Appendix A. Additional Figures and Tables

Appendix Figure A1. Data Collection Template for Delaware Cost Study

(Printout of the data input and associated tables in the EXCEL template. Contact irp-cost@udel.edu to request an Excel template.)

2014 National Study of Instructional Costs and Productivity

(Office use only)

Institution:

Department/Discipline:

Associated CIP Identifier:

Please indicate the **average** number of degrees awarded in this discipline at each degree level over the period from 2010-2011 through 2012-2013. If a degree level is not offered, leave as zero. If data are not available, please enter 'm' in the boxes.

Bachelor's:	0.0	0.0
Master's :	0.0	0.0
Doctorate:	0.0	0.0
Professional:	0.0	0.0

Place an 'X' in the box below if this discipline is non-degree granting.

A. INSTRUCTIONAL COURSELOAD: FALL SEMESTER, 2013

Please complete the following matrix, displaying student credit hours and organized class sections taught, by type of faculty, and by level of instruction. Be sure to consult definitions before proceeding. Do not input data in shaded cells except for those mentioned in the important note below that pertains to (G) and (J).

Faculty				Enter Undergrad Details			Student Credit Hours			Enter Grad Details		Organized Class Sections				
Classification	FTE Faculty (A) Total	(B) Sep. Budg.	(C) Instruc-tional	(D) Lower Div. OC*	(E) Upper Div. OC*	(F) Undergrad Indiv. Instruct.	(G) Total Undergrad SCH	(H) Grad OC*	(I) Graduate Indiv. Instruct.	(J) Total Graduate SCH	(K) Total Student Credit Hours	(L) Lab/Dsc/ Rec. Sections	Other Section Types (Lecture, Seminar, etc.) (M) Lower Div.	(N) Upper Div.	(O) Graduate	(P) Total
Regular faculty: - Tenured/Tenure Eligible	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
- Other Regular Faculty	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
Supplemental Faculty	0.00	NA	0.00	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
Teaching Assistants: - Credit Bearing Courses	0.00	NA	0.00	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
- Non-Credit Bearing Activity	0.00	NA	0.00	NA	NA	NA	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	0.0
TOTAL	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0

* OC = Organized Class NA = Not applicable

In the box to the right, indicate the number of individualized instruction student credit hours from the total that are devoted to supervised doctoral dissertation: 0

Indicate your academic calendar: Semester: Quarter: S

Reminder: Use Fall 2013 semester data as of your official census date.

Important note: If you cannot differentiate between "Organized Class" and "Individualized Instruction" student credit hours, assign all credit hours to the appropriate "Organized Class" column. Similarly, if you cannot differentiate between "Lower Division" and "Upper Division" undergraduate student credit hours, report all those hours under "Total Undergraduate SCH."

B. COST DATA: ACADEMIC AND FISCAL YEAR 2013-2014

1. Total student credit hours generated during Academic Year 2013-2014, that were supported by the department/discipline instructional budget. (NOTE: Semester calendar institutions will typically report fall and spring student credit hours; quarter calendar institutions will report fall, winter, and spring student credit hours.)

0	A. Undergraduate
0	B. Graduate

2. Total direct expenditures for instruction in Fiscal Year 2013-2014

$0	A. Salaries	*Are the benefits included in the number reported for salaries(Y/N)?*		
$0	B. Benefits	*If the dollar value is NOT available, what percent of salary do benefits constitute at your inst.*	0.00%	0
$0	C. Other than personnel expenditures.			0
$0	D. Total (including benefits if it was calculated)			

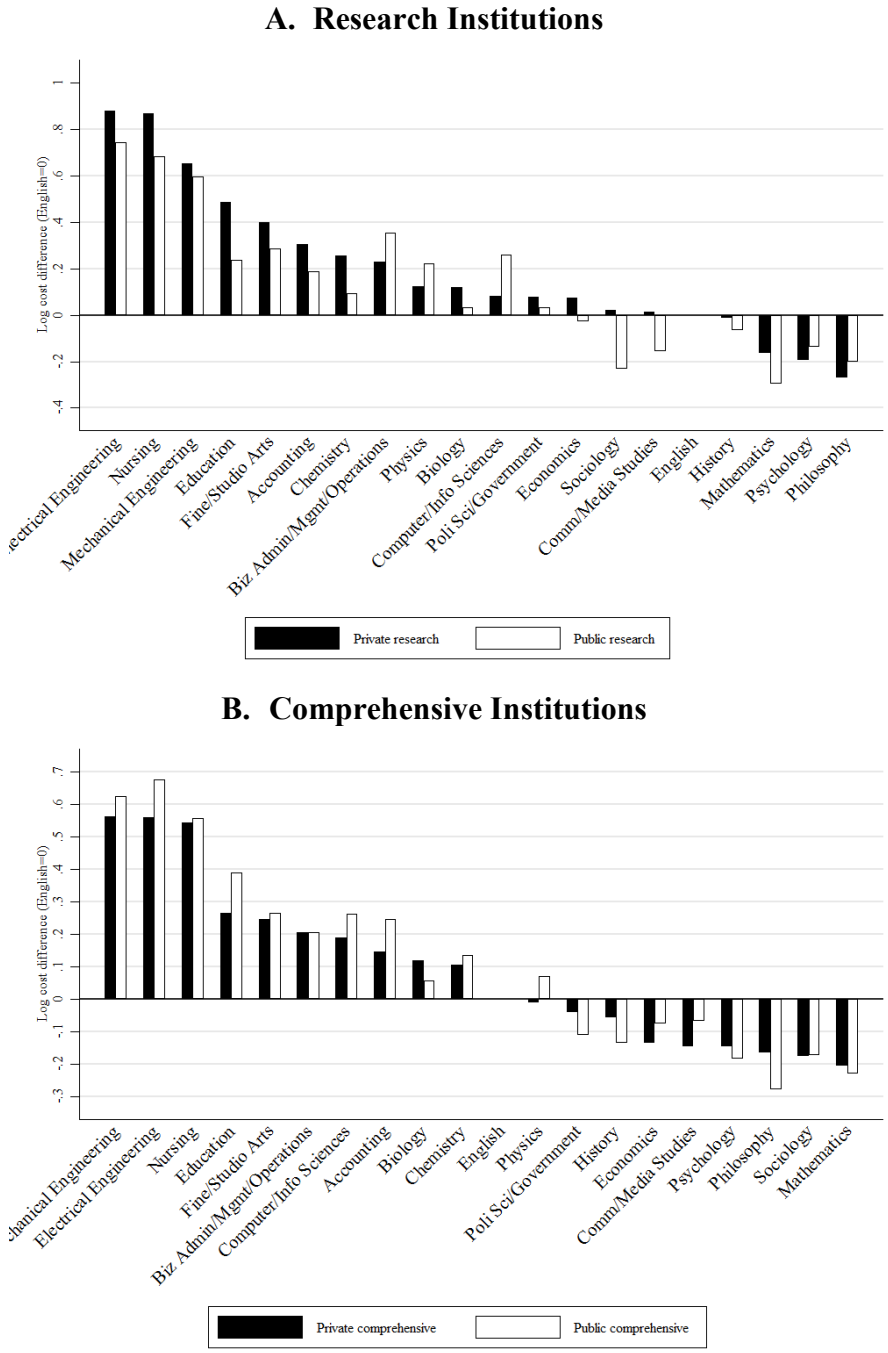
3. Total direct expenditures for separately budgeted research activities in Fiscal Year 2013-2014

