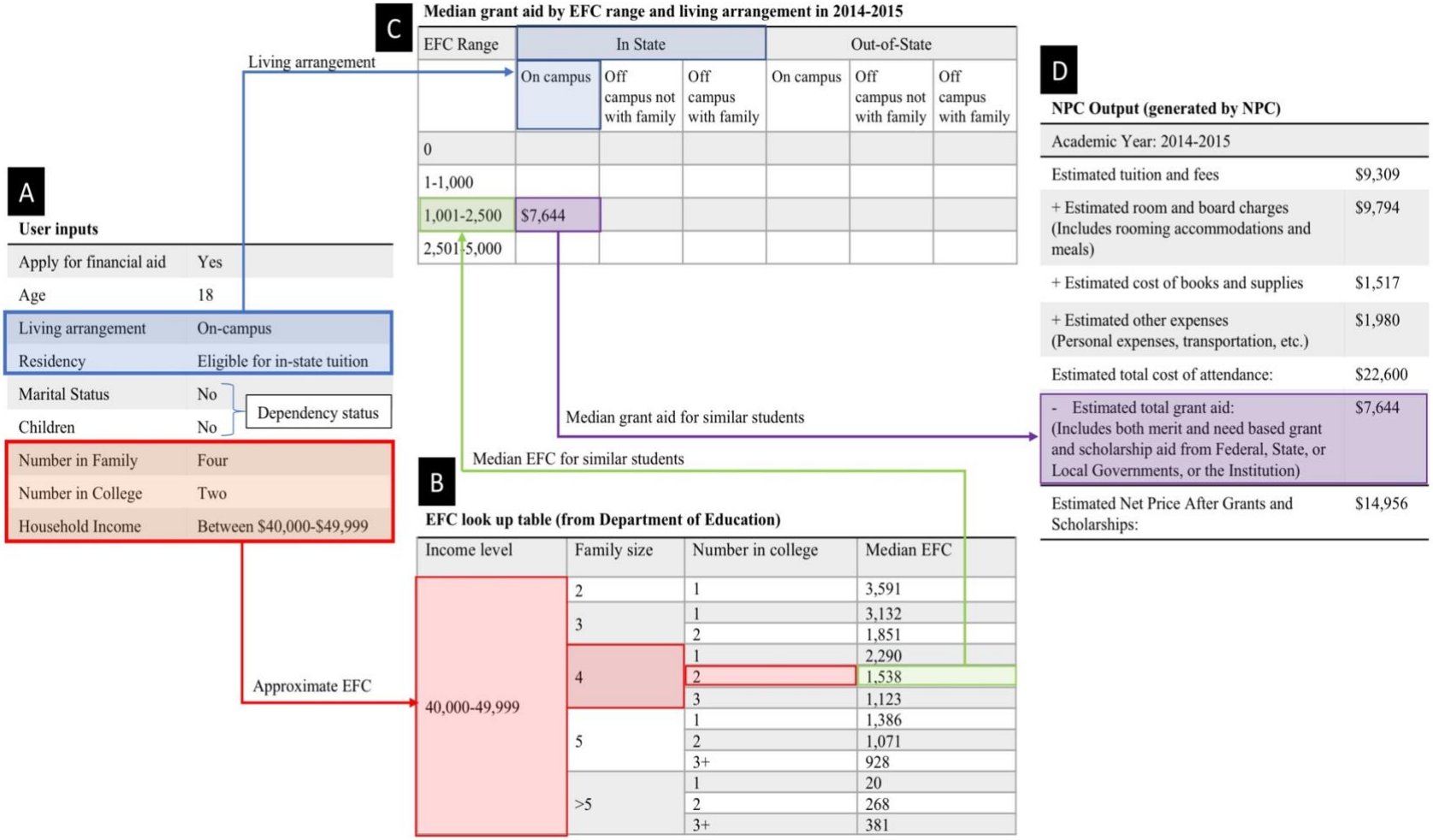

Figure 1. The federal template NPC process.

