Online Appendix

*Will Studying Economics Make You Rich? A Regression Discontinuity Analysis of the Returns to College Major*

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# Figure A-1: UCSC Economics Major Declaration at the Admission Threshold by Year
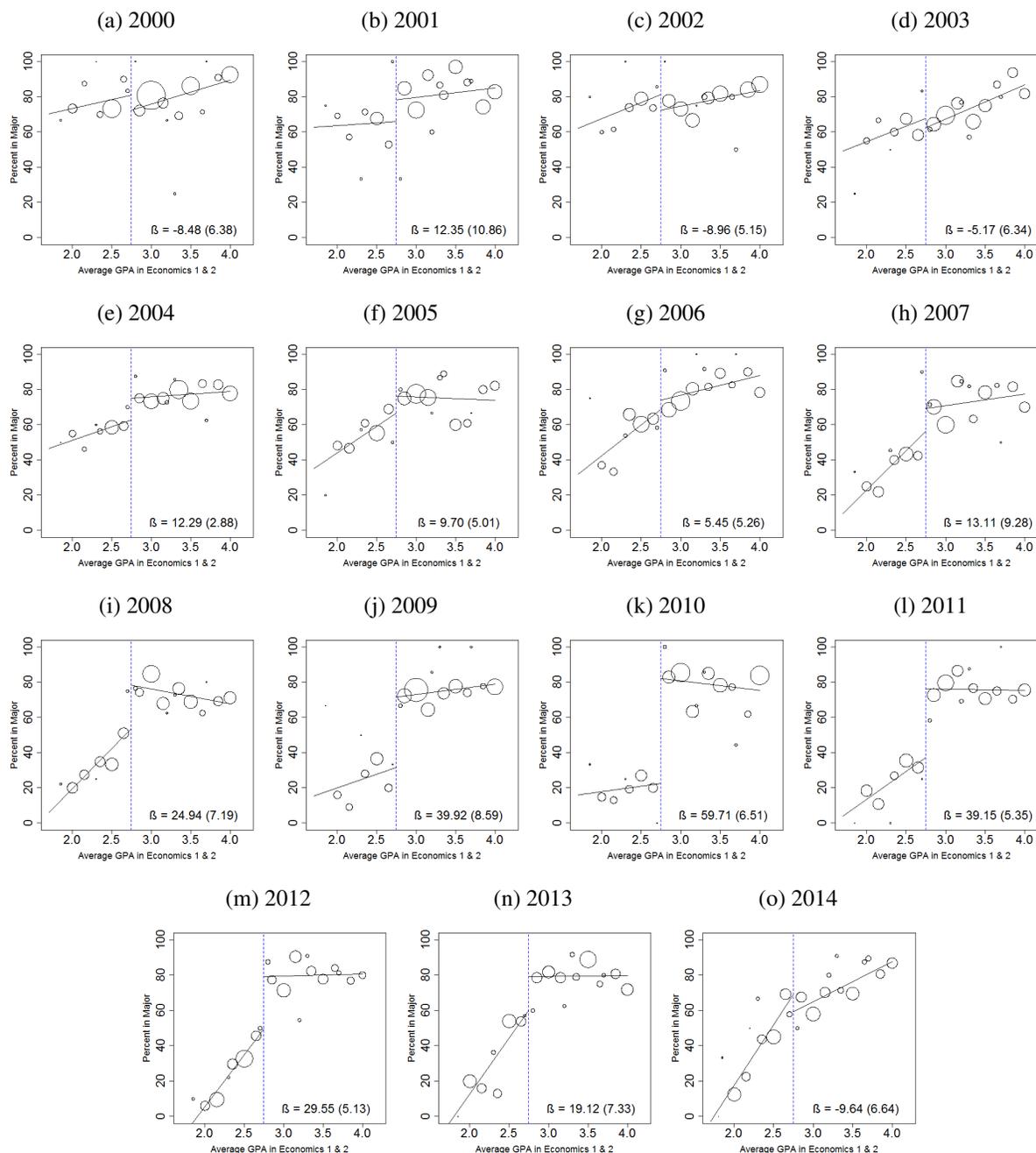


Note: This figure shows the annual bindingness of UCSC's economics major restriction policy by incoming cohort, providing evidence that the policy was hardly binding until the 2008 cohort, most binding in 2010, and became less binding in 2013 (when the $EGPA$ rule may have changed). Each circle represents the percent of economics majors (y axis) among each cohort year of UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Cohort years are defined by year of entry. Majoring in economics indicates declaring any of UCSC's three economics major tracks: economics, global economics, or business management economics. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification; standard error (clustered by $EGPA$) in parentheses. Source: The UC-CHP Student Database.

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## Figure A-2: Trends in UCSC Economics
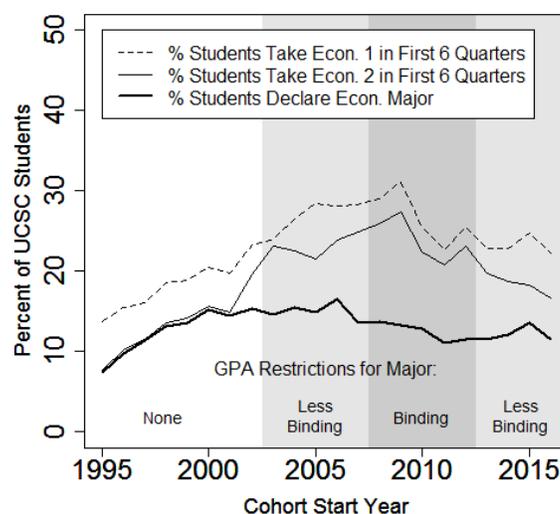


Note: This figure shows that the UCSC major restriction became binding following a substantial increase in student demand for the economics major leading up to and after the 2007-2008 financial crisis. This figure shows the annual proportion of UCSC freshman-admit students who enroll in Economics 1 or Economics 2 prior to the last quarter of their second year, and the proportion of those students who declare the economics major. UCSC formalized its economics major restriction in 2003; the "binding" period is defined as the years in which barely below-threshold students are estimated to be more than 20 percentage points less likely to declare the economics major than barely above-threshold students (see Figure A-1). Sources: The UC-CHP Student Database.

Figure A-3: Selection into Completing the Biannual UCUES Survey

Panel A: Sophomore/Junior Year Survey

(a) Completed Survey

(b) Predicted Wages by Demographics
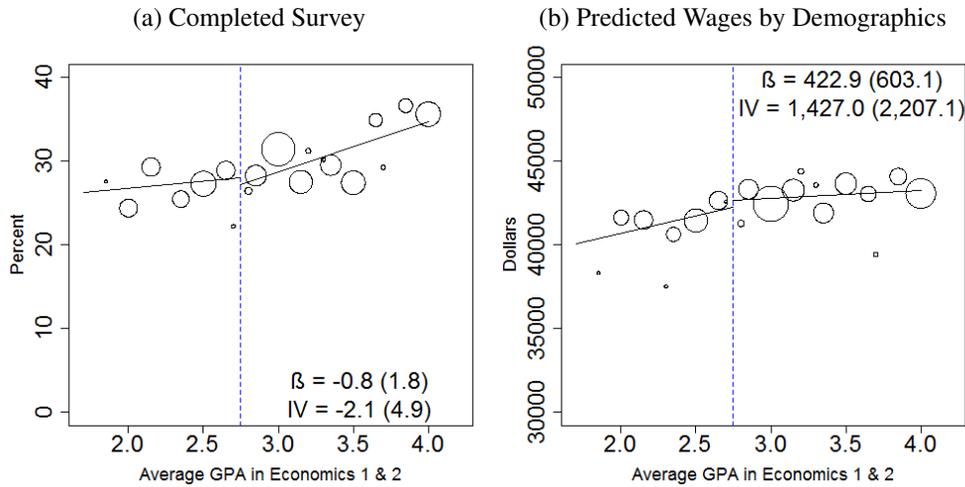


Panel B: Junior/Senior Year Survey

(c) Completed Survey

(d) Predicted Wages by Demographics
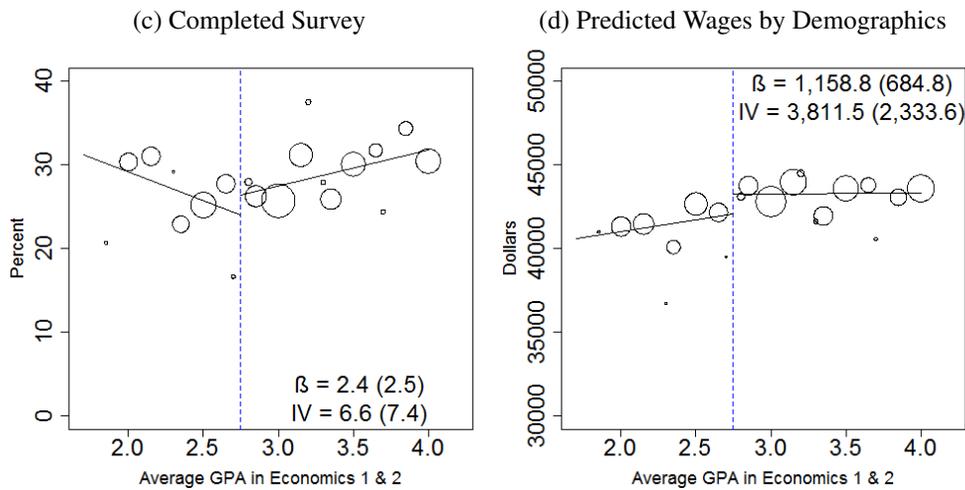


Note: This figure shows that UCUES survey response rates (among sophomore/junior respondents and junior/senior respondents) are smooth across the threshold, as are respondents' demographic and socioeconomic characteristics projected onto predicted postgraduate wages. Each circle represents the percent of students who completed the UCUES survey (for different survey timing) or respondents' predicted wages by demographic and socioeconomic background (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. "Predicted Wages by Demographics" estimates each student's predicted wages by a linear regression (among 2008-2012 UCSC students outside the main sample) of 2017-2018 wages on gender-ethnicity indicators, residency status, and third-order polynomials in SAT score and mean ZIP Code income. 2017-2018 wages are the mean in EDD-covered California wages in those years, omitting zeroes. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Source: The UC-CHP Student Database and the CA Employment Development Department.

