

Online Appendix
for
In-State College Enrollment and Later Life Location Decisions

by

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All data are publicly available. Additional supplementary materials including final data and code to produce the results are available from John Winters immediately and for at least three years after publication via email and at

https://sites.google.com/site/johnvwinters/supplementary_materials

Data Appendix

The main data in this paper are constructed using the 2006-2014 ACS and the 1980-2000 decennial census microdata accessed from IPUMS (Ruggles et al. 2015). Each year of the ACS includes a one percent random sample of the U.S. population and each decennial census file includes a five percent sample of the population. These are independently drawn samples, so roughly five percent of the ACS sample is also included in the census sample, but we cannot link persons across surveys to identify which observations appear in both the ACS and census microdata. The ACS and census microdata both report the state in which an individual currently resides and the state in which they were born, and these variables are used to construct the main variables in this study. These samples include persons residing in traditional households and group quarters such as college dorms, military barracks, and correctional institutions. Survey weights are provided that can be used to account for sampling design and individual non-response to make the samples representative of the U.S. population. I use survey weights for all variables constructed from the decennial censuses and ACS.

The main explanatory variable of interest is subject to measurement error due to sampling since it is computed based on a five percent sample of the U.S. population. Appendix Table B reports summary statistics for college enrollee observation counts per year-of-birth cohort for each birth-state for the relevant cohorts in the 1980-2000 censuses. Some low population states like Alaska, Wyoming, Vermont, Nevada, and Delaware have on average fewer than 200 college enrollees per birth-year cohort.

The in-state tuition data from the National Science Foundation's WebCASPAR database are based on data collected by the National Center for Education Statistics (NCES) Higher Education General Information Survey (HEGIS) and Integrated Postsecondary Education Data

System (IPEDS). For states with multiple public flagship universities, I compute the arithmetic mean of in-state tuition among all public flagships in the state for each year.

The main dependent variable is computed using ACS microdata as:

$$Y_{scat} = \frac{CollegeStayerPopulation}{CollegeCohortPopulation}$$

CollegeStayerPopulation is the total number of college attendees from birth state s and cohort c observed in ACS survey year t at age a who reside in their birth state.

CollegeCohortPopulation is the total number of college attendees from birth state s and cohort c observed in ACS survey year t at age a who reside anywhere in the U.S.

Table 7 presents results using an alternative dependent variable computed using ACS microdata as:

$$\widetilde{Y}_{scat} = \frac{CollegeStayerPopulation}{TotalCohortPopulation}$$

CollegeStayerPopulation is defined the same as above. *TotalCohortPopulation* is the total number of all individuals from birth state s and cohort c observed in ACS survey year t at age a who reside anywhere in the U.S. and have any education level. The main dependent variable and this alternative dependent variable have the same numerator but different denominators. The denominator for the main dependent variable is restricted to college attendees, while the denominator for the alternative dependent variable is not restricted based on education.

Appendix Table A: Analytical Sample Mean Birth-State Enrollment and Adult Residence Rates by State