$0

4. Total direct expenditures for separately budgeted public service activities in Fiscal Year 2013-2014

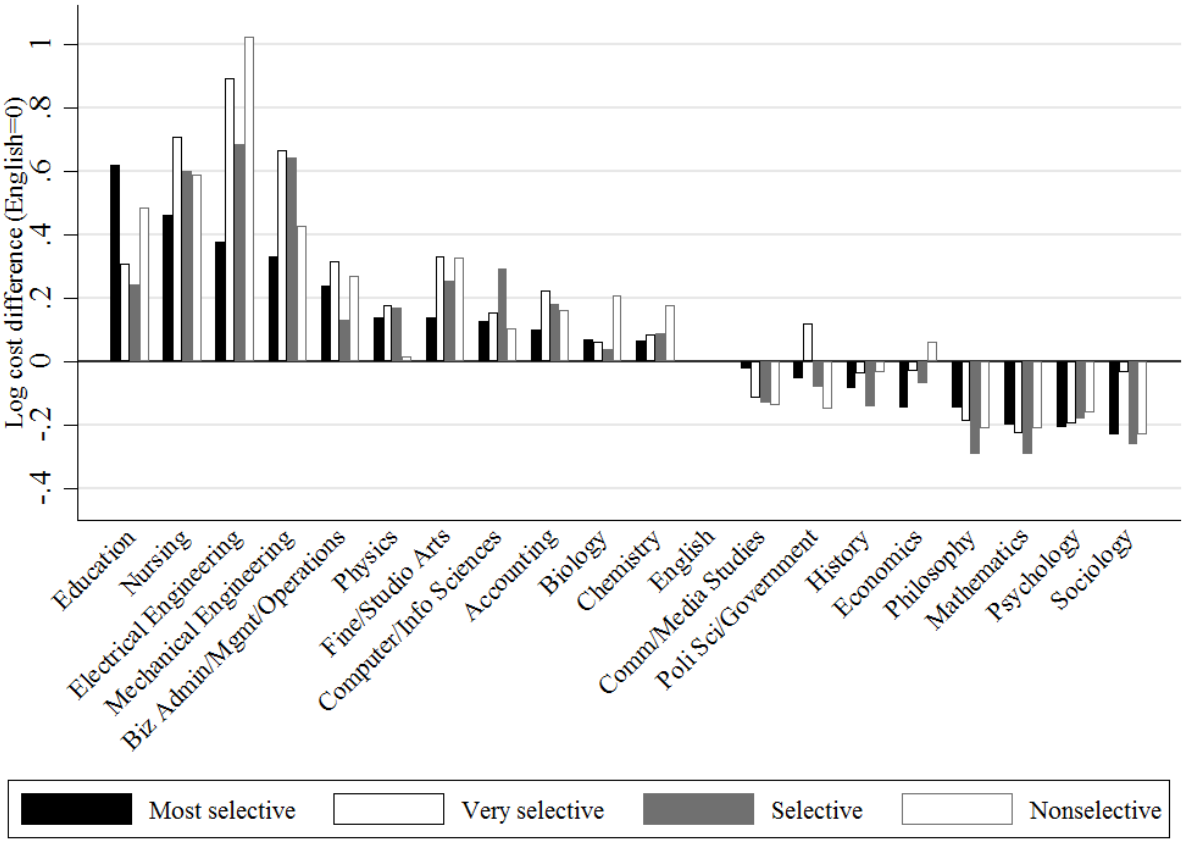
$0

Appendix Figure A2. Cross-Field Cost Differences, by Institution Type



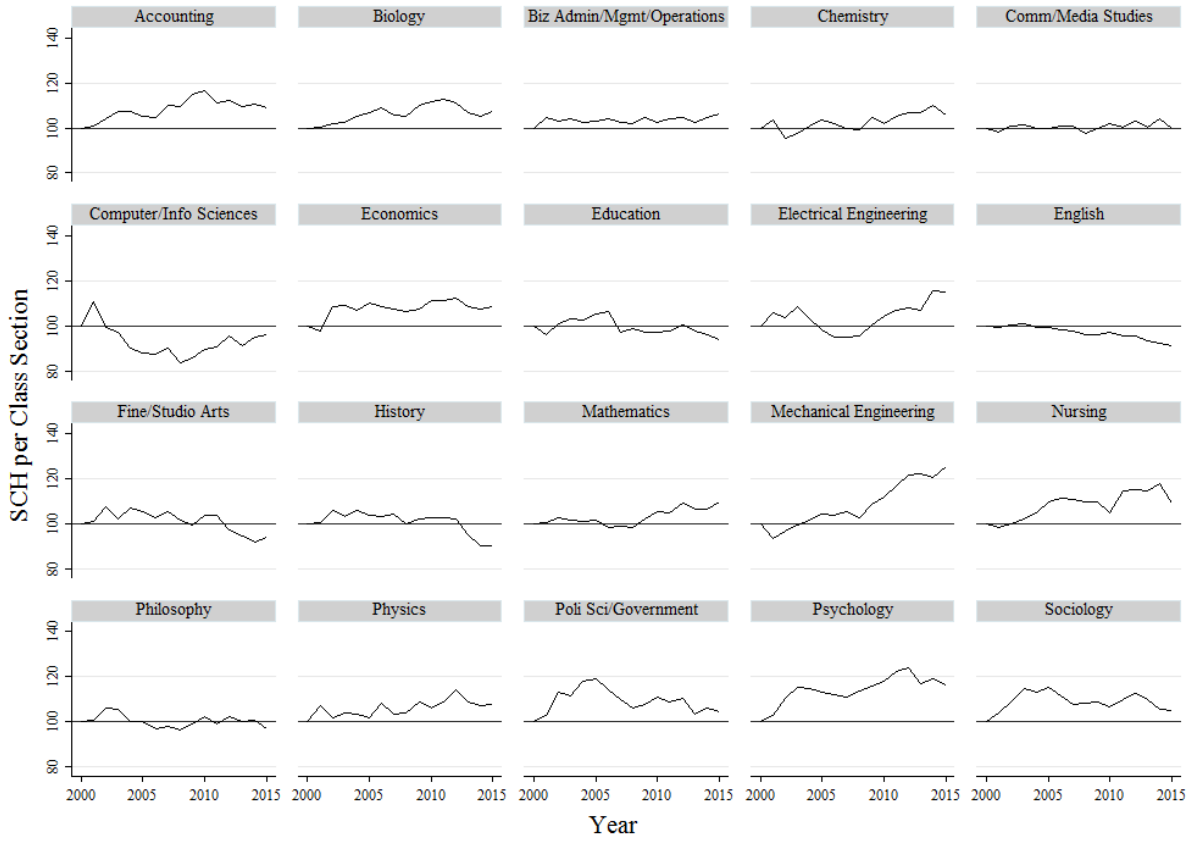
Notes: Each column reports the difference in log of direct instructional cost per SCH between the reported field and English, after controlling for institution and year fixed effects. Positive numbers indicate the field is more expensive than English. Sample includes public and private institutions participating in the Delaware Cost Study between 2013-2015. Only departments in the 20 fields listed in Table A1 are included. A small number of observations with missing or outlier data are excluded. Program-level observations are weighted by number of student credit hours multiplied by the inverse of the probability of being included in the sample (estimated at the institution-year level). Costs are expressed in 2015 dollars.

