The Impact of Pell Grant Aid on Academic Outcomes and Degree Mismatch*

Usamah Wasif† Robert Berrens‡ Richard Santos§

April 18, 2024

Abstract

The Pell Grant, the largest student aid program in the United States, is dispersed in cash grants to eligible students. The EFC, a non-linear formula, is the federal government's measure of financial need and is used to determine Pell Grant eligibility and grant amount. As part of the formula, students whose family's adjusted gross annual income falls below a specific cut-off automatically receive the maximum Pell Award. The partial expiration of the College Cost Reduction and Access Act (CCRAA) in 2012 reduced this cut-off from $31,000 to $23,000. We use this change in the eligibility criteria to ask if Pell Grant generosity impacts academic outcomes and choice of major. We use the Fixed Effects - Instrumental Variable approach coupled with student-level administrative data from the University of New Mexico (UNM) to estimate the effect of the eligibility change on retention, credit hours attempted, and degree choice. We find first-order effects on Pell Grant generosity and second-order effects on retention, credit hours attempted, and degree choice, with Latino and Indigenous students demonstrating the largest magnitudes.

Keywords: Transfer Payments, Education, Welfare
JEL Codes: H5, I2, I3

*Correspondence concerning this article should be addressed to Usamah Wasif, MSU. u.wasif@gmail.com.
†Michigan State University
‡University of New Mexico
§University of New Mexico

1 Introduction

The Pell Grant is the largest United States aid program for low-income students. The assistance is dispersed through cash grants to eligible students at the start of the academic semester. The maximum Pell Award has increased in generosity from $1,400 in 1975 to $5,550 in 2013. Despite an increase in the nominal amount, the Pell Award has undergone a 4 percent decline in real terms (Turner, 2017). More importantly, due to rising education costs, the award has gone from covering 67% to only 27% of the average cost of attendance from 1975 to 2018. This sizable decline in cost coverage of the Pell Grant Award and the continued increase in the cost of attendance led House and Senate democrats to attempt legislation such as the FAFSA Simplification Act in 2020[1] and the Pell Grant Preservation and Expansion Act in 2021[2], and were successful in passing the former. The FAFSA Simplification Act of 2020, which becomes active in the academic year 2023/2024, will result in an additional 610,000 students becoming eligible for the Pell Grant and an additional 1.5 million already eligible students qualifying for the maximum Pell Award. [3]. As a result, Pell Grant Program expenditures will increase from $26.7 billion in 2023 to $38.8 billion in 2024, a massive $12 billion increase in government spending[4]. This increase in public expenditure has an opportunity cost, and estimating the impact of Pell Grant eligibility changes on academic outcomes has become a pressing concern.

How does Pell Grant eligibility impact retention and students' degree choice? This paper investigates the causal relationship between Pell Grant generosity and students' academic outcomes. A decrease in Pell Grant generosity, which results in students reallocating hours from education activities to labor, would support the existence of income and substitution effects from education-specific cash grants. Increased Pell Grant generosity has increased

[1]https://crsreports.congress.gov/product/pdf/R/R46909. Accessed 12/13/2023

[2]https://www.congress.gov/bill/117th-congress/house-bill/3946. Accessed 11/13/2023

[3]https://www.ed.gov/news/press-releases/us-department-education-releases-new-data-highlighting-how-simplified-streamlined-and-redesigned-better-fafsa%C2%AE-form-will-help-deliver-maximum-pell-grants-15-million-more-students. Accessed 12/13/2023

[4]https://www2.ed.gov/about/overview/budget/budget23/justifications/o-sfa.pdf. Accessed 12/13/2023

graduation in specific contexts (Denning, 2017; Denning, Marx, and Turner, 2019; Marx and Turner, 2019), and Denning (2017) has demonstrated an income or substitution effect (or both), with discrete Pell Grant amount increases associated with student labor supply declines. However, these studies used eligibility criteria that create discrete increases in Pell Grant awards (e.g., family income or date of birth); what remains to be studied is the effect of expansion (or retraction) of Pell Grant eligibility. The College Cost Reduction and Access Act (CCRAA) of 2007 expanded the Adjusted Gross Income (AGI) threshold used for automatic eligibility for the maximum Pell Grant Award, and its subsequent expiration in 2012 resulted in a substantial retraction of the threshold to pre-CCRAA levels. This context allows us to evaluate Pell Grant eligibility changes as a policy lever and their impact on students' academic outcomes.

We build on past research that investigates enrollment and educational effects of the Pell Grant program. Most early research found negligible enrollment effects associated with the Pell Grant (Hansen 1983; Kane 1995; Turner 2017; Marx and Turner 2018; Denning 2019; Denning, Marx, and Turner 2019; Carruthers and Welch 2020). More recently, Denning, Marx, and Turner (2019) and Eng and Matsudaira (2021) found effects on graduation rates and time to degree, with the former finding sizable magnitudes and the latter significantly smaller.

Denning, Marx, and Turner (2019) studied 4-year colleges in Texas using the AZ-EFC eligibility threshold in a fuzzy Regression Discontinuity Design (RDD). AZ-EFC eligibility for first-year students increases graduation, earnings, and tax payments, and that increased Pell assistance pays for itself via increased tax payments due to higher earnings. Eng and Matsudaira (2021) replicate the quasi-experimental setting of the AZ-EFC eligibility cut-off on a broader swath of higher education institutes. They find a small increase in degree completion, with the effect not robust to differing sample years and specifications. They highlight the importance of context and speculate that the interaction between the federally provisioned Pell Grant and state or institutional student aid programs may explain the difference between their findings and those of Denning, Marx, and Turner (2019) and other state-specific studies.