	% of College Enrollees Enrolled in Birth State, 1980	% of College Enrollees Enrolled in Birth State, 1990	% of College Enrollees Enrolled in Birth State, 2000	% with Any College Living in Birth State, 2006-2014
Alabama	0.711	0.745	0.733	0.618
Alaska	0.176	0.287	0.242	0.258
Arizona	0.598	0.629	0.647	0.584
Arkansas	0.630	0.682	0.730	0.566
California	0.792	0.766	0.779	0.665
Colorado	0.550	0.545	0.563	0.528
Connecticut	0.542	0.541	0.513	0.513
Delaware	0.471	0.486	0.518	0.433
Florida	0.613	0.630	0.696	0.584
Georgia	0.667	0.673	0.695	0.656
Hawaii	0.536	0.487	0.482	0.473
Idaho	0.428	0.500	0.540	0.463
Illinois	0.650	0.641	0.657	0.573
Indiana	0.678	0.696	0.718	0.577
Iowa	0.631	0.642	0.664	0.511
Kansas	0.588	0.619	0.660	0.496
Kentucky	0.696	0.713	0.683	0.615
Louisiana	0.749	0.733	0.733	0.561
Maine	0.576	0.598	0.555	0.540
Maryland	0.590	0.551	0.584	0.536
Massachusetts	0.677	0.664	0.623	0.563
Michigan	0.771	0.760	0.781	0.628
Minnesota	0.712	0.681	0.653	0.663
Mississippi	0.701	0.725	0.746	0.547
Missouri	0.625	0.638	0.662	0.581
Montana	0.552	0.521	0.522	0.436
Nebraska	0.622	0.621	0.618	0.512
Nevada	0.327	0.438	0.462	0.440
New Hampshire	0.533	0.477	0.428	0.467
New Jersey	0.538	0.547	0.554	0.506
New Mexico	0.487	0.536	0.574	0.469
New York	0.660	0.654	0.662	0.524
North Carolina	0.754	0.770	0.777	0.686
North Dakota	0.586	0.542	0.592	0.417
Ohio	0.689	0.700	0.723	0.602
Oklahoma	0.646	0.689	0.688	0.562
Oregon	0.658	0.630	0.600	0.557
Pennsylvania	0.687	0.717	0.721	0.587
Rhode Island	0.612	0.546	0.557	0.478
South Carolina	0.722	0.739	0.715	0.608
South Dakota	0.525	0.523	0.514	0.430
Tennessee	0.698	0.695	0.681	0.622
Texas	0.772	0.790	0.771	0.739
Utah	0.721	0.734	0.729	0.627
Vermont	0.470	0.508	0.490	0.448
Virginia	0.603	0.610	0.637	0.540
Washington	0.639	0.651	0.665	0.620
West Virginia	0.608	0.632	0.630	0.455
Wisconsin	0.748	0.730	0.727	0.634
Wyoming	0.346	0.480	0.379	0.337

Notes: means are weighted averages over cohorts within states.

Appendix Table B: College Enrollee Sample Observations Counts per Cohort by Birth-State

	Mean	Std. Dev.	Min	Max
Alabama	1,118	442	672	2,279
Alaska	119	52	56	248
Arizona	615	258	302	1,216
Arkansas	530	224	297	1,139
California	6,838	2,017	4,094	10,879
Colorado	800	314	429	1,506
Connecticut	1,011	290	658	1,539
Delaware	182	58	114	329
Florida	1,841	754	908	3,624
Georgia	1,482	655	770	3,198
Hawaii	332	84	209	517
Idaho	251	86	150	477
Illinois	3,830	1,152	2,375	6,426
Indiana	1,584	624	760	3,162
Iowa	956	343	486	1,624
Kansas	738	250	414	1,284
Kentucky	906	343	523	1,767
Louisiana	1,260	446	669	2,400
Maine	292	124	156	636
Maryland	1,090	330	666	1,938
Massachusetts	2,001	631	1,103	3,157
Michigan	2,970	993	1,645	5,355
Minnesota	1,406	494	758	2,558
Mississippi	832	364	420	1,760
Missouri	1,414	508	744	2,529
Montana	235	83	141	457
Nebraska	538	198	297	985
Nevada	163	64	81	313
New Hampshire	222	92	89	442
New Jersey	2,334	708	1,394	3,810
New Mexico	384	155	219	801
New York	6,404	1,958	3,841	10,264
North Carolina	1,610	642	950	3,301
North Dakota	247	88	118	439
Ohio	3,354	1,250	1,704	6,503
Oklahoma	749	278	365	1,421
Oregon	601	215	338	1,031
Pennsylvania	3,561	1,171	2,085	6,229
Rhode Island	310	88	191	520
South Carolina	867	339	466	1,707
South Dakota	226	90	107	435
Tennessee	1,157	455	678	2,369
Texas	4,140	1,760	1,970	8,357
Utah	491	206	272	938
Vermont	130	46	67	237
Virginia	1,428	487	871	2,611
Washington	1,080	352	653	1,892
West Virginia	472	179	283	947
Wisconsin	1,422	483	818	2,522
Wyoming	120	49	56	222

Notes: Cohorts are defined by state-of-birth and year-of-birth and observed at ages 18-22 in the 1980-2000 decennial census 5% PUMS. The observation counts are based on individuals enrolled in college at the time of the census survey, roughly on April 1 of the census year.