Appendix Figure A3. Cross-Field Cost Differences, by Institutional Selectivity



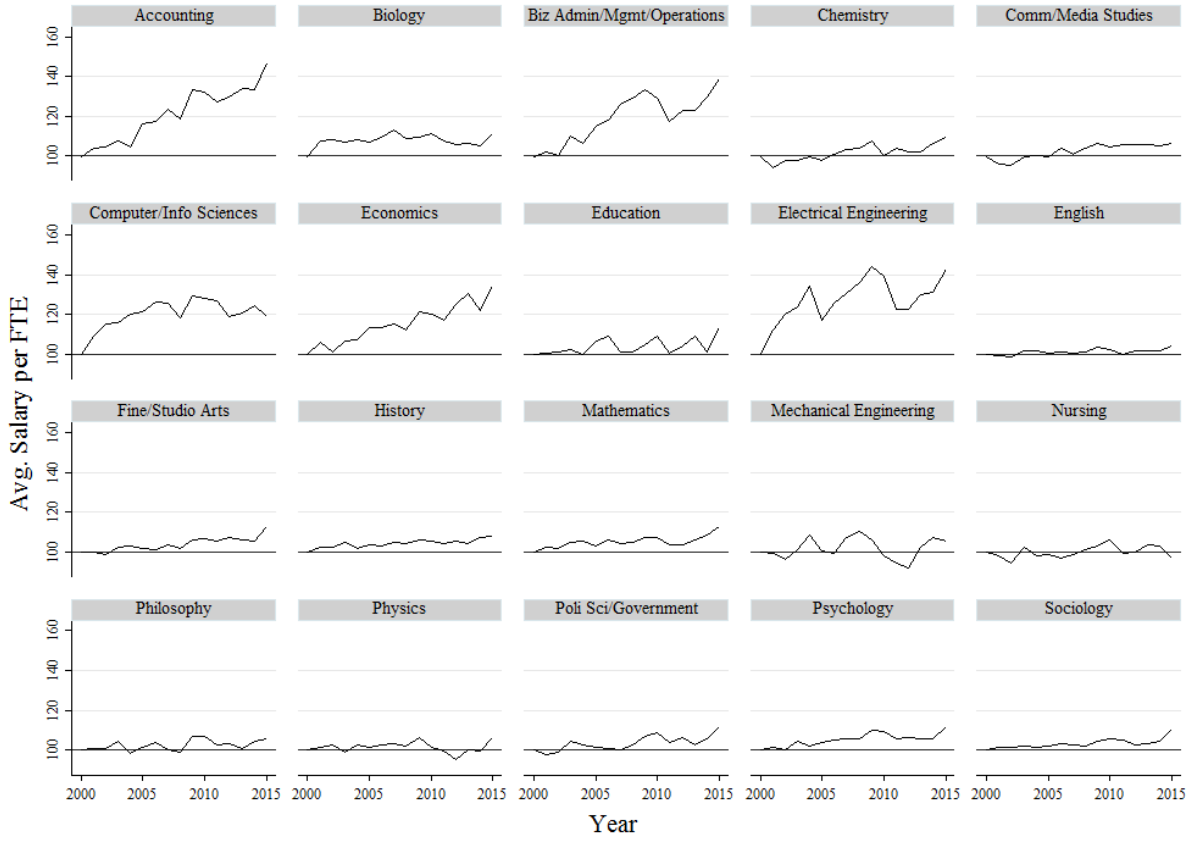
Notes: Each column reports the difference in log of direct instructional cost per SCH between the reported field and English, after controlling for institution and year fixed effects. Positive numbers indicate the field is more expensive than English. Sample includes public and private institutions participating in the Delaware Cost Study between 2013-2015. Only departments in the 20 fields listed in Table A1 are included. A small number of observations with missing or outlier data are excluded. Program-level observations are weighted by number of student credit hours multiplied by the inverse of the probability of being included in the sample (estimated at the institution-year level). Costs are expressed in 2015 dollars.