Marx and Turner (2019) and Denning (2019) are other studies that find an impact of Pell assistance on academic outcomes. Marx and Turner (2019) use the EFC eligibility threshold in a Randomized Control Trial (RCT) to estimate the effect of Pell Grants and student loans on attainment. They found that a $1000 increase in the Pell Grant is associated with an 11-21 percent increase in credits attempted, credits obtained, and college GPA. Students classified as financially independent receive considerably more assistance than financial dependents. Students' status as independent (or dependent) is determined on the 1st of January of each year. If a student is 24 years or older at the beginning of the calendar year, they are considered financially independent. Denning (2019) uses this age cut-off in a Donut RDD framework and finds that financial independence is associated with increased credit hour enrollment and reduced time-to-degree. Notably, Denning (2019) identifies an employment response as the mechanism. Financial independence is associated with a $579 decline in earnings for working students, constituting 55 percent of the increase in grants from financial independence. Lastly, Murphy and Wyness (2023) estimate the impact of institutional aid in the United Kingdom using differences in student aid schedules across nine universities. They find that an increase in institutional financial aid for first-year students increases the probability of first-year completion, improves test scores, and increases the chances of graduating with a "good" degree (a first-class or second-class Upper Division grade).

This paper is the first to study changes in AZ-EFC eligibility as a policy lever to increase college affordability and access to higher education. We use a "heterogeneity robust" Two-Stage Difference-in-Differences (2SDiD) estimator and the longitudinal aspect of our data to account for unobserved heterogeneity to address concerns about unobserved confounders in canonical Difference-in-Differences (DiD) or pooled cross-section approaches. Addressing these concerns is important because policy changes or thresholds associated with the Pell Grant are only partially binding, which leads to the possibility of an unobserved factor (confounder) correlated with Pell Grant recipiency and changes in assistance amounts, as well as students' academic outcomes. Lastly, we create a degree match index to evaluate changes in Pell Grant generosity impact intra-marginal students and their choice of college major.

The remainder of this paper is organized as follows. Section 2 explains the context in which AZ-EFC eligibility threshold changes happened and lays out our conceptual framework. Section 3 details our data sources and characteristics, followed by an explanation of our analysis samples. Section 4 details our empirical methodology and explains the identification. Section 7 presents our primary specifications, mediator, and heterogeneity analysis results, and section 8 concludes with a discussion of our findings, limitations, and suggestions for future research.

2 The Pell Grant Program

The Pell Grant was part of the Higher Education Act of 1965, signed into law by Lyndon B. Johnson to bolster higher education resources. The Pell Grant is a subsidy to aid students from low-income households to afford college, which, unlike student loans, does not have to be repaid. Pell Grant eligibility, for our sample years, depends on two factors: (i) the annual maximum award (set by the federal government) and (ii) the expected family contribution (EFC). The EFC is the federal government's measure of financial need and determines Pell Grant eligibility and amount. It is a non-linear formula calculated using the Free Application for Free Student Aid (FAFSA) information. This information includes family income, the value of assets, and welfare recipiency status. Only those who receive an EFC score of zero qualify for the maximum grant award. One way in which students automatically qualify for the maximum award is if their family's adjusted gross annual income (AGI) falls below a specific threshold. This income cut-off is the automatic zero EFC (AZ-EFC) eligibility threshold. The FAFSA Simplification Act, which becomes effective in the academic year

2023/2024, abolishes the AZ-EFC eligibility threshold, as it replaces the EFC formula with a more simplified student need measure, the Student Aid Index (SAI). It also establishes an AGI cut-off of $60,000, which ensures automatic eligibility for the maximum award without any score conversion. Thus, in reality, the AGI threshold for automatic maximum Pell Award eligibility has increased to $60,000, more than doubling the previous year's threshold of $27,000, while also discarding the now expired "AZ-EFC eligibility threshold" nomenclature. This increase will result in 1.5 million more students receiving the maximum Pell Award [5].

3 The College Cost Reduction and Access Act

The U.S. legislature enacted the College Cost Reduction and Access Act of 2007 (CCRAA) in response to the increasing cost of higher education and the decline in the Pell Grant's cost of attendance coverage. Alongside several other components, it increased the AZ-EFC eligibility threshold from $20,000 in 2008 to $30,000 in 2009. The CCRAA also increased the maximum Pell Grant award from $4,310 to $5,400 by 2012. Some components of the CCRAA, including the increase in the AZ-EFC eligibility threshold, were stipulated to be reversed in 2012, notwithstanding a legislative extension. Congress was unable to agree on an extension, and in 2012, the AZ-EFC eligibility threshold declined from $31,000 to $23,000.

The CCRAA created sizable changes in the AZ-EFC eligibility threshold, with an initial expansion in 2009 and a subsequent decline in 2012. These created exogenous variations in Pell Grant generosity; students whose family income fell between $20,000 and $30,000 qualified for the maximum Pell Award after the initial expansion and experienced a discrete increase in their Pell Grant award. In 2012, when the threshold declined, students whose family income fell between $31,000 and $23,000 no longer qualified for the maximum Pell Award and experienced a discrete decline in their Pell Grant award.

The initial expansion coincided with the Great Recession and the American Recovery and

[5] https://www.ed.gov/news/press-releases/us-department-education-releases-new-data-highlighting-how-simplified-streamlined-and-redesigned-better-fafsa%C2%AE-form-will-help-deliver-maximum-pell-grants-15-million-more-students. Accessed 12/13/2023

Reinvestment Act of 2009 (ARRA). The stimulus component of the ARRA was responsible for substantial federal and state education outlays, including a sizable increase in Pell Grant funding. The ARRA supplemented the annual discretionary appropriation of $17.3 billion for Pell assistance in F.Y. 2009 with a further $15.6 billion in discretionary spending. Thus, the total discretionary appropriation for the Pell Grant Program in F.Y. 2009 was $32.9 billion, a massive 131.6% increase over its F.Y. 2008 level of $14.2 billion. Due to the economic turmoil of the Great Recession and the substantial federal and state stimulus spending on education in 2009, we can not accurately estimate the effect of the AZ-EFC eligibility expansion (2009) on academic outcomes. An empirical methodology using the 2009 AZ-EFC eligibility expansion for causal identification would lack internal validity. As a result, we use the 2012 contraction in the AZ-EFC eligibility threshold as our source of exogenous variation in Pell Grant generosity.

