More than Dollars for Scholars: The Impact of the Dell Scholars Program on College Access, Persistence and Degree Attainment

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Abstract

Socioeconomic inequalities in college completion have widened over time. A critical question is how to support low-income and first-generation students to achieve college success. We investigate one effort, the Dell Scholars Program, which provides a combination of financial support and individualized advising to selected students who attend institutions throughout the US. Using two quasi-experimental analytic strategies, regression discontinuity and difference-in-differences with a matched comparison sample, we find consistent evidence that being selected as a Dell Scholar leads to substantially higher rates of bachelor's degree completion within six years as well improvements on multiple other measures of college success.

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INTRODUCTION

Overall college enrollment rates in the United States have increased substantially over the past several decades. Yet socioeconomic gaps in college completion have widened. For example, the share of young people in the top income quartile earning a four-year college degree by age 25 increased from 36 to 54 percent between birth cohorts from the early 1960s and the late 1970s. In contrast, among those in the lowest income quartile, bachelor's attainment increased only from five to nine percent over the same period (Bailey and Dynarski, 2011). Given the stark differences in these trends and the relationship between educational attainment and subsequent earnings and other life outcomes (Jepsen, Troske and Coomes, 2014; Ma, Pender and Welch, 2016; Oreopoulos, 2007), there is a critical need for additional evidence on effective strategies to support low-income students to complete postsecondary degrees and credentials.

Recognizing this need, a variety of organizations—from local college access programs to the federal government—have invested substantially in programs and policies to support and improve college outcomes for economically-disadvantaged youth. Such efforts can generate improvements in college access for lower-income populations (see Page and Scott-Clayton, 2016, for a comprehensive review of rigorous empirical evidence on efforts to improve college access). In addition, evidence points to positive effects on college persistence and degree attainment from efforts such as: need- and merit-based financial aid (Castleman and Long, 2016; Goldrick-Rab, Kelchen, Harris, and Benson, 2015; Scott-Clayton, 2011); college advising programs that focus on outreach and support to students before or while in college (Bettinger and Baker, 2013; Carrell and Sacerdote, 2017); and even lower-touch nudges that provide simplified information about and assistance with important processes like financial aid renewal (Castleman and Page, 2016). Not all

efforts, however, demonstrate positive long-term effects for students. For example, DesJardins and McCall (2014) find that although the Gates Millennium Scholars Program, which provides scholarship funds to high-achieving, low-income students, led to modest increases in students' GPA through junior year of college, it had no impact on four-year bachelor's degree attainment.[2]

Many prior interventions have focused on a single dimension of students' postsecondary experience. For instance, many financial aid programs provide financial assistance but do not include academic guidance. Similarly, many intensive advising programs do not concurrently address financial constraints students face to degree completion. However, recent evidence suggests that a more comprehensive approach to addressing barriers to degree completion can yield substantial positive impacts. The intensive structural, advising and financial support provided through the Accelerated Study in Associates Program (ASAP) has produced dramatic improvements in associate's degree completion at the City University of New York (Scrivener and Weiss, 2013). Specific to the University of North Carolina-Chapel Hill context, the Carolina Covenant, which provides low-income students admitted to the university with a full cost of attendance scholarship and additional counseling and supports, led to improvements in on-time bachelor's degree attainment on the order of eight percentage points. These strong completion effects emerged only after the program incorporated non-financial supports (Clotfelter, Hemelt and Ladd, 2016). Experimental evidence to date on the Buffett Scholarship, similar in structure the Carolina Covenant but implemented at selected institutions in Nebraska, reveals sizeable impacts on early college persistence (Angrist, Autor, Hudson and Pallais, 2015). Common across these programs that provide multifaceted support is that they reside in and are operated primarily by colleges themselves. A critical question is whether it is feasible and effective to provide a

[2] This lack of impact on degree attainment may relate to the very high performing nature of the students served.

comprehensive set of supports that bolsters the entire college-going pipeline, that is scalable, and that operates independent of (or external to) postsecondary institutions.

We shed light on this question and contribute to the growing literature on comprehensive efforts to promote college completion by investigating the Dell Scholars Program, a college success initiative sponsored and administrated by the Michael and Susan Dell Foundation (MSDF).[3] The program targets motivated low-income students who have overcome adversity in their own lives, who seek to obtain a bachelor's degree, and who have the potential to enroll and succeed in college. Selected students receive financial support, including a total of up to $20,000 in scholarship funds. Beyond this direct financial aid, students also receive ongoing support and assistance, as stated on the program's website, "to address all of the emotional, lifestyle, and financial challenges that may prevent scholars from completing college." The program recognizes and actively supports students in overcoming challenges that include dealing with stress, getting out of debt, managing child care, and dealing with varied other life circumstances as they arise. This programmatic model is motivated by a theory of action that, in order to meaningfully increase the share of lower-income students who earn a college degree, it is necessary both to address financial constraints students face and to provide ongoing support for the academic, cultural and other challenges that students experience during their college careers.

We identify the impact of the Dell Scholars Program on college persistence and completion using two complementary analytic strategies. First, we capitalize on an arbitrary, sharp cutoff in the selection process that determines which applicants are chosen as Dell Scholars and use a regression discontinuity (RD) design to estimate the impact of program selection on college enrollment, persistence and degree attainment using outcome data from the National Student

[3] For more information about the Dell Scholars Program, see http://www.dellscholars.org/.

Clearinghouse. Here, our results indicate that being named a Dell Scholar has little to no impact on initial college enrollment. Yet, the program has positive impacts on college persistence and completion. Second, to bolster our RD results and to extend our inference beyond the margin of selection, we match college-enrolled Dell Scholars and non-scholar finalists (e.g., those below the selection threshold) to observationally similar students from a nationally representative dataset of first-time college students. For college persistence and completion outcomes observable for students above and below the selection threshold, we use a difference-in-differences (DID) strategy to estimate program impacts for all Dell Scholars.

We obtain consistent results across the RD and DID approaches that point to the program's impact on students' postsecondary success. Both at the margin of selection and overall, scholars are 8 to 12 percentage points more likely to persist into their third year of college; 6 to 10 percentage points more likely to earn a bachelor's degree within four years; and 9 to 13 percentage points more likely to earn a bachelor's degree within six years, compared to their non-scholar counterparts. These impacts are sizeable and represent improvements on the order of 20 to 25 percent over baseline levels of four- and six-year bachelor's attainment.

We then consider how the program shapes students' college experiences to derive these results. We are not able to explore college process outcomes with the RD or DID framework, as we cannot observe such outcomes for students not selected into the program. Therefore, we rely on extensive data tracked on the Dell Scholars and analogous data elements collected on comparison students to whom they are matched to estimate covariate-controlled, first-difference impacts on outcomes such as postsecondary academic performance, credit attainment and loan borrowing behavior as well as employment while in college. We show that scholars have significantly higher GPAs, attain college credits at a faster rate, are less likely to fall into academic

probation, are less likely to take on either federal or private loans, and are less likely to work a high number of hours compared to their matched counterparts. Consistent with the programmatic aims, these results provide evidence that the Dell Scholars Program has a positive impact on many aspects of students' undergraduate experiences. We further contextualize these quantitative results drawing from interviews with Dell Scholars Program staff members and scholars, program administrative data, and observations of program practices. In addition to providing generous financial aid, the program has developed a sophisticated system of support to assist Dell Scholars, when needed, to overcome academic and situational barriers that commonly threaten the persistent of first-generation, low-income college students.

In addition to our impact analyses, we conduct a back-of-the-envelope cost-benefit analysis to assess whether these substantial increases in college completion are sufficient to merit the intensive investment that the Dell Scholars Program makes in its recipients. Although our calculations hinge on several assumptions, as we outline, they nevertheless suggest that the program investment has a positive rate of return. Given that those selected as Dell Scholars are predominantly first-generation college students from low-income backgrounds, our findings have important implications for efforts to expand college success in the US.

THE DELL SCHOLAR'S PROGRAM

The Dell Scholars Program is a college-success initiative that provides financial and social support to low-income students identified as having the potential to enroll and succeed in college. MSDF launched the program in 2004 with a goal to support low-income and first-generation students from college enrollment to bachelor's degree completion. Students selected to be Dell Scholars receive generous financial support towards the costs of higher education. This includes a total of

up to $20,000 in scholarship funds, a laptop computer and textbook support.[4] Compared to other scholarship programs, the Dell effort is unique in that it also provides ongoing outreach, close monitoring, and assistance to students, even though they are geographically dispersed to postsecondary institutions across the US.

This ongoing monitoring and support is actualized through a web-based platform that was developed in-house at MSDF to manage student communication, tracking and case management. Through this tool, the program collects data from all Dell Scholars at key check-in points, including the summer before initial enrollment, after their first semester, and after every academic year. For each check-in, students are required to enter information about their academic achievement, financial aid package, and situational information such as work hours, living circumstances and emotional well-being. In addition, they are required to upload supporting documentation to verify their entries. If students do not enter their information, they compromise their access to the scholarship award. Therefore, compliance with reporting is quite high. Based on these data, students who exhibit predetermined academic, financial and/or situational risk indicators are flagged for potential follow up. The program team at MSDF reviews all flagged cases and determines whether follow up is needed. Communication is then managed by a Dell Scholars retention officer. In addition to this staff-led outreach, Dell Scholars are encouraged to reach out to the program team at any time for guidance or help. All communication flows through and is logged in the web-based portal. This data-driven program model allows a small program

[4] The Dell Scholars Program allows participants to use their $20,000 for education-related expenses, and they allow flexibility in how the funds are disbursed. Scholars who receive generous financial aid packages or additional outside support may request that their scholarship award be allocated to tuition and fees for summer courses, study abroad tuition and fees, summer internship stipends, fees for graduate school test preparation course, and/or graduate school tuition. In instances where Dell funds would displace other institutional grant aid in a student's financial aid package, the program recommends withholding use of the Dell dollars and using them for subsequent repayment of loans that may also be a part of the student's financial aid package. Nevertheless, the funds are primarily used for typical college expenses, such as tuition and room and board. On average, MSDF disburses an average of $3,240 per year toward school-year educational expenses in the first four years of college for each Dell Scholar.

team of four full-time staff members to provide proactive, intensive social support to scholars who are at risk of attrition at any point during their postsecondary trajectory.

Scholar application and selection process

Students apply to be Dell Scholars during their high school senior year. To be eligible, students must have participated in an affiliated college-readiness program;[5] earn a minimum GPA of 2.4 from an accredited high school; be low-income as indicated by Pell grant eligibility; and plan to enroll in a four-year college. In a preliminary application, applicants provide information about high school grades, test scores, college plans, home and work responsibilities, and financial status. These applications are scored according to weighted scoring criteria that include factors along three dimensions: academic achievement, disadvantage and responsibility. Applicants are ranked according to the weighted score, and the top 900 students are selected as semifinalists. Semifinalists then submit additional application materials that include short-answer questions to provide deeper insight into students' goals as well as their experiences with overcoming adversity in their own lives.[6] Those who complete this second stage application are referred to as finalists. Each finalist application is reviewed and scored again according to weighted scoring criteria. The top 300 students are then selected as Dell Scholars. See Appendix A for additional detail regarding the applicant scoring and selection process.[7]

[5] At the time of our writing, these programs included Alliance College-Ready Public Schools, AP Strategies, Aspire, AVID, Bottom Line, Breakthrough Austin, College Forward, Cristo Rey Network, Fulfillment Fund, GEAR UP, Genesys Works, Green Dot Public Schools, IDEA Academy, KIPP Academy/ KIPP Through College(KTC), Mastery Charter Schools, Noble Charter, One Goal, Philadelphia Futures, Upward Bound, Upward Bound - Math Science, YES Prep Public Schools, Uncommon Schools, and Uplift Education.

[6] Additional materials also include a high school transcript, a Student Aid Report obtained after completing the Free Application for Federal Student Aid (FAFSA), responses to short-answer questions, and a letter of recommendation.

[7] The two-stage selection process lends itself to investigating both the impact of being selected as a semifinalist and the impact of being selected as a scholar. We explored but found no impacts at the margin of semifinalist selection. Therefore, we refrain from presenting results associated with semifinalist selection and focus attention on the impact of being selected as a Dell Scholar from among those applicants who reach the finalist stage.

Since 2004, the program has selected and supported over 3,000 scholars. Currently, it selects approximately 300 students as Dell Scholars annually. Despite the small annual cohort size, the program is fairly well known. Between 2009 and 2014, for example, the program selected a total of 1,806 scholars from a pool of nearly 40,000 applicants.

DATA AND RESEARCH DESIGN

The processes by which students apply, are selected and are tracked and supported throughout their involvement with the program contribute to a rich database on scholars' experiences prior to and throughout their college careers. We focus all analyses on students from the applicant cohorts of 2009 through 2012.[8] In this section, we describe our data and analytic strategies.

Regression discontinuity: Data and analysis

Dell Scholar selection procedures align perfectly to a regression discontinuity (RD) design for assessing the program's impact. This analysis relies on two primary data sources. First, we utilize Dell Scholar applicant administrative records, which provide detailed demographic information about each applicant, including gender, race / ethnicity, state of residence, and parents' education level and employment status. The data also include indicators of students' academic background, including standardized test scores, high school grade point average (GPA), and participation in college readiness programs. While optional and not factored into the scholar selection process, the large majority of applicants took and reported scores for either the SAT or ACT test. We convert SAT test scores to ACT composite scores using ACT-SAT concordance information.[9] Applicants also provide information about their responsibilities at home, work, and in their community.

[8] We did not consider cohorts prior to 2009 due to data quality issues, and we did not consider cohorts after 2012 to restrict our examination to those cohorts that we can follow through at least four years of postsecondary education.
[9] We use the concordance tables retrieved from: http://www.act.org/aap/concordance/pdf/reference.pdf.

Lastly, these data provide measures of applicants' financial circumstances, including household income and state or federal financial aid eligibility.

In Table 1, we provide counts of applicants to the 2009 through 2012 cohorts. Across these years, the program experienced growth in applications, with the 2012 applicant cohort being nearly 40 percent larger than that of 2009. Selected semifinalists complete the finalist application process with a high rate of compliance (86 percent, on average). The final number of selected scholars varies minimally from the target of 300 annually.[10]

In Table 2, we present descriptive statistics of applicants' demographic characteristics, test score performance, and financial aid eligibility, pooled across cohorts. In the first column we present figures for applicants overall, and in the remaining columns by applicant status (e.g., non-semifinalist, semifinalist, finalist, and scholar). While not reported in the table, rates of missingness on student demographics are very low, ranging from 0 to 4 percent across most items. Missingness was most prevalent for SAT/ACT scores (nearly 16 percent), presumably for those students who either did not take a college entrance test or opted not to report scores in their application.

Of applicants, 70 percent are female, three-quarters are black or Hispanic, and nearly sixty percent are would-be first-generation college goers. Applicants exhibit an average ACT composite score of 20.15, which corresponds to approximately the 50th percentile nationally.[11] Those ultimately selected as scholars are similar in terms of gender and race / ethnicity but are even more likely to be first-generation college goers and have average ACT performance of nearly 22, corresponding to approximately the 63rd percentile. Scholars also achieved a slightly higher high

[10] We are missing 3 observations on the 2010 applicants who are missing the semifinalist algorithm score. We are also missing 139 observations from the 2011 finalists, one of whom is a scholar, due to an unknown system issue.
[11] See http://www.actstudent.org/scores/norms1.html for correspondence between ACT composite scores and percentiles of performance.

school GPA, on average.[12] Therefore, the scholar selection process favors those applicants who are higher performing but from lesser means. For example, while 75 percent of all applicants qualified for subsidized school meals, nearly all of eventual scholars did so.

