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The Effects of At-Scale Career Pathway Investments on the Transition from High School to College

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In this study, we examine an at-scale effort to encourage the formation of career pathways in California, with the goal of estimating the initiative's causal effects on community college enrollment. We leverage a discontinuous assignment rule used to award grant funds to obtain credibly causal estimates of an ambitious $500 million effort to expand and establish career and technical education pathways between K-12 and community colleges. The competitive grant application process used a standardized rubric, and those receiving a score above a predetermined threshold were awarded funding (i.e., treatment group) while those just below received no funding (i.e., control group), allowing for a regression discontinuity (RD) design. We found that successful grantees did not experience overall enrollment increases in postsecondary partnerships; however, there were enrollment increases of 13.5 percent to 14.8 percent in CTE health sector courses, the program targeted the most for expansion. Manufacturing, and information communication technology, the other programs with the most expanded offerings, experienced no increases in postsecondary enrollment. The enrollment increases for the health sector were concentrated amongst female students in line with earlier findings by Bonilla (2020) documenting reductions in high school dropout rates for female students. These findings suggest that partnerships between K-12 schools and postsecondary institutions may be a viable avenue for increasing alignment between enrollment and high- growth sectors.

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Abstract:

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1 Introduction

Renewed federal and state interest in career and technical education (CTE) is fueled by the search for pragmatic solutions for connecting high school students to educational and career opportunities that require less than a 4-year degree. CTE education carries the promise of offering high school students opportunities to participate in applied learning and results in increased exposure to the workplace, which may foster increased student engagement. Another purported benefit of CTE education during the high school years is that earlier exposure will result in better alignment with workforce needs. *Career pathways* are a promising form of CTE; these models provide career training during high school and support participants' transition from high school to postsecondary training opportunities and/or the workforce. Career pathway programs provide students with multiyear training in a high-growth sector, such as healthcare or IT, with occupations that pay a living wage. These programs often provide opportunities for internships through partnerships with local businesses, as well as the option of continuing in the same career pathway at a partner postsecondary institution. This is particularly important considering that the returns to college have increased substantially in recent decades, but the gap of college attainment with regard to family income has increased significantly (Bailey & Dynarski, 2011).

Early, high-quality evidence on participating in career pathways during high school supports the notion that this approach can drive increased educational attainment, reduced unemployment, and increased wages in the labor market. We know less however about *at-scale* implementation of recent CTE pathway efforts because most of our evidence comes from oversubscribed programs that are likely to be of higher quality than would be expansions of CTE

pathways in schools that may not have expertise in best practices. In this study, we examine data from a recently implemented, at-scale career pathways program in California to determine whether it succeeded in increasing educational attainment by improving community college enrollment.

Announced in 2014, the California Careers Pathways Trust (CCPT) was an ambitious $500 million effort that encouraged the establishment and expansion of K–12 and community college CTE partnerships. A 2020 study of the CCPT found promising evidence of reductions in high school dropout rates, suggesting that CTE pathways can facilitate improved educational attainment at scale (Bonilla, 2020). But that study did not examine whether the CCPT program succeeded in facilitating students ’transitions to postsecondary training, a key priority of the program. One known obstacle to postsecondary enrollment for career pathways programs is that public community colleges are slow to respond to labor market demands, meaning that students seeking access to postsecondary CTE programs are often met with waitlists (Grosz, 2022). Partnerships between K-12 schools and postsecondary partners– such as those facilitated by the CCPT program– may encourage better alignment by allowing postsecondary institutional actors to plan for future enrollments. Although the CCPT application structure was designed to facilitate pathways across high school and into college and the workforce, grantees may have struggled to implement critical aspects of the program meant to facilitate transitions to postsecondary training. Prior research on the barriers to postsecondary enrollment are extensive and include numerous financial constraints, informational/behavioral limitations, and academic challenges (Page & Scott-Clayton, 2016). The design of aligned CTE pathways targets some of

the known academic and informational/behavioral barriers to postsecondary enrollment but may be inadequate to support meaningful improvements for students facing multiple hurdles.

Here we extend Bonilla's 2020 study to understand whether the initial increases in educational attainment are sustained by examining postsecondary enrollments at partner community colleges. Our causal estimation strategy relies on unique data from the competitive grant applications which were rated by two to three independent reviewers using a standardized rubric. Awards were granted to those applicants receiving a score above a predetermined threshold (i.e., treatment group) while those just below received no funding (i.e., control group). The use of a threshold (i.e., cut score) for awarding funding allows for the use of a regression discontinuity (RD) design. Bonilla (2020) finds that grant recipients increased their K-12 CTE spending by 21.7 percent relative to non-grantees and dropout rates declined by 23 percent in treatment districts, reductions driven by improved outcomes for female students. In contrast, previous work has suggested that male students receive outsized benefits from CTE programming in terms of educational attainment and wage growth (Hemelt et al., 2019, Ecton & Dougherty, 2023). In this study, we provide additional evidence for how the existing gendered nature of occupations may amplify gendered occupational and educational outcomes through career pathway expansion.

Our paper is organized as follows: in section 2 we describe the California Career Pathways Trust (CCPT) program and its implementation; in section 3 we review the literature and highlight theoretical considerations; in section 4 we describe the data; in section 5 we discuss the estimation strategy; we provide an overview of the results in section 6 and conclude in section 7.

2 California Career Pathways Trust

The CCPT competitive grant program invested an astounding $500-million to help facilitate the wide-scale establishment and expansion of career pathways across California. The legislature earmarked these funds to support the formation of partnerships across K-12 schools, colleges, and local employers to grow career pathway programs in high-growth and high-wage sectors (McLaughlign et al., 2017, 2018). The CCPT grant competition was announced in January of 2014 and was characterized by several notable design features that emphasized sustained progression into postsecondary institutions for career pathways participants[1].

The California Department of Education (CDE) relied on workforce development experts at the K-12 and postsecondary levels to design the application and rate submission quality. The application was highly scaffolded, and applicants were required to respond to specific prompts, including instructions to gather and report regional workforce labor market projections and guidance in building detailed plans for aligned career pathways. The proposed pathways were specified on numerous application forms that provided blank outlines for course sequences, partnership agreements with postsecondary institutions and businesses, and projections for the number of students served rather than a freeform narrative grant application. The curricular sequence for each career pathway (i.e., program of study) included multi-year course progressions with specific course names at the secondary and postsecondary levels, in addition to identifying business partners where students could pursue related internships and apprenticeships to enrich their career training. An interesting feature of the program of study was that it included

[1] The grant competition included two cohorts of applicants, the first cohort received funding beginning in the 2014-15 school year and the second cohort one year later in 2014-15.

both the CTE course sequence for the career pathways alongside required academic high school courses. This application feature highlighted the academic preparation high school participants required to continue on the career pathways at the postsecondary level. Finally, applicants were prompted to include the course sequence available in grades “13” and “14” during their enrollment at the partner community college.

The scaffolded nature of the application also served as an educational tool for educators. Links to Bureau of Labor Statistics websites were included for applicants to identify and provide specific occupations and median wage levels that student participants would be prepared for after completing the career pathway with either a high school diploma or postsecondary credential. For example, a typical health pathway might identify entry-level occupations (e.g., medical record technician) requiring only a high school diploma and the accompanying hourly wage (e.g., $18 per hour) in addition to the postsecondary-level certificate coursework and corresponding occupation (e.g., health information manager/specialist) associated with the respective median wage (e.g., $30–36 per hour). These details highlight how the design of the CCPT application emphasized the importance of career pathways that continued at postsecondary institutions.