Appendix Table C: Results for Control Variables in Full Specification of Tables 2 & 3

	(1) OLS	(2) IV w/ Tuition
% Female for All College Attendees	0.036 (0.012)***	0.036 (0.011)***
% Black for All College Attendees	0.031 (0.035)	0.032 (0.033)
% Asian for All College Attendees	0.162 (0.094)*	0.171 (0.083)**
% Hispanic for All College Attendees	0.109 (0.040)***	0.122 (0.037)***
% Other Non-white for All College Attendees	-0.018 (0.046)	-0.015 (0.045)
Log Personal Income Per Capita at Age 18	-0.082 (0.048)*	-0.077 (0.045)*
Log Housing Price Index at Age 18	-0.016 (0.019)	-0.004 (0.019)
Log of Cohort Size at Age 18	-0.057 (0.026)**	-0.075 (0.026)***
Merit Dummy at Age 18	0.011 (0.005)**	0.006 (0.005)
Unemployment Rate at Age 22	-0.002 (0.002)	-0.001 (0.002)
Return to Bachelor's Degree at Age 22	-0.001 (0.007)	-0.003 (0.007)
Log Median Household Income at Age 22	0.006 (0.018)	0.012 (0.019)
% in 2006-2014 ACS w/ No College Living in Birth State	0.047 (0.013)***	0.036 (0.014)**
% in 1980-2000 Census Enrolled in College	-0.049 (0.031)	-0.126 (0.050)**
% in 2006-2014 ACS with Some College or More	0.098 (0.020)***	0.092 (0.019)***
% in 2006-2014 ACS with a Bachelor's Degree or More	-0.158 (0.024)***	-0.147 (0.024)***
% in 2006-2014 ACS with a Graduate Degree	-0.088 (0.040)**	-0.082 (0.039)**
Full Specification in Column 3 of Tables 2 & 3	Yes	Yes
Number of Observations (Year-State-Age Cohorts)	6750	6750

Notes: Standard errors are clustered by birth state. The dependent variable is the year-state-age cohort percent with any college who live in their birth state during the 2006-2014 ACS.

*Statistically significantly different from zero at the 10% level of significance; **Significant at the 5% level; ***Significant at the 1% level.

Table D: Mean Birth-State Residence Rates by State for Ages 14-17

	% of Ages 14-17 in Birth State, 1980	% of Ages 14-17 in Birth State, 1990	% of Ages 14-17 in Birth State, 2000
Alabama	0.783	0.815	0.847
Alaska	0.483	0.525	0.568
Arizona	0.686	0.719	0.742
Arkansas	0.728	0.762	0.780
California	0.782	0.816	0.806
Colorado	0.681	0.656	0.677
Connecticut	0.771	0.778	0.764
Delaware	0.687	0.659	0.687
Florida	0.747	0.755	0.780
Georgia	0.789	0.811	0.813
Hawaii	0.674	0.642	0.653
Idaho	0.607	0.676	0.706
Illinois	0.786	0.774	0.794
Indiana	0.794	0.792	0.828
Iowa	0.786	0.763	0.790
Kansas	0.667	0.707	0.732
Kentucky	0.798	0.780	0.789
Louisiana	0.819	0.819	0.783
Maine	0.763	0.823	0.845
Maryland	0.754	0.745	0.774
Massachusetts	0.803	0.786	0.792
Michigan	0.859	0.841	0.872
Minnesota	0.835	0.834	0.854
Mississippi	0.719	0.769	0.788
Missouri	0.770	0.761	0.806
Montana	0.669	0.689	0.724
Nebraska	0.711	0.716	0.765
Nevada	0.499	0.609	0.659
New Hampshire	0.740	0.673	0.708
New Jersey	0.783	0.767	0.767
New Mexico	0.645	0.701	0.717
New York	0.790	0.782	0.784
North Carolina	0.810	0.823	0.817
North Dakota	0.653	0.664	0.658
Ohio	0.812	0.810	0.849
Oklahoma	0.742	0.772	0.721
Oregon	0.757	0.742	0.753
Pennsylvania	0.842	0.836	0.846
Rhode Island	0.729	0.717	0.738
South Carolina	0.793	0.809	0.808
South Dakota	0.658	0.694	0.707
Tennessee	0.799	0.791	0.796
Texas	0.832	0.846	0.822
Utah	0.756	0.757	0.746
Vermont	0.734	0.760	0.769
Virginia	0.733	0.739	0.753
Washington	0.721	0.765	0.773
West Virginia	0.733	0.738	0.696
Wisconsin	0.859	0.850	0.868
Wyoming	0.576	0.575	0.529