We analyze the intensive margin, encompassing retention, academic performance, and graduation. Inclusion in our sample is conditional on initial enrollment at UNM. We do not examine the extensive margin (admission enrollment) because of selection bias issues. Given that we use a postsecondary dataset, inclusion in admission enrollment analysis is conditional on a student application, i.e., inclusion in the institutional dataset is conditional on interaction with the institution, which is rarely random. This is a common issue encountered in administrative datasets. As students self-select into the applicant pool, the applicant pool is not a representative sample of the high school graduate population. Using terminology from the Pearl (2009) framework, inclusion in our sample is conditional on a collider variable, which fails the back-door criterion. As demonstrated by Cunningham (2021), the ensuing bias may be sizable enough to switch the sign of our coefficients.

4 Data, Sample, and Descriptive Statistics

We use University of New Mexico (UNM) administrative data with detailed student information by semester from admission until graduation. We use admission and enrollment data from the Institute of Design and Innovation (IDI) at UNM, encompassing the academic years 2006-2018. The administrative data contains information on student demographics, year of application, high school GPA, ACT scores, student's degree major, semester enrollment, and high school information – at the city-only level – for New Mexico residents. Notably, the data also includes detailed financial aid and student loan information. The longitudinal student data tracks all students who attend UNM every semester, including semester-specific financial aid and student loan information. Our data set encompasses cohorts admitted as freshmen in 2007-2018. The freshmen class of the 2018/2019 academic year is our last cohort, and we only observe them for their two freshman semesters.

We obtained information on the AZ-EFC eligibility threshold from each year's Federal Student Aid public release of the EFC formula. Federal Student Aid is an office of the U.S. Department of Education. The AZ-EFC eligibility thresholds for academic years 2008-2012 are given in Table 4.

For the marginal student, the outcome of interest is retention, a dichotomous variable for academic year enrollment. For the intra-marginal student, we are interested in the impact on degree match. For degree major mismatch, we create a continuous measure using standardized examinations (ACT and SAT) by following Maragkou's (2020) approach. The measure has two components: individual ability distribution – the student's position in the ACT (or SAT) distribution - and a distribution of degree quality, the median ACT (or SAT) score of a degree. We construct the index by subtracting the ACT point score of the student from the median ACT point score of students who majored in the student's degree of choice. This measure can identify high and low levels of degree undermatch and overmatch, with a negative value implying that the student is under-matched, meaning the student placed lower on the degree quality distribution relative to the individual ability distribution. In the instance of a positive value, the student placed higher on the degree quality distribution than the individual ability distribution.

The descriptive statistics for the first year of the 2008, 2009, 2010, and 2011 freshmen cohorts are given in Table 2. The percentage of Pell Grant recipients was 28%, 36%, 39%, and 40% for the 2008, 2009, 2010, and 2011 freshmen cohorts, respectively. The rates demonstrate a consistent increase in Pell Grant-eligible students for each new cohort resulting from changes in the socio-economic composition of the freshmen class. The average size of the Pell Grant is $1024.24, $1551.91, $1711.13, and $1787.97 for the 2008, 2009, 2010, and 2011 freshmen cohorts, respectively. There is around a $500 jump in the average award from the 2008 to 2009 freshmen cohort, this is because the 2008 freshmen cohort began their postsecondary education prior to the implementation of the CCRAA, which was first active in fall 2009. We include state and institutional financial aid offers in our model to account for changes in non-Pell assistance. Some need-based state and institutional financial aid programs also use the EFC formula (and, thus, the AZ-EFC eligibility threshold) to determine student aid amounts (Denning, Marx, and Turner, 2019). Moreover, state and institutional student aid may also experience upward pressure as states may reallocate funding in response to decreases in federal student assistance, and institutions may extract less consumer surplus (which they do so via differential pricing) from students in fear of negatively impacting enrollment (Singell and Stone, 2007). Most students receive financial aid from the state, with state aid recipiency ranging from a low 57% to a high of 69% for the cohorts. The average state financial aid award is $1601.03, $1571.05, $1389.70, and $1471.65 for the 2008, 2009, 2010, and 2011 freshmen cohorts, respectively. The New Mexico Lottery Scholarship (NMLS) covers posted tuition for New Mexico residents conditional on GPA and full-time enrollment requirements being met and has a recipiency rate ranging from 72% to 78% for our four sample cohorts.

UNM has a diverse study body; from our primary sample 52% of fall 2011 freshmen students were Latino, representing the largest group. Non-Hispanic White students accounted for 37%, and Indigenous students 5%. The remaining 6% consisted of Asian, Pacific Islander, and Black students. International students are excluded from our analysis.

5 Empirical Specification

In our study, we employ a static Two-way Fixed Effect (TWFE) model using Two-stage Difference-in-Differences (2SDiD) identification (Gardner, 2022). The functional form of the 2SDiD approach is as follows:

$$Y_{gpit} = \lambda_g + \gamma_p + \mathbf{X}_i + \epsilon_{gpit} \tag{1}$$

$$(Y_{gpit} - \hat{\lambda}_g - \hat{\gamma}_p - \hat{\mathbf{X}}_i) = \beta_0 + \beta_1 D_{gp} + \varepsilon_{gpit} \tag{2}$$

Y_{gpit} is the postsecondary outcome of interest for individual i in academic year t, and we further break up individuals and time (enrollment years) into treatment groups g $\in \{0, 1, \ldots, G\}$ and periods $p \in \{0, 1, \ldots, P\}$. D_{gp} is an indicator variable for the expiration of the CCRAA (or treatment status). $\mathbf{X}_i$ is a vector of student-level time-varying covariates, encompassing state and institutional-level financial aid. The individual and academic-enrollment year fixed effects are given by λ_g and γ_p, respectively. The heteroscedasticity robust standard errors are clustered at the individual level.

