Center for STEM EDUCATION & INNOVATION
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DATA BRIEF

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How Much Does It Cost Institutions to Produce STEM Degrees?

This data brief is the fourth in the series *The Price and Cost of Science Degrees.* For more information, visit www.air.org/PriceCostScienceDegrees.

Conversations about the cost of higher education typically focus on the price of a college degree—either the "sticker price" that students are charged (tuition) or the "net price" they end up paying (tuition minus financial aid). The desire to reduce, or at least rein in, what students are paying for college receives constant attention. Students, however, usually pay far less than what it costs colleges and universities to educate students,[1] and courses and degrees in the in-demand science, technology, engineering, and mathematics (STEM) disciplines are often the most expensive for colleges and universities to produce. So as policymakers look to boost U.S. economic competitiveness by beefing up the STEM workforce, conflicts arise among various educational priorities: the need to produce more graduates with STEM degrees, the need to reduce what students pay, and the need for colleges and universities to contain their costs.

It is difficult to estimate how much colleges and universities spend producing degrees in different disciplines because detailed cost data are unavailable at a national level.[2] However, using a combination of state and national data, the Delta Cost Project constructed a preliminary set of "cost per degree" estimates for 28 disciplines. Institutional-level data on educational expenditures and degrees (collected by the federal Integrated Postsecondary Education Data System [IPEDS] surveys) were combined with state-level data on discipline-level credit-hour costs (from Florida, Illinois, and Ohio) to construct various measures of degree production costs.[3] *The estimates presented here should not be interpreted as precise costs,* but the patterns and trends appear durable.

The average cost of producing a bachelor's degree at public four-year institutions is estimated to range from about $45,000 to $60,000 (Desrochers, 2011). The lower bound estimate is a conservative measure that reflects only the cost of completing 120 credit hours as required by most degree programs.[4] The upper bound estimate is a comprehensive measure that reflects the full range of costs that colleges and universities incur in the production of degrees; it captures the costs of credits that exceed degree requirements, student attrition, and the learning by non-degree-seeking students.

[1] The remaining costs are paid for with state appropriations, endowment income, or other revenues.

[2] A few studies looking at various discipline-level cost measures have shown that technical fields such as nursing, engineering, and the sciences tend to be more expensive than other disciplines; these fields often require expensive equipment or laboratory time, or they have practicum components (Basu Conger, Bell, & Stanley, 2010; Brinkman, 1985; Johnson, 2009; Middaugh, Graham, & Shahid, 2003; Romano, Losinger, & Millard, 2010).

[3] Four types of undergraduate costs were estimated by degree type and discipline: (1) the conservative "catalogue cost," which includes only 120 credit hours per degree); (2) the "transcript cost," which reflects the actual number of credits completed by degree holders; (3) a comprehensive "full attribution cost," which includes the cost of excess credits, attrition, and noncredential learning; and (4) a regression estimate that models the relationship between expenditures and degrees (Johnson, 2009; Romano et al., 2010).

[4] Many students take additional classes, and excess credit hours reflected on the average transcript boost costs by another 12 percent, averaging $50,700.