We link applicants' administrative records to data from the National Student Clearinghouse (NSC), which provides semester-level college enrollment information for each student.[13] NSC records provide information on whether and where students enrolled and additionally on students' postsecondary institutions such as whether they are public or private and whether they are two-year or four-year institutions. We observe six years of college enrollment data for the 2009 and 2010 cohorts and four years of data for the 2011 and 2012 cohorts. From the NSC data, we derive a comprehensive set of outcomes related to college enrollment, persistence and degree attainment. We define all outcome variables in Appendix B.

In Table 3, we list the college-going outcomes considered in our RD analysis, the cohorts for which we examine these outcomes, and the average values of these outcomes, disaggregated by applicant status. Descriptively, we observe a consistent pattern of better outcomes among Dell Scholars compared to non-scholar finalists and the applicant pool overall. Being selected as a scholar may drive these differences, or they may also be attributable to differences in the characteristics of students ultimately selected, such as their higher prior academic achievement. We turn to discussing our first analytic strategy for disentangling these possibilities.

We take advantage of the Dell Scholars Program selection processes to identify the causal impact of being selected as a scholar on college enrollment, persistence and completion outcomes

[12] Each applicant's high school GPA is normalized with their high school's GPA scale. For example, an applicant with a GPA of 3.6 from a high school with a 0-4 scale has a scaled GPA of 0.90.

[13] The National Student Clearinghouse is a non-profit organization that maintains postsecondary enrollment records for approximately 96 percent of colleges and universities in the U.S. The NSC represents the best, comprehensive source of college enrollment information for US students. Nevertheless, we recognize that coverage is imperfect and that coverage rates vary across states (Dynarski, Hemelt, and Hyman, 2015).

at the margin of selection. We exploit the fact that the program uses well-specified rank thresholds for the selection of scholars, as detailed above and use a regression discontinuity (RD) design to compare the outcomes of finalists with scores just above and below their year-relevant scholar-selection threshold. The students with scores at the thresholds are comparable on many dimensions, however the finalists with scores just above the relevant thresholds were selected as the program's scholars. Thus, we can rely on the comparison of students at the scholar-selection margins to obtain unbiased estimates of the impacts of scholar selection.

For an RD strategy to yield valid causal inference, several conditions must be met (Schochet et al., 2010). First, the assignment rule must be clear and followed with a high degree of fidelity. Second, the score utilized to determine scholar status, our forcing variable, should be an ordinal measure with sufficient density on either side of the cut off. Third, these scores should be utilized only for the purpose of identifying scholar status such that differences at the relevant margin cannot be attributable to other potential mechanisms. We provide evidence below that these first three conditions are met in the context of the Dell Scholars Program. Finally, applicants must not able to manipulate their own value of the forcing variable. It is highly implausible that applicants would have this ability. The scoring algorithms are complex, are not publically disclosed, and rely on multiple inputs. Further, manipulation of one's position relative to the cutoffs would require perfect information of the selection processes as well as of the inputs associated with other applicants. Of course, rater manipulation is also a potential threat, if raters are overly generous in scoring certain applications. Although we cannot fully rule out the possibility of rater manipulation, it is unlike to have an undue influence on students' final rank order, especially local to the threshold for selection. Each rater evaluates only a small subset of all finalists, and finalist scores are a combination of rater evaluations and scores automatically

attributed to measures like student GPA. Taken together, raters are unlikely to know the marginal score that will be in the top 300 and are unlikely to be able to finely manipulate a student's overall score around the relevant margin of selection. Further, raters are never assigned to review applicants who reside in the same zip code, thus reducing the likelihood that a rater would have a personal connection with any student whose application materials she is reviewing.

In Figure 1, we illustrate the relationship between scholar selection and finalist score, by year. In each year, the relevant threshold is demarcated with a vertical dashed line. The selection rules and processes are followed with a very high – almost perfect – degree of fidelity. Nevertheless, we do observe a few exceptions in which finalists whose scores are above the scholar threshold were not selected as scholars and vice versa. In Appendix Table C1, we report on the relevant selection threshold values and provide counts of the cases in which the selection rules were not strictly followed, by year. These instances of non-compliance are explained by the fact that the Dell Scholars team reserves the right to manually disqualify applicants after initially being selected.[14] Despite these small discrepancies, we collectively have very strong evidence in support of an RD strategy for assessing programmatic impacts.

Next, we test the validity of the RD assumptions related to the continuity of the forcing variables across the year-specific thresholds and assess any evidence of manipulation of position around these thresholds. We utilize the McCrary (2008) test to examine the continuity assumption by assessing the smoothness of the selection score densities across the relevant thresholds. In

[14] There are four main reasons for disqualification. First, an applicant may be disqualified if the applicant received a serious disciplinary action in high school. The Dell Scholar Program has yet to disqualify a scholar for this reason. Second, an applicant may be disqualified if the applicant's essay did not meet the minimum criteria or if the applicant used the same responses for all essays. Third, an applicant may be disqualified if the applicant did not plan to attend a four-year college. While it is permissible for scholars to begin their postsecondary education at a community college, they must demonstrate a goal of completing a four-year degree. Lastly, an applicant may be disqualified if the applicant inflated their high school grades. Specifically, the Dell Scholar Program checks whether the self-reported grades matched with the official high-school transcript.

Figures 2 and 3, we illustrate the graphical presentation of the McCrary test for the finalists' scores. In Figure 2, we present results by year and in Figure 3, we present data pooled across cohorts. In Table 4, we provide summary statistics from the McCrary tests. In all but one cohort and for results pooled across cohorts, the test fails to reject the null hypothesis at the 5 percent significance level. Only for the 2011 cohort do the data reveal potential evidence of lack of continuity in the forcing variable density. This result may be driven by the missing data of 138 finalists and 1 scholar in the 2011 finalist dataset. On the other hand, this may also be a false positive, given the multiple hypotheses being tested.[15] As an additional check, we fit RD models examining potential jumps in individual student-level characteristics at the scholar selection thresholds (see Appendix Table C2 for results and Figure C1 for the graphical relationship between baseline covariates and the forcing variable). In no case did we observe consistent evidence of manipulation (from any potential source) around the selection cutoff. Therefore, we conclude that the Dell Scholars selection rules generate a robust quasi-random assignment of scholars local to the cohort-specific selection thresholds.

Given the minimal non-compliance with the selection process, we rely on a reduced-form model specification to estimate the impact of selection as a Dell Scholar, as follows:

$$Y_{it} = \alpha_0 + \alpha_1 ABOVE_{it} + \alpha_2 SCORE_{it} + \alpha_3 (SCORE \times ABOVE)_{it} + \boldsymbol{\theta X_{it}} + \varepsilon_{it}, \qquad (1)$$

where Y_{it} represents an outcome such as college enrollment or BA attainment for student *i* in cohort *t*; $ABOVE_{it}$ is an indicator for a finalist's score exceeding the cohort-specific threshold, and $SCORE_{it}$ is the forcing variable, the finalist score re-centered around the cohort-specific threshold. The vector $\boldsymbol{X_{it}}$ comprises control covariates included in Table 2 and indicators for cohort and state

[15] We assess the sensitivity of our results to this cohort and find that results are, overall, not sensitive to the inclusion or exclusion of the class of 2011 students for whom score data are complete.

of residence.[16] Our models allow the slope of the forcing variable to vary by cohort.[17] The coefficient α_1 indicates the causal impact of being above one's cohort-specific selection threshold.

In Table 5, we report results associated modeling scholar selection, pooling data across the 2009 through 2012 cohorts. The results of most interest are those associated with the first row, labeled *Above*, which estimate the difference in the probability of being selected as a scholar at the threshold. Visual inspection of Figure 1 foreshadows that coefficients associated with the assignment-rule indicator will be close to but somewhat less than 1. Indeed, in column 1, we estimate that a finalist with a score just above the threshold has a 0.955 higher probability of being selected as a scholar. In the remaining columns, we present estimates associated with varying bandwidths. Across columns, the results are similar in terms of magnitude and statistical significance and are therefore not sensitive to bandwidth selection. While representing a high degree of fidelity, these first-stage results signal modest imperfection in the assignment rule. Therefore, we also consider a two-stage instrumental variables (IV) or "fuzzy" RD approach (e.g., Jacob and Lefgren, 2004; Imbens and Lemieux, 2008) in which we use applicants' scores relative to their year-relevant threshold to instrument for actual scholar selection.

Matching: Data and analysis

Despite the value of RD for attaining causal attribution, it is limitations are clear. Estimation of effects with narrow bandwidths around the selection margin leads to reductions in sample size and statistical power, and inference is limited to students proximal to the selection margin. To estimate impacts beyond the margin of selection and to explore impacts on a richer set of college

[16] We impute zero values and include dummies for missingness where students are missing valid values for these covariates.

[17] Our use of a linear specification for equation (1) is well supported by the data graphically. In addition, when we assess the need for quadratic terms in our specifications, we fail to reject the null that trends are anything but linear. We do not consider higher order polynomial specifications, given recent guidance against doing so (e.g., Gelman and Imbens, 2014).

performance measures, we introduce a second, complementary analytic strategy motivated by prior work on extending inference beyond the assignment threshold (Battistin and Rettore, 2008; Mealli and Rampichini, 2012; Angrist and Rokkanen, 2015) and relying on additional sources of data. Specifically, we use coarsened exact matching (CEM) (Iacus, King and Porro, 2009) to match college-enrolled Dell Scholars and non-scholar finalists (i.e., students above and below the selection threshold who successfully enroll in college) to observationally similar students in the NCES Beginning Postsecondary Students 2004/2009 (BPS:04/09) survey. The BPS:04/09, our third source of data, provides rich, longitudinal information on a nationally representative sample of nearly 16,700 first-time beginning college students in the US.[18]

CEM is an appealing procedure for three primary reasons. First, it does not depend on modeling assumptions. Second, the procedure is straightforward and provides transparency in the matching process and easy interpretability. Third, CEM allows for user autonomy in coarsening and balancing continuous covariates and can easily incorporate observations with missing data.

Our matching process is as follows. We first identify baseline covariates to be used in the matching procedure. We then coarsen continuous covariates and stratify Dell and BPS students into groups defined by each possible combination of categorical and coarsened-continuous covariates. Finally, each observation included in a stratum with at least one Dell and one BPS student is assigned a weight. Matched Dell students are assigned a weight of 1. Within each

[18] The BPS:04/09 provides a near-perfect source of comparison; it captures data on academic achievement and college financing for a nationally representative sample of students. The target population for the BPS:04/09 study was first-time beginning college students during the 2003-2004 academic year. The BPS:04/09 subjects were surveyed in their first year of enrollment, and then three and six years later in follow-up surveys. A key feature of this dataset is that it includes transcript data from all institutions attended by BPS subjects as well as verified federal and state financial aid information. Given that the BPS:04/09 focuses on college-enrolled students, we restrict our matching analysis to those Dell Scholars and finalists who enroll in college on-time. At the margin of selection, we see no systematic impacts on initial college enrollment, which serves as at least partial justification of the decision to focus here on the subset of Dell Scholars and applicants who successfully enroll. For more information on the BPS:04/09 survey, see https://nces.ed.gov/surveys/bps/about.asp.

stratum, comparison BPS students are assigned a weight equal to the total number of Dell students divided by the total number of BPS students. For example, if a stratum has 10 Dell subjects and a 100 BPS subjects, each BPS subject receives a weight of 0.1. We conducted this matching process separately for the Dell Scholars and for the non-scholar finalists. This is so that we can estimate separate effects for these two groups of students.

On average, the Dell applicants and Scholars are quite different from the full BPS sample. Therefore, we trimmed the BPS sample prior to matching by restricting to students who were first-time beginning college students enrolled in college the fall immediately after high school; were US citizens; attained a high school diploma; were intending to earn a bachelor's degree; were between the ages of 17 and 21; and had a parental adjusted gross income below $100,000. These cutoffs were informed by ranges observed for the Dell sample. We matched on a selected set of covariates observable in both the Dell and BPS data at the student and institutional levels, given that factors at both levels can influence subsequent college outcomes. Specifically, we matched on indicators of gender, race / ethnicity, categories of household income, categories of high school GPA, an indicator for English as a primary language, and institutional measures, including indicators for attending a four-year institution, attending a public institution, and the level of institutional selectivity, as indicated by the Barron's 2009 selectivity index.[19] We present descriptive information on these variables for the Dell sample and their matched BPS counterparts in Table 6. CEM produced groups that are highly comparable on observable characteristics. The Dell subjects that did not match included 268 applicants and 151 scholars. The majority of

[19] The Barron's Profile of American Colleges includes a categorical measure of college selectivity that is based on college admission rates and the competitiveness of each institution's student body as measured by high school ranking, GPA, and standardized test scores (Chetty et al., 2017; Reardon, Baker and Klasik, 2012)

unmatched Dell subjects included male minorities in Elite and Highly Selective institutions and students enrolled in Less Selective institutions with high school grade point averages above 3.5.

We use two analytic strategies for comparing the Dell sample to their matched counterparts. For outcomes observable for Dell applicants above and below the selection margin, we utilize a difference-in-differences (DID) approach with the following general specification:

$$Y_i = \beta_0 + \beta_1(DELL \times ABOVE)_i + \beta_2 DELL_i + \beta_3 ABOVE_i + \boldsymbol{\theta X_i} + \varepsilon_i \,, \qquad (2)$$

where, Y_i represents a college-success outcome, such as BA attainment for student i. $DELL_i$ is an indicator for student i being an applicant (both scholars and non-scholars) to the Dell Scholars Program. We preserve the spirit of the regression discontinuity analysis with the variable $ABOVE_i$, which is a binary indicator for being selected as a Dell Scholar or being a student from the BPS data set matched to a Dell Scholar. The vector $\boldsymbol{X_i}$ again represents baseline covariates, including all those utilized in the matching procedure and presented in Table 6. The coefficient β_1 represents the causal effect of the Dell Scholars Program.

We recognize several potential threats to validity of inferences based on this matching strategy. First, a time lag exists between the BPS and Dell samples. Students in the BPS were first-time college students in the 2003-04 academic year, whereas the earliest cohort of Dell applicants that we consider began college in the 2009-10 academic year, a lag of six years. This lag is far from ideal. Yet overall progress in college success and degree attainment for low-income and first-generation college students has been frustratingly slow. Therefore, it would be reasonable to expect similar patterns of college success across this timeframe. A second, related point is that the BPS students began college well before the economic recession, whereas the Dell students enrolled for the first time post-recession. In addition to this time lag, matching on observables invites the

possibility that unobservable factors may drive selection into the Dell sample as well as subsequent outcomes (Rosenbaum and Rubin, 1985).

