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Understanding Within-Discipline Variance in Higher Education Instructional Costs to Enhance Funding Conversations

July 2025

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As the price of college tuition continues to rise, higher education institutions and their governing bodies are facing immense pressure to fully understand and explain how tuition, fees, and other sources of revenue are being spent on their campuses. Understanding these expenditures is not only important for the leadership and constituents of the higher education institution, but it is also essential knowledge at the state level, where decisions regarding equitable funding allocations for public colleges and universities are made.

While research exists on many different facets of higher education costs, price, and expenditures, this research will focus on one particular area of interest—the direct cost to the university to deliver an education to its students, which on average makes up 34% of the core expenses at public four-year institutions and 39% at private, not-for-profit four-year institutions (National Center for Education Statistics, 2023). While instructional costs are just one piece of the overall expenditures puzzle, they play a crucial role in budgetary conversations and decision-making. Interestingly, even though *overall* instructional expenditures at public institutions have been increasing over time (Iwamasa and Thrasher, 2019), the cost of delivering instruction per student has remained relatively constant over the last couple of decades (McPherson & Shulenburger, 2010; Hemelt et al., 2021). However, across disciplines and institutions, instructional costs can vary significantly—Middaugh et al. (2003) found that the majority of variation in costs is discipline-specific.

The current study builds on previous work that explored cost variation *across* disciplines within a single institution as well as *within*-discipline cost variation across numerous institutions. We focus specifically on identifying institution- and program-level cost drivers, while also exploring how those drivers differ between disciplines.[1] Any new insights from this study will have important implications for conversations related to higher education funding, especially equitable funding at public colleges and universities.

Higher Education Instructional Costs

Due to limited access to department- or program-level data, much of the research on higher education instructional costs has been confined to expenditures that are reported at the institution level. This includes important work from Brinkman (1981) on instructional costs at

[1] For this paper, the term "program" refers to an academic unit at a college or university from which data can be collected and analyzed (e.g., program-level costs). These units are typically departments but can also be individual degree programs or entire schools. Conversely, the term "discipline" refers to an academic field of study (e.g., Chemistry or English) to which programs are generally aligned. The two terms are often used interchangeably in higher education, and the distinction has minimal impact on our overall findings. However, we emphasize the distinction to indicate when we are specifically talking about a unit of measurement and analysis versus when we are generalizing the conversation to broader academic disciplines.

major research institutions; Archibald and Feldman (2008) on the causes of the increasing cost and price of higher education; McPherson and Shulenburger (2010) on the relationship between costs and rising tuition; and Desrochers and Hurlburt (2016) with their research on the Delta Cost Project.

At the institution level, instructional costs are driven by a variety of factors, including Carnegie Classification[2] (Desrochers & Hurlburt, 2016; McPherson & Shulenburger, 2010); public or private designation (Desrochers & Hurlburt, 2016; Morphew and Baker, 2007); and region (Morphew and Baker, 2007). Additionally, research on product mix and cost disaggregation found that undergraduate, graduate, and research costs have different impacts on overall costs at a university—particularly, undergraduate education was often subsidizing the more expensive graduate education (James, 1978).

Program-Level Analyses

While it is certainly beneficial to examine expenditures at the level of the institution, a considerable amount of nuance is lost when instructional cost differences across disciplines are not acknowledged. Prior research by both Middaugh et al. (2003) and Hemelt et al. (2021) has confirmed that there are significant differences in instructional costs across disciplines within a single institution. As Tierney (1980) concluded: “departments constitute the fundamental organizational unit of colleges and universities” (p. 454) and are therefore the most appropriate level of analysis for understanding instructional costs. Examining instructional costs at the level of the program also allows for the discovery of additional, program-level cost drivers (e.g., the workload of the faculty in the program) to be considered alongside institution-level drivers (e.g., Carnegie Classification).

In one of the earliest studies conducted at the program level, Tierney (1980) found discipline-specific cost differences when examining departmental cost functions for seven academic disciplines at private liberal arts colleges, with programs in the natural sciences having higher costs than programs in the social sciences and humanities. Two decades later, using data from the National Study of Instructional Costs and Productivity at the University of Delaware (The Cost Study at UD), Middaugh et al. (2003) found that approximately 80% of the variation in instructional costs can be explained by the mix of disciplines at an institution. However, Middaugh et al. (2003) also found significant variation in instructional costs *within disciplines* across institutions. This variation is partly due to institutional mission (as identified by an institution’s Carnegie Classification) and is most apparent at research institutions where faculty typically spend a lot of their time conducting research and are therefore expected to teach less, which can raise costs.

[2] The Carnegie Classification of Institutions of Higher Education is managed by the American Council on Education.

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Building off the work of Brinkman (1990), Middaugh et al. (2003) also concluded that specific program-level factors can impact expenditures. They found that 60-75% of the within-discipline variation in costs can be attributed to the factors identified by Brinkman (1990): volume of teaching activity (measured by student credit hours taught) [higher volume = lower cost]; department size (measured by number of faculty) [larger department = higher cost]; and the percentage of the faculty that are tenured [higher proportion = higher cost]. Additionally, while the effect was not as strong, Middaugh et al. (2003) also found that costs are impacted by the percentage of personnel vs. nonpersonnel costs and the presence of graduate instruction [= higher cost]. However, other research has noted that due to economies of scope, the presence of graduate education may actually lower instructional costs because graduate students can deliver less expensive instruction for the department (Dundar & Lewis, 1995). In related research at two-year colleges, Seybert and Rossol (2010) found that across most disciplines, instructional costs are positively related to the percent of full-time faculty in a program.

More recently, Hemelt et al. (2021) used updated data from The Cost Study to reexamine the trends in discipline-specific instructional costs. They found that while instructional costs have remained relatively stable over time (when adjusting for inflation), costs vary significantly across disciplines, with electrical engineering being the most expensive to deliver and math the least expensive. They also found that instructional costs are primarily driven by four factors at the program level: average instructional workload, approximate number of students per course section, average annual instructional salaries, and the percent of nonpersonnel expenditures in the program. Additionally, costs within a single discipline have also varied over time, which was typically explained by changes in faculty salaries (offset by an increase in workload and/or class size) and faculty composition. Their findings mirrored those of Altonji and Zimmerman (2017), whose research also found substantive discipline-specific cost differences within the Florida State University System.

Significance of the Study

While previous research accounted for disciplinary differences and typical benchmarking characteristics (e.g. Carnegie Classification or highest degree offered), there is still a considerable amount of unexplained within-discipline variation in instructional costs. Not a lot is known about what is driving this specific variation across institutions. Building off of prior work from Middaugh et al. (2003) and Hemelt et al. (2021), this study seeks to further explore this within-discipline variation in instructional costs and serve as a starting point for more in-depth future research into this topic.

The purpose of this research is to use program-level instructional cost and productivity data from The Cost Study, combined with publicly available institution-level data from the National Center for Education Statistics' Integrated Postsecondary Education Data System (IPEDS) and the U.S. Bureau of Economic Analysis' Regional Price Parities by State, to establish a better understanding of how program- and institution-level characteristics can drive within-discipline instructional costs at four-year, public and private, not-for-profit institutions. We aim to answer three questions:

1. *What are the primary drivers of within-discipline variance in instructional costs?*
2. *How do these cost drivers differ between disciplines?*
3. *How much of the within-discipline variation in instructional costs can be explained by institutional and programmatic characteristics?*

The answers to these questions will have undeniable implications for how instructional costs are conceptualized and studied at colleges and universities. Additionally, understanding how cost drivers vary across disciplines will become essential knowledge for anyone evaluating and discussing equitable funding in higher education.

Methods

Data Sources

The primary dataset for this research comes from The Cost Study at the University of Delaware.[3] The Cost Study is a not-for-profit, program-level comparative analysis of instructional costs and faculty productivity. Since 1998, it has been the leading analytical tool for more than 700 four-year, public and private, not-for-profit colleges and universities to benchmark their cost and productivity data. The study collects data related to faculty workload (organized class sections and student credit hours) by rank and course level, as well as direct instructional expenditures (from salaries, benefits, and other nonpersonnel expenditures) and separately budgeted research and public service expenditures.

