Grade Sensitivity and the Economics Major at a Women's College

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Online Appendix

Table A1: Grades in principles courses and student variables

Grade in principles course	Proportion of sample	Quantitative reasoning assessment (mean)	Mathematic SAT (mean)	Preference for Economics on application (mean)	Majored in Economics (mean)
C+ or lower	7.6	11.5	653	0.167	0.189
B-	11.2	12.4	678	0.172	0.285
B	23.1	13.1	688	0.174	0.326
B+	25.1	13.7	708	0.190	0.465
A-	21.4	14.3	718	0.161	0.486
A	11.7	14.9	738	0.253	0.639
Total	100	13.5 (2.43)	702 (63)	0.184	0.418
Observations	2,695	2,695	2,335	2,695	2,583

Notes: The discontinuity sample includes 2,695 observations (see text for details). The number of observations for some variables are lower because of missing values (i.e., when students do not submit SAT scores with their applications, or when they do not graduate from Wellesley College).

Table A2: Descriptive statistics in the full and discontinuity samples

	Full sample	Discontinuity sample
Panel A: Pre-college variables		
Preference for Economics major (1/0)	0.17	0.18
Quantitative reasoning score	13.23	13.53
	(2.57)	(2.43)
ACT	30.04	30.48
	(2.82)	(2.61)
Mathematics SAT	693.21	702.22
	(65.7)	(63.5)
Verbal SAT	689.98	694.00
	(68.6)	(67.5)
Receives no financial aid (1/0)	0.39	0.38
Admissions score	0.00	0.05
	(1.00)	(0.94)
Under-represented minority (1/0)	0.10	0.08
Panel B: College variables		
Grade point in principles course	3.14	3.25
	(0.60)	(0.49)
Non-principles grade point average in same semester	3.33	3.40
	(0.43)	(0.38)
Cumulative grade point average	3.35	3.41
	(0.34)	(0.30)
Economics major (1/0)	0.38	0.42
Double major (1/0)	0.31	0.31
Other social science major (1/0)	0.35	0.33
Humanities major (1/0)	0.31	0.29
Math or science major (1/0)	0.22	0.24
Did not graduate from Wellesley College (1/0)	0.05	0.04
Panel C: Letter-grade cutoff samples		
C+/C (1/0)		0.04
B-/C+ (1/0)		0.08
B/B- (1/0)		0.19
B+/B (1/0)		0.29
A-/B+ (1/0)		0.21
A/A- (1/0)		0.19
Maximum N of observations	4723	2695
Maximum N of students	2999	2032

Notes: The columns reports means for variables in the full and discontinuity samples, described in the text. Dummy variables are indicated by 1/0 in parentheses. Standard deviations are reported in parentheses for continuous variables. The quantitative reasoning score is from a test given annually to first-year students before course registration. The admissions score is based on pre-enrollment evaluations of college applications by three members of the admissions committee.

Table A3: Discontinuities in pre-college variables at letter-grade cutoffs

	Bandwidth		
	4 percentage points		Data-driven
Preference for Economics major (1/0)	-0.003	-0.003	0.007
	(0.031)	(0.032)	(0.052)
N	2,479	2,479	1,537
Quantitative reasoning score	-0.037	-0.090	0.013
	(0.190)	(0.171)	(0.248)
N	2,479	2,479	1,676
ACT	-0.186	-0.016	0.361
	(0.322)	(0.385)	(0.636)
N	848	848	478
Mathematics SAT	-4.760	-3.828	1.929
	(5.136)	(4.831)	(6.681)
N	2,141	2,141	1,547
Verbal SAT	-5.176	-4.439	13.820
	(5.427)	(5.590)	(9.362)
N	2,141	2,141	1,241
Receives no financial aid (1/0)	-0.020	-0.003	-0.014
	(0.037)	(0.038)	(0.052)
N	2,479	2,479	1,778
Admissions score	0.018	0.047	0.115
	(0.072)	(0.070)	(0.109)
N	2,477	2,477	1,511
Under-represented minority (1/0)	0.045	0.049	0.028
	(0.019)	(0.019)	(0.037)
N	2,444	2,444	1,294
Controls?	No	Yes	Yes

