

Academic Peer Effects

Evidence from Student Office Assignments

Introduction

- ▶ Peer effects measure the effect one's peer group has on outcomes, such as academic outcomes.
- ▶ Peer effects have long been thought to play an important role in academic and other outcomes.
 - ▶ E.g Brown v Board of Education, 1954
- ▶ Peer effects plays a central role to issues including: Selective admission processes, busing, affirmative action, merit scholarships, choice of school
- ▶ Understanding peer effects is important for institutions in creating an ideal academic setting.

Measuring Peer Effects

- ▶ Measuring peer effects is difficult for 3 reasons, as outlined by Manski, 1993.
 - ▶ 1) Selection - People generally choose their peer groups in most settings
 - ▶ 2) Reflection - Differentiating the effect group has on individual from the effect the individual has on the group
 - ▶ 3) Identifying channels of peer effects - is it driven by background, behavior, etc.?

Measuring Peer Effects

- ▶ One strategy in overcoming the difficulties present in measuring peer effects, has been to utilize random freshman dorm assignments at universities.
- ▶ Since room assignments are random, we avoid the problem of selection.
- ▶ A key assumption is that one's roommates make up a significant proportion of their peer group.
- ▶ In this study I use random assignment of offices to first-year PhD students.

Literature

- ▶ Sacerdote, Bruce, “Peer Effects With Random Assignment: Results for Dartmouth Roommates,” *Quarterly Journal of Economics*, 2001
 - ▶ Sacerdote utilizes random assignment of freshmen dorms at Dartmouth as a randomized experiment.
 - ▶ Finds significant positive relationship between a student’s GPA and their roommate’s GPA.
 - ▶ Also finds relationship in social outcomes, e.g. joining a fraternity, sorority.
- ▶ Bobonis, Gustavo J., and Finan, Frederico, “Neighborhood Peer Effects in Secondary School Enrollment Decisions,” *Review of Economics and Statistics*
 - ▶ Utilizes data on secondary school enrollment in Mexico
 - ▶ Finds enrollment rate of peers has positive effect on one’s own likeliness to enroll.

Literature

- ▶ Zimmerman, David, J., “Peer Effects in Academic Outcomes: Evidence from a Natural Experiment,” *Williams Project on the Economics of Higher Education*
 - ▶ Utilizes data on random room assignments from Williams College.
 - ▶ Finds small peer effects, in particular, when regressing on roommates SAT verbal.
 - ▶ Finds no peer effects when regressing on SAT math.
- ▶ Carell, Scott, “Does Your Cohort Matter? Measuring Peer Effects in College Achievement,” *Journal of Labor Economics*, 2009
 - ▶ Uses data from randomly assigned squadrons at the US Air Force Academy.
 - ▶ Finds large positive peer effects in academic and fitness outcomes

Data

- ▶ Utilizes data on academic performance of graduate students of an economics program at a single university from the years 2007-2014.
- ▶ First year students who work as a TA are randomly assigned an office, I use this as a randomized experiment.
- ▶ Dataset includes pretreatment characteristics: GRE verbal and quantitative scores, gender and nationality.
- ▶ At the end of first year, students take preliminary tests in macro and micro, I use these as measure of academic success.

