



# Using Big Data to Solve Economic and Social Problems

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HARVARD  
UNIVERSITY



# **The Causal Effects of Colleges**

# Causal Effects of Colleges

- Third factor needed to assess effects of higher education system on mobility:
  - Fraction of earnings variation across colleges due to causal effects
- Why does this matter?
  - Suppose differences in earnings outcomes between students at Harvard and another college were purely driven by selection of who gets in
  - Then reducing segregation across colleges would have no impact on mobility
  - But if differences reflect causal effects, changes in admissions policies could have a big impact on mobility

# Estimating the Causal Effects of Colleges

- Ideal experiment to estimate each college's causal effect: compare earnings at age 30 after random assignment of students to colleges
- Lacking such an experiment, need to find quasi-experimental variation that effectively allocates comparable students to different colleges
- Challenging problem because one needs one experiment per college
- Example: Zimmerman (2014) estimates causal effects by exploiting admissions cutoffs at Florida International University

# Regression Discontinuity Methods

- Zimmerman compares students just above and just below state-level GPA cutoff for admission to the Florida State University System

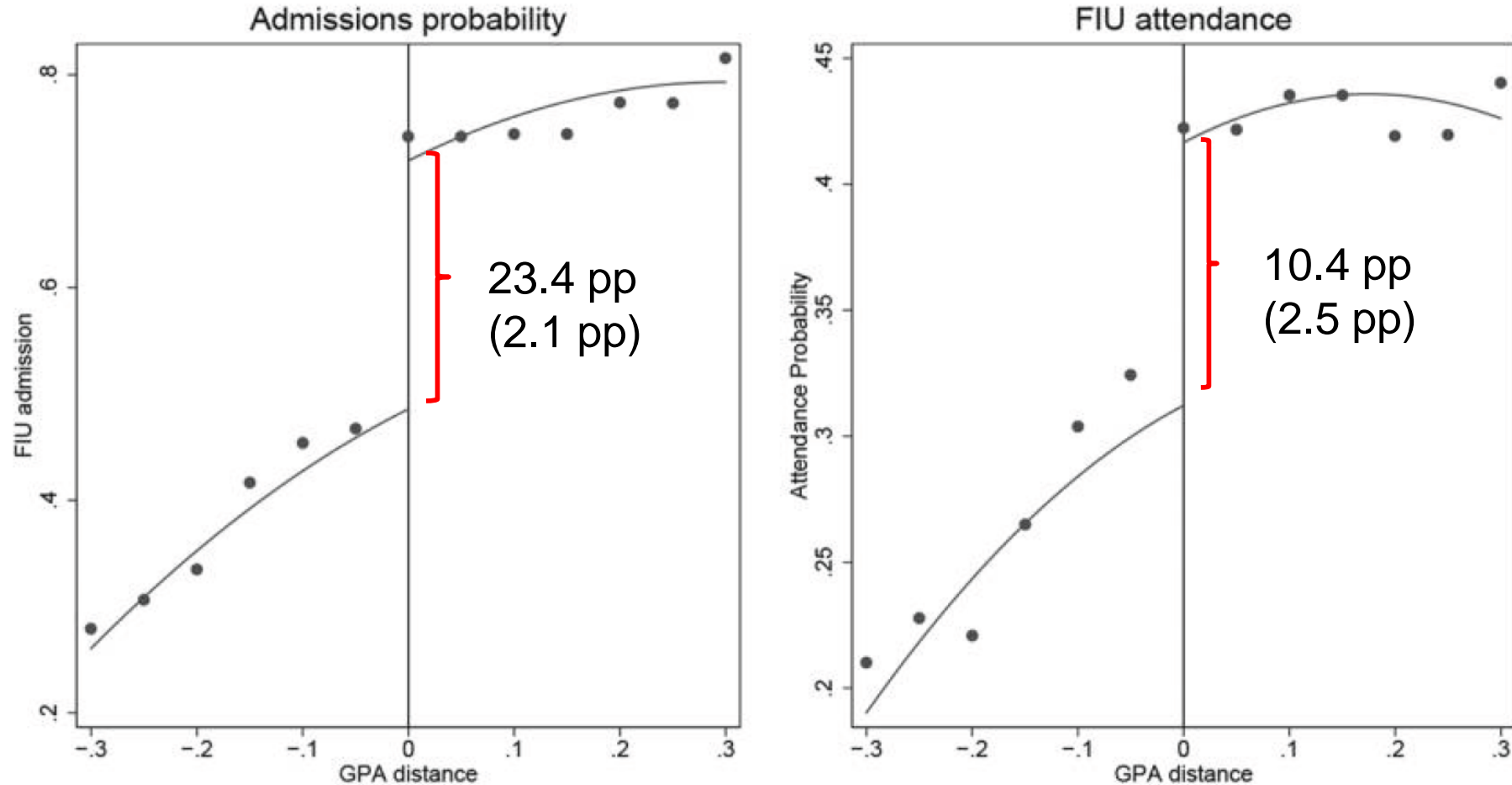
## Florida State University System Admissions Rules

SAT	Required GPA	Fraction of Marginal Applicants
1140	2.0	.00
1110	2.1	.00
1090	2.2	.00
1060	2.3	.00
1030	2.4	.01
1010	2.5	.01
1000	2.6	.01
990	2.7	.01
980	2.8	.02
970	2.9	.02
< 970	3.0	.73
Did not take	3.0	.19

SOURCE.—Florida Administrative Rule 6C-6.002.

