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CHANGING MISSIONS AMONG PUBLIC UNIVERSITIES IN CALIFORNIA AND NEW YORK: Application of a Concentration Equality Index

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ABSTRACT

Capitalizing on the findings in our preceding study of a purely theoretical model, this paper aims to empirically examine whether and to what extent public universities' institutional missions have transformed in recent years in the States of California and New York by quantifying a degree of functional diversification of universities. We focus on research funding and productivity, and public service activities, and have developed a Concentration Equality Index (CEI) to help in this analysis. We then apply the CEI over time to a selected group of public university-system campuses within the State University of New York (SUNY) system, the City University of New York (CUNY), and the California State University (CSU) and the University of California (UC) systems. Among our findings: a select group of CSU campuses which all have roles at teaching-intensive schools, have gained increasingly versatile roles with rapidly expanded spending capacity in research and public service. These focal shifts resulted in some CSU campuses transforming into "UC-like universities", that is, a trend toward an institution with multi-functional operations of equally weighted instruction, research, and public service. In contrast, several campuses of both SUNY and CUNY systems have come to place varied weights on chosen missions rather than evening out their roles in instruction, research, and public service.

Keywords: University Missions, California State University, State University of New York, Functional Differentiation, Resource Allocation, Concentration Equality Index (CEI)

Institutional diversity has long been recognized as a positive and unique aspect of US colleges and universities (Morphew 2009; Trow 1979). Assigning functionally differentiated roles and institutional missions to individual colleges and universities, however, particularly for publicly-funded systems with multiple university campuses, has become a crucial legislative and institutional agenda in the realms of public finance and higher education policy as the public voice increasingly demands accountable and cost-effective provision of postsecondary education. Diversification among colleges and universities is an important policy issue in other countries such as Canada (Higher Education Quality Council of Ontario 2010), Japan (University Council of Japan 2011), Germany (German Council of Science and Humanities 2010), and more widely in the entire EU (Reichert 2009). The multi-fold benefits of greater differentiation among higher education institutions are well articulated in a report by Weingarten and Deller (2010) prepared for the Higher Education Quality Council of Ontario:

> *A more differentiated university system offers students a wider variety of unique and quality programs at both graduate and undergraduate levels. A more differentiated system is purposeful and cohesive, enhances the quality of the entire system and clarifies student choices. It offers a system that builds on institutional strengths and niche areas of expertise…* (Weingarten and Deller 2010, p.6)

Although the potential benefits of differentiated university systems may well be acknowledged and enumerated by researchers and policy makers, there exist only a limited number of documented cases of efficient assignment of such distinct roles and missions to individual institutions of higher education. Since the 1920s, California develop a distinct tier of three public higher duration providers. The California Master Plan for Higher Education of 1960 reinforced and slightly expanded the roles of the state's higher education that today includes the University of California system, California State University system, and the Community Colleges (Douglass 2007). California's highly mission differentiated system is often recognized as a worldwide prototype. Yet as discussed by Gumport and Bastedo (2001), in California and New York "differentiation also created real

problems associated with the allocation of resources and power relations within highly differentiated structures". Douglass has also written on the need to revisit California's tripartite system, including expanding the role of the CSU system, creating a new polytechnic segment, and allowing some community college to grant the bachelor's degree (Douglass 2011).

The 1964 Master Plan proposed by the then Chancellor Albert Bowker of the City University of New York also reorganized CUNY into a more clearly stratified system of colleges, with a two-tiered structure by selectively admitting the top 25% of qualified high school students into the senior colleges and making the community colleges available for the rest of the top two-thirds of eligible students in New York City (Lavin, Alba, & Silberstein 1981). Gumport and Bastedo (2001) claim that the multi-layered structure became "a source of frustration" as they are often "seen as barriers to swift upward mobility" and continue further by stating that "differentiated levels are not only different but are also differently valued; as status distinctions arise, they are reinforced across the levels" and eventually "structural differentiation becomes de facto stratification".

Yet it is clear that many ministries and lawmakers see assigning differentiated missions as a way to make better sense of their higher education systems (Longanecker 2008; Rhoten and Calhoun 2011). The report on Indiana's eight pubic university campuses perhaps illustrates a recent effort on this very issue (Nelms *et al.* 2005). At the same time, many institutions in larger and mission differentiated system evolve and adapt to an increasingly competitive environment and diverse public needs (Jaquette 2013).

This study quantifies the dynamics of university functional diversification and attempts to empirically examine whether and to what extent the institutional missions have transformed in recent years among public university campuses in the States of California and New York. We focus on research funding and productivity, and public service activity, and have developed a Concentration Equality Index (CEI) to help in this analysis.

