Instructional Cost Drivers 1992-2017

Insights from the Delaware Study and the Education Policy Initiative
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“The National Study of Instructional Cost & Productivity”, conducted annually by the Higher Education Consortia at University of Delaware. Results reported here from a grant for public policy research by the Smith Richardson Foundation.

Two decade study, focused at the academic discipline level, of faculty instructional workload and costs, sponsored research and public service from over 700 four-year, public and private non-profit higher education institutions.

Research collaboration with the Education Policy Initiative Dr. Kevin Stange, University of Michigan and Dr. Steven Hemelt University of North Carolina- Chapel Hill.
What data do we use?

- All Institutional Costs
  - Costs Allocated to Departments
  - Central Costs
    - Direct Instructional Costs
    - Direct Public Service Costs (sep. budgeted)
    - Direct Research Costs (sep. budgeted)
    - Indirect Costs
    - Externally Funded Research & Dept. Match
    - Academic Administration

Personnel: Faculty and support staff
- Salary
- Benefits

Non-Personnel
College prices ↑ 36% between 2008 and 2018 (College Board, 2018)
- Student and parents now pay for >50% of costs (Desrochers & Hurlburt, 2016)
- Concerns about access, persistence, and indebtedness

Improved understanding of cost differences by field, trends, and cost drivers is key tool for tempering future cost growth

Better understating of costs → fuller picture of effects of policies such as financial aid, free college, and incentives to major in specific fields
- Example: High cost of engineering majors makes increasing STEM much less welfare-enhancing than earnings differences would imply (Altonji & Zimmerman, 2017)
In other words, by coverage we answer questions like:
- What do DCS participants look like?
- How representative are they of the 4-yr sector as a whole?
- How can we account for discrepancies between DCS sample and 4-yr sector?

“Because the population for this study is self-selected, it is, by definition, not a random sample. Descriptive statistics are applied to data from responding institutions to describe instructional expenditures for those institutions, but the findings cannot be inferentially generalized to the larger population of all Title IV-eligible 4-year colleges and universities in the United States” (Middaugh et al, 2003, p. viii).

What extent is voluntary participation a significant concern?
Delaware Cost Study Participation 1998 - 2015

DCS Coverage over Time

Survey year

DCS respondents as % of PESCS

0

0.025

0.05

0.075

0.1

0.125

0.15
Who’s most likely to participate?
- Public institutions
- Research/master’s universities
- Institutions with larger enrollments
- Institutions with higher tuition than average
- Expenditures per student in line w/ IPEDS data

Who’s less likely to participate?
- Selective private institutions across all degree levels
How do we account for the pattern of participants?

Goal of weighting is to make sample look “more” like nation as a whole
  - Give greater weight to underrepresented schools, less weight to overrepresented schools

Based on model of participation, predict Probability(DCS)

Calculate inverse of probability of participation
  \(1/(\text{Prob.}(\text{DCS}))\)
  - Can think of this is as, how many colleges does one respondent stand in for?
Delaware Cost Study Sample

DCS Sample by Inst Type and Control

- Private:
  - Bachelors: IPEDS, Unweighted, Weighted
  - Masters: IPEDS, Unweighted, Weighted
  - Research: IPEDS, Unweighted, Weighted

- Public:
  - Bachelors: IPEDS, Unweighted, Weighted
  - Masters: IPEDS, Unweighted, Weighted
  - Research: IPEDS, Unweighted, Weighted

% by degree and control
Does the weighting matter?
What type of weighting in the sample normalizes costs the most?

1. By the type of student credit hour (SCH)
2. By the type of institution under consideration (IPW)
3. By the interaction between student credit hour type and institution type (IPW*SCH)
Delaware Cost Study Sample

Direct Instructional Expenditure per Student Credit Hour

Survey year

Unweighted
SCH weighted
IPW weighted
IPW*SCH weighted
Process of constructing weights honed our sample for future analyses
- Identified outliers, missing data patterns

We focus a subset of 20 disciplines in the study 2000-2015
- Panel (2000-2015): 32,496 obs → 6,443 program, → 486 institutions

Supplemented by IPEDS, OK Salary Survey, other sources
Focus on 20 programs (CIP4 codes) using English (CIP 23.0101) as a reference for the other 19.
### Our study sample