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## Figure A-4: Grade Distribution of Potential Economics Majors

(a) Cumulative $EGPA$ Distribution

(b) 2008-2012 Grades in ECON 2



(c) 2003-2007

(d) 2008-2012
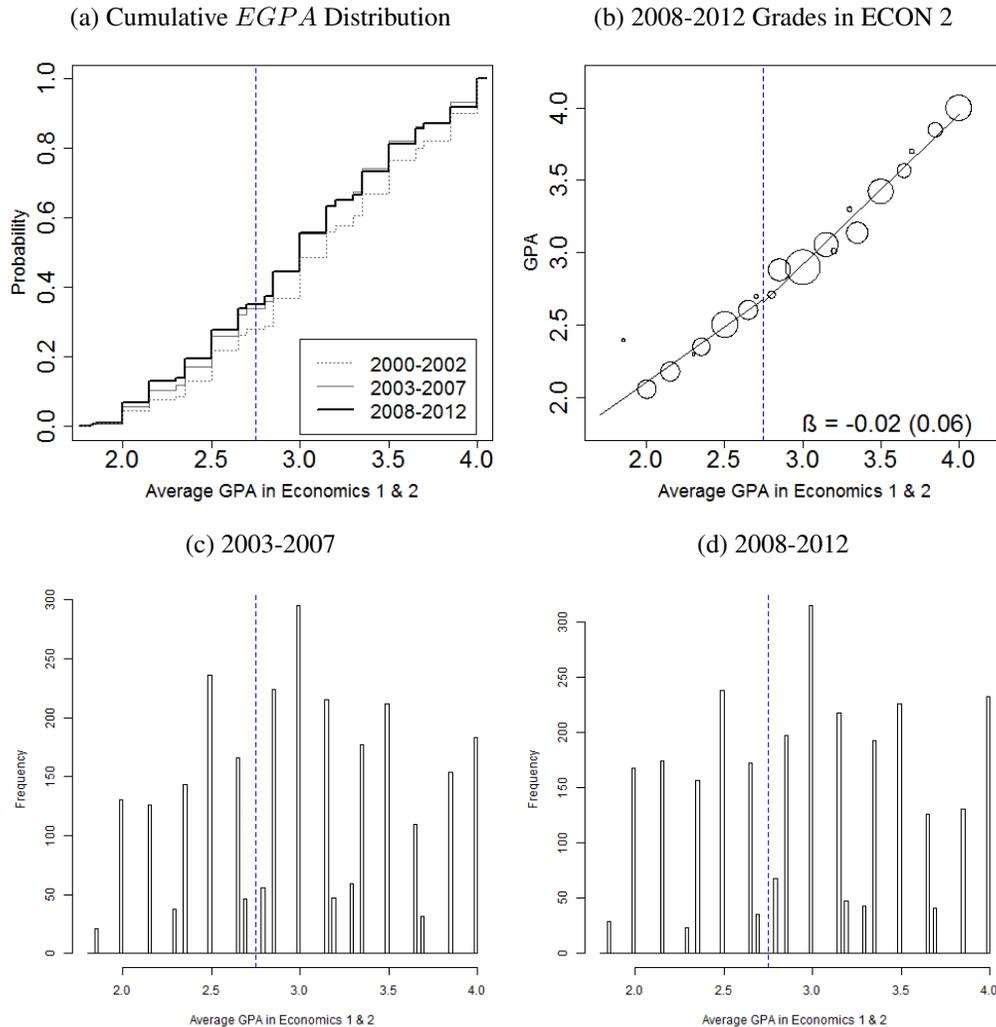


Note: This figure shows the distribution of UCSC Economics 1 and 2 grades ($EGPA$s), showing the absence of a pattern suggesting that students manipulated their grades above the GPA threshold. **Panel (a)** shows the cumulative distribution of Economics 1 and 2 $EGPA$s for three cohorts of freshman-admit UCSC students: 2000-2002, 2003-2007, and 2008-2012. In **Panel (b)**, each circle represents the average Economics 2 grade (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. **Panels (c) and (d)** show the distribution of $EGPA$s among the 2003-2007 cohorts (when the major restriction policy was less-binding) and the 2008-2012 cohorts. Source: The UC-CHP Student Database.

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## Figure A-5: Baseline Balance at the Economics Major Eligibility Threshold



(a) Female      (b) URM      (c) CA Residency

(d) SAT Score      (e) Mean ZIP Code Income      (f) Predicted Wages
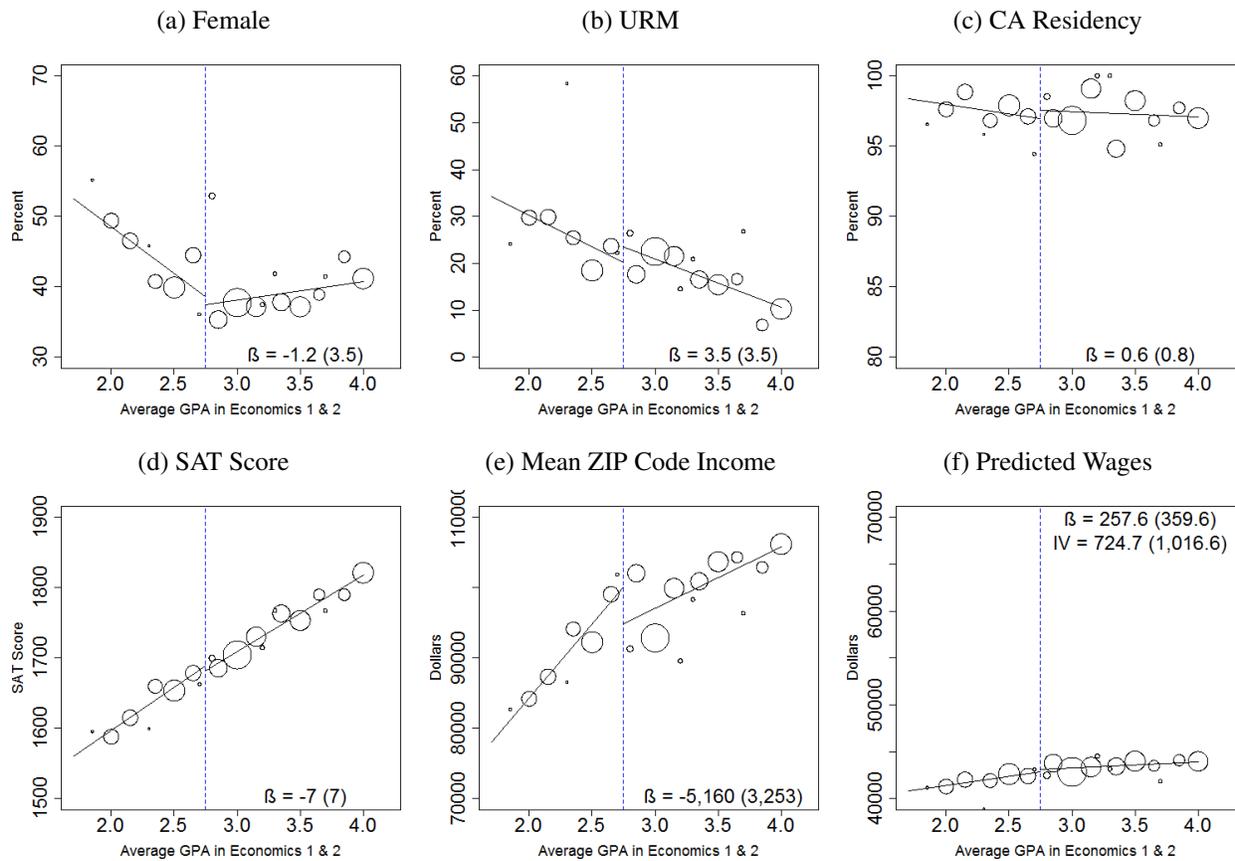
Note: This figure shows that 2008-2012 UCSC students' socioeconomic characteristics were smooth across the economics GPA threshold, separately and together in a one-dimensional prediction of early-career earnings. Each circle represents the mean demographic or socioeconomic characteristic (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. For the 4 percent UC students who submit ACT test scores instead of SAT scores, or SAT scores on a 1600 point basis, the scores are converted to 2400-point SAT scores using standard concordance tables. ZIP Codes are from students' applications, and are matched to reported mean adjusted gross income in their application year. "Predicted Wages" estimates each student's predicted wages by a linear regression (among 2008-2012 UCSC students who did *not* complete Economics 1 and 2) of 2017-2018 wages on gender-ethnicity indicators, residency status, and third-order polynomials in SAT score and mean ZIP Code income. Predicted wages are restricted to students with observed 2017-2018 wages. 2017-2018 wages are the mean in EDD-covered California wages in those years, omitting zeroes; wages are CPI-adjusted to 2018 and winsorized at 2% above and below. $EGPA$s below 1.8 are omitted, leaving 2,839 students in the sample (2,446 with observed wages). Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification; standard error (clustered by $EGPA$) in parentheses. Sources: The UC-CHP Student Database, IRS SOI, and the CA Employment Development Department.

Figure A-6: Placebo Tests: Treatment Effect on Major and Wages with No Restriction or Less-Binding Restriction

## Panel A: 2000-2002 Cohorts (No Restriction)

(a) Economics Major | (b) Annual 2008-2009 Wages
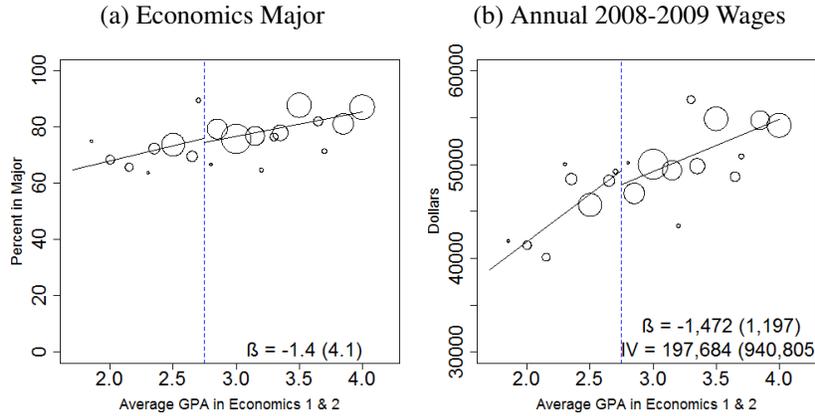


## Panel B: 2003-2007 Cohorts (Less-Binding Restriction)

(c) Economics Major | (d) Annual 2012-2013 Wages
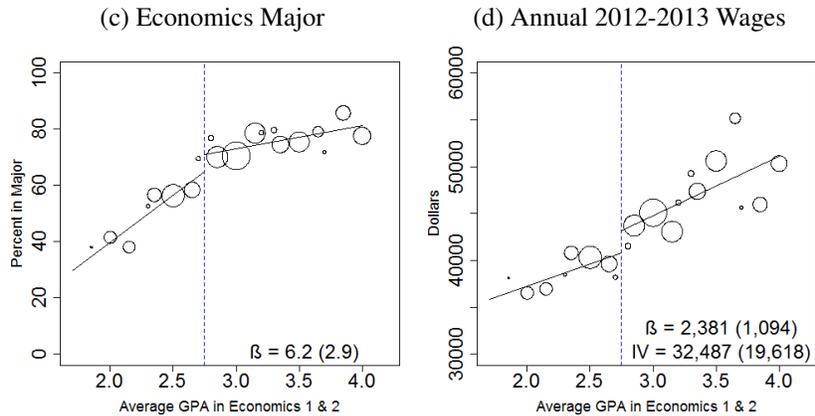


Note: This figure presents two placebo tests showing (A) that major choice and wages were smooth across the 2000-2002 2.8 $EGPA$ threshold (prior to the policy's initial implementation) and (B) both slightly discontinuous in 2003-2007 (during the policy's less-binding phase), generating a similar (but noisy) instrumental variable estimate of the impact of economics major choice on early-career wages. Each circle represents the proportion of economics majors or mean annual wages of UCSC students (y axis) among those who earned a given $EGPA$ in Economics 1 and 2 (x axis), restricted to the 2000-2002 or 2003-2007 UCSC cohorts. The size of each circle corresponds to the proportion of students who earned that $EGPA$. $EGPA$s below 1.8 are omitted. UCSC did not restrict the economics department to the 2000-2002, and only maintained a loosely-binding major restriction for the 2003-2007 cohorts. Wages are presented for each cohort when they were approximately the same age as in the main analysis. 2008-2009 and 2012-2013 wages are the mean in EDD-observed California wages in those years; individuals with no wages in one year are assigned the other year's wages, and those with no observed wages in either are omitted. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Source: The UC-CHP Student Database and the CA Employment Development Department.