Appendix Figure A4. Class Size Trends Over Time, by CIP4 (2000 = 100), 2000-2015



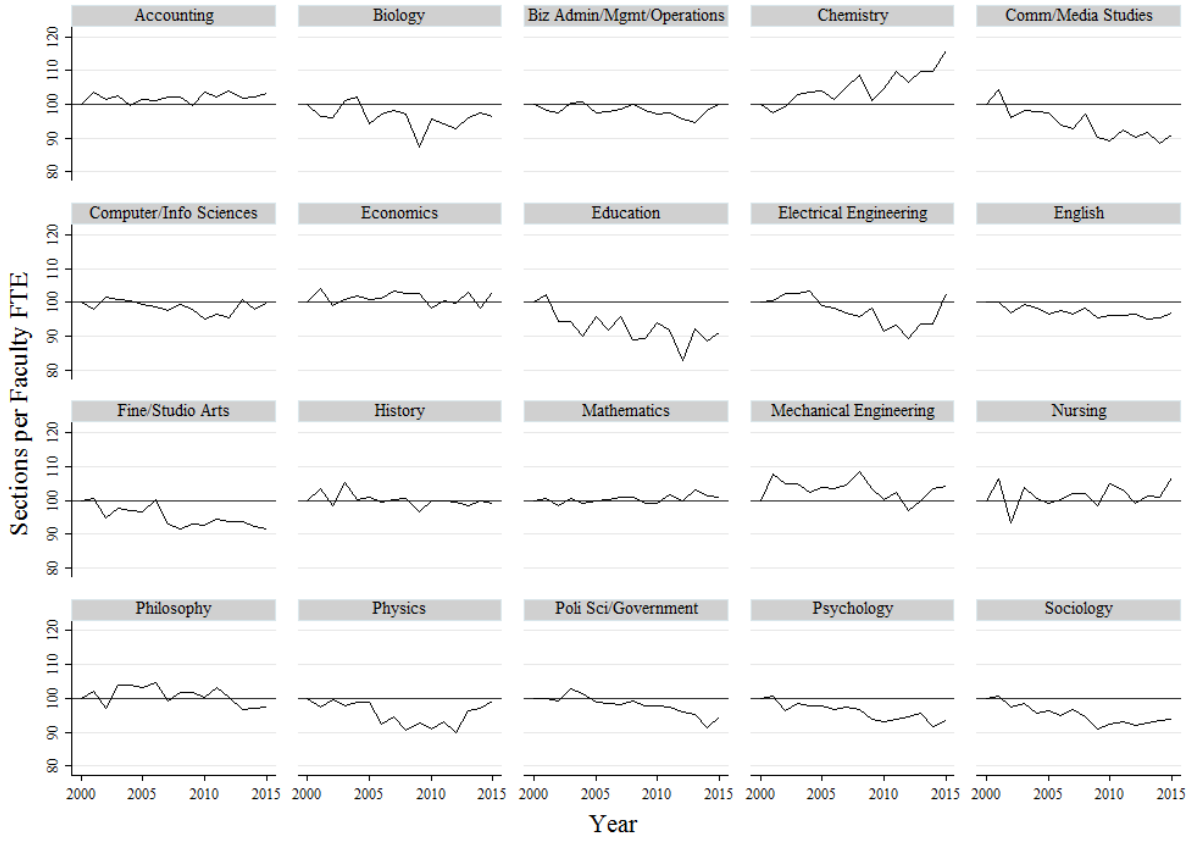
Notes: Class size is measured by the number of student credit hours (SCH) per organized class section (OCS). Sample includes public and private institutions participating in the Delaware Cost Study between 2000-2015. Only departments in the 20 fields listed in Table A1 are included. A small number of observations with missing or outlier data are excluded. Program-level observations are weighted by number of student credit hours multiplied by the inverse of the probability of being included in the sample (estimated at the institution-year level). Trends are normalized to the year 2000 and net of institution-by-field fixed effects.

Appendix Figure A5. Faculty Salary Trends Over Time, by CIP4 (2000 = 100), 2000-2015



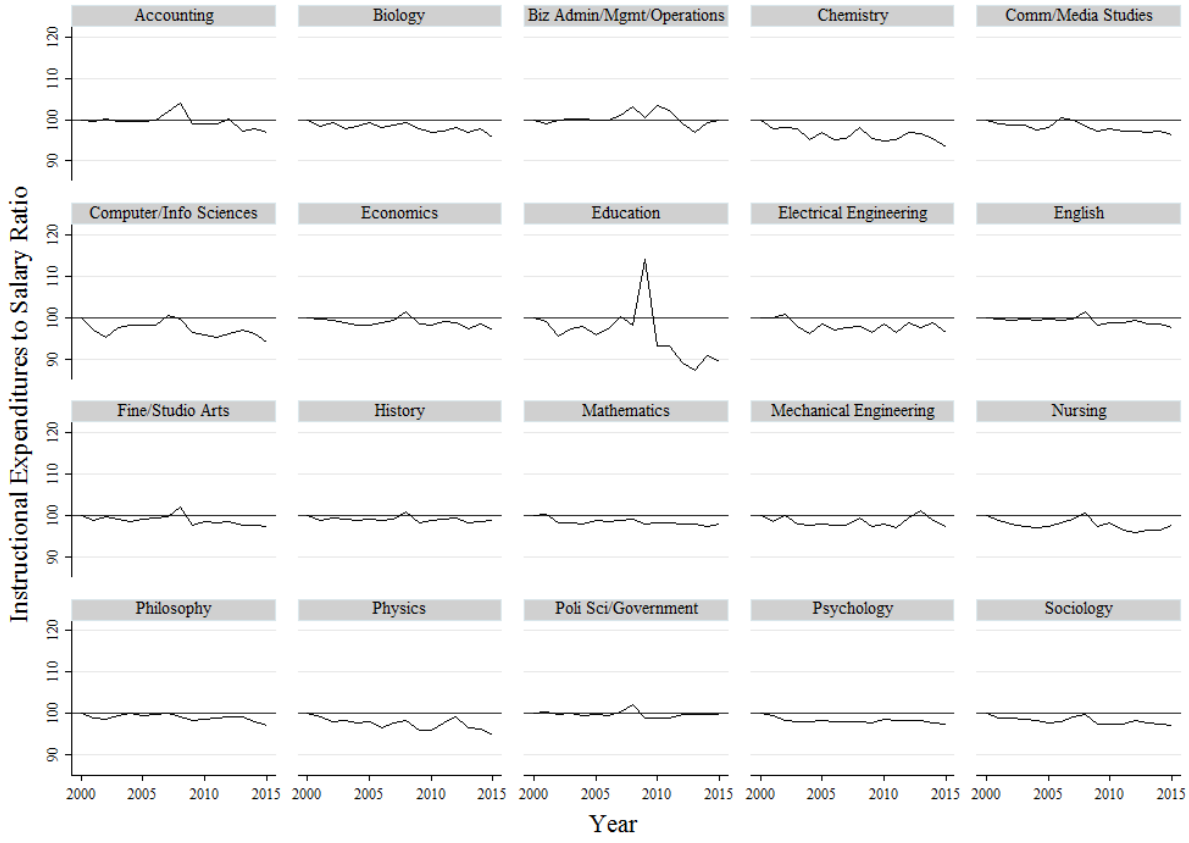
Notes: Faculty salary is measured by total faculty personnel expenditures per FTE. Sample includes public and private institutions participating in the Delaware Cost Study between 2000-2015. Only departments in the 20 fields listed in Table A1 are included. A small number of observations with missing or outlier data are excluded. Program-level observations are weighted by number of student credit hours multiplied by the inverse of the probability of being included in the sample (estimated at the institution-year level). Trends are normalized to the year 2000 and net of institution-by-field fixed effects.