NOTE.—Sample: marginal applicants are defined as all FIU applicants with FIU-computed GPAs within .3 grade points of their individual-specific cutoff GPA, computed using SAT scores.  $N = 6,542$ .

## Florida International University Admissions and Attendance Rates Around FIU GPA Admissions Cutoffs




# Regression Discontinuity Methods

- Zimmerman compares students just above and just below state-level GPA cutoff for admission to the Florida State University System
  - Those with GPA just above cutoff are “treatment” group and those below are “control”
  - Control group typically attends a two-year community college instead of FIU

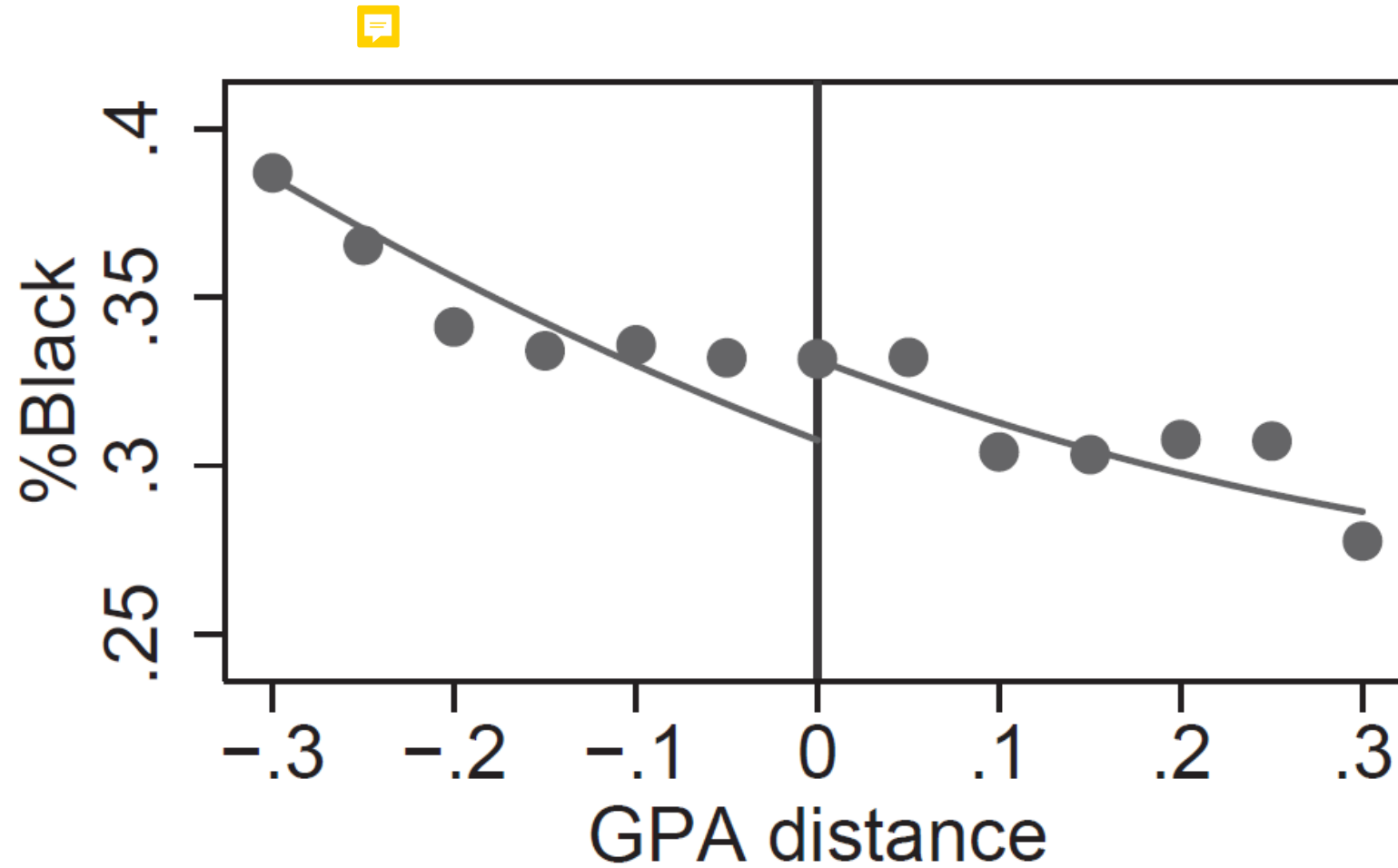


# Regression Discontinuity Methods

- Key identification assumption to estimate causal effects: all other determinants of earnings are balanced on either side of the cutoff 
  - Any difference in earnings at the threshold must then be due to the discrete jump in chance of attending FIU instead of community college
- Assumption is plausible because admission threshold was not publicized
  - If cutoffs were well publicized, may worry that students just above cutoff are different from those below (“manipulation” of running variable)
- Evaluate validity of assumption by making sure observable characteristics are similar on both sides of cutoff