Additionally, given our use of the BPS as the source for the matched comparison, we are limiting our analysis to those in the Dell sample who successfully enrolled in college. This analytic decision is driven by practical necessity, as the BPS is limited to enrolled college students. As we show, this analytic decision finds some justification in the fact that we observe limited impacts of the Dell Scholars opportunity on whether (Table 7) or where (Table 9) students enroll, at least at the margin of selection. Of course, it may be that the opportunity is improving college enrollment outcomes for students further from the selection threshold. To the extent that this is the case, we argue that matching among college-enrolled students would, if anything, lead to downward bias in our estimated impacts of the program. For students below the threshold of selection, we argue that conditioning on college enrollment does not introduce bias, as the non-selected Dell applicants received no treatment, except for being turned down by the program.

For students above the threshold, bias would exist if there are scholars who enroll in college who would not have enrolled if they were not selected. In our sample, 88 percent of those selected as Dell Scholars enroll in college on-time (Table 3), and we observe no impact on enrollment at the threshold of selection. For any selected student who enrolls due to the support of the program, if anything, we might predict their subsequent chances of college success to be more tenuous absent the support of the program. If this is the case, then the opportunity to match them to similarly college-intending students who do not enroll on-time would lead to larger rather than smaller estimates of the program's impact. Therefore, although we recognize the potential threats to validity, we reason that any impacts that we estimate may reasonably be considered lower bounds on the effects of the program at least for those who enroll on-time.

In addition, our DID strategy allows us to assess whether these potential limitations hinder our ability to derive causal inferences. Our analytic approach relies on the comparison of non-scholar finalists and Dell Scholars to their respective matched BPS counterparts. We hypothesize that we will see little difference in outcomes between non-scholars and the students to whom they are matched. Based on equation (2) above, this is equivalent to estimates of β_2 that are close to zero and not statistically significant. Such results will serve as evidence that the BPS students represent an appropriate counterfactual for the Dell applicants.[20] In contrast, we hypothesize large and significant differences between scholars and their matched counterparts, which would result in non-zero estimates of coefficient β_1. We will interpret such a pattern of effects as evidence of the causal effect of the Dell Scholars Program on student outcomes.

A primary purpose of our DID strategy is as a gateway step to investigating whether and how the Dell Scholars Program impacts students' postsecondary experiences. For students selected as Dell Scholars, the program's administrative database provides detailed information about their progress through and experiences in college, as does the BPS for sampled students. Therefore, for Dell Scholars and their BPS comparisons, we estimate covariate-controlled first-differences in selected metrics of college success using the following specification:

$$Y_i = \gamma_0 + \gamma_1 DELL_SCHOLAR_i + \boldsymbol{\theta X_i} + \varepsilon_i \,, \tag{3}$$

where γ_1 is the coefficient of interest, representing differences between Dell Scholars and their BPS matched counterparts. This analysis is necessarily limited to those outcomes that we can observe consistently across the Dell and BPS data sets. We estimate first-difference impacts on the following outcomes: cumulative GPA and credit attainment in first four years of college; rate

[20] If we observe that the non-Scholar finalists perform more poorly than their BPS matched counterparts, this may be an indication of negative consequences of the recession. To these extent that these negative consequences would otherwise be the same for students above and below the threshold, the DID strategy will account for this possibility.

of success with credits attempted; incidence of GPA falling below 2.0 (a common threshold for satisfactory academic progress); loan borrowing behavior; and whether and the extent to which students are working while in college. In Appendix B, we provide detailed information about the construction of these outcome measures.

RESULTS

We begin by examining the impacts of being selected as a Dell Scholar on immediate four-year college enrollment, persistence into the second and third years of college, and bachelor's degree completion within four or six years.[21] In Table 7, we present impacts at the margin of selection from our reduced-form RD analyses. For all outcomes of interest, we present results derived from the full sample as well as from those within an intermediate bandwidth of +/- 100 points, a narrow bandwidth of +/- 40 points, and an "optimal" bandwidth around the threshold. In selecting an optimal bandwidth, we utilize a first-order polynomial, a uniform kernel, and the bandwidth selector of Calonico, Cattaneo, and Titiunik (CCT) (2014). Because of this process, the optimal bandwidth varies modestly across outcomes. The column labeled μ presents fitted averages for students just below the threshold.[22] In Table 8, we present impacts on the same set of outcomes based on our DID analysis of the Dell and BPS matched samples. In Tables 8 and 9, we report results for all four cohorts through four-year BA attainment and for the 2009 and 2010 cohorts through six-year BA attainment to present results for consistent samples over time.

[21] We focus on immediate enrollment in a four-year institution since the program requires applicants to plan for enrollment in a four-year institution. We additionally examined retention within the same postsecondary institution. Because institutional retention and persistence outcomes yielded similar results, we omit the retention outcomes in our presentation for parsimony.

[22] For each student, we calculate fitted outcomes using the estimated coefficients. Then, we calculate the average fitted value of the outcome for students within a bandwidth of 10 below the cohort-specific thresholds.

Just below the margin of selection, 85 percent of non-scholar applicants matriculate to college on-time, and qualifying as a Dell Scholar does not consistently impact timely enrollment (Table 7, row 1). Lack of impact on enrollment is not necessarily surprising. All students who achieve finalist status are likely to be highly college intending, and students were notified of their scholar status well after deciding where to apply and, for many, where to attend. Even for these highly college-intending students, however, it is notable that approximately 15 percent do not successfully matriculate to college the fall after high school graduation, potentially facing other barriers to timely college enrollment during the summer transition (e.g., Castleman and Page, 2014a, 2014b).

Both the RD and DID estimates indicate meaningful programmatic impacts on college persistence. Focusing on RD results derived from the narrow bandwidth, impacts on persistence into the second year range from 3 to 7 percentage points (n.s.) at the margin of selection, aligning with the significant DID impact estimate of 4 percentage points. Impacts on persistence into the third year are consistent in statistical significance and magnitude across analytic approaches, ranging from 8 to 12 percentage points. We also estimate consistent effects on four- and six-year bachelor's degree attainment. Students selected into the program are 6 to 10 percentage points more likely to earn a BA within four years and 9 to 13 percentage points more likely to do so within six years.[23] As is typical in the RD context, we face a trade-off between statistical power and estimating effects local to the selection thresholds (e.g., Ludwig and Miller, 2007). In Table 7, for example, the magnitude of the effects on four-year BA attainment are consistent across

[23] We focus on four-year college outcomes, specifically because of the aims of the Dell Scholars Program. Nevertheless, in Appendix Table C3, we examine impacts on enrollment in a two-year institution as well as two-year degree attainment within four years. We find no evidence that the scholarship offer impacts enrollment in a two-year institution but some evidence that it leads to reductions in two-year degree attainment. Therefore, the program may help students from "dropping back" from a four-year to a two-year institution.

bandwidths while statistical significance differs in some instances due to a loss of precision when restricting the sample. Nevertheless, the degree completion impacts are sizeable and represent improvements on the order of 20 – 25 percent over baseline levels of degree attainment.[24]

A key question is what the mechanisms are by which the program is improving students' college outcomes. We consider five dimensions, broadly defined, on which the program might operate. First, being selected as a Dell Scholar may impact the type or "quality" of the institution in which students enroll. Upon being selected as a Dell Scholar, students participate in in-take interviews conducted prior to postsecondary matriculation. During this interview, the Dell Scholars team provides feedback on college plans and, in some cases, counsels students against certain postsecondary choices, such as planning to enroll in an out-of-state public institution, as attending an in-state public institution is likely to be a more financially viable option. In addition, the Dell Scholars Program award includes a sizeable amount of grant-based financial aid that may enable students to view a different postsecondary option as within reach financially. If students are enrolling in "higher quality" institutions as a result of the Dell support, this may translate to better college completion outcomes (e.g., Goodman, Hurwitz and Smith, 2015; Howell and Pender, 2016). To investigate this possibility, we examine a set of indicators related to institutional quality and type.[25] Related to quality, we examine whether students at the margin of selection initially enroll in institutions that differ in terms of graduation rates, instructional expenditure per full-time student, and whether a student attended a school in one of the top three classifications of selectivity

[24] See Appendix Tables C4 for RD results using an IV specification to handle first-stage non-compliance and Tables C5 and C6 for additional sensitivity analyses of RD estimates using different optimal bandwidths for impacts estimated on the 2009 through 2012 cohorts and the 2009 and 2010 cohorts, respectively.

[25] We obtained year-specific data on institutional quality from the Integrated Postsecondary Data System (IPEDS) and linked to students by institution name. Approximately 15 percent of the Dell finalist sample has missing quality indicators because their institutions were not in the IPEDS data. Therefore, the final outcome in Table 9 pertains to an examination of whether there is a systematic difference in our ability to match students to IPEDS data across the threshold. As we show, we find no evidence that missingness is related to selection into the program.

based on the Barron's Profile of American Colleges. Related to college type, we specifically examine whether students enroll in an in-state, public institution, given the program guidance noted above. We present the RD results in Table 9.

We do not find consistent evidence that students' institutional choices change as a result of being selected as Dell Scholars. Certain specifications indicate that Dell Scholars attend institutions with somewhat higher instructional expenditure and that they attend more selective schools, on average, but these results, particularly with regard to institutional selectivity, lack consistency across the bandwidths. Given the timing of the application and selection process, the overall lack of impact on where to enroll, is not surprising. By the time selected scholars are notified, they have already made decisions about where to apply and have received college acceptances. Generally, the quality of the college in which a student enrolls is more heavily driven by the set of schools to which she applies and less by the choice she makes among the schools to which she has been admitted (Hoxby and Avery, 2013; Smith, Pender and Howell, 2013). Therefore, the lack of impact here is understandable.

Second, conditional on the schools in which Dell Scholars enroll, we hypothesize that the program helps students to improve their chances of success. This may be especially so for the Dell Scholars who enroll in less selective institutions where average rates of persistence and success are lower. In Table 10, we disaggregate the DID impacts on persistence and degree attainment by institutional selectivity. The top panel pertains to students enrolling in less-selective institutions and the bottom panel to those in more-selective institutions.[26] About half of the Dell finalists and scholars attend less selective institutions.

[26] Less selective institutions are those that are categorized in the Barron's ratings as Selective, Less Selective or are unrated. More selective institutions are those ranked as Elite, Highly Selective or Very Selective. Analyses based on finer-grained categorizations yield results that are consistent in magnitude but less precisely estimated.

The results in Table 10 reveal impacts on persistence and degree attainment that are consistently larger in magnitude and statistically significant for Dell Scholars attending less selective institutions. For these students, we observe DID impacts on second and third year persistence of 5 and 11 percentage points, respectively, and an impact on four-year BA attainment of 9 percentage points, a sizeable impact over the baseline rate of 17 percent. We additionally estimate an improvement in six-year BA attainment of 18 percentage points. In contrast, impacts on persistence are generally smaller for students attending more selective institutions, although impacts are somewhat imprecisely estimated. Neither persistence nor four-year BA attainment rates are significantly impacted for these students. Our results for six-year BA attainment, however, reveal an interesting pattern. For Dell finalists who are not selected as scholars, we estimate that without the support of the program, they are 9 percentage points less likely to attain a BA within six years. For those selected as Dell Scholars, however, the program essentially mitigates this negative effect.

Third, the generous financial support that Dell Scholars receive may help students avoid accumulating loan debt to which they may be averse or may otherwise help alleviate financial constraints that students and families experience in covering costs associated with college attendance. These include academic costs, such as tuition, fees, and books, as well as non-academic costs, such as child care. If the scholarship improves students' ability to finance college, semester over semester, then we may expect to see substantially higher persistence among Dell Scholars. In Table 11, we present results from covariate-controlled, first-difference comparisons between Dell Scholars and their BPS matched counterparts on loan borrowing in the first year of college. The top panel of results pertains to the sample overall. The bottom panels present results by levels of

institutional selectivity. We report on borrowing of federal loans, Parent PLUS loans,[27] and private loans.[28] We observe substantial differences in borrowing behavior. Overall, Dell Scholars are 27 percentage points less likely to take on federal loans, three percentage points less likely to take on a Parent PLUS loan, and five percentage points less likely to take a private loan and in their first year. These impacts are somewhat larger among students attending more selective institutions where scholars may otherwise face a higher out-of-pocket cost of attendance.

Fourth, the financial support offered by the Dell Scholars Program may enable scholars to allocate more of their time to studying and integrating into campus life instead of working to cover tuition and living expenses. In Table 12, we present results of covariate-controlled first-difference estimates of working patterns in the first year of enrollment.[29] Dell Scholars are 8 percentage points more likely to work at all and 7 percentage points more likely to work at least 10 hours a week. Yet they are less likely to work a high number of hours. For example, Dell Scholars are 5 percentage points less likely to work at least 30 hours a week. These impacts are larger for students enrolled in more selective institutions. Prior research has shown that the number of hours a student works during the school year matters in predicting subsequent academic outcomes. Students who work more than 25 hours a week are more likely to experience negative academic consequences, as opposed to students who take on part-time employment, which is linked to positive impacts on persistence and degree attainment (Leppel, 2002; Scott-Clayton and Minaya, 2016). During the program registration process, each Dell Scholar reports the number of hours that they intend to work during the school year. This information is reviewed by a member of the Dell Scholars

[27] Parent PLUS loan borrowing is of interest because it is recognized as a more burdensome form of college financing. Compared to other federal loans, Parent PLUS loans have higher interest rates, require immediate repayment, and are more utilized by underrepresented students attending institutions with limited institutional aid (Rodriguez, 2015; U.S. Department of Education, 2014)

[28] Private loan borrowing was only available for the first year of college enrollment for the BPS sample. We are only able to observe federal loan borrowing behavior in the first year for the 2010 through 2012 Dell cohorts.

[29] We are only able to observe first-year working patterns for the 2012 Dell Scholars cohort.

Program team prior to a scheduled one-hour welcome call with each scholar the summer prior to fall enrollment. Dell Scholars that report an intention to work more than 20 hours a week are flagged and given detailed advising around course and work scheduling. We therefore attribute the impacts on working patterns to both the financial award and the robust counseling that the program team provides to Dell Scholars and their encouragement against taking on burdensome work hours.

Fifth, gathering data on scholars' postsecondary experiences and providing them with follow-up, feedback and support, as needed, the program may provide students with the guideposts, encouragement and direction that they need to be more academically successful. Improvements in outcomes such as persistence as well as other success metrics such as college GPA, credit attainment, and maintaining satisfactory academic progress (e.g., a GPA greater than or equal to 2.0) would align with this mechanism. To explore these hypotheses, we again rely on our first-difference comparisons of the Dell Scholars and their matched counterparts to examine program impacts on credit attainment (Table 13) and GPA (Table 14), overall and by institutional selectivity. In Table 13, we examine the cumulative attainment of credits across the first four years of college. Although credit attainment was more similar for Dell and comparison students in the first year of college, Dell Scholars earned a significantly greater number of credits in subsequent years. In addition, we examine whether a student earned fewer than three-quarters of credits attempted in any semester enrolled, and find that the Dell Scholars were significantly more likely to earn a substantial proportion of credits attempted. In short, the Dell Scholars exhibit better progress towards degree attainment over time. In Table 14, we present results related to academic performance as measured by cumulative GPA across the first four years of college.[30] Results again indicate significant differences between Dell Scholars and their matched counterparts. These

[30] To handle student stop out / dropout, for any year in which a student is not enrolled, his cumulative GPA from the previous year is carried forward.

differences are particularly large and significant for students at less selective institutions and correspond to effect sizes on the order of half of a standard deviation. Finally, Dell Scholars are less likely to experience a cumulative GPA that drops below 2.0 during the first four years of college. Given that all Dell Scholars are Pell eligible, this may mean that the program not only provides students with a generous scholarship that can be used flexibly during their undergraduate career but that the program also helps students to maintain more consistent access to other sources of need-based aid, such as the Pell Grant, by maintaining satisfactory academic progress (Schudde and Scott-Clayton, 2016).

