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When Pell Today Doesn't Mean Pell Tomorrow: Evaluating Aid Programs With Dynamic Eligibility

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Generally, need-based financial aid improves students' academic outcomes. However, the largest source of need-based grant aid in the United States, the Federal Pell Grant Program (Pell), has a mixed evaluation record. We assess the minimum Pell Grant in a regression discontinuity framework, using Kentucky administrative data. We focus on whether and how year-to-year changes in aid eligibility and interactions with other sources of aid attenuate Pell's estimated effects on post-secondary outcomes. This evaluation complements past work by assessing explanations for the null or muted impacts found in our analysis and other Pell evaluations. We also discuss the limitations of using regression discontinuity methods to evaluate Pell—or other interventions with dynamic eligibility criteria—with respect to generalizability and construct validity.

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Abstract

Generally, need-based financial aid improves students' academic outcomes. However, the largest source of need-based grant aid in the United States, the Federal Pell Grant Program (Pell), has a mixed evaluation record. We assess the minimum Pell Grant in a regression discontinuity framework, using Kentucky administrative data. We focus on whether and how year-to-year changes in aid eligibility and interactions with other sources of aid attenuate Pell's estimated effects on post-secondary outcomes. This evaluation complements past work by assessing explanations for the null or muted impacts found in our analysis and other Pell evaluations. We also discuss the limitations of using regression discontinuity methods to evaluate Pell—or other interventions with dynamic eligibility criteria—with respect to generalizability and construct validity.

(1) Introduction

Between 1992 and 2022, published tuition and fees at public four-year U.S. colleges and universities more than doubled in real terms (Ma & Pender, 2022). For cohorts facing high direct costs of college, student financial aid (via grants and loans) has become an essential resource to facilitate access to post-secondary training. Indeed, an extensive literature documents that students respond positively to the availability of need-based financial aid. Need-based grant aid can increase rates of post-secondary enrollment, credit accumulation, and degree attainment (Nguyen, Kramer & Evans, 2019). Similarly, non-experimental research in many other contexts suggest that a $1,000 reduction in college costs increases enrollment and graduation rates by 3–5 percentage points (Deming & Dynarski, 2010; Page & Scott-Clayton, 2016).

While the results of randomized control trials and quasi-experimental evaluations show the benefits of need-based grant aid, not all aid programs have clear evidence of positive impacts on student outcomes (Nguyen et al., 2019). Despite being the largest source of need-based grant aid in the United States, the Federal Pell Grant Program (Pell) is one such example, with extant causal research documenting mixed effects on college enrollment, persistence, and completion (Bettinger, 2004; Rubin, 2011; Marx & Turner, 2018; Park & Scott-Clayton, 2018; Carruthers & Welch, 2019; Denning, Marx, & Turner, 2019; Liu, 2020; Eng & Matsudaira, 2021).

In this paper, we examine the impacts of receiving a minimum Pell Grant for first-time, first-year students who enroll and file a FAFSA at Kentucky public colleges and universities between 2011 and 2017. Consistent with past studies of the minimum Pell grant (e.g., Marx & Turner, 2018; Park & Scott-Clayton, 2018), we find no evidence that initial Pell eligibility confers academic advantages to marginally eligible students. We also find that initial Pell eligibility significantly decreases the amount a student borrows in their first year; and, for some

groups of students, this reduction in borrowing grows over time. We also build upon past studies to consider the ways annual changes in Pell eligibility ("churn") may affect our estimates by assessing the impact of initial Pell eligibility in the population of FAFSA filers who are disproportionately exposed to instability in Pell aid over time.

Our findings suggest important interactions between financial aid programs both in the short- and medium-run. Overall, examining heterogeneity of impacts across subgroups who experience more or less "churn" in aid eligibility, we find only a weak relationship between the stability of Pell aid over time, borrowing effects, and Pell impacts on educational attainment.

In general, the availability of close substitutes for a Pell Grant via subsidized loans may attenuate estimates of its impact, especially in subgroups with limited variation in total aid and on short-term academic outcomes, before loan repayment begins (Kline & Walters, 2016; Park & Scott-Clayton, 2018). In the full sample as well as within most subgroups, the Pell advantage in grant aid is offset by reduced borrowing, such that we cannot reject the null hypothesis of no difference in total aid (all grants plus all loans) at the Pell eligibility threshold, either initially or cumulatively. These null estimated differences in total aid correspond with null estimated impacts on academic outcomes. However, within the subgroups that experience the strongest contrasts in aid stability, we find correspondingly large differences in borrowing effects (with smaller, less negative borrowing effects for subgroups that experience more aid stability), which exceed the Pell advantage in grant aid. Within these groups, we find suggestive evidence connecting aid instability and reduced borrowing to worse academic outcomes.

In our context, marginal Pell eligibility in one year is a poor predictor of future Pell receipt. This lack of predictability in Pell eligibility emphasizes the barriers complex aid applications and annual renewal processes can create for students (Bettinger et al., 2012; Baum

& Scott-Clayton, 2013; Dynarski, Page & Scott-Clayton, 2022). National estimates suggest that roughly 20% of students fail to reapply for student financial aid even though they re-enrolled in a second year of college (Bird & Castleman, 2016), and even among those who do reapply, Pell eligibility in one year does not guarantee future eligibility. Among re-enrolling students in our analytic sample who did re-apply for federal aid after receiving a Pell grant in their first year, less than 65% maintained any Pell aid, while nearly 16% of initially ineligible students received a Pell grant in their second year of enrollment. In other words, aid recipients often lose Pell grant eligibility from year-to-year, while non-aid recipients can gain eligibility. This "churn" between Pell-eligibility and ineligibility means that cross-sectional estimates of the longer-term effects of receiving a Pell Grant in one year may be attenuated by a narrowing of differences in Pell aid received over time, especially near the Pell eligibility threshold, where year-to-year changes in Pell eligibility are most common.

Since Pell aid is least stable for students with EFCs near the minimum Pell threshold, and these students provide identifying variation in aid eligibility for evaluations of the minimum Pell grant that rely on a regression discontinuity (RD) design, attending to year-to-year variation in aid receipt is central to understanding the character of the treatment-comparison contrast in policy exposure in this type of quasi-experimental evaluation of the Pell grant. While the null relationship between initial Pell eligibility and future Pell aid supports our use of a traditional RD estimator, as opposed to a model that takes dynamic eligibility into account (Cellini, Ferreira & Rothstein, 2010), we emphasize that researchers and policymakers should thus interpret our findings as estimating the effect of receiving a ~$300 award for a single year (about half the minimum Pell Grant award for a full-time student during our sample period) in contrast to reflecting aid impacts for "typical" or "average" Pell recipient. This is because the majority of

Pell students receive larger awards and are more likely to maintain year-to-year Pell eligibility than students with a first-year EFC near the Pell-eligibility threshold, like those in our sample.

These facts emphasize the limitations of RD evaluations of the minimum Pell Grant with respect to external validity (i.e., how the results should be expected to generalize) and construct validity (in this case, with respect to what "treatment" the treatment-comparison contrast represents), despite maintaining a strong claim as an internally valid method to estimate the total impact of marginal Pell eligibility in a student's first-year of college. The impact of Pell "churn" on our results thus has important implications for future design and evaluations of broad-reaching student aid programs or any repeated intervention with time-varying, dynamic eligibility criteria. Researchers and policymakers should exercise caution when extrapolating results from this study (or any RD evaluation of the minimum Pell grant) to other groups of students, other amounts of Pell aid, or other grant aid programs.

We begin this paper with an overview of the Federal Pell Grant Program in Section 2. Section 3 describes our data, and Section 4 explains our empirical approach. Section 5 presents results, and Section 6 concludes with a discussion and potential pathways for future research.

(2) Background & Context

2.1 The Federal Pell Grant

The Federal Pell Grant reaches over 30% of all undergraduates, providing aid to six to nine million students each year at an annual cost of $25 to $45 billion dollars (Ma & Pender, 2022). The awards themselves make up 15% of all grant and loan aid awarded to undergraduate students (Ma & Pender, 2022) and is annually awarded to students based on information they provide on the Free Application for Federal Student Aid (FAFSA). The U.S. Department of Education converts information submitted on the application into an Expected Family

Contribution (EFC), which represents the amount of money a family or student is expected to pay towards that student's post-secondary education expenses. Beyond the federal government, states and institutions may use the EFC to determine student eligibility for need-based aid programs. Institutional financial aid offices also use this information to package grant and loan aid to make up some or all costs of attendance remaining after accounting for a student's EFC.

An individual's EFC in a given year is subtracted from the maximum Pell award for that year to determine whether a student is eligible to receive Pell aid and the size of their award, if eligible. Aid applicants with the most limited financial resources have an EFC of $0 and receive the maximum Pell award for their enrollment intensity. For aid applicants with sufficient financial resources to generate a non-zero EFC, Pell aid declines linearly with the EFC until reaching the maximum Pell-eligible EFC, when aid discontinuously declines to $0. The Pell Grant's authorizing legislation sets the minimum award at ten percent of the maximum award, so when the difference between an aid applicant's EFC and the maximum award falls below this minimum, that student is ineligible for a Pell Grant and receives no Pell aid (Cordray, 2023). This idiosyncrasy in the mapping from a student's EFC to their Pell award creates the discontinuity in aid receipt at the minimum Pell threshold that provides the identifying variation for RD evaluations of the minimum Pell grant.

An individual's exact EFC value is difficult for applicants to determine before submitting their FAFSA, although online calculators are available to help students and their families estimate their EFC based on their income. Additionally, income reported on the FAFSA is subject to verification by the IRS, leading to low rates of misreporting or falsification (Warwick, 2018; Eng & Matsudara, 2021). At the upper end of the Pell-eligible EFC distribution, even an accurate estimate of the EFC may not guarantee future Pell eligibility because funding for the

program and the overall eligibility threshold can vary from year to year. Between AY2010-11 and AY2019-20, the academic years included in this study, the maximum EFC eligibility threshold for the minimum Pell Grant ranged from $4,995 to $5,576. The minimum annual Pell Grant awarded to full-time students ranged from $555 to $650 (Table 1).

[Table 1]

Past analyses of the Pell Grant program have demonstrated that exogenous changes in Pell aid can cause small positive effects on student persistence (Bettinger, 2004), enrollment intensity (Park & Scott-Clayton, 2018), and summer enrollment (Liu, 2020). For students with the most limited financial resources (and largest Pell awards), the program can also increase degree attainment and longer-term earnings (Denning, Marx & Turner, 2019), although these impacts may vary by context (Eng & Matsudaira, 2021). However, among students at the cusp of Pell eligibility, longer-term effects on educational attainment and labor market outcomes are statistically indistinguishable from zero (Marx & Turner, 2018; Park & Scott-Clayton, 2018).

Some of this variance in estimated impacts may result from program characteristics that belie a straightforward analysis, specifically Pell's interaction with other student aid programs, annual reapplication requirements, and changing program eligibility thresholds. As a first-dollar scholarship, the Pell Grant is awarded to eligible students before other sources of aid (e.g., state and institutional grants or federal student loans). Because institution and state aid administrators may incorporate a student's expected Pell Grant into subsequent aid awards, Pell Grant eligibility does not always substantially lower costs for students (Turner, 2017; Park & Scott-Clayton, 2018). Some institutions, for example, award additional aid to students who were marginally ineligible for the minimum Pell Grant, eliminating differences in total cost of attendance at the Pell-eligibility EFC threshold (Park & Scott-Clayton, 2018). Other institutions with more limited

grant resources may offer students access to subsidized or unsubsidized federal loans that offset differences in liquidity between Pell-eligible and Pell-ineligible students.

Another possible explanation for the Pell Grant's mixed evaluation record is the instability and unpredictability of Pell aid over time. Some students who initially receive a Pell Grant may choose not to apply in subsequent years or forget to submit an application despite being eligible and enrolled in college. Students whose personal or family income fluctuates from year-to-year may lose or gain eligibility when their income rises or falls. Additionally, year-to-year changes in the Pell Grant eligibility threshold may lead other students to gain or lose eligibility over time even if their financial circumstances do not change. Over time, annual reapplication requirements and changes to program eligibility rules thus narrow the contrast in total aid exposure between initially Pell-eligible and ineligible students, potentially attenuating the impact of initial Pell eligibility on longer-term outcomes like persistence and graduation.

While some students receive Pell Grants of similar magnitudes throughout their college career, others see large fluctuations in the size of their Pell grant over time, and a non-trivial share of applicants gain or lose eligibility each year. The rate of "churn" in Pell eligibility is highest near the EFC threshold for the minimum Pell Grant, where small changes in applicants' family income, the EFC formula, or the mapping from EFC to aid may impact an individual's aid eligibility over time. Our analysis complements Schudde and Scott-Clayton's (2016, 2020) work examining how academic requirements for aid renewal can impact the efficacy of need-based aid (another mechanism that contributes to instability in Pell aid).

Given that complex aid applications can negatively impact student success (Bettinger et al., 2012; Baum & Scott-Clayton, 2013; Dynarski, Page & Scott-Clayton, 2022) and reducing uncertainty in aid eligibility increases application and enrollment rates (Dynarski et al., 2021;

Burland et al., 2022; Anderson et al., 2023), certainty of year-to-year stability in financial aid could promote students' longer-term academic outcomes. Unfortunately, students do not always view federal financial aid as particularly predictable and reliable compared to other financial resources, such as earnings from work (Ziskin et al, 2014; Goldrick-Rab et al., 2016). Assessing the extent to which aid stability and predictability mediates financial aid program effectiveness could help inform financial aid policy and program design. We estimate the impact of initial Pell eligibility in a sample of FAFSA filers who are disproportionately exposed to instability in Pell aid over time (those with an initial EFC near the threshold for Pell eligibility), and we further examine how award impacts vary across subgroups within this sample who experience the most and least instability in Pell aid over their first four to six years of potential college enrollment.

(3) Data & Descriptive Statistics

Before examining how Pell eligibility affects a student's academic outcomes and borrowing decisions, we describe our dataset, sample restrictions, and document how students' Pell eligibility status changes over time.

3.1 Data and Sample Construction

Our analysis focuses on first-time first-year undergraduate students who enrolled in a Kentucky public two- or four-year post-secondary institution between AY2010-11 and AY2016-17. We observe outcome data through AY2019-20, allowing us to examine impacts on outcomes at least four years after initial enrollment for our analytic sample. We use higher education administrative records collected by the Kentucky Center for Statistics, including detailed financial aid records for students who apply for aid and enroll at all public institutions in the state. Financial aid records include information on the amount and source of any federal, state, or institutional aid (grants and loans) a student is offered each academic year. We assume that if a

student is missing a financial aid record in a given year, then they did not receive any federal, state, or institutional aid during that academic year. If a student is missing all FAFSA data in a period, we assume they did not file a FAFSA in the state during that period. We link these data to students' demographic, course enrollment, and degree attainment records from public two- and four-year institutions in the state.

Students' demographic data include an indicator for male gender, a mutually exclusive set of race indicators (racial categories include Asian/Pacific Islander, Black/African-American, multiple races, Native American, white, and unknown), an indicator for Latino/Hispanic ethnicity, and birthyear. We use students' birthyear to approximate their age at first college enrollment.

We use course enrollment and degree attainment records to construct various measures of college outcomes. We calculate the total number of college-level credits earned and grade point average (GPA) in college-level courses by academic year and overall. We also use the course enrollment file to measure whether a student re-enrolled in a given academic year. We assume that missing college graduation or enrollment information in a given period indicates that a student did not graduate from or enroll in an institution covered by the state's database during the relevant period.

Our primary analysis focuses on first-time, first-year students who began their studies in the fall semester of AY2010-11 through AY2016-17 at a two- or four-year public postsecondary institution in Kentucky. We determined students' first-year, first-time status through a combination of prior enrollment records going back to AY2008-2009, degree conferral dates, and institutional definitions of student type. In our preferred specifications, we further limit our analytic sample to those students who applied for financial aid and had an EFC within $2,000 of

the minimum Pell grant eligibility threshold during their first year. To assess the sensitivity of our findings to this choice of bandwidth, we replicate our findings in a variety of bandwidths from within $250 to within $3000 of the Pell eligibility threshold, including using the optimal bandwidths recommended by Calonico, Cattaneo, Farrell, and Titiunik (2017) for each outcome. See Section 4.2, Section 5.5, and Table 7 for details. We exclude students who enrolled in more than one institution during their first semester, who were younger than 16 at the time of their first enrollment, or who had inconsistent course credit records across state enrollment files in their first year. These decisions result in a total analytic sample of 16,553 students in our preferred specifications, although we examine alternative samples that range from 2,003 (BW=$250) to 25,461 (BW=$3,000) individuals.

