Higher Education Product Baskets: Degree Offering Distributions and the Financial Strength of Colleges and Universities

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Abstract

This paper evaluates the relationship between the distributions of degrees offered by a college and the financial strength of that institution. While no causal relationship is established, the findings generally show that the more specialized an institution is, the more net wealth it is likely to hold. Additional evidence points to how this effect differs depending on the degrees themselves: High concentrations of STEM fields, for example, tend to benefit the home college's financial position.

This research highlights the importance of the considerations by which university systems balance the types of institutions in their network. It adds to the small but growing research into higher education finance. Finally, it advocates for an understanding of public institutions as policy platforms. By paying attention to the implementers of public policies, those policies might have more sustainable impacts.

Introduction

Public and non-profit institutions of higher education are facing significant challenges in how they are funded. This paper explored how college and university financial strength might be connected to the types and distributions of degrees offered by these institutions.

Public funding for colleges and universities has decreased significantly while tuition rates, particularly at private institutions, are increasing at remarkable rates (IPEDS, 2017). U.S. institutions of higher education are increasingly concerned with survivability while labor market forces demand increasingly specialized graduates. (The terms "college," "university," "school," and "institution" are used interchangeably except when regression analysis distinguishes between institutional types.) When colleges do not survive, students can be left with no degree at one of the most important times in their careers (Puzzanghera & White, 2016). In contrast to institutional weakening, a strong college or university provides employment to its local community. Further, universities serve as the primary engine of national research and development. From a civic perspective, they guard free speech and foster an informed voter base. Public and private colleges serve to transform young adults by enlightening their minds and encouraging their development. This paper operates on the assumption that increased institutional strength of colleges and universities benefits society more broadly.

Without examining causal dynamics, this paper examines the relationship between institutional financial strength and the types of degrees offered by institutions; it attempts to answer the question, "How does the distribution of academic disciplines (ex., English, Math, Engineering) correlate to a college or university's sustainability?" This paper makes two broad assumptions: First, that the distribution of academic disciplines is relevant to a college's identity

and has consequences for the students and institutions that interact with that college; and second, that institutional strength can be measured by a college or university's financial position. This is more tenuous given the significant role of brand and tradition in U.S. higher education.

Regarding the former: Academic disciplinary distributions are measured here by degree offering distributions—the numbers of graduates in various academic fields. These distributions embody the degree to which society's labor market and intellectual culture will be either specialized or generalized. Highly concentrated distributions will tend to favor subject-specific labor market utility (neurosurgeons) while more broadly spread distributions will tend to graduate a more socially equitable and interdisciplinary cohort.

Regarding the latter: This paper makes the assumption that university strength can be approximated by financial position. This is not a perfect proxy, and indeed several measures are not taken into account. University reputation, brand, and social position are very difficult to model. The Historically Black Colleges and Universities (HBCU's), Ivy League schools, and Jesuit colleges are all examples of groups whose institutional strength can arguably be derived from other factors. That said, the approach implemented here is designed to provide a generalizable structure for institutions that cannot rely on external reputations.

This research relied on the U.S. Department of Education's Integrated Post- secondary Data Service (IPEDS) for panel data on 7,514 institutions of higher education collected over thirty years. The analytic methodology will investigate individual academic disciplines, the STEM grouping of disciplines, and a broader measure of relative distribution to differentiate broad-based institutions from those that are more highly concentrated. The paper begins with a review of the literature and proceeds through discussions of the conceptual framework, data and methods, and concludes with presenting findings and discussing their implications.

Literature Review

The relationship between degree offerings and a college or university's financial strength and opportunity touches on several fields of study in the social and management

sciences. While the emergent and interdisciplinary field of higher education studies provides a certain amount of structure to integrating these disciplines, the independent fields remain significantly important. The following literature review examines three overlapping fields of progressively greater subject-matter specificity: the economic dynamics of the higher education market, the industry- accepted approaches to college and university finance, and the collected set of works touching on course- and degree-offering product portfolios. This approach to the literature is designed to deliver general background on the field under examination, advance an understanding of the principal agents involved, and discuss the current state of the field. Each subsection within the review surveys the available research and indicates the ways in the which this paper question would either advance novelty or evaluate existing analysis.