The paper first describes the CEI followed by a description of the dataset used. The empirical results are then discussed for the public systems of higher education in California and New York, with some campuses selected from each system to exemplify the typical changes observed during the studied period. In doing so, we also demonstrate the validity of the Concentration Equality Index (CEI) as a measure to quantify the state of diversification within each institution. The paper then concludes with some implications and future agenda. Our finding suggests that the CSU campuses, most of which were once teaching-focused schools, have gained increasingly versatile roles with rapidly expanded spending capacity in research and public service. These focal shifts resulted in some CSU campuses transforming into "UC-like universities", that is, a trend toward an institution with multi-functional operations of equally weighted instruction, research, and public service. In contrast, several campuses of both SUNY and CUNY systems have come to place varied weights on chosen missions rather than evening out their roles in instruction, research, and public service.

Concentration Equality Index (CEI) as a measure of functional concentration

i. Basic framework

Our analytical model is postulated on the fundamental concept that each institution of higher education is a prestige- or reputation-maximizing entity (*e.g.*, Abe and Watanabe 2012a, 2012b, 2015; Baumol *et al.* 1982; Breneman 1976; Brewer *et al.* 2001; Cohn *et al*. 1989; Cyrenne and Grant, 2009; James 1990; Massy 1996; Melguizo & Strober 2005); that is, every college or university attempts to maximize institutional performance defined discretely as

$$P = \sum_{i=1}^{N} p_i, \tag{1}$$

where p_i represents partial assessment of performance in functional activities $i = 1, 2, \dots, N$, e.g., student teaching, faculty research, social service, and so on, as demonstrated by a substantive output measure. The mathematical description of the analytical model is omitted due to limitation of space, and readers with particular interests in the technical aspects of the model are asked to refer to Abe and Watanabe (2012a, 2012b, 2015) for more detailed discussion of optimizing behaviors taken by individual universities.

In order to achieve the objective of this paper and examine a degree of functional diversification within each institution, let us introduce an index Θ, which is defined by

$$\Theta = 1 - \frac{2}{N-1}\frac{\sum_{i<j} p_i p_j}{\sum_i p_i^2}, \quad 0 \leq \Theta \leq 1. \tag{2}$$

By structural design, the *Concentration Equality Index* (CEI) or Θ equals 0 when the values of p_i are identical for all i (non-concentrated state), and it equals 1 if $p_i = 0$ for all i except for a single function $j \neq i$ (perfectly concentrated state). Thus, the index Θ may be seen as a measure to quantify the degree of functional diversification for an institution with N dimensions of functional activities. Using this basic setup, we empirically analyze the change in the functional diversification for some of the major public systems of higher education in the United States, while we also demonstrate the validity of CEI as a measure of institutional effort to focus on selected roles, rather than managing versatile institutional operations with equal weights.

ii. Data

The dataset used for the empirical analysis of this paper is downloaded from a data platform of the US Department of Education's National Center for Education Statistics (NCES). More precisely, financial data of public colleges and universities, which is reported by each institution based on the Governmental Accounting Standards Board (GASB) Statement Number 34 and Number 35 (GASB34/35), have been extracted from NCES's IPEDS (Integrated Postsecondary Education Data System) Data Center. Three financial variables used in the analysis are "Instruction-Current year total", "Research-Current year total", and "Public service-Current year total" for the span covering FY2002 through FY2014. Thus, the current study focuses on the three variables of operating expenses associated with instruction, research, and public service of selected universities and examines how the weights given to these functional roles have changed among the universities over the studied period. Further detailed descriptions of each variable are provided in Table 1.

In the following empirical analysis of selected US public institutions of higher education, the assessment of performance p_i of a university campus in the ith activity is measured by the total funds granted to (and expended by) that campus for the operation of the ith area of function, say "research". That is, research capacity of a university, and the reputation accompanied as such, is captured as an indicator by the total amount of funding acquired for the purpose of conducting and supporting research activities. Similarly, variables on the total expenditures on instruction and public service which represent the institutional capacities in those operations are extracted from the same IPEDS dataset for FY2002- 2014.

Table 1. Descriptions of variables drawn from IPEDS finance component 2002-2014

Variable	Description
Instruction – Current year total	Total expenses is the sum of all operating expenses associated with the colleges, schools, departments, and other instructional divisions of the institution and for departmental research and public service that are not separately budgeted. This would include compensation for academic instruction, occupational and vocational instruction, community education, preparatory and adult basic education, and remedial and tutorial instruction conducted by the teaching faculty for the institution's students.
Research – Current year total	Total expenses is the sum of all operating expenses associated with activities specifically organized to produce research outcomes and commissioned by an agency either external to the institution or separately budgeted by an organizational unit within the institution. The category includes institutes and research centers and individual and project research. This function does not include non-research sponsored programs (e.g., training programs).
Public service – Current year total	Total expenses is the sum of all operating expenses associated with activities established primarily to provide non- instructional services beneficial to individuals and groups external to the institution. Examples are conferences, institutes, general advisory services, reference bureaus, and similar services provided to particular sectors of the community. This function includes expenses for community services, cooperative extension services, and public broadcasting services.