DISCUSSION

Some college access and persistence efforts focus on financial barriers to college success by providing students with funds to defray the cost of college. Focus on financial barriers has gained traction in recent policy discussions of debt- or tuition-free college (e.g., Chingos, 2016). Other efforts focus on additional outreach and counseling to assist students in navigating the academic and behavioral challenges that emerge in college. Evidence suggests that both types of efforts hold promise for improving the college outcomes of low-income and first-generation college-going students. Yet offering students a suite of supports across these domains may be more successful than the sum of its parts. The ASAP program in New York City suggests this to be true in the community college context. Our examination of the Dell Scholars Program provides further supporting evidence, primarily in the context of four-year colleges and universities.

The evidence that we present indicates that the Dell Scholars Program leads to meaningful improvements in college performance, persistence and success. Based on our regression discontinuity and difference-in-differences analyses, scholars are substantially more likely to

persist into the third year of college. Further, scholars are 6 to 10 percentage points more likely to earn a bachelor's degree on-time and nearly 9 to 13 percentage points more likely to do so within six years than they would have been absent the Dell Scholar opportunity. These degree attainment impacts are larger among students who attend less selective colleges and universities where rates of persistence and completion are otherwise lower, on average. The Dell Scholars Program does not appear to shift the institutional choices that selected students make. Instead, the program supports students to earn higher GPAs, to avoid academic probation, to earn college credits more successfully, and to reduce borrowing at a wide variety of postsecondary institutions across the US, and particularly at those that are less selective.

The heterogeneity in effects across institutional selectivity is important, given that increased enrollment for low-income and first-generation college students has been concentrated predominantly in less selective institutions (Carnevale and Strohl, 2013). Policy and programmatic efforts aiming to close the college completion gap need to be particularly attuned to interventions that effectively support low-income students where they tend to enroll. Why do less selective institutions exhibit lower rates of degree completion? One hypothesis is that institutional performance is weighed down by the influx of an underprepared student population. Examining increases in time-to-completion trends outside of the nation's most selective colleges and universities, Bound, Lovenheim and Turner (2010) find that the changes in the composition of the student body accounts for essentially none of these increases and that this trend is more attributable to reductions in college resources and per-student expenditure on support services and faculty quality. That is, institutions that are enrolling more low-income students are also those that have fewer resources dedicated to support students to degree attainment. Thus, it is possible that the impacts of the Dell Scholars Program are large in less selective institutions because the program

is stepping in with support services that are no longer, or were never, offered on those campuses (e.g., Deming and Walters, 2017).

It is notable that the program's large persistence impacts emerge in what would be students' third year of college. Programs like Dell Scholars that provide ongoing supports across a variety of domains may be particularly important to increase degree attainment among students who complete substantial credits but are at risk of withdrawal before earning their diploma as a result of obstacles arising later in college. Campus-based support programs at many institutions primarily target first-year students, and with high student-to-counselor ratios at broad access institutions, students may receive little in the way of proactive advising or outreach (Scott-Clayton, 2015). Students may also experience challenges paying for later terms in college, especially if they fail to make satisfactory academic progress or otherwise run out of financial aid eligibility (Schudde and Scott-Clayton, 2016). Students are thus in the position of finding campus resources on their own or having to make difficult decisions, such as which courses most efficiently lead them to a degree, independently.

Owing in part to challenges such as these, more than 40 percent of college students who fail to complete their degrees leave after their second year of college (Bowen, Chingos, and McPherson, 2009). Of students who have earned 75 percent of the credits they need to graduate, upwards of 25 percent of students at open-enrollment four-year universities do not graduate within six years of starting college (Mabel and Britton, 2015). By virtue of providing financial and advising supports consistently throughout college, the Dell Scholars Program may help students overcome these late hurdles and successfully complete their degrees.

Of course, the multifaceted nature of the program challenges our ability to pinpoint a singular causal driver of the impacts that we observe. From the perspective of the program staff,

there may not be a single mechanism but rather different mechanisms for different students as the program flexibly and proactively responds to student needs and indicators of risk. Observations of program practices and descriptive analysis of administrative data reveal that the program is designed to be highly responsive to indicators of risk of student drop out, such as earning a low GPA during a semester or withdrawing from multiple courses. Such indicators drive program engagement with students. Interactions between program staff and Dell Scholars are routinely documented when a student reaches out for support, or if the student submits information during a check-in period that triggers outreach from the program. For example, if a student reports that he failed courses during his first year of enrollment, a Dell Scholars Program team member will schedule a phone call with the student to discuss what happened and devise an academic plan for the following semester. The content of this conversation, agreed-upon next steps, and any related follow up via email, text or phone, for example, are archived in that scholar's file as a contact note. The average Dell Scholar has 2.26 contact notes annually, but this ranges substantially from 0 to 35 and has a standard deviation of 3.32. Nearly 40 percent of scholars have no contact notes in a given year.

Consistent with this tailoring of outreach, a relationship exists between scholars' number of contact notes and their indicators of risk. For example, scholars who experience a GPA below 2.0 had an average of 11 contact notes over the first four years of college, compared to an average of 9 contact notes for those who do not experience a GPA level that might threaten their financial aid. Yet, the program administrative records also reveal substantial and ongoing support of and contact with Dell Scholars who do not exhibit academic risk. This is because these students may exhibit risk factors related to other aspects of their student experience. Like other low-income, first-generation college students, Dell Scholars are susceptible to other challenges along their way

to degree attainment. Over time, the program has evolved to have routines and expertise in place to help their participants grapple with hurdles beyond academics including complex bureaucratic, financial and life challenges that may lead to attrition.

Qualitative evidence that we have gathered also reveals variation in how students experience the program. For some, the funding is the primary component on which they rely. For others, the program serves as their only source of stable support during their undergraduate career. Even with this rich data, it is difficult to identify the scenarios in which the Dell Scholars Program is most likely to have the largest impact given the unique and complex circumstances of each scholar's case.

Given the positive impacts on degree attainment, we explore whether the benefits associated with these increases in college completion justify the program costs. We provide a back-of-the envelope calculation of relative costs and benefits of the program in the spirit of Deming (2009), Pallais (2015) and Hurwitz et al (2016). Drawing on our DID analyses, we estimate that the program improves six-year BA attainment by 13 percentage points. This corresponds to 39 students in each cohort of 300 students. The total cost of the Dell Scholars Program is approximately $25,000 per student, or $7,500,000 per cohort.[31] Therefore, the cost per student induced to earn a bachelor's degree is approximately $192,000.

Next, consider the benefits of this increase in educational attainment. The differential in annual earnings and tax payments between median full-time workers with a bachelor's degree and those with only some college was $16,100 in 2011 (Baum, Ma, and Payea, 2013). Although this

[31] The average Dell Scholar is active in the program system for 4.67 years, and the program estimates its per-student, per-year cost to be $465, for a total of just over $3100 in costs associated with program employees who interact directly with the scholars, as well as the cost of employees who support the technology used by the program team. To estimate total cost, we add to this the cost of the laptop computer and book credits and roundly estimate that the per-student cost of the program is approximately $25,000. 80 percent of this cost goes directly to the student, and 20 percent is devoted to operations associated with interacting with the scholars.

is an observed difference, Card (1999) reports that causal estimates of the effect of education on earnings are often 20 to 40 percent larger. Using this observed differential and assuming, for the sake of simplicity, that it remains constant over time, the social and private monetary benefits of the Dell Scholars Program would exceed the costs after 12 years of post-college earning. Even if the earnings differential were smaller, the program still looks to have a positive rate of return, albeit over a long time horizon.

Of course, this simple calculation leaves aside many factors. For example, we might consider this estimate conservative, in that we do not attempt to monetize the many other types of benefits, both public and private, that accrue because of higher education (Ma, Pender and Welch, 2016). Similarly, we do not adjust for an increase in earnings differentials over time. While recognizing the many assumptions that we have made, these calculations nevertheless suggest a positive rate of return for the MSDF investment in their Dell Scholars Program.

An important question that remains unanswered is whether the effects that we observe are driven by the funding support, by the non-monetary support or by the unique combination of the two. It is certainly the case that the generous and flexible financial support provides a strong incentive for the Dell Scholars to comply with program reporting requirements. To remain eligible, scholars must regularly report back to program staff on their academic progress as well as challenges that they are facing, be they related to academics, physical health, mental health, college finances, or general life management. By incorporating this reporting mechanism into their ongoing work with scholars, the program staff can track students closely and triage additional support to them when needed. It is an open question whether such a system of tracking and follow up would be possible without the strong incentive that the funding creates.

Instead, if complementarities are realized by the combination of monetary and non-monetary support, the Dell Scholars approach through which a small program team efficiently tracks and provides follow up to a large number of geographically disbursed students may provide a model for scholarship programs (e.g., place-based promise programs and state-level merit aid programs) to layer on robust student tracking and support. Given the technological system that the program has developed, the small program team is able to implement a proactive approach to providing social supports as well as financial assistance. The operational core of the program model is a sophisticated web-based system that collects extensive, validated information on student progress to guide the provision of targeted social and informational support. This sophisticated tool allows for a large student-to-staff ratio and potential for scalability. It affords program staff the opportunity to meet students where they are and to respond flexibly to the challenges that they face. Such features may serve as a model to improve the efficacy of the substantial investments already being made to increase college success for low-income and first-generation college-goers throughout the US.

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TABLES AND FIGURES

Table 1. Counts of applicants across cohorts with non-missing applicant scores

Year	Total Applicants	Semifinalists	Finalists	Scholars
2009	4,912	775	643	300
2010	5,340	921	811	301
2011	6,533	900	760	299
2012	6,815	901	805	301
Total	23,600	3,497	3,019	1,201

Source: The Dell Scholars Program database.

Notes: three 2010 non-semifinalists are missing the semifinalist score. In the 2011 cohort, there are 138 finalists and 1 scholar missing the finalist score.

Table 2. Summary statistics of all applicants, overall and by applicant status

Variables	All	Non Semi-finalist	Semi-finalist	Finalist	Non-Scholar Finalist	Scholar
Scaled GPA	0.85 (0.11)	0.84 (0.11)	0.89 (0.11)	0.90 (0.11)	0.88 (0.11)	0.92 (0.11)
ACT Equivalent Score	20.15 (3.84)	19.93 (3.78)	21.38 (3.92)	21.49 (3.90)	20.92 (3.76)	22.33 (3.95)
Age	18.26 (0.49)	18.25 (0.48)	18.32 (0.53)	18.32 (0.53)	18.31 (0.52)	18.32 (0.54)
Female	0.70	0.69	0.71	0.71	0.71	0.71
Asian	0.10	0.09	0.15	0.16	0.15	0.17
Black	0.23	0.23	0.24	0.23	0.23	0.23
White	0.16	0.16	0.13	0.12	0.12	0.14
Hispanic	0.53	0.53	0.47	0.48	0.50	0.45
Other Ethnicity	0.04	0.04	0.04	0.04	0.04	0.04
Received lunch program	0.75	0.72	0.95	0.96	0.96	0.96
Received food stamp	0.24	0.19	0.53	0.53	0.54	0.53
Enrolled in WIC	0.09	0.08	0.17	0.18	0.19	0.16
Enrolled in TANF	0.03	0.02	0.08	0.09	0.08	0.09
Enrolled in LIHEAP	0.10	0.08	0.21	0.21	0.20	0.23
Enrolled in SSI	0.08	0.06	0.17	0.18	0.18	0.18
Enrolled in free housing	0.06	0.05	0.16	0.16	0.16	0.17
Enrolled in SSD	0.10	0.09	0.17	0.17	0.15	0.19
Enrolled in health insurance	0.28	0.25	0.44	0.46	0.45	0.48
Enrolled in Medicaid	0.20	0.17	0.42	0.42	0.42	0.41
Parents' education, < HS	0.31	0.29	0.47	0.48	0.48	0.49
Parents' education, HS	0.26	0.26	0.27	0.26	0.26	0.27
Parents' education, some college	0.27	0.28	0.19	0.18	0.18	0.17
Parents' education, college	0.13	0.14	0.06	0.06	0.07	0.06
Parents' education, missing	0.03	0.03	0.02	0.02	0.01	0.02
ACT equivalent score, missing	0.08	0.08	0.06	0.05	0.06	0.04
N	23,600	20,103	3,497	3,019	1,818	1,201

Source: The Dell Scholars Program database.

Table 3. Summary statistics of applicants' outcome, by applicant status

Outcomes	All Applicants		Non-semifinalists		Semifinalists		Finalists		Non-scholars		Scholars	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Immediate enrollment	0.73	23,600	0.71	20,103	0.82	3,497	0.84	3,019	0.82	1,818	0.88	1,201
Second year persistence	0.62	23,600	0.60	20,103	0.72	3,497	0.75	3,019	0.70	1,818	0.82	1,201
Third year persistence	0.55	23,600	0.53	20,103	0.64	3,497	0.67	3,019	0.61	1,818	0.76	1,201
Completed bachelor's degree on time	0.20	23,600	0.19	20,103	0.25	3,497	0.27	3,019	0.22	1,818	0.34	1,201
Completed bachelor's degree in 6 years	0.49	10,252	0.47	8,556	0.58	1,696	0.60	1,454	0.53	853	0.70	601

Source: The Dell Scholars Program database.
Notes: Statistics for the bachelor's degree in 6 years outcome are calculated using the 2009 and 2010 cohorts.

Table 4. Results of the McCrary Density Tests, by cohort

		Finalist	
Cohort	**Mean**	**SE**	**t-statistic**
2009	0.049	0.180	0.275
2010	-0.177	0.185	-0.954
2011	0.460	0.205	2.250
2012	0.128	0.156	0.822
2009-2012 (pooled)	0.086	0.085	1.013

Source: The Dell Scholars Program database.

Table 5. First-stage RD estimation: relationship between scholar status and finalist score

	Full sample	**Intermediate bandwidth (+/-100)**	**Narrow bandwidth (+/-40)**	**Optimal bandwidth (+-30)**
Above	0.955***	0.953***	0.947***	0.946***
	(0.010)	(0.009)	(0.011)	(0.012)
Centered score	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Centered Score x Above	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
μ	0.025	0.024	0.023	0.023
N	3,019	2,992	2,299	1,944
R^2	0.95	0.96	0.95	0.95

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database.

Notes: Robust standard errors in parentheses. To obtain the optimal bandwidth, we use a first-order polynomial, a uniform kernel, and bandwidth selector of Calonico, Cattaneo, and Titiunik (2014). μ indicates average fitted values for finalists within a bandwidth of 10 below the cohort-specific thresholds.