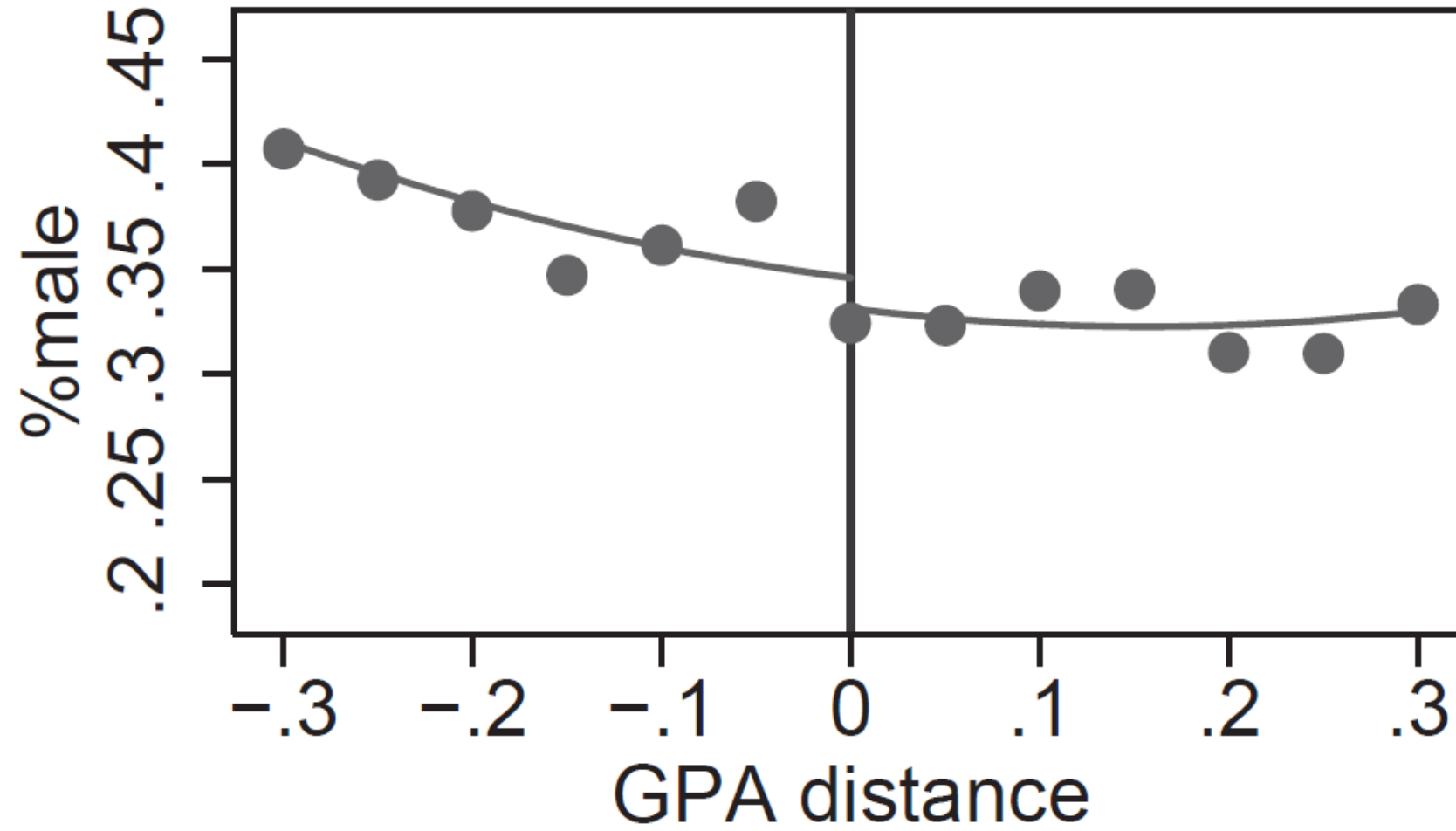
# Tests for Covariate Balance Around GPA Admissions Cutoffs