Notes: means are weighted averages over cohorts within states.

Table E: Weighted Means of Dummy Variables

Dummy Variable	Mean	Dummy Variable	Mean	Dummy Variable	Mean
Alaska	0.003	Northeast & Year of Birth = 1959	0.017	Age = 25	0.014
Arizona	0.010	Northeast & Year of Birth = 1960	0.017	Age = 26	0.022
Arkansas	0.009	Northeast & Year of Birth = 1961	0.017	Age = 27	0.029
California	0.103	Northeast & Year of Birth = 1962	0.017	Age = 28	0.036
Colorado	0.013	Northeast & Year of Birth = 1968	0.015	Age = 29	0.036
Connecticut	0.013	Northeast & Year of Birth = 1969	0.015	Age = 30	0.038
Delaware	0.003	Northeast & Year of Birth = 1970	0.016	Age = 31	0.037
Florida	0.028	Northeast & Year of Birth = 1971	0.016	Age = 32	0.038
Georgia	0.022	Northeast & Year of Birth = 1972	0.014	Age = 33	0.029
Hawaii	0.005	Northeast & Year of Birth = 1978	0.013	Age = 34	0.029
Idaho	0.005	Northeast & Year of Birth = 1979	0.013	Age = 35	0.030
Illinois	0.057	Northeast & Year of Birth = 1980	0.013	Age = 36	0.029
Indiana	0.025	Northeast & Year of Birth = 1981	0.013	Age = 37	0.029
Iowa	0.016	Northeast & Year of Birth = 1982	0.013	Age = 38	0.036
Kansas	0.012	Midwest & Year of Birth = 1958	0.021	Age = 39	0.036
Kentucky	0.015	Midwest & Year of Birth = 1959	0.021	Age = 40	0.039
Louisiana	0.018	Midwest & Year of Birth = 1960	0.021	Age = 41	0.036
Maine	0.005	Midwest & Year of Birth = 1961	0.021	Age = 42	0.037
Maryland	0.015	Midwest & Year of Birth = 1962	0.021	Age = 43	0.029
Massachusetts	0.027	Midwest & Year of Birth = 1968	0.018	Age = 44	0.029
Michigan	0.046	Midwest & Year of Birth = 1969	0.019	Age = 45	0.030
Minnesota	0.022	Midwest & Year of Birth = 1970	0.020	Age = 46	0.029
Mississippi	0.011	Midwest & Year of Birth = 1971	0.020	Age = 47	0.030
Missouri	0.022	Midwest & Year of Birth = 1972	0.018	Age = 48	0.038
Montana	0.004	Midwest & Year of Birth = 1978	0.018	Age = 49	0.038
Nebraska	0.009	Midwest & Year of Birth = 1979	0.018	Age = 50	0.040
Nevada	0.003	Midwest & Year of Birth = 1980	0.019	Age = 51	0.037
New Hampshire	0.003	Midwest & Year of Birth = 1981	0.019	Age = 52	0.037
New Jersey	0.031	Midwest & Year of Birth = 1982	0.019	Age = 53	0.030
New Mexico	0.006	South & Year of Birth = 1958	0.019	Age = 54	0.023
New York	0.087	South & Year of Birth = 1959	0.019	Age = 55	0.015
North Carolina	0.024	South & Year of Birth = 1960	0.019	Age = 56	0.007
North Dakota	0.004	South & Year of Birth = 1961	0.019	ACS Year = 2007	0.108
Ohio	0.050	South & Year of Birth = 1962	0.019	ACS Year = 2008	0.113
Oklahoma	0.012	South & Year of Birth = 1968	0.018	ACS Year = 2009	0.113
Oregon	0.011	South & Year of Birth = 1969	0.019	ACS Year = 2010	0.112
Pennsylvania	0.051	South & Year of Birth = 1970	0.020	ACS Year = 2011	0.112
Rhode Island	0.004	South & Year of Birth = 1971	0.021	ACS Year = 2012	0.113
South Carolina	0.012	South & Year of Birth = 1972	0.020	ACS Year = 2013	0.112
South Dakota	0.004	South & Year of Birth = 1978	0.019	ACS Year = 2014	0.112
Tennessee	0.017	South & Year of Birth = 1979	0.020		
Texas	0.063	South & Year of Birth = 1980	0.021		
Utah	0.010	South & Year of Birth = 1981	0.021		
Vermont	0.002	South & Year of Birth = 1982	0.021		
Virginia	0.021	West & Year of Birth = 1958	0.012		
Washington	0.018	West & Year of Birth = 1959	0.012		
West Virginia	0.007	West & Year of Birth = 1960	0.012		
Wisconsin	0.024	West & Year of Birth = 1961	0.012		
Wyoming	0.002	West & Year of Birth = 1962	0.012		
		West & Year of Birth = 1968	0.011		
		West & Year of Birth = 1969	0.012		
		West & Year of Birth = 1970	0.013		
		West & Year of Birth = 1971	0.013		
		West & Year of Birth = 1972	0.012		
		West & Year of Birth = 1978	0.013		
		West & Year of Birth = 1979	0.014		
		West & Year of Birth = 1980	0.015		
		West & Year of Birth = 1981	0.015		
		West & Year of Birth = 1982	0.015		