In the 2SDiD approach, we estimate the student, academic-enrollment year fixed effects, and covariates in the first stage for the untreated group. The individual and period effects are removed from the outcome, creating a "potential outcome" or adjusted outcome for the untreated group. We estimate the average treatment effect in the second stage by introducing the newly estimated adjusted outcome as our counterfactual. The classical DiD approach does not identify individual-level treatment heterogeneity – the individual × period average treatment effect – which may introduce bias into DiD estimates. The 2SDiD is robust to treatment-effect heterogeneity, an important property in our context.

We first estimate the impact of CCRAA Expiration on the Pell Grant Award outcome to establish their first-order relationship. Second, we estimate the impact of CCRAA Expiration on a student-level dichotomous retention outcome to establish a relationship between changes in Pell Grant generosity and the marginal student. Lastly, we estimate the impact of CCRAA Expiration on the Degree Match Index to establish a relationship between changes in Pell Grant generosity and the intra-marginal student. We disaggregate our regression samples by enrollment year (e.g., first-year, second-year, etc.), as we expect student responsiveness to changes in financial aid to differ by what point they are in their postsecondary education.

Our hypothesis is given by:

$$H_0 : \beta_1 = 0$$

$$H_A : \beta_1 \neq 0$$

where H_0 is the null hypothesis, i.e., the effect is statistically indistinguishable from zero, and H_A is the alternative hypothesis, representing a causal impact of CCRAA expiration on the outcome of interest.

We estimate a dynamic (event study) 2SDiD model to evaluate anticipatory and lagged effects.

$$Y_{gpit} = \lambda_g + \gamma_p + \mathbf{X}_i + \epsilon_{gpit} \tag{3}$$

$$(Y_{gpit} - \hat{\lambda}_g - \hat{\gamma}_p - \hat{\mathbf{X}}_i) = \beta_0 + \sum_{r=-R}^{P} \beta_r D_{rgp} + \varepsilon_{gpit} \tag{4}$$

We replace the D_{gp} variable with a series of dichotomous variables representing enrollment year. For our sample period, the dichotomous variables track the sample period beginning in the fall of 2008 and ending in the spring semester of 2013. The enrollment-year leads prior to treatment are given by -3, -2, and -1, the treatment enrollment year is denoted 0, and the enrollment-year lags are denoted by $+1$ and $+2$.

To obtain the average treatment effect on the treated (ATE), we estimate a Two-Stage

Triple Difference (2SDDD) model of the following functional form:

$$Y_{gpit} = \lambda_g + \gamma_p + \theta PellElig_i + \mathbf{X}_i + \epsilon_{gpit} \tag{5}$$

$$(Y_{gpit} - \hat{\lambda}_g - \hat{\gamma}_p - \hat{\mathbf{X}}_i) = \beta_0 + \beta_1(D_{gp} \times PellElig_i) + \beta_2 D_{gp} + \beta_3 PellElig_i + \varepsilon_{gpit} \tag{6}$$

$PellElig_i$ is a student-level indicator variable for first-year Pell Grant eligibility. The Pell Grant-eligible student population is expected to demonstrate larger generosity effects than the aggregate student population, i.e., the ATET is expected to be larger than the ATE. On the average treatment effect on the untreated (ATEU), also obtained from the 2SDDD approach, the Pell Grant ineligible population is expected to demonstrate no discernible impact of CCRAA expiration on Pell Grant generosity. Thus, the ATEU estimate is used to check the robustness and validity of our findings.

6 Identification

In the context of the CCRAA expiration, students are treated at different points during their postsecondary education, even though the AZ-EFC eligibility threshold change impacted everyone in the fall of 2012. This creates a staggered setup, and we use the "heterogeneity robust" 2SDiD estimator to ensure unbiased estimates.

The identification assumptions for the 2SDiD are the same as those for the canonical DiD. First is the parallel trends assumption that in the absence of treatment, the average outcome (i.e., Pell Grant Award, retention, and DMI) for each of the sample cohorts evolves parallel to each other. The second key assumption is that there are no anticipatory effects on the average outcome due to the coming CCRAA expiration. Lastly, for quasi-randomness to hold, students and their families can not select into treatment or control, i.e., students or their families cannot manipulate their AGI in response to changes in the AZ-EFC eligibility threshold. Such manipulation is unlikely because over half of all students eligible for the Pell

Grant have previously undergone FAFSA audits (Denning, Marx, and Turner 2019). Second, the AZ-EFC eligibility threshold and its role are not well known; the complicated setup and inaccessibility of the EFC are the main reasons the system has been reworked and simplified in the FAFSA Simplification Act. Lastly, we only analyze the intensive margin of college attendance. The FAFSA is submitted every academic year. Post-freshmen submissions usually entail mechanically pulling past information, with limited effort spent on understanding the EFC formula and changes.

Our analysis sample includes four cohorts: freshmen entry cohorts for the fall years 2008, 2009, 2010, and 2011. Table 3 shows the treatment status of each cohort by enrollment year. The fall 2008 cohort was treated in its first year before the CCRAA was enacted and was untreated in all subsequent years when the CCRAA was in place. The fall 2009 cohort is untreated for its first, second and third years, and treated in its fourth year. The fall 2010 cohort is untreated for its first and second years and treated in its third and fourth years. The fall 2011 cohort is untreated in its first year and treated for all subsequent years. The fall 2012 cohort (not in our sample) is the first freshmen entry cohort after the CCRAA's expiration and is treated for all enrollment years. The last column of Table 3 lists the identification sample of each enrollment year. The impact on second-year students' Pell Grant Award, Retention, and DMI outcomes is estimated using the first two periods of the 2009, 2010, and 2011 freshmen cohorts. We exclude the 2008 cohort as it was treated in its first period, and its inclusion risks violating the parallel trends assumption. Of those included cohorts 2009 and 2010 are the control group, and 2011 the treated. Our sample for third-year student response estimation encompasses the first three periods for the 2009 and 2010 freshmen cohorts. The 2009 cohort is the control, and the 2010 cohort is the treatment group. For fourth-year student response estimation, our sample consists of the four periods for the 2008 and 2009 freshmen cohort. We include the 2008 cohort because the assumption of parallel trends is more likely to hold in this instance, as the model uses a weighted average of the first three periods as the pretrend. The 2008 cohort is the control, and the 2009 cohort is the treatment group. For simplification, we code the first year of the 2008 cohort as untreated. For the dynamic 2SDID (event study) we include in our sample all four periods of the 2008, 2009, 2010, and 2011 freshmen cohorts. To ensure there are no issues with treatment switching off and on, we code the first year of the 2008 cohort as untreated.