## Racial Shares

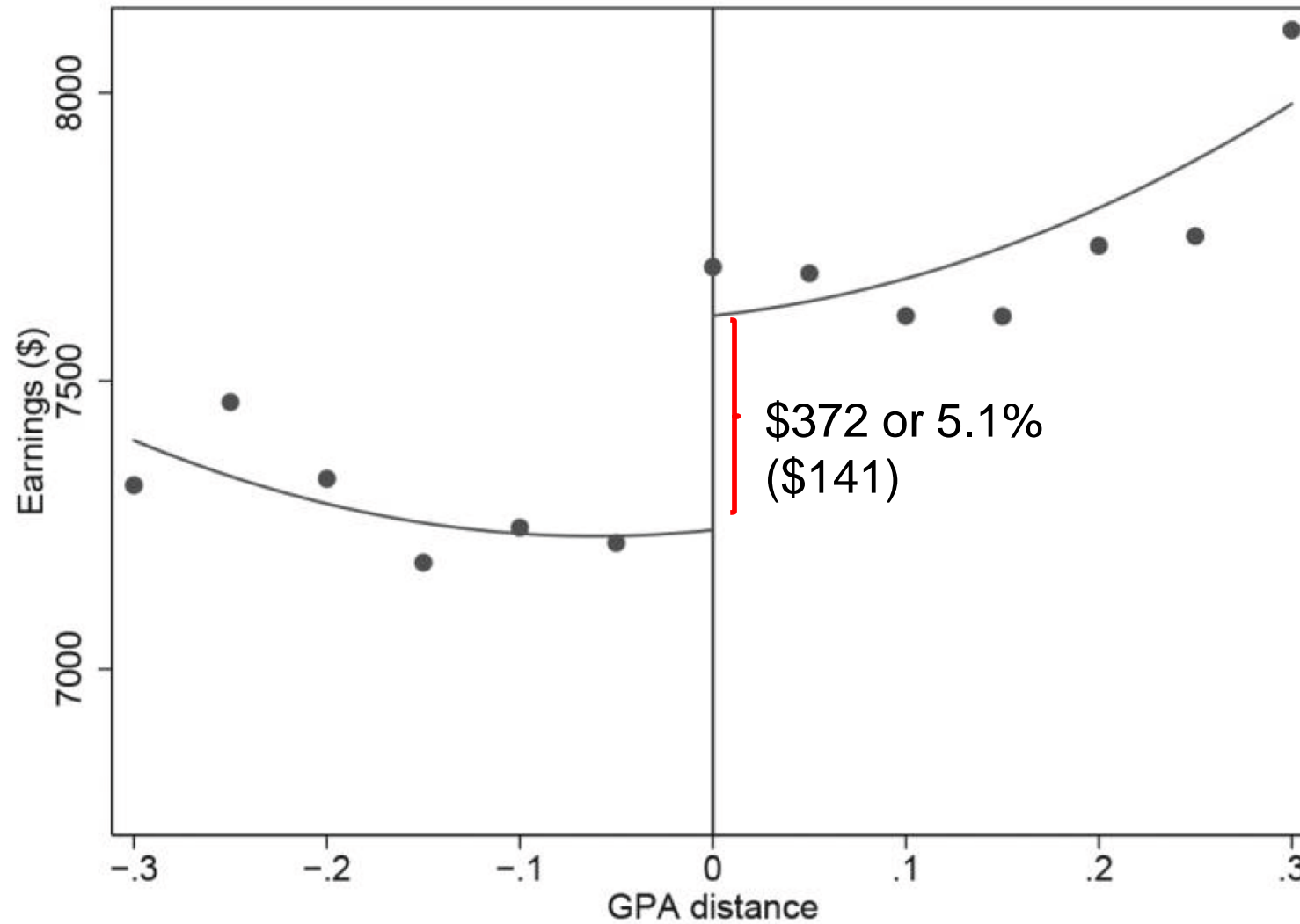


## Tests for Covariate Balance Around GPA Admissions Cutoffs


Gender



## Mean Quarterly Earnings 8-14 Years after HS Graduation Around FIU GPA Admissions Cutoffs



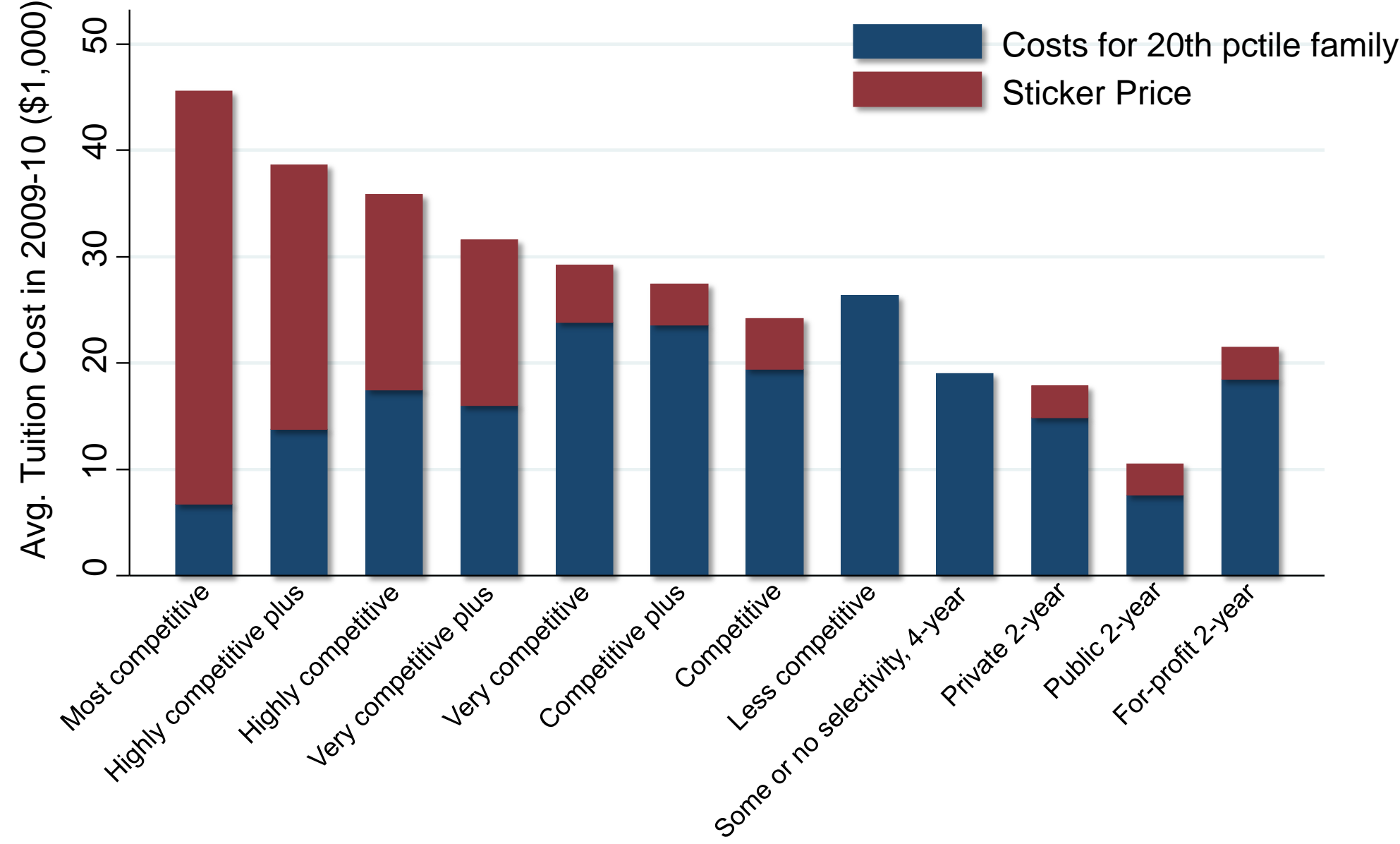
# Causal Effects of Colleges

- Ideally, we would estimate causal effect of *every* college relative to every other college using a method analogous to the one we just discussed 
- This is infeasible in practice → use earnings controlling for SAT scores and parent income as an estimate of each college's causal effect
- At least in case of Florida International University, this simple regression estimate matches quasi-experimental estimate
- Therefore use these estimates to gauge portion of variation in earnings that is due to colleges' causal effects when analyzing impacts on mobility

# Increasing Applications from High-Achieving, Low-Income Students

- There is some scope to increase low and middle-income shares at highly selective colleges by admitting and enrolling more high-achieving, lower-income students
- Under-representation of low-income students at these colleges is partly driven by lower **application rates** of well qualified low-income students
- This “undermatching” phenomenon is not simply explained by differences in **costs** of attendance [Hoxby and Avery 2013]