Notes: Cells in the first column report estimates of β from equation (1), applying triangular weights within a bandwidth of 4 percentage points. Robust standard errors, clustered by student, are in parentheses. The final row indicates specifications that control for fixed effects for semester-by-instructor-by-cutoff groups (δ_{jk}^{s}). The mean-squared-error optimal bandwidth selector assumes a uniform bandwidth on either side of the cutoff (Calonico, Cattaneo, and Titiunik, 2014). Asterisks indicate significance after adjusting for multiple comparisons across 24 estimates (Benjamini and Hochberg, 1995).

** Significant at the 1 percent level.

* Significant at the 5 percent level.

Table A4: Discontinuities in student outcomes at letter-grade cutoffs (omitting observations near cutoffs)

	Grade points in principles course	Non-principles G.P.A. in same semester	Cumulative grade point average	Economics major
Panel A: Omitting observations ±.25 percentage points from cutoff				
	0.307**	0.017	0.019	0.165**
	(0.006)	(0.029)	(0.020)	(0.042)
N	2,309	2,303	2,309	2,220
Panel B: Omitting observations ±.5 percentage points from cutoff				
	0.299**	0.029	0.049	0.161**
	(0.008)	(0.035)	(0.027)	(0.051)
N	1,992	1,986	1,992	1,915

Notes: Cells report estimates of β from equation (1), applying triangular weights within a bandwidth of 4 percentage points, and including fixed effects for semester-by-instructor-by-cutoff groups (δ_{jk}^{s}); controls for the pre-college variables in panel A of Table A2; and dummy variables indicating missing values of these variables. Robust standard errors, clustered by student, are in parentheses.

** Significant at the 1 percent level.

* Significant at the 5 percent level.

Table A5: Heterogeneity by course attributes

	Grade points in principles course	Non-principles G.P.A. in same semester	Cumulative grade point average	Economics major
Panel A: Letter-grade cutoffs				
A/A-	0.324**	0.070	0.066*	0.209**
	(0.003)	(0.038)	(0.026)	(0.069)
A-/B+	0.329**	0.028	0.045	0.103
	(0.006)	(0.040)	(0.026)	(0.071)
B+/B	0.307**	0.038	0.011	0.190**
	(0.010)	(0.041)	(0.027)	(0.056)
B/B-	0.308**	0.084	0.031	0.083
	(0.013)	(0.050)	(0.037)	(0.073)
B-/C+	0.293**	-0.097	-0.019	0.324**
	(0.020)	(0.094)	(0.064)	(0.093)
p-value	.12	.47	.55	.24
Panel B: Microeconomic and macroeconomic principles				
Micro	0.311**	0.021	0.032	0.138**
	(0.008)	(0.034)	(0.024)	(0.049)
Macro	0.304**	-0.008	-0.030	0.223**
	(0.008)	(0.038)	(0.025)	(0.055)
p-value	.52	.56	.07	.25
Panel C: Gender of instructor				
Female	0.311**	-0.038	-0.002	0.260**
	(0.008)	(0.041)	(0.027)	(0.060)
Male	0.305**	0.040	0.011	0.111*
	(0.008)	(0.032)	(0.023)	(0.047)
p-value	.6	.13	.70	.05

Notes: For each moderating variable (e.g., five categories of letter-grade cutoffs in panel A), we calculate dummy variables indicating the mutually-exclusive and exhaustive set of categories. We fully interact the dummies with G_{ijk}^{s} in equation (1) and report these coefficients in the tables. In addition, we fully interact the dummies with the continuous measures of the assignment variable in equation (1), so that estimated slopes are allowed to vary by each category of the moderator. All regressions include fixed effects for semester-by-instructor-by-cutoff groups (δ_{jk}^{s}); controls for the pre-college variables in panel A of Table A2; and dummy variables indicating missing values of these variables. Robust standard errors, clustered by student, are in parentheses. The p-values correspond to a test of the null that the coefficients are jointly equal.