## Figure A-7: Earnings Effect Heterogeneity at the Economics GPA Threshold, 2008-2012
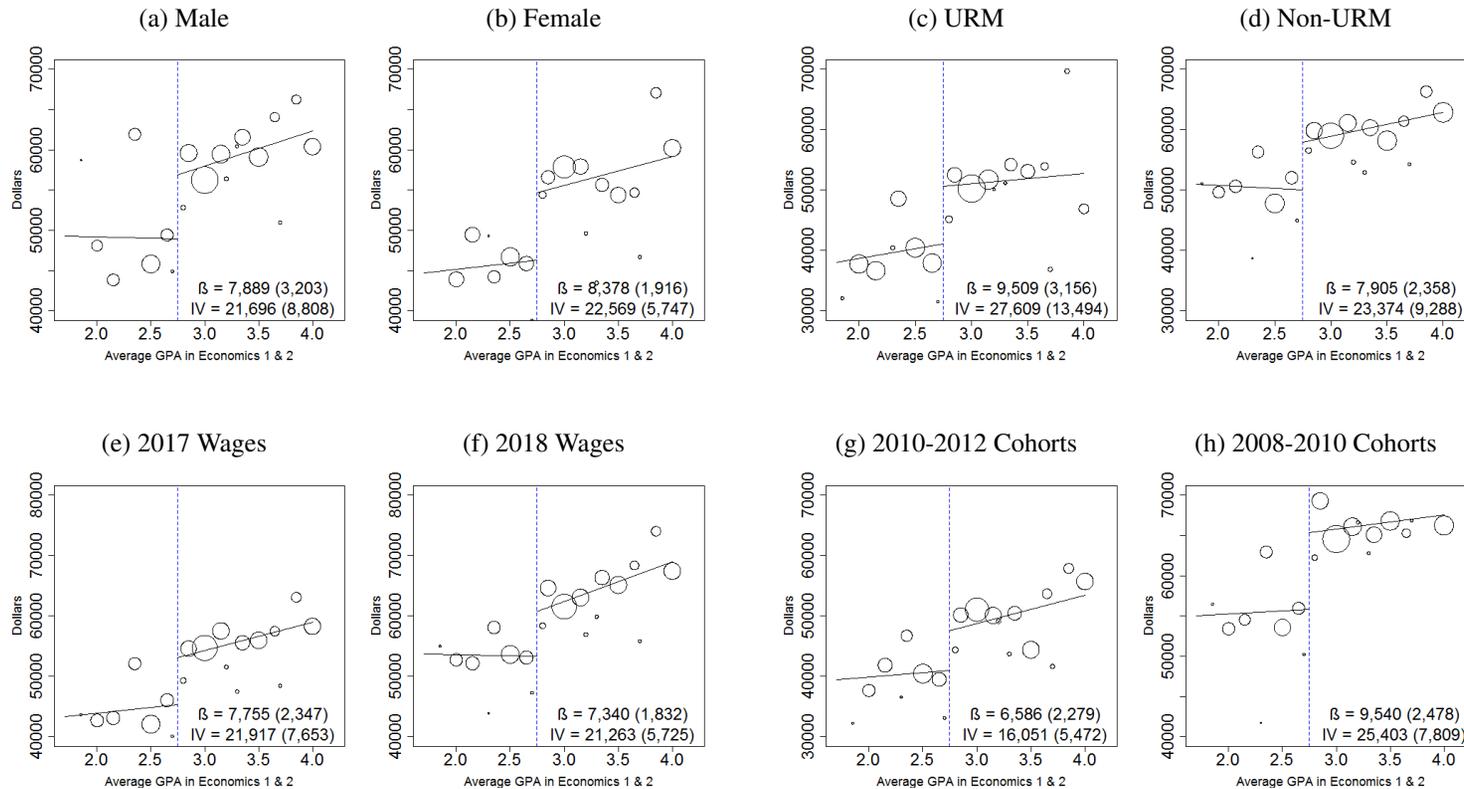


Note: This figure shows that the wage return to majoring in economics is of similar magnitude when measured among male and female students or among underrepresented minority (URM) and non-URM students, is of similar magnitude when measured in 2017 or 2018, and appears somewhat larger for earlier (and thus older) cohorts. Each circle represents the mean annual wages of UCSC students (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Panels (a) to (d) restrict the sample to male, female, URM (Black, Hispanic, or Native American), and non-URM students, respectively. Panels (e) and (f) measure wages in 2017 or 2018, respectively; all other panels measure wages as the mean between EDD-observed 2017 and 2018 California wages in those years, where individuals with no wages in one year are assigned the other year's wages. Panels (g) and (h) restrict the sample to only the 2010-2012 and the 2008-2010 cohorts, respectively. $EGPA$s below 1.8 are omitted. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Source: The UC-CHP Student Database and the CA Employment Development Department.

Figure A-8: Lifetime Earnings Difference for Economics Majors in the ACS
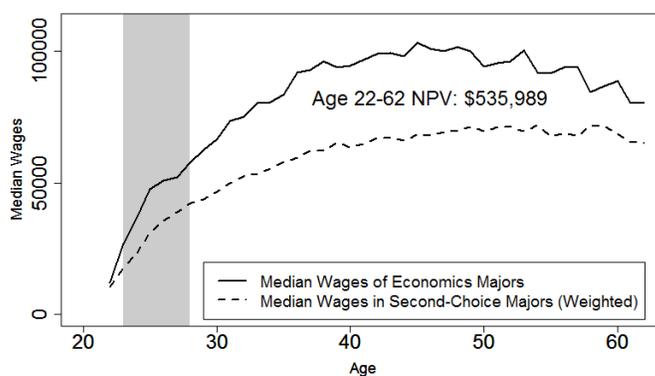


Note: This figure shows that the relative observational return to majoring in economics increases with age in workers' 20s and 30s and remains large throughout workers' careers, resulting in a $536,000 observational net present value of majoring in economics (relative to barely above-threshold UCSC students' distribution of second-choice majors). This figure shows annual median wages of economics majors and other majors (weighted by policy compliers' counterfactual likelihood of earning that major; see Figure 6) by age among all 22-62 ACS respondents between 2009 and 2018, CPI-adjusting wages to 2018 dollars. The "Age 22-62 NPV" is the net present value (at age 22) of majoring in economics, assuming that a worker working full-time and full-year would receive the median economics wage at each age between 22 and 62 if she majors in economics and the weighted other majors' median wage at each age otherwise (and assuming a 3 percent discount rate). The shaded area overlaps with our observed sample, enabling empirical validation. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. Sources: The UC-CHP Student Database and the American Community Survey (Ruggles et al., 2020).

Figure A-9: California Employment at the Economics GPA Threshold, 2008-2012

(a) 2017-2018
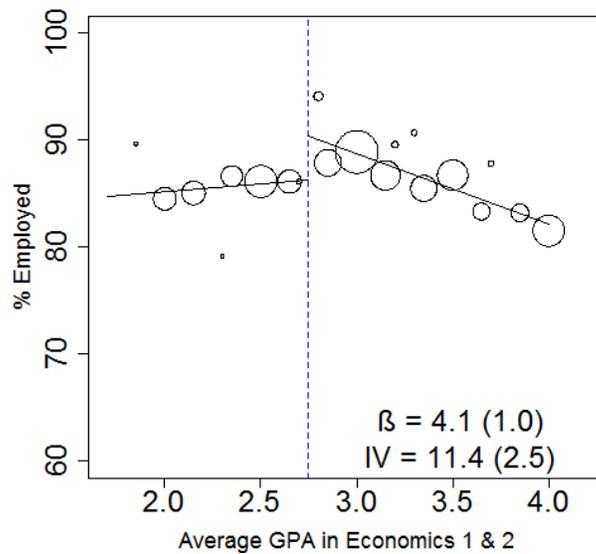


Note: This figure shows that 2017-2018 California employment is high (over 85 percent) for UCSC students near the GPA threshold, with some evidence (depending on specification) of slightly increased employment likelihood just above the economics GPA threshold. Each circle represents the percent of 2017-2018 California employment (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Employment is defined as earning non-zero EDD wages in either 2017 or 2018. $EGPA$s below 1.8 are omitted. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Source: The UC-CHP Student Database and the CA Employment Development Department.