Summary Statistics

Table 1: Summary Statistics

	Year								
	2007	2008	2009	2010	2011	2012	2013	2014	Total
International	0.533 (0.516)	0.556 (0.527)	0.625 (0.500)	0.571 (0.514)	0.273 (0.467)	0.500 (0.516)	0.125 (0.342)	0.273 (0.467)	0.435 (0.498)
Female	0.400 (0.507)	0.333 (0.500)	0.438 (0.512)	0.143 (0.363)	0.273 (0.467)	0.250 (0.447)	0.375 (0.500)	0.364 (0.505)	0.324 (0.470)
GRE Quant. Score	90.80 (5.735)	91.11 (4.137)	91.06 (3.785)	91.71 (3.099)	85 (5.967)	89.50 (5.797)	93.69 (3.842)	91.91 (5.991)	90.74 (5.237)
GRE Verbal Score	80.73 (17.52)	77.67 (17.09)	79.88 (20.10)	70.36 (28.75)	73.64 (20.80)	77.38 (25.46)	84.88 (18.22)	82.73 (13.18)	78.60 (20.82)
Macro Score	1.935 (0.869)	1.972 (0.815)	1.530 (0.877)	2.183 (0.795)	2.078 (0.590)	1.862 (0.451)	1.910 (0.427)	2.015 (0.436)	1.919 (0.688)
Micro Score	1.977 (0.997)	1.842 (1.029)	1.629 (0.992)	2.184 (0.940)	2.053 (0.604)	2.278 (1.008)	1.736 (0.813)	1.763 (0.663)	1.936 (0.903)
Passed Macro (1st Attempt)	0.467 (0.516)	0.556 (0.527)	0.312 (0.479)	0.571 (0.514)	0.545 (0.522)	0.375 (0.500)	0.375 (0.500)	0.636 (0.505)	0.463 (0.501)
Passed Micro (1st Attempt)	0.400 (0.507)	0.444 (0.527)	0.250 (0.447)	0.500 (0.519)	0.636 (0.505)	0.625 (0.500)	0.375 (0.500)	0.455 (0.522)	0.454 (0.500)
Passed Both (1st Attempt)	0.333 (0.488)	0.333 (0.500)	0.188 (0.403)	0.429 (0.514)	0.545 (0.522)	0.375 (0.500)	0.312 (0.479)	0.364 (0.505)	0.352 (0.480)

mean coefficients; sd in parentheses

Testing Randomness

- ▶ In my first attempt at testing randomness, I used standard OLS regressions, using own pretreatment characteristics as the dependent variable and average office pretreatment characteristics as the regressors.
- ▶ Because of the small number of observations each year, regressions were not accurate in demonstrating the randomness of office assignments. E.g., this method suggested that own GRE verbal score significantly and inversely related to average GRE verbal of the office.

Testing Randomness Using a Simulation

- ▶ A program regresses own characteristic on average characteristics of office, then stores the beta coefficients.
- ▶ Then, all first-year students are randomly assigned new offices, office characteristics are calculated, and the same regression is run again.
- ▶ This is repeated n times. The program counts how many times the newly produced beta coefficient is larger in magnitude than our initially observed beta and stores this result as c . Thus we can approximate the p-value for each beta as simply $p = \frac{c}{n}$.
- ▶ This approach has benefit of not having to make assumptions about probability distributions of the variables involved.

Dependent Variable: GRE Quantitative

Office Char.	Observed β	c	n	p=c/n	SE(p)	[95% conf. int.]
Average GRE Quantitative	0.070	8,465	10,000	0.847	0.004	0.839 - 0.854
Average GRE Verbal	0.027	6,211	10,000	0.643	0.005	0.612 - 0.631
Proportion Female	2.943	2,346	10,000	0.237	0.004	0.226 - 0.243
Proportion International	-0.194	9,312	10,000	0.922	0.003	0.926 - 0.936

Dependent Variable: GRE Verbal

Office Char.	Observed β	c	n	p=c/n	SE(p)	[95% Conf. Int.]
Average GRE Quantitative	0.215	7,909	10,000	0.791	0.004	0.783 - 0.799
Average GRE Verbal	-0.610	1,292	10,000	0.129	0.003	0.122 - 0.136
Proportion Female	2.621	7,844	10,000	0.784	0.004	0.776 - 0.792
Proportion International	-19.211	491	10,000	0.049	0.002	0.045 - 0.053

Dependent Variable: Female

Office Char.	Observed β	c	n	p=c/n	SE(p)	[95% Conf. Int.]
Average GRE Quantitative	0.002	9,137	10,000	0.914	0.003	0.908 - 0.919
Average GRE Verbal	0.008	1,106	10,000	0.011	0.003	0.105 - 0.117
Proportion Female	0.368	3,345	10,000	0.335	0.004	0.325 - 0.344
Proportion International	0.158	4,241	10,000	0.424	0.005	0.414 - 0.434

Dependent Variable: International

Office Char.	Observed β	c	n	p=c/n	SE(p)	[95% Conf. Int.]
Average GRE Quantitative	0.007	7,184	10,000	0.718	0.005	0.709 - 0.727
Average GRE Verbal	0.007	2,232	10,000	0.223	0.004	0.215 - 0.231
Proportion Female	0.354	8,795	10,000	0.880	0.003	0.873 - 0.886
Proportion International	0.108	7,162	10,000	0.716	0.005	0.707 - 0.725

Randomness

- ▶ Only one of the sixteen estimated beta coefficients is significant 5% level, the rest are not significant even at 10% level.