Because the subject at hand is academia itself, it should be little surprise that there has been significant study of the subject. There are two reasons why more research is not publicly available. First, the emergence of "higher education as a business" is a relatively recent phenomenon, largely coinciding with increased demand and evolving parent and student expectations. (Soares 2016) Second, little research on university finance is available because many institutions treat their approach to market strategy as proprietary--unlike corporate counterparts, universities do not hold earnings calls. (Hinrichs 2017) These challenges are surmountable in large part due to comparative analysis across different countries, the industry and professional associations incentivized to move the field forward, and the credit market evaluation (bond-rating) that developed as a consequence of institutional borrowing.

The Higher Education Market (Background):

Due to data limitations and the fact that educational globalization is a relatively recent phenomenon, research in higher education is largely single-country focused. The exception to this are comparative studies that examine the impact of education on inequality and labor market outcomes. This subsection will briefly examine macro trends in higher education at the global and US levels before focusing strictly on specific domestic trends. These local trends focus on two market-scale characteristics: stability and growth potential.

Internationally, higher education growth has rapidly accelerated in the last 40 years, largely due to public funding. In 1980, 3.5% of the OECD population completed tertiary education; in 2000, it was 15%. Unfortunately, the labor market has not kept pace, and many of these graduates wind up working blue-collar jobs. Another concern is that higher education is not bridging the income and wealth gaps. In Britain, for example, the proportion of low-income students participating in higher education is roughly equal to what it was in the 1960s. A similar trend had been evident in developing countries, though the past ten years have seen the beginnings of increased access to higher education (Holmes, 2016).

The enrollment trends in the United States generally reflect those of OECD countries, despite the fact that our sector is structured with a greater emphasis on private funding. Public support for higher education has stayed relatively flat since 1985—roughly $5,000 per student—while costs of education have increased from $12,000 to almost $20,000 over the same period (Hinrichs, 2017) The remaining costs are being borne by students, resulting in changes tinstitutional behavior: where public funders could force institutions to prioritize research, the increased proportional demand of student spending results in responses to their desires, including dorm amenities and athletics (Hinrichs, 2016).

Financial journalism about the US education market often emphasizes institutional wealth, particularly ballooning endowments and debt crunches. Still, the higher educaiton credit market has been largely stable, with colleges borrowing for one of two reasons: to expand growth or to cover tuition discounting. While the overall credit ratings have declined across higher education, this is largely seen as the sector becoming comfortable with capital financing—a positive development so far (Logue, 2014). During the Great Recession, many university administrators feared their endowments' exposure to the stock market would lead to contagion and a restructuring of the sector. This focus on wealth, however, misunderstood a fundamental characteristic of university endowments: They are largely supplemental to university operating cash flow, precisely designed to absorb shocks (Weisbrod, 2016). Credit ratings agencies and endowment analysts continue to signal the US higher education market is a stable sector that is only likely to become more stable.

Given this stability, this literature review turned towards opportunities for growth in the higher education market. The first question was whether or not higher education meets market demand. Several studies have looked at this question, and most concur that streamlined curricula, IT training, and school-to-work pipelines are needed to enhance demand matching (Hanson, 2016). Another area for exploration is on the institutional side: Simply, is there an overabundance of institutions of higher education in the U.S.? Recent working papers on higher education consolidation have examined this question and found that past mergers of institutions generated no public or private benefits, except regarding of institutional market power (Russell, 2017). Finally, the area of degree- and product-diversification—and its relationship to institutional growth—remains relatively unexamined. The remainder of this review will look at the broad categories of both university finance and product offering diversification (I view a degree in an academic discipline as a product).