# Figure A-10: Effect of Economics Major Access on Other Educational Outcomes

## Panel A: Educational Experience

### (a) Median Class Size      (b) # Hours/Week Studying     (c) Years Enrolled



## Panel B: Student Grade Point Average Measures

### (d) Standard GPA     (e) Standard Relative GPA     (f) GPA Net Course FEs
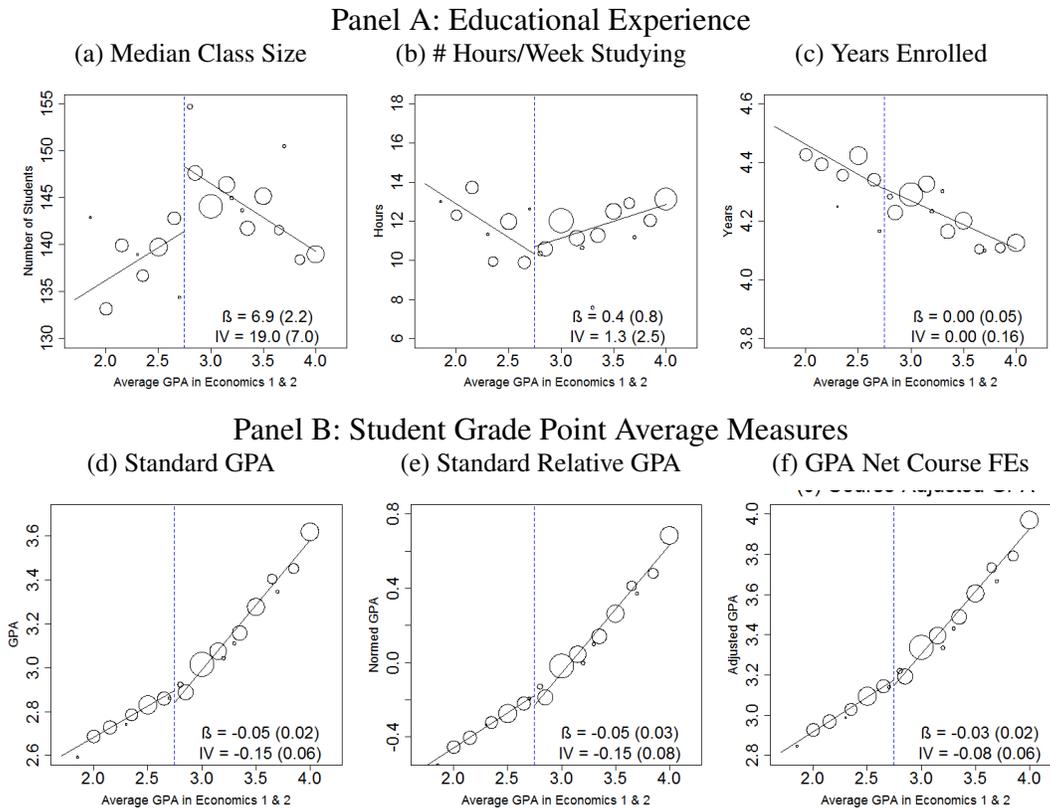


Note: This figure shows that barely above-threshold UCSC students had larger classes but spent similar time studying when compared to below-threshold peers. They also had smooth (or slightly lower) average grades, average grades compared to their peers, and average grades partialing out course fixed effects (from a two-way FE model). This suggests both both that students' educational intensity and performance cannot explain their labor market success and that the students hardly (if at all) struggled in the courses they were nearly restricted from. Each circle represents the mean educational characteristic (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Median class size measured by course department, number, and term. Number of hours studying per week measured among 789 in-sample UCUES survey respondents in their third or fourth year (the survey is biannual). Years enrolled measures the number of academic years (of the seven following high school graduation) in which the student is observed as enrolled in NSC but has not yet earned a Bachelor's degree. Standard GPA is a weighted average over students' grades by units. Standardized Relative GPA is the credit-unit-weighted average over students' within-course standardized grades (using course grade means and standard deviations). GPA Net Course FEs is calculated as each student's credit-unit-weighted mean of the differences between students' grades and each course's fixed effect from a two-way fixed effect model of UCSC course grades on student and course effects, with a 2013 writing course as the omitted course. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Sources: The UC-CHP Student Database and the Student Experience in the Research University (SERU) database.

# Figure A-11: Major Choice at the Economics GPA Threshold, 2008-2012

## Panel A: Change in Major Choice



(a) Economics     (b) Humanities     (c) Other Social Sciences     (d) Natural Sciences     (e) Engineering
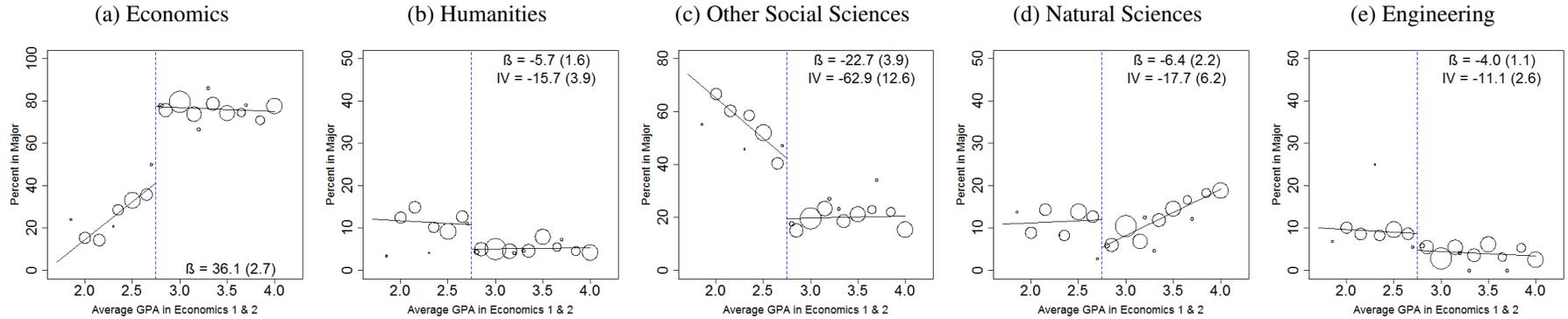
## Panel B: Change in Course Enrollment



(f) Economics     (g) Humanities     (h) Other Social Sciences     (i) Math/Statistics     (j) Other Natural Sciences
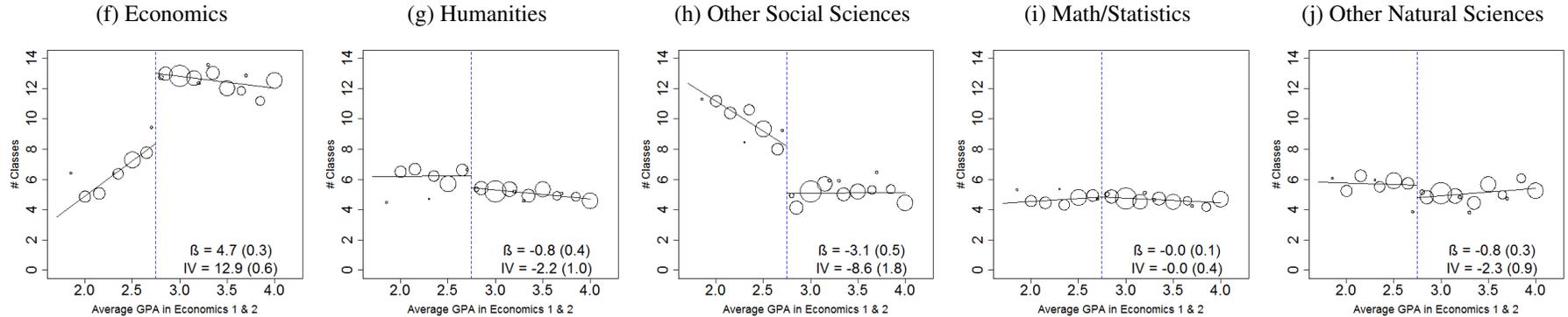
Note: This figure shows that about two-thirds of barely above-threshold policy compliers would have otherwise earned degrees in the other social sciences, and that about 8.5 of economics majors additional 13 economics courses would have otherwise been in other social science departments (though there is no net change in their number of completed mathematics and statistics courses). Each circle represents the mean percent of students in the major area or the mean number of courses taken in an area (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Major indicators include students with multiple majors. Majoring in economics indicates declaring any of UCSC's three economics major tracks: economics, global economics, or business management economics. "Other social sciences" includes all social sciences other than economics. "Math/Statistics" includes all courses in the Mathematics or Applied Mathematics and Statistics departments; "other natural sciences" includes all other natural sciences. Source: The UC-CHP Student Database.

Figure A-12: Detailed Economics Course Completions at the Economics GPA Threshold, 2008-2012



(a) Economics Sub-Disciplines    (b) Business Sub-Disciplines    (c) Quant. Method. Courses

ß = 2.5 (0.2)
IV = 6.9 (0.3)

ß = 2.0 (0.1)
IV = 5.7 (0.5)

ß = 0.6 (0.1)
IV = 1.7 (0.3)
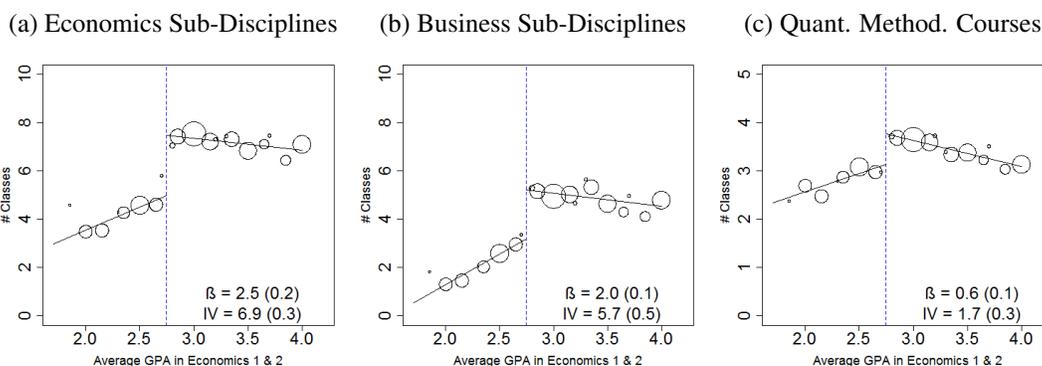
Note: This figure shows that the 13 additional economics courses taken by barely above-threshold economics majors were split between traditional economics sub-disciplines and business and finance sub-disciplines, and that economics majors took two additional quantitative methodology courses across departments. Each circle represents the mean number of courses taken in an area (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Business sub-disciplines include all accounting or "business management upper division electives" as designated by UCSC, which include courses in management, finance, and marketing; traditional economics subdisciplines include all other courses in offered by the Department of Economics. Quantitative methodology courses include any course that mentions 'statistics', 'econometrics', 'psychometrics' or 'quantitative/math/research/information methods' in its title. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Source: The UC-CHP Student Database.

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Figure A-13: Histograms of Economics Courses taken by UCSC Economics Majors and Non-Majors

## Panel A: All Economics Courses

(a) All Non-Economics Majors        (b) Excluding TIM Majors



## Panel B: Upper-Division Economics Courses

(c) All Non-Economics Majors        (d) Excluding TIM Majors
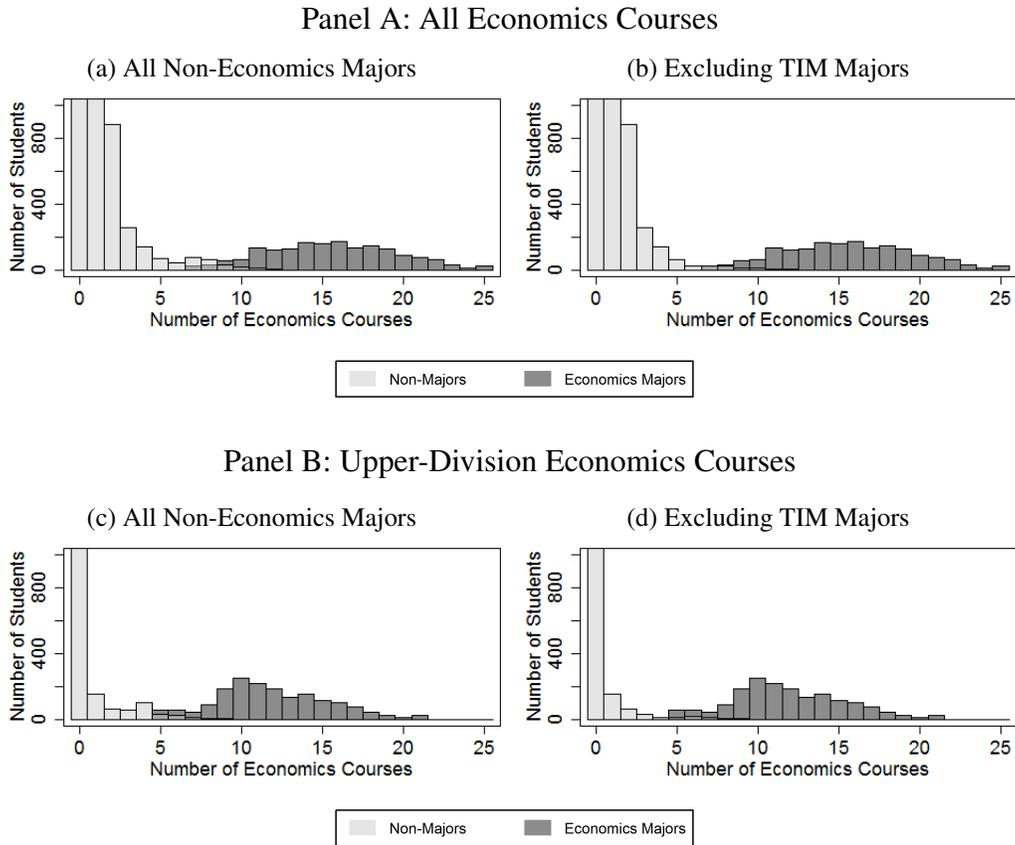


