A Case Study of Propensity Score Matching to Evaluate Undergraduate Research as High-Impact Practices

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More Need for Rigorous Evaluation

- Programs and High Impact Practices (HIPs) to increase overall retention/graduation rates and close achievement gaps
- Increased scrutiny on program funding and performance necessitates the proper evaluation of program efficacy
Challenges

- Randomized controlled experiments are not usually feasible
- Need a method to create comparable groups
- Remove confounds relate to outcome, e.g., academic preparation, gender, first generation college, URM etc.
Advantages of Propensity Score Matching Techniques

- PSM allow you to control for multiple confounding variables simultaneously.
- PSM is more appropriate for evaluating the “average treatment effect on the treated” (ATT), (i.e. participants) than other methods.
- Not as interested in the average treatment effect (ATE) on the entire population.
Propensity Score Estimation

- Assume the chance of participation is a function of observable variables
- Match people with a similar probability of treatment, but one received it and the other did not
- Therefore the difference in outcomes is due to the treatment
Matching

- Match cases with the closest propensity score(s), i.e. the “nearest neighbor” criterion
- Greedy algorithm pairs the first randomly chosen treatment with a control with the closest PS
- Proceed to the next treatment-control pair with the closest score and so on
Matching

- Compare the two groups on each predictor variable
- Use Mean, SD, effect size, graphs
- Add terms to the model such as new variables and/or interactions
- Stop when balance is achieved
Other Options & Nuances

- Calipers: only match if scores are within a range
- Optimal matching pairs the two groups such that the average difference in scores is minimized overall
- Other estimates of PS (probit, neural networks)
- Post-match Analysis as matched pairs
- Include covariates in post-match analysis
Related Techniques

- Stratify data based on PS quantiles (e.g., 5 groups)
- Propensity score weighting (PSW) assigns weights to cases based on the PS
- Use PS as a covariate
HIPS (High Impact Practices)
- Deepen Engagement & learning

- HIP Goal at Fullerton: Complete at least 2 HIPS
- Titans REACH Higher
  - Engaging Research
  - Participate Experience-based learning
  - Invest time & energy to become Active engaged learner
  - Become a contributing member of Community
  - Experience Diverse Cultures thru Human Explorations
Undergraduate Research

- Developing reflective understanding in major field
- Interaction, Motivation, Aspiration, Community of Practice
- Covariates Controlled in Propensity Score Matching
  - Participants vs. Non-Participants in Research Courses
  - Pre-College GPA, Campus GPA, SAT Score, Parent Education, Ethnicity, Sex, Total Units Earned, Low Income, Major, Local Area, Entering Characteristics, Full-/Part-Time, Matric Term, Enroll Term
- Outcome Measures:
  - Time-To-Degree
  - Graduation GPA
  - Post-Bac Graduate Program Enrollment
Propensity Score Matching

5 steps:

1) variables that tend to associate with participants’ characteristics were selected as covariates

2) set of covariates, logistic regression was conducted to estimate propensity score.

3) actual matching process was implemented, employing the nearest neighbor matching method

4) balance of covariates was checked

5) Post-Matching Analysis
   ◦ ANCOVA on Time-To-Degree & Graduation GPA
   ◦ Logistic Regression on Graduate Program Enrollment
Propensity Score Matching

Time-To-Degree (Months)

Participated in Research
Not Participated in Research
Propensity Score Matching
Propensity Score Matching

Graduate Program Enrollment

Participated in Research

Not Participated in Research