Notably, our $2,000 bandwidth—and each optimal bandwidth calculated by rdrobust—excludes students with a $0 EFC, a large share of the Kentucky undergraduate population (46.4% of first-time first-year students who filed a FAFSA). Because RD point estimates represent local effects, our results may not extrapolate to this important group of students. The average Pell Grant award of first-year Pell recipients within our sample was $1,364, significantly less than the average Pell Grant award received among all first-time freshman who applied for aid in Kentucky ($3,880). We note these differences to emphasize that our analysis should be interpreted as the local effect of crossing the minimum Pell Grant eligibility threshold for students at the margin of Pell eligibility and may not generalize to other Pell recipients or typical Pell award sizes. Table 2 demonstrates how our analytic sample compares to the general population of first-time, first-year students in Kentucky.

3.2 Descriptive Statistics

Panel A of Table 2 compares the mean demographic characteristics of our analytic

sample (column 1) with all institutionally designated first-year students who filed a FAFSA in the full state administrative dataset (column 2). Compared to all first-year students in Kentucky who applied for financial aid, our sample is younger and has a larger share of financial dependents. Students in our sample are more likely to identify as male or white and less likely to identify as Black or African-American. Compared to the demographic characteristics of a nationally representative sample of first-time college students, our sample tends to be older, whiter, and less likely to identify as Hispanic (NCES, 2017).

Panel B examines mean differences in baseline college enrollment behavior between our analytic sample and their peers across the state. In our analytic sample, 44% of students began their studies at a community college in the state, while the remaining 56% first enrolled at a public four-year institution. Across all institutionally-designated first-year students in Kentucky, 54% (46%) were enrolled at a public two-year (four-year) institution. Relative to the general population of first-year students, members of our analytic sample are also more likely to enroll full-time and less likely to have taken a developmental education course during their first year.

[Table 2]

Panel C of Table 2 examines patterns of financial aid receipt and application within our analytic sample and the statewide sample. The analytic sample received a smaller average Pell award in their first year of enrollment ($676 vs. $2492) and were much less likely than the general population of first-year students to ever have a $0 EFC during the four years we observe aid receipt for all cohorts (10% vs. 52%). The analytic sample is also less likely to receive a Pell award in their first year (50%) or second year (29%) than the statewide sample (64% and 34%, respectively). Members of the analytic sample were more likely to ever take out a loan (74% vs. 66%) or file a FAFSA in their second potential year of enrollment (61% vs. 54%).

In addition to observing aid applications each year, we can also assess whether and how students gain and lose Pell eligibility over time. Figures 1 and 2 show patterns of aid receipt over time, demonstrating that after the first year of college enrollment, many initially ineligible Pell Grant students receive Pell Grant funds at some point in their college career.

[Figure 1]

[Figure 2]

(4) Method & Empirical Strategy

In this section, we describe the RD method we use to estimate the effect of the Pell Grant on student outcomes. Two key assumptions are required for the unbiasedness and consistency of our RD estimates if they are to be interpreted as the total effect of first-year Pell Grant eligibility on student outcomes. First, a student's EFC must strongly predict Pell eligibility (similar to the requirement of instrument relevance in instrumental variables estimation). Second, a student must not be able to manipulate where their EFC (the running variable in our RD analysis) falls relative to the Pell eligibility threshold. In other words, we must be able to demonstrate that a student's position relative to the EFC threshold is a good predictor of "treatment" (Pell eligibility) and that eligibility at the threshold is as-good-as-random with respect to potential outcomes.

Figures 3a-3d show that the EFC threshold does indeed determine whether a student receives Pell aid. To assess whether students can manipulate their position relative to this threshold, we examine the density of observations above and below the threshold (Figure 4). Since eligibility at the margin is determined by the relation of a student's family income to an EFC cutoff that is not known ex-ante to the student or her family, we believe that it is unlikely that students or families are able to manipulate their position relative to the threshold. If students

were able to manipulate their EFC, we would expect the density to be higher immediately below the threshold, where students become eligible for more federal and state grant aid. We find some evidence of bunching immediately *above* the EFC threshold, which is the opposite of what we would expect to find if students and families were able to strategically manipulate the FAFSA. This pattern of non-strategic bunching occurs in other Pell grant evaluations (e.g., Park & Scott-Clayton, 2018; Carruthers & Welch, 2019). While the missingness might be due to student selection into institutions outside of our sample, others have found only small impacts of Pell on college choice (Marx & Turner, 2018; Carruthers & Welch, 2019). Despite this precedent, uneven density on either side of the cut-off raises concerns that students immediately above and below the threshold may differ in their observable and unobservable characteristics, including their potential outcomes.

[Figure 3a-3d]

[Figure 4]

To address this concern, we assess whether sharp changes in outcomes at the threshold could be explained by discontinuities in observable student characteristics by testing whether student demographics are a smooth function of EFC at the threshold in Table 3. We also test for any discontinuities in non-need-based grant aid at the Pell eligibility threshold, since non-need grants are often awarded based on academic performance or other measures of ability or achievement. While any discontinuities in *unobservable* characteristics at the Pell-eligibility threshold are in-principle untestable, it is reassuring that we find no evidence of discontinuities in the demographic characteristics or non-need-based aid at the Pell eligibility threshold.

[Table 3]

4.1 Local Polynomial RD Model

We use Calonico and coauthors' (2017) robust bias-corrected regression discontinuity method to assess the impact of being marginally Pell-eligible in a student's first year (t=1) on our outcomes of interest in year *t*, using the rdrobust package in Stata to estimate equation (1):

$$Y_{it} = f(EFC_{i1}) + \delta Z_{i1} + \boldsymbol{X_i'\theta} + \gamma_s + \tau_c + \epsilon_{istc} \qquad (1)$$

where EFC_{i1} is the running variable, centered at the threshold for Pell Grant eligibility in year 1, and Z_{i1} is an indicator variable that takes on a value of one if EFC_{i1} is below the Pell-eligibility threshold in year 1 and zero otherwise (i.e., EFC_{i1}<=0 implies $Z_{i1} = 1$), which means individual *i* was eligible to receive a Pell grant in year 1 based on EFC_{i1}). Y_{it}, the dependent variable, may represent a first-stage measure (e.g., amount of Pell-aid received in Year *t*) or an outcome of interest (e.g., borrowing behavior or measures of educational attainment in year *t*). In our main results, $f(EFC_{i1})$ represents a local-polynomial function linking individual's EFC in year 1 to a given outcome $Y_{it}, t \in \{1,2,3,4\}$. In specifications that limit the sample to cohorts who enrolled in 2014 or earlier, we can also assess outcomes measured through Year 6. We use a local-linear model to generate our preferred estimate and discuss the sensitivity of our results to alternative polynomial specifications in Section 5.5 and present results from local quadratic and local cubic models in Online Appendix Tables A2a and A2b. Across all specifications, standard errors are robust to account for possible heteroskedasticity.

The vector, $\boldsymbol{X_i}$, accounts for student-level covariates such as age, race, and financial dependency status. We include cohort fixed effects, τ_c , to account for any year-specific common shocks, including stability of the Pell grant eligibility threshold over time and the availability of financial aid in any given year. In our main results, we also include institution fixed effects, γ_s. Institution fixed effects account for institution-specific practices and differences, such as the amount of institutional aid available to offset any unmet financial need; tuition and fee rates; and

other practices that may affect student success. We discuss the implications of conditioning on first-year institution in our robustness checks in Section 5.5 and present alternative specifications in Online Appendix Tables A3a and A3b, where we remove institutional fixed effects entirely (A3a) or replace institutional fixed effects with post-secondary sector (i.e., two-year versus four-year) fixed effects (A3b).

The parameter δ represents our estimate of the discontinuous change in the predicted value of Y_{it} from the left and right of the minimum Pell-eligibility threshold, which we interpret as the total causal impact of becoming Pell-eligible (by crossing the EFC threshold) in a student's first year on Y_{it}. In addition to estimating the impact of Pell-eligibility on cross-sectional outcomes using Equation (1), some of our outcomes are also aggregated over time. For outcomes that sum over multiple time periods, we replace the left-hand side variable with a measure that sums that outcome over time (e.g., $TotalPell_i = \sum_{t=1}^{4} PellAmount_{it}$). To measure the impact of Pell eligibility on the maximum value of a binary outcome, such as whether a student every borrowed across multiple years, we replace the left hand side variable with a measure that identifies the maximum value of that outcome over time, [e.g., $everPell_i = \max(ReceivedPell_{it}), t \in \{1,2,3,4\}$].

4.2 Bandwidth Selection

Another critical component of RD analyses is bandwidth selection. A large bandwidth, such as $4,000 above and below the EFC threshold for Pell eligibility, would increase the statistical power of our analysis by increasing the sample size. Large bandwidths, however, also increase the difficulty of accurately modeling the relationship between EFC and our outcomes of interest at the Pell-eligibility threshold, a version of the bias versus variance trade-off (Imbens & Kalyanaraman, 2012). Smaller bandwidths may facilitate more credible extrapolation at the

threshold, but at the cost of larger confidence intervals and lower statistical power. Past evaluations of need-based grant aid that use a RD design to examine differences in outcomes at minimum aid eligibility thresholds have generally used bandwidths ranging from $1,000 to $4,000 (e.g., Castleman & Long, 2016; Park & Scott-Clayton, 2018; Castleman, Long & Mabel, 2018; Marx & Turner, 2018; Carruthers & Welch, 2019).

Recent developments in the RD literature facilitate data-driven optimal bandwidth selection (Calonico, Cattaneo, Farrell & Tituinik, 2017), however because an optimal bandwidth is calculated based on features of the running variable *and* the target outcome variable, there is no single well-defined "optimal" analytical sample in analyses with multiple outcomes. We use a $2,000 bandwidth for our preferred specifications because it is near the mean of the optimal bandwidths for the outcomes we consider and similar to the bandwidths used in other RD evaluations of the Pell grant (see above). Additionally, using a single common bandwidth throughout our analyses ensures that our impact estimates are generated by a common sample of students and allows us to conduct placebo tests within this sample. In Table 8, we assess the sensitivity of our results to our choice of bandwidth by replicating our main results in several different bandwidths ($250; $500; $1,000; $1,500; $2,000; and $3,000), as well as the optimal bandwidths for each outcome calculated using Calonico and coauthors' (2017) method. In all Online Appendix Tables, which assess the sensitivity of our results to alternative modeling decisions, these alternative models are also estimated over these alternative bandwidths, including the outcome-specific optimal bandwidths. We present results from our preferred local linear model, varying only the bandwidth in Table 7. The correlation of impact estimates across outcomes using the $2,000 bandwidth ($\delta_{2000}$) and the optimal bandwidth (δ_{opt}) is over 0.995 and for all outcomes, δ_{2000} is within the 95% confidence interval of δ_{opt}, suggesting strong

consistency between our preferred estimates and those generated by restricting the sample to the optimal bandwidths for each outcome.

(5) Results

5.1 First-Year Effects on Financial Aid

Figures 3a, 3b, 5a-5d, and Column 1 of Table 4 examines how Pell eligibility affects financial aid outcomes during a student's first year of enrollment. We first examine the direct relationship between first-year Pell eligibility and first-year Pell aid at the extensive and intensive margins. We find that marginally Pell-eligible students were 77 percentage points (SE=1.4pp; hereafter, standard errors follow point estimates in parentheses) more likely to receive a Pell grant in their first year, receiving an additional $351 ($10) in first-year Pell aid. Additionally, the Pell-eligibility threshold appears to be used for other need-based awards, as marginally Pell-eligible students receive an additional $582 ($29) in other need-based aid in their first year of enrollment. We find no differences in non-need based grants or institutional grants at the threshold.

However, marginal Pell eligibility reduces rates of borrowing by 9.7pp (2.2pp) in a student's first year of enrollment. The majority of marginally Pell-eligible students' first-year advantage in total grant aid [$897 ($239)] is offset by reduced borrowing [-$734 ($275)], so that summing across all grants and loans, students on either side of the Pell-eligibility threshold have similar access to total financial aid in their first year of college [$164 ($301)]. Notably, the reduction in borrowing is driven by lower takeup of subsidized federal loans [-$801 ($257)], rather than reductions in other sources of loan aid [+$68 ($126)].

5.2 Total Effects on Financial Aid

As shown in Columns 2 and 3 of Table 4, the relationship between first-year Pell

eligibility and financial aid changes in subsequent years. First-year Pell eligibility is a poor predictor of future Pell receipt. Students who were marginally Pell-eligible based on their first year EFC are no more likely to receive a Pell grant during the next three years than their marginally ineligible peers. While marginally eligible students are 77pp more likely to receive a Pell grant in their first year of enrollment, they are only 46pp more likely to ever receive a Pell grant during their first four years of potential enrollment. Taking point estimates at face value, the gap in total Pell aid received attenuates by nearly 30% over the next three years following a student's first year of enrollment [-$98 ($154)], so that summing over a student's first four years of potential enrollment, first-year Pell eligibility predicts just $253 ($156) more total Pell aid, which is indistinguishable from no difference in total aid at conventional levels of statistical significance. This echoes the pattern of aid dynamics shown in Figures 1 and 2: a large number of students who were initially ineligible for the Pell grant ultimately gained Pell eligibility at some point after their first year in college, while some initial Pell recipients stopped receiving aid, narrowing the gap in aid receipt over time.

Similarly, first-year Pell eligibility stops predicting non-Pell need-based aid after a student's first year of enrollment. In subsequent years, marginally Pell-eligible students receive no more non-Pell need-based aid than their marginally ineligible peers [$15 ($61)], maintaining their initial advantage in non-Pell need-based aid, but not adding to it after four years of potential enrollment.

Despite this weakening of the relationship between first-year Pell eligibility and need-based financial aid over time, the gap in borrowing rates at the first-year EFC threshold does not substantively narrow. While Pell eligibility initially decreases a student's likelihood of borrowing by 9.7pp (2.2pp), marginally Pell-eligible students are still 8.3pp (2.1pp) less likely to

ever borrow through four years of potential enrollment. Similarly, taking point estimates at face value, the initial $733 ($275) gap in borrowing increases over time, nearly doubling to $1,339 ($892) through four years of potential enrollment. While we are unable to isolate how much of the estimates in intermediate years are due to the churn in students' Pell eligibility—and large confidence intervals preclude any firm conclusions about the dynamics of borrowing behavior over time—we take this as suggestive evidence that initial borrowing attitudes may be persistent, consistent with Marx and Turner's (2018) finding that borrowing has fixed costs. In other words, the initial presence of grant aid may induce some students to permanently forgo borrowing in a manner that creates or aggravates credit constraints when grants are temporary. In section 5.4 below, we examine whether and how the noisy full-sample relationship between initial Pell eligibility and later borrowing behavior masks heterogeneous borrowing impacts across subgroups of students.

[Table 4]

5.3 Impacts on Academic Outcomes

We examine measures related to academic progress, persistence, and attainment during a student's first four to six years of potential enrollment to assess the impact of marginal Pell eligibility on students' post-secondary educational success. In the full analytic sample, we find no statistically significant effect of receiving a minimum Pell grant on academic outcomes during a student's first four to six years of potential enrollment.

In Table 5, we see that overall, marginal first-year Pell recipients are no more likely to re-enroll, earn no more credits, and are no more likely to earn a degree within four or six years than their peers whose first-year EFC makes them marginally ineligible for Pell aid. In fact, if anything, taking the point estimates at face value suggests a small negative relationship between

Pell receipt and academic outcomes at the Pell-eligibility threshold. While the confidence intervals are too wide to rule out the null hypothesis of no effects, they are sufficiently narrow to rule out large positive effects of marginal Pell eligibility on academic outcomes. This is consistent with the mixed effects of the Pell Grant across multiple contexts (see Dynarski, Page & Scott-Clayton, 2022 for a review).

Note that we do not assess the Pell Grant's impact on college enrollment decisions because our data is limited to students who have already enrolled in college at a particular institution, and our preferred model conditions on first-year institution. In section 5.5 below, we present estimate from models that relax this condition to assess whether Pell eligibility influences college choice.