Note: Histograms showing the number of freshman-admit UCSC graduates from the 2008-2012 cohorts by the number of economics courses they completed. The sample is split by whether the student earned a major in economics, with 'non-majors' including (excluding) Technology and Information Management (TIM) majors in panels a and c (b and d). Panel A includes all economics courses; Panel B includes only upper-division economics courses (that is, with course numbers above 99). Course counts are winsorized at 25 for all courses and 21 for upper-division courses, with fewer than 25 students having taken more such courses. Some bars are taller than the chosen y-axis. Source: The UC-CHP Student Database.

Figure A-14: Additional Specifications of the Intended Career in Business/Finance Survey Responses at the 2008-2012 Economics GPA Threshold

Panel A: Freshman UCUES Survey Responses on Intend Career in Bus/Fin.

(a) First-Year Respondents



ß = -2.1 (9.0)
IV = -4.8 (20.4)
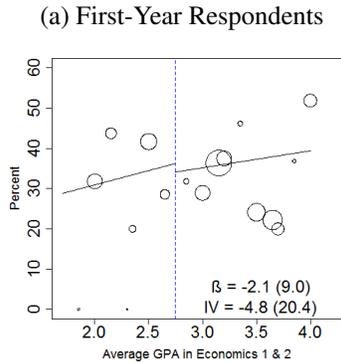
Panel B: Alternative Sample Specifications of Sophomore/Junior Responses

(b) Full 2008-2012 Sample    (c) Omitting Outliers    (d) 2008-2011 Sample



ß = 10.8 (9.5)
IV = 36.8 (29.7)

ß = 16.1 (6.9)
IV = 51.8 (23.0)

ß = 18.7 (8.1)
IV = 51.6 (24.1)
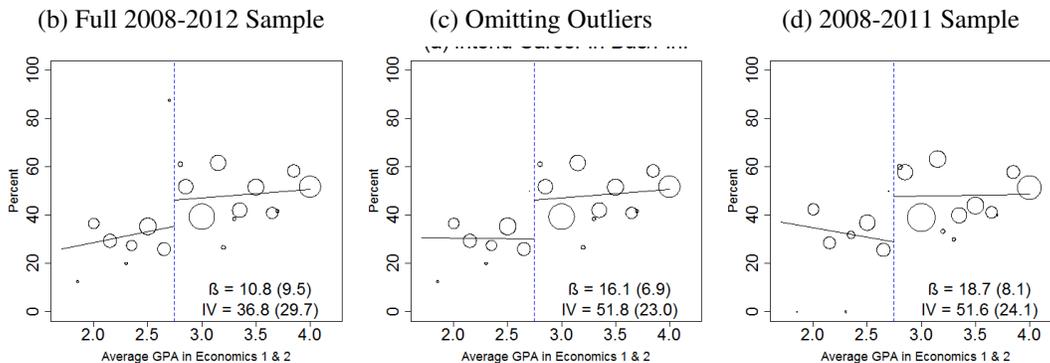
Note: This figure shows that (A) there was no difference in *first-year* survey respondents' baseline business/finance career intentions (prior to taking many economics courses), and (B) estimated differences in sophomore-junior responses are sensitive to six 2.7-$EGPA$ 2012 sophomore economics major "outliers" (who make up 75% of all 2.7-$EGPA$ UCUES respondents, and all intend business/finance careers). Each circle represents the percent of students in different samples who report intending business/finance careers (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Panel A is restricted to the 338 in-sample students who completed the survey in the spring of their first year; Panel B is restricted to the 874 students who completed in it in their second or third year. Panel (c) further omits six "outlier" students easily-observable in (b): they are all 2012 second-year respondents with 2.7 (below-threshold) $EGPA$s, economics majors, and report intending business/finance careers, which given their closeness to the threshold strongly shifts the estimated effect of majoring in economics despite their non-compliance and small number. Panel (d) instead omits all 2012 respondents, showing a similar pattern to (c). Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Source: The UC-CHP Student Database.

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Figure A-15: Share of 2008-2012 UCSC Economics Majors on the "Business Management Economics" Track
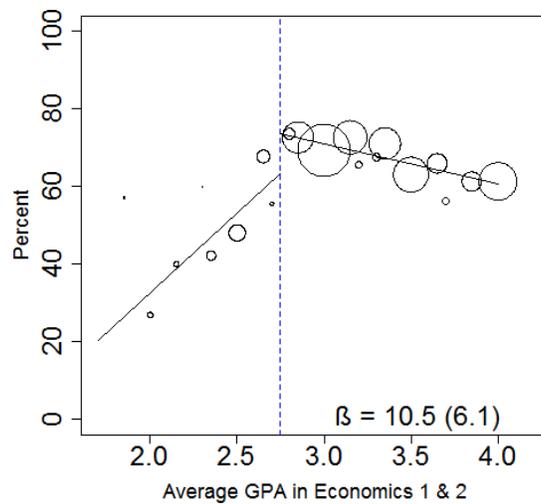


Note: This figure shows that the proportion of economics majors on the business economics track is relatively smooth across the GPA threshold, implying that the wage returns at the threshold are unlikely to arise as a result of access specifically to the business economics track changing at the GPA threshold. Each circle represents the percent of economics majors on the business management economics track (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. $EGPA$s below 1.8 are omitted, leaving 1,671 economics majors. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Source: The UC-CHP Student Database.

Figure A-16: Median Wages in the 2008-2012 UCSC Cohorts' Chosen Majors, Imputed from Different Samples

(a) UCSC Economics 1&2 Students



(b) All UCSC Students



(c) All California Workers



(d) All U.S. Workers
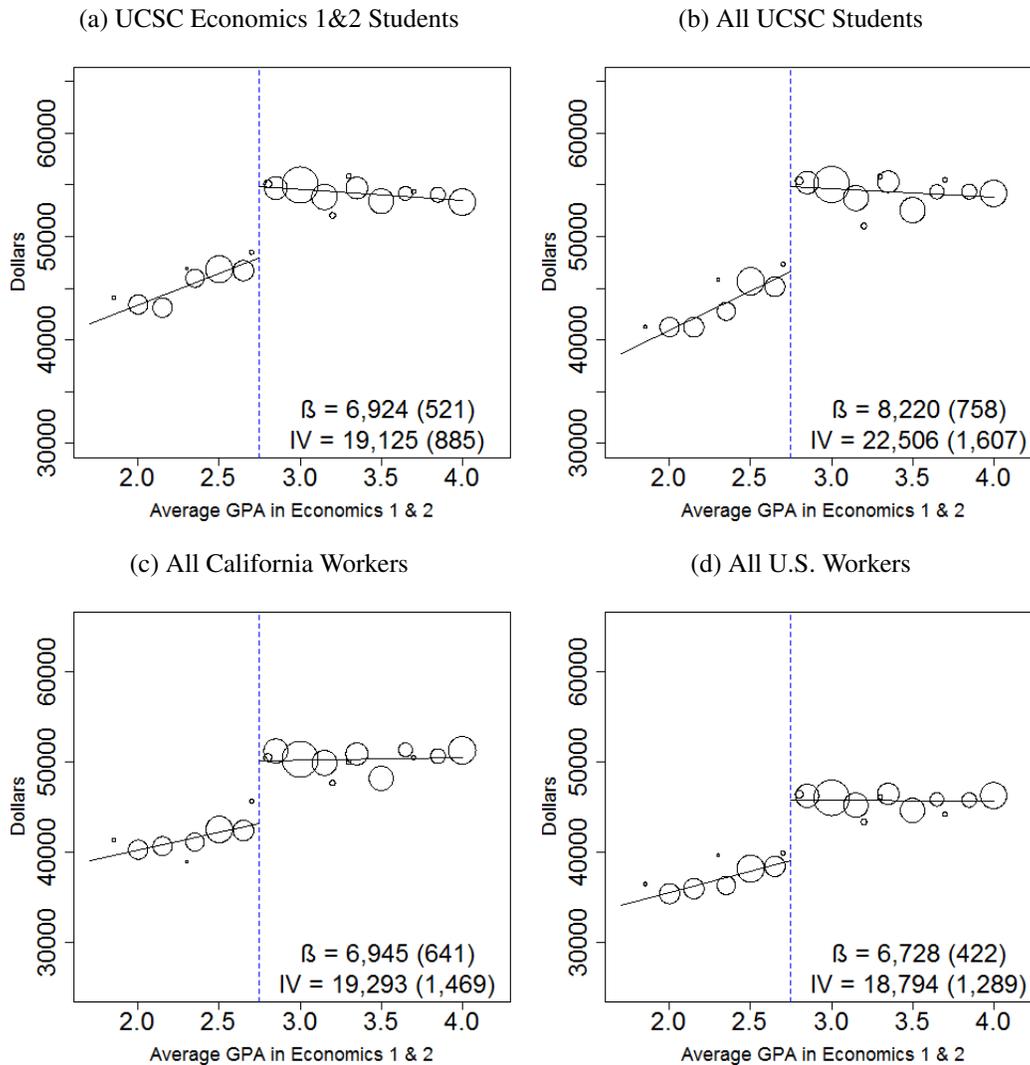


Note: This figure shows that when wages are imputed for each student by the median wages of similar-age workers with their same major choice – among the 2008-2012 main UCSC sample, among all 2008-2012 UCSC students, among all similar-age California-residing ACS respondents, or among all similar-age ACS respodents – the imputed wages increase across the GPA threshold by \$6,700 to \$8,200, similar (or slightly smaller) magnitude to the true change in students' early-career wages. Each circle represents the imputed wages associated with students' chosen majors (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Wage-by-major medians are calculated using 2017-2018 wages for four groups: (a) 2008-2012 freshman-admit UCSC students who completed Economics 1 and 2; (b) all 2008-2012 freshman-admit UCSC students; (c) 23-to-27-year-olds in the 2017 ACS and 24-to-28-year-olds in the 2018 ACS employed in California; and (d) all employed ACS respondents of those same ages. Students with double majors are characterized by that double-major (irrespective of order) in both data sets, with independent wage medians for each major pair. ACS medians are weighted by sample weights. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. $EGPA$s below 1.8 are omitted, leaving 2,839 students. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Sources: The UC-CHP Student Database, the CA Employment Development Department, and the American Community Survey (Ruggles et al., 2020).