** Significant at the 1 percent level.

* Significant at the 5 percent level.

Table A6: Heterogeneity by student attributes (additional dependent variables)

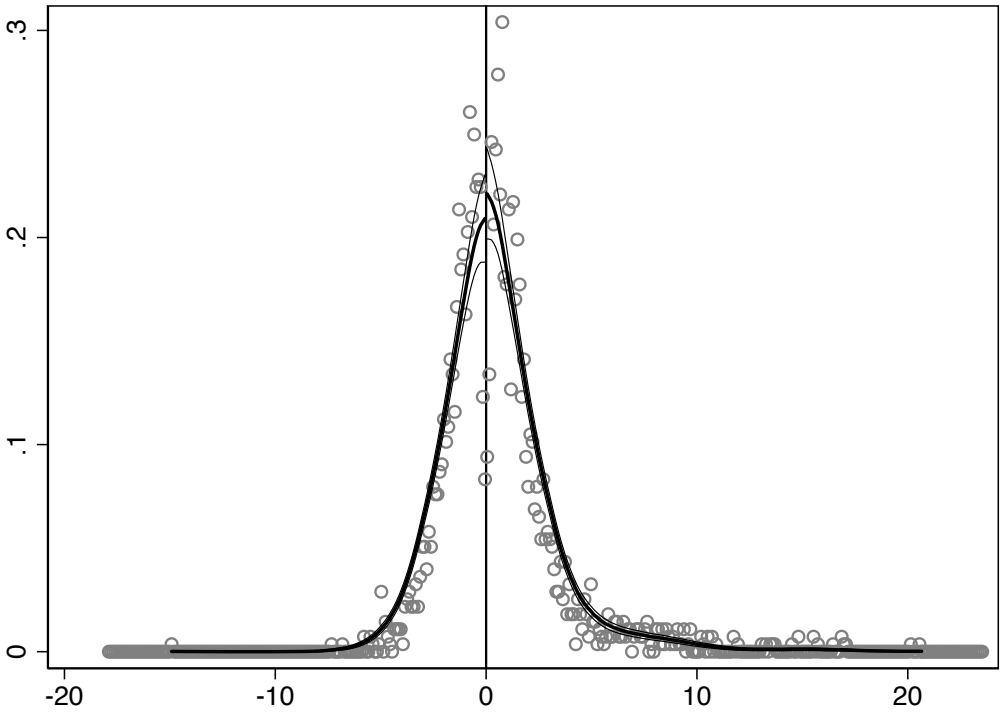
	Non-principles G.P.A. in same semester	Cumulative grade point average
Panel A: Quantitative reasoning assessment		
Lower QR score	0.009	0.001
	(0.032)	(0.021)
Higher QR score	0.008	0.012
	(0.033)	(0.024)
p-value	.99	.72
Panel B: Preference for Economics major		
Econ preference	0.019	0.008
	(0.060)	(0.041)
No Econ preference	0.008	0.007
	(0.029)	(0.020)
p-value	.87	.99
Panel C: Receipt of financial aid		
Any financial aid	-0.006	0.012
	(0.034)	(0.023)
No financial aid	0.032	-0.003
	(0.042)	(0.029)
p-value	.48	.69
Panel D: Under-represented minority status		
U-R minority	-0.155	-0.069
	(0.112)	(0.078)
Not U-R minority	0.018	0.012
	(0.027)	(0.018)
p-value	.13	.31

Notes: For each moderating variable (e.g., two categories of quantitative reasoning scores in panel A), we calculate dummy variables indicating both categories. We fully interact the dummies with G_{ijk}^{s} in equation (1) and report these coefficients in the tables. In addition, we fully interact the dummies with the continuous measures of the assignment variable in equation (1), so that estimated slopes are allowed to vary by each category of the moderator. All regressions include fixed effects for semester-by-instructor-by-cutoff groups (δ_{jk}^{s}); controls for the pre-college variables in panel A of Table A2; and dummy variables indicating missing values of these variables. Robust standard errors, clustered by student, are in parentheses. The p-values correspond to a test of the null that the coefficients are jointly equal.

