



CTE | Career & Technical Education
RESEARCH NETWORK



Understanding the Counterfactual for Program Evaluation of Career and Technical Education

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Interpreting Program Evaluations in CTE

- Opportunities for selection in and out programs (internal validity)
 - Selection of a comparison or control group for CTE participants
 - CTE capacity adjusted to historic and current demand
 - Access to limited electives managed by informal process
- Variety of contexts in which CTE is delivered (external validity)
 - CTE in traditional schools, supplemental centers, stand-alone high schools
 - Students may select into sample based on anticipation of large returns from CTE or based on unobservables that reduce CTE returns.
- Experiences of control group relative to CTE students (Counterfactual)
 - Alternative avenues for obtaining CTE experiences
 - What treatment group experiences would be if they were in control group.
 - Program itself may change choices of those in control group

Approaches to Internal Validity

- Conditioning on observables including matching

$$E[Y_{1i}|x_i] - E[Y_{0j}|x_j] \text{ or } E[Y_{1i} - Y_{0j}|p(x_i) \approx p(x_j)]$$

- Instrumental variables (exogenous shock to incidence of treatment)

$$(E[y_i|z_i = 1] - E[y_i|z_i = 0]) / (E[T_i|z_i = 1] - E[T_i|z_i = 0])$$

- Regression discontinuity

$$E[Y_{1i}|x_i, c + b \geq x_i \geq c] - E[Y_{0i}|x_i, c \geq x_i \geq c - b]$$

- Lottery admissions or randomized treatment

$$E[Y_{1i}] - E[Y_{0i}]$$

Case Studies

- Conditioning on observables including matching
 - SRI International in 2016 of the California Linked Learning District Initiative
- Instrumental variables (exogenous shock to incidence of treatment)
 - Cullen, Jacob and Levitt (2005) investigation of school choice in Chicago
- Regression discontinuity
 - Brunner, Dougherty and Ross (2019) study admission to Connecticut Technical High School System
- Lottery admissions or randomized treatment
 - MDRC study of students admitted to Career Academies from 1993-1995

California Linked Learning District Initiative

- Districts selected among applying districts
 - High share of disadvantaged or minority students
 - Demonstrated track record creating career pathways
- Creation of certified linked learning pathways
- 46 pathways certified across the nine districts from 2006 to 2016
- Control group was a sample of all other students in each district
- Administrative data analyzed using regression analysis, survey data on student perceptions analyzed using propensity score matching

Threats to Internal Validity

- What schools would pathway participants have attended
 - Estimates fall from 13 percentage point increase in graduation to 11 points when control group is students attending traditional high schools
 - Students often select pathways at their assigned school (school as control)
- Pathway students may differ from non-pathway students in district
 - Estimates fall from 11 to 5 points after controlling for student attributes
- Existing quality pathways primary candidates for certification, and so students may have been in that pathway even without LLDI

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School Choice in Chicago Public Schools

- Examine effects of student choice into non-neighborhood traditional high schools, high achieving high schools, or career academies
- Use proximity to choice school to predict likelihood of attendance
- No effects found for choice into either non-neighborhood or high performing schools, but career academy attendance raises graduation rates by 5 percentage points for middle ability students
- However, proximity to assigned school also influences graduation rates

Threats to Internal and External Validity

- Location may affect performance directly (violating exclusion)
 - Note that proximity to home school was associated with student success
- School choice may have other effects like improved peers
 - Find of no effects from choice into high performing schools
 - Find no effects of peer quality in career academies
- IV only identified by compliers – distance actually affects treatment
 - Many students will not select career academy even if residing very close
 - Compliers likely students with strong preferences for career academy
- No documentation of how much career education is available to the “control group” of students residing further away from academies

Connecticut Technical High School System

- Stand alone school district with 16 dedicated technical high schools
- At scale, serving approximately 11,000 students, or 7% of all high school students in Connecticut
- Admission primarily based on a scoring system and analyzed using a noisy regression discontinuity approach
- Attendance raises male high school graduation rates by 10 percentage points and earnings in young adulthood by over 30 percent
- Effects largest when assigned high school has limited CTE options
 - Offerings explain only 20-30% of effect
- No effect on females who tend to pursue very different CTE programs

External Validity and Counterfactual

- Treatment effect is estimated for students who are near the admissions boundary
 - Most students are well above the boundary
 - Effects on marginal student important if policy involves expanding capacity
 - Minimal evidence of heterogeneity across students including over score
- Rough evidence of counterfactual provided
 - Model examines extent of CTE options for students who are not admitted
 - Course offering differences across schools cannot explain entire effect
 - Features of stand-alone schools: integrated curriculum, work based learning
- CTHSS experience likely very different than most CTE in U.S.

MDRC Study of Career Academies

- Small career focused learning communities in traditional high schools
- Three cohorts of students (1993-95) in nine schools across country
- Volunteers were randomly assigned to learning community or control
- High school completion same for treatment and control, but underlying rate of graduation very high
- Found positive effects on earnings (11 percent higher – effects concentrated on males) and higher marriage rates
- Efforts to measure “service contrast” through student survey
 - Treatment group higher on teacher and peer support, motivation for school, and perceived relevance of school work

External Validity and Counterfactual

- Effects may be different among those who take-up the program relative to non-compliers among the treated
 - Program had a high take-up rate (87%)
- Analysis of volunteers for new or experimental program may not generalize to population that would participate in at-scale program
- Service contrast may not capture influence of the program on the counterfactual experience
 - Survey findings focused more on sentiment rather than objective information on course work and specific career focused learning
 - Program may raise general interest in and salience of CTE
 - Losing the lottery may change perceptions of school environment

Summary and Conclusions

- Internal validity is critical given opportunities for student selection and simple regression or scoring techniques are insufficient
- External validity issues tend to be application specific
 - Effect for volunteers for a program, especially new or at-capacity program, may be different than effects for population
 - Estimated effects always for individuals who comply with treatment
 - Method determines whether effects are for average or marginal student
- Understanding the counterfactual for treated students if untreated
 - Detailed content of CTE treatment, CTE opportunities for control/untreated
 - Control group choices may differ from counterfactual choice of treated
 - Influence of program on control group or untreated individuals



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