6.1 Results

The impact of CCRAA expiration on Pell Grant generosity represents the first-order relationship between the AZ-EFC eligibility threshold and the Pell Grant Award. Establishing this first-order relationship is vital before studying the second-order effects on academic outcomes. The first stage estimates in Table 6 represent the exogenous variation in the Pell Grant Award resulting from the CCRAA expiration shift in the AZ-EFC eligibility threshold. The estimates for the 2SDiD model without covariates are in Column 1, and the 2SDiD model estimates with covariates are in Column 2. The "with covariates" Column 2 findings show a \$279 decline in the Pell Grant Award of second-year students resulting from the expiration of the CCRAA. Third-year and fourth-year students show a \$237 and \$115 decline in Pell Grant generosity from the expiration of the CCRAA, respectively. The Pell Grant 2SDiD coefficients are statistically significant at the 1 percent level for all student years.

Table 7 shows the 2SDID estimates for the impact of the CCRAA expiration on retention by enrollment year. Second-year students experience a sizable 11 percent point decline in retention due to the CCRAA expiration. Third-year and fourth-year students experience a 7.6 and 3.4 percent point decline in retention, respectively. The estimates for second-, third-, and fourth-year students are all statistically significant at the 1 percent level. The findings for Pell Grant generosity and retention demonstrate that students early in their postsecondary tenure will experience the largest first-order (Pell Grant) and second-order (retention) effects. The magnitudes decline the further students are in their postsecondary tenure, which means the nearer students are to postsecondary graduation, the less responsive they are to changes in Pell Grant or financial aid generosity.

Figure 1 shows the dynamic 2SDID for the Pell Grant award in Panels A and B. Panel A shows the event study without covariates, and Panel B shows the event study with covariates. We find no evidence of anticipatory effects or violation of the parallel trends assumption in either panel. The periods -3, -2, and -1 are statistically indistinguishable from zero, while we find a consistent post-treatment negative effect on Pell Grant generosity. Figure 2 shows the dynamic 2SDID for retention. We find no evidence of anticipatory effects on retention or violation of the parallel trends assumption. The periods -3, -2, and -1 are statistically indistinguishable from zero, while we find a consistent post-treatment negative effect on retention analogous to Pell Grant generosity.

6.2 Treatment Heterogeneity

New Mexico is a minority-majority state, with the highest proportion of Latino ancestry among the fifty states, with Latinos accounting for 47.7% of the state population in 2020. These include the Hispanos of New Mexico, also known as Neomexicanos, and more recent immigrants from Latin America. New Mexico also has a sizable Indigenous population, accounting for 10.0% of the state population in 2020. Our dataset gives a rare opportunity to study the grant responsiveness of historically marginalized groups, especially given the demographic change in the K-12 and postsecondary population ages in the U.S. The Pell Grant can be a remedy for wealth inequities perpetuated by the lack of college affordability and, in doing so, can serve a long-term equity function. We disaggregate our sample by White, Latino, and Indigenous students and estimate the 2SDiD model for each group separately. Our findings by race and ethnicity are given in Table 8. Among second-year students, indigenous students demonstrate the largest decline in Pell Grant generosity of \$554, Latino students experience the second largest decline at \$364, and White students demonstrate the smallest magnitude of the three groups at \$135. The declines in Pell Grant generosity for third and fourth years mirror the above pattern of Indigenous students experiencing the largest decline, Latino students the second largest, and White students the smallest. These findings reflect the lower average household income and wealth among minorities compared to White households in the U.S., with New Mexico representative of the United States. As a result, Latino and Indigenous households are more affected by the decline in the AZ-EFC eligibility Threshold.

These findings reflect the lower average household income and wealth among minorities compared to White households in the U.S., with New Mexico representative of the United States. As a result, Latinos and Native American households are more affected by the decline in the AZ-EFC eligibility Threshold. White, Latino, and Indigenous students in their second year experience a 9.2, 14, and 8.3 percentage point decline in retention, respectively. The magnitudes decline the further along students are in their degree, with third and fourth years demonstrating smaller but still sizable retention effects.

6.3 Limitations

Given the uniqueness of UNM and New Mexico, there are concerns about generalizing these findings. New Mexico is a majority-minority state with sizable Hispanic and Native American populations, and UNM is a Hispanic-serving flagship university. Moreover, New Mexico is the third poorest state in the U.S., with the two poorer states (Mississippi and Louisiana) having very different demographic composition.

The rapidly rising cost of higher education means that the net price of a college degree is at a very different region on the demand curve. The implication is that the contemporary net price elasticity of enrollment is very different from 2012, and students will react differently to changes in the net price compared to 2012. This limits the extrapolation of our findings to contemporary settings, if not their generalizability.

7 Summary and Concluding Remarks

This study, taken in the context of the national conversation on college affordability and a substantial federal push to increase Pell Grant eligibility and cost coverage, demonstrates the efficacy of education-specific cash grants to needy students. We find that a decline in Pell Grant generosity results in decreased retention, and the reverse is true of an increase. As greater educational attainment is associated with higher expected income, increasing Pell Grant generosity results in higher earnings for recipients, and higher earnings will result in greater tax collection. Denning, Marx, and Turner (2019) demonstrated that the increase in Pell assistance that results from falling just below the AZ-EFC eligibility cut-off is recouped in ten years from the additional payments that result from higher earnings. The increase in Pell Grant generosity will pay for itself over time.