Table 6. Descriptive statistics for Dell and BPS matched analytic samples

	Dell Applicants			Dell Scholars		
	BPS	**Dell**	**Diff**	**BPS**	**Dell**	**Diff**
Student-level characteristics						
Female	0.75	0.75	-0.00	0.75	0.76	-0.00
Black or Hispanic	0.70	0.70	0.00	0.65	0.64	0.00
First Generation	0.93	0.93	0.00	0.93	0.93	-0.00
English	0.51	0.51	0.00	0.46	0.46	-0.00
High School GPA 2.0 - 2.5	0.00	0.00	-0.00	0.00	0.00	-0.00
High School GPA 2.5 - 3.0	0.06	0.06	0.00	0.05	0.05	0.00
High School GPA 3.0 - 3.5	0.28	0.28	0.00	0.15	0.15	0.00
High School GPA > 3.5	0.65	0.65	0.00	0.80	0.80	-0.00
Parental Income (2016$)	20,971 (14,706)	20,468 (13,832)	-503	20,158 (13,314)	18,257 (12,752)	-1,900
Institution-level characteristics						
Four-year institution	0.95	0.95	0.00	0.97	0.97	-0.00
Public institution	0.84	0.84	-0.00	0.76	0.76	0.00
Barron's Selectivity						
Elite	0.04	0.04	0.00	0.13	0.13	0.00
Highly Selective	0.17	0.17	-0.00	0.24	0.24	-0.00
Very Selective	0.18	0.18	0.00	0.22	0.22	-0.00
Selective	0.39	0.39	0.00	0.28	0.28	0.00
Less Selective	0.23	0.23	0.00	0.13	0.13	0.00
N	3244	1351	4595	2378	950	3328

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database and the BPS:04/09.

Notes: Standard deviations reported in parentheses for continuous variables. This table presents mean values of baseline characteristics for Dell applicants and Scholars and their matched BPS comparison students. The means are weighted according to the weights created through the CEM procedure. For each set of students, the difference column presents differences in means. Significant differences in baseline characteristics are assessed with a t-test.

Table 7. RD impacts of scholar selection on college enrollment, persistence and completion outcomes, reduced-form specification

	2009 – 2012 cohorts						2009 – 2010 cohorts					
Outcome	**μ**	**Full sample**	**Intermediate bandwidth (+/-100)**	**Narrow bandwidth (+-40)**	**Optimal bandwidth**	**Range of optimal bandwidth**	**μ**	**Full sample**	**Intermediate bandwidth (+/-100)**	**Narrow bandwidth (+-40)**	**Optimal bandwidth**	**Range of optimal bandwidth**
Immediate enrollment	0.853	0.015	0.022	0.023	0.014	44	0.850	0.032	0.037	0.064	0.098*	36
		(0.022)	(0.025)	(0.037)	(0.036)			(0.031)	(0.036)	(0.054)	(0.057)	
					[1,482]						[602]	
2nd year persistence rate	0.752	0.023	0.036	0.032	0.025	44	0.751	0.034	0.054	0.072	0.103	38
		(0.026)	(0.030)	(0.044)	(0.043)			(0.037)	(0.043)	(0.064)	(0.067)	
					[1,482]						[631]	
3rd year persistence rate	0.674	0.046*	0.060*	0.081*	0.110**	36	0.658	0.067*	0.090*	0.121*	0.184**	36
		(0.028)	(0.032)	(0.048)	(0.050)			(0.040)	(0.046)	(0.069)	(0.074)	
					[1,240]						[602]	
BA attainment, in 4 years	0.284	0.062**	0.056*	0.065	0.059	34	0.266	0.081**	0.096**	0.101	0.090	31
		(0.028)	(0.032)	(0.051)	(0.055)			(0.041)	(0.047)	(0.075)	(0.087)	
					[1,176]						[530]	
BA attainment, in 6 years	--	--	--	--	--	--	0.633	0.042	0.056	0.093	0.158*	30
								(0.042)	(0.048)	(0.075)	(0.090)	
											[512]	
N		3,019	2,585	1,372				1,454	1245	668		

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database and the National Student Clearinghouse.

Notes: Robust standard errors in parentheses. μ indicates average fitted values for finalists within a bandwidth of 10 below the cohort-specific thresholds. Number of observations are in the brackets where applicable. All models estimated using baseline covariate controls, including age, scaled GPA, ACT equivalent score, state of residence, gender, race / ethnicity dummies, parents' income (in $1,000), parental education, free or reduced-lunch eligibility, receipt of food stamps, receipt of federal health insurance, and receipt of Medicaid. Models also include cohort dummies, and slopes of the relationship between the outcome and assignment score are allowed to vary by cohort. We impute zero values and include dummies for missingness where students are missing valid values for covariates. To obtain the optimal bandwidth, we use a first-order polynomial, a uniform kernel, and bandwidth selector of Calonico, Cattaneo, and Titiunik (2014).

Table 8. DID impacts of scholar selection on college enrollment, persistence and completion outcomes

	2009 – 2012 cohorts			**2009 – 2010 cohorts**			
	2nd year persistence	**3rd year persistence**	**BA attainment in 4 years**	**2nd year persistence**	**3rd year persistence**	**BA attainment in 4 years**	**BA attainment in 6 years**
Above x Dell	0.041**	0.086***	0.056*	0.014	0.083**	0.074*	0.132***
	(0.021)	(0.026)	(0.029)	(0.028)	(0.038)	(0.040)	(0.041)
Above	-0.006	-0.018	0.002	-0.002	-0.012	-0.007	-0.025
	(0.017)	(0.021)	(0.022)	(0.023)	(0.029)	(0.030)	(0.031)
Dell	0.013	0.022	-0.017	0.028	0.016	-0.036	-0.074***
	(0.014)	(0.018)	(0.018)	(0.020)	(0.026)	(0.025)	(0.029)
Average rate for BPS students matched to non-scholar finalists	0.871	0.764	0.260	0.869	0.761	0.254	0.656
N	7923	7923	7923	3933	3933	3933	3933
R^2	0.050	0.051	0.129	0.056	0.051	0.121	0.099

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity. We impute zero values and include dummies for missingness where students are missing valid values for covariates.

Table 9. RD impacts of scholar selection on college quality and college type, reduced-form specification

		Treatment effect estimates across bandwidths				
Outcome	μ	**Full sample**	**Intermediate bandwidth (+/-100)**	**Narrow bandwidth (+/-40)**	**Optimal bandwidth**	**Range of optimal bandwidth**
Institutional degree completion	25.142	0.740*	0.704	0.551	0.432	37
		(0.434)	(0.522)	(0.754)	(1.265)	
		[2,564]	[2,209]	[1,166]	[1,278]	
Instructional expenditure PFTE[a]	$4,422	455.9*	630.0**	902.8**	571.7	29
		(264.4)	(292.1)	(430.3)	(481.7)	
		[2,564]	[2,209]	[1,159]	[1,019]	
Enrollment in in-state public four-year institution	0.698	-0.011	-0.014	0.003	0.045	32
		(0.030)	(0.034)	(0.051)	(0.056)	
		[3,019]	[2,585]	[1,372]	[1,117]	
Barron's category of elite, highly selective or very selective	0.440	0.045	0.060*	0.022	-0.017	26
		(0.028)	(0.033)	(0.049)	(0.062)	
		[3,019]	[2,585]	[1,372]	[911]	
1 if missing quality indicators	0.144	0.026	-0.004	-0.002	-0.008	30
		(0.022)	(0.026)	(0.040)	(0.047)	
		[3,019]	[2,585]	[1,372]	[1,049]	

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the Integrated Postsecondary Education Data System.

Notes: Robust standard errors in parentheses. μ indicates average fitted values for finalists within a bandwidth of 10 below the cohort-specific thresholds. Number of observations are in the brackets where applicable. All models estimated using baseline covariate controls, including age, scaled GPA, ACT equivalent score, state of residence, gender, race / ethnicity dummies, parents' income (in $1,000), parental education, free or reduced-lunch eligibility, receipt of food stamps, receipt of federal health insurance, and receipt of Medicaid. Models also include cohort dummies, and slopes of the relationship between the outcome and assignment score are allowed to vary by cohort. We impute zero values and include dummies for missingness where students are missing valid values for covariates. To obtain the optimal bandwidth, we use a first-order polynomial, a uniform kernel, and bandwidth selector of Calonico, Cattaneo, and Titiunik (2014).

[a] Instructional expenditure per FTE is adjusted to inflation

Table 10. DID impacts of scholar selection on college enrollment, persistence and completion outcomes, by institutional selectivity

	2009 – 2012 cohorts			2009 – 2010 cohorts			
	2nd year persistence	**3rd year persistence**	**BA attainment in 4 years**	**2nd year persistence**	**3rd year persistence**	**BA attainment in 4 years**	**BA attainment in 6 years**
Students attending less-selective institutions							
Above x Dell	0.055*	0.111***	0.089***	-0.008	0.078	0.093**	0.180***
	(0.028)	(0.035)	(0.033)	(0.042)	(0.053)	(0.046)	(0.059)
Above	0.006	-0.010	0.005	0.013	-0.000	-0.001	-0.034
	(0.022)	(0.027)	(0.021)	(0.029)	(0.037)	(0.030)	(0.043)
Dell	0.004	0.013	0.012	0.023	0.011	-0.016	-0.067*
	(0.020)	(0.024)	(0.019)	(0.027)	(0.033)	(0.028)	(0.038)
Average rate for BPS students matched to non-scholar finalists	0.853	0.729	0.172	0.856	0.732	0.179	0.567
Students attending more selective institutions							
Above x Dell	0.023	0.059	0.057	0.024	0.083	0.078	0.102*
	(0.029)	(0.038)	(0.048)	(0.040)	(0.055)	(0.069)	(0.058)
Above	-0.018	-0.026	-0.012	-0.016	-0.023	0.028	-0.020
	(0.025)	(0.032)	(0.038)	(0.035)	(0.046)	(0.054)	(0.046)
Dell	0.027	0.037	-0.061*	0.035	0.024	-0.070	-0.086**
	(0.020)	(0.026)	(0.034)	(0.030)	(0.040)	(0.048)	(0.042)
Average rate for BPS students matched to non-scholar finalists	0.901	0.819	0.400	0.892	0.806	0.379	0.802
N	7923	7923	7923	3933	3933	3933	3933
R^2	0.051	0.052	0.131	0.057	0.051	0.122	0.100

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity. We impute zero values and include dummies for missingness where students are missing valid values for covariates.

Table 11. First-difference impacts of scholar selection on first-year borrowing

	2009 – 2012 cohorts			2009 – 2010 cohorts		
	Federal loan[a]	**Parent PLUS loan**[a]	**Private loan**	**Federal loan**[a]	**Parent PLUS loan**[a]	**Private loan**
			Overall			
Dell Scholar	-0.265***	-0.034***	-0.045***	-0.368***	-0.041**	-0.048***
	(0.021)	(0.009)	(0.009)	(0.035)	(0.016)	(0.012)
Baseline comparison	0.522	0.053	0.082	0.559	0.061	0.079
N	2465	2465	3326	828	828	1691
R^2	0.142	0.060	0.105	0.206	0.070	0.130
			Students attending less-selective institutions			
Dell Scholar	-0.209***	-0.026*	-0.030**	-0.351***	-0.031	-0.035*
	(0.032)	(0.014)	(0.014)	(0.053)	(0.025)	(0.019)
Baseline comparison	0.473	0.042	0.060	0.525	0.053	0.059
			Students attending more selective institutions			
Dell Scholar	-0.304***	-0.040***	-0.057***	-0.381***	-0.048**	-0.058***
	(0.027)	(0.011)	(0.012)	(0.046)	(0.021)	(0.016)
Baseline comparison	0.556	0.060	0.097	0.584	0.066	0.093
N	2465	2465	3326	828	828	1691
R^2	0.144	0.060	0.105	0.206	0.070	0.131

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity. We impute zero values and include dummies for missingness where students are missing valid values for covariates.

[a] Data is not available for the 2009 Dell cohort.

Table 12. First-difference impacts of scholar selection on first year working patterns

	Any work hours	Work at least 10 hours/week	Work at least 20 hours/week	Work at least 30 hours/week	Work at least 40 hours/week
			Overall		
Dell Scholar	0.077**	0.066*	0.010	-0.054***	-0.049***
	(0.037)	(0.037)	(0.027)	(0.018)	(0.014)
Baseline comparison	0.591	0.432	0.153	0.074	0.052
N	853	853	853	853	853
R^2	0.053	0.087	0.080	0.064	0.079
			Students attending less-selective institutions		
Dell Scholar	0.025	0.065	0.016	-0.043	-0.060**
	(0.059)	(0.060)	(0.044)	(0.029)	(0.023)
Baseline comparison	0.612	0.522	0.226	0.098	0.070
			Students attending more-selective institutions		
Dell Scholar	0.109**	0.067	0.006	-0.061***	-0.042**
	(0.047)	(0.047)	(0.035)	(0.023)	(0.018)
Baseline comparison	0.578	0.377	0.107	0.059	0.041
N	853	853	853	853	853
R^2	0.054	0.087	0.081	0.064	0.079

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity. We impute zero values and include dummies for missingness where students are missing valid values for covariates.

Table 13. First-difference impacts of scholar selection on course credit attainment

	2009-2012 cohorts					2009-2010 cohorts				
	Credits earned, cumulative					Credits earned, cumulative				
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Earned < ¾ of credits attempted, years 1 - 4**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Earned < ¾ of credits attempted, years 1 - 4**
Overall										
Dell Scholar	0.495	6.601***	10.827***	8.946***	-0.131***	4.574***	10.774***	14.428***	12.326***	-0.174***
	(0.389)	(0.730)	(1.063)	(1.451)	(0.018)	(0.491)	(0.993)	(1.487)	(2.062)	(0.025)
Baseline comparison	23.253	44.279	65.219	93.965	0.482	23.355	44.297	65.179	92.707	0.523
N	3326	3326	3326	3326	3326	1689	1689	1689	1689	1689
R^2	0.061	0.093	0.100	0.132	0.090	0.141	0.161	0.146	0.152	0.118
Students attending less-selective institutions										
Dell Scholar	0.743	7.262***	9.563***	10.503***	-0.169***	3.821***	9.714***	10.066***	10.297***	-0.208***
	(0.681)	(1.280)	(1.865)	(2.545)	(0.028)	(0.845)	(1.711)	(2.559)	(3.551)	(0.039)
Baseline comparison	22.382	42.790	63.046	85.722	0.599	22.405	42.683	63.047	84.893	0.646
Students attending more selective institutions										
Dell Scholar	0.377	6.285***	11.433***	8.199***	-0.104***	4.956***	11.312***	16.640***	13.356***	-0.149***
	(0.472)	(0.888)	(1.293)	(1.764)	(0.024)	(0.602)	(1.219)	(1.823)	(2.530)	(0.034)
Baseline comparison	23.872	45.335	66.762	99.819	0.399***	24.071	45.516	66.786	98.603	0.430
N	3326	3326	3326	3326	3326	1689	1689	1689	1689	1689
R^2	0.061	0.093	0.100	0.132	0.091	0.141	0.162	0.148	0.152	0.119

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity. We impute zero values and include dummies for missingness where students are missing valid values for covariates.