Appendix Figure A6. Teaching Load Trends Over Time, by CIP4 (2000 = 100). 2000-2015



Notes: Teaching load is measured by the number of course sections taught by FTE. Sample includes public and private institutions participating in the Delaware Cost Study between 2000-2015. Only departments in the 20 fields listed in Table A1 are included. A small number of observations with missing or outlier data are excluded. Program-level observations are weighted by number of student credit hours multiplied by the inverse of the probability of being included in the sample (estimated at the institution-year level). Trends are normalized to the year 2000 and net of institution-by-field fixed effects.

Appendix Figure A7. Non-Personnel Trends Over Time, by CIP4 (2000 = 100). 2000-2015



Notes: Non-personnel expenditures measured as the ratio of direct instructional expenditures to personnel expenditures. Sample includes public and private institutions participating in the Delaware Cost Study between 2000-2015. Only departments in the 20 fields listed in Table A1 are included. A small number of observations with missing or outlier data are excluded. Program-level observations are weighted by number of student credit hours multiplied by the inverse of the probability of being included in the sample (estimated at the institution-year level). Trends are normalized to the year 2000 and net of institution-by-field fixed effects.

Appendix Table A1. List of Participating Institutions

Note: Over 700 institutions have participated in the study. Below we only list the 148 institutions that participated in the study for at least 8 years between 1998 and 2015, though our analysis includes all institutions. Parentheses indicate the number of years that the institution participated over this period.

Appalachian State University (NC) (19)
Arizona State University (AZ) (13)
Auburn University - Montgomery (AL) (14)
Austin Peay State University (TN) (12)
Baylor University (TX) (16)
Belmont University (TN) (14)
Bowling Green State University (OH) (16)
California State University - San Marcos (CA) (10)
Catholic University of America (DC) (9)
Central Connecticut State University (CT) (14)
Central Michigan University (MI) (17)
Clarkson University (NY) (11)
Clemson University (SC) (18)
Cleveland State University (OH) (11)
College of Charleston (SC) (13)
College of Notre Dame of Maryland (MD) (8)
College of St. Elizabeth (NJ) (9)
College of St. Scholastica (MN) (10)
Columbia College, SC (SC) (9)
Delaware Valley College (PA) (8)
DePaul University (IL) (15)
Drew University (NJ) (11)
East Carolina University (NC) (19)
East Tennessee State University (TN) (10)
Eastern Washington University (WA) (8)
Edinboro University of Pennsylvania (PA) (9)
Elizabeth City State University (NC) (18)
Fayetteville State University (NC) (16)
Ferrum College (VA) (9)
Florida International University (FL) (16)
Florida State University (FL) (15)
Gannon University (PA) (9)
Geneva College (PA) (11)
Georgia Institute of Technology (GA) (8)
Georgia Southern University (GA) (8)
Georgia State University (GA) (11)
Gonzaga University (WA) (13)
Goshen College (IN) (12)
Grand Valley State University (MI) (13)
Hartwick College (NY) (11)
Indiana State University (IN) (11)
Indiana University - South Bend (IN) (12)
Iowa State University (IA) (10)
Ithaca College (NY) (12)
James Madison University (VA) (15)
Seattle University (WA) (8)
Shepherd University (WV) (10)
Slippery Rock University (PA) (15)
South Dakota State University (SD) (10)
Southeastern Louisiana University (LA) (14)
Southern Univ and A&M College - Baton Rouge (LA) (8)
Stonehill College (MA) (8)
SUNY - Stony Brook (NY) (9)
SUNY - University at Buffalo (NY) (12)
Tennessee Technological University (TN) (18)
Union University (TN) (15)
University of Alabama - Birmingham (AL) (9)
University of Alabama - Huntsville (AL) (11)
University of Alabama - Tuscaloosa (AL) (15)
University of Arizona (AZ) (14)
University of Arkansas - Fayetteville (AR) (13)
University of Central Florida (FL) (13)
University of Colorado at Boulder (CO) (11)
University of Colorado at Colorado Springs (CO) (11)
University of Connecticut (CT) (16)
University of Delaware (DE) (17)
University of Houston (TX) (11)
University of Idaho (ID) (14)
University of Kansas (KS) (18)
University of Maine (ME) (11)
University of Mary Washington (VA) (8)
University of Massachusetts - Amherst (MA) (16)
University of Massachusetts - Dartmouth (MA) (11)
University of Memphis (TN) (11)
University of Minnesota - Morris (MN) (8)
University of Mississippi (MS) (15)
University of Missouri - Columbia (MO) (16)
University of Missouri - Kansas City (MO) (16)
University of Missouri - St. Louis (MO) (19)
University of Montevallo (AL) (9)
University of Nebraska - Lincoln (NE) (12)
University of Nebraska at Kearney (NE) (11)
University of Nebraska at Omaha (NE) (11)
University of New Hampshire (NH) (14)
University of North Carolina - Asheville (NC) (15)
University of North Carolina - Chapel Hill (NC) (14)
University of North Carolina - Charlotte (NC) (14)
University of North Carolina - Greensboro (NC) (15)
University of North Carolina - Pembroke (NC) (14)
University of North Carolina - Wilmington (NC) (10)