Source: Integrated Postsecondary Education Data Systems (IPEDS) Data Center, National Center for Education Statistics. https://nces.ed.gov/ipeds/datacenter/Default.aspx.

For computation of the CEI (Θ) as described in equation (2) above, the total expenditure by a specific institution in one area of functional role is calculated as a share of the expenditure in that function made by all the public institutions within the same state. For example, if there exist three 4-year institutions in a state, say "A State University", "B State University", and "C State University", then the research performance $p_{research}^{A}$ for A State University is measured as the total research expenses made by A State University divided by the sum of research expenses for all three universities. Similarly, the assessment of $p_{Research}^{B}$ for B State University is measured as the total research spending by B State University as a share of the sum of all research expenses by the three state universities, and so on. The same calculation rule is applied for the measurement of relative performance in instruction and public service. In this study, therefore, the strength of a university in instruction, research, and public service are captured by the annual spending in each of these functions, in relation to the summed expenditures for all the within-state public institutions in

those respective functions. A short caveat must be noted, however, on the limitations or IPEDS data as to its accuracy as these are self-reported expenditures by individual institutions.

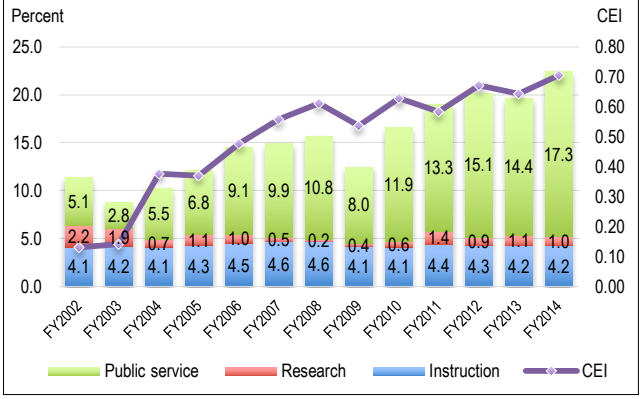
Empirical Analysis and Validity of the Concentration Equality Index (CEI)

i. Analysis of the City University of New York senior colleges

As a starting point, the Concentration Equality Index (CEI) or Θ as described in equation (2) was calculated, based on the computed values of p_i for three primary institutional functions, *i.e.*, instruction, research, and public service, using the IPEDS data for each of the City University of New York (CUNY) senior colleges. There are eleven senior colleges in the CUNY system spread over the five boroughs of New York City that grant bachelor's degrees; namely Baruch College, Brooklyn College, The City College of New York, Hunter College, John Jay College of Criminal Justice, Lehman College, Medgar Evers College, New York City College of Technology, Queens College, College of Staten Island, and York College. As demonstrated in the analysis below, each college has built institutional strengths over the years through gaining varying spending capacities to support the three functions of operation. In addition, our analysis result shows that the focal shift among these functions within each college is properly captured by the CEI, as a measure of functional diversification or concentration.

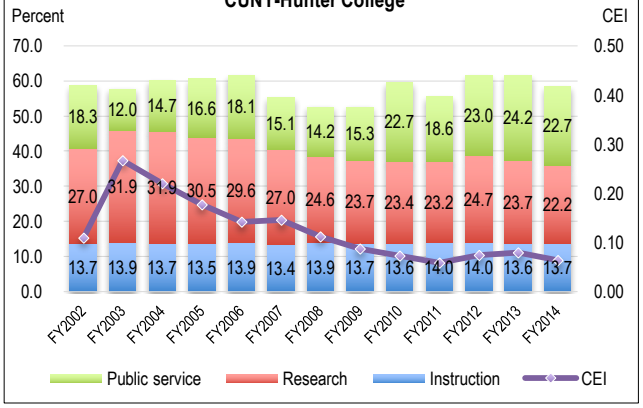
Figure 1 presents the first example of our analysis with the IPEDS data extracted for Medgar Evers College of the CUNY system. As explained in the previous section, the relative performance by Medgar Evers College in each functional role was calculated based on the operating expenses in all three functions as a percentage of the total expenses made by all the eleven senior colleges in each respective function. The CEI scores (drawn in purple) soared from a relatively non-concentrated state (Θ=.13) in FY 2002 to a highly concentrated state (Θ=.71) in FY2014. That is, Medgar Evers College once acquired relatively equal percentages of spending capacity in all three functions in FY2002, *i.e.*, 4.1% (instruction), 2.2% (research), 5.1% (public service), indicating similar relative strengths in terms of the three functions within the CUNY system. However, the CEI rose dramatically by FY2014, reflecting that the College began to stand out in public service by increasingly acquiring necessary funds targeted to implementing the expanded function, *i.e.*, from 5.1% of the overall CUNY system-wide funding expended for public service in FY2002 to 17.3% in FY2014. The relative overall performance by Medgar Evers College, in relation with other CUNY campuses, also rose as represented by the sum of the percentage points, *i.e.*, 11.4 in FY2002 and up to 22.5 in FY2014. (Note that the maximum value of the sum is 300 percentage points, *i.e.*, 100% for instruction, 100% for research, and 100% for public service, which would only be the case where a single university campus takes all the funding available in all three functions.)