The CCPT grant provided startup funding to educational organizations across the state. The structure of the grant provided successful applicants with funding over a 3-year-period, with half of the total grant dollars provided in Year 1 to support the initial planning, training, and capital expenditures necessary to support the formation of new pathways and expand existing ones. Grantees received smaller disbursements in Years 2 and Year 3 (i.e., 35 percent and 15 percent, respectively). Bonilla (2020) examined K-12 district CTE expenditures and found that

grant recipients used nearly 100% of the grant money to increase CTE expenditures, representing a significant investment in CTE education across California. Other implementation evidence from a CDE report noted that most funds received by grantees were spent on curriculum development (35 percent) in addition to the purchase of equipment and professional development for CTE teachers at K-12 sites (10 percent). Critically, nearly 20 percent of funding was dedicated to the aligning career pathways between the secondary and postsecondary levels; and 15 percent of grant expenditures was spent to aid the formation of regional partnerships. These figures provide further support for an intervention that was designed to facilitate transitions to career pathways at community colleges.

Ensuring access to CCPT grant funds required a conscientious structure that was sensitive to the reality of uneven population distribution across California. The state comprises densely populated urban and suburban regions as well as sparsely populated regions in the north and east. To provide access to career pathway partnerships serving students across all these regions, the CCPT grant was a one-time payment available at three funding levels (i.e., $600,000, $6 million, and $15 million). Together the aforementioned design features and implementation details suggest that the CCPT grant program not only provided institutions across the state with an influx of funds to support CTE pathway formation and expansion but also offered detailed guidance on how to identify high-growth occupations and create comprehensive career pathways.

Despite the highly scaffolded process, a qualitative implementation study of CCPT found that applicants faced structural challenges that may have prevented the creation of robust partnerships between secondary and postsecondary institutions (CDE, 2017; McLaughlin et al.,

2017). The legislative report noted that grantees concentrated grant expenditures on redesigning the secondary school curriculum. Furthermore, while applicants were required to align their career pathways, only 40 percent of grantees in the first cohort had a Program of Study affiliated with their postsecondary partners (CDE, 2017). Additional evidence comes from an independent implementation study conducted by McLaughlin and colleagues that relied on document reviews, interviews at 20 grantee sites, and multiday site visits for three grantees. The researchers noted that the sites focused on training staff to implement pathways at the high school level and that grantees lacked personnel who could coordinate pathways with businesses and postsecondary partners (McLaughlin et al., 2017). Although the intent of the CCPT grant was to facilitate transitions to postsecondary workforce training opportunities, these additional implementation details suggest that grantees may have faced challenges hiring personnel and coordinating across educational institutions. However, it is noteworthy that McLaughlin and colleagues examined only grantee sites. Accordingly, their study cannot provide information on the treatment contrast between grantee recipients and those applicants that received no CCPT funding to establish and expand career pathways into postsecondary institutions. Our ability to incorporate administrative data comparing grantee and non-grantees provides complementary evidence.

Although the aforementioned studies provide evidence of implementation challenges, the CCPT grant resulted in overall increased CTE spending in high schools and a 20 percent reduction in dropout rates at implementing high schools (Bonilla, 2020). The introduction of new pathways and expansion of others via CCPT funding may operate on two margins. First, the reduction in high school dropout documented by Bonilla (2020) provides evidence that the career pathway intervention affected students on the margin of high school completion. National data

indicate that approximately two thirds of graduates enroll immediately in college after high school completion, which suggests a second margin. The presence of career pathways may also induce new and/or existing high school graduates to become postsecondary enrollees[2]. We next discuss potential theorized mechanisms by which career pathways may promote enhanced educational attainment and relevant literature.

3 Theoretical Framework and Related Literature

We suggest three potential mechanisms for how the provision of career pathway availability and participation may impact postsecondary enrollment. The first mechanism is by simply providing information to students– the availability of the high school career pathway and its continuation at the partner postsecondary may reduce information asymmetries about the available careers and the academic preparation needed to attain those related careers. A second and related potential mechanism by which career pathways may induce enhanced educational attainment is through the behavioral nudge that the career pathways ʾpresence provides. Students may simply continue participating in the designated career pathway that they were part of during high school if it continues at the local community college. In other words, the default choice architecture of the career pathway serves as an implicit recommendation for a program of study, postsecondary institution, and subsequent career choices. Notably, this mechanism may result in diversion from 4-year institutions. Lastly, career pathways may serve to increase students ʾsense of belonging and engagement with schooling by communicating to students that they can succeed in these designated course sequences that culminate in a postsecondary credential and

[2] Immediate College Enrollment Rate retrieved from U.S. Department of Education, National Center for Education Statistics. (2021). *The Condition of Education 2021* (2021-144).

the associated careers (Benebou & Tirole 2003). As such, career pathway participation may generate increased student effort and postsecondary enrollment because of changes in students ' expectations of their own capabilities. This final theorized mechanism is distinct in that it suggests that career pathway availability and participation influences student outcomes by shifting fundamental self-beliefs about students 'own capacity. This final mechanism implies that career pathways have the potential to catalyze student engagement and may operate on the margin of increasing educational attainment of marginal high school graduates and/or postsecondary enrollees.

The potential reduction of information asymmetries or responses to behavioral nudges do not necessarily imply an overall increase in postsecondary enrollment. On the contrary, career pathways may facilitate enrollment in career pathways at partner schools by diverting enrollment from other postsecondary programs, other institutions or directly to the labor market. Diversion may be an efficient outcome if better matches between student interests are achieved without reducing completion and subsequent labor market participation and wages. Notably, diversion from 4-year institutions is commonly viewed as a potential negative byproduct of CTE because of the improved employment prospects, both in earnings and employment duration, of bachelor's degree earners. This argument maintains that the net benefit of attending a four-year institution is positive for most CTE participants. While graduation rates are superior at 4-year institutions compared to 2-year colleges (where most CTE takes place), they are not unitary, and are accompanied by increased educational debt and reduced wages whilst enrolled. And importantly, the benefits associated with bachelor's degree are often not realized for marginal college enrollees, many of whom will not graduate.

The counterpoint of this argument is that career pathways may divert some students who would have successfully enrolled and completed a bachelor's degree in the absence of a career pathway program. Completion of a certificate or 2-year degree at a community college need not be the terminal step of a student's education, nevertheless, it likely that students who are historically underrepresented and marginalized in society—low-income and first-generation students, who depend more heavily on career and educational guidance from the school system— will be those diverted away from 4-year degrees. To assess the general equilibrium effects of a diversionary career pathway intervention we must understand whether there is a net increase in educational attainment to determine career pathway efficacy. Yet, policymakers and educators may wish to evaluate such a policy through a Rawlsian lens: how do the most vulnerable members of society fare when exposed to career pathways? This approach suggests that we use a multiplier to calculate the benefits conferred for marginal high school graduates and/or marginal postsecondary enrollees over the individuals who experience postsecondary enrollment diversion.

It is worth noting that the career pathway intervention also provides educators and school systems with a structure for advising and supporting students. The application process may also reduce information asymmetries for school systems on available careers and course sequences. The default choice architecture of career pathway sequences can institutionalize and standardize counseling processes. The presence of career pathways may also serve to transform educator beliefs about what students are capable of. These theorized mechanisms support a hypothesis of increased community college enrollment, specifically in the targeted career pathways. This

hypothesis is supported by a growing body of evidence that educational attainment may be linked to CTE participation. We turn to summarizing this evidence now.