John Carroll University (OH) (8)
Kansas State University (KS) (10)
Kent State University (OH) (14)
Lander University (SC) (9)
Louisiana State University (LA) (15)
Loyola University of Chicago (IL) (8)
Lynchburg College (VA) (12)
McMurry University (TX) (8)
Mercer University (GA) (11)
Middle Tennessee State University (TN) (9)
Mississippi State University (MS) (18)
Missouri State University (MO) (11)
Missouri University of Science and Technology (MO) (10)
Montana State University-Billings (MT) (15)
Montana State University-Bozeman (MT) (15)
North Carolina A&T State University (NC) (16)
North Carolina Central University (NC) (18)
North Carolina State University (NC) (15)
Northeastern University (MA) (13)
Northern Arizona University (AZ) (15)
Northwestern State University of Louisiana (LA) (12)
Oakland University (MI) (18)
Ohio Northern University (OH) (8)
Oklahoma State University (OK) (9)
Radford University (VA) (11)
Ramapo College of New Jersey (NJ) (11)
Rowan University (NJ) (12)
Saint Francis University (PA) (10)
Schreiner University (TX) (11)
University of North Dakota (ND) (9)
University of Northern Iowa (IA) (16)
University of Notre Dame (IN) (8)
University of Oregon (OR) (14)
University of Rhode Island (RI) (8)
University of South Carolina - Columbia (SC) (17)
University of South Carolina - Upstate (SC) (9)
University of South Florida (FL) (11)
University of Southern Mississippi (MS) (10)
University of Tennessee - Chattanooga (TN) (12)
University of Tennessee - Knoxville (TN) (16)
University of Tennessee - Martin (TN) (13)
University of Texas at Austin (TX) (8)
University of Toledo (OH) (8)
University of Utah (UT) (19)
University of Vermont (VT) (11)
University of Virginia - Charlottesville (VA) (10)
University of West Florida (FL) (12)
University of West Georgia (GA) (11)
University of Wisconsin - Madison (WI) (10)
Virginia Polytechnic Inst. & State Univ. (VA) (14)
Washington State University (WA) (8)
West Virginia University (WV) (18)
Western Carolina University (NC) (19)
Wichita State University (KS) (14)
Wilkes University (PA) (14)
Winston-Salem State University (NC) (18)
Wright State University (OH) (11)
Youngstown State University (OH) (9)

Appendix Table A2. Fields of Study in Sample, by Four-Digit CIP Classification

CIP4 Code	Title	Short title
0901	Communication and Media Studies	Comm/Media Studies
1101	Computer and Information Sciences, General	Computer/Info Sciences
1301	Education, General	Education
1410	Electrical, Electronics and Communications Engineering	Electrical Engineering
1419	Mechanical Engineering	Mechanical Engineering
2301	English Language and Literature, General	English
2601	Biology, General	Biology
2701	Mathematics	Mathematics
3801	Philosophy	Philosophy
4005	Chemistry	Chemistry
4008	Physics	Physics
4201	Psychology, General	Psychology
4506	Economics	Economics
4510	Political Science and Government	Poli Sci/Government
4511	Sociology	Sociology
5007	Fine and Studio Arts	Fine/Studio Arts
5138	Registered Nursing, Nursing Administration, Nursing Research and Clinical Nursing	Nursing
5202	Business Administration, Management and Operations	Biz Admin/Mgmt/Operations
5203	Accounting and Related Services	Accounting
5401	History	History

Appendix Table A3. Summary Statistics for Pooled Cross-Sectional Sample, 2013-2015

	All		Research - High		Research - Moderate		Masters		Baccalaureate	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Public Institutions	64%		91%		37%		62%		21%	
Total Degrees Awarded	132		207		216		77		31	
BA as Share of Total Degrees	84%		77%		78%		88%		97%	
MA as Share of Total Degrees	14%		17%		21%		12%		3%	
Prof as Share of Total Degrees	0%		0%		0%		0%		0%	
PhD as Share of Total Degrees	2%		6%		1%		0%		0%	
Full-Time Equivalents for All Faculty										
Fall Semester Total FTE	33	28	54	33	36	24	22	16	9	9
Fall Semester Instructional FTE	33	28	52	32	36	24	22	16	9	9
Tenured Faculty Share of Instructional FTE	61%		58%		59%		62%		66%	
Student Credit Hours										
Fall Semester SCH by All Faculty	8,323	7,898	14,035	9,664	8,430	5,316	5,481	4,274	1,869	1,846
Undergrad Share of All SCH	93%		91%		89%		94%		98%	
Organized Class Sections										
Fall Semester OCS – All	102	87	152	106	112	70	78	59	34	30
Undergrad Share of OCS	86%		79%		82%		91%		98%	
Grad Share of OCS	14%		21%		18%		9%		2%	
Expenditures										
Direct Instructional Expenditures ($1000) - includes salary, benefits, and other expenses	$3,443	$3,625	$5,921	$4,483	$4,261	$3,515	$1,992	$1,453	$672	$670
Personnel Spending as a Share of Instructional Spending	94%		92%		94%		96%		95%	
Analysis Variables										
Total Faculty per Student	0.07	0.03	0.06	0.03	0.07	0.02	0.07	0.02	0.08	0.03
Estimated Class Size	33	19	45	23	32	15	27	10	21	7
Undergraduate Class Size	38	26	56	33	37	19	28	12	22	8
Graduate Class Size	12	7	12	7	14	7	12	7	10	6
Instructional Faculty Course Load including Labs/Discussions/Recitations	3.4	1.0	2.9	1.1	3.2	0.9	3.6	0.9	4.0	1.1
Instructional Spending per SCH	$ 225	$ 111	$ 246	$ 138	$ 251	$ 106	$ 209	$ 90	$ 195	$ 82
Instructional Personnel Spending per SCH	$ 211	$ 101	$ 227	$ 125	$ 235	$ 94	$ 199	$ 84	$ 184	$ 74
Total Spending per SCH	$ 257	$ 181	$ 325	$ 258	$ 277	$ 149	$ 213	$ 94	$ 195	$ 82
N (institution-program-year)	7,245		2,425		673		3,428		719	
Weighted by IPW * SCH	100%		34%		12%		43%		11%	

Note: Observations are weighted by the inverse of the likelihood that a given institution participates in the Delaware Cost Study multiplied by a measure of the program's size (total fall student credit hours).

Appendix Table A4. Approximation of the Accounting Identify

	Outcome = Log Instructional costs per SCH	
	(1)	(2)
DIE/Personnel	0.944***	0.931***
	(0.039)	(0.039)
Personnel/FTE (salaries)	0.927***	0.939***
	(0.014)	(0.006)
Faculty FTE/Class sections (workload)	0.898***	0.909***
	(0.015)	(0.006)
Class sections/SCH (class size)	0.928***	0.941***
	(0.009)	(0.004)
Observations	7,191	32,422
R-squared	0.971	0.970
Fixed effects	Institution	Program

Notes: Column 1 reports results for cross-section (2013-2015); column 2 reports results for full panel (2000-2015). All independent variables are entered as logs. Robust standard errors are clustered at the institution (column 1) or program (column 2) level. All models are weighted by total student credit hours*IPW. ***p<.001; **p<.01; *p<.05; ~p<0.1

Appendix B. Detailed Data Overview

In this appendix, we provide more information about the National Study of Instructional Cost and Productivity, explore coverage of the data, and detail our weighting approach.