Figure 1. Changing campus shares of CUNY spending: CUNY-Medgar Evers College



Similarly, Figure 2 shows the analysis result for Hunter College, the second oldest senior college in the CUNY system founded in 1870 which has its origin as a normal college. As the largest college in the CUNY system today, Hunter College has been characterized with a large share of research spending within the system. In FY2003 the College spent 31.9% of the total funds that were available to the CUNY system aimed for research activities, while it spent 13.9% and 12.0% of overall CUNY system-wide funds expended for instruction and public service, respectively. However, as the CEI scores in Figure 2 indicate, the functional strengths of Hunter College have been blurred by FY2014, with relatively similar shares of funding acquired to support the three dimensions of institutional functions, *i.e.*, 13.7% (instruction), 22.2% (research), and 22.7% (public service) in FY2014. As a result, the CEI scores for Hunter College dropped sharply from Θ=.27 in FY2003 down to .06 in FY2014. The overall performance of Hunter College in relation with other branch

Figure 2. Changing campus shares of CUNY spending: CUNY-Hunter College



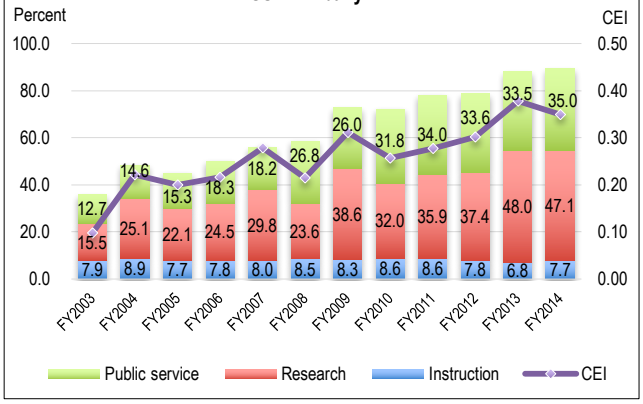
campuses of CUNY remained stable as represented by the sum of the percentage points, *i.e.*, 59.0 in FY2002 and 58.6 in FYY2014 during the studied period.

ii. Analysis of the State University of New York (SUNY) campuses

For the next example in the State of New York, all the senior colleges offering 4-year degrees in the State University of New York (SUNY) system are considered. The SUNY schools included in the analysis are 29 campuses; namely (with undergraduate enrollment as of Fall 2015, in parenthesis), Albany (12,967), Alfred State (3,699), Binghamton (13,491), Buffalo State (9,187), Brockport (7,069), Canton (3,140), Cobleskill (2,441), Cortland (6,283), Delhi (3,431), Downstate Medical Center (348), Empire State (10,807), Environmental Science and Forestry (1,755), Farmingdale State (8,648), FIT (9,386), Fredonia (4,582), Geneseo (5,583), Maritime College (1,676), Morrisville State (2,940), New Paltz (6,699), Old Westbury (4,125), Oneonta (5,850), Oswego (7,104), Plattsburgh (5,377), Polytechnic Institute (2,065), Potsdam (3,614), Purchase (4,077), Stony Brook (16,831), University at Buffalo (19,953), and Upstate Medical University (219). As the undergraduate enrollment of each campus indicates, there exist wide differences in operational size among the SUNY schools.

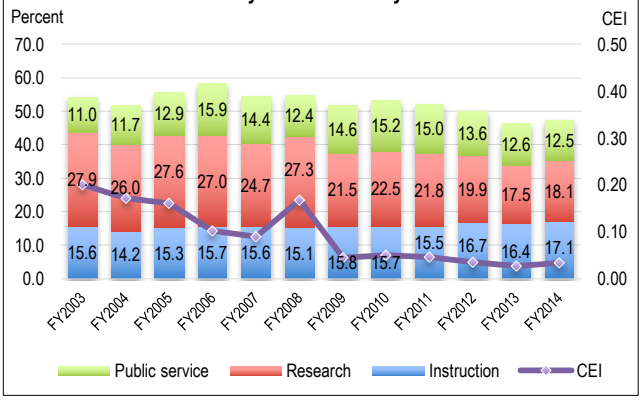
Figure 3 shows the case of SUNY-Albany, perhaps deemed as one of the flagship campuses of the system, which exhibits a significant shift in functional focus toward research and public service over the years, while the role of instruction at Albany remained similar relative to other 4-year degree granting colleges in the entire SUNY system. As a result of the focal shifts during the studied period, the CEI for SUNY-Albany rose dramatically from Θ=.10 in FY2003 to the index score of .35 in FY2014.