[Table 5]

5.4 Subgroup Analysis

We also examine whether and how our impact estimates vary across student subgroups by their demographic characteristics and receipt of merit aid (Table 6a). A mature literature has established that borrowing behavior varies by students gender, race, and financial dependence (Miller, 2017; Chan et al., 2019; Furquim et al., 2022). To further explore aid stability (i.e., the extent to which initial Pell eligibility predicts aid receipt in year 2 and beyond) and borrowing effects as potential mediators of Pell effects on academic outcomes, we interact the characteristics of groups with higher or lower rates of aid stability and more or less persistent borrowing effects to isolate subgroups with the greatest contrast in their exposure to these mechanisms (Table 6b).

5.4.1 Heterogeneity by Gender, Race/Ethnicity, Financial Dependency, and Merit Aid

Examining impacts on Pell aid receipt and borrowing across demographic subgroups, two

distinct patterns emerge. First, across gender and racial groups, initial Pell-eligibility is generally a weak predictor of future Pell receipt, and heterogeneity in borrowing impacts by gender and race emerge over time. For male, female, URM and non-URM students, there is limited short-run variation in borrowing impacts: across all gender and race subgroups, first-year Pell-eligibility predicts ~$700-$900 less borrowing in a student's first-year of enrollment. This decrease in borrowing more or less offsets the Pell-advantage in first-year grant aid within a subgroup, such that we cannot reject the null hypothesis that marginal first-year Pell eligibility has no effect on total first-year aid in any subgroup. However, for female students, an initial -$735 ($388) reduction in first-year borrowing grows by nearly 300% to -$2,872 ($1,263) through four years of potential enrollment. Similarly, for non-URM students, the -$886 ($300) gap in first-year borrowing more than doubles to $2,147 ($961) over the same period. Conversely, for male and URM students, the initial borrowing deficit for Pell-eligible students disappears over time.

Second, a large initial contrast in borrowing impacts by financial dependency widens over time. First-year Pell-eligibility is a modest predictor of future Pell receipt for financially dependent students [4.7pp (2.3pp)], but not for financially independent students [-3.6pp (5.1pp)]. For financially dependent students, Pell-eligibility has a limited impact on borrowing in a student's first-year of enrollment or through four years of potential enrollment. Marginal Pell eligibility does not predict a statistically significant gap in borrowing in the short or medium-term for these students. In contrast, marginal Pell-eligibility substantially reduces the amount of money financially independent students borrow in both the short and medium-term. Marginally Pell-eligible financial independents borrow $1,641 ($412) less in their first year of enrollment, which more than doubles to $3,719 ($1,275) less through four years of potential enrollment. Financial dependency is closely related to age at first enrollment, and a similar pattern holds if

we split the sample by age, with younger students replacing financial dependents and older students replacing financial independents.

We also examine Pell effects by participation in Kentucky's largest merit aid program, the Kentucky Educational Excellence Scholarship (KEES), a renewable award that provides up to $2,500 per year in grant aid to students who enroll in participating Kentucky institutions (including all public institutions in our dataset) based on their annual high school GPA and ACT score. Students need not be exceptionally high achievers to earn KEES aid: students are eligible for a minimum KEES grant of $125 for each year they earn a high school GPA of 2.5 or higher, earning an additional $25 for each one-tenth of a grade point above 2.5 up to a maximum of $500 for each high school year they earn a 4.0 GPA (i.e., up to $2,000 in total grant aid per year based on GPA alone). Students who earn a high school GPA of at least 2.5 in any year are eligible to receive additional KEES grant aid based on their ACT score if they earn a composite score of 15 or higher, far below the national average, which ranged from 20.8 to 21.1 between 2009 and 2016, when the majority of our sample would have graduated from high school (NCES, 2022). The ACT bonus begins at $36 per year for a composite score of 15, reaching a maximum of $500 per year if a student earns a composite score of 28 or higher. There are no clear patterns of heterogeneous Pell impacts based on whether a student received a KEES award.

As within our full sample, marginal Pell eligibility appears to have no statistically significant effect on credits earned, persistence, or graduation in any gender, race, financial dependency, or merit-aid subgroup. Even in the subgroups where Pell eligibility leads to the largest decline in borrowing, the negative estimated effects on academic outcomes are indistinguishable from zero. In other contexts, the credit constraints introduced by Pell eligibility negatively impacted students' academic outcomes (Marx & Turner, 2018), suggesting that our

null findings could be a result of statistical imprecision or contextually heterogeneous effects of Pell aid. We note that despite wide confidence intervals in our estimated impacts on academic outcomes, the point estimates of the impact of Pell-eligibility on short-term re-enrollment and credit attainment are consistently negative for those groups that experienced the largest overall decrease in borrowing as a result of being marginally Pell eligible. The correlation between estimated impacts by subgroup on total loans and second year reenrollment is 0.95 ($p<0.001$), while the correlation between estimated impacts on total loans and credit attainment is 0.62 ($p=0.103$). There is no correlation between estimated impacts by subgroup on total loans and degree attainment ($\rho=-0.35$, $p=0.395$).

[Table 6a]

5.4.2 Contrasts in Aid Stability and Borrowing Impacts, by Intersectional Identity

In Table 6b and Online Appendix Table A5, we interact the demographic characteristics in Table 6a to assess potential heterogeneity in Pell effects based on students' intersectional identities. In Table 6a, financial independence, female gender identity, and non-URM group membership were the strongest predictors of Pell effects on immediate and cumulative borrowing outcomes, so we interact all possible combinations of financial independence, non-URM group membership, and female gender to explore the heterogeneous impacts of marginal Pell eligibility across these subgroups. Additionally, female gender and receipt of a KEES grant were the strongest predictors of aid stability, so we also interact these subgroups to further assess how and whether variation in "churn" relates to effects on aid or academic outcomes. We isolate the intersectional subgroups with the strongest contrast in Pell effects and present these subgroup results in Table 6b; subgroup impact estimate for the remaining subgroups are reported in Online Appendix Table A5.

Table 6b reveals substantial variation in Pell stability and borrowing effects across intersectional identity subgroups, and the sharpest contrasts in borrowing effects correspond with the sharpest contrasts in aid stability. In columns (1)-(4) of Table 6b, we can see that while financially *independent* female or non-URM students forgo the most loan aid, both initially and cumulatively, they are also subgroups where the first-year Pell eligibility does not predict second year Pell aid—in fact the point estimates predicting differences in second year Pell aid at the first-year Pell eligibility threshold are negative in both cases. Marginally Pell-eligible students who are female and financially independent forgo $1,403 ($585) of loans in their first year of enrollment, are 5.4pp (7.6pp) *less* likely to receive Pell aid in their second year of potential enrollment and borrow $4,924 ($1,919) less through four potential years of enrollment. Conversely, marginally Pell-eligible students who are financially *dependent* and female are 7.7pp (3.3pp) *more* likely to receive Pell aid in their second year of enrollment, and their borrowing behavior is statistically indistinguishable from that of their marginally Pell-ineligible peers (although point estimates are also negative). A similar pattern holds when we compare Pell-effects for financially dependent versus financially independent non-URM students in columns (3) and (4). Taking point estimates at face value, Pell impacts on borrowing behavior of these subgroups of financially independent students are roughly two to three times larger than for their financially dependent peers.

This pattern is magnified when we further interact female gender with non-URM identity *and* financial dependence in columns (5) and (6). First, financially dependent female, non-URM students experience more consistency in year-to-year Pell aid. While marginally Pell-eligible, female, non-URM, financially dependent students are 9.1pp (3.6pp) more likely to receive a Pell award in their second potential year of enrollment, initial Pell-eligibility does not predict

subsequent Pell receipt for their financially independent peers [-7.2pp (8.5pp)]. Additionally, for non-URM, female, financially independent students, marginal Pell eligibility leads to substantially lower borrowing rates [-20.6pp (6.9pp) in Y1; -16.8pp (6.9pp) through Y4], borrowing amounts [-$1,899 ($619) in Y1; -$6,171 ($2,116) through Y4], and total aid [-$1,828 ($683) in Y1; -$6,720 ($2,786) through Y4]. Effects on borrowing outcomes are substantially attenuated and usually statistically indistinguishable from zero for non-URM, female, financially dependent students, and effects on second year Pell receipt and first-year combined aid flip their sign. Furthermore, we find suggestive evidence that the stark contrast in aid stability and borrowing effects may have academic consequences: marginally Pell-eligible, female, non-URM, financially independent students are 18.5pp (8.9pp) less likely to re-enroll for a second year of college and earn 10.5 (5.6) fewer credits through four potential years of enrollment. In contrast, marginally Pell-eligible, female, non-URM, financially dependent students are no less likely to re-enroll for a second year [-2.6pp (3.5pp)] and earn no fewer credits [-2.2 (3.3)] than their marginally Pell-ineligible peers. Marginal Pell eligibility does not appear to impact degree attainment for either group.

Among those who received a KEES grant, marginally Pell eligible female students were 12.2pp (4.3pp) more likely to earn a Pell grant in their second year, while at the EFC threshold, initial Pell eligibility remained a poor predictor of future Pell receipt for female students who did not receive a KEES grant (as well as for male students with and without KEES). Despite this stark contrast in aid stability, there are no clear patterns linking KEES receipt to Pell effects on borrowing among female students. While marginally Pell eligible female students who did not receive a KEES grant are 10.3pp (4.6pp) less likely to re-enroll for a second year of college, there are no differences in Pell impacts on total credits or degree attainment by KEES receipt for

female students.

Given the number of subgroup tests we have conducted and the relatively small samples that comprise our intersectional identity subgroups, we note that these results are not robust to corrections for multiple-hypothesis testing and should be interpreted cautiously. The patterns across high-contrast pairs, however, suggests differences in how student subpopulations experience the student financial aid system: financially independent, non-URM students may experience more aid instability and higher credit constraints via less borrowing than their financially dependent peers from similar racial and ethnic backgrounds. Similarly, higher-achieving female students (i.e., those eligible for the state merit award) also experienced more aid stability and more muted long-term borrowing effects than students ineligible for the state merit award.

[Table 6b]

5.5 Robustness Checks

We test the sensitivity of our cross-sectional results in various ways. First, we examine whether our functional form assumptions impact our results. Our preferred estimates assume a local-linear relationship between our outcomes of interest and the running variable. Appendix Tables A2a and A2b relax this linearity assumption to examine how our estimates change when the relationship between EFC and outcomes of interest is modeled as using a local-quadratic (Appendix Table A2a) or local-cubic (Appendix Table A2b) function.

Next, we allow for the possibility that Pell eligibility may induce students to select into specific institutions or post-secondary sectors by removing institutional fixed effects (Appendix Table A3a) entirely. Then, we consider replacing institutional fixed effects with post-secondary sector fixed effects (Appendix Table A3b), allowing us to measure possible impacts on

institutional choice within, but not across sectors. Sector fixed effects account for systematic differences across institutional sectors; this might include higher acceptance rates and lower tuition and fees at community colleges compared to public four-year institutions.

Across all model specifications, first-year Pell grant eligibility significantly reduces the likelihood and amount of borrowing in students' first year. Across multiple years of college enrollment, Pell eligible students remain less likely to borrow, although estimates of differences in the amount borrowed become noisy. Estimates with and without institutional or sector fixed effects are similar, as are the estimates from the polynomial specifications. Across models, effects on credit completion, enrollment, and graduation are small and insignificant in the full sample.

Removing institutional fixed effects allows us to examine the extent to which Pell eligibility influences college choice, within or across post-secondary sector (i.e., two-year vs. four-year institutions). Removing institution fixed effects entirely, we find no evidence that Pell-eligibility makes students more likely to sort to two- or four-year institutions in their first year or over their first four years of potential enrollment. Examining RD estimates with and without conditioning on a student's initial post-secondary sector, we find no evidence that Pell-eligibility makes students or less likely to enroll in Kentucky's state flagship institutions (i.e., University of Kentucky or University of Louisville) in their first year or over their first four years of potential enrollment.

We also examine our estimates' sensitivity to our choice of bandwidth by presenting estimates for various bandwidths ranging from within $250 to within $3000 of the Pell eligibility threshold in Table 7. Larger bandwidths enable greater statistical power, but require stronger assumptions that the functional form of our model accurately estimates the relationship between

the running variable, a student's EFC, and our outcomes of interest. At the smallest bandwidths, we find suggestive evidence that Pell eligibility decreased the total number of credits earned through Year 4, while larger bandwidths, including our preferred $2,000 bandwidth and the optimal bandwidth, suggest there was no relationship between marginal Pell eligibility and credit attainment. While point estimates are qualitatively similar across bandwidth choices, the observed differences may reflect heterogeneity in how students respond to Pell Grant receipt across the EFC distribution. Studies in other contexts have found larger positive effects of Pell receipt at the opposite end of the EFC distribution, where students qualify for the largest Pell grants (Denning, Marx & Turner, 2019).

[Table 7]

Finally, to account for the possibility that our youngest cohort's four-year outcomes may have been affected by disruptions associated with the COVID-19 pandemic during spring 2020 (the end of their fourth year after initial enrollment), we replicate our main results in a restricted sample that excludes the AY2016-17 entering cohort and find qualitatively similar results (Appendix Table A6).

(6) Discussion

In this paper, we use administrative data from public post-secondary institutions in Kentucky to examine potential explanations for the Federal Pell Grant Program's weak evaluation record. Like many other Pell evaluations (e.g., Marx and Turner, 2018; Park and Scott-Clayton, 2018), we use a regression discontinuity framework to estimate the impact of being marginally eligible for a minimum Pell grant. Our results are aligned with prior research on the effect of the minimum Pell Grant on students' academic outcomes and borrowing behavior. In our sample, we find no evidence that Pell eligibility confers academic advantages to

marginal recipients overall, or in any subgroup of students. The short- and medium-run advantages in grant aid associated with initial marginal Pell-eligibility is offset by reduced takeup of subsidized Federal loans. Additionally, we find that marginal first-year Pell eligibility does not predict Pell receipt in future years. Rather, there is a substantial amount of churn across the Pell eligibility threshold throughout students' college years. This aid instability may help explain the small and often insignificant effects on students' longer-term academic outcomes.

Additionally, the availability of close substitutes for a Pell Grant, such as other forms of grant or loan aid, may attenuate estimates of its impact. This is particularly true in samples without a comparison group that received substantially less total financial aid (e.g., those near the Pell eligibility threshold), when the reduction in borrowing offsets—or more than offsets—an initial or cumulative advantage in grant aid (e.g., for financially independent students in our sample), and for short-term academic outcomes, when loans have not yet come due (Kline & Walters, 2016; Park & Scott-Clayton, 2018). Indeed, Marx and Turner (2018) find evidence that Pell's limited impact on the outcomes of marginally eligible students may be mediated by changes in students' borrowing behavior: the Pell Grant positively and significantly increases credit attainment among students who never borrow, but reduces credit attainment among students who are induced to stop borrowing after receiving a Pell Grant.

In other contexts, experimentally induced declines in student borrowing negatively affected graduation rates, showing that loans can play an important role in relieving financial constraints (Marx & Turner, 2019). Student attitudes toward borrowing, however, are complex (Boatman, et al., 2017) and grants can induce students to reduce borrowing to the point of introducing financial constraints (Marx & Turner, 2018). It is thus possible that the weak relationship between marginal Pell-eligibility and students' academic outcomes is reflective of

complex interactions between aid programs and students' borrowing behavior.

Initially, marginally Pell-eligible Kentucky students in our sample forgo $0.82 ($734/$897) in loans for each $1 of grant aid received in their first year. These first-year effects are larger than similar estimations from Marx and Turner (2018), who find that $1 of Pell-aid crowds out just $0.43 of borrowing in their full sample of first-year students (but over $1.80 of borrowing among the more responsive subset of would-be borrowers). However, taking our imprecise point estimates at face value, the widening gap in borrowing and narrowing gap in grant aid at the first-year EFC threshold suggests that over four years of potential enrollment, $1 of grant-aid may crowd out over $2.50 of borrowing for marginally Pell-eligible Kentucky students, and even more in the subgroups with the largest borrowing responses.

In subgroups where we see large gaps in total aid without large differences in rates of re-enrollment or credit attainment, this suggests that initial Pell eligibility substantially reduces access to liquidity for marginally-eligible students. Aid packages awarded in students' first year may fix borrowing preferences in the short- and medium-term (Marx & Turner, 2018), suggesting that anchoring effects observed in other contexts could also apply to student borrowing decisions (Furnham & Boo, 2011). However, in subgroups where Pell eligibility leads to reduced borrowing *and* lower rates of re-enrollment, longer-term borrowing effects could be driven by reduced attainment. Further research to identify the specific mechanisms that explain the relationship between initial Pell eligibility and longer-term borrowing or re-enrollment behavior could help policymakers more effectively design and deploy financial aid resources.