A previous generation of federally funded efforts to encourage high school completion and promote college enrollment through technical vocational training programs in the early 1990's, known as Tech-Prep, delivered mixed results. Tech-Prep programs awarded transferable credits for careers that required some postsecondary training and provided students with applied coursework and career development during high school. Cellini (2006) examined the benefits of participating in Tech-Prep using a within-family fixed effects strategy and found that siblings who participated in Tech-Prep had higher high school graduation rates and increased enrollment at 2-year colleges compared to their siblings who did not enroll in Tech-Prep. However, Cellini notes that the 2-year college enrollment increase appeared to be driven by diverting Tech-Prep participants away from 4-year colleges, potentially resulting in lower earnings and employment in the longer term. D'Amico and colleagues (2013) examine dual enrollees in a descriptive study using data from South Carolina and found that students were more likely to persist at the community college campus if they completed dual enrollment career focused courses as high school students rather than traditional academic courses that would transfer to a 4-year institution Both studies suggest the potential for CTE partnerships between K-12 and 2-year colleges to increase postsecondary enrollment rates, however, the South Carolina study is correlational in nature and does not address salient issues of selection.

Other recent studies of career pathways with strong causal warrant have focused on stand-alone CTE-focused high schools that are singularly dedicated to career training. These schools require students to navigate an admissions process to gain admission that privileges

students with higher levels of social capital and who have higher academic achievement than the lowest performing students (Schneider et al., 1997). Furthermore, these contexts are homogenous because all students have opted into a career training program. Though these programs appear to promote higher rates of high school graduation and employment rates (Hemelt et al., 2019; Dougherty, 2018; Kemple, 2008), there is an outstanding question of whether these results can be replicated in traditional comprehensive high schools on a wider scale.

A particularly important finding from a study by Brunner and colleagues of specialized CTE high schools in Connecticut was that male students enrolled in postsecondary education at lower rates, similar to Cellini's (2006) findings. Diversion from postsecondary enrollment may be more prevalent when students attend CTE-intensive schools because they do not experience, or benefit from, the college-readiness supports typically available at traditional high schools. Another noteworthy difference between specialized and integrated CTE instruction is that male students are overrepresented in stand-alone CTE high schools (Brunner et al. 2019; Dougherty et al. 2019, Hemelt et al. 2019) and there may be differential impacts for career pathway participation for traditionally male versus female dominated programs.

In observational work that included CTE students 'outcomes from specialized and integrated CTE high school programming, Ecton and Daugherty (2023) examine statewide panel data from Massachusetts to characterize wages over students 'early careers and their postsecondary educational attainment separately by career pathway sector and by student subgroups. They found that, compared to observationally similar non-CTE participants, male high school students who participated in CTE courses during high school were less likely, overall, to enroll in college while female participants were more likely to enroll. Their findings

vary by CTE sector, with health care, education, and IT CTE participants more likely to enroll in 2-year community college programs. Comparable to Cellini's findings (2006), Ecton and Dougherty (2023) found that participation in CTE programs in high school is associated with increases in 2-year enrollment and a null or reduced likelihood of enrolling in 4-year college. In our study, the expansion and addition of CTE pathways in CCPT grant-winning school districts were primarily concentrated in health care, information technology and engineering pathways. Especially relevant to our study, Ecton and Dougherty's (2023) observational analysis in Massachusetts showed that high school CTE participants experience increased enrollments in 2-year postsecondary training programs for health care, information technology, and engineering pathways; these are the three CTE pathways that the CCPT grant-winning districts primarily focused on adding or expanding.

Treatment heterogeneity by sector is supported by previous research documenting distinct labor market outcomes due to the required skills and working conditions (e.g., hours, physical environment etc.) of different occupations. Additionally, a rich literature has examined disparities in educational attainment and subsequent labor market outcomes by gender and race. Populations, including women and minoritized racial/ethnic groups, that experience increased discrimination in the labor market tend to pursue additional educational credentials (Lang & Manove, 2011). Accordingly, our analysis considers sector-level outcomes separately and examines differences by gender.

4 Data and Analytic Sample

Our data come from several public agencies, and we combined them to construct a novel data set to understand the impacts of CCPT grant receipt on postsecondary enrollment. First, we used data from the California Department of Education (CDE) that includes the original grant applications (i.e., narrative, partner lists), the application rubric, and rating score used to determine funding. We used the application narrative with the accompanying appendices containing the list of proposed partners to obtain the postsecondary institution(s) for each applicant. Most of the applicants provided information on their postsecondary partner(s), and we used these lists to locate publicly available data for the postsecondary institutions[3]. More specifically, the postsecondary data includes enrollment from the Chancellor's Community College Office (CCCO) and enrollment & institutional characteristics (e.g., financial data, directory information) from the Integrated Postsecondary Education Data System (IPEDS) survey by the National Center for Education Statistics (NCES). Additionally, we acquired data on CTE-sector-specific enrollments (e.g., health, engineering etc.) from a state-sponsored data dashboard that contains rich data on student enrollment and outcomes for California community colleges[4]. Throughout this paper we focus on these sector-specific enrollments to examine outcomes for the specific career pathways that CCPT grant recipients expanded. We now turn to describing the distinct elements from these data sources.

[3] Of the 230 CCPT applicants, ten do not list postsecondary partners and thus have no postsecondary enrollment data. We estimate auxiliary RD models (see Appendix Table 1) and find that the likelihood of listing any postsecondary partner institutions is continuous across the grant eligibility threshold.

[4] The Launch Board portal is supported by the CCCO office and managed by a coalition of not-for-profit agencies to develop data dashboard metrics for community colleges and workforce programs (see https://www.calpassplus.org/LaunchBoard/Home.aspx)

The postsecondary administrative data provides rich student sociodemographic characteristics, sector-specific enrollments, and college-level characteristics. To construct outcomes, we relied on enrollments from CCCO that contain information for different age groups, racial/ethnic groups, and genders. These data represent enrollments across the academic year (i.e., all academic terms), and are thus comprehensive in terms of capturing student enrollment counts[5]. We complemented these data with directory and financial information from IPEDS including federal Pell grants received by students at the college, California state grant aid, and operating expenditures. The directory information includes the community college locale (e.g., rural, suburban) and whether the community college is part of a multi-site governance structure. We supplemented these data with the CTE sector specific enrollments cited for expansion most often by CCPT applicants–namely, health, information and communication technologies (ICT), and advanced manufacturing.

We now turn to the construction of our analytic sample–though we considered all grant applicants, we made several important exclusions. Overall, there were 230 CCPT applicants and 110 public community college partners. First, we excluded 12 applicants because they did not list any community college partners or have incomplete applications. This resulted in a final analytic sample of 110 community colleges and 218 CCPT applicants, which resulted in 595 unique K-12 community college partnerships. We further excluded partnerships that were missing baseline postsecondary enrollment data (n = 5) and directory or financial information from IPEDS (n = 23) resulting in an analytic sample of 567. Our analyses also relied on sector-specific

[5] We compare the comprehensive annual (i.e., fall, spring, and summer) enrollments available from the state with federal enrollment records maintained by IPEDS. The total enrollments from the state and IPEDS are highly correlated, however, IPEDS enrollments include fall enrollment counts only and do not contain sector-specific enrollments. For these reasons, we rely on the comprehensive state enrollment data.

enrollments which restricts the sample to include only those partnerships offering programs of study in each sector. We estimated auxiliary RD regressions that examined data availability for each of the restrictions listed above and find no evidence of any discontinuity at the grant eligibility threshold (see Appendix 1).