Institutional Finance in Higher Education:

In order to measure the impact of academic diversification on US college and university institutional financial strength and growth, there needs to be a baseline understanding of how strength and growth are best measured. To investigate this, the author's review examined traditional standards as well as more heterodox methods. The tradi-

tional standards can be broken into those established by trade groups, by credit rating agencies, and by public-sector entities. The novel methods include both international approaches and the hybridization of traditional approaches.

The major higher education finance trade group in the U.S. is the National Association of College and University Business Officers (NACUBO), a group which serves to advise higher education CFOs on best practices. Their approach is to translate investment banking metrics to the higher education field. For example, a "profit margin" is recoded as a "net income ratio" to emphasise the non-profit nature of the business. Other metrics identified by NACUBO include measures of liquidity (viability ratio), general operations (return on assets) and wealth (primary reserve ratio) (Guastella, 2013).

Many of these metrics are among those also used by credit rating agencies to assess financial performance. Moody's, Fitch's, and Standard and Poor's all work in the higher education space. While equipped to do sophisticated analysis, these firms only share their analyses with contracted universities, often when that school is looking to issue bonds. In addition to the metrics advanced by NACUBO, the ratings agencies also look at governance structures and market position. For example, the ratings agencies might look at the number of faculty who hold tenure; if it is high, they will consider that metric a liability.

The one drawback to their approach is the issue of moral hazard: Because these firms are paid for by universities on a contracted basis, there is concern that they do not always use consistent standards (Spainer, 2010) Researchers looking for more unbiased set of metrics might turn toward the U.S. Department of Education's partnership with the American Institutes of Research, a contracted project intended to perform objective analysis of publicly available university-based financial information. This initiative--the Delta Cost Project--examined the Integrated Postsecondary Education Data Service (IPEDS) data to arrive at a set of generally accepted metrics. (Hurlburt 2017) Many of these—in particular their tuition discount rate calculation—will be used in the analysis put forth later in this paper.

In addition to trade group, rating agency, and public sector approaches, it is worth briefly mentioning two others. First, work done in the U.K. provides a source for comparative analysis. Recent research examines product pipeline approaches to measuring university operations, specifically through principal component analysis, multilevel modelling, and data envelopment analysis methodologies. (Johnes and Johnes 2014) While these approaches will surely be picked up by individual institutions, they are difficult to apply to institutions that do not make granular data public. Another novel approach, one that has potential to be adopted to U.S. public data, is a factor analysis system that combines the above-mentioned ratings-agency approach with new variables and factor analysis. Research recently presented at the Association of Institutional Researchers by Henry Zheng, includes as a metrics "degree diversification" and could be used as a starting point for condensing multivariate approaches (Zheng, 2017). The author examined the concept of the degree-as-product, looking to both higher education and business literature.

Product and Degree Diversification

Degree diversification refers to the number of degrees offered by an institution as segmented by the fields of degrees offered. It could refer to the number of Ph.D.'s relative to the number of bachelor's; or it could refer to the number of combined STEM degrees (associate's, bachelor's, master's, doctorate's) relative to the number of total combined degrees; finally, it might refer to the density of distributions within groupings. I approached this concept by examining three distinct fields: public policy, to understand whether the degree mix offered reflects the degree mix most beneficial to society; marketing, to understand whether degree mixes benefit universities; and through the higher education studies lens, to understand how the distributions affect campus cultures.

The public policy analysis points to a method of understanding degree distributions within the context of labor market demand. Research by Anthony Carnevale at the Center for Education and the Workforce uses U.S. Census survey, employer survey, and proprietary online HR data to determine whether the types of degrees held by workers matches the types of skills required by employers. While it does not consider institution-level enrollment or graduation data, it does emphasize the importance of laborforce matching techniques beyond program and degree alignment (the core focus of the paper and of this paper). In particular, the paper discusses counseling, career services, and job placement requirements that must accompany program diversification (Carnevale, 2016).

While there is an abundance of public policy research on higher education, marketing research tends to operate at a strictly commercial level. One methodology that was particularly attractive was developed by marketing scientists at the Indian Institute of Technology. Using hierarchical regression and entropy measures, the researchers developed three core metrics for diversification, with the key insight being that product categories can be measured against product subcategories (i.e., the percent of students in STEM fields can be measured against the percent of STEM fields themselves) (Srinivasan, 2016).

