Understanding the Counterfactual for Program Evaluation of Career and Technical Education

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American Educational Research Association Annual Meeting
April 10, 2021

The work of the CTE Research Network Lead is supported by the Institute of Education Sciences at the U.S. Department of Education with funds provided under the Carl D. Perkins Career and Technical Education Act through Grant R305N180005 to the American Institutes for Research (AIR). The work of the Network member projects is supported by the Institute. The opinions expressed are those of the authors and do not represent the views of the Institute or the U.S. Department of Education.
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
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
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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