Critics of federal student aid policy may interpret null academic findings from regression discontinuity evaluations like ours as evidence that the Federal Pell Grant Program is not an engine for human capital investment among low-income students. However, the Pell aid

advantage at the maximum EFC threshold is small ($351 [10] in year 1) and short-lived (-$98 [154] total in years 2-4). Over time, this short-run advantage in grant aid associated with marginal Pell-eligibility is more-than-offset by reduced takeup of subsidized Federal loans. Since subsidized loans provide a readily available substitute for the modest gap in grant aid between marginally Pell-eligible students and their ineligible peers, it is unsurprising that eligibility for a minimum Pell grant has limited short-run benefits for students.

While our analysis and similar studies present internally valid estimates of the effect of marginal Pell grant eligibility on outcomes of interest, three characteristics of the Federal Pell Grant Program make it unlikely that local RD estimates generalize far from the Pell-eligibility threshold, and call into question whether the effects of the minimum Pell grant can be rescaled or extrapolated to evaluate the program as a whole. First, the character of the "treatment" at the Pell eligibility threshold diverges substantially from the typical Pell recipients' aid experience. The Pell aid advantage for marginally eligible students is over an order of magnitude smaller than the average Pell grant, which is over $4,000 per year (NCES, 2020). In our sample, the Pell-eligibility threshold confers a cumulative, four-year advantage in Pell aid of less than $300 ($253 [156]) from an additional 0.73 Pell grants, which, combined with the borrowing effects we estimate does not increase students' total financial resources, leading to a total aid *disadvantage* of -$823 (1199) over time. Among all first-time, full-time undergraduates in Kentucky, we calculate the average Pell recipient received a total of $7,973 via 2.03 Pell grants over four years of potential enrollment.

Second, dynamic eligibility requirements mean that at the margin, initial Pell eligibility does not predict future Pell aid. Despite being a relatively stable source of aid for most students, RD impact estimates are identified in a sample where Pell aid is least stable from year-to-year.

Finally, subsidized loans offer a close substitute for the minimum Pell grant that is readily available and, importantly, less costly at the eligibility threshold than for the typical Pell recipient (since marginally ineligible applicants need only replace an average of ~$300 of aid, rather than thousands of dollars).

Moreover, from a student's perspective, the lack of predictability in aid renewal year over year can create stress and credit constraints that can also impact longer-term outcomes (Baum & Scott-Clayton, 2013; Dynarski et al, 2022). Cross-sectional RD estimates like the ones we present do not empirically account for these aid dynamics. Together, these facts make it unsurprising that initial eligibility for a minimum Pell grant has limited short-run impacts on students' academic outcomes. It is possible that if the minimum Pell grant were more predictable, perhaps longer-term effects of the grant would be more aligned with estimates found from the evaluations of other grant aid programs.

Relatedly, the weak contrast in Pell aid at the Pell eligibility threshold calls into question whether the effect of minimum Pell eligibility can reasonably be considered an evaluation of "the Pell Grant" or "the Federal Pell Grant Program" from a construct validity perspective—especially when this contrast is juxtaposed against the magnitude of aid awarded to a typical Pell recipient. While regression discontinuity methods are appropriate for answering the narrow question of how expanding or contracting eligibility for the minimum Pell grant at the maximum EFC margin is likely to affect student outcomes, the RD estimates are less informative—and perhaps even uninformative—with respect to the broader question of how the Pell grant program affects representative students.

More broadly, the Pell Grant's tapered award schedule, interaction with student borrowing, and dynamic eligibility requirements introduce complexities for students and

researchers. To more accurately measure the impact of Pell across the EFC distribution—and in particular, to estimate the effect of the Pell aid for typical Pell recipients, who receive over $4,000 per year on average—researchers and policymakers must look beyond regression discontinuity evaluations of the minimum Pell grant. Promising sources of evidence include evaluations of interventions that encourage FAFSA submission, exogenously varying aid access across the EFC distribution (e.g., Bettinger et al., 2012; Page, Castleman & Meyer, 2020); evaluations of other aid programs that leverage exogenous variation in larger amounts of aid, closer to the median or maximum Pell Grant (e.g., Castleman & Long, 2016, Goldrick-Rab et al., 2016); and finally, analyses of Pell impacts in states or institutions that amplify Pell aid through complementary programs (e.g., Park & Scott-Clayton, 2018; Eng & Matsudaira, 2021).

While dynamic aid eligibility and reapplication requirements may be necessary to appropriately target need-based aid, these features of the Federal Pell Grant Program have consequences for students and complicate efforts to evaluate the impacts of Pell aid. Researchers and policymakers should exercise caution when extrapolating from inherently local RD estimates of the minimum Pell grant's impact, paying careful attention to interactions between Pell and other sources of aid as well as the stability of aid at the Pell-eligibility threshold. However, evidence from RD evaluations of the minimum Pell grant does suggest that higher education leaders and policy makers should recognize that aid instability resulting from annual renewal requirements may interact with precedents set in a student's first year of college in ways that resonate throughout students' academic careers. Moreover, mechanisms to support continued access to grant and loan aid resources for initial aid recipients may be an important part of ongoing efforts to maximize the returns to need-based aid by helping lower income students persist in and graduate from college.

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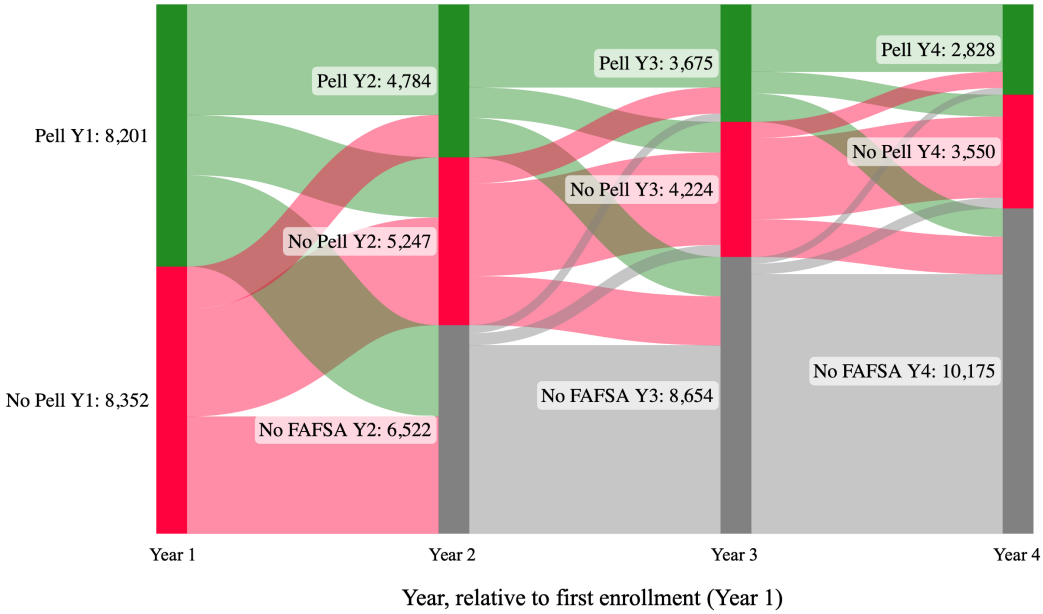
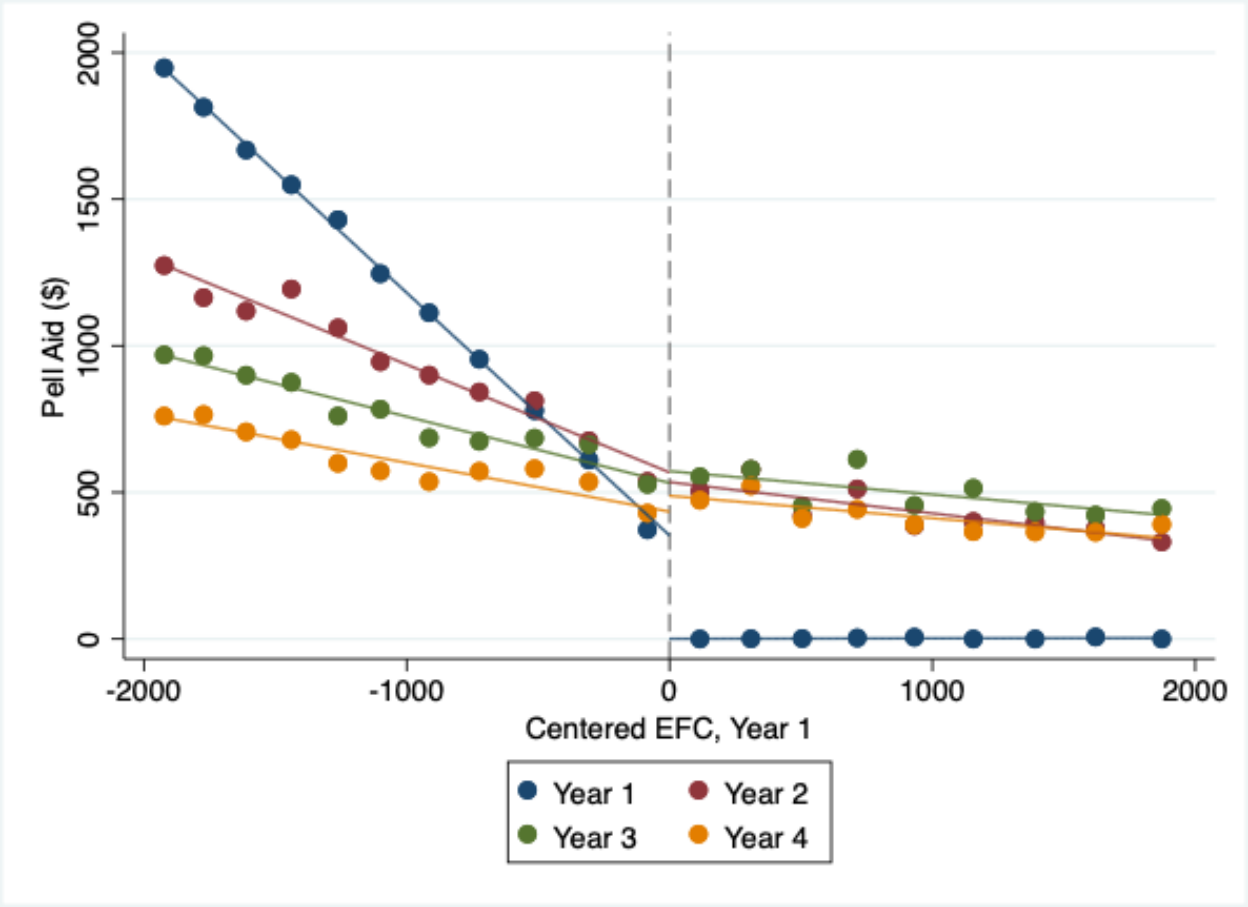
(8) Figures

Figure 1: Year-to-Year Changes in Pell Aid Receipt



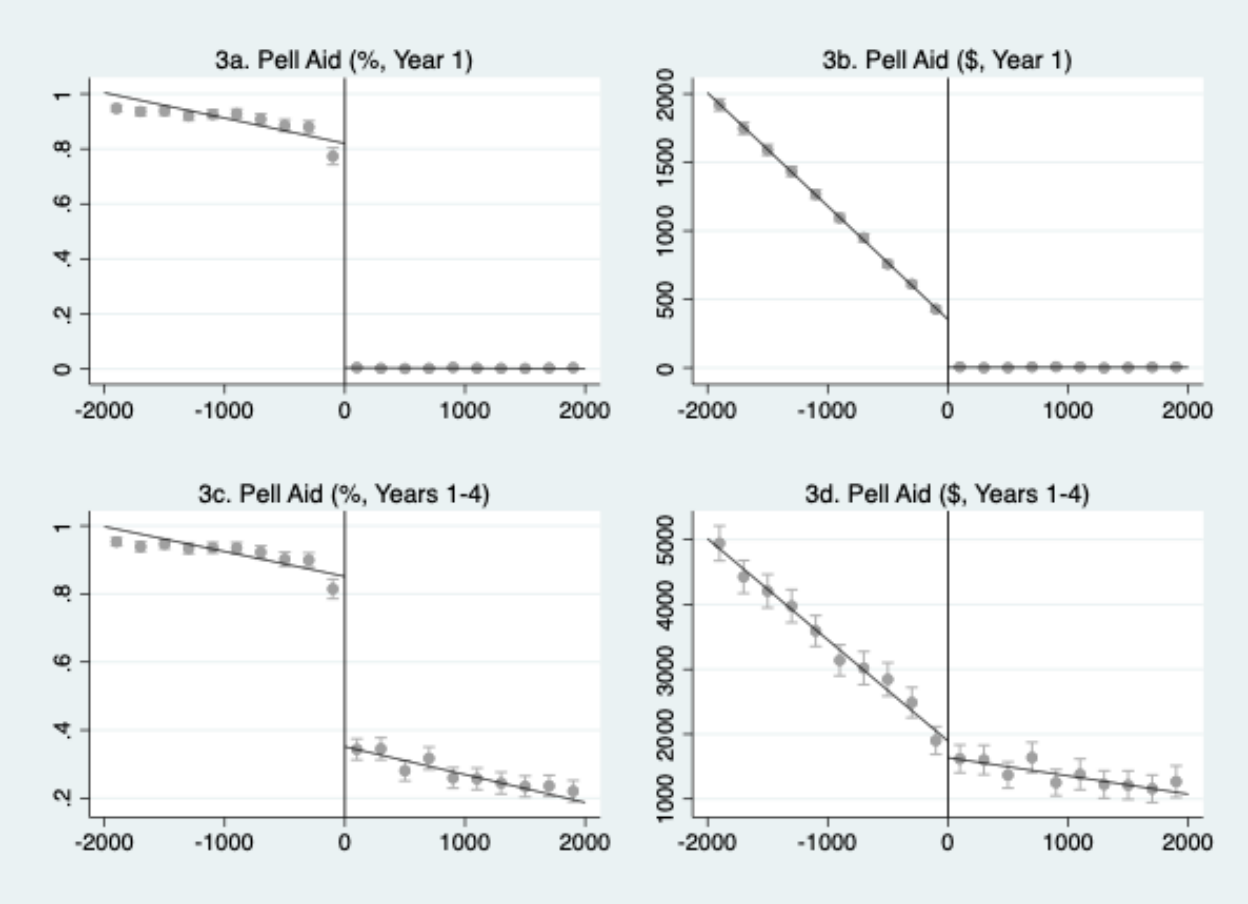
Notes: The sample includes all students who enrolled and submitted a FAFSA as a first-time, full-time freshman student at a Kentucky public college or university between 2011 and 2017, and whose year 1 EFC fell within $2,000 of the maximum EFC for Pell grant eligibility in that year (n=16,553). Diagram created using Sankeymatic (https://sankeymatic.com/build/).