Figure A-17: Median Early-Career 2009-2010 Wages of the Majors Chosen by the 2008-2012 UCSC Cohorts

(a) Medians of UCSC Economics 1&2 Students

(b) Medians of All UCSC Students

(c) Medians of All California Workers

(d) Medians of All U.S. Workers
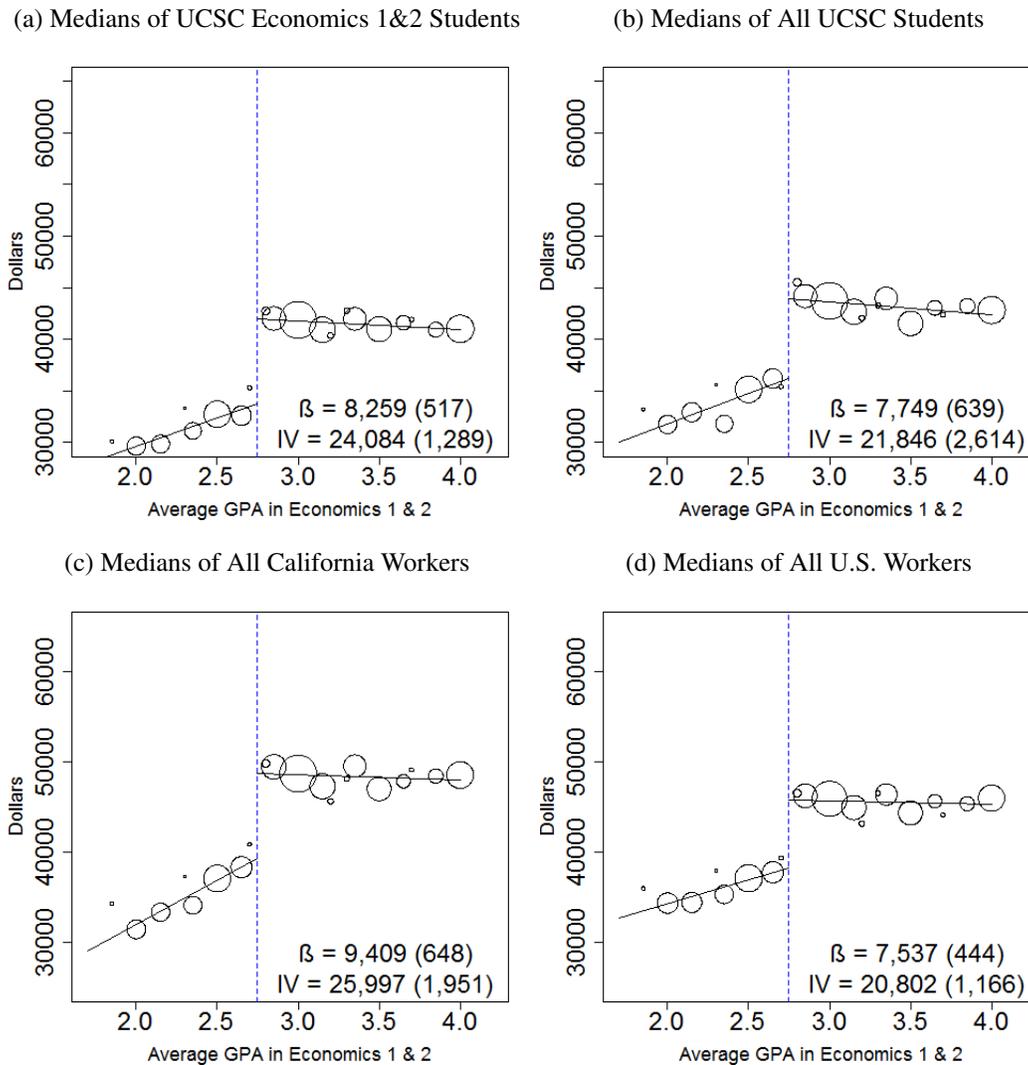


Note: This figure shows that imputing wages using wage-by-major medians (as in Figure A-16), but using 2009-2010 CPI-adjusted medians from the 2000-2004 cohorts, provides highly similar estimates, implying average wage differences across majors are relatively persistent over time. Each circle represents the imputed wages associated with students' chosen majors (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Wage-by-major medians are calculated using 2009-2010 wages for four groups: (a) 2000-2004 freshman-admit UCSC students who completed Economics 1 and 2; (b) all 2000-2004 freshman-admit UCSC students; (c) 23-to-27-year-olds in the 2009 ACS and 24-to-28-year-olds in the 2010 ACS employed in California; and (d) all employed ACS respondents of those same ages. Students with double majors are characterized by that double-major (irrespective of order) in both data sets, with independent wage medians for each major pair. ACS medians are weighted by sample weights. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. $EGPA$s below 1.8 are omitted, leaving 2,839 students. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Sources: The UC-CHP Student Database, the CA Employment Development Department, and the American Community Survey (Ruggles et al., 2020).

Figure A-18: Median Wages in the 2008-2012 UCSC Cohorts' Chosen Majors, Imputed from States Dissimilar to California

(a) State PCA Decomposition

(b) Imputed Wages by Major
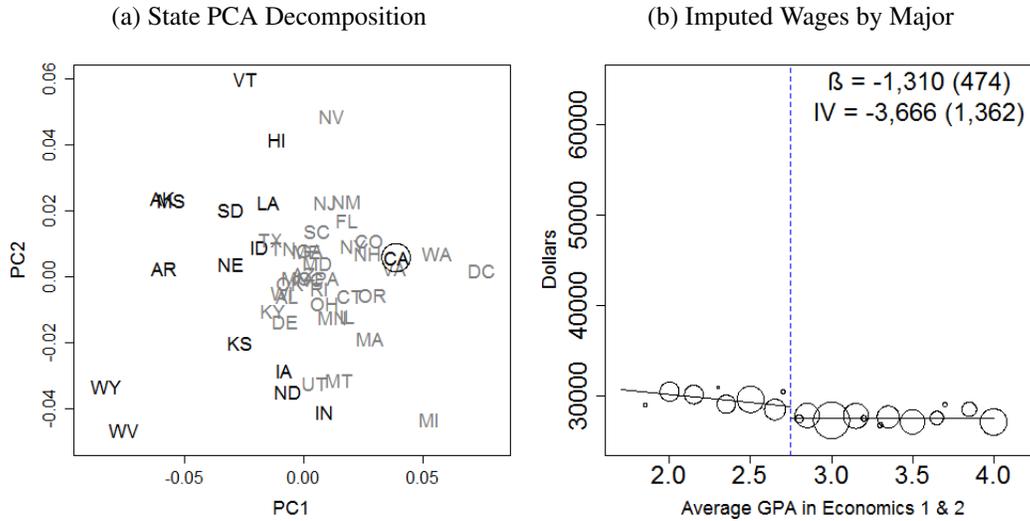


Note: This figure shows that when wages are imputed for each UCSC student by the median wages of similar-age workers with their same major choice **from states with highly-dissimilar college-educated labor markets from California's**, economics majors do not have higher average wages than college graduates with the second-choice majors chosen by policy compliers below UCSC's GPA threshold. Panel (a) shows the 15 states most-dissimilar from California in distance on the first two principal components of college-educated employment shares by industry, measured using the full ACS industry codes of the 23-to-27-year-old respondents in the 2017 ACS and 24-to-28-year-olds in the 2018 ACS. In Panel (b), each circle represents the imputed wages associated with students' chosen majors (y axis) among 2008-2012 UCSC students who earned a given $EGPA$ in Economics 1 and 2 (x axis). The size of each circle corresponds to the proportion of students who earned that $EGPA$. Wage-by-major medians are calculated using the 2017-2018 wages of all employed ACS respondents of those same ages who reside in one of the fifteen states most-dissimilar from California. Students with double majors are characterized by that double-major (irrespective of order) in both data sets, with independent wage medians for each major pair. ACS medians are weighted by sample weights. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. $EGPA$s below 1.8 are omitted, leaving 2,839 students. Fit lines and beta estimate (at the 2.8 GPA threshold) from linear regression discontinuity specification and instrumental variable specification (with majoring in economics as the endogenous variable); standard error (clustered by $EGPA$) in parentheses. Sources: The UC-CHP Student Database and the American Community Survey (Ruggles et al., 2020).

Table A-1: Alternative RD Model Specifications for Figures 1 and 2

| | Major in Economics | Predicted Wages by Demographics | | | 2017-2018 Wages | 2017-2018 Log Wages | 2017-2018 CA Employ. |
| | | All | Emp. 17-18 | UCUES | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Baseline | 36.1 | -15.0 | 998.9 | -15.0 | 7,989 | 0.21 | 4.1 |
| | (2.7) | (392.3) | (733.9) | (392.3) | (1,885) | (0.05) | (1.0) |
| Quadratic Run. Var. | 31.8 | -114.6 | 405.9 | -114.6 | 12,584 | 0.29 | 2.8 |
| | (5.5) | (661.4) | (839.2) | (661.4) | (2,979) | (0.07) | (1.8) |
| Detailed Covariates | 35.2 | -288.1 | -159.4 | -288.1 | 8,579 | 0.19 | 4.7 |
| | (4.4) | (258.2) | (504.8) | (258.2) | (2,599) | (0.08) | (2.8) |
| Narrow Bandwidth | 37.5 | -346.2 | -766.2 | -346.2 | 12,336 | 0.31 | 3.9 |
| | (4.3) | (821.1) | (951.6) | (821.1) | (3,242) | (0.07) | (2.2) |
| "Honest" Local Lin. | 29.4 | 554.3 | 2,590.3 | 554.3 | 10,977 | 0.18 | 4.3 |
| | (7.9) | (1,047.5) | (2,357.2) | (1,047.5) | (5,020) | (0.15) | (5.5) |

Note: This table shows that the results presented in Figures 1 and 2 are highly robust to alternative regression specifications, though the conservative "honest" local linear estimation on log wages estimates a statistically-insignificant effect on log wages (because its wide bandwidth just includes $EGPA = 2.35$, which has unexpectedly high wages). Regression discontinuity specifications estimating the reduced-form effect of economics major access on major choice and labor market outcomes for 2008-2012 UCSC students who completed Economics 1 and 2. Baseline specification is the beta coefficient from a regression discontinuity OLS model linear in the running variable (Econ $EGPA$). The second specification includes quadratic terms in the running variable on either side of the threshold. The third specification includes linear running variable terms along with gender-ethnicity indicators, cohort indicators, and high school indicators. The fourth specification includes linear running variable terms but restricts the sample to within 0.5 $EGPA$ points of the threshold, resulting in 10 available $EGPA$s. The fifth specification estimates "honest" local linear RD coefficients with optimal bandwidth, triangular kernel, and an assumed constant bound on the second derivative of the conditional expectation function following Kolesár and Rothe (2018). "Major in economics" indicates declaring any of UCSC's three economics major tracks: economics, global economics, or business management economics. "Predicted Wages by Demographics" estimates each student's predicted wages by a linear regression (among 2008-2012 UCSC students outside the main sample) of 2017-2018 wages on gender-ethnicity indicators, residency status, and third-order polynomials in SAT score and mean ZIP Code income. The effects on predicted wages are included for three samples: the full sample, those who are employed in 2017-2018, and those who complete the UCUES survey in their junior or senior year (see Figure A-3). 2017-2018 wages are the mean in EDD-covered California wages in those years, omitting zeroes. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. Employment is defined as earning non-zero EDD wages in either 2017 or 2018. $EGPA$s below 1.8 are omitted, leaving 2,839 students in the sample (2,446 with observed wages). All standard errors are clustered by the 20 available $EGPA$s earned by students in Economics 1 and 2.