I. The Delaware Cost Study Data

We use data from the National Study of Instructional Cost and Productivity from the University of Delaware (referred to as the Delaware Cost Study). Since 1998, the study has collected program-level data from over 700 four-year public and private non-profit higher education institutions. We provide a list of participating institutions in Appendix Table A1.

Each year, institutions report degrees awarded, fall semester instructional activity, and annual expenditure data for each of their academic programs, which are identified at the four-digit Classification of Instructional Program (CIP) code level. Degrees awarded are reported in rolling three-year averages by level: bachelors, master's, professional, and doctorate. Measures of fall term instructional activity include total faculty FTEs, total student credit hours, and total organized class sections. These measures are disaggregated in various ways. Faculty FTEs are categorized by rank: tenured and tenure eligible, other regular, supplemental, credit-bearing teaching assistants, and non-credit-bearing teaching assistants.[1] Student credit hours and organized class sections are broken out by course level (undergraduate lower division, undergraduate upper division, and graduate) and are also associated with a specific faculty rank. Finally, institutions report total direct expenditures for instruction, research, and public service and total undergraduate and graduate student credit hours for the entire academic year. We construct quarterly rescaled measures for some of our analyses to preserve consistency in numerators and denominators when possible.

[1]The distinction between "other regular" and "supplemental" faculty relates to length of contracts and the sources of funds. Other regular faculty have a recurring relationship with the institution and have a recurring appointment. Supplemental faculty are paid from temporary funds for non-recurring teaching assignments. Detailed definitions for each survey item are available online at https://ire.udel.edu/definitions/.

The institutional research department at the University of Delaware uses these data to develop national cost benchmarks and peer analyses for participating institutions, which may use the information for their own budgeting and strategic planning.

II. Coverage of U.S. Institutions

Because participation in the Delaware Cost Study (DCS) is optional, we analyzed the representativeness of our sample against the universe of public and private non-profit institutions that are US-based and that report information to the Integrated Postsecondary Education Data System (IPEDS).[2] The final universe includes 1,786 institutions and 34.9 million degrees. While the majority of schools were private institutions (67.4%), public schools produced the most graduates (64.2% of all degrees).

Using the IPEDS Completions survey, we analyze how nationally representative the DCS is at the two-digit CIP code level. Over one-third of all institutions reported to the Delaware Cost Study at least once (34.2%), accounting for 60.1 percent of all the degrees awarded between 1998 and 2015. However, institutions do not participate every year and some fail to report data for all of their departments (CIP2). When participating, institutions report most their departments to the study (82%) and these departments represent more than 90 percent of the degrees they award (92.3%). Taking these gaps into account, we estimate that our sample represents 23.3 percent of all degrees awarded over this period. Coverage is significantly higher for public degrees than for private degrees (32.2% versus 7.8%, respectively), and among public institutions, those rated very competitive or competitive by Barron's have the highest participation rates. The relationship between selectivity and participation reverses among private

[2] We also dropped institutions identified by Carnegie Classification as tribal, special focus (mostly private faith-related institutions, medical and health professional schools, and schools of art, music, and design), and unclassified (mostly unaccredited schools). A small number of international and special focus institutions report to the Delaware Cost Study (n=15), but we decided to drop these institutions because the sample of similar institutions would be too small to draw meaningful comparisons. We also dropped a small number of institution-year-CIP2 records that were observed in the Delaware Cost Study, but not in the Completions survey (<1%).

colleges: most competitive and highly competitive institutions are less likely to participate, compared to noncompetitive private colleges (35.4 and 17.6 percentage points, respectively). Larger public institutions, as well as private institutions with higher tuition prices, are more likely to participate. Finally, expenditures per FTE and state and local appropriations are uncorrelated with participation.

Because certain types of institutions are overrepresented in the data, we construct analytic weights that improve the representativeness of the sample. For each institution, we estimate a probability of participating in the DCS for each year. We weight observations by the inverse of the probability of participation, giving more weight to programs that were underrepresented that year. Since our analyses are at the CIP-4 level, we then interact that inverse probability weight with the total student credit hours for each institution at each CIP-4, giving more weight to larger programs. We model DCS participation by institution (*i*) and year (*t*) using the variables considered in the sampling frame of the National Postsecondary Student Aid Study (NPSAS). The NPSAS is a survey that is nationally representative at the institution and student level, and provided a reasonable guide to choosing observable characteristics for inclusion in our model of DCS participation. We estimate the following model:

$$\Pr(Participate)_{it} = \Phi(\alpha + \beta Inst_i + \gamma enroll_{it} + \delta expend_{it} + \varepsilon_{it}) \quad (1)$$

Where $Inst_i$ is a set of indicator variables for unique combinations of institutional control (public or private), Carnegie Classification (research, master's, or baccalaureate), Barron's selectivity rating (most/highly competitive, very competitive, or other)[3], and region. We also include 12-month unduplicated enrollment and expenditures per FTE. The model includes

[3] For master's and baccalaureate institutions, we created two selectivity groups (instead of three) to achieve large enough cell sizes. Specifically, we grouped together very, most, and highly competitive institutions to compare against "other" institutions. "Other" includes less competitive, noncompetitive, and special institutions. To deal with missingness in the Barron's and Carnegie Classification variables (as described in the Coverage section), institutions missing Barron's data are grouped with "other" institutions and institutions missing Carnegie Classification data are grouped with baccalaureate institutions.

polynomials of the latter two variables (quadratic and cubic) and interactions of all terms with institutional control (public or private). Appendix Table B1 reports some descriptive statistics for the unweighted and weighted samples across all years, and Appendix Table B2 reports the average weight given to each observation in an institutional category for select years.