Figure 3. Changing campus shares of SUNY spending: SUNY-Albany



Clearly, the rise in the CEI was due largely to the dramatic gain in research spending capacity by the campus, from 15.5% in FY2003 to 47.1% in FY2014 as a proportion of the overall research spending for all the 4-year degree granting campuses in the SUNY system. SUNY-Albany also increasingly expanded the role of public service, from consuming 12.7% of the overall SUNY funds available for implementing the function of public service in FY2003 to 35.0% as the share of the entire SUNY spending on public service. For instruction, the share for the campus in the SUNY system remained within the small band of 6.8% (FY2013) and 8.9% (FY2008). As a result, the relative institutional performance of the Albany campus, in comparison to the entire SUNY system, grew dramatically over the period, by spending the sum of 36.1 percentage points in FY2003 to 89.8 in FY2014.

Figure 4. Changing campus shares of SUNY spending: Stony Brook University

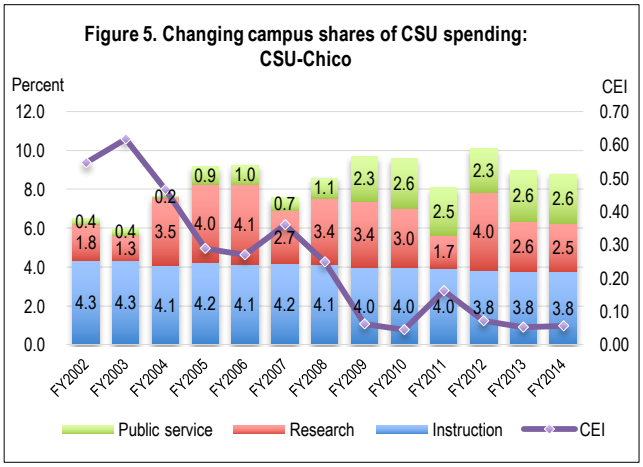


Similarly, Figure 4 shows the analysis result for Stony Brook University, the second largest campus in the system in terms of undergraduate enrollment. The figure exhibits that Stony Brook, which was once characterized with a relatively high weight on research activities with the CEI score of Θ=.20 in FY2003, evened out to a nearly non-concentrated state (Θ =.03) with equivalent proportions of gained appropriations for all three functions in FY2014. The analysis of Stony Brook University particularly reveals a reduced capacity in research for which the institution spent 27.9% of the research funds consumed by all the SUNY's bachelor's degree-granting campuses in FY2003 to 18.1% in FY2014. As shown in the figure, spending on both instruction and public service remained relatively stable, with a slight increase during the same period, from 15.6% to 17.1% for instruction and 11.0% to 12.5% for public service. The relative overall performance of Stony Brook University, as a share of the entire spending by the SUNY 4-year degree granting institutions in all three functions declined from 54.5 in FY2003 to 47.7 in FY2014.

iii. Analysis of the California State University (CSU) system campuses

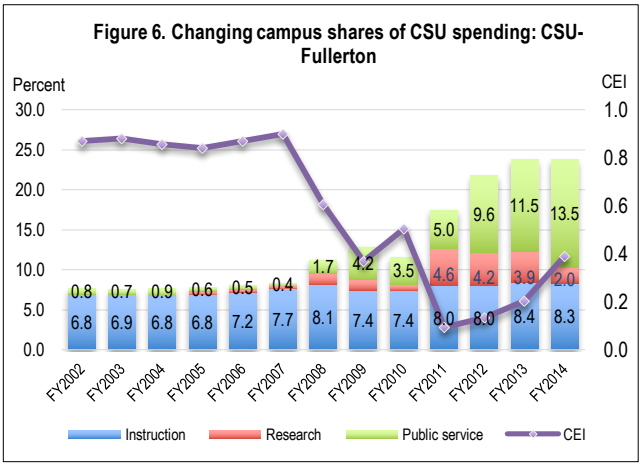
We now turn to examining a public system of higher education in the State of California. Figure 5 shows the case for California State University (CSU)-Chico. The figure depicts a sharp drop of the CEI scores from Θ=.55 in FY2002 down to a nearly non-concentrated state with the index score of .06. Figure 5 clearly shows that CSU-Chico was once an instruction-focused campus with 4.3% of the overall CSU system-wide spending on instruction in FY2002. However, the share of instructional spending within the CSU system slightly declined to 3.8% by FY2014. Instead, the research function for Chico State rose with a growing share of research spending among other CSU campuses, from 1.8% in FY2002 to 4.1% in FY2006, and then down to 2.5% in FY2014. Most notable in the figure is that the largest contribution to the drop in the CEI score was made by the expanded role of public service, for which Chico's annual spending grew from less than 1% during the early years to 2.6% by FY2014, of the entire CSU system-wide spending on public service. The relative performance of Chico State as a share of the spending by other CSU campuses also grew from taking the sum of 6.5 percentage points in FY2002 to 8.8 in FY2014.