This raises the possibility of the federal government recouping the cost of increasing Pell Grant generosity. Denning, Marx, and Turner (2019) found that the discrete increase in Pell Grant associated with falling just below the AZ-EFC eligibility threshold versus just above is paid back to the state in 10 years by the increase in tax collection associated with recipients' higher earnings.

The means-tested nature of the Pell Grant program and the use of family income as a determinant in aid amount calculation result in the Pell Grant program serving a valuable equity function in the higher education ecosystem. The decline in the AZ-EFC eligibility threshold resulted in students of color experiencing the largest declines in Pell generosity and college retention, considerably larger than their White counterparts.

The FAFSA Simplification Act raises the AGI threshold for automatic maximum award eligibility from $27000 to $60,000, and given our findings that greater Pell Grant generosity is associated with improved academic performance and future earning prospects, the expansion of the AGI threshold will significantly benefit students. Moreover, since minority households nationally have lower household income and wealth than their White counterparts (similar to New Mexico), students of color will experience greater increases in Pell generosity, which may, in turn, spur social mobility.

Despite these positives, the FAFSA Simplification Act's expansion of the AGI threshold is considerably larger than any previous attempt, with 1.5 million additional students becoming eligible for the maximum Pell Award. The substantial increase in government expenditure that will result raises the possibility of diminishing returns to Pell Grant assistance as less needy students become eligible for aid. Thus, future research must study changes to the Pell Grant Program's Marginal Value of Public Funds (MVPF) that results from the FAFSA Simplification Act and compare the MVPF across public assistance programs to gauge the opportunity cost of the massive increase in government spending.

REFERENCES

Carruthers, C. K., & Welch, J. G. (2020). Not whether, but where? Pell grants and college choices. Journal of Public Economics, 172, 1–19.

Cunningham, C. (2021). Causal inference: The mixtape. Yale university press.

Denning, J. T. (2017). College on the cheap: Consequences of community college tuition reductions. American Economic Journal: Economic Policy, 9(2), 155–188.

Denning, J. T. (2019). Born under a lucky star: Financial aid, college completion, labor supply, and credit constraints. Journal of Human Resources, 54(3), 760–784.

Denning, J. T., Marx, B. M., & Turner, Lesly. J. (2019). ProPelled: The effects of grants on graduation, earnings, and welfare. American Economic Journal: Applied Economics, 11(3), 193–224.

Denning, J. T., & Turley, P. (2017). Was that SMART? Institutional Financial Incentives and Field of Study. Journal of Human Resources, 52(1), 152–186.

Eng, A., & Matsudaira, J. (2021). Pell grants and student success: Evidence from the universe of federal aid recipients. Journal of Labor Economics, 39(S2), S413– S454.

Hansen, W. L. (1983). Impact of student financial aid on access. Proceedings of the Academy of Political Science, 35(2), 84–96.

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

Maragkou, K. (2020). Socio-economic inequality and academic match among post-compulsory education participants. Economics of Education Review, 79, 102060.

Marx, B. M., & Turner, Lesly. J. (2019). Attainment Effects of Student Loans and Pell Grants. AEA Papers and Proceedings, 109, 223–226.

Murphy, R., & Wyness, G. (2023). Testing means-tested aid. Journal of Labor Economics, 41(3), 687–727.

Pearl, J. (2009). Causality (2nd ed.). Cambridge University Press.

Singell Jr, L. D., & Stone, J. A. (2007). For whom the Pell tolls: The response of university tuition to federal grants-in-aid. Economics of Education Review, 26(3), 285–295.

Wooldridge, J. M. (2021). Two-way fixed effects, the two-way mundlak regression, and difference-in-differences estimators. SSRN 3906345

Table 1: Data Description for Selected Variables

Variable Name	**Description**
Enrollment	Binary variable for enrollment in the academic year
Degree Match Index (DMI)	Student-level measure of major over or under-match (Median ACT score for major - Students ACT score)
Pell Award	Amount of Pell Grant assistance amount received
State Aid	Student financial aid amount received from the state of New Mexico
Institutional Aid	Student financial aid amount received from the University of New Mexico
NM Lottery Scholarship	Binary indicator for NM Lottery Scholarship Recipient
Bridge Scholarship	Binary indicator for NM Bridge Scholarship Recipient

Notes: This table describes retention and degree match outcomes and financial aid covariates included in our model specifications.

Table 2: First Year Student Descriptive Statistics for 2010, 2011, 2012, and 2013 Freshmen Cohorts

Variable Name	**Cohort 2008**	**Cohort 2009**	**Cohort 2010**	**Cohort 2011**
White	42%	38%	37%	32%
Latino	42%	45%	50%	52%
Indigenous	6%	5%	5%	5%
Pell Grant Recipient	28%	36%	39%	40%
State Aid Recipient	65%	69%	57%	62%
Institutional Aid Recipient	58%	53%	59%	46%
NM Lottery Scholarship	78%	76%	73%	72%
Bridge Scholarship	37%	30%	41%	30%
Pell Award	\$1024.24	\$1551.91	\$1711.13	\$1787.97
	(1779.46)	(2244.42)	(2434.54)	(2439.11)
State Aid	\$1601.03	\$1571.05	\$1389.70	\$1471.65
	(2209.57)	(2145.49)	(2382.31)	(2427.83)
Institutional Aid	\$1423.16	\$1229.92	\$1196.89	\$1142.63
	(2229.10)	(2237.67)	(2179.09)	(2761.03)
N	2,777	2,902	3,049	2,866

Notes: Columns 1, 2, 3, and 4 display mean and standard deviations for selected variables for the first year of the 2008, 2009, 2010, and 2011 freshmen cohorts, respectively. Standard Deviations are in parenthesis.