Appendix Table B1. Descriptive Statistics for IPEDS, DCS Sample, and Weighted Sampl

	IPEDS	Sample (unweighted)	Sample (weighted)
Institution Group			
Research Univ, Most/High Comp, Public	1.8%	5.1%	1.9%
Research Univ, Most/High Comp, Private	3.4%	2.4%	3.2%
Research Univ, Very Comp, Public	3.1%	13.4%	3.1%
Research Univ, Very Comp, Private	1.2%	2.0%	1.5%
Research Univ, Comp, Public	5.8%	20.9%	6.2%
Research Univ, Comp, Private	2.1%	0.8%	1.5%
Masters Univ, Most/High/Very Comp, Publ	2.4%	5.9%	2.4%
Masters Univ, Most/High/Very Comp, Priv	5.1%	5.0%	5.6%
Masters Univ, Comp, Public	14.5%	20.3%	13.8%
Masters Univ, Comp, Private	16.7%	10.0%	17.5%
Bach Univ, Most/High/Very Comp, Public	0.7%	0.9%	0.4%
Bach Univ, Most/High/Very Comp, Private	11.3%	3.4%	13.8%
Bach Univ, Comp, Public	7.3%	4.0%	5.5%
Bach Univ, Comp, Private	24.4%	5.9%	23.7%
Region			
New England	9.1%	6.2%	6.2%
MidEast	19.9%	17.4%	23.9%
Great Lakes	15.6%	14.2%	18.8%
Plains	10.3%	11.6%	9.3%
Southeast	24.8%	34.9%	20.4%
Southwest	7.4%	6.2%	9.5%
Rocky Mountains	3.1%	5.0%	2.6%
Far West	9.8%	4.5%	9.4%
Enrollment (12-month, unduplicated)	7,939	15,704	7,496
Total Expenses per FTE	$ 21,035	$ 20,857	$ 20,438

Notes: Table reports summary statistics for IPEDS Completions survey. The second and third columns report the same characteristics for the DCS sample and then characteristics weighted by the inverse probability of participating in the DCS times student credit hours.

Appendix Table B2. Average Weights by Institution Group for Select Years

	IPW only			IPW*SCH		
	2000	2007	2015	2000	2007	2015
Research Univ, Most/High Comp, Public	1.8	3.9	3.0	12,878	25,899	26,086
Research Univ, Most/High Comp, Private	5.2	3.2	30.0	22,301	15,148	179,245
Research Univ, Very Comp, Public	2.1	1.6	2.1	11,490	10,129	17,665
Research Univ, Very Comp, Private	27.2	5.5	10.1	65,122	29,362	46,887
Research Univ, Comp, Public	2.2	2.1	2.2	10,098	11,263	11,533
Research Univ, Comp, Private	9.5	13.8	5.6	24,515	48,616	18,869
Masters Univ, Most/High/Very Comp, Public	6.2	2.5	2.2	24,405	11,383	9,721
Masters Univ, Most/High/Very Comp, Private	12.9	5.3	12.2	23,373	9,604	25,260
Masters Univ, Comp, Public	5.3	6.2	5.2	17,938	20,829	18,480
Masters Univ, Comp, Private	56.2	12.7	12.8	65,282	18,642	21,067
Bach Univ, Most/High/Very Comp, Public	4.9	2.5	5.6	7,611	4,210	10,172
Bach Univ, Most/High/Very Comp, Private	75.5	40.7	40.7	52,800	55,812	49,108
Bach Univ, Comp, Public	13.2	9.6	14.7	17,354	23,774	51,844
Bach Univ, Comp, Private	287.2	22.3	50.2	393,495	25,366	37,073

Notes: Average weights by institution group indicate the analytic weight given to observations in each category under two weighting schemes: the inverse of the probability of participating in the DCS, and the IPW interacted with number of student credit hours for each CIP4.

Appendix C. Details on Measurement of Costs and Cost Drivers

Our goal is to understand the relative importance of each cost driver in generating across-field cost differences. We begin with the accounting identity:

$$\frac{DIE}{SCH} = \left(\frac{DIE}{PERSONNEL}\right)\left(\frac{PERSONNEL}{\#FACULTY\ FTE}\right)\left(\frac{\#FACULTY\ FTE}{CLASS\ SECTIONS}\right)\left(\frac{CLASS\ SECTIONS}{SCH}\right)$$

This would exactly hold for each program if we were able to measure all variables on the same time scale. However, some variables are measured in only the fall semester while others are measured for the full year. Whenever possible, we construct our drivers so that the numerator and denominator of each driver are measured for the same period. Given our units for the dependent variable, we want to convert all cost drivers to those units using appropriate scaling factors, γ_d, for cost driver element *d*. Then, letting *f* denote that the variable was measured for the fall semester only and *y* the full year, we can rewrite our accounting identity as:

$$\frac{DIE_y}{SCH_y} = \left(\frac{DIE_y}{PERSONNEL_y}\right)\left(\frac{PERSONNEL_y}{\gamma_1 \#FACULTY\ FTE_f}\right)\left(\frac{\gamma_1 \#FACULTY\ FTE_f}{\gamma_2 CLASS\ SECTIONS_f}\right)\left(\frac{\gamma_2 CLASS\ SECTIONS_f}{\gamma_3 SCH_f}\right)$$

If fall and spring semesters were identical across all drivers, then the γ_d would not enter the equation. However, these semesters may be different and the difference may vary by program. If fall-to-spring differences were identical across programs, then the constant from equation (2) would be non-zero, but the coefficients on the drivers would be one.

Taking logs, we have:

$$ln\left(\frac{DIE_y}{SCH_y}\right) = \ln\left(\frac{DIE_y}{pers\$_y}\right)_{ci} + \ln\left(\frac{pers\$_y}{facFTE_f}\right)_{ci} + \ln\left(\frac{facFTE_f}{sections_f}\right)_{ci} + \ln\left(\frac{sections_f}{SCH_f}\right)_{ci} - \gamma_3$$

If we knew γ_3, we could exactly fit this equation. Instead, we appropriate them using field (i.e., CIP-4) and institution fixed effects. Some fields may spend relatively more in one semester (i.e., fall or spring) than the other – for example, many math and science fields may have higher costs in the fall than in the spring due to tight course sequences. Since we cannot directly observe such

field-specific scaling factors, our model is an approximation of the underlying accounting identity and the coefficients on the four cost drivers in equation (2) will not exactly equal one. Indeed, the magnitude of the bias is a function of (a) the inverse covariance matrix of the log cost drivers and the proxies; (b) the covariance of γ_3 with each logged cost driver and the proxies; (c) and the magnitudes of γ_3. We use institution and field fixed effects to control for such unobserved differences and find that the coefficients are very close to one (see Appendix Table A4).