In Table 1, we present descriptive statistics for this sample. Our sample consists of community colleges of widely varying size, ranging from 2,800 to 68,000 unique students engaged in course taking, with an average annual enrollment count of approximately 20,000 students. Enrollment at the community colleges in our sample are majority female–on average, 53.3 percent–similar to national trends in community college enrollment (58.2 percent nationally)[6]. Many of the community colleges serve a plurality of Hispanic/Latino students with an average of 37.9 percent (22.4 percent nationally) with students identifying as White being the second largest demographic (32.3 percent versus 39.3 percent nationally). Mirroring California demographics, Asian students outnumber Black students, 9.9 percent and 7.6 percent, respectively. We focused on the health, ICT, and advanced manufacturing pathways[7] because these were the most frequently cited pathways amongst applicants due to their projected labor market growth and the relatively higher wages for workers with certifications in these areas. Unsurprisingly, CTE-sector specific enrollments mirror longstanding occupational sex segregation; for example, health enrollments were majority female (66 percent) and advanced

[6] All demographic estimates are from Fall 2022 enrollment figures for public 2-year college enrollees obtained from the National Student Clearinghouse Research Center "Current Term Enrollment Estimate" retrieved from https://nscresearchcenter.org/current-term-enrollment-estimates/

[7] Throughout this paper we provide outcomes based on enrollment data for the advanced manufacturing sector though CCPT applicants cited engineering/advanced manufacturing. We also estimate outcomes based on the combination of several engineering related sectors (i.e., advanced manufacturing and engineering, construction and utilities) and find qualitatively similar results.

manufacturing enrollments were majority male (78 percent) whereas ICT sector enrollments were closer to parity (53 percent male).

For our study, we focused on two distinct age-defined cohorts to delineate between those affected by CCPT grant investments (i.e., intent to treat =1) and unaffected cohorts (i.e., intent to treat=0). For our main outcome, we focused on the enrollment of students who were 19 or younger, 4 and 5 years after CCPT grants are awarded because this cohort was the only age group impacted by the creation (or expansion) of career pathways at the partner high schools. As previously mentioned, the duration of CCPT grants was 3 years, so we examine outcomes 4 and 5 years after initial CCPT grant receipt to represent the cohorts who enrolled in postsecondary institutions after attending a treated high school for the duration of a career pathway sequence. The older student cohort (i.e., ages 25-29), are unaffected by the expansion and creation of career pathways and serve as a control group or a "placebo" test because they enrolled in high school prior to the CCPT grant investments[8]. Critically, the older cohort may be impacted by CCPT investments made at the postsecondary institution and thus provide an important opportunity to assess whether the career pathway strategy of supporting transitions from high school to college were operationalized by the CCPT funded partnerships. We discuss the placebo tests in greater detail in the following section describing our analytic strategy.

5 Analytic Strategy

5.1 Estimation strategy

[8] We chose this age group because they do not overlap in high school with the treated cohorts but face similar labor market opportunities as relatively young workers. The 20-24 age group may contain some students who experienced CCPT investments for part of their high school experience.

We estimated the postsecondary enrollment effects of the CCPT grant using a regression discontinuity (RD) design based on the assignment rule that provided CCPT applicants with a grant if their application score was above a prespecified threshold. We compare those applicants with scores just above the grant receipt threshold (i.e., intent to treat=1) to those applicants who just missed the grant award benchmark (i.e., intent to treat=0). The estimation strategy can be described as follows:

$$Y_{id} = \beta I(CCPTScore_i \geq 0) + f(CCPTScore_i) + X_d + \boldsymbol{\tau} + \varepsilon_{id} \quad (1)$$

Where $I(CCPTScore_i \geq 0)$ is an indicator for whether the application score was above the minimum specified threshold for the applicant, *i*, that partnered with community college, *d*. The variable, X_d represents college-level baseline characteristics, $\boldsymbol{\tau}$ represents a vector of fixed effects for cohort and the grant level amount. Finally, ε_{id} represents the error term, which are clustered at the applicant level. The estimand of interest, β represents the change in enrollment at the CCPT assignment threshold controlling for a function of the application score $f(CCPTScore_i)$.

The causal warrant of the regression discontinuity estimation strategy relies on the assumption that the two groups of applicants, those who scored one point above and one point below the score cutoff, are approximately equal, except that one group received a large grant to create career pathways. In other words, to provide credibly causal estimates of increased funding for career pathways on subsequent outcomes, the only change at the margin of CCPT grant award status is the probability of grant receipt. Guidance put forth by the What Works Clearinghouse (WWC) (2022) provides standardized recommendations for ensuring that a RD

design meets the “as good as random” assignment assumption to merit causal interpretation (Lee & Lemieux, 2010).

The first consideration, the integrity of the forcing variable, requires that there is no evidence of systematic manipulation of the assignment variable. We use both our institutional knowledge of the application process and empirical analyses (i.e., density test) to assess whether treatment assignment could be manipulated. Specifically, we employed the density test proposed by Cattaneo, Janson, and Ma (2020). While applicant identity was known to the professionals assessing application quality, a pre-established rubric, external raters and the averaging of three independent scores makes it unlikely that CPPT applicant scores were easily manipulated on any scale.

The second standard concerns the threat of non-random attrition and evidence of balance for baseline covariates. We included data from all grant applicants with complete data, and conducted auxiliary RD estimates of data availability (See Appendix Table 1) to determine whether differential attrition is present. If assignment to the CCPT grant is “as good as random” then we expect applicant baseline characteristics to be smooth at the grantee assignment threshold. While Bonilla (2020) provided evidence of well-established equivalence at the baseline based on K-12 characteristics, for this study, we provided evidence of baseline equivalence of the postsecondary partner institutions attributes. The third related standard requires continuity between the outcome, enrollment, and the forcing variable. To address this standard we examined baseline equivalence in postsecondary enrollment, overall, by sector and by subgroup at baseline.

The final standard addresses the sensitivity of the results to functional form considerations and the range of the assignment variable (i.e., bandwidth) used to estimate results. We estimated various specifications including linear and quadratic splines in addition to visual inspection of the data to inform our intuition around bandwidth selection and functional form. Importantly, we showed results of local linear regressions using observations in increasingly smaller bandwidths close to the grant assignment threshold (Lee & Lemieux, 2010). We used an empirically computed method for determining bandwidth size based on a local-polynomial density estimator proposed by Cattaneo and colleagues (2018). Further, in addition to standard rectangular weights we estimated our results using triangular kernel weighting, in which observations closer to the threshold are given a progressively greater weight compared to distal observations (Fan & Gijbels, 1996). Finally, we augmented these considerations with additional models that exclude the largest observation by a great order of magnitude (Los Angeles Unified School District), examined estimates weighted by applicant size (i.e., community college enrollment at baseline), and specifications that transform enrollment counts to their log equivalent. We also attend to literature on construct validity and the administrative details of the grant to inform our estimation strategy.

The literature on dynamic treatment effects suggests fitting treatment effects at different points in time (i.e., 1 year after treatment, 2 years after treatment etc.) rather than assuming constant effects. We implemented this strategy and relied on estimates 4 and 5 years after grant receipt to allow students to transition completely from the high school career pathway to the postsecondary partner institution. Importantly, we also included fixed effects for the cohort

which also captures time-varying changes that may differentially affect postsecondary enrollment, such as labor market conditions.

5.2 Treatment Assignment

We used the same assignment variable (i.e., CCPT grantee rating score) as Bonilla (2020) and complemented the evidence provided on the well-behaved nature of the RD with additional checks to support the causal warrant of our analytic approach. We demonstrate the integrity of the assignment variable in Figure 1. First, we show the first-stage relationship between application scores and grant receipt in Figure 1a. The relationship is fuzzy: At the assignment threshold there is a shift of 0.846 in the probability of grant receipt. As previously mentioned, there is one applicant that received a CCPT grant despite having an average score below the designated threshold; because of this discrepancy, we proceeded with an intent to treat approach throughout this paper. Second, we examined the assignment variable for evidence of heaping—namely, clustered values of the forcing variable that would suggest applicants or the raters were manipulating rating scores to choose treatment status. Figure 1b contains a histogram of the assignment variable that shows no concerning pattern of heaps over the distribution of applicant scores. Third, we estimated the Cattaneo, Jansson and Ma (2018) density test with a value of 0.015 at the discontinuity with a standard error of 0.792, further bolstering the well-behaved nature of the RD design.