Participation in The Cost Study is entirely voluntary, and while it serves a variety of institutional types, certain sectors and Carnegie Classifications are overrepresented compared to the larger population. During the 2022 cycle, 79% of the participating institutions were public and 21% were private, compared to all four-year, not-for-profit institutions in the U.S. in 2022, among which 33% were public and 67% were private.[4] Additionally, study participants are typically limited to eight standard Carnegie Classification categories: Doctoral Universities: Very High Research Activity; Doctoral Universities: High Research Activity; Doctoral/Professional Universities; Master's Colleges & Universities: Larger Programs; Master's Colleges & Universities: Medium Programs; Master's Colleges & Universities: Small Programs; Baccalaureate Colleges: Arts & Sciences Focus; and Baccalaureate Colleges: Diverse Fields.

[3] The authors of this paper are responsible for managing the annual administration of The Cost Study through the Higher Education Consortia at the University of Delaware (UD). Permission to use study data for this research was granted by UD leadership and approved by the Higher Education Consortia Advisory Board.
[4] Based on our own analysis of the 2022 Institutional Characteristics survey data from IPEDS.

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During the 2022 cycle, 59% of the participating institutions were research universities, 11% were doctoral/professional universities, 24% were master's, and 6% were baccalaureate. In 2022, approximately 64% of all four-year, public or private, not-for-profit institutions in the U.S. fell into those eight classifications, and within that group, 18% were research universities, 11% were doctoral/professional universities, 40% were master's, and 31% were baccalaureate.[5] Thus, while The Cost Study is available to all four-year, not-for-profit institutions, participation is overrepresented by public research universities.

Participants in The Cost Study submit their institution's data at the program level, defined as an academic unit with its own distinguishable budget, typically a department or school/college. For comparison purposes, institutions assign each of their programs a discipline-specific code from the Classification of Instructional Programs (CIP), either at the 2-, 4-, or 6-digit level. For the present analysis, programs are classified using their 4-digit CIP code.

The program-level dataset from The Cost Study was supplemented with institution- and state-level data from two publicly available data sources: IPEDS and Regional Price Parities by State.

Variables

We examined the impact of 20 predictor variables on Cost per SCH ($)—a program-level metric from The Cost Study that captures the annual direct instructional expenditures per annual student credit hour (undergraduate and graduate combined). Cost per SCH ($) is the most commonly used and discussed comparative metric from the study.

The 20 predictor variables included eight program-level predictors from The Cost Study, 11 institution-level predictors from IPEDS, and one state-level predictor from the U.S. Bureau of Economic Analysis (mapped to each institution using the state code). Program-level predictors are denoted in-text with a "prog" subscript (e.g., Variable X_{prog}), and institution- and state-level predictors are denoted with an "inst" subscript (e.g., Variable Y_{inst}). The predictor variables were selected conceptually based on prior higher education cost research, as well as experiential expertise from researchers familiar with The Cost Study. A full list of the variables used in our analyses, including descriptions and data source, can be found in Appendix A.

Sample

The analysis in this paper examines program-level data from the 2022 cycle of The Cost Study, which covers fall 2021 instructional activity and academic/fiscal year 2021-22 annual instructional activity and expenditures data. To maximize sample size, we selected the top 10 most-reported 4-digit CIPs to the 2022 cycle:

- 23.01 – English Language and Literature, General (English)

[5] Based on our own analysis of the 2022 Institutional Characteristics survey data from IPEDS.

- 26.01 – Biology, General (Biology)
- 27.01 – Mathematics (Math)
- 40.05 – Chemistry (Chemistry)
- 42.01 – Psychology, General (Psychology)
- 45.10 – Political Science and Government (Political Science)
- 50.07 – Fine and Studio Arts (Fine & Studio Arts)
- 50.09 – Music (Music)
- 52.02 – Business Administration, Management and Operations (Bus Admin & Mgmt)
- 54.01 – History (History)

These 10 CIPs contributed 825 programs to the dataset and they represent a diverse selection of academic disciplines commonly found at four-year, public and private, not-for-profit colleges and universities.[6] Each of the 89 participating institutions from the 2022 cycle contributed a program to at least three of the 4-digit CIP groups in our sample; however, the majority of the participants contributed between eight and 12 programs across the 10 CIP groups.[7] The full list of participating institutions and their program contributions can be found in Appendix B.

The institution-level data from IPEDS corresponds with the same time period as the 2022 cycle of The Cost Study, covering data from fall 2021 and the academic/fiscal year 2021-22. The state Regional Price Parities from the U.S. Bureau of Economic Analysis reflect the 2022 calendar year. The institution-level data was merged into the program-level dataset so that each program row contained its respective institution's data.

Analysis

The final dataset was analyzed using descriptive statistical analyses and simple linear regression (Ordinary Least Squares) to determine which institutional and programmatic characteristics account for the variation in within-discipline costs. We conducted 12 separate regression analyses (one for all CIPs, one for all CIPs from public institutions, and 10 for the individual 4-digit CIPs).

Prior to running the regressions for each of the 12 analyses, we independently removed Cost per SCH ($) outliers that were three standard deviations away from the mean. Since The Cost Study contains self-reported data, it is an acceptable practice to eliminate outliers to correct for possible errors in data reporting. This decision was confirmed by analyzing scatterplots, which revealed that certain outliers were erroneously forcing a strong association between the dependent variable and some of the predictor variables.

[6] The full dataset from the 2022 cycle of The Cost Study contains 3,537 programs across 240 different 4-digit CIPs.
[7] Institutions are permitted to submit more than one program that rolls up to the same 4-digit CIP code.

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Additional data transformations (i.e., log10) were conducted on two predictor variables, Personnel Cost $(\%)_{prog}$ and Instructional $Faculty_{prog}$, to correct for skewedness. Finally, the predictor variables were evaluated for multicollinearity, and there were no concerns with any of the correlations.

The full regression model was first run on the entire sample of programs from all 10 CIP groups and then on the programs that were only from public institutions. Those two models contain an additional predictor variable, 4-digit CIP, to account for the known impact of discipline-specific cost differences. Subsequent regressions were then run on each of the ten 4-digit CIP groups separately in order to isolate the independent variables that best predict instructional costs for each discipline.

Results

While cost variation *between* disciplines has been explored in prior research (see Hemelt et al. 2016) and has been attributed to various program-level characteristics, here we explore the unique variability *within* disciplines.

Table 1 provides descriptive statistics for the dependent variable (Cost per SCH ($)) and the predictor variables for each of the 12 regression analyses, demonstrating the variability between 4-digit CIPs.[8] The average cost per SCH was $298 ($SD$ = 130) for the All CIPs group and $295 ($SD$ = 130) for the All CIPs Public, with the 4-digit CIP groups ranging from $216 ($SD$ = 77) for Psychology to $489 ($SD$ = 204) for Music. *Figure 1* provides box-and-whisker plots of Cost per SCH ($) for the All CIPs, All CIPs Public, and ten 4-digit CIP groupings to illustrate the within-discipline variance in instructional costs.

Simple linear regression analyses were conducted to evaluate the extent to which our predictor variables could predict within-discipline (by 4-digit CIP) cost per SCH. A significant model was found for all 12 analyses. For All CIPs, the model explained 54% of the variance in cost per SCH ($R^2 = .54$, $F(21,789) = 46.86$, $p < .01$). For All CIPs Public, the model explained 56% of the variance in cost per SCH ($R^2 = .56$, $F(21,628) = 42.44$, $p < .01$). As expected, in both regressions, 4-digit CIP significantly predicted cost per SCH ($\beta = .09$, $p < .01$ for both models). Complete results for the 12 regression analyses are presented in *Table 2*.

The fit of these two overall regression models should be interpreted with caution. Each of the programs in the dataset belongs to one of 89 institutions, with institutions contributing between 3 and 13 programs to the sample (Appendix A). However, due to sample size limitations, we were unable to employ multilevel modeling techniques to these regressions. As a result, the All CIPs and All CIPs Public groupings overrepresent institutions that contributed more programs to the data set, i.e., they offer programs from all or most of the 10 specific

[8] *Table 1* also shows the discipline name that corresponds with each 4-digit CIP code.

disciplines that we selected for our analysis. Thus, the findings from those two regressions are for illustrative purposes only to provide a conceptual baseline for understanding the regression results of the ten 4-digit CIPs. This limitation is not a concern for the 10 discipline-specific analyses since only a handful of institutions submitted more than one program to any given discipline. Among the 4-digit CIPs, two of the models explained more than 70% of the variance in instructional costs: History and English. For History, the predictors explained 77% of the within-discipline variance in cost per SCH ($R^2 = .77$, $F(20,63) = 14.80$, $p < .01$). For English, the predictors explained 72% of the within-discipline variance in cost per SCH ($R^2 = .72$, $F(20,61) = 11.27$, $p < .01$). The predictors explained the least amount of within-discipline variance in cost per SCH (37%) for Chemistry ($R^2 = .37$, $F(20,61) = 3.40$, $p < .01$), indicating that there may be other cost drivers better suited to understanding cost variation in Chemistry departments.