Table 3: List of Binary Cohort-Year Treatment Status for Two-Stage Difference-in-Differences (2SDID) Identification

Year No.	**2008**	**2009**	**2010**	**2011**	**2012**	**DiD Sample**
Year 1	1	0	0	0	1	
Year 2	0	0	0	1	1	**Y09,Y10,Y11**
Year 3	0	0	1	1	1	**Y08,Y09,Y10**
Year 4	0	1	1	1	1	**Y08,Y09**

Notes: This table displays treatment and control cohorts for each enrollment year. The samples consist of students who graduated from a high school in New Mexico and enrolled full-time at the University of New Mexico in the following academic year.

Table 4: The AZ-EFC Eligibility Threshold for the 2008-2012 Freshmen Cohorts by Enrollment Year

Year No.	**2008**	**2009**	**2010**	**2011**	**2012**
Year 1 AGI Thres.	20,000	30,000	30,000	31,000	23,000
Year 2 AGI Thres.	30,000	30,000	31,000	23,000	24,000
Year 3 AGI Thres.	30,000	31,000	23,000	24,000	24,000
Year 4 AGI Thres.	31,000	23,000	24,000	24,000	24,000

Notes: This table displays the AZ-EFC Eligibility Threshold for the 2008-2012 freshmen cohorts for each enrollment year. The samples consist of students who graduated from a high school in New Mexico and enrolled full-time at the University of New Mexico in the following academic year.

Table 5: Descriptive Statistics for Enrollment and Degree Match Index by Cohort and Enrollment Year

Variable	**Pell Grant**				**Enrollment**			
	First Year	**Second Year**	**Third Year**	**Fourth Year**	**First Year**	**Second Year**	**Third Year**	**Fourth Year**
Cohort 2008	\$1024.24	\$1298.85	\$1391.04	\$1388.98	1	0.80	0.70	0.65
	(1779.46)	(2134.86)	(2244.94)	(2215.30)	(0)	(0.40)	(0.46)	(0.48)
N	2,777	2,233	1,939	1,793	2,777	2,777	2,777	2,777
Cohort 2009	\$1551.91	\$1522.26	\$1427.32	\$1367.36	1	0.80	0.70	0.64
	(2244.42)	(2269.93)	(2245.04)	(2225.95)	(0)	(0.40)	(0.46)	(0.48)
N	2,902	2,334	2,017	1,850	2,902	2,902	2,902	2,902
Cohort 2010	\$1711.13	\$1616.63	\$1531.29	\$1511.97	1	0.77	0.65	0.60
	(2434.54)	(2417.78)	(2392.77)	(2377.59)	(0)	(0.42)	(0.48)	(0.49)
N	3,049	2,338	1,987	1,829	3,049	3,049	3,049	3,049
Cohort 2011	\$1787.97	\$1638.57	\$1628.03	\$1524.44	1	0.78	0.67	0.62
	(2439.11)	(2373.57)	(2426.64)	(2374.50)	(0)	(0.41)	(0.47)	(0.49)
N	2,866	2,249	1,927	1,767	2,866	2,866	2,866	2,866

Notes: This table displays the mean and standard deviation of enrollment and credit hours attempted outcomes by cohort and enrollment year. The samples consist of students who graduated from a high school in New Mexico and enrolled as full-time 4-year degree freshmen at the University of New Mexico in the following academic year.

Table 6: Difference-in-Differences Estimates for the Impact of CCRAA Expiration on Pell Grant Assistance by Year of Student Enrollment

Variable	**Two-Stage DID (2SDID)**	
	Pell Grant	**Pell Grant**
Year 2	-389.14***	-278.80***
SE	(32.45)	(45.51)
N	17,634	17,634
Year 3	-294.24***	-237.30***
SE	(28.24)	(28.59)
N	17,853	17,853
Year 4	-140.62***	-114.97***
SE	(25.26)	(25.38)
N	17,037	17,037
Covariates	NO	YES

Notes: Column 1 displays DID estimates for AZ-EFC eligibility threshold changes on Pell Award without including covariates. Column 2 displays DID estimates for AZ-EFC eligibility threshold changes on Pell Award, including covariates. The sample consists of students who graduated from a high school in New Mexico and enrolled full-time at the University of New Mexico the following academic year. All models include individual and academic year-enrollment year fixed effects. Robust standard errors, clustered by individual, are in parentheses

Table 7: Difference-in-Differences Estimates for the Impact of CCRAA Expiration on Enrollment by Year of Student Enrollment

Variable	**Two-Stage DID (2SDID)**	
	Enrollment	**Enrollment**
Year 2	-0.22***	-0.11***
SE	(0.0077)	(0.010)
N	17,634	17,634
Year 3	-0.12***	-0.076***
SE	(0.0064)	(0.0061)
N	17,853	17,853
Year 4	-0.058***	-0.034***
SE	(0.005)	(0.0051)
N	17,037	17,037
Covariates	NO	YES

Notes: Column 1 displays DID estimates for AZ-EFC eligibility threshold changes on enrollment without including covariates. Column 2 displays DID estimates for AZ-EFC eligibility threshold changes on enrollment, including covariates. The sample consists of students who graduated from a high school in New Mexico and enrolled full-time at the University of New Mexico the following academic year. All models include individual and academic year-enrollment year fixed effects. Robust standard errors, clustered by individual, are in parentheses

Table 8: Difference-in-Differences Estimates for the Impact of CCRAA Expiration on Pell Grant, Enrollment, and Degree Match Index by Year of Student Enrollment and Race & Ethnicity

Variable	Pell Grant			Enrollment		
	White	Latino	Indigenous	White	Latino	Indigenous
Year 2	-135.41**	-363.79***	-554.17***	-0.092***	-0.14***	-0.083*
SE	(64.79)	(69.02)	(209.85)	(0.016)	(0.015)	(0.043)
N	6,274	8,680	876	6,274	8,680	876
Year 3	-162.47***	-263.26***	-714.36***	-0.063***	-0.079***	-0.13***
SE	(38.81)	(42.64)	(172.63)	(0.0094)	(0.0090)	(0.029)
N	6,618	8,508	885	6,618	8,508	885
Year 4	-47.70	-156.48***	-179.21	-0.023***	-0.041***	-0.031
SE	(36.95)	(40.21)	(114.11)	(0.0079)	(0.0082)	(0.019)
N	6,786	7,440	957	6,786	7,440	957
Covariates	YES	YES	YES	YES	YES	YES