Table 14. First-difference impacts of scholar selection on postsecondary GPA

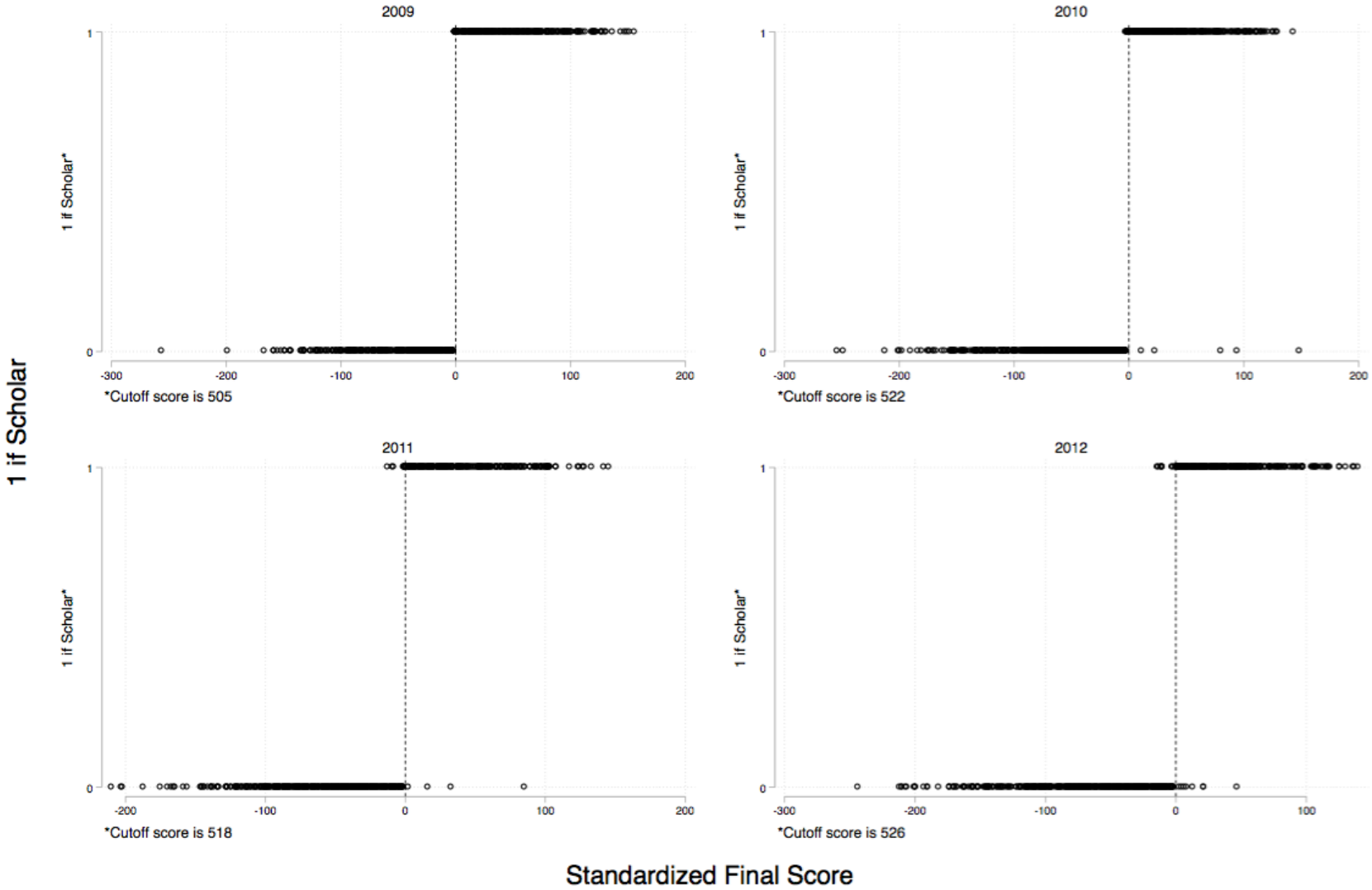
	2009-2012 cohorts					2009-2010 cohorts				
	Cumulative GPA					Cumulative GPA				
	Year 1	**Year 2**	**Year 3**	**Year 4**	**GPA < 2.0 during years 1 - 4**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**GPA < 2.0 during years 1 - 4**
Dell Scholar	0.090***	0.093***	0.115***	0.111***	-0.082***	0.047	0.049	0.071*	0.079**	-0.085***
	(0.028)	(0.026)	(0.026)	(0.026)	(0.018)	(0.040)	(0.038)	(0.036)	(0.036)	(0.025)
Baseline comparison	2.864	2.846	2.849	2.861	0.380	2.861	2.841	2.841	2.844	0.404
N	3326	3326	3326	3326	3326	1689	1689	1689	1689	1689
*R*2	0.110	0.120	0.121	0.135	0.099	0.118	0.120	0.122	0.140	0.113
Students attending less-selective institutions										
Dell Scholar	0.278***	0.338***	0.301***	0.304***	-0.145***	0.308***	0.267***	0.226***	0.252***	-0.153***
	(0.042)	(0.046)	(0.045)	(0.044)	(0.027)	(0.069)	(0.065)	(0.063)	(0.062)	(0.038)
Baseline comparison	2.685	2.983	2.672	2.671	0.496	2.684	2.664	2.672	2.658	0.510
Students attending more selective institutions										
Dell Scholar	-0.049	-0.026	0.024	0.017	-0.038	-0.086*	-0.062	-0.008	-0.008	-0.034
	(0.036)	(0.032)	(0.031)	(0.031)	(0.023)	(0.049)	(0.046)	(0.045)	(0.044)	(0.033)
Baseline comparison	2.995	2.658	2.979	3.000	0.297	2.997	2.979	2.972	2.990	0.324
N	3326	3326	3326	3326	3326	1689	1689	1689	1689	1689
*R*2	0.122	0.132	0.128	0.142	0.101	0.129	0.129	0.127	0.146	0.116

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

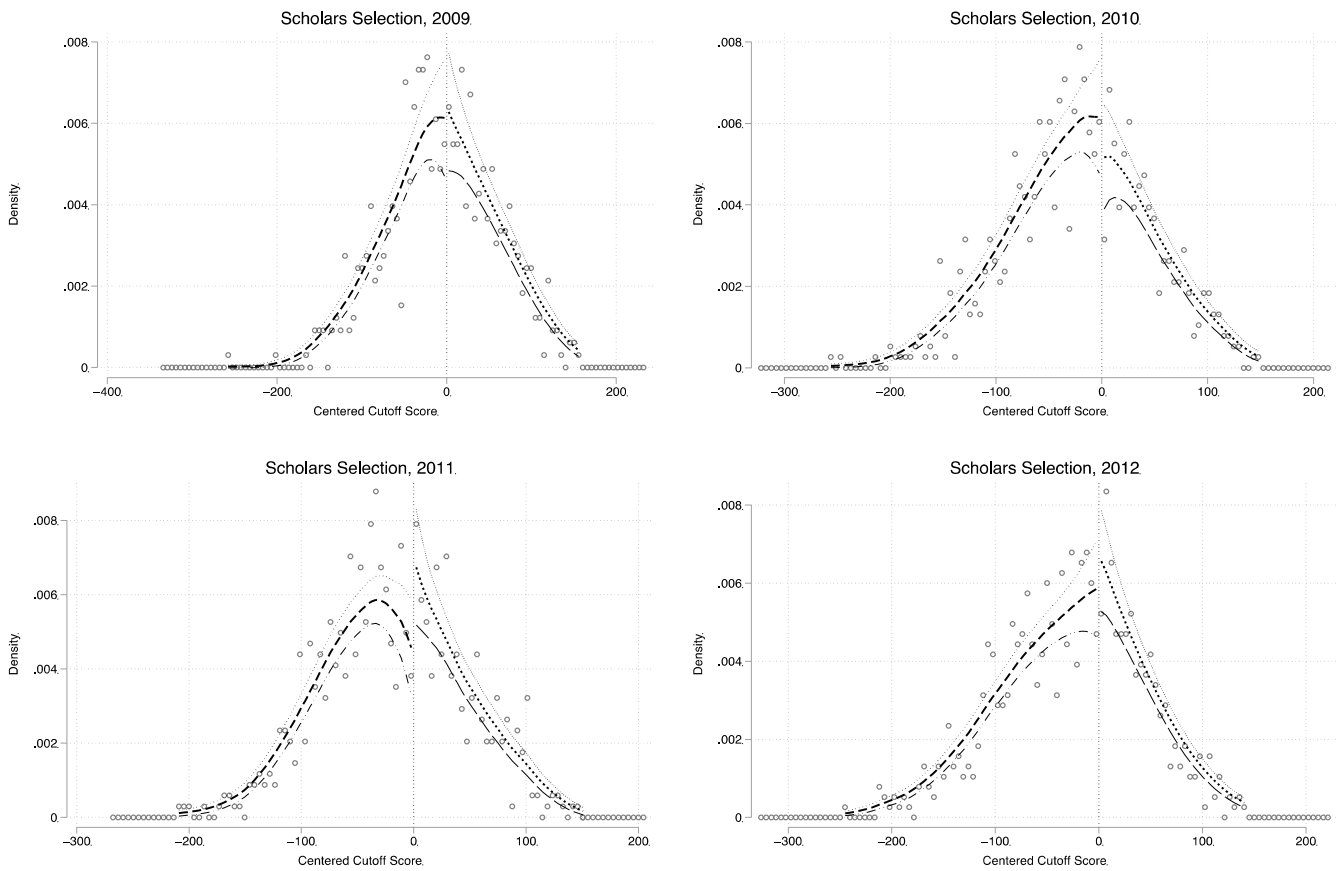
Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity. We impute zero values and include dummies for missingness where students are missing valid values for covariates.

Figure 1. Relationship between scholar status and finalist score, by year



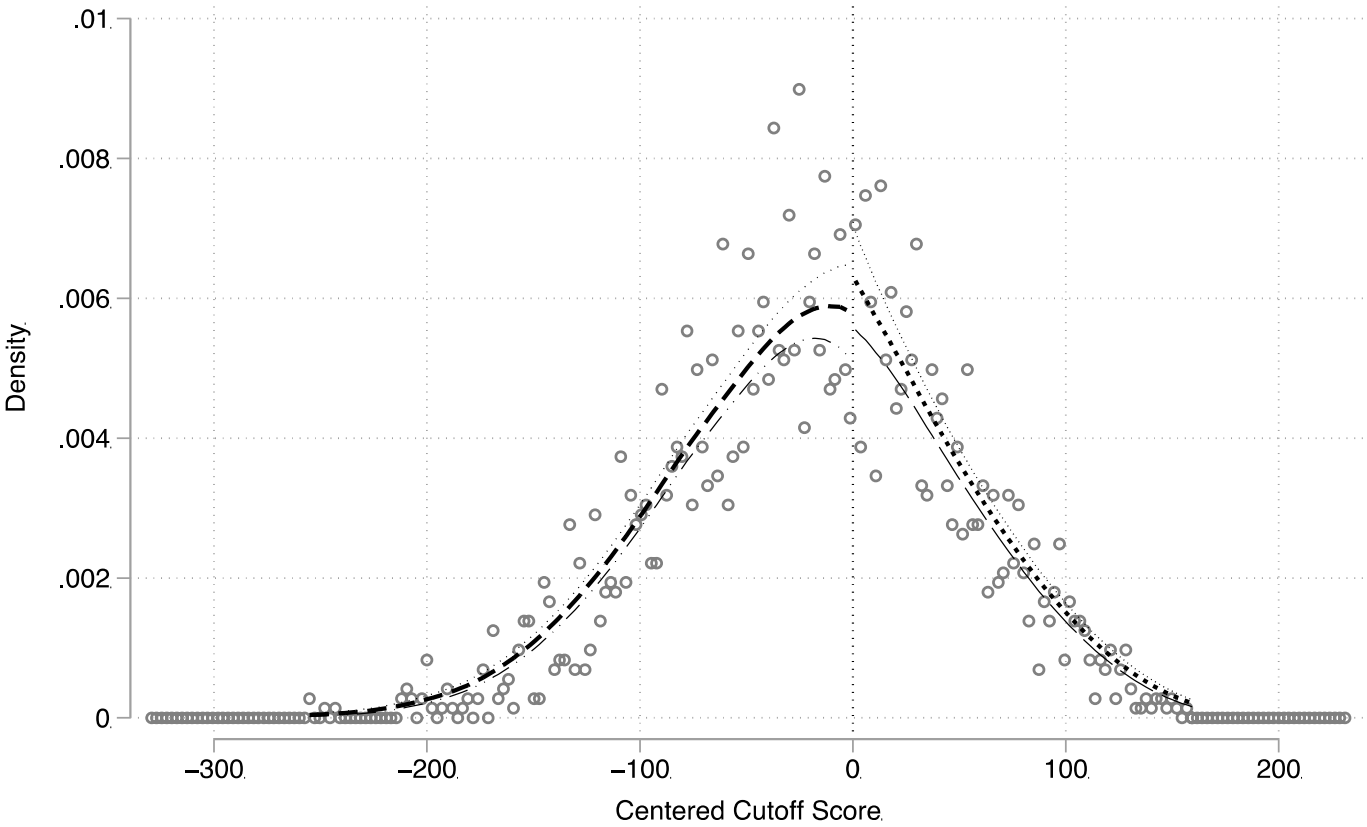
Source: The Dell Scholars Program database.

Figure 2. Graphical representation of the McCrary density tests by year for the scholar selection



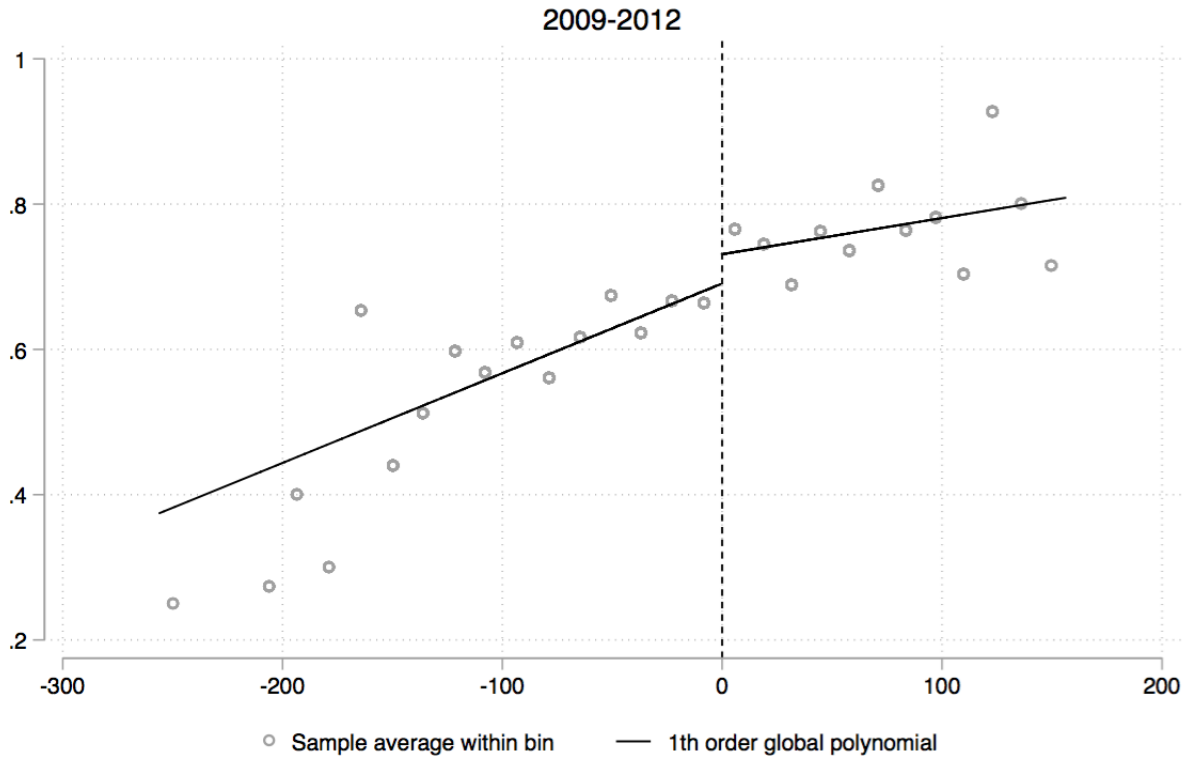
Source: The Dell Scholars Program database.