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Table 1

Descriptive Statistics by CIP Grouping

	All CIPs		All CIPs Public		23.01 English		26.01 Biology		27.01 Math		40.05 Chemistry	
N	*811*		*649*		*82*		*81*		*78*		*82*	
Variable	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Cost per SCH ($)	298	130	295	130	276	111	284	98	220	69	329	100
Personnel Cost (%)$_{prog}$[a]	95.9	4.9	96.0	4.8	98.1	2.0	93.7	4.3	98.0	2.1	92.1	5.8
T/TT Faculty (%)$_{prog}$	60.0	19.3	59.9	18.3	53.6	18.7	61.7	15.6	56.1	17.0	59.6	18.8
Instructional Faculty$_{prog}$[a]	27.5	22.0	30.8	22.1	39.5	26.6	30.0	18.8	38.3	27.0	27.9	22.0
Faculty Workload$_{prog}$	2.9	1.2	2.8	1.2	3.1	0.8	2.4	1.1	3.0	0.8	2.3	1.5
Students per Faculty$_{prog}$	15.7	6.7	16.7	6.8	12.6	3.0	17.1	6.0	18.8	5.1	17.0	8.4
Student Size$_{inst}$[b]	13.9	10.0	16.0	9.9	13.6	10.1	13.3	10.0	14.3	10.2	14.2	10.0
Faculty-to-Staff$_{inst}$	0.47	0.14	0.45	0.13	0.47	0.14	0.49	0.14	0.47	0.14	0.47	0.14
Draw Rate$_{inst}$	0.30	0.24	0.32	0.26	0.31	0.25	0.30	0.25	0.31	0.25	0.31	0.25
Pell (%)$_{inst}$	32.4	14.8	33.1	15.9	32.3	15.3	33.0	15.1	31.7	14.6	32.1	14.8
Tuition/Fees (%)$_{inst}$	39.6	22.4	30.7	11.8	39.0	22.5	38.5	22.3	39.7	22.6	38.0	21.0
Faculty Salary ($)$_{inst}$[b]	89.2	17.4	91.0	17.1	87.8	16.8	86.6	14.3	88.9	18.2	89.3	18.1
Support per Student ($)$_{inst}$[b]	6.4	2.7	5.7	2.0	6.4	2.7	6.2	2.6	6.4	2.7	6.4	2.7
Net Price ($)$_{inst}$[b]	18.7	6.9	16.2	4.1	18.5	6.7	18.1	6.8	18.7	6.5	18.4	6.5
Regional Price Parities$_{inst}$	98.8	7.8	98.4	7.6	98.3	7.6	97.9	7.4	98.9	7.8	98.5	7.9
Variable	n	%	n	%	n	%	n	%	n	%	n	%
Awards Grad Degrees$_{prog}$	505	62	450	69	57	70	56	69	49	63	50	61
Uses TAs$_{prog}$	300	37	282	43	43	52	28	35	40	51	30	37
Has Research/Public Service $$_{prog}$	479	59	441	68	46	56	53	65	52	67	57	70
Research University$_{inst}$	474	58	422	65	46	56	45	56	44	56	50	61
Public$_{inst}$	649	80	649	100	65	79	65	80	62	79	67	82
Located in City$_{inst}$	411	51	332	51	41	50	39	48	38	49	43	52

[a] Variable transformed using log function prior to regression analyses. Descriptive statistics presented for untransformed variable.

[b] Values presented in thousands.

Table 1 *(continued)*

Descriptive Statistics by CIP Grouping

	42.01 Psychology		45.10 Political Science		50.07 Fine & Studio Arts		50.09 Music		52.02 Bus Admin & Mgmt		54.01 History	
N	*78*		*80*		*83*		*82*		*84*		*84*	
Variable	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Cost per SCH ($)	216	77	282	100	335	129	489	204	307	155	275	107
Personnel Cost (%)$_{prog}$[a]	97.7	1.9	97.4	3.4	94.3	4.8	93.3	5.9	95.8	7.6	98.1	2.1
T/TT Faculty (%)$_{prog}$	63.8	17.6	72.5	18.0	53.8	18.5	49.6	20.5	57.3	18.4	71.9	15.7
Instructional Faculty$_{prog}$[a]	28.7	18.6	17.2	12.5	19.6	16.6	30.2	20.6	25.9	27.8	20.0	12.7
Faculty Workload$_{prog}$	2.8	0.9	2.8	1.0	2.7	1.2	3.2	1.7	3.3	0.9	2.8	1.0
Students per Faculty$_{prog}$	20.1	6.1	15.8	5.1	11.4	3.4	8.3	3.6	20.7	8.2	15.2	4.3
Student Size$_{inst}$[b]	13.8	10.1	14.4	10.0	14.6	10.1	13.6	9.9	13.5	10.1	13.9	10.0
Faculty-to-Staff$_{inst}$	0.47	0.14	0.47	0.14	0.47	0.14	0.47	0.13	0.48	0.13	0.47	0.14
Draw Rate$_{inst}$	0.27	0.11	0.30	0.25	0.30	0.25	0.30	0.25	0.30	0.24	0.30	0.25
Pell (%)$_{inst}$	32.4	15.0	31.9	14.2	32.3	15.0	32.0	14.8	33.1	15.0	32.6	14.9
Tuition/Fees (%)$_{inst}$	39.6	22.4	39.0	21.8	41.0	22.9	41.3	23.9	41.8	24.5	38.9	22.0
Faculty Salary ($)$_{inst}$[b]	88.4	15.9	90.0	17.3	92.2	19.3	89.2	17.9	88.1	17.7	89.7	17.8
Support per Student ($)$_{inst}$[b]	6.3	2.7	6.5	2.8	6.6	2.8	6.6	2.8	6.4	2.7	6.5	2.7
Net Price ($)$_{inst}$[b]	18.5	6.5	18.5	6.5	19.2	7.5	19.6	8.8	18.6	6.6	18.5	6.3
Regional Price Parities$_{inst}$	98.9	7.7	99.0	7.9	100.1	7.9	98.9	7.8	98.2	7.7	99.0	7.9
Variable	n	%	n	%	n	%	n	%	n	%	n	%
Awards Grad Degrees$_{prog}$	56	72	42	53	38	46	44	54	63	75	50	60
Uses TAs$_{prog}$	40	51	26	33	24	29	29	35	16	19	24	29
Has Research/Public Service $$_{prog}$	52	67	46	58	40	48	40	49	44	52	49	58
Research University$_{inst}$	45	58	49	61	50	60	49	60	45	54	50	60
Public$_{inst}$	63	81	65	81	67	81	63	77	64	76	68	81
Located in City$_{inst}$	38	49	41	51	45	54	43	52	41	49	43	51

[a] Variable transformed using log function prior to regression analyses. Descriptive statistics presented for untransformed variable.

[b] Values presented in thousands.