The interdisciplinary field of higher education studies refers to quantitative degree and program evaluation as "enrollment management," a term often employed to soften the news to a department that may be closing. While the field does not to the author's knowledge explicitly discuss degree diversification, it does provide a context for determining which variables should and should not be controlled for. Most notable are variables involving the size of the institutions (smaller can mean unmet enrollment targets) and the extent of financial aid provided. Regarding financial aid: While students may generally prefer degree offerings that grant them the best job prospects after graduation, an institution could distort the effect of those offerings by providing financial incentives to students who enroll in programs that reduce job prospects but increase

institutional prestige or justify critical faculty hiring (Kalsbeek, 2013).

A survey of the available research reveals that the study of degree diversification fits neatly between the study of labor market demand and the study of university operations. It may

be that because this research is not squarely in one field or the other that it has not been researched to a greater extent. To further the current literature on the relationship between degree diversification and institutional strength will require adopting methods used in microeconomics, institutional finance, and higher education studies.

Conceptual Framework

This research saught to develop an understanding of how a college's financial growth potential is related to the types and distributions of degrees offered by that institution. To understand the economic dynamics that would factor into this relationship, I separated the higher education market into two sets of forces impacting our dependent variable: on the left of the below chart are those demand-side forces; on the right, supply-side; in the middle column are those market effects that do not fall squarely into either supply or demand categories.

The author's operating hypopaper is that highly concentrated degree offering distributions are associated with lower university financial growth potential. The null hypopaper is that these relationships are positively related or not related at all. This hypopaper is based on the intuition that over-specialization creates systemic risk when certain disciplines fall out of favor with prospective student preferences or employer demands. This effect would likely be different for different types of institutions, with the possibility of sign change occurring for different institutional types. A full exploration of this relationship would require a longer, more historic time-series than is available.

The demand-side of this framework takes the student and their families as the consumers of the educational service and implies a sensitivity to price and the personal and career utility derived from its consumption. While the supply-side of the framework considers the ability of the school to meet student demand, it also reveals demand dynamics of faculty, administrators, and academia's interest in shaping intellectual culture.

Given these market dynamics, it is important to note that the relationship of distributions of degrees to financial growth is likely mitigated by the demand-side provision of education.

The specific, impactful variables denoted by this framework include the availability of faculty, institutional reputation, local laborforce demands, social trends in automation and economic growth, and the operational (in)efficiencies of a given institution.

Additional data on local labor market demand was sourced from the American Community Survey's five-year estimates of median income. These data are collected at the county level and merged with institution's in those counties for the relevant years. The collection was limited to the 2011-2016 years in which a richer IPEDS iteration allowed for more sophisticated analysis of institutional finances.

Variables

The variables included in this analysis fell broadly into four categories: financial strength, disciplinary strategy, enrollment, institution type; generally speaking, the relationship between the first two will be assessed by controlling for the last two.

Financial Strength (Dependent)

Institutional financial strength, the primary dependent variable, was measured using two separate techniques, each with multiple components. The techniques are respectively based on corporate finance and credit analysis. The corporate finance measures are adapted from the NACUBO approach and decompose return on equity net income. (NACUBO) These measures are defined using IPEDS variables as calculated by the Delta Cost Project (Hurlburt ,2017). The main purpose of this approach was to determine the effectiveness with which an institution grew its current equity, as measured by total revenue minus total expenses. Net-income is a public and non-profit accounting term synonymous with what for-profit entities refer to as "profit."

The second measure of financial strength was at the heart of the asset management approach developed by Dr. Henry Zheng using the IPEDS variables and based on Moody's credit ratings. (Zheng 2017) In this approach, fourteen different metrics are indexed into three categories: market position, operational performance, and asset usage. The approach used here takes the simplest metric available: The natural log of total equity, computed by subtracting total liabilities from total assets.