Table F: Estimates of Birth-State Enrollment Effects on Birth-State Residence 20 Years Post-Census

	(1)	(2)
	OLS	2SLS Tuition IV
% of College Enrollees Enrolled in Birth State	0.076 (0.063)	0.481 (0.510)
First-stage F-Statistic	N/A	2.69
Birth-State Dummies	Yes	Yes
Region*Year-of-Birth Dummies	Yes	Yes
Age Dummies	Yes	Yes
Survey Year Dummies	Yes	Yes
ACS Demographic Variables	Yes	Yes
Other Baseline Explanatory Variables	Yes	Yes
ACS % with No College Living in Birth State	Yes	Yes
ACS and Census Education Control Variables	Yes	Yes
Number of Year-State-Age Cohorts	500	500

Notes: Standard errors are clustered by birth state. The dependent variable is the year-state-age cohort percent with any college who live in their birth state 20 years after their college location decisions are observed; these adult location decisions are observed via the 2000 Census for the cohorts enrolled in college in 1980 and the pooled 2009-2011 ACS for cohorts enrolled in 1990. Cohorts enrolled in 2000 are excluded.

Table G: Estimates of Birth-State Enrollment Effects on Birth-State Residence Excluding Earliest Cohorts

	(1)	(2)
	OLS	2SLS Tuition IV
% of College Enrollees Enrolled in Birth State	0.162 (0.039)***	0.442 (0.237)*
First-stage F-Statistic	N/A	12.76
Birth-State Dummies	Yes	Yes
Region*Year-of-Birth Dummies	Yes	Yes
Age Dummies	Yes	Yes
Survey Year Dummies	Yes	Yes
ACS Demographic Variables	Yes	Yes
Other Baseline Explanatory Variables	Yes	Yes
ACS % with No College Living in Birth State	Yes	Yes
ACS and Census Education Control Variables	Yes	Yes
Number of Year-State-Age Cohorts	4500	4500

Notes: Standard errors are clustered by birth state. The dependent variable is the year-state-age cohort percent with any college who live in their birth state during the 2006-2014 ACS. 1980 college-age cohorts are excluded.