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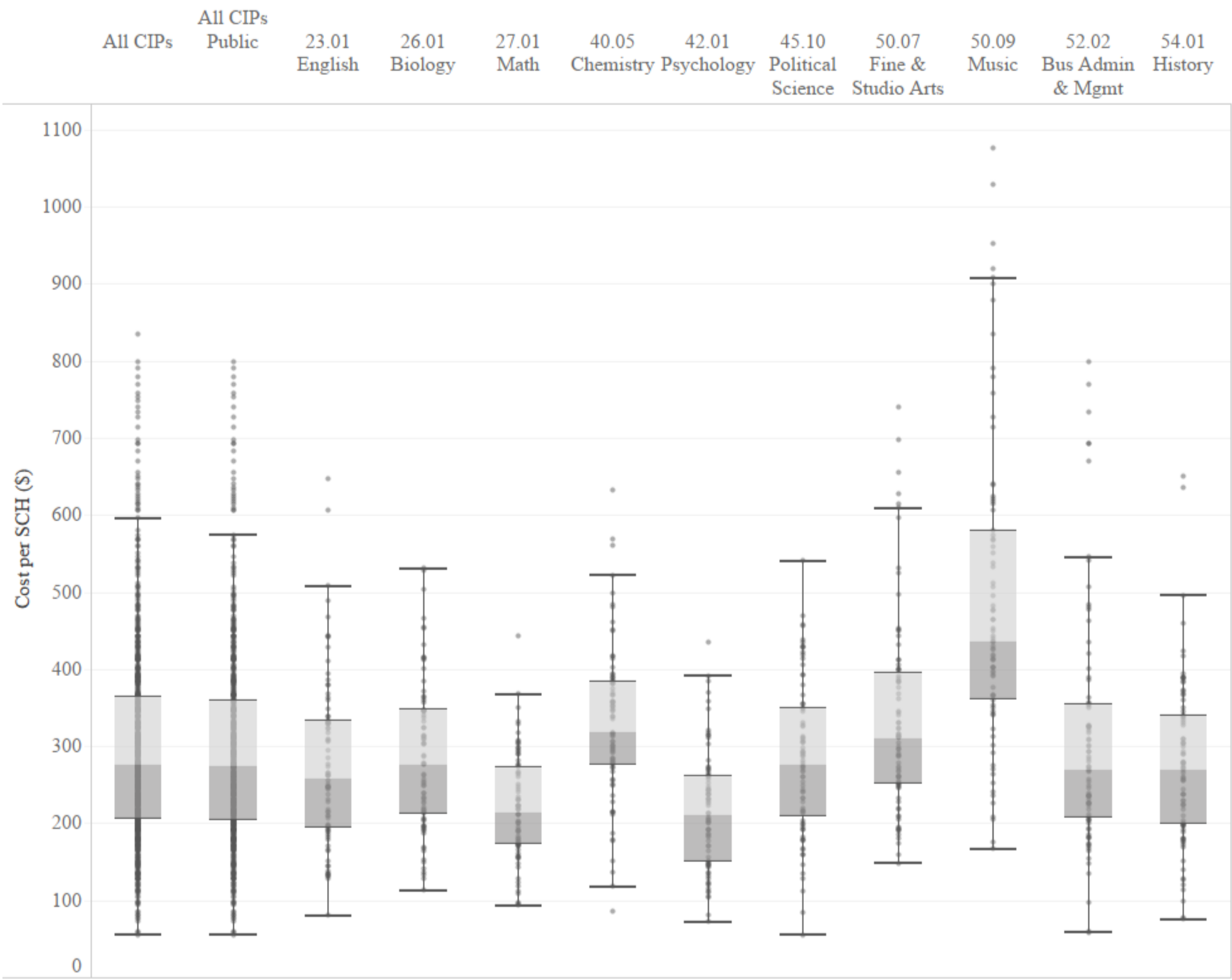
Figure 1
Variation in Cost per SCH ($) by CIP Grouping



Apart from Chemistry, all the regressions explained at least 54% of the within-discipline variance in instructional costs. However, while all the regressions were significant, there were noticeable differences between 4-digit CIPs as to which predictors were significant. Finding differences between regressions using the same predictor variables confirms our interest in better understanding within-discipline instructional cost variation.

Table 2
Linear Regression Results for Cost per SCH ($) by CIP Grouping[a]

	All CIPs	All CIPs Public	23.01 English	26.01 Biology	27.01 Math	40.05 Chemistry

N	*811*		*649*		*82*		*81*		*78*		*82*	
4-digit CIP	**.09**	**	**.09**	**								
Awards Grad Degrees$_{prog}$	**.11**	**	**.09**	*	-.07		-.06		.04		.09	
Uses Tas$_{prog}$	-.05		-.04		.22		.05		-.09		-.09	
Has Research/Public Service \$$_{prog}$	-.05		-.04		.05		-.15		.09		.02	
Personnel Cost (%)$_{prog}$	**-.26**	**	**-.25**	**	**-.14**	*	-0.1		-.08		**-.25**	*
T/TT Faculty (%)$_{prog}$	**.24**	**	**.23**	**	**.46**	**	**.43**	**	**.44**	**	**.43**	**
Instructional Faculty$_{prog}$	-.01		-.04		-.27		-.20		.06		-.15	
Faculty Workload$_{prog}$	.00		-.01		-.06		-.10		.11		.03	
Students per Faculty$_{prog}$	**-.56**	**	**-.56**	**	**-.53**	**	**-.58**	**	**-.74**	**	**-.76**	**
Research University$_{inst}$	.04		.07		-.10		.15		.26		.05	
Public$_{inst}$	.12				.28		.17		.10		.15	
Located in City$_{inst}$	.03		.04		.09		.14		.09		.18	
Student Size$_{inst}$	-.02		.00		.19		.16		.01		.01	
Faculty-to-Staff$_{inst}$	.02		.07		.12		-.01		.18		-.08	
Draw Rate$_{inst}$	**.09**	**	**.10**	**	.03		.01		.03		.04	
Pell (%)$_{inst}$	-.02		-.06		.09		-.18		-.09		-.15	
Tuition/Fees (%)$_{inst}$	-.04		-.04		.11		.03		-.13		.01	
Faculty Salary (\$)$_{inst}$	**.35**	**	**.33**	**	**.34**	**	**.37**	**	**.56**	**	**.41**	*
Support per Student (\$)$_{inst}$	-.02		-.01		.04		-.02		-.03		.02	
Net Price (\$)$_{inst}$	**.14**	**	.04		-.01		.09		.16		.04	
Regional Price Parities$_{inst}$	**.11**	**	**.14**	**	.18		.20		.17		.14	
Adjusted R Square	.54		.56		.72		.54		.69		.37	
F	46.86	**	42.44	**	11.27	**	5.69	**	9.49	**	3.40	**
df	21,789		21,628		20,61		20,60		20,57		20,61	

[a] Standardized regression coefficients
* $p < .05$, ** $p < .01$

Table 2 (continued)

Linear Regression Results for Cost per SCH ($) by CIP Grouping[a]

	42.01 Psychology		45.10 Political Science		50.07 Fine & Studio Arts		50.09 Music		52.02 Bus Admin & Mgmt		54.01 History	
N	*78*		*80*		*83*		*82*		*84*		*84*	
4-digit CIP												
Awards Grad Degrees$_{prog}$	.20		.01		-.08		**-.30**	*	.04		**.39**	*
Uses TAs$_{prog}$	.06		.01		.05		.09		.05		.00	
Has Research/Public Service $$_{prog}$	.12		-.12		-.10		.09		-.15		-.06	
Personnel Cost (%)$_{prog}$	-.06		-.11		**-.18**	*	-.14		**-.38**	**	-.03	
T/TT Faculty (%)$_{prog}$	**.55**	**	**.35**	**	**.40**	**	**.43**	**	**.24**	*	**.30**	**
Instructional Faculty$_{prog}$	-.07		.06		.09		**.46**	**	**-.33**	**	-.07	
Faculty Workload$_{prog}$	.12		.07		-.06		-.14		-.03		.14	
Students per Faculty$_{prog}$	**-.56**	**	**-.70**	**	**-.64**	**	**-.71**	**	**-.60**	**	**-.50**	**
Research University$_{inst}$	.10		.19		-.03		-.12		.19		.11	
Public$_{inst}$	-.05		.01		**.42**	*	.06		.17		.11	
Located in City$_{inst}$	-.04		.02		-.09		.02		.17		.07	
Student Size$_{inst}$	-.06		-.05		.01		-.04		.29		**-.25**	*
Faculty-to-Staff$_{inst}$	.03		.16		-.10		.00		.00		**.18**	*
Draw Rate$_{inst}$	.00		.10		**.17**	*	.04		**.33**	**	**.14**	*
Pell (%)$_{inst}$	-.10		-.10		.16		.10		-.02		-.07	
Tuition/Fees (%)$_{inst}$	-.01		**-.32**	*	.16		.10		.24		-.19	
Faculty Salary ($)$_{inst}$	**.52**	**	**.43**	**	**.43**	**	**.32**	*	**.28**	*	**.41**	**
Support per Student ($)$_{inst}$	-.07		-.19		-.02		.12		.08		.06	
Net Price ($)$_{inst}$	-.04		.25		.24		.09		-.14		.05	
Regional Price Parities$_{inst}$	.20		.19		.17		.02		.13		**.33**	**
Adjusted R Square	.67		.55		.67		.60		.61		.77	
F	8.91	**	5.80	**	9.16	**	7.12	**	7.60	**	14.80	**
df	20,57		20,59		20,62		20,61		20,63		20,63	