Figure 2: Annual Pell Award Size by Year 1 EFC



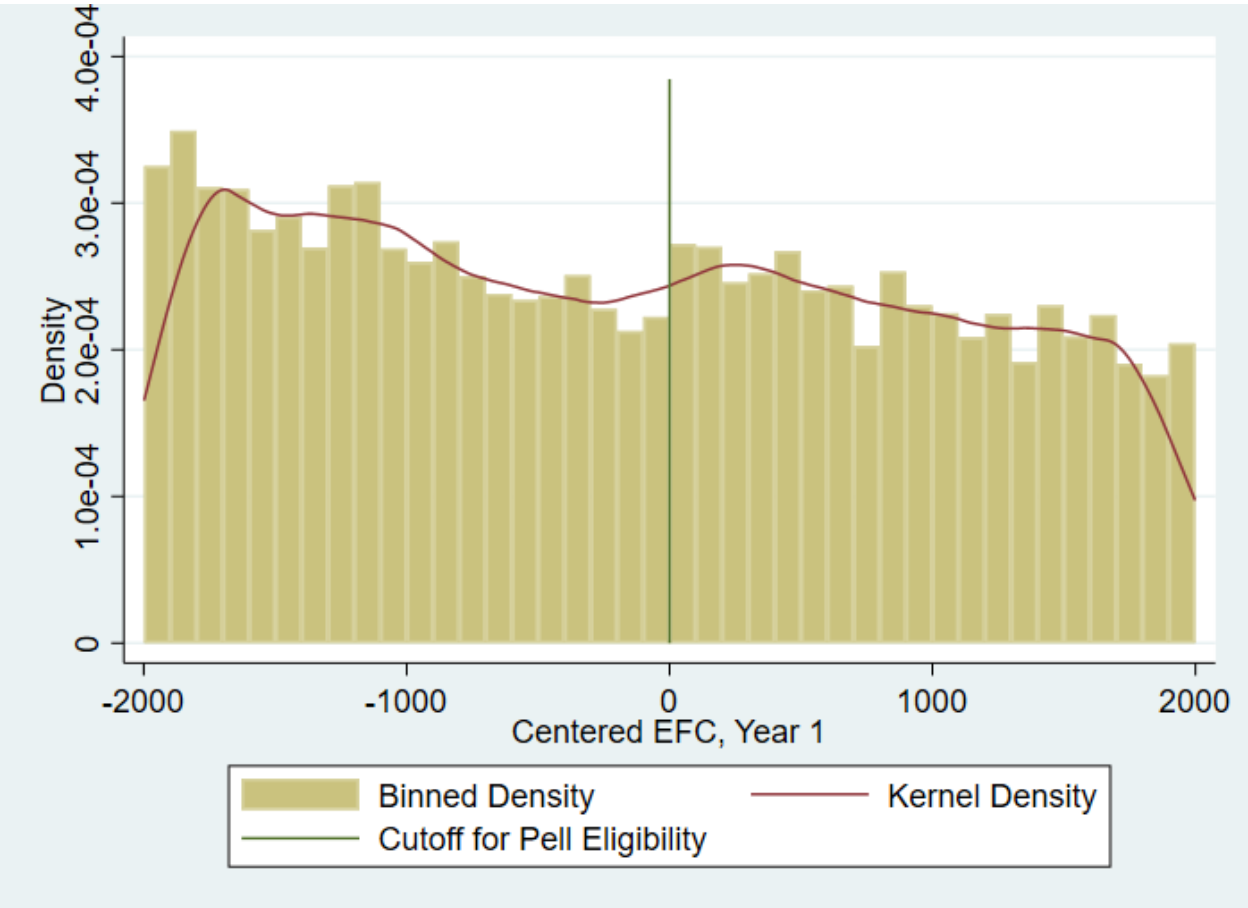
Notes: The figure above plots average annual Pell Grant award size by centered year 1 EFC bins for the first four years of potential enrollment of all students who enrolled and submitted a FAFSA as a first-time, full-time freshman student at a Kentucky public college or university between 2011 and 2017, and whose year 1 EFC fell within $2,000 of the maximum EFC for Pell grant eligibility in that year (n=16,553). Students who did not receive a Pell grant in a given year or did not submit a FAFSA in that year are recorded as receiving $0 in Pell aid for that year.

Figure 3: Changes in Pell Aid at the Year 1 EFC Threshold



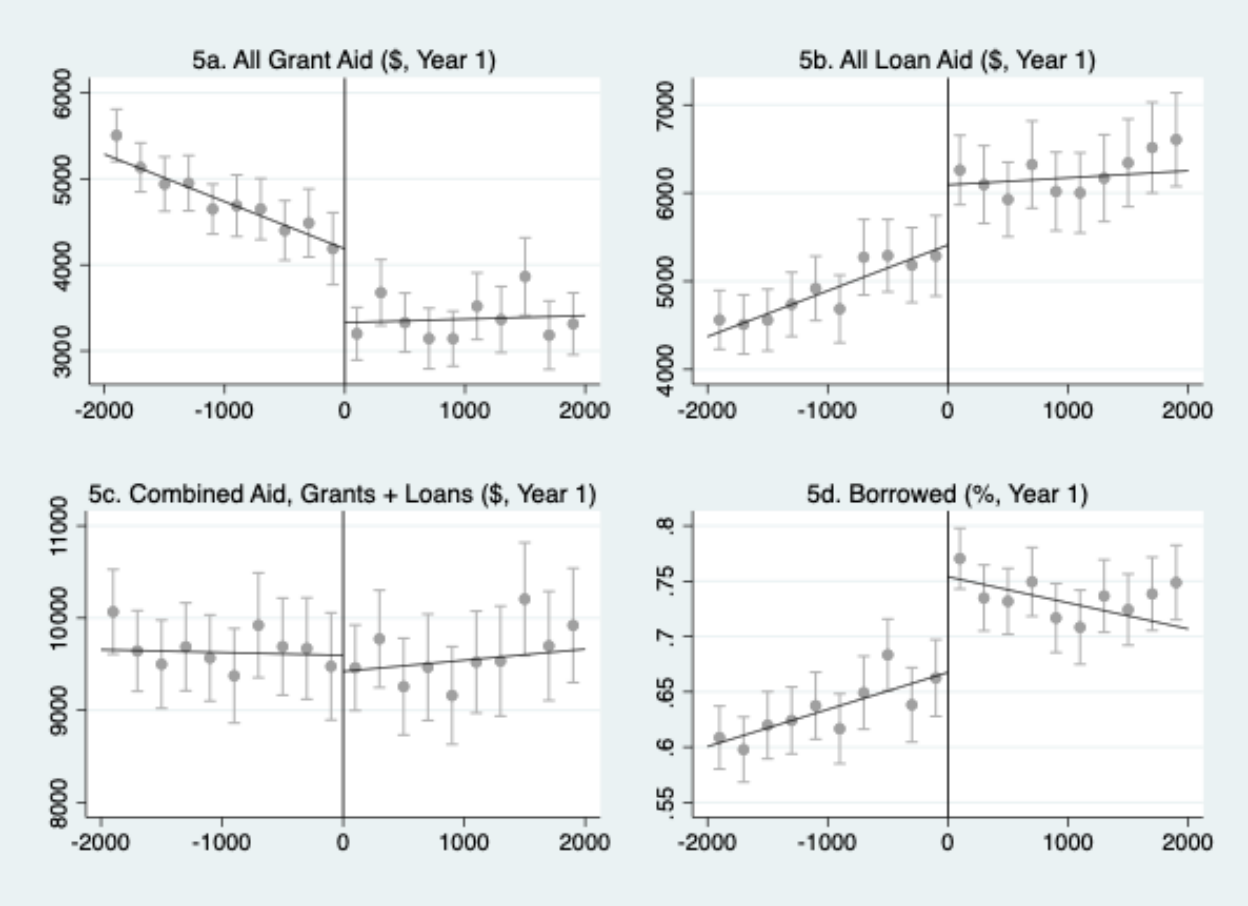
Notes: The figure above plots average Pell outcomes by centered year 1 EFC bins for Year 1 (3a and 3b) and cumulatively over the first four years of potential enrollment (3c and 3d) for all students who enrolled and submitted a FAFSA as a first-time, full-time freshman student at a Kentucky public college or university between 2011 and 2017, and whose year 1 EFC fell within $2,000 of the maximum EFC for Pell grant eligibility in that year (n=16,553). Students who did not receive a Pell grant in a given year or did not submit a FAFSA in that year are recorded as receiving $0 in Pell aid for that year.

Figure 4: Sample Density by Year 1 EFC



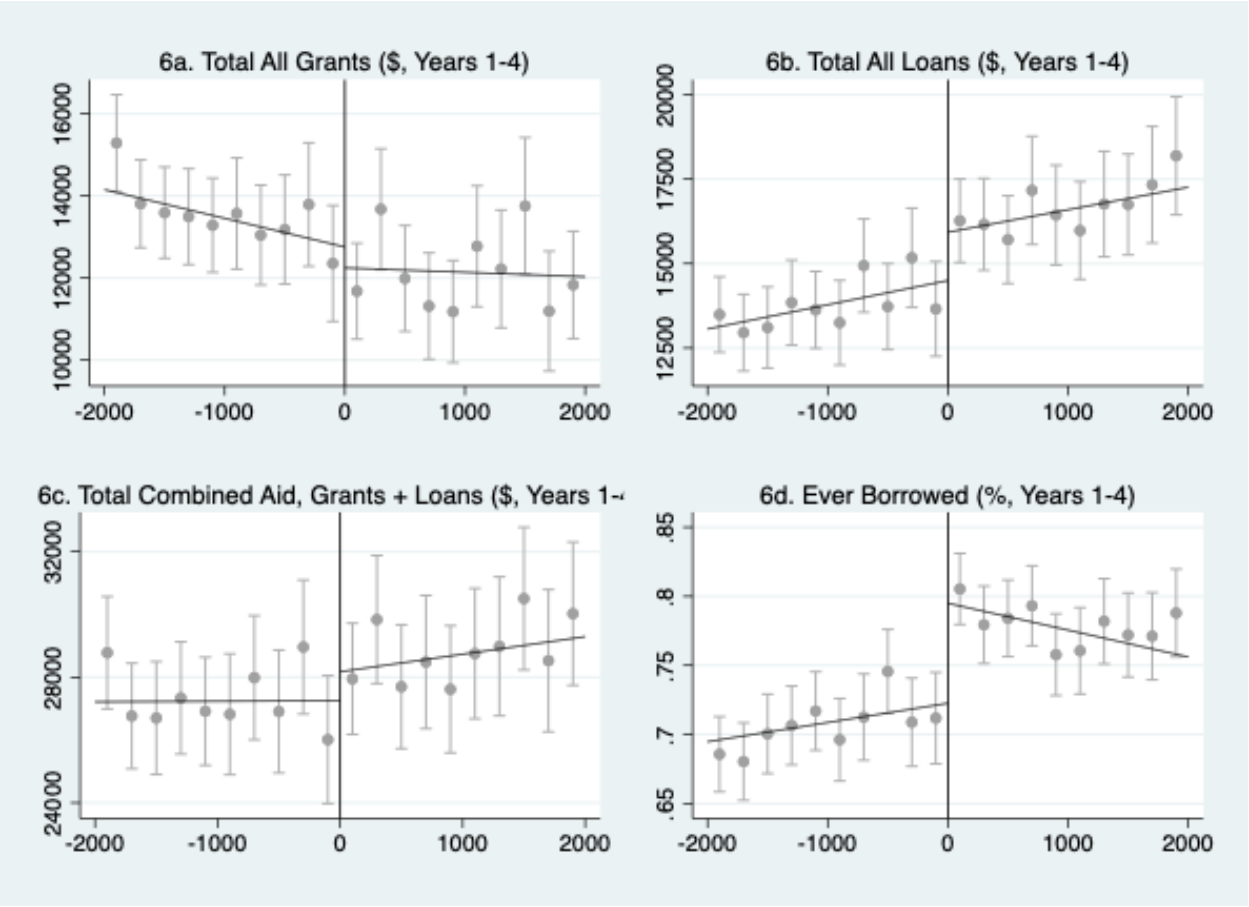
Notes: The figure above plots the density of observations by centered year 1EFC bins for all students who enrolled and submitted a FAFSA as a first-time, full-time freshman student at a Kentucky public college or university between 2011 and 2017, and whose year 1 EFC fell within $2,000 of the maximum EFC for Pell grant eligibility in that year (n=16,553).

Figure 5: Changes in Non-Pell Financial Aid at the Year 1 EFC Threshold in Year 1



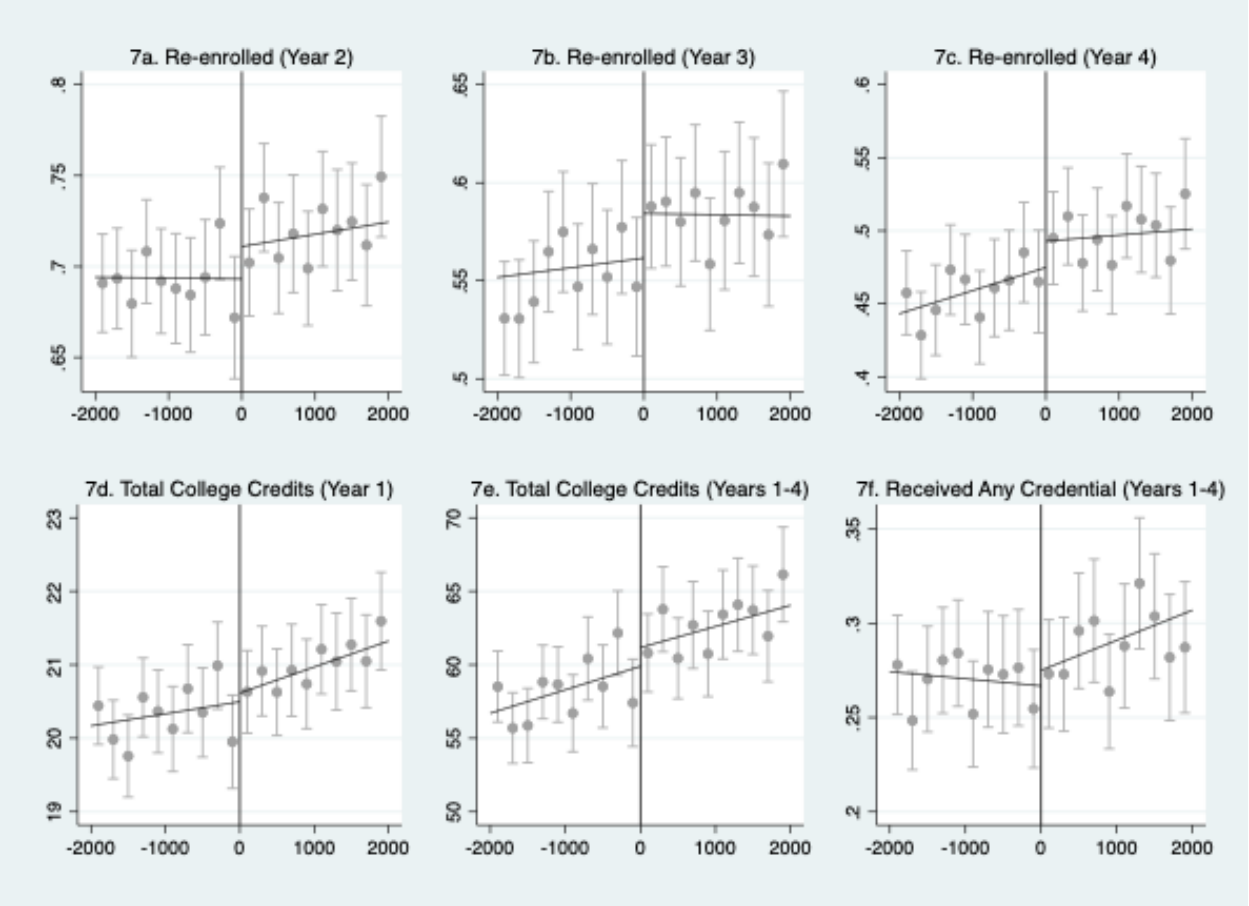
Notes: The figure above plots average Year 1 Non-Pell Financial Aid outcomes by centered year 1 EFC bins for all students who enrolled and submitted a FAFSA as a first-time, full-time freshman student at a Kentucky public college or university between 2011 and 2017, and whose year 1 EFC fell within $2,000 of the maximum EFC for Pell grant eligibility in that year (n=16,553). Students who did not apply for or receive aid from the indicated sources in a given year are recorded as receiving $0 in aid from that source for that year.

Figure 6: Changes in Total Non-Pell Financial Aid at the Year 1 EFC Threshold, Years 1–4



Notes: The figure above plots average Cumulative Non-Pell Financial Aid outcomes (summing over Year 1 through Year 4) by centered year 1 EFC bins for all students who enrolled and submitted a FAFSA as a first-time, full-time freshman student at a Kentucky public college or university between 2011 and 2017, and whose year 1 EFC fell within $2,000 of the maximum EFC for Pell grant eligibility in that year (n=16,553). Students who did not apply for or receive aid from the indicated sources in a given year are recorded as receiving $0 in aid from that source for that year.

Figure 7: Changes in Academic Outcomes at the Year 1 EFC Threshold



Notes: The figure above plots average academic outcomes by centered year 1 EFC bins for all students who enrolled and submitted a FAFSA as a first-time, full-time freshman student at a Kentucky public college or university between 2011 and 2017, and whose year 1 EFC fell within $2,000 of the maximum EFC for Pell grant eligibility in that year (n=16,553). Students who did not re-enroll in a given year are recorded as receiving 0 college credits for that year.