Sources: The UC-CHP Student Database and the CA Employment Development Department

Table A-2: Alternative RD Model Specifications for Figure 4

| | College GPA | Degree Attain. | Years Enr. | Grad. Deg. Enr. | Median Class Size | # Hours/Week Studying | # Econ. Courses |
|---|---|---|---|---|---|---|---|
| Baseline | -0.05 (0.02) | -0.4 (1.5) | 0.00 (0.05) | -2.3 (2.2) | 7.0 (2.3) | 0.4 (0.8) | 4.7 (0.3) |
| Quadratic Run. Var. | 0.00 (0.03) | -3.8 (2.1) | -0.07 (0.08) | -2.8 (4.1) | 6.5 (4.0) | 0.8 (1.3) | 4.0 (0.6) |
| Detailed Covariates | -0.05 (0.02) | -1.6 (1.9) | -0.06 (0.05) | -2.5 (4.8) | 9.1 (2.3) | 0.3 (0.8) | 4.6 (0.5) |
| Narrow Bandwidth | -0.02 (0.03) | -2.6 (2.0) | -0.09 (0.06) | -1.4 (3.8) | 7.2 (3.4) | -0.0 (1.3) | 4.4 (0.4) |
| "Honest" Local Lin. | -0.00 (0.05) | 1.3 (3.6) | 0.07 (0.13) | 1.3 (6.2) | 12.0 (6.8) | 0.5 (2.7) | 2.9 (1.4) |

Note: This table shows that the results presented in Figure 4 are highly robust to alternative regression specifications. Regression discontinuity specifications estimating the reduced-form effect of economics major access on educational outcomes for 2008-2012 UCSC students who completed Economics 1 and 2. Baseline specification is the beta coefficient from a regression discontinuity OLS model linear in the running variable (Econ $EGPA$). The second specification includes quadratic terms in the running variable on either side of the threshold. The third specification includes linear running variable terms along with gender-ethnicity indicators, cohort indicators, and high school indicators. The fourth specification includes linear running variable terms but restricts the sample to within 0.5 $EGPA$ points of the threshold, resulting in 10 available $EGPA$s. The fifth specification estimates "honest" local linear RD coefficients with optimal bandwidth, triangular kernel, and an assumed constant bound on the second derivative of the conditional expectation function following Kolesár and Rothe (2018). College GPA includes all courses and is weighted by units. Degree attainment measured in 2019 and includes degrees earned at other institutions (by students who transfer away from UCSC) measured in NSC. Years enrolled measures the number of academic years (of the seven following high school graduation) in which the student is observed as enrolled in NSC but has not yet earned a Bachelor's degree. Graduate degree enrollment indicates having enrolled in a graduate degree (measured in NSC) within seven years of high school graduation. Median class size measured by course department, number, and term. Number of hours studying per week measured among 789 in-sample UCUES survey respondents in their third or fourth year (the survey is biannual). Number of economics courses measures the number of courses listed on the student's transcript as having been taught in the Department of Economics. All standard errors are clustered by the 20 available $EGPA$s earned by students in Economics 1 and 2, with the sample restricted to $EGPA$s above 1.8.

Sources: The UC-CHP Student Database, the Student Experience in the Research University (SERU) database, and the National Student Clearinghouse

Table A-3: Alternative RD Model Specifications for Figure 5

| | Intend. In Bus/Fin[†] | Intend. In Bus/Fin | FIRE and Account. | FIRE | Account. | Imp. UCSC Wages by Ind. |
|---|---|---|---|---|---|---|
| Baseline | 16.1 (6.9) | 10.8 (9.5) | 9.1 (2.3) | 6.3 (2.3) | 3.4 (1.1) | 3,937 (1,166) |
| Quadratic Run. Var. | 24.7 (7.7) | 12.3 (17.5) | 11.4 (3.2) | 10.0 (2.9) | 3.2 (1.7) | 6,431 (1,473) |
| Detailed Covariates | 17.0 (6.9) | 12.5 (8.6) | 9.6 (3.7) | 7.1 (4.0) | 2.4 (1.3) | 3,471 (1,604) |
| Narrow Bandwidth | 18.4 (10.1) | 8.9 (16.7) | 6.8 (2.9) | 4.3 (2.5) | 3.6 (1.5) | 7,374 (1,053) |
| "Honest" Local Lin. | 36.9 (15.9) | -13.0 (14.6) | 11.0 (5.3) | 8.9 (5.2) | 5.1 (3.6) | 9,498 (3,387) |

Note: This table shows that the results presented in Figure 5 are highly robust to alternative regression specifications, though some specifications find larger estimates on imputed wages by industry. Regression discontinuity specifications estimating the reduced-form effect of economics major access on educational outcomes for 2008-2012 UCSC students who completed Economics 1 and 2. Baseline specification is the beta coefficient from a regression discontinuity OLS model linear in the running variable (Econ $EGPA$). The second specification includes quadratic terms in the running variable on either side of the threshold. The third specification includes linear running variable terms along with gender-ethnicity indicators, cohort indicators, and high school indicators. The fourth specification includes linear running variable terms but restricts the sample to within 0.5 $EGPA$ points of the threshold, resulting in 10 available $EGPA$s. The fifth specification estimates "honest" local linear RD coefficients with optimal bandwidth, triangular kernel, and an assumed constant bound on the second derivative of the conditional expectation function following Kolesár and Rothe (2018). Intended career in business/finance indicates selecting "Business, finance-related professions" on a survey asking "Career hope to eventually have after education complete" (see Appendix A) among 834 in-sample UCUES survey respondents in their second or third year (the survey is biannual). Employment in FIRE and accounting indicates 2017 or 2018 employment in the finance, insurance, and real estate (NAICS codes 52 and 531) or accounting (541211) industries, both of which employ large shares of UCSC economics majors; see Figure A-5. Imputed wages by industry (6-digit NAICS) are calculated as the mean 2017-2018 wages of all 2008-2012 freshman-admit UCSC students. Imputed wages are CPI-adjusted to 2018 and winsorized at 2% above and below. All standard errors are clustered by the 20 available $EGPA$s earned by students in Economics 1 and 2, with the sample restricted to $EGPA$s above 1.8. [†] Six 2012 sophomore respondents – economics majors with 2.7 $EGPAs$ – were omitted from estimation; see Figure A-14.

Sources: The UC-CHP Student Database, the Student Experience in the Research University (SERU) database, and the CA Employment Development Department

Table A-4: Alternative RD Model Specifications for Figure 6

| | UCSC OLS Coef. | | Median Wages | | |
| | No Cont. | Controls | UCSC | CA | U.S. |
|---|---|---|---|---|---|
| Baseline | 7,178 | 5,579 | 8,065 | 6,945 | 6,728 |
| | (547) | (1,333) | (599) | (641) | (422) |
| Quadratic | 7,731 | 7,491 | 8,100 | 7,250 | 6,969 |
| Run. Var. | (715) | (1,475) | (996) | (1,151) | (620) |
| Detailed | 6,693 | 1,778 | 7,727 | 7,082 | 6,592 |
| Covariates | (823) | (2,123) | (830) | (1,018) | (683) |
| Narrow | 8,156 | 8,111 | 9,106 | 7,590 | 7,557 |
| Bandwidth | (674) | (1,360) | (861) | (1,001) | (603) |
| "Honest" | 8,072 | 6,873 | 8,404 | 7,075 | 6,868 |
| Local Lin. | (1,894) | (2,269) | (1,753) | (1,437) | (1,252) |

Note: This table shows that the reduced-form versions of the RD IV estimates presented in Figure 6 are highly robust to alternative regression specifications. Regression discontinuity specifications estimating the reduced-form effect of economics major access on imputed wages (by college majors) for 2008-2012 UCSC students who completed Economics 1 and 2. Baseline specification is the beta coefficient from a regression discontinuity OLS model linear in the running variable (Econ $EGPA$). The second specification includes quadratic terms in the running variable on either side of the threshold. The third specification includes linear running variable terms along with gender-ethnicity indicators, cohort indicators, and high school indicators. The fourth specification includes linear running variable terms but restricts the sample to within 0.5 $EGPA$ points of the threshold, resulting in 10 available $EGPA$s. The fifth specification estimates "honest" local linear RD coefficients with optimal bandwidth, triangular kernel, and an assumed constant bound on the second derivative of the conditional expectation function following Kolesár and Rothe (2018). The outcome variables assign each 2008-2012 UCSC student to their corresponding majors' average wage – partitioning students by their set of majors, and in the UCSC no-controls sample using leave-one-out models – and estimates the linear RD IV model on the resulting imputed wages. OLS coefficients from a linear regression of wages on major dummies with or without covariates (gender-ethnicity, cohort year, and high school), partitioning students by majors and omitting Business Management Economics. Median wages calculated by majors for UCSC sample, for the ACS sample of California residents, and for the full ACS sample. See the appendix for UCSC-ACS major mapping. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. All standard errors are clustered by the 20 available $EGPA$s earned by students in Economics 1 and 2, with the sample restricted to $EGPA$s above 1.8.

Sources: The UC-CHP Student Database, the CA Employment Development Department, and the American Community Survey (Ruggles et al., 2020).