[a] Standardized regression coefficients

* $p < .05$, ** $p < .01$

Differences in Predictors

Of particular interest to the present study is the differences in significant predictors between each regression. In addition to 4-digit CIP, eight other predictors were significant in the two overall All CIPs regressions: four program-level and four institution-level. In the All CIPs regression, cost per SCH was significantly predicted by the following:

- whether a program awards graduate degrees (Awards Grad Degrees_{prog}) ($\beta = .11$, $p < .01$)
- the percent of instructional expenditures in a program that come from personnel costs (Personnel Cost $(\%)_{prog}$) ($\beta = -.26$, $p < .01$)
- the percent of faculty in the program that are tenured or tenure-track (T/TT Faculty $(\%)_{prog}$) ($\beta = .25$, $p < .01$)
- the number of FTE students per FTE faculty in the program (Students per Faculty_{prog}) ($\beta = -.56$, $p < .01$)
- the draw rate of the institution (Draw Rate_{inst}) ($\beta = .09$, $p < .01$)
- the average salary of the faculty at the institution (Faculty Salary $(\$)_{inst}$) ($\beta = .35$, $p < .01$);
- the net price for students receiving financial aid at the institution (Net Price $(\$)_{inst}$) ($\beta = .14$, $p < .01$);
- the state regional price parities (Regional Price Parities_{inst}) ($\beta = .11$, $p < .01$)

There were minimal differences in the Betas between the All CIPs group and the All CIPs Public group, and apart from Net Price $(\$)_{inst}$,[9] the same set of predictors significantly predicted instructional costs in the All CIPs Public group.

Of these eight significant predictors from the All CIPs regressions, three also significantly predicted cost per SCH in all 10 of the 4-digit CIP regressions: the percent of faculty in the program that are tenured or tenure-track; the number of FTE students per FTE faculty in the program; and the average salary of the faculty at the institution.

Four of the predictors from the All CIPs model significantly predicted cost per SCH in some, but not all, of the 4-digit CIP regressions.

First, whether a program awards graduate degrees significantly predicted cost per SCH for Music ($\beta = -.30$, $p < .05$) and History ($\beta = .39$, $p < .05$) but in opposite directions. Interestingly, awarding graduate degrees predicted an *increase* in cost per SCH in the History, All CIPs, and All CIPs Public models; but it predicted a *decrease* in the Music model.

Second, the percent of instructional expenditures in a program that come from personnel costs significantly predicted cost per SCH for English ($\beta = -.14$, $p < .05$), Chemistry ($\beta = -.25$, $p < .05$),

[9] Net Price $(\$)_{inst}$ was also not a significant predictor of cost per SCH in any of the 4-digit CIP regressions.

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Fine and Studio Arts ($\beta = -.18$, $p < .05$), and Business Administration and Management ($\beta = -.38$, $p < .01$).

Third, the draw rate of the institution significantly predicted cost per SCH for Fine and Studio Arts ($\beta = .17$, $p < .05$), Business Administration and Management ($\beta = .33$, $p < .01$), and History ($\beta = .14$, $p < .05$).

Finally, the state regional price parities significantly predicted cost per SCH for History ($\beta = .33$, $p < .01$).

Unique Predictors

In addition to examining how significant predictors from the two All CIPs regressions were similar to and different from those in the 4-digit CIPs regressions, we are also interested in a second set of five predictors that were not significant in the All CIPs regressions but emerged as significant predictors in at least one 4-digit CIP.

From the program-level variables, total instructional faculty in the program (Instructional Faculty_{prog}), a variable used to capture the overall size and capacity of a program, significantly predicted cost per SCH for two 4-digit CIPs: Music ($\beta = .46$, $p < .01$) and Business Administration and Management ($\beta = -.33$, $p < .01$). Similar to graduate degrees being offered in a program, the effect for total instructional faculty in the program was both positive and negative between the two regressions, meaning that an increase in the number of instructional faculty significantly predicted an *increase* in instructional costs for Music but a *decrease* in instructional costs for Business Administration and Management.

Additionally, four institution-level predictors were significantly associated with instructional costs in a single 4-digit CIP. An institution's public status (versus private) (Public_{inst}) was a statistically significant predictor of cost per SCH only for Fine and Studio Arts ($\beta = .42$, $p < .05$). Both the overall size of an institution's student body (Student Size_{inst}) and the ratio of total instructional staff to full-time noninstructional staff ($\text{Faculty-to-Staff}_{inst}$) were significant predictors of cost per SCH for History ($\beta = -.25$, $p < .05$ and $\beta = .18$, $p < .05$). Finally, the percent of core revenues that come from tuition and fees ($\text{Tuition/Fees (\%)}_{inst}$) significantly predicted cost per SCH for Political Science ($\beta = -.32$, $p<.05$).

The emergence of this new set of significant predictors confirms the importance of exploring the 4-digit CIP regressions by themselves. By isolating the 4-digit CIPs for analysis, we were able to identify important predictors that were "missed" when running the All CIPs regression, even when accounting for 4-digit CIP as a predictor. Additionally, because our sample only contained programs from ten 4-digit CIPs, it is possible that there are additional "missed" predictors that would significantly predict cost per SCH in other 4-digit CIPs not included in this analysis.

Insignificant Predictors

Seven of the 20 predictors in the model were not significant in any of the 12 regression analyses: Uses TAs_{prog}, Has Research/Public Service $\$_{prog}$, Faculty $Workload_{prog}$, Research $University_{inst}$, Located in $City_{inst}$, Pell $(\%)_{inst}$, and Support per $Student_{inst}$. Possible explanations for their insignificance are considered in the discussion section of this paper. However, it is also necessary to note that while these predictors were not significant in our regressions, it would be premature to conclude that they have zero impact on instructional costs. Our analysis was limited to the 10 most commonly reported 4-digit CIPs to the 2022 cycle of The Cost Study. It is possible that any of these variables could be significant predictors of instructional costs for other disciplines.

Differences in Models

Overall, while there were similarities, there were also considerable differences between the ten 4-digit CIP models. Three of the CIPs contained the same three significant predictors in their model but differed in the amount of variance that was explained: Biology with 54%, Math with 69%, and Psychology with 67%.

Three other CIPs had the same three significant predictors with one additional predictor: Political Science (explaining 55% of the variance), English (explaining 72%), and Chemistry (explaining 37%). Interestingly, English and Chemistry had the same fourth significant predictor, but they had considerably different amounts of explainable variance.

Additionally, Music had a unique set of five predictors that explained 60% of the variance; and Fine and Studio Art and Business Management and Administration both had a similar but distinct set of six predictors that explained 67% and 61% of their respective variance.

Finally, with eight significant predictors, the History model was able to explain the most within-discipline variance in instructional costs (77%). Although the All CIPs model also had eight significant predictors, there were numerous differences from the predictors in the History model, and the All CIPs model was only able to explain 54% of the variance.

Discussion

The current study explored the primary cost drivers of within-discipline variance in instructional costs, resulting in five key findings. We begin our discussion by focusing on the combined sample from all ten 4-digit CIP groupings in order to establish a baseline for understanding within-discipline cost variation. We then further explore the 10 individual disciplines, identifying the unique role that cost drivers play in explaining cost variation.

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Predicting Instructional Costs Across Disciplines

The first major finding was the identification of three cost drivers that consistently predicted cost per SCH across all 12 analyses—the percent of tenured/tenure-track faculty in the program, average faculty salary for the institution, and FTE students per FTE faculty in the program.

Similar to Brinkman (1990) and Middaugh et al. (2003), we found that an increase in the percent of faculty in the program that are tenured or tenure-track is related to an increase in instructional costs. These findings also mirror the two-year colleges study, which found higher costs for programs that utilized more full-time faculty for instruction (Seybert and Rossol, 2010). Faculty of higher ranks tend to have higher rates of compensation; however, decisions about faculty allocations are often made in line with an institution's mission rather than a simple cost analysis.