<table>
<thead>
<tr>
<th>Code</th>
<th>Department</th>
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<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>0901</td>
<td>Communication/Media Studies</td>
<td>4008</td>
<td>Physics</td>
</tr>
<tr>
<td>1101</td>
<td>Computer/Info sciences</td>
<td>4201</td>
<td>Psychology, General</td>
</tr>
<tr>
<td>1301</td>
<td>Education</td>
<td>4506</td>
<td>Economics</td>
</tr>
<tr>
<td>1410</td>
<td>Electrical Engineering</td>
<td>4510</td>
<td>Political Science and Government</td>
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<tr>
<td>1419</td>
<td>Mechanical Engineering</td>
<td>4511</td>
<td>Sociology</td>
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<tr>
<td>2301</td>
<td>English</td>
<td>5007</td>
<td>Fine and Studio Arts</td>
</tr>
<tr>
<td>2601</td>
<td>Biology</td>
<td>5138</td>
<td>Nursing</td>
</tr>
<tr>
<td>2701</td>
<td>Mathematics</td>
<td>5202</td>
<td>Business</td>
</tr>
<tr>
<td>3801</td>
<td>Philosophy</td>
<td>5203</td>
<td>Accounting and Related Services</td>
</tr>
<tr>
<td>4005</td>
<td>Chemistry</td>
<td>5401</td>
<td>History</td>
</tr>
</tbody>
</table>

- Selected largely based on size, coverage, policy relevance
1) What are the cost differences, direct instructional expenses (DIE) by field of study?
   - At point in time as well as trends over time

2) What drivers account for cost differences by field?
   - Decompose level and trend differences into 4 candidate drivers:
     (A) Personnel costs per FTE instructor
     (B) Non-personnel costs
     (C) Faculty workload
     (D) Class size

3) Lessons and next steps
Snapshot: Differences in Cost Drivers by Field

Average Personnel Expenses

- English
- Comm/Media Studies
- Education
- Fine/Studio Arts
- Philosophy
- History
- Mathematics
- Sociology
- Psychology
- Biology
- Poli Sci/Government
- Chemistry
- Nursing
- Physics
- Computer/Info Sciences
- Economics
- Biz Admin/Mgmt/Operations
- Electrical Engineering
- Mechanical Engineering
- Accounting

Average Non-personnel Share of DIE

- Philosophy
- History
- Sociology
- Accounting
- English
- Economics
- Mathematics
- Poli Sci/Government
- Psychology
- Biz Admin/Mgmt/Operations
- Comm/Media Studies
- Physics
- Computer/Info Sciences
- Electrical Engineering
- Fine/Studio Arts
- Mechanical Engineering
- Nursing
- Biology
- Education
- Chemistry

++ denotes 95% CI
X-section sample. Weight=SCH*IPW.
Decomposition → Decompose within-institution cross-field cost differences using accounting identity (which we log):

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

- Non-personnel expenses
- Average salary + benefits
- 1/workload
- 1/class size

Simulate what DIE/SCH would be if actual average class size for field \( c \) at institution \( i \) were replaced with average for English at that same institution (but other factors held constant)

\[ \ln(y_{ci}) = \varphi_i + \ln\left( \frac{DIE}{pers\$}_{ci} \right) + \ln\left( \frac{pers\$}{facFTE}_{ci} \right) + \ln\left( \frac{facFTE}{sections}_{ci} \right) + \ln\left( \frac{sections}{SCH}_{ci} \right) + \epsilon_{ci} \]
Economics cheaper on average than English

Faculty get paid a lot more

But teach bigger classes that slightly more than offset salary difference
Stories: Tale of Mechanical Engineering

- M.E. more expensive than English
- Faculty get paid a lot more
- With slightly lower teaching loads
- But class size similar to English
Similar stories emerge...

1: Actual difference; 2: Equate other exp; 3: Equate salary; 4: Equate workload; 5: Equate class size
Decomposition of cost differences

Trends in costs over time

Potential policy implications

Longitudinal panel 2000 through 2015
Average Direct Instructional Expenditures per Student Credit Hour: 2000-2015

Notes: Expressed in constant 2015 dollars; weighted by SCH*IPW.