Disciplinary Strategies (Independent)

Disciplinary strategies—the primary independent variables investigated—are in many ways the defining characteristic of an institution's academic environment. At the university level, some schools might prefer a narrow, STEM-heavy research approach while others might prefer a well-rounded liberal arts curriculum. At the two-year level, some community colleges focus on completing general education requirements that would allow students to transfer into four-year programs as juniors; others might focus specifically on the disciplines preferred by a founding religious order.

This paper defined disciplinary strategy in three ways: by the proportions of disciplines themselves, by the ratio of a specific subfield of degrees (STEM) granted to all other degrees, as well as by the overall distribution of degrees granted. I should also note here that a "degree" is defined by the discipline of study (i.e., Microbiology) rather than the level of the graduate's career (i.e., Associates degree). Further, disciplines of study would follow the National Center on Education Statistic's Classification of Instructional Program (CIP) system of categorizing disciplines and sub-disciplines. (NCES 2010) The three types of disciplinary strategies were explored in greater length.

Enrollment (Control)

The enrollment variables are used to measure the size, selectivity, and demographic composition of the school. Institution size is measured by the full-time equivalent number of students enrolled during a 12-month period (prior-year July through labelled-year June). To account for different credit-counting systems, a single full-time equivalent student is equal to three part-time students, with "part-time" being defined as those taking at least half the typical number of credits for a full-time degree program. While counterintuitive, the convention of valuing part-time students at one-third the rate of full-timers (despite them taking up to one half of the classes of full-timers) is designed to account for the wide variety of courseloads taken by part-time students (some take as few as one fifth).

The selectivity or exclusivity of the student body enrollment is measured by dividing the admissions rate by the yield rate, with "yield rate" being the number of admitted students who actually enroll. The advantage of an approach including both admissions and yield rather than a simple admissions rate is that it accounts for some unrepresentative variation in application volumes, which are easily manipulated by colleges seeking to optimize rankings. Enrollment demographics are measured by gender and race. Gender remains a binary designation according to IPEDS and race is codified in legislation, specifically Title IX of the Higher Education Act (HEA, 2008). Because the racial categories have been incompatibly reorganized three times since the debut of IPEDS, this paper would likely use a single derived metric: percent non-white.

Demographic measures are used in exploratory analysis only.

As stated above, enrollment variables are included to mediate some of the variation between disciplinary strategy and institutional financial strength. By way of example, enrollment size may bias in favor of the economies of scale achieved by large universities; selectivity in favor of reputational advantages by highly ranked institutions; and demographics both for and against schools that service specific sub-populations: elite women- or black-serving institutions on the one hand, and refugee- or oppressed-population serving institutions on the other.

Institution Types (Control)

In addition to variables measuring enrollment, this paper makes use of institution-type variables for controlling the primary relationship. There are two principal elements to institution type: its surrounding labor market, its functional tradition, and its organizational control.

Surrounding labor market-years can be analyzed as a fixed effect at several units of measurement, including zip code, commuting zone, city, county, state, or national region. Given the sample size and the fact that more granular levels of analysis absorb high numbers of degrees of freedom, this analysis may be limited to only controlling for statewide and annual fixed effects. To mitigate the breadth of variation within a state, county-level income controls from the American Community Survey are included.

The second institution-type control, an institution's functional tradition, can be described as a school's interpretation of and adherence to the purpose of higher education. While some institutions attempt to organize their efforts around educating students, others might instead emphasize research, or even civic service. The dominant approach to classifying institutions in this way is to account for their "Carnegie Classification", a taxonomy first developed by the Carnegie Commission on Higher Education in 1970 and refined frequently since then. (Carnegie 2015) The Carnegie approach is generally accepted as a classification schema by the literature, but is applied differently from year to year. To account for this, a simplified derivation takes into account the three mid-level categories of baccalaureate colleges and both master's and research universities.