Unsurprisingly, the average salary of all faculty significantly predicted cost per SCH in both our study and in Hemelt et al. (2021). While they examined an approximate measure of faculty salary at the program-level, our predictor captured this average at the institution-level, which measures an institution's overall investment in faculty salary expenditures. It is worth noting that an institution-level faculty salary variable was selected for the current study because program-level salary data from The Cost Study captures expenditures from both faculty salaries and other support staff who contribute to the instructional function of the program (e.g., clerical staff, lab technicians). Since only the faculty are captured in the reported FTE values, we were not able to produce a true measure of faculty salary using only Cost Study data. Even still, finding faculty salary as a significant institution-level predictor has important implications for funding conversations, especially because it is easily measured through public data sources (i.e., IPEDS) and it represents an institution's overall commitment to faculty compensation.

Across all the groups, the number of FTE students per FTE faculty in the program significantly predicted cost per SCH. We used this measure as a proxy for course size because it captures the overall instructional lift that faculty members undergo. Hemelt et al. (2021) used a different variable to represent class size (total SCH divided by the number of course sections) but still had a similar finding. Notably, we found that the student-to-faculty ratio had the highest standardized regression coefficient in all 12 of our models, suggesting that it may be one of the most important cost drivers for instructional costs regardless of discipline. This finding is congruent with prior research and practical reasoning—as the ratio of students per faculty member goes down, instructional costs are going to go up.

These three indicators together provide a baseline for understanding the rest of our results as they appear to universally predict cost per SCH, even if they may have varying degrees of importance across disciplines. As funding models are developed and implemented, institutions should consider the discipline-specific nuances of these variables in alignment with their institutional mission, campus culture, satisfaction, and other outcomes. For instance, how important is the personal connection between students and faculty, and how does this student-to-faculty ratio impact retention and graduation rates? How do professional development and promotion opportunities (e.g., more higher-ranking positions available) impact faculty satisfaction and retention? Future research with larger sample sizes could utilize multivariate analyses to simultaneously investigate cost and other outcome variables, such as student success.

Differences in Cost Drivers Between Disciplines

The second major finding is that a few predictors were significant for the All CIPs models but were only significant for some of the 4-digit CIPs. For example, consistent with prior research from Middaugh et al. (2003), whether a program awards graduate degrees significantly predicted an increase in cost per SCH, but only for History programs. In fact, it predicted a decrease in cost per SCH for Music programs. Although no prior research has explored this level of nuance for different disciplines, we can use our descriptive statistics to hypothesize why these opposing results were found. For instance, graduate education can increase instructional costs due to smaller class sizes, but *Table 1* shows that Music already has a low number of students per faculty member (M = 8.3) compared to 15.2 students per faculty for History and 15.7 for All CIPs together. Perhaps the presence of graduate education in Music does not alter class sizes (because they are already smaller classes than other disciplines) and therefore does not increase costs. Additionally, we expect that the presence of graduate education may help lower the cost of instruction for Music because the graduate students are available to help with instruction in a way that was not captured by our binary variable of whether or not TAs are used for instruction.

Additionally, prior findings from Middaugh et al. (2003) and Hemelt et al. (2021), matched our finding that programs that have a higher percentage of nonpersonnel expenditures have higher instructional costs. However, that is only true for a handful of programs (English, Chemistry, Fine and Studio Arts, and Business Administration and Management). We were unable to identify a pattern between those specific programs, so additional research is needed to determine the true impact of nonpersonnel expenditures.

Another interesting finding was that regional price parities were significant for the two All CIPs models, but it lacked significance for all 10 CIPs, except one—History. Given that geography and its associated cost of living affects salaries and expenses in daily American life, it is surprising that regional price differences do not represent a significant cost driver in the most of the CIPs. However, there are important methodology implications for insignificant findings (considered further below).

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Interpreting Insignificant Predictors of Instructional Costs

The third major finding is that despite having support in prior research, some of the variables did not significantly predict instructional costs in any of the regression models. It is important to remember that insignificant findings do not imply a lack of a relationship, just that there is not sufficient evidence to make a conclusion. It is possible that our study is underpowered to detect small effects, and future research should utilize a larger sample size if possible. Likewise, our analyses were limited to only ten 4-digit CIPs at a nonrepresentative sample of institutions (i.e., an overrepresentation of public research institutions), and these predictors may be significantly related to cost per SCH in other disciplines and institutions beyond those that we examined. Additionally, the findings are heavily reliant on the specific way that we operationalized our predictor variables and redefining them may yield different results.

A program's use of TAs for instruction, which was not a significant predictor in any of our models, has long been thought to reduce the cost per SCH in some programs because TAs are typically much lower paid than full-time or supplemental faculty (Dundar and Lewis, 1995). However, as both our current findings and prior findings from Middaugh et al. (2003) discovered, the presence of graduate instruction also raises the cost per SCH because the courses taken by graduate students are typically smaller classes taught by T/TT faculty and are therefore more expensive to teach. Thus, any possible cost savings stemming from using TAs to teach in a program may be cancelled out by the expensive nature of educating graduate students in that same program. Additionally, as implied above, future research should explore alternative ways of measuring the use of TAs for instruction rather than just a binary variable.

We were also surprised by the insignificance of two additional predictors–program-level faculty workload and an institution's status as a research university–especially because faculty workload was found to be a significant cost driver in Hemelt et al. (2021), and Carnegie Classification has been found to be a consistent predictor across various studies (e.g., Desrochers & Hurlburt, 2016; McPherson & Shulenburger, 2010; Middaugh et al., 2003).

Emergence of Unique Cost Drivers

The fourth major finding of this study is that five predictors were *not* significant in the All CIPs models but *were* significant in some of the analyses of individual disciplines. The overall instructional capacity of a program, as measured by its total instructional faculty, significantly predicted instructional costs for Music and Business Administration and Management, albeit in different directions (a positive relationship for Music and a negative relationship for Business). These differences between disciplines are consistent with the findings from Middaugh et al. (2003); however, in their analyses, total FTE tenured/tenure-track faculty (which we did not include in our model) was a significant predictor across more disciplines. Additionally, they found a positive relationship between the number of faculty and instructional cost in all but one discipline, Nursing. According to the CUPA-HR survey, Business is one of the disciplines with the highest average faculty salaries (HigherEdJobs - News & Resources, 2025). Perhaps if an institution has more faculty in its department, it would be more likely to have lower-ranking faculty in the instructional mix, thereby bringing down its average costs. Future research should further investigate these interactions between the size of the faculty and the mix of faculty rank within departments.

We also found that the overall volume of an institution's instructional output, as measured by student enrollment, did significantly predict cost per SCH in History. Middaugh et al. (2003) similarly found that total program-level instructional output, as measured by student credit hours taught, was a significant predictor in most disciplines. In both cases, a higher volume of instructional output (either at the institution or within the program) was associated with lower instructional costs at the program level. While this economies-of-scale result is not surprising, it is interesting that we only found a relationship for this institution-level variable for History. Perhaps quantifying the volume of instruction as a predictor of instructional costs should use a program-level variable, as in Middaugh et al. (2003).

An institution's control (public vs. private) was also a statistically significant predictor of cost per SCH, but only for Fine and Studio Arts. Our sample had a limited number of private institutions, which could have affected this finding. Still, institutional control has been found throughout higher education research to have an impact on instructional expenditures (e.g., Desrochers & Hurlburt, 2016; Morphew and Baker, 2007).

Two additional institution-level predictors–the ratio of total instructional staff to full-time noninstructional staff and the percent of core revenues that come from tuition and fees–significantly predicted instructional costs in History and Political Science, respectively. Because each of these predictors was only significant in one discipline, more research is needed to understand these impacts.

Within-Discipline Variance in Instructional Costs

Finally, the fifth–and arguably most major–finding is that all the discipline-specific models contained a distinctive set of significant predictors that explained a unique amount of the variance in instructional costs. The predictors in the models explained a considerable amount of variance in some disciplines, such as English and History (72% and 77% of variance explained), but not as much for other disciplines, such as Chemistry (37% of variance explained). These findings show that not only is there within-discipline variation in instructional costs, but there are also major differences in how that variance can be explained.