While Bonilla (2020) found that the baseline characteristics of K-12 district partners were continuous at the assignment threshold, we complemented her checks by further examining the baseline covariates for the community college partners. We conducted auxiliary RD regressions of the estimated effect of having an application rating score above the centered assignment

threshold, $I(CCPT_i \geq 0)$, on the attributes of the community college partners at baseline, whose results are shown in Table 2. As expected, the attributes of the community college partners were similarly continuous at the grantee threshold prior to the announcement of the CCPT grant competition. Together, this empirical evidence provides a strong basis for the causal warrant of our RD design. We now turn to describing our main results.

6 Results

The hypothesis that career pathway funding has a causal impact on postsecondary enrollment suggests that any enrollment increase would be uniquely observed for those student cohorts who experienced increased access to career pathways during high school. In other words, we expect the treated cohorts to experience an increase in postsecondary enrollment while older cohorts, who attended high school in the absence of career pathways funding and high school–college partnerships, would be unaffected. First, we begin by examining overall enrollment for the treated cohort, those students aged 19 or younger, 4 and 5 years after the CCPT grant was awarded in Table 3. The top row of each panel (i.e., 4 and 5 years after treatment) in Table 3 depict total community college enrollment (i.e., enrollment in any program), which show no statistically significant increase at the threshold for grant receipt. Overall enrollment figures, however, may obscure patterns of enrollment changes for those career pathways specifically targeted by the CCPT grant.

We subsequently examined enrollments in the sectors most targeted by the grant applicants: health, advanced manufacturing, and ICT. Health care pathways were the most commonly proposed career pathway by grant applicants. Notably, we report statistically

significant increases in health enrollment in years 4 and 5, respectively, with increases in enrollment of 13.5 percent to 14.8 percent (i.e., equivalent to 40 to 43 additional students). We privileged the linear estimates for all models based on our examination of Akaike's Information Criterion. Figure 2 depicts the increase in health enrollment visually. Interestingly, Bonilla (2020) found that the CCPT grant effect of reduced high school dropout stemmed from female students and posited that female students may have been more likely to enroll in targeted health care pathways due to gender norms. We saw no evidence of enrollment increases for ICT nor advanced manufacturing, the second and third most-cited career pathways for expansion by CCPT applicants. Importantly, these results suggest that career pathways funding may not have increased overall postsecondary enrollment but rather shifted the distribution of enrollments towards health, a sector experiencing above average growth in employment compared to overall employment growth[9].

Given the previous gender-specific findings for high school educational attainment we examine treatment heterogeneity. Unfortunately, specific data on gender by age group is not available for sector-specific enrollments. However, we were able to examine imperfect gender-based differences in enrollment by examining the age-inclusive female subgroup (i.e., female students of all ages). Table 4 depicts gender-specific enrollments by sector with increases in health enrollments that appear to be driven by increased female enrollments. Though the estimates for females are not statistically significant in year 4 and only marginally significant in year 5, the enrollment counts include treated and untreated cohorts, obscuring the unique

[9] According to the Bureau of Labor Statistics Occupational Outlook Handbook, health occupations are projected to grown 13 percent by 1.9 million jobs between 2021 and 2031. See https://www.bls.gov/ooh/healthcare/home.html

contribution of the treated cohort of females. In summary, the results provide suggestive evidence that the treated female cohort's enrollment in health sector programs was facilitated by career pathways.

Given the outsized growth of the health care sector, we might anticipate that any increases in health enrollments simply reflect greater investments by individuals and postsecondary institutions to respond to labor market demand for health care workers. One way to examine this theory is to estimate auxiliary regressions of postsecondary enrollment for students aged 25-29. Notably, the students aged 25-29 were unaffected by the CCPT grant funding but may have been affected by other investments that college partners were making to expand targeted sectors. In Table 5 we present null impacts for this untreated subgroup in (Column 3) in contrast to increases in health enrollments for treated students (Column 1). There is no evidence of enrollment changes for advanced manufacturing or ICT. These findings for health enrollments suggest that the younger cohorts attending schools with expanded and new pathways uniquely shifted their enrollments into postsecondary pathways in the health sector. Critically, the treated and untreated cohorts faced similar labor market opportunities including increased opportunities in the health sector. Indeed, it is important to mention that the enrollment figures we are examining are pre-COVID 19, in which there was a particularly substantial increase in job opportunities in healthcare, therefore this would not be a confounding factor in our enrollment data for the health sector. These findings suggest that high school–postsecondary partnerships play an important role in informing and guiding students.

Our estimates are imprecise given the relatively small number of high school and postsecondary partnerships across the state. Table 6 shows that estimates based on increasingly

tighter bandwidths around the cutoff threshold are statistically imprecise, with standard errors increasing over 60 percent for the tightest bandwidths. Remarkably, the direction and order of magnitude of the estimates and the direction remains relatively consistent. We also estimate models with log enrollment outcomes, weighted estimates and estimates that omit the largest applicant by orders of magnitude (Los Angeles) and found qualitatively similar results of health enrollment increases 4 and 5 years later for the treated cohort (Appendix Table 1). Because we relied on the age group data to identify the treated cohorts and those are not available by enrollment sector for racial/ethnic and gender subgroups we cannot provide specific estimates for treated cohorts by these demographic categories. However, we estimate impacts for racial and ethnic subgroups of all ages (Appendix Table 2). These estimates combine estimates for the treated and untreated cohorts and provide suggestive evidence that female and white enrollments may have increased at the postsecondary partners' health program of study.

7 Discussion

This study provides evidence, using RD designs, that the receipt of grant funding to establish and expand career pathways between K-12 and community college leads to an increase in students pursuing healthcare training at partner community colleges. Our findings are based on a unique at-scale effort of $500-million-dollar effort to seed the establishment and expansion of career pathways in high-growth and high-wage occupations. While we find evidence of enrollment growth in health care pathways, we find no evidence of increases in the other programs targeted for expansion including manufacturing, engineering, and ICT programs of study. Our findings are consistent with students substituting away from other community college

programs to the health care sector because we find no net increase in overall community college enrollments. These results highlight the potential of aligned career pathways as a promising intervention to bring students ’educational and occupational training choices in alignment with the labor market.

Our findings build on a robust and growing literature on how participating in CTE education in high school effects educational attainment. While a growing number of studies find positive gains for high school completion for CTE participants, studies examining the transition to college have found small (Cellini, 2006; Hemelt et al., 2019; Theobald et al. 2019) or null impacts (Brunner et al. 2021; Gottfried & Plasman, 2018; Kemple & Willner, 2008). These contrary findings may be the result of two potential sources of heterogeneous treatment effects. First, CTE education and career pathways comprise a diverse group of sectors that may result in different labor market requirements. For example, construction career pathways pursued in high school may qualify participants for direct entry into the labor market. Second, the availability of CTE career pathway training may have differential impacts on participants based on their sociodemographic attributes. Labor market outcomes are correlated with race/ethnicity and gender due to labor market discrimination, employer, and worker preferences (Lang & Spitzer, 2020). In this study, we estimate the postsecondary enrollment impacts separately by sector and by student attributes due to a key feature of the competitive grant process that required applicants to identify plans for creating and growing sector-specific career pathways.