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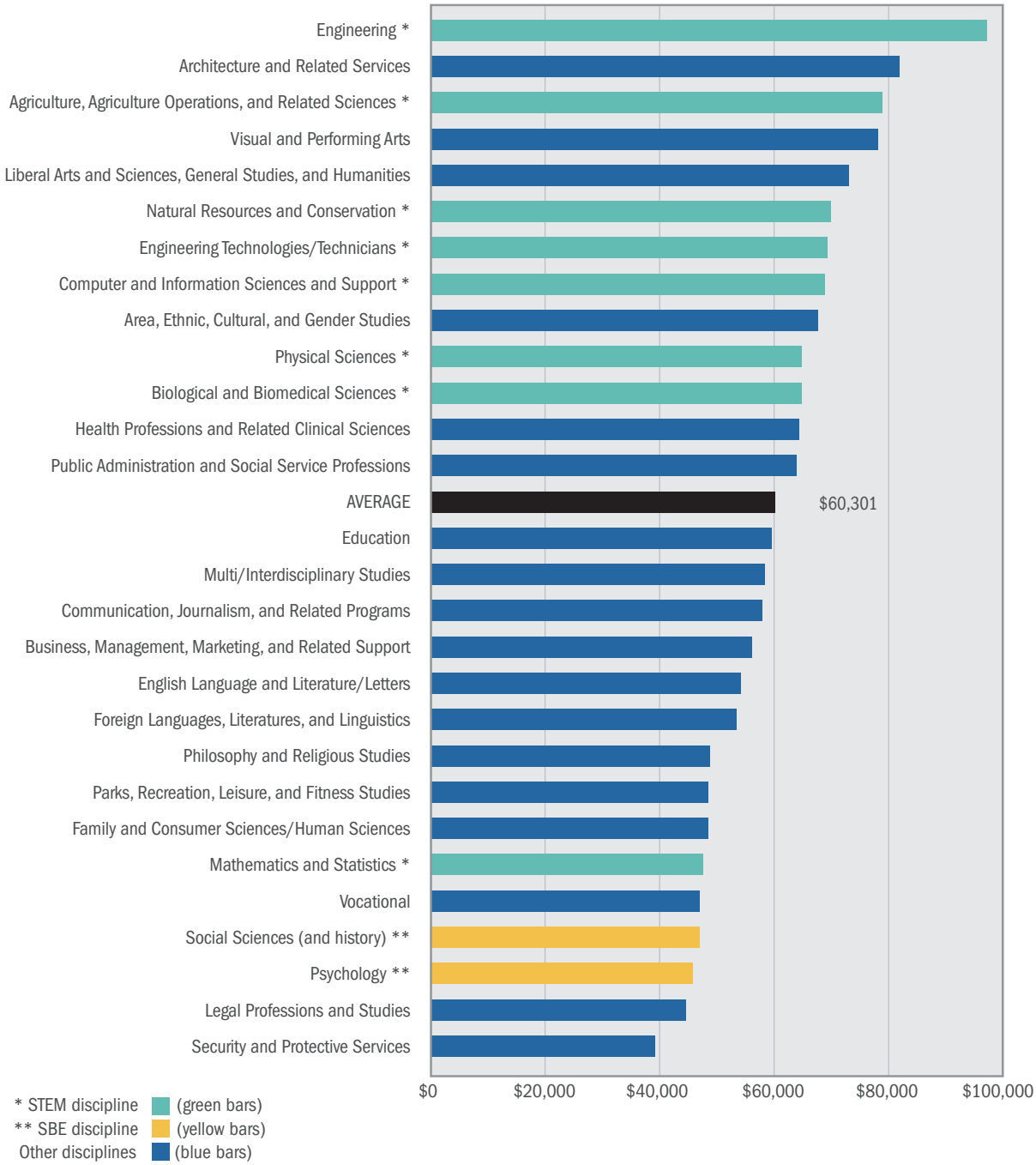
Comparing comprehensive cost estimates for 28 undergraduate disciplines shows that most STEM degrees—including undergraduate degrees in engineering, agriculture, computer, and science-related fields—have higher than average production costs (see Table 1). Although degree costs in most STEM fields range between $65,000 and $80,000, engineering degree costs are significantly higher. Those STEM fields that primarily require classroom time rather than lab work—such as mathematics and statistics, and the SBE[5] disciplines in social science and psychology—are some of the least expensive degrees that colleges and universities produce. Although health professions are not designated as STEM fields, they often require a heavy science and mathematics curriculum, and they demonstrate higher than average costs.

Table 1. Full Attribution Cost—Education and Related Spending per Undergraduate Completion at Public Four-Year Institutions, by Discipline, 2009