While not explicitly evaluated by Middaugh et al. (2003), this difference in models across disciplines mirrors their findings. However, our research diverges in a few key areas, including the method of grouping disciplines, the specific variables used as predictors, and our addition of institution-level variables sourced from IPEDS. Future research should continue to explore a mix

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of both institution- and program-level variables within each of these disciplines to gain a better understanding of which measures best predict instructional costs. Understanding these nuances can then help institutions control their instructional costs in more creative and supportive ways rather than just increasing workloads, reducing the number of employees, and cutting salaries.

Implications for Higher Education Funding

The findings from our study have important implications for discussions about higher education funding. Academic programs are complex entities with unique purposes and characteristics that drive their instructional costs and dictate funding needs. If institutions and funding agencies are committed to equitable funding practices, this uniqueness needs to be carefully considered within the context of the mission of the institution, the type of disciplines they specialize in, and how different variables can impact cost in each of those disciplines.

For colleges and universities engaging in program reprioritization–especially when proposing new programs–knowing which discipline-specific, program-level characteristics could uniquely impact the costs of each program will be an invaluable resource. Additionally, if an institution attempts to simultaneously reduce instructional costs in every program, changes to many institution-level characteristics, such as the faculty-to-staff ratio, will not impact all programs in the same way.

An equally important component of funding conversations is the question of funding adequacy, i.e., what do colleges and universities actually *need* to deliver instruction in alignment with their goals and desired outcomes. Unfortunately, the data from The Cost Study can only speak to what institutions are currently spending on instruction, as well as how that spending compares to similar institutions (which may or may not be a valid representation of what they *should* be spending). For higher education leaders, researchers, and policymakers, determining overall funding adequacy and its relationship to discipline-specific cost drivers at four-year colleges and universities will require supplemental data and analysis beyond what is possible with The Cost Study.[10]

Finally, as more states begin incorporating discipline-specific cost differences into their funding models, it is vital that we continue to explore these types of differences. Within any given state there exists a multitude of unique institutions with specific funding needs for their instructional costs. Failing to account for institutional differences and, therefore, not incorporating these variables into a model, may result in inequitable funding for institutions.

Ultimately, the goal of higher education is to enable and support educational success that can benefit the broader society. To accomplish that, four-year, public and private, not-for-profit

[10] Similar research on student funding needs and adequacy gaps at community colleges has been conducted by Baker and Levin (2017) and Levin et al. (2022); however, additional research is required to understand the full breadth of institutional funding needs, particularly at four-year colleges and universities.

institutions are in a unique position that requires them to balance and reconcile business decisions—supported by the best-available data—with their institutional mission.

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Appendix A

Variable Names, Descriptions, and Source

Level	Variable	Description	Data Source
Sorting Variable	4-digit CIP	4-digit code from the Classification of Instructional Programs (CIP) used to classify programs into analytical units for The Cost Study; Programs submitted under a 6-digit CIP were recoded into their corresponding 4-digit CIP	The Cost Study - Program Info
Dependent Variable	Cost per SCH ($)	Program-level, annual direct instructional expenditures (from salaries, benefits, and nonpersonnel expenditures) per annual student credit hour (undergraduate and graduate combined)	The Cost Study - Expenditures
Program-Level Predictors	Awards Grad Degrees_{prog}	Does the program offer graduate degrees (Master's, Doctorate, or Professional)? [0 = no; 1 = yes]	The Cost Study - Program Info
	Uses TAs_{prog}	Does the program use Teaching Assistants to deliver instruction (at any level)? [0 = no; 1 = yes]	The Cost Study - Productivity
	Has Research/Public Service $\$_{prog}$	Did the program report separately budgeted research or public service expenditures? [0 = no; 1 = yes]	The Cost Study - Expenditures
	Personnel Cost $(\%)_{prog}$	Annual personnel expenditures (salaries & benefits) as a percent of the total direct instructional expenditures [log10]	The Cost Study - Expenditures
	T/TT Faculty $(\%)_{prog}$	Percent of total full-time equivalent (FTE) faculty in the program that are tenured/tenure-track	The Cost Study - Program Info
	Instructional Faculty_{prog}	Total FTE instructional faculty in the program [log10]	The Cost Study - Program Info
	Faculty Workload_{prog}	Average number of organized class sections (OCS) (excluding lab, discussion, and recitation sections) per FTE faculty for all faculty types	The Cost Study - Productivity
	Students per Faculty_{prog}	Number of FTE student per FTE faculty for all faculty types	The Cost Study - Productivity
Institution-Level Predictors	Research University_{inst}	Is the institution designated a research university ("R1 – Doctoral Universities: Very high research activity" or "R2 – Doctoral Universities: High research activity") in the 2021 Carnegie Classifications - Basic Classification system? [0 = no; 1 = yes]	IPEDS - Institutional Characteristics

	Public_{inst}	Is the institution a public institution? [0 = no; 1 = yes]	IPEDS - Institutional Characteristics
	$\text{Located in City}_{inst}$	Institution is located in a city; Recoded from NCES Locale designations [0 = Suburban, Town, or Rural; 1 = City]	IPEDS - Institutional Characteristics
	$\text{Student Size}_{inst}$	Size of the student population measured by 12-month FTE enrollment	IPEDS - 12-month Enrollment
	$\text{Faculty-to-Staff}_{inst}$	Ratio of total instructional staff to full-time non-instructional staff	IPEDS - Human Resources
	Draw Rate_{inst}	Institution's draw rate calculated from total admissions yield divided by total percent admitted	IPEDS - Admissions
	$\text{Pell (\%)}_{inst}$	Percent of full-time first-time undergraduates awarded Pell grants	IPEDS - Student Financial Aid
	$\text{Tuition/Fees (\%)}_{inst}$	Tuition and fees as a percent of core revenues; Values from Governmental Accounting Standards Board (GASB) form and Financial Accounting Standards Board (FASB) form merged into one variable	IPEDS - Finance
	$\text{Faculty Salary (\\$)}_{inst}$	Average salary equated to 9 months of full-time instructional staff for all ranks	IPEDS - Human Resources
	$\text{Support per Student (\\$)}_{inst}$	Academic support expenses + student services expenses per 12-month FTE enrollment; Values from GASB form and FASB form merged into one variable	IPEDS - Finance
	$\text{Net Price (\\$)}_{inst}$	Average net price for students awarded grant or scholarship aid	IPEDS - Student Financial Aid
State-Level Predictor	$\text{Regional Price Parities}_{inst}$	Regional price parities by state; Matched to institution using state code	U.S. Bureau of Economic Analysis

Appendix B

List of Institutions w/Characteristics and Programs in Full Dataset

	State	Public/ Private	2021 Basic Car. Class.	All CIPs	All CIPs Public	23.01	26.01	27.01	40.05	42.01	45.1	50.07	50.09	52.02	54.01
All Institutions				825	657	83	82	79	83	79	81	85	83	85	85
Appalachian State University	NC	Public	M1	10	10	1	1	1	1	1	1	1	1	1	1
Auburn University	AL	Public	R1	11	11	1	1	1	1	1	1	1	1	2	1
Azusa Pacific University	CA	Private	R2	13	0	1	1	1	1	1	1	2	2	2	1
Baylor University	TX	Private	R1	10	0	1	1	1	1	1	1	1	1	1	1
Binghamton University	NY	Public	R1	10	10	1	1	1	1	1	1	2	1	0	1
Bradley University	IL	Private	D/PU	10	0	1	1	1	1	1	1	1	1	1	1
Central Michigan University	MI	Public	R2	8	8	1	1	1	0	1	1	1	1	0	1
Christopher Newport University	VA	Public	M3	10	10	1	1	1	1	1	1	1	1	1	1
College of Charleston	SC	Public	M2	12	12	1	1	1	1	1	1	2	1	2	1
DePaul University	IL	Private	R2	10	0	1	1	1	1	1	1	1	1	1	1
Dordt University	IA	Private	M3	9	0	1	1	1	1	1	1	1	1	0	1
East Carolina University	NC	Public	R2	10	10	1	1	1	1	1	1	1	1	1	1
Elizabeth City State University	NC	Public	B2	4	4	1	1	0	0	0	0	0	1	1	0
Fayetteville State University	NC	Public	M2	10	10	1	1	1	1	1	1	1	1	1	1
Georgia Southern University	GA	Public	R2	10	10	0	1	1	1	1	1	1	1	2	1
Grand Valley State University	MI	Public	D/PU	10	10	1	2	1	1	1	1	1	1	0	1
Hartwick College	NY	Private	B1	8	0	1	0	1	0	1	1	1	1	1	1
James Madison University	VA	Public	R2	9	9	1	1	1	1	1	1	1	1	0	1
Kansas State University	KS	Public	R1	10	10	1	1	1	1	1	1	1	1	1	1