Consistent with recent research (Ecton & Dougherty, 2023) on the varied impacts of high school CTE outcomes, we found evidence for two forms of treatment heterogeneity in our setting. First, increases in postsecondary enrollment are evident in the health career pathway and

not in the manufacturing, engineering, and ICT pathways. These results suggest that the impacts of CTE access in high school are unlikely to be uniform and that sector-specific analyses are critical in future work. Secondly, female enrollments in health career pathways appear to drive the health pathway enrollment increase. Gender sorting into occupations is an enduring characteristic of the U.S. labor market and career pathway availability may reinforce existing gender segregation without targeted interventions to increase the representation of underrepresented groups (Montoya, Peterson, & Bonilla 2020). The role that CTE plays in reinforcing or breaking down these gender norms should be further explored in future research.

Proponents of CTE education in high school have embraced career pathways as a pragmatic and inclusive curricular approach that combines academic and workforce-focused skill building. A clear channel through which CTE education may improve students ’labor market prospects is through increased educational attainment. The evidence for increased high school completion across numerous studies supports this theory of change. Career pathways may also support transitions to postsecondary education by inducing new and/or existing high school graduates to pursue college. Our results suggest that CTE education in high school may influence students already graduating and enrolling in postsecondary institutions by shifting enrollment to targeted programs. Federal policy has incentivized state education agencies to grow enrollment in high-demand fields, particularly health and applied STEM (Bonilla, Dougherty & Ecton, forthcoming). Shifting student enrollment and certifications to these high-demand occupations may result in increased labor market participation and earnings.

In summary, the results of this study provide leading evidence on the at-scale impacts of a statewide investment to increase access to and participation in aligned K-12 postsecondary

career pathways. The unique features of this grant competition allowed for the use of a robust research design that corresponds with a growing body of evidence on the impacts of high school CTE education on postsecondary enrollment. Our results are distinctive in that they represent findings for a large U.S. state and provide sector-specific analyses of career pathway outcomes. The results suggest that future research must attend to sector-specific outcomes and how CTE participation and outcomes affect students based on their gender identity.

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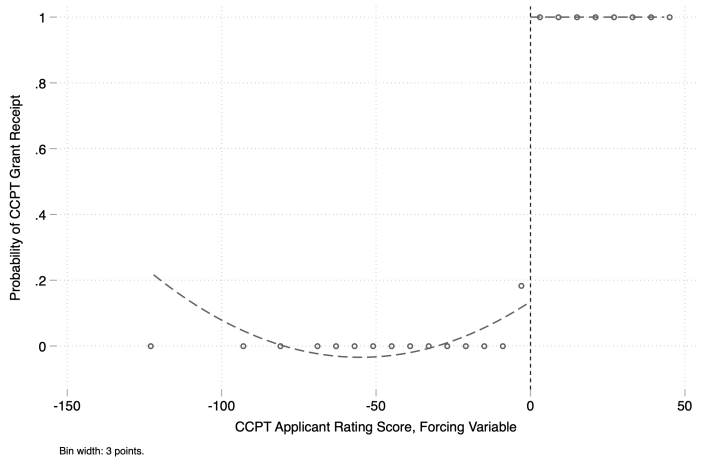
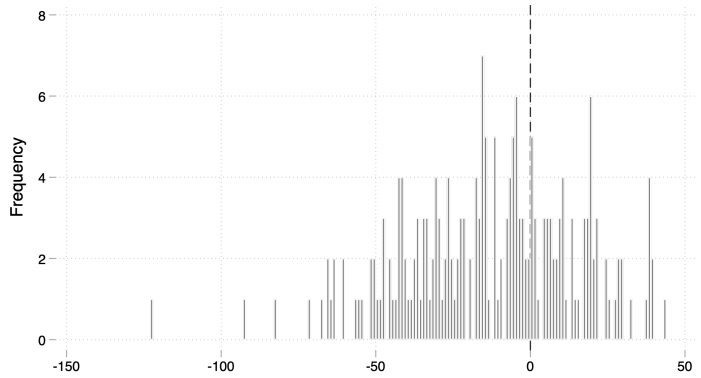
(a) First-stage, CCPT grantee status



(b) Histogram of assignment variable



(c) Density of assignment variable

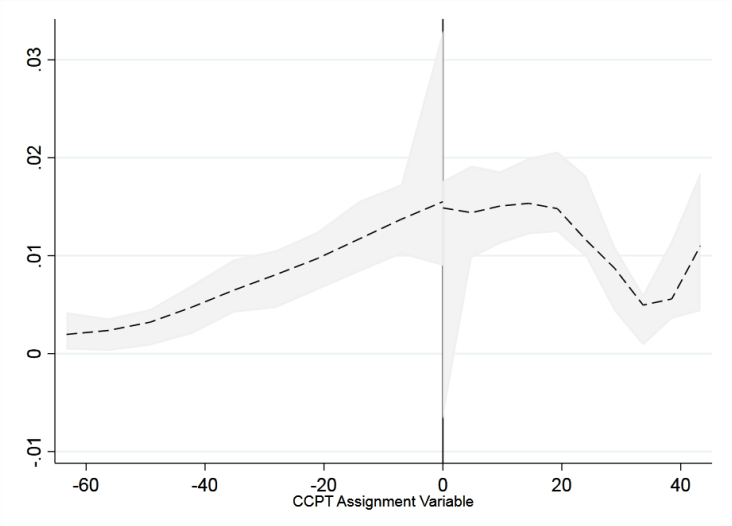
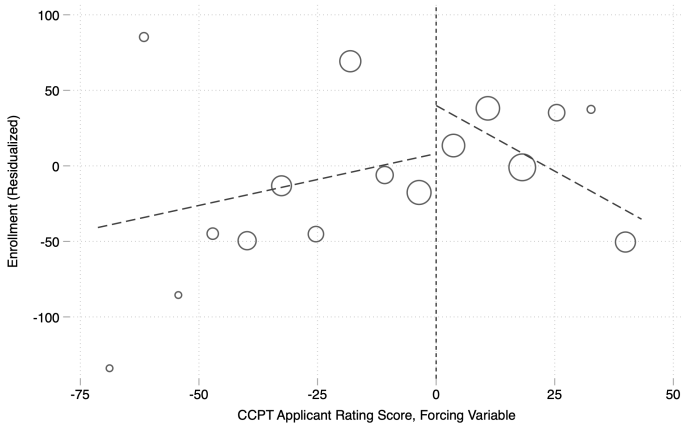


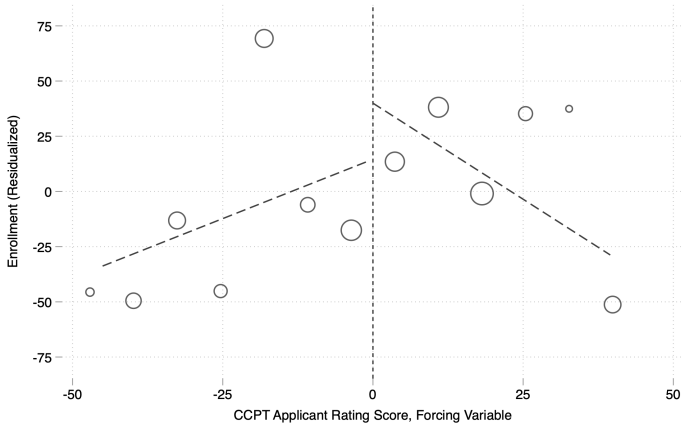
Figure 1. Visual evidence for the integrity of the assignment variable.

Notes: Graphs of the forcing variable (i.e., CCPT application rating score), centered at award threshold. All Graphs utilize the full sample and a bin width of 3 assignment score points.