(9) Tables

Table 1: Pell Grant Eligibility Thresholds & Award Size Over Time

Academic Year	EFC Threshold	Maximum Award	Minimum Award
2010-11	$5,273	$5,550	$555
2011-12	$5,273	$5,550	$555
2012-13	$4,995	$5,550	$602
2013-14	$5,081	$5,645	$582
2014-15	$5,157	$5,730	$587
2015-16	$5,198	$5,775	$581
2016-17	$5,234	$5,815	$589
2017-18	$5,328	$5,920	$593
2018-19	$5,486	$6,095	$650
2019-20	$5,576	$6,195	$650
Source: U.S. Department of Education (2020)			

Table 2: Summary Statistics of First-Time Freshman FAFSA Filers

	Analytical Sample	All KY FTFY FAFSA Filers	P-Value
Student Characteristics	(1)	(2)	(3)
A. Demographics			
Male	.468	.425	0
Asian/Pacific Islander	.013	.013	.349
Black	.111	.149	0
Native American	.003	.003	.942
White	.818	.784	0
Two or More Races	.025	.023	.739
Missing Race Data	.031	.029	.078
Hispanic	.054	.055	.799
Financial Dependent	.797	.648	0
Age at College Entry	22.3	23.7	0
B. Enrollment Patterns			
Enrolled in a KY Public 2-year Institution	.443	.536	—
Enrolled in a KY Public 4-year Institution	.557	.464	—
Ever Enrolled Full-Time, Year 1	.864	.835	.001
Enrolled in Any Developmental Ed. Course, Year 1	.352	.419	0
Re-enrolled, Year 2	.705	.647	0
C. Financial Aid Patterns (All Students)			
Ever Had EFC=$0, Through Year 4	.098	.519	0
Received Pell Aid, Year 1	.495	.642	0
Received Pell Aid, Year 2	.289	.335	0
Received Pell Aid in Year 2 (Enrolled in Year 2)	.410	.518	0
Received Pell Aid in Year 2 (Enrolled and Filed in Year 2)	.477	.615	0
Pell Amount (in $), Year 1	676	2,492	0
Ever Received a Pell Grant Award, Through Year 4	.628	.683	0
Ever Took a Loan, Through Year 4	.739	.656	0
Filed a FAFSA in Year 2	.606	.544	0
Filed a FAFSA in Year 2 (Enrolled in Year 2)	.860	.841	0
Observations	16,553	165,070	

Notes: Column (1) describes the characteristics of the analytical sample, while Column (2) describes the characteristics of all first-time, first-year students who submitted a FAFSA and enrolled in public Kentucky post-secondary institutions between 2009 and 2016. Column (3) present the p-value from a hypothesis test of whether the means in columns (1) and (2) are statistically equivalent. Rows followed by with (Enrolled in Year 2) condition on year 2 re-enrollment (n1=11,665 and n2=106,724). Rows followed by with (Enrolled and Filed in Year 2) condition on both year 2 re-enrollment and FAFSA submission (n1=10,031 and n2=89,789).

Table 3: Placebo Tests - Estimating Discontinuities in Baseline Covariates

	RD Estimate	P-Value	Observations
Student Characteristics	(1)	(2)	(3)
Male	-.009	.725	16,550
	(.025)		
Asian/Pacific Islander	.004	.463	16,043
	(.006)		
Black	-.021	.169	16,043
	(.015)		
Native American	.001	.778	16,043
	(.002)		
White	.023	.191	16,043
	(.018)		
Two or More Races	-.007	.373	16,043
	(.008)		
Hispanic	.019	.096	16,553
	(.012)		
Financial Dependent	.000	.990	16,553
	(.017)		
Age at College Entry	.020	.949	16,553
	(.31)		
Enrolled in Any Developmental Ed. Course, Year 1	.002	.932	16,553
	(.023)		
KEES Grant Award, Year 1 ($)	-8	.837	16,553
	(40)		
Total State Non-Need Grants, Year 1 ($)	-22	.596	16,553
	(42)		
Total Federal Non-Need Grants, Year 1 ($)	105	.083	16,553
	(60)		

Notes: Column (1) reports the predicted discontinuity in the student characteristic listed in each row above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-linear, robust bias-corrected regression discontinuity method with a triangular kernel, Year 1 EFC as the running variable, and a bandwidth of $2,000. Column (2) presents the p-values from a hypothesis test of whether the estimated discontinuity is equal to 0. All estimates condition on institution and cohort fixed effects.

Table 4: First-Stages and Aid Impacts

Outcome	Y1 RD Estimate	Total, Y2-Y4	Total, Y1-Y4	Total, Y1-Y6
	(1)	(2)	(3)	(4)
A. First-Stage Impacts on Pell Receipt				
Received Pell (%)	.771***	-.009	.455***	.443***
	(.014)	(.024)	(.021)	(.024)
Pell Count (#)	.771***	-.004	.768***	.781***
	(.014)	(.046)	(.049)	(.070)
Pell ($)	351***	-98	253	116
	(10)	(154)	(156)	(235)
B. Impacts on Other Aid Outcomes				
Non-Pell Need-Based Grants ($)	582***	15	597***	562***
	(29)	(60)	(72)	(93)
All Grants ($)	897***	-381	516	578
	(239)	(693)	(879)	(1053)
Federal Loans ($)	-801**	-350	-1151	-1250
	(257)	(646)	(807)	(1047)
All Loans ($)	-734**	-605	-1339	-1548
	(275)	(721)	(892)	(1162)
Borrowed (%)	-.097***	-.027	-.083***	-.076**
	(.022)	(.024)	(.021)	(.023)
All Aid (Grants + Loans, $)	164	-986	-823	-970
	(301)	(1013)	(1199)	(1508)
Observations	16,553	16,553	16,553	12,437

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, measured over the time period listed in each column, above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-linear, robust bias-corrected regression discontinuity method with a triangular kernel, Year 1 EFC as the running variable, and a bandwidth of $2,000. All estimates condition on the student demographics listed in Table 3 as well as institution and cohort fixed effects. *=p<0.05; **=p<0.01; ***=p<0.001.

Table 5: Impacts on Academic Outcomes

Outcome	RD Estimate
	(1)
A. Full Sample, Years 1–4	
Re-enrolled, Year 2	-.014
	(.023)
Re-enrolled, Year 3	-.033
	(.024)
Re-enrolled, Year 4	-.020
	(.023)
Total College-Level Credits, Year 1	-.206
	(.395)
Total College-Level Credits, Through Year 4	-1.386
	(1.892)
Earned Any Degree, Through Year 4	-.007
	(.022)
Observations	16,553
B. 2011-2015 Cohorts Only, Years 1-6	
Total College-Level Credits, Through Year 6	-1.409
	(2.55)
Earned Any Degree, Through Year 6	-.034
	(.028)
Observations	12,437
Notes: Column (1) presents the predicted discontinuity in the academic outcome listed in each row above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-linear, robust bias-corrected regression discontinuity method with a triangular kernel, Year 1 EFC as the running variable, and a bandwidth of $2,000. All estimates condition on the student demographics listed in Table 3 as well as institution and cohort fixed effects. *=p<0.05; **=p<0.01; ***=p<0.001.	

Table 6a: Borrowing and Academic Impacts by Demographic Subgroup

Outcome	Male	Female	URM	Non-URM	Dependent	Independent	KEES	No KEES
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Award, Year 2	-.001	.053	.001	.032	.047*	-.036	.056	.005
	(.029)	(.031)	(.051)	(.023)	(.023)	(.051)	(.031)	(.030)
Total Pell ($), Through Year 4	133	358	-81	319	257	257	37	482*
	(214)	(220)	(412)	(169)	(167)	(393)	(228)	(210)
B. Other Aid Outcomes								
All Loans ($), Year 1	-705	-735	-624	-886**	-492	-1641***	-568	-913*
	(393)	(388)	(684)	(300)	(321)	(412)	(308)	(452)
Total All Loans ($), Through Year 4	485	-2872*	258	-2147*	-697	-3719**	-921	-1902
	(1246)	(1263)	(2079)	(961)	(1046)	(1276)	(978)	(1473)
Borrowed (%), Year 1	-.11***	-.088**	-.057	-.109***	-.078**	-.169***	-.078*	-.118***
	(.031)	(.030)	(.047)	(.024)	(.024)	(.048)	(.032)	(.029)
Ever Borrowed (%), Through Year 4	-.088**	-.079**	-0.064	-.092***	-.070**	-.132**	-.051	-.121***
	(.031)	(.028)	(.045)	(.023)	(.023)	(.047)	(.030)	(.028)
Combined Aid (Grants + Loans, $), Year 1	-41	394	120	71	548	-1415***	481	-105
	(433)	(417)	(828)	(318)	(352)	(428)	(343)	(490)
Total Combined Aid (Grants + Loans, $),	70	-1425	589	-1413	-183	-3462*	-1560	-37
Through Year 4	(1654)	(1726)	(3263)	(1266)	(1418)	(1639)	(1455)	(1900)
C. Academic Outcomes								
Re-enrolled, Year 2	.027	-.051	.009	-.021	-.006	-.051	-.010	-.018
	(.033)	(.030)	(.055)	(.024)	(.025)	(.054)	(.030)	(.034)
Total Credits Earned, Through Year 4	0.941	-3.269	1.389	-2.172	-1.234	-2.677	-3.437	.527
	(2.669)	(2.667)	(4.367)	(2.072)	(2.186)	(3.312)	(2.717)	(2.595)
Earned Any Degree, Through Year 4	-.020	.004	-.008	-.005	-.007	-.010	-.032	.021
	(.030)	(.031)	(.046)	(.025)	(.024)	(.048)	(.031)	(.030)
Observations	7,751	8,799	2,691	13,787	13,187	3,366	8,351	8,202

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the sample listed in each column, above its standard error in parentheses. See notes of Tables 4 and 5 for RD model details. *=p<0.05; **=p<0.01; ***=p<0.001.

Table 6b: Borrowing and Academic Impacts by Intersectional Identity

Outcome	Dep.* Female	Indep.* Female	Dep.* Non-URM	Indep.* Non-URM	Fem.* Dep.* Non-URM	Fem.* Indep.* Non-URM	KEES* Female	No KEES* Female
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Award, Year 2	.077*	-.054	.051*	-.042	.091*	-.072	.122**	-.011
	(.033)	(.076)	(.025)	(.059)	(.036)	(.085)	(.043)	(.042)
Total Pell ($), Through Year 4	340	463	315	401	449	402	325	417
	(236)	(584)	(177)	(472)	(250)	(688)	(313)	(302)
B. Other Aid Outcomes								
All Loans ($), Year 1	-596	-1403*	-692*	-1794***	-452	-1899**	-965*	-445
	(446)	(585)	(345)	(474)	(486)	(619)	(414)	(626)
Total All Loans ($), Through Year 4	-2423	-4924*	-1658	-4488**	-2723	-6171**	-2998*	-2892
	(1463)	(1919)	(1119)	(1470)	(1564)	(2116)	(1306)	(2130)
Borrowed (%), Year 1	-.079*	-.139*	-.089***	-.195***	-.078*	-.206**	-.101*	-.069
	(.033)	(.066)	(.027)	(.056)	(.037)	(.069)	(.044)	(.038)
Ever Borrowed (%), Through Year 4	-.072*	-.131*	-.081**	-.144**	-.076*	-.168*	-.07	-.085*
	(.031)	(.066)	(.026)	(.054)	(.035)	(.069)	(.042)	(.036)
Combined Aid (Grants + Loans, $), Year 1	707	-1376*	386	-1478**	741	-1828**	421	465
	(484)	(619)	(367)	(506)	(515)	(683)	(473)	(692)
Total Combined Aid (Grants + Loans, $),	-732	-5306*	-903	-4008*	-1172	-6720*	-2695	-138
Through Year 4	(2028)	(2450)	(1477)	(1944)	(2073)	(2786)	(2023)	(2843)
C. Academic Outcomes								
Re-enrolled, Year 2	-.036	-.129	-.01	-.077	-.026	-.185*	-.005	-.103*
	(.033)	(.076)	(.026)	(.06)	(.035)	(.089)	(.039)	(.046)
Total Credits Earned, Through Year 4	-2.559	-8.37	-2.037	-3.24	-2.21	-10.549	-4.663	-2.624
	(3.062)	(4.842)	(2.345)	(3.93)	(3.257)	(5.638)	(3.718)	(3.766)
Earned Any Degree, Through Year 4	.01	-.02	-.012	.026	.012	-.002	-.013	.02
	(.034)	(.075)	(.027)	(.058)	(.037)	(.085)	(.044)	(.045)
Observations	7,109	1,690	11,076	2,711	5,955	1,373	4,397	4,402

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the sample listed in each column, above its standard error in parentheses. See notes of Tables 4 and 5 for RD model details. *=p<0.05; **=p<0.01; ***=p<0.001.

Table 7: Alternative Bandwidths

Outcome	BW=$250	$500	$1,000	$1,500	$2,000	$3,000	Optimal	[Opt. BW]
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Award, Year 2	.066	.028	.027	.036	.028	.024	.445***	[804.7]
	(.062)	(.043)	(.03)	(.025)	(.021)	(.017)	(.025)	
Total Pell ($), Through Year 4	60	125	173	258	253	245	261	[1219.9]
	(412)	(298)	(215)	(178)	(156)	(130)	(163)	
B. Other Aid Outcomes								
All Loans ($), Year 1	-1314	-940	-748	-703*	-734**	-642**	-711**	[1592.2]
	(764)	(536)	(382)	(316)	(275)	(226)	(254)	
Total All Loans ($), Through Year 4	-3655	-3615*	-1671	-1283	-1339	-1359	-1351	[1443.7]
	(2526)	(1784)	(1236)	(1022)	(892)	(734)	(865)	
Borrowed (%), Year 1	-.076	-.104*	-.105***	-.097***	-.097***	-.09***	-.087***	[2065.6]
	(.059)	(.043)	(.031)	(.025)	(.022)	(.018)	(.017)	
Ever Borrowed (%), Through Year 4	-.069	-.103*	-.09**	-.082***	-.083***	-.078***	-.083***	[1276.1]
	(.059)	(.042)	(.03)	(.024)	(.021)	(.017)	(.021)	
Combined Aid (Grants + Loans, $), Year 1	-771	-106	241	125	164	236	177	[1429.6]
	(815)	(573)	(416)	(346)	(301)	(248)	(293)	
Total Combined Aid (Grants + Loans, $),	-4472	-3529	-894	-1076	-823	-786	-748	[1467.1]
Through Year 4	(3359)	(2338)	(1655)	(1373)	(1199)	(991)	(1158)	
C. Academic Outcomes								
Re-enrolled, Year 2	-.003	-.002	-.01	-.011	-.014	-.021	-.013	[1312.5]
	(.064)	(.045)	(.032)	(.026)	(.023)	(.018)	(.023)	
Total Credits Earned, Through Year 4	-8.343	-7.293*	-2.528	-1.854	-1.386	-1.209	-1.442	[1319.7]
	(5.133)	(3.683)	(2.658)	(2.188)	(1.892)	(1.539)	(1.905)	
Earned Any Degree, Through Year 4	-.028	-.042	-.012	-.006	-.007	-.01	-.007	[1470.4]
	(.06)	(.043)	(.031)	(.025)	(.022)	(.018)	(.021)	
Observations	2,003	4,066	8,080	12,274	16,553	25,461		

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the bandwidth listed in each column, above its standard error in parentheses. See notes of Tables 4 and 5 for RD model details. *=p<0.05; **=p<0.01; ***=p<0.001.