Figure 5. Changing campus shares of CSU spending: CSU-Chico



The CEI scores for CSU-Fullerton also dropped sharply from Θ=.87 in FY2002 to Θ=.09 in FY2011, followed by a recovered gain in the score by FY2014 to Θ=.39 (Figure 6). Similar to the Chico campus, CSU-Fullerton has also been characterized as a primarily instruction-focused campus, with a gradual increase in instructional spending from 6.8% in FY2002 to 8.3% in FY2014.

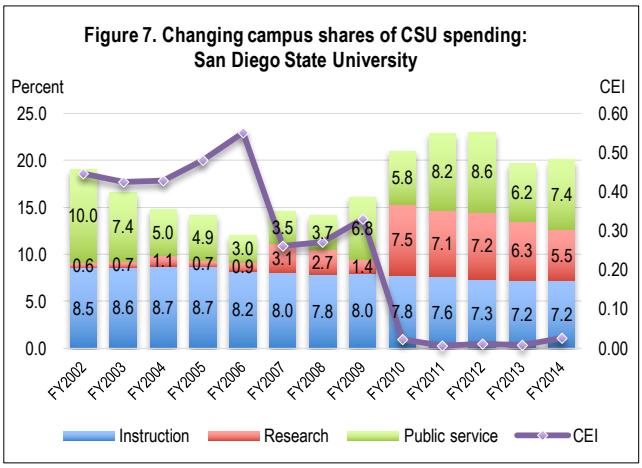
Figure 6. Changing campus shares of CSU spending: CSU-Fullerton



A startling focal shift made by CSU-Fullerton in terms of spending capacity among the three functions was found in the rapid expansion in the roles played by the campus in public service, which increased from less than 1.0% in FY2002 to 13.5% in FY2014 as a share of the overall CSU system-wide spending on public service. Figure 6 shows that Fullerton campus also gained in the research capacity by FY2011 with 4.6% of an acquired share within the system, for which the campus received less than one percent available to the entire CSU system back in FY2002. The spending share of the Fullerton campus in research, however, declined to 2.0% by FY2014.

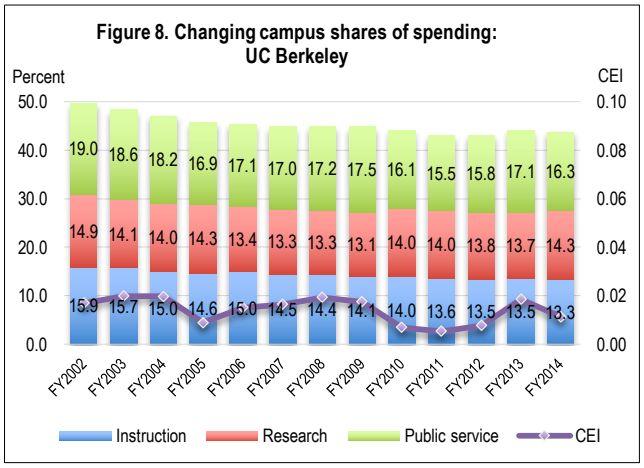
As the last example of the CSU-campus analysis, Figure 7 shows the result for San Diego State University (SDSU). The CEI scores for SDSU also dropped sharply from Θ=.45 in FY2002 to Θ=.03 by FY2014, indicating that the relative strengths of SDSU distributed among the three functions have blurred between these years. SDSU placed relatively greater weights on instruction (8.5%) and public service (10.0%) in FY2002, compared to .6% of CSU system-wide spending on research. However, as the campus gained a growing share of spending capacity for conducting research by FY2010, SDSU became a branch campus with similarly weighted performance for all three functions, *i.e.*, 7.8% (instruction), 7.5% (research), and 5.8% (public service). As a result, the CEI score plunged to Θ=.02 in FY2010. Since then, a similar pattern of spending shares for the three functions were retained through FY2014.

Figure 7. Changing campus shares of CSU spending: San Diego State University



iv. Analysis of the University of California (UC) system campuses

Examining each of ten campuses of the University of California system provides a different picture of within-campus functional distribution from the analysis result obtained for the CSU system campuses. The functional roles played by the Berkeley campus in the UC system, measured by spending as a proportion of UC system-wide expenditures in each of instruction, research, and public service, remained relatively stable over the studied period, despite slight declines in those spending shares. For instance, Figure 8 shows that Berkeley's spending share in instruction declined from 15.9% in FY2002 to 13.3% in FY2014. Similarly, Berkeley lost its spending shares in research (from 14.9% to 14.3%) and public service (from 19.0% to 16.3%) during the same period. As a result, the main campus of the UC system which has no affiliated school of medicine, slightly lost the summed shares of operating expenses for the three functions, *i.e.*, from 49.8 percentage points in FY2002 down to 43.9 percentage points in FY2014. The CEI score, however, remained stable over the twelve-year span within the range of Θ=.01 and .02, indicating that the Berkeley campus retained a non-concentrated or balanced state of relative operation distributed among instruction, research, and public service over the period.