Table A-5: Changes in 2017-18 Industry

| Two-Digit NAICS Industry | IV Est. ($\beta$) | (s.e.) | Econ. Maj. Share | | Young Coll. Work. Share | |
|---|---|---|---|---|---|---|
| | | | UCSC | U.S. | UCSC | U.S. |
| FIRE | 17.2 | (5.4) | 14.0 | 24.0 | 4.9 | 7.3 |
| Accounting | 9.3 | (2.8) | 10.8 | 3.1 | 1.6 | 1.7 |
| Professional Services | 5.7 | (10.0) | 32.6 | 18.8 | 20.5 | 12.9 |
| Public Administration | 4.2 | (4.3) | 4.2 | 5.8 | 5.3 | 5.2 |
| Construction | 4.0 | (2.3) | 2.0 | 1.5 | 1.3 | 1.9 |
| Transportation | 4.0 | (2.9) | 2.2 | 2.5 | 1.6 | 1.6 |
| Management Firms | 3.5 | (1.5) | 0.5 | 0.4 | 0.3 | 0.2 |
| Agriculture | 2.1 | (2.3) | 1.6 | 0.5 | 1.2 | 0.6 |
| Manufacturing | 1.8 | (6.0) | 7.6 | 4.5 | 6.5 | 6.6 |
| Utilities | 1.2 | (1.3) | 0.6 | 0.4 | 0.3 | 0.5 |
| Admin. Support | 0.5 | (4.3) | 10.9 | 2.6 | 10.2 | 2.6 |
| Rental/Leasing | 0.0 | (1.3) | 0.7 | 0.4 | 0.5 | 0.4 |
| Arts and Entertainment | -0.7 | (3.7) | 2.4 | 1.6 | 4.3 | 2.8 |
| Other Services | -1.0 | (2.8) | 2.0 | 2.7 | 4.8 | 3.3 |
| Information | -1.3 | (10.0) | 9.9 | 3.8 | 7.2 | 3.4 |
| Accomodation and Food | -4.1 | (2.9) | 5.3 | 3.2 | 8.4 | 4.8 |
| Retail Trade | -5.1 | (8.8) | 8.2 | 6.8 | 9.9 | 7.9 |
| Education | -8.1 | (4.0) | 6.6 | 10.8 | 19.5 | 18.3 |
| Wholesale Trade | -8.5 | (6.6) | 5.2 | 2.2 | 3.3 | 1.8 |
| Healthcare and Social Assist. | -8.6 | (3.4) | 4.6 | 3.9 | 15.1 | 15.6 |

Note: This table shows the two-digit-NAICS industries of 2017-2018 employment most impacted across the 2008-2012 UCSC economics GPA threshold, with workers flowing most into FIRE and out of education, healthcare and social assistance, and (noisily) wholesale trade, along with the worker shares at UCSC and across the country (for economics majors and all college graduates). Columns one and two show estimates from instrumental variable regression discontinuity specifications of indicators for 2017 or 2018 employment in each two-digit NAICS industry on economics major choice (instrumented by the 2.8 $EGPA$ threshold; standard error (clustered by $EGPA$) in parentheses. The remaining columns show the proportion of 2008-2012 UCSC students or 23-to-28-year-old 2017-2018 ACS respondents employed (in 2017-2018) in each industry, overall and among economics majors. The following NAICS codes are combined for similarity: 52/531 (FIRE), 31/32/33 (manufacturing), 44/45 (retail trade), and 48/49 (transportation). Accounting (541211, or 5412 in the ACS) is separated out from professional services. Employment industry is the reported NAICS code of an individual's highest-paying position in the year's fourth quarter.

Sources: The UC-CHP Student Database, the CA Employment Development Department, and the American Community Survey (Ruggles et al., 2020).

Table A-6: Counterfactual Major Choice and Average Wages by Major

| Major | % of Grads | | Δ Among Comp. (%) | UCSC OLS Coef. | | Median Wages | | |
|---|---|---|---|---|---|---|---|---|
| | UCSC | U.S. | | No Cont. | Controls | UCSC | CA | U.S. |
| Psychology | 12.9 | 6.4 | -20.4 (4.3) | -26,088 (1,146) | -24,160 (1,253) | 33,875 | 30,661 | 30,000 |
| Environmental Studies | 6.1 | 0.8 | -14.1 (6.8) | -24,602 (1,473) | -23,561 (1,609) | 38,135 | 40,606 | 33,915 |
| Tech. & Info. Mgmt. | 1.2 | 0.2 | -11.6 (1.5) | 3,410 (2,682) | 1,183 (2,698) | 61,672 | 48,000 | 49,871 |
| Sociology | 6.0 | 1.7 | -9.8 (2.4) | -22,014 (1,341) | -19,316 (1,543) | 37,024 | 35,055 | 32,000 |
| Film and Dig. Media | 3.4 | 0.7 | -8.0 (2.7) | -28,599 (1,638) | -25,241 (1,845) | 30,685 | 30,594 | 28,617 |
| Legal Studies | 2.6 | 0.2 | -7.7 (1.8) | -14,636 (1,897) | -13,140 (2,054) | 42,500 | 46,828 | 34,749 |
| Mathematics | 2.0 | 1.4 | -6.5 (3.0) | -17,446 (2,256) | -12,911 (2,590) | 44,577 | 50,000 | 38,899 |
| Latin Amer. Studies | 2.0 | 0.7 | -5.1 (1.2) | -28,369 (2,846) | -21,465 (3,160) | 35,112 | 32,007 | 30,661 |
| Art | 3.6 | 1.0 | -3.9 (1.5) | -34,687 (1,809) | -31,265 (1,932) | 25,641 | 30,661 | 28,000 |
| Anthropology | 4.7 | 0.7 | -3.6 (1.8) | -26,810 (1,556) | -26,426 (1,854) | 32,032 | 26,711 | 25,551 |
| ... | | | | | | | | |
| Economics | 3.4 | | 4.0 (8.9) | -8,071 (1,623) | -7,085 (1,737) | 50,317 | | |
| | | 2.4 | | | | | 55,560 | 50,000 |
| Global Economics | 0.9 | | 5.9 (1.7) | -5,848 (2,947) | -7,788 (3,085) | 53,689 | 55,560 | |
| Bus. Mgmt. Economics | 7.1 | 0.2 | 90.1 (8.2) | - | - | 61,872 | 54,538 | 48,025 |
| Weighted Sum by UCSC Major Shares | | | | 20,039 | 18,073 | 21,287 | 17,436 | 15,385 |
| RD IV Estimate on Imputed Wages by Majors | | | | 19,247 | 17,461 | 22,171 | 19,293 | 18,794 |

Note: This table presents the statistics used to generate Figure 6, showing that observational average differences in early-career earnings – at the university, state, or national level, and in the presence or absence of control variables – well-approximate the causal estimate of the wage return to economics for policy compliers near the GPA threshold. This table presents shares and average wages by major among 2008-2012 UCSC students (in 2017-2018) and 2017-2018 ACS respondents (age 23-28), along with estimates of the difference between the average wages of majors chosen by above-threshold policy compliers and average wages of their counterfactual majors. Columns 1 and 2 present the proportion of students who choose each major in each sample. The third column shows the change in major choice at the GPA threshold estimated using the linear RD IV specification described in the text; majors are ordered by this column, with those outside the top ten (and bottom three) omitted from the table. OLS coefficients from a linear regression of wages on major dummies with or without covariates (gender-ethnicity, SAT score, ZIP Code average AGI, cohort year, and high school), partitioning students by major (choosing higher-earning major among in-sample single majors for multi-major students) and omitting Business Management Economics. Median wages calculated by higher-earning major for UCSC sample and full ACS sample. "**Weighted Sum Using UCSC Major Shares**" shows the difference between the weighted sum of Econ wage values by the share of UCSC students in that major (using highest-earning majors) and that of non-Econ wage values. "**RD IV Estimate on Imputed Wages**" assigns each 2008-2012 UCSC student to their corresponding majors' average wage – now partitioning students by their set of majors (not their higher-earning major), and in the UCSC no-controls sample using leave-one-out averages – and estimates the linear RD IV model on the resulting imputed wages. The ACS does not have separate major categories for Economics and Global Economics; see the appendix for UCSC-ACS major mapping. Wages are CPI-adjusted to 2018 and winsorized at 2% above and below. Sources: The UC-CHP Student Database, the CA Employment Development Department, and the American Community Survey (Ruggles et al., 2020).

## Table A-7: UCSC Major to ACS Major Mapping

| Major | ACS Field | Prop. in Sample |
|---|---|---|
| American Studies | 1501 | 0.6 |
| Anthropology | 5502 | 1.1 |
| Applied Ling and Multiling | 2601 | 0.0 |
| Art | 6000 | 1.7 |
| Art History | 6006 | 0.6 |
| Biochemistry&Molecular Bio | 3603 | 0.4 |
| Bioengineering | 2402 | 0.1 |
| Bioinformatics | 2402 | 0.0 |
| Biology | 3600 | 1.3 |
| Business Mgmt Economics | 6205 | 50.9 |
| Chemistry | 5003 | 0.4 |
| Cognitive Science | 4006 | 0.6 |
| Community Studies | 5403 | 0.4 |
| Comp Sci Computer Game Des | 2407 | 0.4 |
| Computer Engineering | 2407 | 0.4 |
| Computer Science | 2102 | 2.4 |
| Critical Race&EthnicStudies | 1501 | 0.1 |
| Earth Sciences | 5004 | 0.6 |
| Ecology and Evolution | 3604 | 0.1 |
| Economics | 5501 | 20.2 |
| Electrical Engineering | 2408 | 0.2 |
| Environmental Studies | 1301 | 9.5 |
| Feminist Studies | 4007 | 0.3 |
| Film and Digital Media | 6005 | 2.9 |
| German Studies | 2602 | 0.1 |
| Global Economics | 5501 | 5.5 |
| Health Sciences | 6100 | 0.2 |
| History | 6402 | 3.4 |
| Human Biology | 3699 | 0.1 |
| Individual | 4000 | 0.1 |
| Information Systems Management | 2106 | 1.7 |
| Jewish Studies | 1501 | 0.0 |
| Language Studies | 2601 | 0.7 |
| Latin Amer & Latino Studies | 1501 | 2.1 |
| Legal Studies | 3202 | 3.6 |
| Linguistics | 2601 | 0.4 |
| Literature | 3301 | 1.5 |
| Marine Biology | 3699 | 0.3 |
| Mathematics | 3700 | 3.5 |
| Molec Cell Develop Biology | 3603 | 2.1 |
| Music | 6002 | 0.3 |
| Neuroscience | 3611 | 0.2 |
| Philosophy | 4801 | 1.1 |
| Physics | 5007 | 0.2 |
| Plant Sciences | 1105 | 0.1 |
| Politics | 1105 | 5.0 |
| Psychology | 5200 | 8.5 |
| Sociology | 5507 | 4.1 |
| Spanish Studies | 2602 | 0.3 |
| Technology&Info Management | 2106 | 6.0 |
| Theater Arts | 6001 | 0.5 |
| Women's Studies | 4007 | 0.0 |

Note: This table shows the employed mapping between UCSC majors and ACS "Detailed Field of Degree" codes, along with the proportion of students in the 2008-2012 main UCSC sample in each major. Multiple UCSC majors may be mapped to the same ACS degree field. See https://usa.ipums.org/usa-action/variables/DEGFIELD.

Sources: The UC-CHP Student Database and the American Community Survey (Ruggles et al., 2020).