*Statistically significantly different from zero at the 10% level of significance; ***Significant at the 1% level.

Table H: 2SLS In-State Flagship Tuition IV Sensitivity Analysis

Specification:	(1) Exclude states with 1980 population < 1 million	(2) Exclude states with 1980 population < 2 million	(3) Exclude states with very low 1980 in-state enrollment	(4) Dependent and independent variable in logs
<u>A. First-Stage</u>				
Log In-State Tuition Flagship Universities Age 17	-0.036 (0.009)***	-0.035 (0.009)***	-0.035 (0.010)***	-0.060 (0.014)***
F-Statistic	15.34	14.58	13.80	17.45
<u>B. Second Stage</u>				
% of College Enrollees Enrolled in Birth State	0.416 (0.122)***	0.421 (0.116)***	0.450 (0.136)***	0.505 (0.160)***
Birth-State Dummies	Yes	Yes	Yes	Yes
Region*Year-of-Birth Dummies	Yes	Yes	Yes	Yes
Age Dummies	Yes	Yes	Yes	Yes
Survey Year Dummies	Yes	Yes	Yes	Yes
ACS Demographic Variables	Yes	Yes	Yes	Yes
Other Baseline Explanatory Variables	Yes	Yes	Yes	Yes
ACS % with No College Living in Birth State	Yes	Yes	Yes	Yes
ACS and Census Education Control Variables	Yes	Yes	Yes	Yes
Number of Year-State-Age Cohorts	5130	4455	5805	6750

Notes: Standard errors are clustered by birth state. The specifications are the same as in Table 3 column 3 except as indicated. For column 3, the seven states are excluded for which less than half of college enrollees ages 18-22 in 1980 are enrolled in their birth state.

***Statistically significantly different from zero at the 1% level of significance.

Table I: 2SLS Estimates with Log ACS Cohort Size as Dependent Variable

	(1)	(2)	(3)
Log 1980-2000 Census Cohort Size	0.988 (0.042)***	0.983 (0.038)***	0.969 (0.041)***
Log In-State Tuition Flagship Universities at Age 17		-0.026 (0.023)	-0.026 (0.023)
Birth-State Dummies	Yes	Yes	Yes
Region*Year-of-Birth Dummies	Yes	Yes	Yes
Age Dummies	Yes	Yes	Yes
Survey Year Dummies	Yes	Yes	Yes
ACS Demographic Variables	No	No	Yes
Other Baseline Explanatory Variables	No	No	Yes
ACS % with No College Living in Birth State	No	No	Yes
ACS and Census Education Control Variables	No	No	Yes
Number of Year-State-Age Cohorts	6750	6750	6750

Notes: Standard errors are clustered by birth state. Log Census Cohort Size is instrumented using the one cohort year lag to account for measurement error due to sampling. Other Baseline Explanatory Variables excludes log cohort size at age 18.

***Statistically significantly different from zero at the 1% level.

Table J: Relationship Between 2001-2015 Changes in Mean Flagship Tuition and Test Scores

	(1)	(2)	(3)	(4)	(5)	(6)
Δ SAT Verbal 25th Percentile	0.0010 (0.0018)					
Δ SAT Verbal 75th Percentile		0.0011 (0.0019)				
Δ SAT Math 25th Percentile			0.0006 (0.0016)			
Δ SAT Math 75th Percentile				0.0011 (0.0016)		
Δ ACT Composite 25th Percentile					0.0264 (0.0238)	
Δ ACT Composite 75th Percentile						0.0286 (0.0271)
Number of state observations	38	38	38	38	39	39

Notes: Dependent variable is 2001-2015 change in Log In-State Tuition of Flagship Universities. The number of states varies across specifications because many states have flagship institution reporting only SAT or only ACT. Some institutions report both and I include the data if it exists.