Modest increase in average cost...
... masks trend differences by field of study
Annual Growth in Faculty Salaries, 2000-2015

The chart illustrates the annual percentage change in faculty salaries across various fields from 2000 to 2015. The fields are ranked from top to bottom in terms of the annual percentage change, with Accounting showing the highest growth and Nursing showing the lowest decline.
Trends in Faculty Mix

Year


Weighted by SCH*IPW
Credit-Level Mix by Field:

- Accounting
- Biology
- Biz Admin/Mgmt/Operations
- Chemistry
- Comm/Media Studies
- Computer/Info Sciences
- Economics
- Education
- Electrical Engineering
- English
- Fine/Studio Arts
- History
- Mathematics
- Mechanical Engineering
- Nursing
- Philosophy
- Physics
- Poli Sci/Government
- Psychology
- Sociology

Legend:
- Lower division
- Upper division
- Graduate
How do institutions respond to large increases in total and discipline-specific enrollment demand?

Do institutions
- Expand number of sections?
- Hire adjuncts?
- Increase class size?
- Increase faculty workload?
- Other strategies?

How do these patterns differ across discipline?
Audience Q & A
Have you experienced any large increases in student enrollment?
  - Institution-wide?
  - For specific majors/programs?

What caused the increase? Was it expected?

How did you respond? What levers did you adjust? Were you able to maintain quality?
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Delaware Cost Study
Sharing Results with Chairs and Deans

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Share data with chairs/directors prior to submission to help with data validation

VIEW ONLY
Feature on the Cost Study Web Portal

Share results with chairs/directors and Deans to guide discipline-level conversations about cost and productivity

Share results with important decision-makers in your institution

http://ire.udel.edu/cost  ire-cost@udel.edu  UD_DECoststudy
Thank you

Please remember to submit your evaluation for this session.
Vast majority of studies use institution-level data from IPEDS/Delta Cost

A few existing case studies focus on a subset of elite institutions
- Clotfelter (1997): costs rise due to broad investments in quality, financial aid
- Ehrenberg (2000): Lack of central control fails to restrain spending by units

Most similar previous work focused on department level analysis
- Middaugh et al (2003): Cost differences across fields are sizable and explain much of the variation in costs across institutions
- Johnson and Turner (2009): Large differences in students per faculty across departments
- Courant and Turner (2017): Departments with expensive faculty economize by having larger classes
- Altonji and Zimmerman (2017): Cost of producing a major has welfare implications for college major returns
Delaware Cost Study Sample

DCS Sample by Selectivity

% by selectivity

- Most Competitive
- Highly Competitive
- Very Competitive
- Competitive
- Less Competitive
- Non-Competitive

IPEDS vs. DCS
## Delaware Cost Study Sample

### Sample weighting and coverage

<table>
<thead>
<tr>
<th></th>
<th>In IPEDS</th>
<th>In DCS</th>
<th>% covered</th>
<th>% covered w/ weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>582</td>
<td>333</td>
<td>57.2%</td>
<td>73.3%</td>
</tr>
<tr>
<td>Private</td>
<td>1,204</td>
<td>278</td>
<td>23.1%</td>
<td>36.5%</td>
</tr>
<tr>
<td>ALL</td>
<td>1,786</td>
<td>611</td>
<td>34.2%</td>
<td>60.1%</td>
</tr>
</tbody>
</table>
Snapshot: Cost Differences by Carnegie Class
Faculty workload, 2000-2015
Annual Percentage Change In Costs: 2000-2015

-2 -1 0 1 2

Annual % change

Fine/Studio Arts
Education
Poli Sci/Government
History
Biz Admin/Manage/Operations
Comm/Media Studies
English
Economics
Accounting
Philosophy
Sociology
Psychology
Computer/Info Sciences
Mathematics
Biology
Physics
Chemistry
Nursing
Mechanical Engineering
Faculty salaries, Annual % Change 2000-2015

[Graph showing annual percentage change in salaries across various academic fields]
Tales with Trends: Changes over time
Class sizes, 2000-2015

Annual % change

Mechanical Engineering
Nursing
Electrical Engineering
Physics
Biology
Chemistry
Psychology
Accounting
Mathematics
Economics
Comm/Media Studies
Biz Admin/Mgmt/Operations
Sociology
Philosophy
Pol Sci/Government
Computer/Info Sciences
History
Fine/Studio Arts
English
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Tales with Trends: Changes over time

Faculty salaries, 2000-2015

Faculty workload, 2000-2015

Class sizes, 2000-2015
Tales with Trends: Changes over time

Faculty salaries, 2000-2015

Faculty workload, 2000-2015

Class sizes, 2000-2015
Very preliminary evidence

5 ppt increase in unemployment rate
20% increase student credit hours

Note: Sample restricted to balanced panel of programs participating in Delaware Cost Study at least 13 times