# Costs of Attending Colleges by Selectivity Tier for Low-Income Students

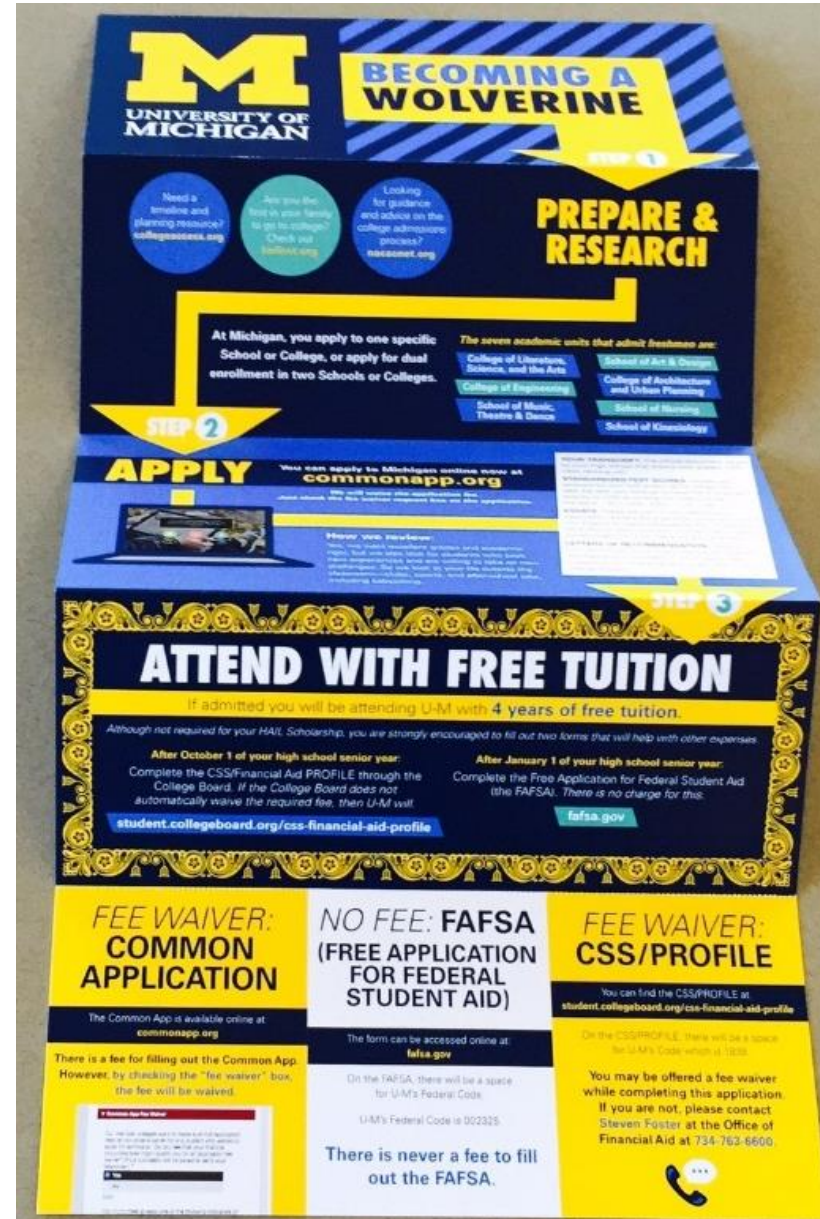


# University of Michigan HAIL Experiment

- Alternative hypothesis: lack of information or application support for low-income students limits their applications even when tuition cost is low [Hoxby and Turner 2013]
- Dynarski et al. (2018) test this hypothesis in a recent experiment at the University of Michigan that exploits big data for targeting
  - Provide information about applying to U of M to high-achieving ( $\text{GPA} > 3.3$ ,  $\text{SAT} > 1100$ ) students from low-income families (incomes  $< \$47\text{K}$ )
  - Identify all such students in the state of Michigan using administrative data from schools on GPAs, SAT scores (mandatory in Michigan), and eligibility for free/reduced price lunch
  - 2,000 students meet these criteria each year; 50% randomly assigned to receive treatment of additional information and support



# HAIL Scholarship Mailings Sent to Students in the Treatment Group



Source: Dynarski et al. (2018)

## Excerpt of HAIL Scholarship Mailings Sent to Parents of Students in the Treatment Group

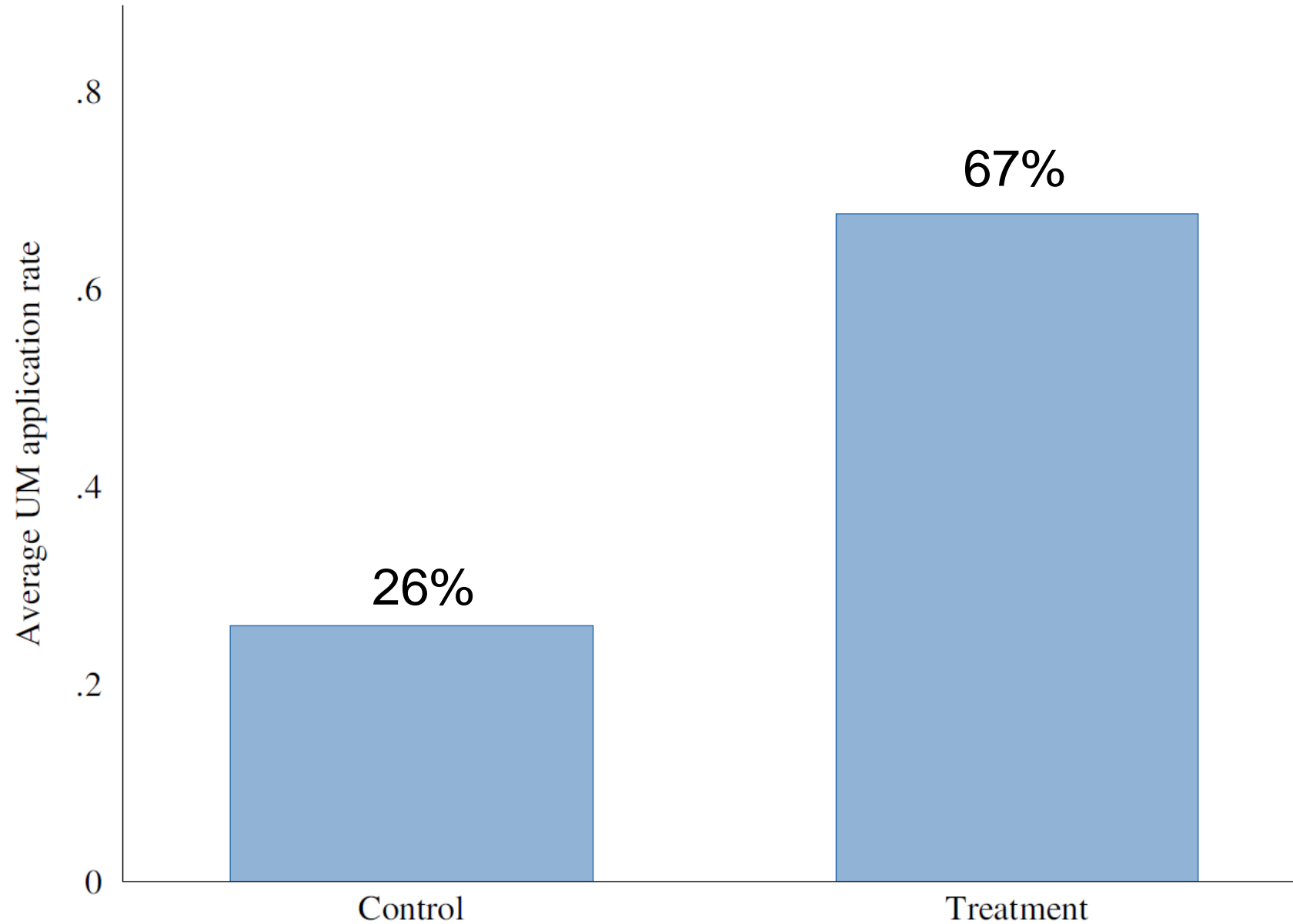
Dear Parent or Guardian of <<first name>> <<last name>>:

Since your child is an excellent student, we want to offer a potentially transformative college opportunity:

If <<first name>> applies and is admitted to the University of Michigan - Ann Arbor, your child will be awarded the HAIL Scholarship covering the entire cost of U-M tuition and fees for four years. This is an offer we are delighted to make, worth approximately \$60,000. Furthermore, after a review of their financial aid applications, your student will likely be eligible for additional aid to cover other costs such as housing and textbooks.

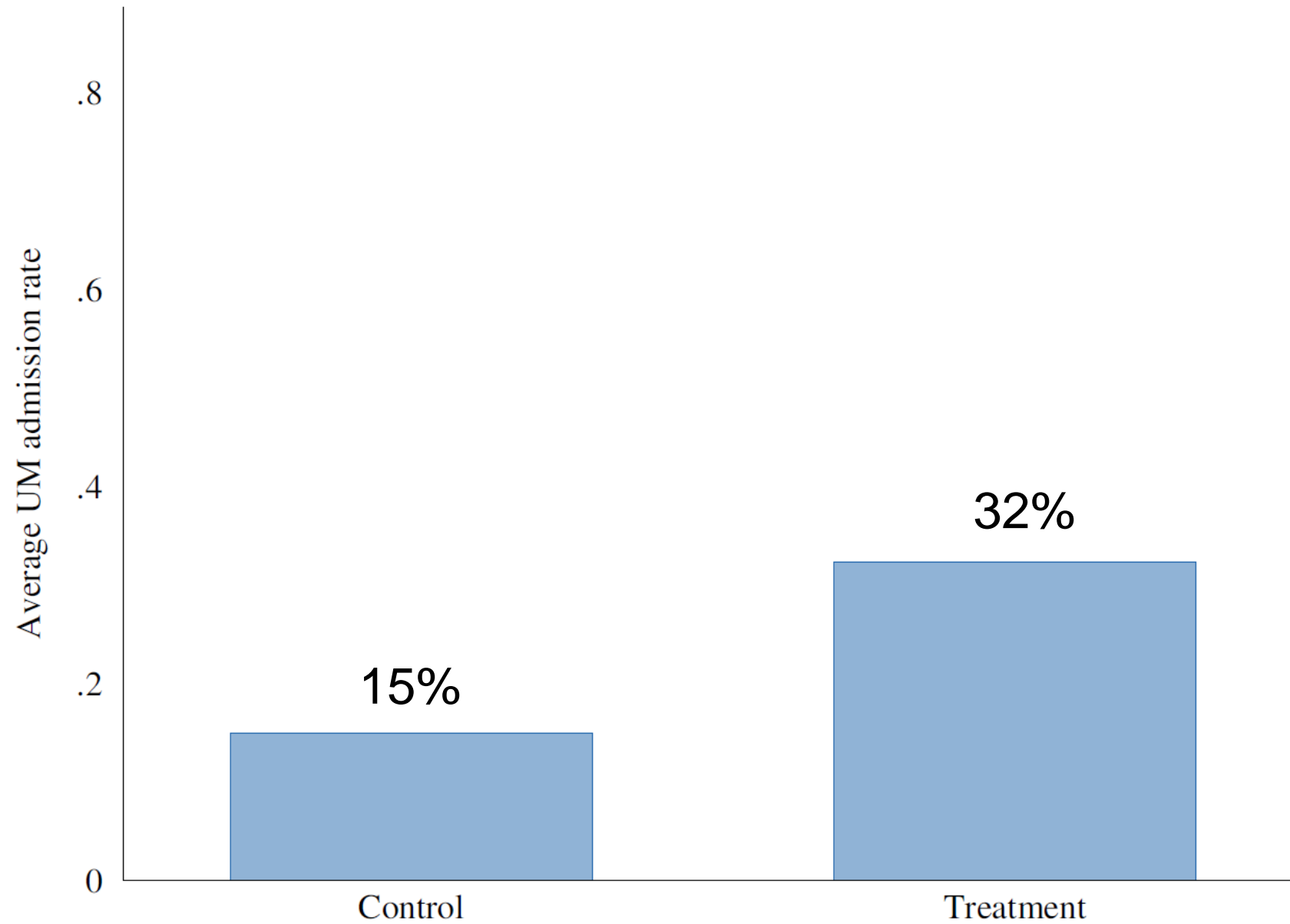
Sincerely,  
Kedra Ishop, PhD  
Associate Vice President  
Office of Enrollment Management