(A) Appendix Tables

Appendix Table A1a: Alternative Bandwidths (Uniform Kernel)

Outcome	BW=250	500	1000	1500	2000	3000	Optimal	[Opt. BW]
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Y1 (%)	.71***	.699***	.747***	.768***	.788***	.814***	.725***	[418.0]
	(.04)	(.028)	(.019)	(.015)	(.012)	(.01)	(.021)	
Ever Received Pell, Through Year 4	.348***	.407***	.445***	.455***	.47***	.495***	.034	[933.7]
	(.055)	(.039)	(.027)	(.022)	(.019)	(.015)	(.021)	
Received Pell Award, Year 2	.065	.029	.038	.036	.02	.034*	.440***	[624.7]
	(.058)	(.04)	(.028)	(.023)	(.02)	(.016)	(.025)	
Total Pell ($), Through Year 4	197	165	301	311	246	291*	226	[1004.0]
	(392)	(284)	(206)	(170)	(150)	(126)	(163)	
B. Other Aid Outcomes								
All Loans ($), Year 1	-786	-810	-636	-712*	-739**	-600**	-727**	[1046.0]
	(718)	(505)	(363)	(298)	(260)	(213)	(281)	
Total All Loans ($), Through Year 4	-2002	-2892	-1072	-1265	-1447	-1105	-1414	[1328.2]
	(2382)	(1658)	(1172)	(969)	(844)	(691)	(796)	
Borrowed (%), Year 1	-.074	-.111**	-.095***	-.094***	-.097***	-.084***	-.089***	[896.3]
	(.057)	(.041)	(.029)	(.024)	(.020)	(.017)	(.024)	
Ever Borrowed (%), Through Year 4	-.059	-.108**	-.079**	-.08***	-.086***	-.07***	-.077***	[923.3]
	(.056)	(.039)	(.028)	(.023)	(.020)	(.016)	(.022)	
Combined Aid (Grants + Loans, $), Year 1	-527	103	393	21	285	236	295	[1686.6]
	(768)	(543)	(397)	(328)	(285)	(234)	(244)	
Total Combined Aid (Grants + Loans, $),	-3706	-2441	123	-1466	-382	-586	-545	[1355.5]
Through Year 4	(3141)	(2201)	(1570)	(1303)	(1140)	(938)	(1091)	
C. Academic Outcomes								
Re-enrolled, Year 2	.021	-.010	-.001	-.013	-.023	-.013	-.026	[1275.9]
	(.060)	(.042)	(.030)	(.024)	(.021)	(.017)	(.020)	
Total Credits Earned, Through Year 4	-7.424	-5.027	-1.314	-1.896	-1.07	-.785	-1.263	[1724.4]
	(4.87)	(3.496)	(2.504)	(2.043)	(1.768)	(1.435)	(1.490)	
Earned Any Degree, Through Year 4	-.023	-.034	-.002	-.006	-.005	-.010	-.009	[1260.7]
	(.057)	(.041)	(.029)	(.024)	(.021)	(.017)	(.020)	
Observations	2,003	4,066	8,080	12,274	16,553	25,461		

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the bandwidth listed in each column, above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-linear, robust bias-corrected regression discontinuity method with a uniform kernel and Year 1 EFC as the running variable. *=p<0.05; **=p<0.01; ***=p<0.001.

Appendix Table A1b: Alternative Bandwidths (Epanechnikov Kernel)

Outcome	BW=250	500	1000	1500	2000	3000	Optimal	[Opt. BW]
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Y1 (%)	.705***	.703***	.739***	.758***	.777***	.803***	.735***	[511.7]
	(.041)	(.029)	(.02)	(.016)	(.014)	(.01)	(.021)	
Ever Received Pell, Through Year 4	.349***	.386***	.436***	.448***	.459***	.483***	.033	[1140.7]
	(.056)	(.041)	(.029)	(.023)	(.02)	(.016)	(.022)	
Received Pell Award, Year 2	.071	.022	.027	.038	.026	.024	.449***	[768.3]
	(.06)	(.042)	(.03)	(.024)	(.021)	(.017)	(.024)	
Total Pell ($), Through Year 4	155	124	179	273	253	248	269	[1126.3]
	(403)	(294)	(211)	(175)	(154)	(128)	(166)	
B. Other Aid Outcomes								
All Loans ($), Year 1	-1174	-940	-727	-694*	-736**	-625**	-727**	[1398.0]
	(751)	(523)	(375)	(310)	(270)	(222)	(261)	
Total All Loans ($), Through Year 4	-3041	-3653*	-1454	-1191	-1334	-1343	-1327	[1331.9]
	(2493)	(1738)	(1209)	(1005)	(876)	(719)	(874)	
Borrowed (%), Year 1	-.076	-.108*	-.106***	-.096***	-.097***	-.089***	-.090***	[1741.7]
	(.059)	(.042)	(.030)	(.025)	(.021)	(.017)	(.018)	
Ever Borrowed (%), Through Year 4	-.067	-.109**	-.088**	-.081***	-.083***	-.077***	-.082***	[1176.0]
	(.058)	(.041)	(.029)	(.024)	(.020)	(.017)	(.021)	
Combined Aid (Grants + Loans, $), Year 1	-674	-42	272	104	175	245	152	[1317.2]
	(798)	(562)	(410)	(340)	(296)	(243)	(295)	
Total Combined Aid (Grants + Loans, $),	-3981	-3335	-649	-1111	-752	-778	-798	[1351.6]
Through Year 4	(3286)	(2285)	(1624)	(1350)	(1179)	(972)	(1172)	
C. Academic Outcomes								
Re-enrolled, Year 2	.008	-.003	-.010	-.012	-.015	-.021	-.013	[1194.9]
	(.063)	(.044)	(.031)	(.026)	(.022)	(.018)	(.023)	
Total Credits Earned, Through Year 4	-7.459	-6.838	-2.103	-1.724	-1.243	-1.132	-1.327	[1223.1]
	(5.044)	(3.619)	(2.607)	(2.14)	(1.849)	(1.502)	(1.917)	
Earned Any Degree, Through Year 4	-.030	-.042	-.010	-.006	-.007	-.010	-.008	[1344.5]
	(.059)	(.042)	(.030)	(.025)	(.021)	(.018)	(.021)	
Observations	2,003	4,066	8,080	12,274	16,553	25,461		

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the bandwidth listed in each column, above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-linear, robust bias-corrected regression discontinuity method with an Epanechnikov kernel and Year 1 EFC as the running variable. *=p<0.05; **=p<0.01; ***=p<0.001.

Appendix Table A2a: Alternative Functional Form (Quadratic Model)

Outcome	BW=250	500	1000	1500	2000	3000	Optimal	[Opt. BW]
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Y1 (%)	.696***	.715***	.705***	.727***	.739***	.762***	.735***	[1158.9]
	(.054)	(.039)	(.028)	(.023)	(.019)	(.015)	(.021)	
Ever Received Pell, Through Year 4	.311***	.361***	.394***	.425***	.436***	.447***	.021	[2254.9]
	(.073)	(.054)	(.039)	(.032)	(.027)	(.022)	(.023)	
Received Pell Award, Year 2	.050	.064	.034	.029	.040	.021	.441***	[1603.2]
	(.082)	(.058)	(.04)	(.033)	(.028)	(.023)	(.026)	
Total Pell ($), Through Year 4	-555	138	181	180	254	227	237	[2216.4]
	(553)	(390)	(281)	(231)	(202)	(168)	(169)	
B. Other Aid Outcomes								
All Loans ($), Year 1	-2208*	-1390*	-1057*	-932*	-836*	-809**	-732*	[2389.5]
	(967)	(692)	(473)	(386)	(337)	(276)	(287)	
Total All Loans ($), Through Year 4	-6436*	-3634	-2810	-1903	-1429	-1238	-1374	[2209.4]
	(2983)	(2238)	(1534)	(1229)	(1062)	(867)	(971)	
Borrowed (%), Year 1	-.066	-.083	-.102*	-.102**	-.098***	-.097***	-.098***	[2247]
	(.076)	(.056)	(.04)	(.033)	(.029)	(.023)	(.023)	
Ever Borrowed (%), Through Year 4	-.078	-.074	-.095*	-.087**	-.082**	-.084***	-.085***	[2232]
	(.076)	(.055)	(.039)	(.032)	(.028)	(.022)	(.022)	
Combined Aid (Grants + Loans, $), Year 1	-1195	-477	70	255	93	191	169	[2107.6]
	(1079)	(760)	(537)	(445)	(392)	(323)	(335)	
Total Combined Aid (Grants + Loans, $),	-7258	-4491	-2158	-801	-1229	-834	-715	[2257.5]
Through Year 4	(4402)	(3127)	(2175)	(1776)	(1554)	(1287)	(1292)	
C. Academic Outcomes								
Re-enrolled, Year 2	-.061	.005	-.010	-.008	-.009	-.019	-.009	[1934.3]
	(.085)	(.06)	(.042)	(.034)	(.030)	(.024)	(.026)	
Total Credits Earned, Through Year 4	-13.064	-9.456*	-4.786	-2.534	-2.243	-1.711	-1.477	[2240.6]
	(6.709)	(4.798)	(3.452)	(2.851)	(2.487)	(2.032)	(2.042)	
Earned Any Degree, Through Year 4	-.014	-.041	-.027	-.009	-.007	-.007	-.005	[2228.8]
	(.079)	(.056)	(.040)	(.033)	(.029)	(.024)	(.024)	
Observations	2,003	4,066	8,080	12,274	16,553	25,461		

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the bandwidth listed in each column, above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-quadratic, robust bias-corrected regression discontinuity method with a triangular kernel and Year 1 EFC as the running variable.
*=p<0.05; **=p<0.01; ***=p<0.001.

Appendix Table A2b: Alternative Functional Form (Cubic Model)

Outcome	BW=250	500	1000	1500	2000	3000	Optimal	[Opt. BW]
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Y1 (%)	.704***	.703***	.699***	.706***	.719***	.739***	.726***	[1724.7]
	(.068)	(.048)	(.035)	(.028)	(.024)	(.019)	(.022)	
Ever Received Pell, Through Year 4	.254**	.342***	.384***	.4***	.42***	.434***	.045	[2050.1]
	(.089)	(.066)	(.048)	(.039)	(.034)	(.028)	(.030)	
Received Pell Award, Year 2	.035	.093	.057	.03	.031	.046	.436***	[2371.7]
	(.102)	(.072)	(.05)	(.041)	(.035)	(.028)	(.028)	
Total Pell ($), Through Year 4	-824	-9.059	242.088	174.188	186.524	306.152	301	[2296.0]
	(702)	(487.665)	(346.029)	(285.257)	(248.514)	(205.481)	(209)	
B. Other Aid Outcomes								
All Loans ($), Year 1	-2290	-1264	-935	-899	-773	-772*	-790*	[2524.7]
	(1222)	(890)	(627)	(507)	(440)	(363)	(355)	
Total All Loans ($), Through Year 4	-8149*	-3544	-3993	-2894	-2014	-1227	-1253	[2896.2]
	(3618)	(2875)	(2080)	(1668)	(1431)	(1174)	(1073)	
Borrowed (%), Year 1	-.05	-.049	-.086	-.109**	-.104**	-.101***	-.103***	[2343.6]
	(.092)	(.068)	(.05)	(.041)	(.035)	(.029)	(.029)	
Ever Borrowed (%), Through Year 4	-.075	-.044	-.086	-.098*	-.088**	-.082**	-.084**	[2315.8]
	(.092)	(.068)	(.049)	(.04)	(.034)	(.028)	(.028)	
Combined Aid (Grants + Loans, $), Year 1	-1485	-927	-155	114	252	81	45	[2330.0]
	(1317)	(949)	(664)	(543)	(476)	(397)	(403)	
Total Combined Aid (Grants + Loans, $),	-7131	-4791	-3656	-1961	-971	-972	-829	[2569.5]
Through Year 4	(5398)	(3903)	(2713)	(2198)	(1905)	(1575)	(1531)	
C. Academic Outcomes								
Re-enrolled, Year 2	-.068	-.015	.009	-.011	-.009	-.001	.000	[2403.3]
	(.106)	(.074)	(.052)	(.043)	(.037)	(.03)	(.030)	
Total Credits Earned, Through Year 4	-15.682	-8.957	-8.025	-4.87	-3.036	-1.785	-1.574	[2659.8]
	(8.279)	(5.899)	(4.235)	(3.491)	(3.051)	(2.515)	(2.403)	
Earned Any Degree, Through Year 4	.009	-.017	-.041	-.031	-.011	-.006	-.007	[3031.9]
	(.098)	(.070)	(.050)	(.041)	(.035)	(.029)	(.026)	
Observations	2,003	4,066	8,080	12,274	16,553	25,461		

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the bandwidth listed in each column, above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-cubic, robust bias-corrected regression discontinuity method with a triangular kernel and Year 1 EFC as the running variable.
*=p<0.05; **=p<0.01; ***=p<0.001.

Appendix Table A3a: Alternative Model (Cohort Fixed Effects Only)

Outcome	BW=250	500	1000	1500	2000	3000	Optimal	[Opt. BW]
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Y1 (%)	.713***	.701***	.729***	.75***	.769***	.796***	.725***	[526.5]
	(.044)	(.031)	(.022)	(.017)	(.014)	(.011)	(.022)	
Ever Received Pell, Through Year 4	.363***	.380***	.423***	.439***	.451***	.476***	.028	[1217.9]
	(.059)	(.043)	(.030)	(.024)	(.021)	(.017)	(.022)	
Received Pell Award, Year 2	.08	.033	.025	.033	.025	.022	.437***	[781.7]
	(.062)	(.044)	(.030)	(.025)	(.021)	(.018)	(.025)	
Total Pell ($), Through Year 4	98	118	133	217	218	223	221.754	[1206.8]
	(421)	(302)	(218)	(181)	158)	(131)	(165.82)	
B. Other Aid Outcomes								
All Loans ($), Year 1	-979	-912	-863*	-795*	-818**	-693**	-786**	[1535.4]
	(837)	(586)	(417)	(344)	(298)	(245)	(279)	
Total All Loans ($), Through Year 4	-3026	-3696	-2050	-1593	-1641	-1536*	-1627	[1416.3]
	(2723)	(1930)	(1332)	(1096)	(953)	(782)	(929)	
Borrowed (%), Year 1	-.063	-.108*	-.116***	-.106***	-.104***	-.094***	-.097***	[1681.5]
	(.065)	(.046)	(.032)	(.026)	(.023)	(.018)	(.019)	
Ever Borrowed (%), Through Year 4	-.056	-.106*	-.099**	-.09***	-.09***	-.082***	-.09***	[1215.5]
	(.064)	(.044)	(.031)	(.025)	(.022)	(.017)	(.022)	
Combined Aid (Grants + Loans, $), Year 1	-668	-257	25	-50	-25	135	-18.587	[1367.9]
	(992)	(698)	(504)	(418)	(362)	(298)	(356.4)	
Total Combined Aid (Grants + Loans, $),	-4340	-4020	-1533	-1620	-1439	-1104	-1412.998	[1417]
Through Year 4	(3938)	(2738)	(1921)	(1578)	(1371)	(1129)	(1338.108)	
C. Academic Outcomes								
Re-enrolled, Year 2	.001	-.003	-.014	-.015	-.019	-.023	-.018	[1293]
	(.066)	(.046)	(.033)	(.027)	(.023)	(.019)	(.023)	
Total Credits Earned, Through Year 4	-7.186	-7.487	-3.289	-2.641	-2.189	-1.588	-2.285	[1252.8]
	(5.582)	(4.035)	(2.881)	(2.359)	(2.035)	(1.654)	(2.083)	
Earned Any Degree, Through Year 4	-.023	-.042	-.014	-.010	-.010	-.010	-.01	[1447.8]
	(.063)	(.044)	(.031)	(.026)	(.022)	(.018)	(.022)	
Enrolled in KY public 2-year inst., Year 1	-.028	.015	.024	.020	.020	.011	.010	[1834.9]
	(.062)	(.044)	(.031)	(.025)	(.022)	(.018)	(.019)	
Ever Enrolled in KY public 2-year inst.,	-.051	.011	.018	.018	.016	.008	.006	[1849.9]
Through Year 4	(.063)	(.045)	(.032)	(.026)	(.022)	(.018)	(.019)	
Enrolled in KY public 4-year inst., Year 1	.028	-.015	-.024	-.020	-.020	-.011	-.010	[1834.9]
	(.062)	(.044)	(.031)	(.025)	(.022)	(.018)	(.019)	
Ever Enrolled in KY public 4-year inst.,	-.013	-.056	-.049	-.035	-.030	-.018	-.028	[1410.0]
Through Year 4	(.061)	(.043)	(.031)	(.025)	(.022)	(.018)	(.021)	
Observations	2,003	4,066	8,080	12,274	16,553	25,461		

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the bandwidth listed in each column, above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-linear, robust bias-corrected regression discontinuity method with a triangular kernel, Year 1 EFC as the running variable, and a bandwidth of $2,000. All estimates condition on the student demographics listed in Table 3 as well as cohort fixed effects. *=p<0.05; **=p<0.01; ***=p<0.001.