Kean University	NJ	Public	D/PU	13	13	1	1	1	1	1	1	2	2	2	1
Lewis University	IL	Private	M1	12	0	1	1	1	1	1	1	1	1	3	1
Loyola University New Orleans	LA	Private	D/PU	10	0	1	1	1	1	1	1	1	1	1	1
Manhattan College	NY	Private	M1	10	0	1	1	1	1	1	1	1	1	1	1
Mississippi State University	MS	Public	R1	8	8	1	1	1	1	1	1	0	0	1	1
Missouri University of Science and Technology	MO	Public	R2	7	7	1	1	1	1	1	0	0	0	1	1
Molloy College	NY	Private	M1	10	0	1	1	1	0	1	1	1	1	2	1
Montana State University	MT	Public	R1	8	8	1	0	1	1	1	1	1	1	0	1
Montclair State University	NJ	Public	R2	9	9	1	1	1	1	0	1	1	1	1	1
New Jersey City University	NJ	Public	M1	10	10	1	1	1	1	1	1	1	1	1	1
New Jersey Institute of Technology	NJ	Public	R1	5	5	0	1	1	1	0	0	0	0	1	1
Norfolk State University	VA	Public	M2	3	3	1	0	0	0	0	0	1	0	0	1
North Carolina A & T State University	NC	Public	R2	7	7	1	1	1	1	1	1	0	0	1	0
North Carolina Central University	NC	Public	M1	10	10	1	1	1	1	1	1	1	1	1	1
North Carolina State University at Raleigh	NC	Public	R1	8	8	1	1	1	1	1	1	0	0	1	1
Northwest Nazarene University	ID	Private	M1	10	0	1	1	1	1	1	0	1	1	2	1
Radford University	VA	Public	D/PU	11	11	1	2	1	1	1	1	1	1	1	1
Ramapo College of New Jersey	NJ	Public	M1	8	8	1	1	1	1	1	1	0	1	0	1
Rhode Island College	RI	Public	M1	10	10	1	1	1	1	1	1	1	1	1	1

Rowan University	NJ	Public	R2	10	10	1	1	1	1	1	1	1	1	1	1
Rutgers University-Camden	NJ	Public	R2	11	11	1	1	1	1	1	1	2	1	1	1
Shepherd University	WV	Public	M3	10	10	1	1	1	1	1	1	1	1	1	1
Southern Adventist University	TN	Private	M2	7	0	1	1	1	1	0	0	0	1	1	1
St Bonaventure University	NY	Private	M2	8	0	1	1	1	1	1	1	0	0	1	1
Stockton University	NJ	Public	D/PU	9	9	1	1	1	1	1	1	1	0	1	1
Taylor University	IN	Private	B2	8	0	1	1	1	1	1	1	0	1	1	0
Tennessee Technological University	TN	Public	R2	9	9	1	1	1	1	0	1	1	1	1	1
The Catholic University of America	DC	Private	R2	9	0	1	1	1	1	1	1	1	1	0	1
The College of New Jersey	NJ	Public	M1	11	11	1	1	1	1	1	1	2	1	1	1
The New School	NY	Private	R2	6	0	0	0	0	0	1	1	1	2	0	1
University at Buffalo	NY	Public	R1	10	10	1	1	1	1	1	1	1	1	1	1
University of Akron Main Campus	OH	Public	R2	9	9	1	1	0	1	1	1	1	1	1	1
University of Albany	NY	Public	R1	10	10	1	1	1	1	1	1	2	1	0	1
University of California-Irvine	CA	Public	R1	9	9	1	0	1	1	0	1	2	1	1	1
University of California-Merced	CA	Public	R2	6	6	0	1	0	1	1	1	0	0	1	1
University of California-Riverside	CA	Public	R1	10	10	1	0	1	1	1	1	2	1	1	1
University of California-Santa Cruz	CA	Public	R1	8	8	0	0	1	1	1	1	2	1	0	1
University of Colorado Boulder	CO	Public	R1	9	9	1	0	1	1	1	1	1	1	1	1
University of Connecticut	CT	Public	R1	9	9	1	0	1	1	1	1	1	1	1	1

University of Delaware	DE	Public	R1	11	11	1	1	1	1	1	1	2	1	1	1
University of Idaho	ID	Public	R2	9	9	1	1	1	1	1	1	0	1	1	1
University of Maine	ME	Public	R1	8	8	1	1	0	1	1	1	1	1	0	1
University of Mary Washington	VA	Public	B1	10	10	1	1	1	1	1	1	1	1	1	1
University of Massachusetts-Amherst	MA	Public	R1	12	12	1	1	1	1	1	1	2	1	2	1
University of Massachusetts-Dartmouth	MA	Public	R2	9	9	1	1	1	1	1	1	0	1	1	1
University of Mississippi	MS	Public	R1	10	10	1	1	1	1	1	1	1	1	1	1
University of Missouri-Columbia	MO	Public	R1	9	9	1	1	1	1	1	1	0	1	1	1
University of Missouri-Kansas City	MO	Public	R2	10	10	1	1	0	1	1	1	1	2	1	1
University of Missouri-St. Louis	MO	Public	R2	10	10	1	1	1	1	1	1	1	1	1	1
University of North Carolina Asheville	NC	Public	B1	10	10	1	1	1	1	1	1	1	1	1	1
University of North Carolina at Chapel Hill	NC	Public	R1	9	9	1	1	1	1	0	1	1	1	1	1
University of North Carolina at Charlotte	NC	Public	R2	10	10	1	1	1	1	1	1	1	1	1	1
University of North Carolina at Greensboro	NC	Public	R2	10	10	1	1	1	1	1	1	1	1	1	1
University of North Carolina at Pembroke	NC	Public	M1	10	10	1	1	1	1	1	1	1	1	1	1
University of North Carolina at Wilmington	NC	Public	R2	10	10	1	1	1	1	1	1	1	1	1	1

University of Northern Iowa	IA	Public	M1	10	10	1	1	1	1	1	1	1	1	1	1
University of Rhode Island	RI	Public	R2	8	8	1	0	1	1	1	1	1	1	0	1
University of South Florida	FL	Public	R1	11	11	1	2	1	1	2	1	1	1	0	1
University of Tennessee-Knoxville	TN	Public	R1	9	9	1	0	1	1	0	1	1	1	2	1
University of Tulsa	OK	Private	R2	8	0	1	1	0	1	0	1	1	1	1	1
University of Utah	UT	Public	R1	11	11	1	2	1	1	1	1	1	1	1	1
University of Vermont	VT	Public	R2	10	10	1	1	1	1	1	1	1	1	1	1
University of Wisconsin-La Crosse	WI	Public	D/PU	10	10	1	1	1	1	1	1	1	1	1	1
University of Wisconsin-Stevens Point	WI	Public	M2	11	11	1	1	1	1	1	1	1	1	2	1
Western Carolina University	NC	Public	D/PU	10	10	1	1	1	1	1	1	1	1	1	1
Western Michigan University	MI	Public	R2	10	10	1	1	1	1	1	1	1	1	1	1
Wichita State University	KS	Public	R2	7	7	1	1	0	1	0	1	0	1	1	1
Wilkes University	PA	Private	D/PU	10	0	1	1	1	1	1	1	1	1	1	1
Winston-Salem State University	NC	Public	D/PU	9	9	1	1	1	1	1	0	1	1	1	1
Wright State University-Main Campus	OH	Public	R2	3	3	0	1	0	1	1	0	0	0	0	0

[a] R1=Doctoral Universities: Very High Research Activity, R2=Doctoral Universities: High Research Activity, D/PU=Doctoral/Professional Universities, M1= Master's Colleges & Universities: Large Programs, M2= Master's Colleges & Universities: Medium Programs, M3=Master's Colleges & Universities: Small Programs, B1=Baccalaureate Colleges: Arts & Sciences Focus, B2=Baccalaureate Colleges: Diverse Fields