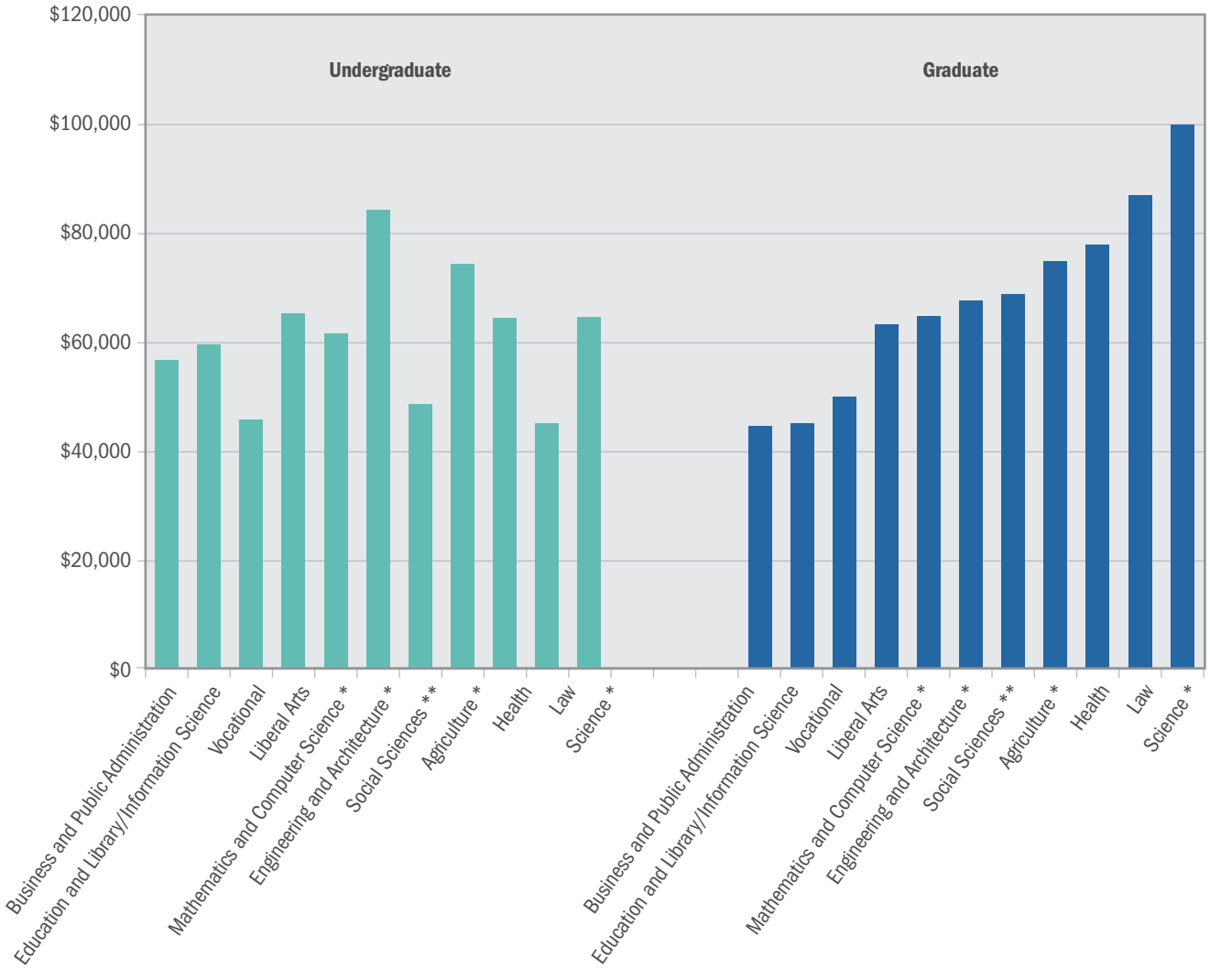


[5] Social, behavioral, and economic sciences.

Source: The data in this report are from a special tabulation of the Delta Cost Project IPEDS Database, 2004–09; discipline-level data on degrees are from the 2004 and 2009 IPEDS Completion Surveys. Discipline-level cost weights were derived from state-level data (for Florida, Illinois, and Ohio) published by the State Higher Education Executive Officers.

At the graduate level, degree costs can be quite different from patterns observed at the undergraduate level. Comparing undergraduate and graduate costs per degree aggregated into 11 broad categories shows that production costs for graduate-level engineering and architecture are about average, rather than ranking among the most expensive (see Table 2). Instead, graduate science degrees are the most costly to produce; although the agriculture disciplines remain expensive at the graduate level, non-STEM law and health graduate degrees also have high costs.

Table 2. Undergraduate and Graduate Education and Related per Completion, Public Four-Year Institutions, 2009



* STEM discipline
** SBE discipline

Implications

In recent years, many colleges and universities have responded to the variation in discipline costs by implementing differential tuition policies. These policies may apply a surcharge to students enrolled in particular colleges or majors, or charge upper level students more per credit hour. By academic year 2010–11, about 25 percent of public four-year colleges and universities had some form of differential tuition policies (Ehrenberg, 2011). The most common majors with differential pricing were not necessarily STEM disciplines; they included business, nursing, and STEM programs in engineering (Ehrenberg, 2011). From the standpoint of the college or university, these pricing differentials make sense for engineering and nursing as they are higher cost degree programs. But the upcharge for business degrees is at odds with their lower production costs and may be motivated by students' higher earnings opportunities upon graduation or by the large number of students enrolled as business majors.

Though broader economic and educational policies around STEM are aimed at creating a better educated and more productive workforce, the sticking point is how to finance it. Producing degrees in costly STEM fields while limiting increases in tuitions and holding down institutional costs appear at odds. Differential tuition policies can be a double-edged sword—charging STEM majors higher tuitions may seem fair, but doing so may defeat the broader economic goals of graduating more STEM degree-holders. Colleges and universities that explore additional ways to manage costs—such as reducing attrition and extraneous credits, and implementing cost-effective course redesigns—also can lower costs and prices without jeopardizing the future of our STEM workforce.

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