Appendix Table A3b: Alternative Model (Sector Fixed Effects)

Outcome	BW=250	500	1000	1500	2000	3000	Optimal	[Opt. BW]
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Y1 (%)	.711***	.702***	.73***	.751***	.770***	.796***	.726***	[525.8]
	(.043)	(.031)	(.021)	(.017)	(.014)	(.011)	(.021)	
Ever Received Pell, Through Year 4	.361***	.381***	.425***	.441***	.453***	.477***	.029	[1223.6]
	(.059)	(.042)	(.03)	(.024)	(.021)	(.017)	(.022)	
Received Pell Award, Year 2	.079	.034	.026	.034	.026	.023	.439***	[786.5]
	(.062)	(.044)	(.03)	(.025)	(.021)	(.018)	(.025)	
Total Pell ($), Through Year 4	81	128	150	233	235	235	239	[1222.7]
	(421)	(302)	(217)	(180)	(157)	(131)	(164)	
B. Other Aid Outcomes								
All Loans ($), Year 1	-1112	-839	-747	-696*	-720**	-638**	-676**	[1691.0]
	(779)	(544)	(387)	(320)	(278)	(228)	(250)	
Total All Loans ($), Through Year 4	-3405	-3484	-1711	-1302	-1349	-1371	-1377	[1449.8]
	(2567)	(1813)	(1254)	(1033)	(900)	(739)	(870)	
Borrowed (%), Year 1	-.069	-.104*	-.111***	-.101***	-.099***	-.091***	-.089***	[1963.8]
	(.061)	(.044)	(.031)	(.025)	(.022)	(.018)	(.017)	
Ever Borrowed (%), Through Year 4	-.061	-.103*	-.095**	-.086***	-.086***	-.079***	-.086***	[1240.9]
	(.061)	(.043)	(.03)	(.024)	(.021)	(.017)	(.021)	
Combined Aid (Grants + Loans, $), Year 1	-906	-125	232	126	149	233	155	[1424.8]
	(846)	(590)	(429)	(357)	(310)	(254)	(301)	
Total Combined Aid (Grants + Loans, $),	-5063	-3613	-885	-1068	-887	-793	-869	[1457.9]
Through Year 4	(3597)	(2470)	(1734)	(1427)	(1240)	(1021)	(1199)	
C. Academic Outcomes								
Re-enrolled, Year 2	-.002	-.001	-.011	-.013	-.016	-.021	-.016	[1301.5]
	(.066)	(.046)	(.032)	(.026)	(.023)	(.018)	(.023)	
Total Credits Earned, Through Year 4	-8.027	-7.009	-2.531	-1.992	-1.538	-1.221	-1.644	[1299.7]
	(5.273)	(3.776)	(2.704)	(2.218)	(1.915)	(1.555)	(1.938)	
Earned Any Degree, Through Year 4	-.021	-.043	-.015	-.010	-.011	-.011	-.010	[1443.3]
	(.063)	(.044)	(.031)	(.026)	(.022)	(.018)	(.022)	
Observations	2,003	4,066	8,080	12,274	16,553	25,461		

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the bandwidth listed in each column, above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-linear, robust bias-corrected regression discontinuity method with a triangular kernel, Year 1 EFC as the running variable, and a bandwidth of $2,000. All estimates condition on the student demographics listed in Table 3 as well as sector and cohort fixed effects. *=p<0.05; **=p<0.01; ***=p<0.001.

Appendix Table A4: Placebo Tests in Alternative Bandwidths

Student Characteristics	BW=250	500	1000	1500	2000	3000	Optimal	[Opt. BW]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	-.025	-.006	-.006	-.005	-.009	-.002	-.007	[1610.4]
	(.071)	(.051)	(.036)	(.029)	(.025)	(.021)	(.023)	
Observations	2,003	4,066	8,079	12,273	16,550	25,456		
Asian/Pacific Islander	.008	.006	-.001	.001	.004	.003	.003	[2264.8]
	(.016)	(.011)	(.008)	(.006)	(.006)	(.005)	(.004)	
Black	-.009	-.035	-.017	-.016	-.021	-.016	-.022	[1452.5]
	(.043)	(.031)	(.022)	(.018)	(.015)	(.012)	(.014)	
Native American	.000	.000	.000	.000	.001	.001	.001	[1935.9]
	(.002)	(.004)	(.003)	(.003)	(.002)	(.002)	(.002)	
White	.035	.058	.032	.023	.023	.014	.021	[1426.4]
	(.049)	(.036)	(.025)	(.02)	(.018)	(.014)	(.016)	
Two or More Races	-.035	-.028	-.014	-.009	-.007	-.003	-.003	[1803.5]
	(.019)	(.014)	(.011)	(.009)	(.008)	(.006)	(.007)	
Observations	1,931	3,925	7,813	11,899	16,043	24,674		
Hispanic	.006	.004	.012	.016	.019	.022*	.023*	[1721.4]
	(.031)	(.024)	(.017)	(.014)	(.012)	(.009)	(.010)	
Financial Dependent	-.056	-.032	-.01	-.007	.000	.001	.000	[1333.8]
	(.047)	(.034)	(.024)	(.02)	(.017)	(.014)	(.017)	
Age at College Entry	.734	.452	.097	.066	.020	.044	.054	[2030.8]
	(.963)	(.662)	(.449)	(.361)	(.31)	(.251)	(.250)	
Enrolled in Any Dev. Ed. Course, Year 1	.098	.062	.039	.020	.002	.002	-.003	[1505.8]
	(.065)	(.047)	(.033)	(.027)	(.023)	(.019)	(.022)	
KEES Grant Award, Year 1 ($)	-15	-46	-35	-47	-8	-1	1	[2099.0]
	(119)	(82)	(56)	(46)	(40)	(32)	(32)	
Total State Non-Need Grants, Year 1 ($)	-8	-41	-44	-52	-22	-20	-15	[1851.5]
	(120)	(83)	(58)	(48)	(42)	(35)	(36)	
Total Federal Non-Need Grants, Year 1 ($)	191	233	175*	133	105	82	81	[2099.7]
	(159)	(132)	(89)	(71)	(60)	(48)	(47)	
Observations	2,003	4,066	8,080	12,274	16,553	25,461		

Notes: Each cell reports the predicted discontinuity in the student characteristic listed in each row, estimated in the bandwidth listed in each column, above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-linear, robust bias-corrected regression discontinuity method with a triangular kernel, Year 1 EFC as the running variable, and a bandwidth of $2,000. Column (2) presents the p-values from a hypothesis test of whether the estimated discontinuity is equal to 0. All estimates condition on institution and cohort fixed effects.

Appendix Table A5: Borrowing and Academic Impacts Within Selected Subgroups (1/3)

Outcome	KEES* Male	No KEES* Male	KEES* URM	No KEES* URM	Dependent* Male	Independent* Male
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)
Received Pell Award, Year 2	-.019	.019	-.127	.067	.009	-.027
	(.043)	(.041)	(.096)	(.062)	(.032)	(.068)
Total Pell ($), Through Year 4	-321	581*	-1182	579	158	155
	(320)	(284)	(826)	(448)	(228)	(522)
B. Other Aid Outcomes						
All Loans ($), Year 1	-178	-1277*	-466	-967	-358	-1641**
	(444)	(644)	(903)	(940)	(464)	(582)
Total All Loans ($), Through Year 4	1465	-527	-849	-13	1434	-2300
	(1422)	(2040)	(2774)	(2867)	(1502)	(1739)
Borrowed (%), Year 1	-.067	-.168***	-.031	-.076	-.083*	-.187**
	(.044)	(.044)	(.072)	(.063)	(.035)	(.066)
Ever Borrowed (%), Through Year 4	-.041	-.151***	-.015	-.094	-.073*	-.12
	(.043)	(.043)	(.067)	(.061)	(.034)	(.065)
Combined Aid (Grants + Loans, $), Year 1	596	-657	260	18	408	-1348*
	(495)	(691)	(987)	(1163)	(514)	(598)
Total Combined Aid (Grants + Loans, $),	73	172	-3936	2836	713	-1632
Through Year 4	(2076)	(2555)	(4963)	(4415)	(1991)	(2199)
C. Academic Outcomes						
Re-enrolled, Year 2	-.007	.071	-.068	.057	.031	.014
	(.044)	(.049)	(.081)	(.074)	(.036)	(.073)
Total Credits Earned, Through Year 4	-.915	3.405	-1.1513	3.647	.584	1.925
	(3.937)	(3.506)	(7.553)	(5.363)	(3.13)	(4.296)
Earned Any Degree, Through Year 4	-.053	.016	.013	-.016	-.026	.004
	(.045)	(.039)	(.075)	(.058)	(.034)	(.063)
Observations	3954	3797	1032	1659	6078	1673

Note: This is page 1 of 3. Table continues on next page.

Appendix Table A5: Borrowing and Academic Impacts Within Selected Subgroups (cont. 2/3)

Outcome	Dependent* URM	Independent* URM	Male* URM	Male* Non-URM	KEES* Non-URM	No KEES* Non-URM
A. Pell Outcomes	(7)	(8)	(9)	(10)	(11)	(12)
Received Pell Award, Year 2	.009	-.032	-.017	-.003	.068	-.015
	(.032)	(.102)	(.072)	(.033)	(.033)	(.034)
Total Pell ($), Through Year 4	-3	-280	-202	206	181	409
	(509)	(643)	(592)	(234)	(241)	(235)
B. Other Aid Outcomes						
All Loans ($), Year 1	-340	-1033	-80	-1111*	-754*	-1302*
	(848)	(808)	(954)	(422)	(356)	(558)
Total All Loans ($), Through Year 4	1189	-913	1813	-750	-1224	-4029
	(2549)	(2605)	(2911)	(1328)	(1130)	(1787)
Borrowed (%), Year 1	-.046	-.079	-.084	-.126***	-.093*	-.146***
	(.053)	(.092)	(.070)	(.034)	(.036)	(.035)
Ever Borrowed (%), Through Year 4	-.052	-.077	-.088	-.099**	-59	-.147***
	(.050)	(.093)	(.069)	(.034)	(.034)	(.034)
Combined Aid (Grants + Loans, $), Year 1	790	-952	382	-276	415	-854
	(1056)	(794)	(1336)	(448)	(455)	(633)
Total Combined Aid (Grants + Loans, $),	2013	-1154	974	-554	-1132	-3209
Through Year 4	(4304)	(3105)	(4914)	(1721)	(1790)	(2328)
C. Academic Outcomes						
Re-enrolled, Year 2	-.004	.056	.084	.011	.001	-.055
	(.061)	(.111)	(.080)	(.036)	(.032)	(.039)
Total Credits Earned, Through Year 4	2.472	-1.62	7.412	-.614	-3.325	-2.784
	(5.574)	(5.53)	(6.246)	(2.947)	(3.165)	(3.177)
Earned Any Degree, Through Year 4	.037	-.166*	.024	-.018	-.043	.033
	(.053)	(.084)	(.063)	(.034)	(.034)	(.036)
Observations	2044	647	1254	6458	7312	6475

Note: This is page 2 of 3. Table continues on next page.

Appendix Table A5: Borrowing and Academic Impacts Within Selected Subgroups (cont. 3/3)

Outcome	Female* URM	Female* Non-URM	Dependent* No KEES	Independent* No KEES	Dependent* KEES	Independent* KEES
A. Pell Outcomes	(13)	(14)	(15)	(16)	(17)	(18)
Received Pell Award, Year 2	-.001	.063	.037	-.042	.057	.115
	(.075)	(.033)	(.036)	(.052)	(.031)	(.158)
Total Pell ($), Through Year 4	12	433	627**	237	50	-1253
	(591)	(235)	(233)	(387)	(225)	(1955)
B. Other Aid Outcomes						
All Loans ($), Year 1	-1154	-653	-380	-1663***	-547	-1722
	(900)	(423)	(655)	(417)	(311)	(1149)
Total All Loans ($), Through Year 4	-1883	-3197*	-615	-3689**	-836	-5291
	(2987)	(1361)	(2186)	(1304)	(988)	(3161)
Borrowed (%), Year 1	-.048	-.096**	-.089*	-.164***	-.074*	-.350*
	(.061)	(.033)	(.035)	(.048)	(.032)	(.165)
Ever Borrowed (%), Through Year 4	-.06	-.087**	-.107**	-.138**	-.051	-.018
	(.055)	(.032)	(.034)	(.047)	(.03)	(.203)
Combined Aid (Grants + Loans, $), Year 1	116	423	743	-1457***	513	-2453
	(1048)	(454)	(702)	(435)	(347)	(1685)
Total Combined Aid (Grants + Loans, $),	299	-1843	1897	-3256	-1359	-25604**
Through Year 4	(4729)	(1811)	(2820)	(1677)	(1469)	(7790)
C. Academic Outcomes						
Re-enrolled, Year 2	-.065	-.048	.001	-.052	-.008	.139
	(.076)	(.033)	(.042)	(.055)	(.03)	(.195)
Total Credits Earned, Through Year 4	-4.893	-3.061	1.964	-2.389	-3.262	-34.480*
	(6.370)	(2.867)	(3.572)	(3.363)	(2.738)	(13.877)
Earned Any Degree, Through Year 4	-.033	.01	.037	-.012	-.032	-.181
	(.065)	(.034)	(.038)	(.049)	(.032)	(.197)
Observations	1435	7328	4943	3259	8244	107
Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the sample listed in each column,						

Appendix Table A6: Alternative Sample (excluding 2016-17 freshman cohort)

Outcome	BW=250	500	1000	1500	2000	3000	Optimal	[Opt. BW]
A. Pell Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Received Pell Y1 (%)	.712***	.714***	.745***	.763***	.780***	.807***	.746***	[568.1]
	(.045)	(.032)	(.022)	(.018)	(.015)	(.012)	(.022)	
Ever Received Pell, Through Year 4	.365***	.421***	.462***	.470***	.477***	.494***	.033	[1423.6]
	(.06)	(.043)	(.031)	(.025)	(.022)	(.018)	(.022)	
Received Pell Award, Year 2	.139*	.101*	.071*	.057*	.038	.019	.475***	[935.6]
	(.066)	(.046)	(.032)	(.026)	(.023)	(.019)	(.024)	
Total Pell ($), Through Year 4	289	368	361	391*	354*	287*	376*	[1226.9]
	(444)	(322)	(233)	(193)	(169)	(140)	(175)	
B. Other Aid Outcomes								
All Loans ($), Year 1	-808	-652	-645	-699*	-764**	-732**	-753**	[1934.9]
	(812)	(567)	(408)	(337)	(293)	(240)	(247)	
Total All Loans ($), Through Year 4	-2081	-2292	-985	-1137	-1180	-1391	-1302	[1600.8]
	(2728)	(1913)	(1330)	(1092)	(949)	(776)	(873)	
Borrowed (%), Year 1	-.078	-.097*	-.101**	-.089***	-.093***	-.092***	-.091***	[2186.0]
	(.064)	(.046)	(.033)	(.027)	(.023)	(.019)	(.018)	
Ever Borrowed (%), Through Year 4	-.071	-.104*	-.089**	-.077**	-.082***	-.083***	-.084***	[1564.1]
	(.064)	(.045)	(.032)	(.026)	(.022)	(.018)	(.00)	
Combined Aid (Grants + Loans, $), Year 1	-436	83	353	141	185	197	195	[1478.5]
	(887)	(619)	(445)	(367)	(319)	(261)	(305)	
Total Combined Aid (Grants + Loans, $),	-2591	-1730	366	-487	-229	-547	-200	[1486.8]
Through Year 4	(3640)	(2501)	(1763)	(1452)	(1265)	(1044)	(1205)	
C. Academic Outcomes								
Re-enrolled, Year 2	.019	.030	.014	.002	-.002	-.010	-.002	[1325.8]
	(.067)	(.047)	(.034)	(.028)	(.024)	(.019)	(.024)	
Total Credits Earned, Through Year 4	-7.303	-5.096	-.888	-.880	-.376	-.484	-.303	[1414.9]
	(5.419)	(3.882)	(2.811)	(2.319)	(2.009)	(1.639)	(1.962)	
Earned Any Degree, Through Year 4	-.024	-.022	-.003	-.007	-.008	-.008	-.007	[1566.9]
	(.065)	(.046)	(.033)	(.027)	(.023)	(.019)	(.022)	
Observations	1,748	3,535	7,029	10,685	14,447	22,256		

Notes: Each cell presents the predicted discontinuity in the outcome listed in each row, estimated in the bandwidth listed in each column, above its standard error in parentheses. Discontinuities are estimated at the maximum EFC threshold for Pell Grant eligibility using Calonico and coauthors' (2017) local-linear, robust bias-corrected regression discontinuity method with a triangular kernel and Year 1 EFC as the running variable. *=p<0.05; **=p<0.01; ***=p<0.001.