** Significant at the 1 percent level.

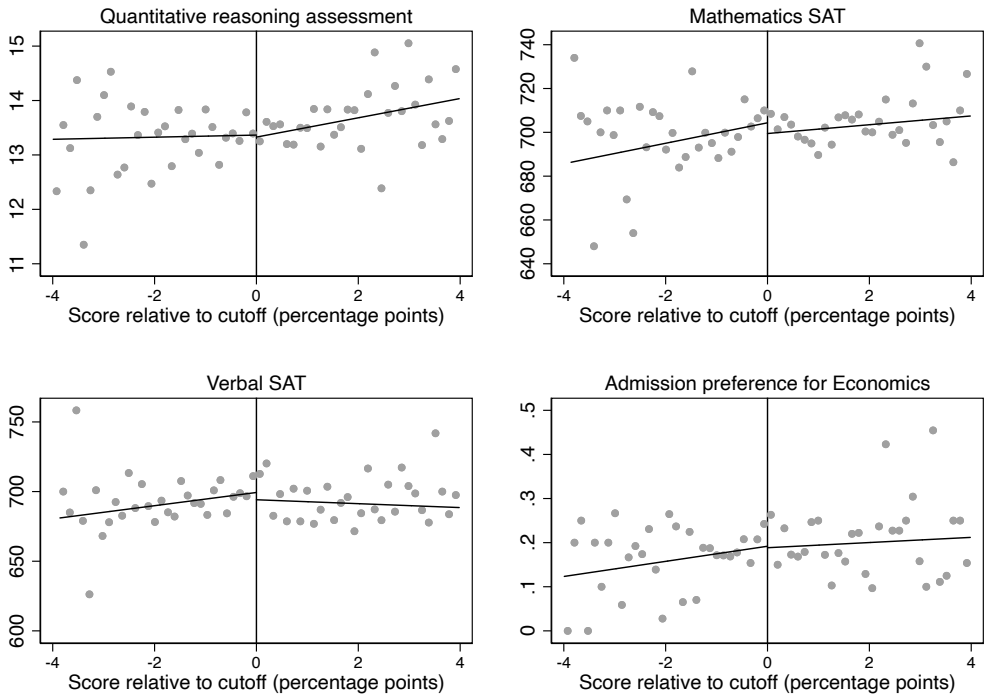
* Significant at the 5 percent level.

Figure A1: Density of assignment variable ($S^s_{ijk} - z^s_{jk}$)



Notes: The histogram and estimated density are obtained with the procedure described in McCrary (2008). Since the z^s_{jk} are imputed as midpoints between two scores, there is a mechanical dip in the density around the centered cutoff. However, the dips are roughly symmetrical and the confidence intervals show that we cannot reject the null hypothesis of no discontinuity.

Figure A2: Pre-college variables at letter-grade cutoffs



Note: The discontinuity sample includes a maximum of 2,479 observations that are within 4 percentage points of letter-grade cutoffs. Circles indicate unadjusted means of the y-axis variable, taken within 30 evenly-spaced bins on each side of the cutoff. The solid lines are fitted values from linear regressions estimated separately on each side of the cutoff, applying triangular weights.

Additional References

McCrary, Justin. 2008. "Manipulation of the Running Variable in the Regression-Discontinuity Design: A Density Test." *Journal of Econometrics* 142: 698–714.