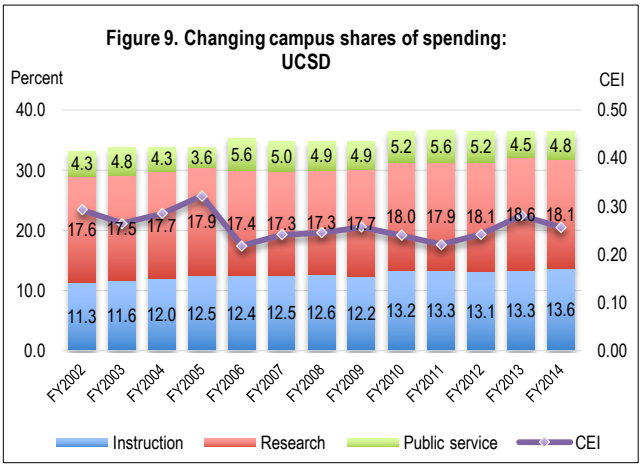
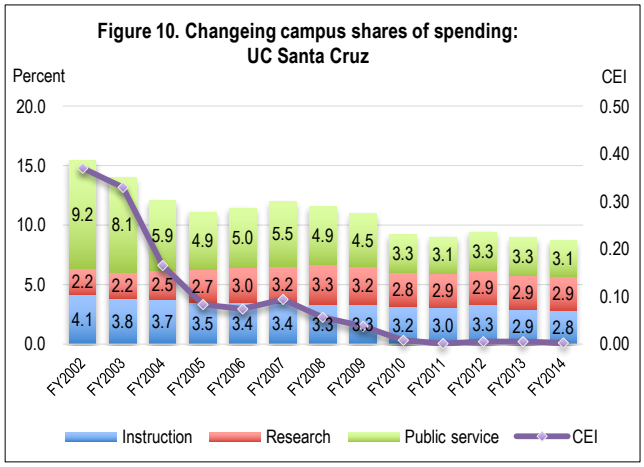
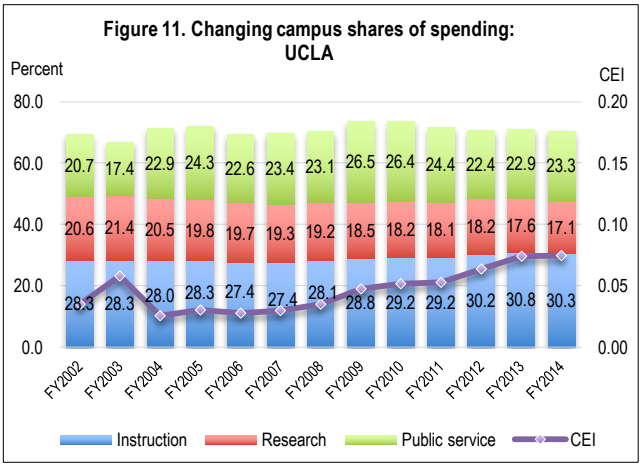


Figure 9 shows a similar pattern of functional focus for UC San Diego, with a relatively stable spending share in each of the three domains. Although the height of the bands in the graph is shorter than Berkeley, *i.e.*, below or around the sum of 35.0 percentage points, which simply indicates the difference in the operational scales between the two campuses, UCSD has been characterized with a relatively higher weight on research over the years, *i.e.*, a 17.6% of a share of the UC system-wide spending on research in FY2002, in comparison to instruction (11.3%) and public service (4.3%) in the same year. Moreover, the spending share of research rose to over 18% of the entire UC system by FY2014, and it remains the area of operation for which UCSD has the highest share. The proportions of annual spending on instruction and public service also grew slightly from 11.3% and 4.3% in FY2002 to 13.6% and 4.8% in FY2014, respectively. The CEI scores for UCSD remained relatively stable although the score declined from Θ=.29 in FY2002 to .26 in FY2014 (the highest CEI score of Θ=.32 was found in FY2005 and the lowest score of .22 in FY2006). Similar to the case of Berkeley, the overall performance as a share of the system-wide spending remained stable, although the actual sum slightly rose from the sum of 33.2 percentage points in FY2002 to 36.5 in FY2014.

Yet a completely different picture emerges for UC Santa Cruz, as depicted in Figure 10. A relative strength of UC Santa Cruz among other UC system schools was demonstrated by the campus' role in public service, consuming 9.2% as a share of the entire UC spending on public service in FY2002, while the shares of spending on instruction (4.1%) and research (2.2%) within the system were much smaller in the same year. As the decreasing trend of the CEI exhibits with a relatively concentrated state with the index score of Θ=.37 (with a higher weight on public service) in FY2002 to a nearly non-concentrated score of Θ=.002 in FY2014, the spending shares of the campus within the UC system in all three functions became non-variant by FY2014, *i.e.*, 2.8% on instruction, 2.9% on





research, and 3.1 on public service. In addition, the operational scale of UC Santa Cruz in relation to the overall UC system clearly shrank during the studied period from the sum of 15.5 percentage points in FY2002 down to 8.8 points in FY2014.