(a) 4 years after treatment, full sample



(b) 4 years after treatment, +/- 45



(c) 5 years after treatment, full sample

(d) 5 years after treatment, +/- 45

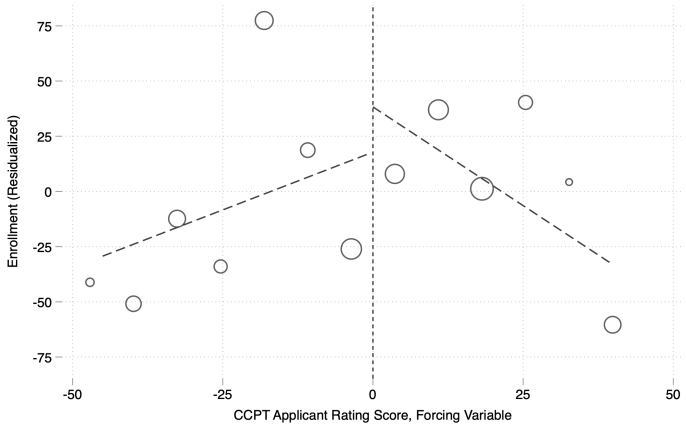


Figure 2. Measures of Postsecondary Health Enrollment, Age 19 or Less

Notes: Graphs of the forcing variable (i.e., CCPT application rating score), centered at award threshold, and measures of postsecondary enrollment in CTE health fields. Graphs (a) and (c) utilize the full sample and graphs (b) and (d) use a bandwidth of +/- 45 points. All graphs use a bin width of 7.25 points.

Table 1. Descriptive Characteristics

Variable	Mean	Std. Dev.	Minimum	Maximim
Application Characteristics				
CCPT Grant Recipient (Year 1 or 2)	0.639	0.481	0	1.0
CCPT Score (centered)	3.2	21.65	-83.3	43.3
I(CCPT Score$_i \geq 0$)	0.636	0.481	0	1.0
Round 1 applicant	0.473	0.500	0	1.0
Round 2 applicant	0.527	0.500	0	1.0
600,000 dollar grant	0.055	0.229	0	1.0
6 million dollar grant	0.448	0.498	0	1.0
15 million dollar grant	0.496	0.500	0	1.0
Enrollmemt Outcomes				
Health, age 19 or less, 4 years later	99.3	94.9	10	526
Health, age 19 or less, 5 years later	43.7	29.8	10	157
Adv. Manufacturing, age 19 or less, 4 years later	139.7	131.5	10	500
Adv. Manufacturing, age 19 or less, 5 years later	100.0	132.7	10	757
ICT, age 19 or less, 4 years later	289.7	253.4	11	1083
ICT, age 19 or less, 5 years later	226.9	170.2	21	1180
Baseline Characteristics				
Total Enrollment	9265.55	5930.83	1391	38908
Male	0.457	0.061	0.316	0.772
Female	0.533	0.059	0.227	0.684
Asian	0.099	0.085	0.005	0.384
Black	0.076	0.074	0.006	0.446
Hispanic	0.379	0.158	0.127	0.894
White	0.323	0.157	0.014	0.737
Multiethnic	0.034	0.015	0.002	0.075
Age 19 or less	6508.44	3673.28	799	16193
Age 25 - 29	1574.21	1089.30	276	7962
Per pupil Pell Grants ($)	1290.27	452.39	520.67	2590.03
Per pupil state aid ($)	281.92	315.37	0.00	1157.18
Per pupil operating expenditures ($)	7762.94	1769.21	4168.61	12945.63

Notes: Sample includes 218 CCPT grant applicants that partnered with one or more of the 110 community colleges, leading to 607 unique partnerships. The student enrollment outcomes retrieved from the California Community College Chancellors Office (https://datamart.cccco.edu/). Financial data and institutitonal characteristics retrieved from IPEDS. N = 218 for application characteristics, N = 110 for CCCCO Datamart data, and N = 114 for IPEDS data. Outcome data comes from Launchboard, with N = 567. Abbreviations: CCPT, California Career Pathways Trust. ICT, Information and Communication Technologies.

Table 2. Auxiliary RD estimates of baseline covariate balance

	(1)	(2)	(3)	(4)
Sample:	Full Sample		1 SD ($CCPT_i$)	0.5 SD ($CCPT_i$)
Baseline Covariate				
Per pupil Pell Grants	5.259	-1.186	13.830	-40.989
	(23.106)	(31.693)	(31.034)	(68.906)
Per pupil state aid	-13.585	-19.714	-9.766	-23.258
	(9.627)	(12.004)	(10.427)	(15.639)
Per pupil operating expenditures	101.931	165.498	60.461	47.315
	(111.448)	(169.367)	(151.343)	(228.877)
Multi-system college	0.037	0.065	0.099	0.160
	(0.056)	(0.080)	(0.080)	(0.109)
Rural	-0.036	0.020	-0.019	-0.034
	(0.034)	(0.054)	(0.051)	(0.069)
Suburban	-0.068	-0.100	-0.100	-0.047
	(0.072)	(0.103)	(0.100)	(0.143)
Female	0.003	0.001	-0.001	-0.002
	(0.002)	(0.003)	(0.003)	(0.003)
White	0.003	0.002	0.005	0.009
	(0.002)	(0.004)	(0.003)	(0.005)
Black	-0.001	-0.000	-0.000	-0.000
	(0.001)	(0.002)	(0.001)	(0.002)
Asian	0.002	0.008	0.001	-0.001
	(0.005)	(0.007)	(0.007)	(0.008)
Hispanic/Latino/a	-0.004*	-0.003	-0.002	-0.001
	(0.002)	(0.004)	(0.003)	(0.004)
Multiracial	-0.001	-0.007	-0.005	-0.003
	(0.002)	(0.004)	(0.003)	(0.004)
Total enrollment (log)	-0.010	-0.024*	-0.010	-0.012
	(0.008)	(0.011)	(0.010)	(0.013)
Unemployment rate	-0.000	-0.046	-0.061	-0.011
	(0.096)	(0.148)	(0.115)	(0.134)
N	567	567	372	234
Controls	yes	yes	yes	yes
Linear spline	yes	yes	yes	yes
Quadratic spline	no	yes	no	no

Notes: Each cell contains the result of a separate regression of the estimated effect of $I(CCPT_i \geq 0)$ on the listed baseline covariate and the indicated controls (e.g., functional form). The baseline control variables included in these models are from 2013, before the CCPT grant competition was announced; see Table 1 for a complete list. Applicant group clustered standard errors in parentheses.

*** $p < .001$ ** $p < .01$ * $p < .05$.

Table 3. Reduced-form RD estimates of enrollment by sector

	(1)	(2)	(3)	(4)
	4 years after treatment			
Sector	est.	est.	mean	n
Total enrollment, 19 or less	89.103	-156.663	6028.4	567
	(199.508)	(280.897)		
Health, 19 or less	43.069**	29.607	2823.0	532
	(21.834)	(29.471)		
Advanced Manfacturing, 19 or less	12.219	5.521	84.8	380
	(15.303)	(21.577)		
ICT, 19 or less	-3.117	32.135	102.3	559
	(29.520)	(40.080)		
	5 years after treatment			
	est.	est.	mean	n
Total enrollment, 19 or less	44.047	-339.548	6293.9	567
	(198.553)	(279.258)		
Health, 19 or less	40.558*	9.388	70.7	537
	(22.891)	(29.249)		
Advanced Manufacturing, 19 or less	17.918	19.280	50.9	383
	(17.991)	(26.664)		
ICT, 19 or less	-15.348	16.300	180.1	554
	(29.739)	(41.063)		
Linear spline	yes	yes		
Quadratic spline	no	yes		

Notes: Each cell contains the result of a separate regression of the effect of I(CCPT Score$_i$ > 0) on total enrollment of treatment students (i.e., aged 19 or less) for total enrollment and the top three sectors identified by CCPT applicants. All models condition on a linear spline of the assignment variable and the full set of baseline controls (See Table 1). ICT, Information and Communication Technologies. Applicant group clustered standard errors in parentheses.