Beyond labor market location and functional tradition, an institution may be generally classifiable by its organizational ownership. This analysis will control for the three typical categories used by higher education researchers: public, non-profit, and private-for profit. This differentiation accounts for the different responsibilities that might bias the relationship between discipline strategy and financial strength. For example, public institutions might focus on creating the highest return on taxpayer investment by producing a diversified workforce and thus a diversified discipline mix. In contrast, a for-profit might work on a contract basis for a specific corporate employer and thus develop very narrow disciplinary offerings.

Discussion

The findings of the author’s research examined potential practical implications, denoting the limitations of the study, and finally suggesting new avenues for research.

The theory as laid out in the author’s Conceptual Framework was that higher distributions of degree offerings is positively associated with higher net income and wealth. In the author’s analysis of the aggregate distribution of all degrees. The research found that colleges and universities that offer more equal distributions of several disciplines tend to have more wealth than institutions that tend to graduate most students in fewer disciplines. This evaluation only holds up for wealth—there was not sufficient evidence to support that either wide or narrow distributions are associated with institutional net income. That said, the pattern of high distribution-high wealth breaks down when individual disciplines are aggregated at different levels. For example, the analysis of STEM degrees shows that, as a group, a denser distribution is better.

That these results take on different magnitudes for different types of institutions is also notable. While many schools aspire to be research powerhouses with high specializations in very narrow fields, few are able to obtain it. Similarly, many small rural colleges aspire to the broad curricula of the top liberal arts programs. The reality is that the fiscal sustainability of high academic distribution for small private colleges looks very different than that of large

public research institutions. The data and coefficients reviewed show significant difference between institutional types, but identifying specific trends would be premature.

The most significant surprise came from an evaluation of the individual degrees that were associated with high institutional wealth. It was striking to discover that even though a profession is associated with high pay (Lawyers, for example), the education of that profession might be associated with weaker institutional finance (law school dependent colleges, in this case). The inverse appeared to be true, with languages and linguistics—as well as visual and performing arts—being associated with superior institutional wealth.

Whether these surprising results have their roots in elite education as a social marker or in the nature of the disciplines themselves, it is clear that the effects are real. Whether private non-profit or public, the leaders of these institutions and the policy makers that govern them must grapple with the tradeoffs implied by this research.

Practical Implications

The practical extensions of this research might fall into two categories: a contribution to the growing literature on the organizational theory of public institutions, and a set of recommendations for policy makers.

Regarding the first practical extension—to organizational theory of public institutions— this analysis adapts the perspective of colleges and universities as public institutions—this definition applies to private non-profit colleges in addition to traditional public colleges on the grounds that they take as their mission a further contribution to social welfare.

By examining the impact of a college's service-provision on institutional strength, policy researchers and decision makers are able to better manage the durations of a given intervention's impact. Because these institutions often outlast specific public policies (ex., financial aid programs and research grants), ensuring their persistence and sustainability means reducing the up-front outlays for tomorrow's intervention. Put another way, strengthening colleges and universities means strengthening a policy platform.

The specific contribution of this paper to the field of public institution analysis is in understanding what I refer to as "product baskets" or the distribution of types of degrees offered. A similar approach in other fields might look to some of the following: the types of medical services offered by hospitals, where the over-concentration of certain types of surgeries might generate institutional risk; the portfolio distributions of housing units available for subsidization by neighborhood development banks; or the concentration of job training programs by local governments and trade organizations.

Regarding the second practical extension—of specific recommendations—this analysis can point to two specific governmental actions: Public university structuring and higher education consolidation. Public university systems could leverage this analysis in their allocation of academic departments and programs. A hypothetical state system looking to open new data science program might consider locating it at a school with a low number of humanities-focused majors. Similarly, a new anthropology program might be best suited within an institution with dense concentrations in STEM fields. New programs might be less suited for schools with broad program distributions.

In the area of higher education consolidation, this research contributes to a better understanding of which universities should work together, and which might weaken their general financial position. The analysis suggests that schools with similar offerings might actually worsen their financial strength if they were to consolidate. This supplements current research that suggests that the improved market power of mergers between similar schools can result in increased market power and thus detrimental increases in student costs. (Russell, 2017)

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