Methodology

- ▶ Standard Ordinary Least Squares regression.
- ▶ Dependent variable is contemporaneous academic performance.
- ▶ Regressors include individual controls, as well as average characteristics of office mates including a dummy for international students and gender, and average GRE scores. Controls for yearly fixed effects
- ▶ $s_i = \theta_1 q_i + \theta_2 v_i + \theta_3 f_i + \theta_4 n_i + \beta_1 \bar{q}_{ot} + \beta_2 \bar{v}_{ot} + y_t$
 - ▶ s = Preliminary Score (individual i , time t , of fice o)
 - ▶ q = GRE quant Score
 - ▶ v = GRE verbal score
 - ▶ f = Gender dummy
 - ▶ y = Year dummy
- ▶ Variables of interest are β_1, β_2 which measure the effect of peer performance on one's own performance.

Results

REGRESSION TABLE:

	Passed Macro	Passed Macro	Macro Score	Macro Score
GRE Quant.	0.027** (0.010)	0.027** (0.010)	0.051*** (0.012)	0.051*** (0.012)
GRE Verbal	0.009*** (0.003)	0.009*** (0.003)	0.011*** (0.004)	0.011** (0.004)
International	0.334*** (0.122)	0.332*** (0.120)	0.398*** 0.142	0.400*** (0.140)
Female	-0.306** (0.121)	0.307** (0.119)	-0.254* (0.141)	-0.251* (0.139)
Avg. GRE Verbal (Office)	0.011** (0.005)	0.011** (0.005)	0.011** (0.005)	0.011** (0.005)
Avg. GRE Quant (Office)	-0.002 (1.903)		0.005 (0.020)	
Observations:	77	77	77	77

Checking Significance of Regression Coefficients with Resampling

DEPENDENT VARIABLE: Passed Macro

	Observed β	c	n	$p=c/n$	SE(p)
Avg. GRE Quant	0.011**	31	1,000	0.031	0.011
Avg. GRE Verbal	-0.002	901	1,000	0.901	0.009

DEPENDENT VARIABLE: Macro Score

	Observed β	c	n	$p=c/n$	SE(p)
Avg. GRE Quant	0.011**	75	1,000	0.075	0.008
Avg. GRE Verbal	0.005	835	1,000	0.835	0.012

Results

REGRESSION TABLE:

	Passed Micro	Passed Micro	Micro Score	Micro Score
GRE Quant.	0.033*** (0.011)	0.033*** (0.011)	0.083*** (0.016)	0.084*** (0.016)
GRE Verbal	0.005** (0.003)	0.005** (0.003)	0.012** (0.005)	0.011** (0.005)
International	0.334** (0.128)	0.267** (0.128)	0.596*** 0.184	0.605*** 0.184
Female	-0.090 (0.127)	-0.087 (0.126)	-0.102 (0.183)	-0.091 (0.183)
Avg. GRE Verbal (Office)	0.002 (0.005)	0.002 (0.005)	0.008 (0.008)	0.008 (0.008)
Avg. GRE Quant (Office)	0.008 (2.005)		0.026 (0.026)	
Observations:	77	77	77	77

Conclusions

- ▶ Pass rate of macro preliminary is correlated with average GRE verbal score of office.
- ▶ An increase in one standard deviation of office average GRE verbal is associated with a 10% increase in passing macro preliminary.
- ▶ An increase in one standard deviation of office average GRE verbal is associated with .10 increase in score.
- ▶ No link found between average GRE verbal of office and performance on micro preliminary.
- ▶ No link found between average GRE quantitative score of office and performance on either exam.