## Effect of HAIL Scholarship on Application to University of Michigan



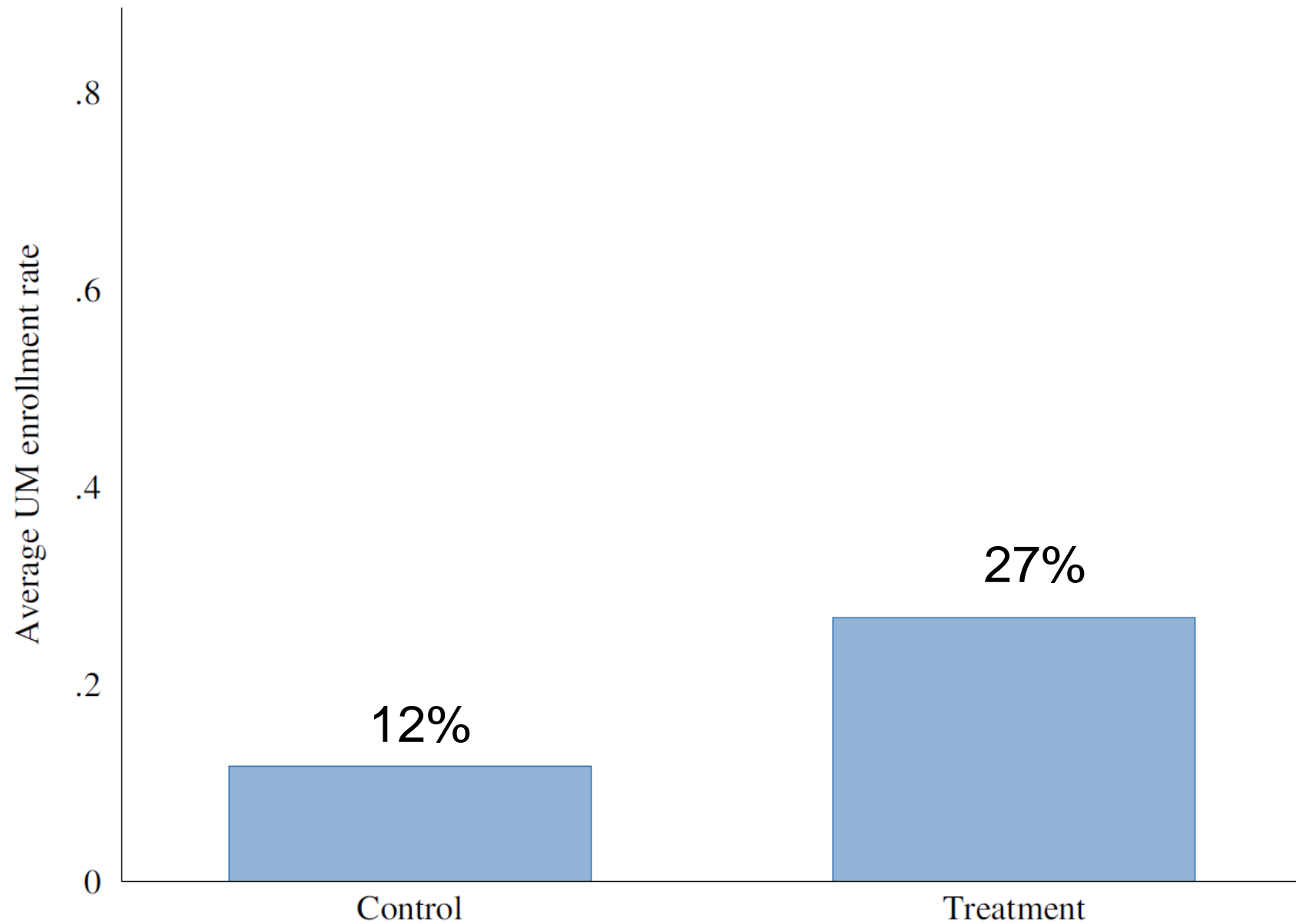
Source: Dynarski et al. (2018)

## Effect of HAIL Scholarship on Admission to University of Michigan



Source: Dynarski et al. (2018)

## Effect of HAIL Scholarship on Enrollment at University of Michigan



Source: Dynarski et al. (2018)