*** p < .01 ** p < .05 * p < .1.

Table 4. Reduced-form RD estimates by sector and student gender

	(1)	(2)	(3)	(4)
	Enrollment 4 years after treatment, male		Enrollment 4 years after treatment, female	
Sector	est.	mean	est.	mean
Health	-36.980	544.4	56.077	1106.7
	(32.384)		(37.757)	
Advanced Manufacturing	-6.605	443.8	-3.955	74.0
	(30.532)		(25.049)	
ICT	-36.247	1370.7	-18.395	1148.1
	(42.869)		(36.511)	
	Enrollment 5 years after treatment, male		Enrollment 5 years after treatment, female	
	est.	mean	est.	mean
Health	-35.132	549.2	73.807*	1131.2
	(32.286)		(40.354)	
Advanced Manufacturing	14.159	445.8	9.985	76.7
	(39.385)		(9.025)	
ICT	-38.944	1380.6	-18.566	1137.2
	(44.247)		(37.095)	

Notes: Each cell contains the result of a separate regression of I(CCPT Score$_i$ ≥ 0) on student enrollment for different sectors, by gender. Columns 2 and 4 contain the dependent variable mean (i.e., female health enrollment five years post treatment). All models condition on a linear spline of the assignment variable and the full set of baseline controls (See Table 1). N= 567 applicant-community college pairs for all regressions. ICT, Information and Communication Technologies. Applicant group clustered standard errors in parentheses.

*** p < .01 ** p < .05 * p < .1.

Table 5. Auxilliary RD estimates by sector and treatment status

	(1)	(2)	(3)	(4)
	Enrollment 4 years after treatment,			
	Age 19 or less		Age 25-29	
Sector	est.	mean	est.	mean
Health	43.069**	2823.0	-5.246	1621.9
	(21.834)		(6.934)	
Advanced Manufacturing	12.219	84.8	-4.748	2581.6
	(15.303)		(6.538)	
ICT	-3.117	102.3	-9.645	43.7
	(29.520)		(10.592)	
	Enrollment 5 years after treatment,			
	Age 19 or less		Age 25-29	
	est.	mean	est.	mean
Health	40.558*	70.7	-0.709	1691.6
	(22.891)		(7.651)	
Advanced Manufacturing	17.918	50.9	1.686	2581.8
	(17.991)		(9.030)	
ICT	-15.348	180.1	-7.543	176.0
	(29.739)		(10.674)	

Notes: Each cell contains the result of a separate regression of I(CCPT $Score_i \geq 0$) on student enrollment for different sectors for the treated age group (i.e., age 19 or less) and the placebo control (i.e., age 25-29). Columns 2 and 4 contain the dependent variable mean. All models condition on a linear spline of the assignment variable and the full set of baseline controls (See Table 1). N= 567 applicant-community college pairs for all regressions. ICT, Information and Communication Technologies. Applicant group clustered standard errors in parentheses.

*** $p < .01$ ** $p < .05$ * $p < .1$.

Table 6. Reduced-form RD estimates of postsecondary enrollment with bandwidth restrictions

	Health enrollment, 4 years later	5 years later	Sample size
Sample			
Full Sample	43.069**	40.558*	532
	(21.834)	(22.891)	
$\|CCPT\ Score_i\| \leq 25$	32.689	24.083	338
	(29.610)	(29.220)	
$\|CCPT\ Score_i\| \leq 20$	49.139	35.658	302
	(31.333)	(30.974)	
$\|CCPT\ Score_i\| \leq 15$	21.845	18.276	208
	(34.736)	(36.094)	
$\|CCPT\ Score_i\| \leq 10$	63.186	90.185*	162
	(47.254)	(46.913)	
Kernel Weights	37.469	28.135	338
	(28.765)	(28.064)	
CCT Optimal	31.473	26.836	202/238
	(35.178)	(31.572)	

Notes: Each cell contains a regression of age 19 or less enrollment in the Health program of study for community colleges within the specified bandwidth on $I(CCPT\ Score_i \geq 0)$, a linear spline of the assignment variable and baseline covariates. CCT= Calonico, Cattaneo & Titunik; The kernel and CCT estimates utilize triangular kernels. All other estimates utilize uniform weights. Applicant group clustered standard errors in parentheses.

*** p < .01 ** p < .05 * p < .1.

Appendix Table 1. Reduced-form RD estimates of health enrollment using alternative specifications

	(1)	(2)	(3)	(4)	(5)	(6)
	Age 25-29			Age 19 or less		
	4 years later	5 years later		4 years later	5 years later	
Sample	est.	est.	n	est.	est.	n
Full sample	-5.246	-0.709	542	43.069**	40.558*	532
	(6.934)	(7.651)		(21.834)	(22.891)	
Without LAUSD	-5.068	-0.575	536	42.756*	40.505*	527
	(6.980)	(7.688)		(21.795)	(22.844)	
Weighted by enrollmen	-1.467	7.435	542	48.386*	55.387*	532
	(9.405)	(10.495)		(29.166)	(32.062)	
Log(enrollment)	-0.055	-0.038	542	0.168*	0.182**	532
	(0.054)	(0.057)		(0.094)	(0.091)	

Notes: Each cell contains a regression of health enrollment for the placebo age group, in columns 1 and 2, or the treated age group, in columns 4 and 5, on I(CCPT Score$_i$ ≥ 0), a linear spline of the assignment variable and baseline covariates. Columns 3 and 6 contain the number of applicant-college partnerships in the bandwidth. LAUSD: Los Angeles Unified School District. Applicant group clustered standard errors in parentheses.
*** p < .01 ** p < .05 * p < .1.

Appendix Table 2. Reduced-form RD estimates of health enrollment by racial/ethnic group and sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	4 years after treatment				5 years after treatment			
Subgroup	est.	est.	mean	n	est.	est.	mean	n
19 or less	43.069**	29.607	2823.0	532	40.558*	9.388	70.7	537
	(21.834)	(29.471)			(22.891)	(29.249)		
Hispanic/Latino	12.657	-11.642	223.9	547	16.263	-2.296	251.5	549
	(36.844)	(50.846)			(40.109)	(56.339)		
Asian	-3.384	16.124	42.7	515	7.540	19.241	54.8	519
	(14.018)	(21.037)			(14.130)	(22.220)		
African American	-13.065*	-16.191	2909.2	524	-15.631*	-16.899	2823.0	527
	(7.756)	(10.571)			(8.514)	(11.561)		
White	35.977	6.013	247.0	537	54.804**	7.549	30.4	545
	(23.728)	(34.583)			(24.846)	(33.324)		
Female	56.077	52.583	2823.0	547	73.807*	54.959	74.0	549
	(37.757)	(54.702)			(40.354)	(57.832)		
Male	-36.980	-71.693*	287.6	547	-35.132	-79.777*	262.7	537
	(32.384)	(43.363)			(32.286)	(43.107)		
Quadratic Spline	no	yes			no	yes		

Notes: Each cell contains the result of a separate regression of I(CCPT Score$_i$ ≥ 0) on enrollment in the health sector for different subgroups. Columns 3 and 6 contain the dependent variable mean. All models condition on a linear spline of the assignment variable and full set of baseline controls (See Table 1). Applicant group clustered standard errors in parentheses.

*** p < .01 ** p < .05 * p < .1.