Figure 3. Graphical representation of the McCrary density tests for the scholar selection, 2009-2012



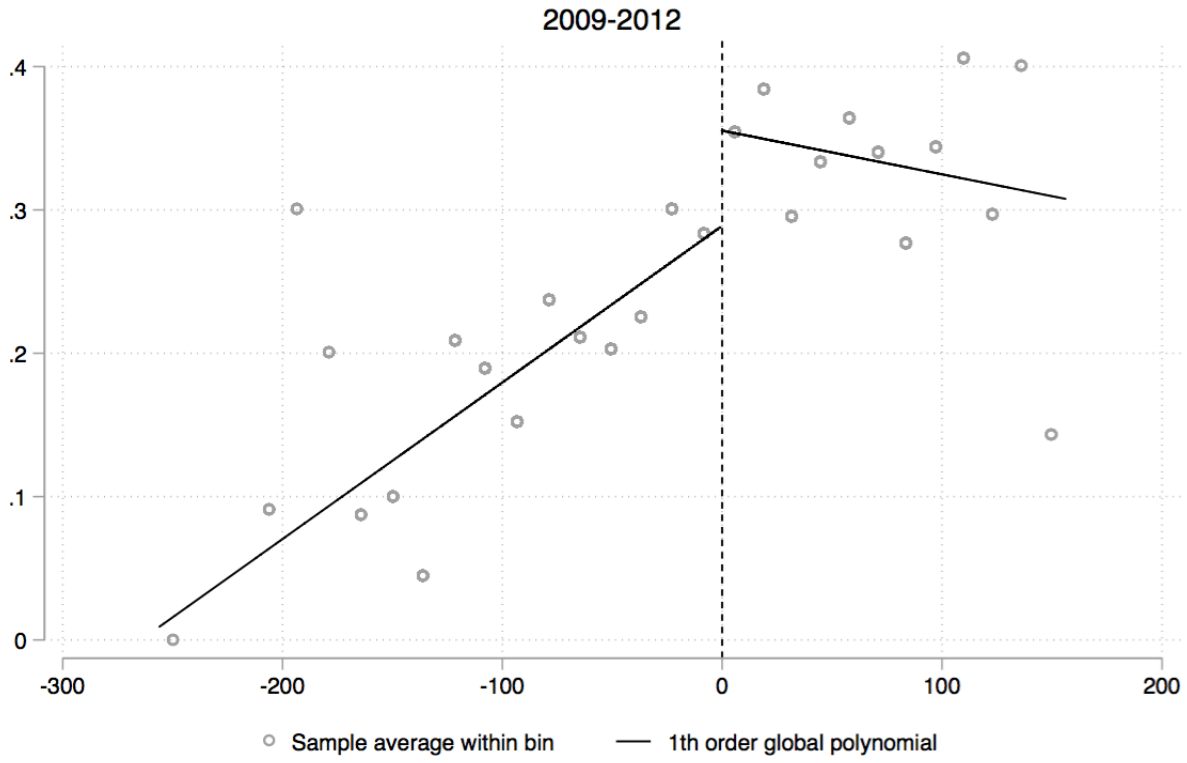
Source: The Dell Scholars Program database.

Figure 4. Regression discontinuity plot: 3rd year persistence



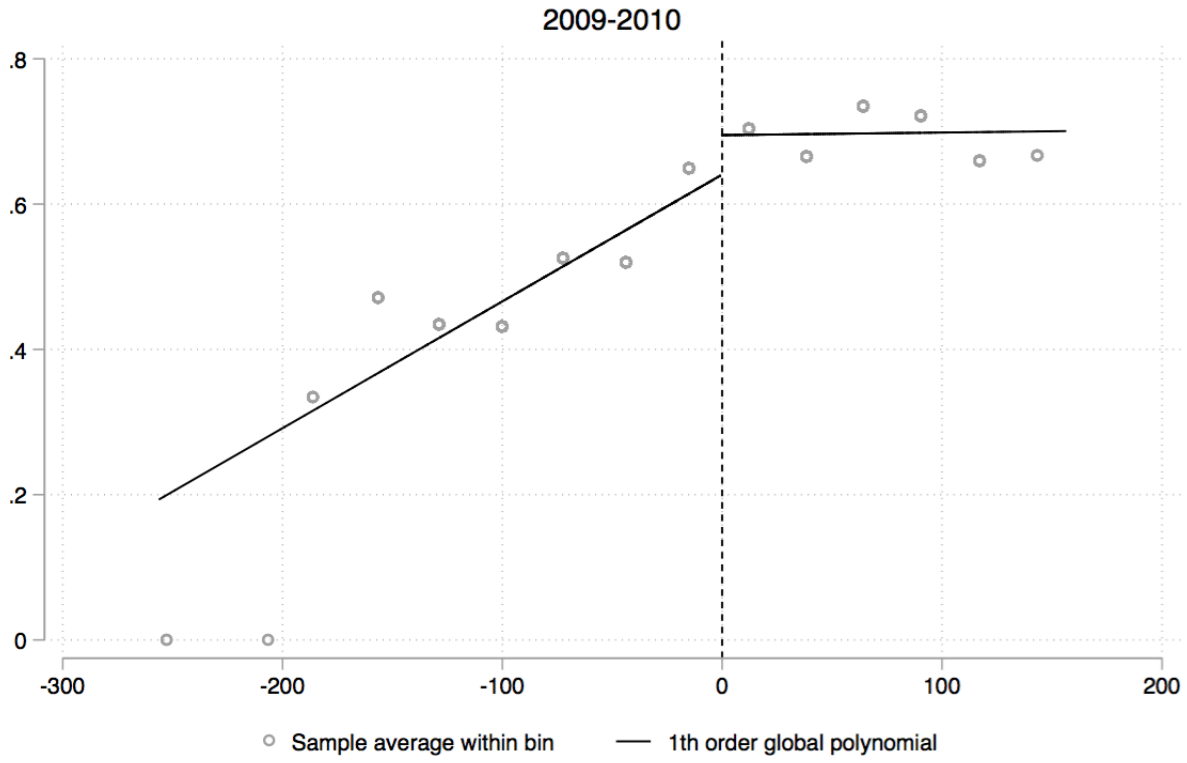
Source: The Dell Scholars Program database and the National Student Clearinghouse.

Figure 5. Regression discontinuity plot: On-time BA degree attainment



Source: The Dell Scholars Program database and the National Student Clearinghouse.

Figure 6. Regression discontinuity plot: BA degree attainment in 6 years, 2009-2010



Source: The Dell Scholars Program database and the National Student Clearinghouse.

APPENDIX A: DELL SCHOLARS SELECTION PROCESS

The Dell Scholars Program assesses prospective scholars based on three main criteria referred to as *GPA*: Grit, Potential, and Ambition. In each selection phase, the program scores students numerically along three dimensions: academics, disadvantage, and responsibility. These dimensions along with the eligibility criteria map directly onto the Grit-Potential-Ambition framework. Participating in a college readiness program and having a plan to enroll in a four-year college show an applicant's ambition. The academics dimension, which assesses academic achievements in high school, measures the applicant's potential. The final criterion, grit, is intended to target students who have overcome personal challenges in their lives related to their families, schools or communities. This criterion is assessed with the measures of disadvantage and student responsibility. Each dimension includes several inputs. For example, the academics dimension includes an academic difficulty index, course count, and high school grade point average.

The Dell Scholars Program utilizes applicant scoring algorithms, one for each selection phase, to compute overall scores. We refer to these as the semifinalist algorithm and the scholar algorithm, respectively. See Table A1 for the dimensions of the semifinalist and finalist scoring algorithms and their corresponding weights. The semifinalist algorithm is used to compute a total application score for each student who starts an application. Students are then ranked on this application score, and the top 900 students are selected as semifinalists. Semifinalists are notified on February 1 and are then required to provide additional application materials, including a high school transcript, a Student Aid Report obtained after completing the Free Application for Federal Student Aid (FAFSA), responses to additional short-answer questions, and a letter of recommendation before March 10. The semifinalists who complete these requirements are referred to as finalists and enter the scholar selection process.

Finalist applications are distributed among and reviewed by a selection committee consisting of approximately 60 members. Each finalist's full application is reviewed and scored by two readers.[32] Each reader in the pair individually reviews each assigned complete application, including recommendation letters, and scores each item in the application. At the end of March, the readers submit all application reviews, and the scholar algorithm is used to compute a final score for each application.[33] Students are ranked on these scores, and the top 300 finalists are selected as Dell Scholars and announced on April 10.

Table A1. Categories and corresponding weights in the semifinalist and finalist selection algorithms

Category	**Semifinalist algorithm**	**Finalist algorithm**
Academics	0.28	0.34
Disadvantage index	0.28	0.34
Responsibility: home	0.18	0.16
Responsibility: work	0.18	0.16
Responsibility: community	0.08	

Source: The Dell Scholars Program database.

[32] This assignment process ensures that both readers in the pair have zip codes different from the finalists they are reviewing.

[33] Super-readers, a subset of readers with extensive experience in scoring applications, review and score applications that need an additional evaluation because first two readers awarded scores that deviated substantially from each other.

APPENDIX B: DEFINITION OF OUTCOME VARIABLES

In this appendix, we detail the construction of the outcome variables considered, the relevant data sources, and the analyses in which we consider each outcome variable.

Variable name	Description	Data source(s)	Analytic approach		
			RD	DID	FD
Immediate college enrollment	Enrollment in a four-year college in the fall of the year in which the student graduated from high school. We assign a value of 1 if a student was immediately enrolled in college after high school graduation and a value of 0 otherwise.	NSC	✓		
2nd year persistence	For each student in cohort *t*, enrollment in the fall and spring of year *t* and in the fall of year *t*+1. We assign a value of 1 if a student persisted into the second year and a value of 0 otherwise.	NSC; BPS 04/09	✓	✓	
3rd year persistence	For each student in cohort *t*, enrollment in the fall and spring of year *t* and *t+1*, and in the fall of year *t*+2. We assign a value of 1 if a student persisted into the third year and a value of 0 otherwise.	NSC; BPS 04/09	✓	✓	
On-time BA attainment	Completion of a bachelor's degree within 48 months of initial enrollment. The list of bachelor's degrees that students earned includes, but is not limited to, Bachelor of Arts (BA or AB), Bachelor of Science (BS), Bachelor of Science in Nursing (BSN), Bachelor of Interdisciplinary Study (BIS), Bachelor of Business Administration (BBA), Bachelor of Fine Arts (BFA), Bachelor of Music (BM), Bachelor of Architecture, Bachelor of Education, and Bachelor of Social Work (BSW). We assign a value of 1 if a student earned a bachelor's degree within 48 months of initial enrollment and a value of 0 otherwise.	NSC; BPS 04/09	✓	✓	
Six-year BA attainment	Completion of a bachelor's degree within 72 months. We assign a value of 1 if a student earned a bachelor's degree within 72 months and a value of 0 otherwise.	NSC; BPS 04/09	✓	✓	

Variable name	Description	Data source(s)	Analytic approach		
			RD	DID	FD
First-year loan borrowing	We investigate types of loan borrowing: federal loans, Parent PLUS loans, and private loans. We assign a value of 1 if a student takes on that type of loan. Federal loans include Stafford and Perkins loans.	BPS 04/09; Dell administrative dataset			✓
Credits earned, cumulative	Cumulative credits earned in an academic year. We adjusted the raw number of credits using enrollment intensity data and information in the IPEDs datasets that reports the number of credits that are required for students to be considered full-time enrollees. The number of cumulative credits that a subject earned were adjusted using this information to allow for analysis of student progress across a common scale. Students were enrolled full-time and on-track if they had 32, 64, 96 and 128 adjusted cumulative credits earned in their first, second, third and fourth years of enrollment, respectively.	BPS 04/09; Dell administrative dataset			✓
Earned less than <3/4 credits attempted, years 1-4	Drawing on term-level academic performance data, we assign a value of 1 if a student earned less than three-quarters of the credits they attempted in any term within the first four years after initial enrollment.	BPS 04/09; Dell administrative dataset			✓
Cumulative GPA	We use term-level academic performance data to construct the cumulative grade point average for each of the first four years of enrollment. The cumulative grade point average is the mean of the reported grade point averages for each term leading to the time point of interest. For example, the second year cumulative GPA is the mean of the GPAs reported in the first four terms of enrollment. Missing term-level grade point averages are included in mean. For example, if a student only stopped out during the third expected term of enrollment, the cumulative GPA for year two is the mean of the GPAs reported in the first, second, and fourth terms.	BPS 04/09; Dell administrative dataset			✓
GPA < 2.0 during years 1-4	Drawing on term-level academic performance data, we assign a value of 1 if a student earned less than a 2.0 GPA in any term within the first four years after initial enrollment	BPS 04/09; Dell administrative dataset			✓

APPENDIX C: SUPPLEMENTARY TABLES

Table C1. Threshold scores and assignment of scholars by year

Year	Threshold score	N Non Scholar with score below threshold	N Non Scholar with score above threshold	N Scholar with score below threshold	N Scholar with score above threshold	N Scholars
2009	505	343	0	0	300	300
2010	522	505	5	6	295	301
2011	518	457	4	4	295	299
2012	526	496	8	8	293	301

Source: The Dell Scholars Program database.