Notes: Panel 1 displays first-stage estimates for AZ-EFC eligibility threshold changes on Pell Award, scaled per additional $1,000 change in the AZ-EFC eligibility threshold. Panel 2 displays second-stage estimates for Pell Award changes on retention, scaled per additional $100 in baseline grant aid. The sample consists of students who graduated from a high school in New Mexico and enrolled full-time at the University of New Mexico in the following academic year. CSEYT stands for Cohort-Specific Enrollment Year trends. Robust standard errors, clustered by individual, are in parentheses

Table 9: Triple Difference Estimates for CCRAA Expiration on Pell Award

Variable	**Pell Grant**			
	Full	**White**	**Latino**	**Indigenous**
CCRAA Expir.	-0.000***	-0.000	-0.000**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Pell Offer	-0.000***	-0.000***	0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
CCRAA Expir. × Pell Offer	-967.28***	-801.40***	-1012.83***	-1324.86***
	(36.83)	(74.017)	(49.08)	(133.18)
N	46,376	17,236	22,024	2,424
Covariates	YES	YES	YES	YES

Notes: Column 1 displays DID estimates for AZ-EFC eligibility threshold changes on enrollment without including covariates. Column 2 displays DID estimates for AZ-EFC eligibility threshold changes on enrollment, including covariates. The sample consists of students who graduated from a high school in New Mexico and enrolled full-time at the University of New Mexico the following academic year. All models include individual and academic year-enrollment year fixed effects. Robust standard errors, clustered by individual, are in parentheses

Table 10: Triple Difference Estimates for CCRAA Expiration on Enrollment

Variable	**Enrollment**			
	Full	**White**	**Latino**	**Indigenous**
CCRAA Expir.	0.012***	0.0077***	0.016***	0.024**
	(0.0015)	(0.0019)	(0.0026)	(0.011)
Pell Offer	-0.0012*	-0.0035*	-0.0010	-0.00035
	(0.000 73)	(0.0018)	(0.000 91)	(0.0020)
CCRAA Expir. × Pell Offer	-0.044***	-0.049***	-0.029**	-0.074*
	(0.0087)	(0.015)	(0.012)	(0.038)
N	46,376	17,236	22,024	2,424
Covariates	YES	YES	YES	YES

Notes: Column 1 displays DID estimates for AZ-EFC eligibility threshold changes on enrollment without including covariates. Column 2 displays DID estimates for AZ-EFC eligibility threshold changes on enrollment, including covariates. The sample consists of students who graduated from a high school in New Mexico and enrolled full-time at the University of New Mexico the following academic year. All models include individual and academic year-enrollment year fixed effects. Robust standard errors, clustered by individual, are in parentheses

Figure 1: Two-Stage Difference-in-Differences Event Study for Impact of CCRAA Expiration on Pell Grant Generosity With and Without Covariates

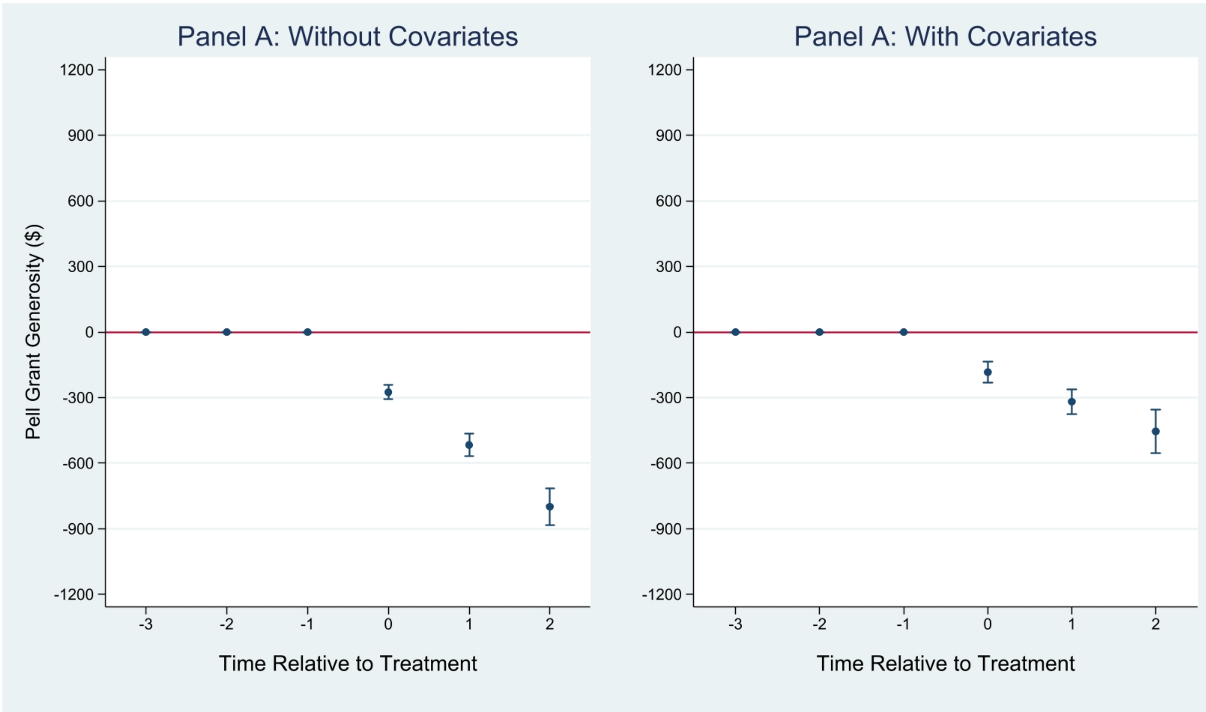

Figure 2: Two-Stage Difference-in-Differences Event Study for Impact of CCRAA Expiration on Retention With and Without Covariates