	In-State			Out-of-State		
EFC Range ($)	On-campus	Off-campus	Off-campus with family	On-campus	Off-campus	Off-campus with family
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. Back-end NPC table populated by institutions with median grant aid awarded in a previous academic year within each EFC rage by residency cell

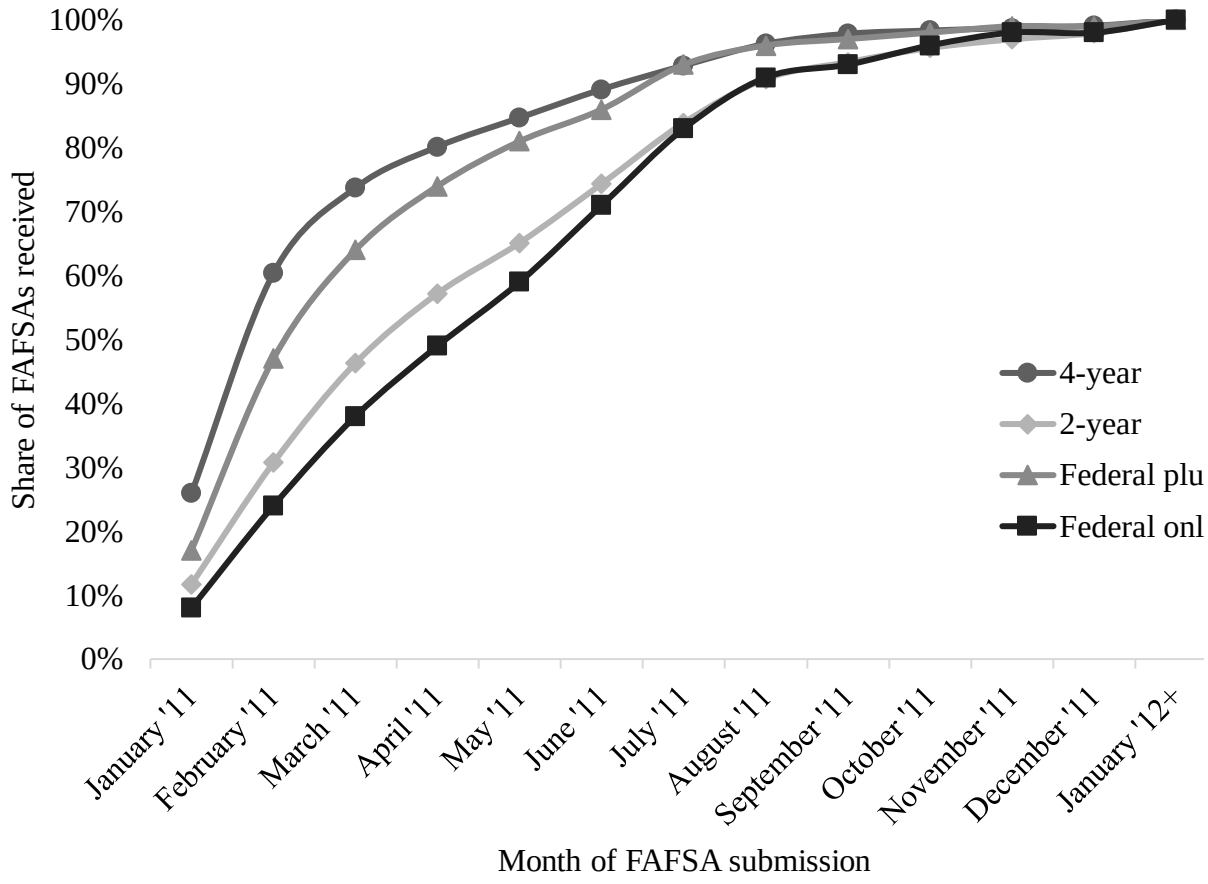

Figure 3. FAFSA filing time by source of financial aid and type of institution

Appendix A

EXPECTED FAMILY CONTRIBUTION FORMULA INFORMATION

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.[20] 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 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.

[20] 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. WE discuss this "prior prior" year tax information policy change in more detail later in this section.