Table C2. Relationship between scholar selection and covariates at threshold of selection

		Treatment effect estimates across bandwidths				
Outcome	μ	**Full sample**	**Intermediate bandwidth (+/-100)**	**Narrow bandwidth (+/-40)**	**Optimal bandwidth**	**Range of optimal bandwidth**
Female	0.762	-0.022	-0.008	-0.038	-0.069	35
		(0.029)	(0.033)	(0.050)	(0.054)	
		[3,019]	[2,585]	[1,372]	[1,209]	
Age	18.277	0.015	0.053	0.063	0.105*	30
		(0.032)	(0.036)	(0.054)	(0.063)	
		[3,019]	[2,585]	[1,372]	[1,049]	
Black / Hispanic	0.707	-0.007	-0.009	-0.036	-0.031	43
		(0.015)	(0.017)	(0.025)	(0.025)	
		[3,019]	[2,585]	[1,372]	[1,448]	
White / Asian	0.273	0.001	-0.006	-0.025	-0.017	42
		(0.016)	(0.018)	(0.026)	(0.026)	
		[3,019]	[2,585]	[1,372]	[1,425]	
ACT equivalent score	20.369	0.025	0.006	-0.011	-0.033	34
		(0.204)	(0.237)	(0.361)	(0.387)	
		[3,019]	[2,585]	[1,372]	[1,176]	
Scaled GPA	0.904	0.002	0.007	-0.002	0.001	30
		(0.006)	(0.007)	(0.010)	(0.012)	
		[3,019]	[2,585]	[1,372]	[1,049]	
Free/reduced lunch	0.966	-0.007	-0.017	-0.019	-0.013	27
		(0.011)	(0.013)	(0.018)	(0.021)	
		[3,019]	[2,585]	[1,372]	[948]	
First-generation	0.761	-0.003	-0.027	0.010	0.007	39
		(0.025)	(0.030)	(0.045)	(0.046)	
		[3,019]	[2,585]	[1,372]	[1,049]	

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database and the National Student Clearinghouse.

Notes: Robust standard errors in parentheses. μ indicates average fitted values for finalists within a bandwidth of 10 below the cohort-specific thresholds. Number of observations in the brackets where applicable. To obtain the optimal bandwidth, we use a first-order polynomial, a uniform kernel, and bandwidth selector of Calonico, Cattaneo, and Titiunik (2014).

Table C3. RD impacts on two-year college enrollment and completion, reduced-form specification

		Treatment effect estimates across bandwidths					
Outcome	μ	**Full sample**	**Intermediate bandwidth (+/-100)**	**Narrow bandwidth (+/-40)**	**Optimal bandwidth**	**Range of optimal bandwidth**	**Cohorts**
Immediate enrollment	0.052	-0.013	-0.016	0.009	0.003	+/-29	2009-12
		(0.014)	(0.015)	(0.023)	(0.026)		
		[3019]	[2585]	[1372]	[1019]		
Associate's degree attainment	0.065	-0.025*	-0.012	-0.030	-0.041*	+/-32	2009-12
		(0.013)	(0.015)	(0.022)	(0.024)		
		[3019]	[2585]	[1372]	[1117]		

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database and the National Student Clearinghouse.

Notes: Robust standard errors in parentheses. μ indicates average fitted values for finalists within a bandwidth of 10 below the cohort-specific thresholds. Number of observations are in the brackets where applicable. The impact coefficients of being selected as a scholar are estimated using an instrumental variable estimation, where scholar status is instrumented by the assignment rule. All models estimated using baseline covariate controls, including age, scaled GPA, ACT equivalent score, state of residence, gender, race / ethnicity dummies, parents' income (in $1,000), parental education, free or reduced-lunch eligibility, receipt of food stamps, receipt of federal health insurance, and receipt of Medicaid. Models also include cohort dummies, and slopes of the relationship between the outcome and assignment score are allowed to vary by cohort. We impute zero values and include dummies for missingness where students are missing valid values for covariates. To obtain the optimal bandwidth, we use a first-order polynomial, a uniform kernel, and bandwidth selector of Calonico, Cattaneo, and Titiunik (2014).

Table C4. RD impacts of scholar selection on immediate college enrollment, persistence and completion outcomes: fuzzy RD estimates

	2009 – 2012 cohorts						2009 – 2010 cohorts					
Outcome	**μ**	**Full sample**	**Intermediate bandwidth (+/-100)**	**Narrow bandwidth (+-40)**	**Optimal bandwidth**	**Range of optimal bandwidth**	**μ**	**Full sample**	**Intermediate bandwidth (+/-100)**	**Narrow bandwidth (+-40)**	**Optimal bandwidth**	**Range of optimal bandwidth**
Immediate enrollment	0.854	0.016	0.023	0.026	0.016	44	0.852	0.032	0.039	0.069	0.107*	36
		(0.023)	(0.026)	(0.041)	(0.039)			(0.031)	(0.036)	(0.056)	(0.059)	
					[1,482]						[602]	
2nd year persistence rate	0.753	0.024	0.040	0.036	0.028	44	0.753	0.035	0.056	0.078	0.112	38
		(0.026)	(0.031)	(0.049)	(0.047)			(0.036)	(0.043)	(0.066)	(0.069)	
					[1,482]						[631]	
3rd year persistence rate	0.677	0.048*	0.064*	0.092*	0.128**	36	0.661	0.068*	0.093**	0.132*	0.202***	36
		(0.028)	(0.034)	(0.053)	(0.056)			(0.039)	(0.046)	(0.071)	(0.076)	
					[1,240]						[602]	
BA attainment, in 4 years	0.287	0.064**	0.060*	0.074	0.068	34	0.271	0.082**	0.099**	0.110	0.100	31
		(0.029)	(0.035)	(0.056)	(0.062)			(0.040)	(0.047)	(0.077)	(0.090)	
					[1,176]						[530]	
BA attainment, in 6 years	--	--	--	--	--	--	0.635	0.061	0.058	0.101	0.176*	30
								(0.041)	(0.049)	(0.077)	(0.092)	
											[512]	
Total Observations		3,019	2,585	1,372				1,454	1245	668		

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database and the National Student Clearinghouse.

Notes: Robust standard errors in parentheses. μ indicates average fitted values for finalists within a bandwidth of 10 below the cohort-specific thresholds. Number of observations are in the brackets where applicable. The impact coefficients of being selected as a scholar are estimated using an instrumental variable estimation, where scholar status is instrumented by the assignment rule. All models estimated using baseline covariate controls, including age, scaled GPA, ACT equivalent score, state of residence, gender, race / ethnicity dummies, parents' income (in $1,000), parental education, free or reduced-lunch eligibility, receipt of food stamps, receipt of federal health insurance, and receipt of Medicaid. Models also include cohort dummies, and slopes of the relationship between the outcome and assignment score are allowed to vary by cohort. We impute zero values and include dummies for missingness where students are missing valid values for covariates. To obtain the optimal bandwidth, we use a first-order polynomial, a uniform kernel, and bandwidth selector of Calonico, Cattaneo, and Titiunik (2014)

Table C5. Sensitivity analyses of RD estimates using different optimal bandwidths, 2009-2012 cohorts

Outcome	Treatment effect estimates across bandwidths						
	Full	**Intermediate**	**Narrow bandwidth (+-40)**	**Optimal bandwidth (CCT, Uniform)**	**Optimal bandwidth (CCT, triangular)**	**Optimal bandwidth (CCT, Epanechnikov)**	**Optimal bandwidth (IK, uniform)**
Immediate enrollment	0.016	0.023	0.026	0.016	0.027	0.024	0.041
	(0.023)	(0.026)	(0.041)	(0.039)	(0.032)	(0.033)	(0.039)
	[3019]	[2585]	[1372]	[1482]	[1765]	[1667]	[1240]
2nd year persistence rate	0.024	0.040	0.0356	0.028	0.033	0.042	0.052
	(0.026)	(0.031)	(0.049)	(0.047)	(0.038)	(0.040)	(0.046)
	[3019]	[2585]	[1372]	[1482]	[1736]	[1642]	[1306]
3rd year persistence rate	0.048*	0.064*	0.092*	0.126**	0.082*	0.081*	0.113**
	(0.028)	(0.034)	(0.053)	(0.056)	(0.045)	(0.047)	(0.050)
	[3019]	[2585]	[1372]	[1240]	[1512]	[1425]	[1278]
BA attainment, in 4 years	0.064**	0.060*	0.074	0.068	0.038	0.068	0.052
	(0.029)	(0.035)	(0.056)	(0.062)	(0.049)	(0.051)	(0.052)
	[3019]	[2585]	[1372]	[1176]	[1482]	[1392]	[1342]

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database and the National Student Clearinghouse.

Notes: Robust standard errors in parentheses. μ indicates average fitted values for finalists within a bandwidth of 10 below the cohort-specific thresholds. Number of observations are in the brackets where applicable. All models estimated using baseline covariate controls, including age, scaled GPA, ACT equivalent score, state of residence, gender, race / ethnicity dummies, parents' income (in $1,000), parental education, free or reduced-lunch eligibility, receipt of food stamps, receipt of federal health insurance, and receipt of Medicaid. Models also include cohort dummies, and slopes of the relationship between the outcome and assignment score are allowed to vary by cohort. We impute zero values and include dummies for missingness where students are missing valid values for covariates. We use first-order polynomial for all specifications of the bandwidth selector.

Table C6. Sensitivity analyses of RD estimates using different optimal bandwidths, 2009-2010 cohorts

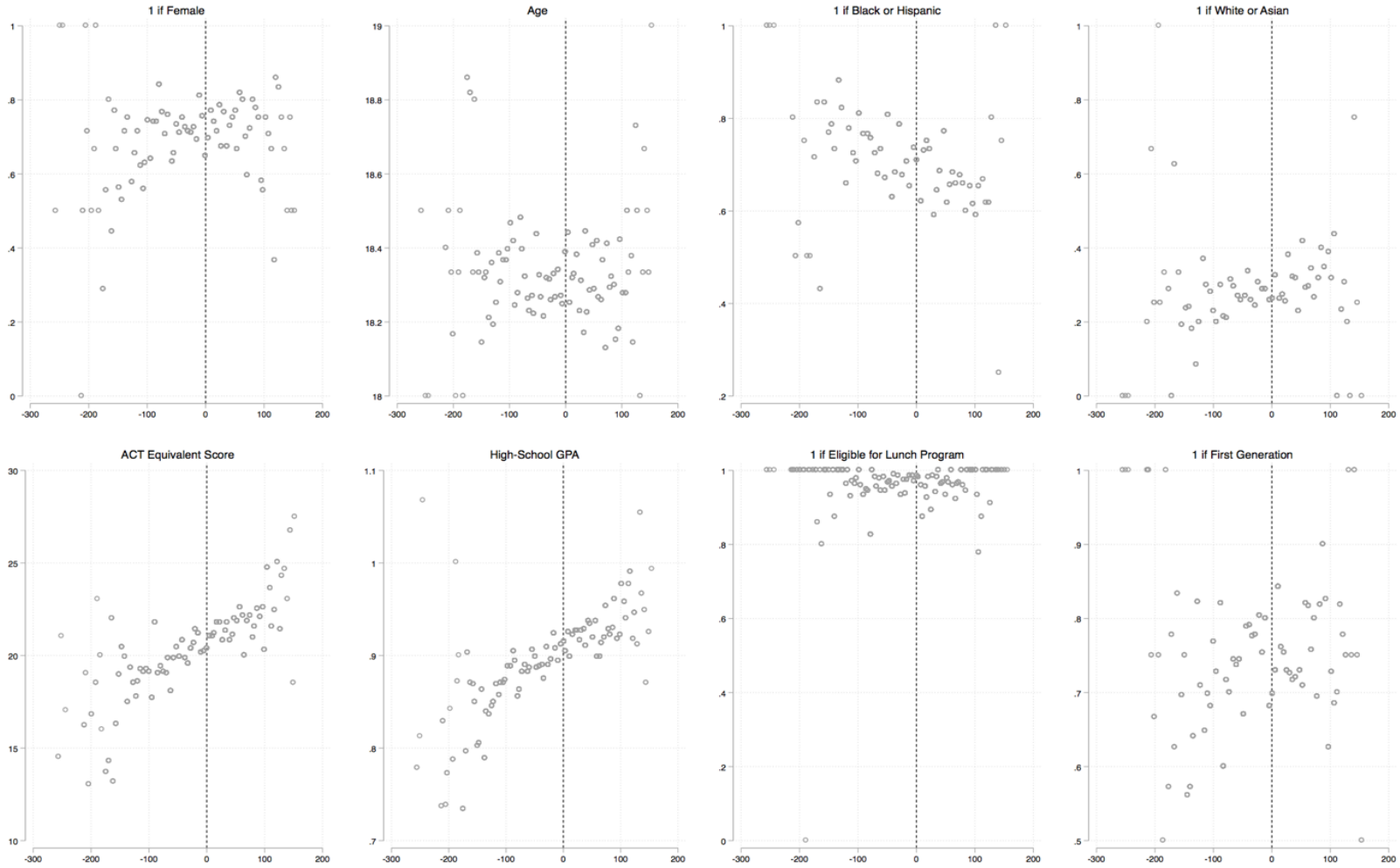
Outcome	Treatment effect estimates across bandwidths						
	Full	**Intermediate**	**Narrow bandwidth (+-40)**	**Optimal bandwidth (CCT, Uniform)**	**Optimal bandwidth (CCT, triangular)**	**Optimal bandwidth (CCT, Epanechnikov)**	**Optimal bandwidth (IK, uniform)**
Immediate enrollment	0.032	0.039	0.069	0.098*	0.059	0.051	0.098*
	(0.031)	(0.036)	(0.056)	(0.057)	(0.052)	(0.052)	(0.057)
	[1454]	[1245]	[668]	[602]	[736]	[709]	[602]
2nd year persistence rate	0.035	0.056	0.078	0.103	0.067	0.075	0.067
	(0.036)	(0.043)	(0.066)	(0.067)	(0.059)	(0.060)	(0.061)
	[1454]	[1245]	[668]	[631]	[801]	[765]	[736]
3rd year persistence rate	0.068*	0.093**	0.132*	0.184**	0.132**	0.132*	0.244***
	(0.039)	(0.046)	(0.071)	(0.074)	(0.065)	(0.067)	(0.083)
	[1454]	[1245]	[668]	[602]	[736]	[709]	[502]
BA attainment, in 4 years	0.082**	0.099**	0.110	0.090	0.094	0.101	0.098
	(0.040)	(0.047)	(0.077)	(0.087)	(0.074)	(0.075)	(0.079)
	[1454]	[1245]	[668]	[530]	[696]	[668]	[619]
BA attainment, in 6 years	0.061	0.058	0.101	0.158*	0.122*	0.093	0.087
	(0.041)	(0.049)	(0.077)	(0.090)	(0.073)	(0.075)	(0.079)
	[1454]	[1245]	[668]	[512]	[723]	[677]	[619]

*p<.10 **p<.05 ***p<.01

Source: The Dell Scholars Program database and the National Student Clearinghouse.

Notes: Robust standard errors in parentheses. μ indicates average fitted values for finalists within a bandwidth of 10 below the cohort-specific thresholds. Number of observations are in the brackets where applicable. All models estimated using baseline covariate controls, including age, scaled GPA, ACT equivalent score, state of residence, gender, race / ethnicity dummies, parents' income (in $1,000), parental education, free or reduced-lunch eligibility, receipt of food stamps, receipt of federal health insurance, and receipt of Medicaid. Models also include cohort dummies, and slopes of the relationship between the outcome and assignment score are allowed to vary by cohort. We impute zero values and include dummies for missingness where students are missing valid values for covariates. We use first-order polynomial for all specifications of the bandwidth selector.

Figure C1. Relationship between student-level baseline covariates and scholar selection score



Source: The Dell Scholars Program database.