As the last example of the UC system, the analysis of data for UCLA reveals a slightly different scenario from the aforementioned UC schools, with increasingly variant shares of gained spending capacity. Figure 11 shows that UCLA, which takes the largest spending share in all three areas of operation, except for UC San Francisco in research (19.9% in FY2014), was once a relatively non-concentrated campus in terms of instruction (28.3%), research (20.6%), and public service (20.7%) with the CEI score of Θ=.03 in FY2002. However, UCLA gradually expanded the relative operational scales of instruction and public service by FY2014, taking 30.3% and 23.3% of the overall spending by the UC schools, while the share of research spending shrunk from 20.6% in FY2002 to 17.1% in FY2014. As a result, despite a small change in magnitude, the CEI score steadily rose from Θ=.03 in FY2004 to .07 in FY2014.

Finally, a summary of the changing CEI scores for all ten campuses of the University of California system is depicted in Figure 12. Most notably, UC Merced which is the newest campus of the UC system founded in 2005, began operation in a highly concentrated state (the highest weight on instruction) at the outset with Θ=.53 in FY2006. However, as Merced rapidly gained spending capacity in research and public service as a share of the UC system-wide overall spending, the youngest campus was submerged among the older UC colleagues with equally balanced operating expenses for the three functions.

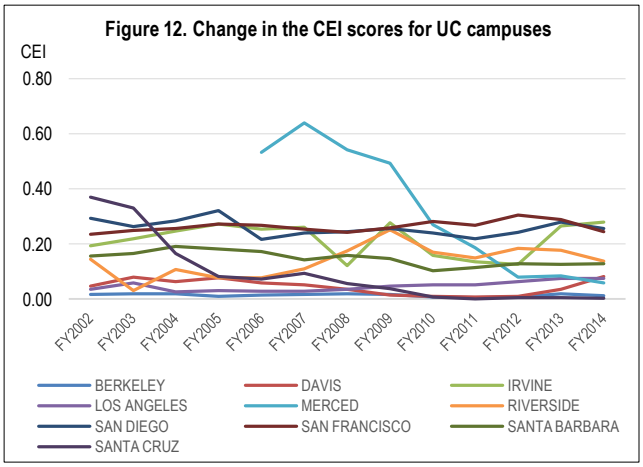


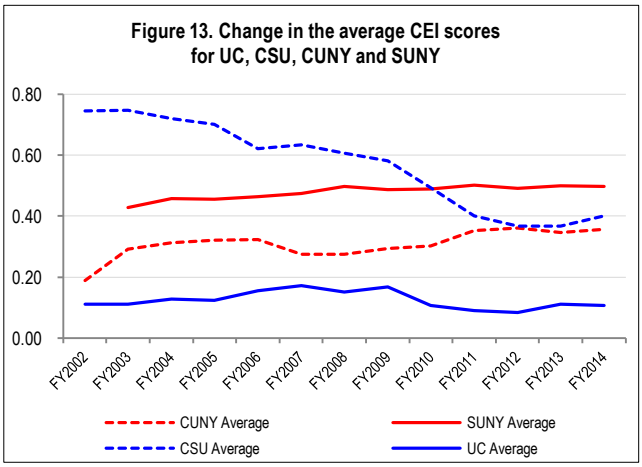
Figure 12 also shows that UC San Francisco, which placed relatively heavier weights on research (17.9%) and public service (18.5%) in the areas of medical and life sciences rather than instruction (5.4%) in FY2014, the campus of only graduate-level education programs in the UC schools is characterized with the highest average CEI score with Θ=.263, followed by the average score of Θ=.258 for UCSD, and the averages of Θ=.222 for Merced and .216 for Irvine. Berkeley, Davis, Los Angeles, and Santa Cruz are the only campuses with CEI scores hovering below Θ=.10 with equally balanced spending proportions among the three functions rather than gaining a greater spending share for a specific operating function.

v. Overall analysis: Change in the CEI scores for CUNY, SUNY, CSU, and UC systems

In the previous sub-sections, the validity of the Concentration Equality Index (CEI) scores was demonstrated, with selected examples of public university-system campuses of CUNY, SUNY, CSU, and UC. The focal shifts among the operating functions within each of the public systems of higher education in California and New York are summarized in Figure 13. In the figure, the average CEI score was calculated for each system for the period covering FY2002 through FY2014.

The most notable change over the studied period is the decline of the average index score for the CSU system from Θ=.75 in FY2002 down to Θ=.40 in FY2014. As shown in the empirical analysis section, the CSU campuses, most of which were once instruction-focused schools, have gained increasingly versatile roles with rapidly expanded spending capacity in research and public service. These focal shifts resulted in the CSU campuses transforming into "UC-like universities" with multi-functional operations of equally weighted instruction, research, and public service. For example, in the case of Chico State, the functional weights on research and public service grew over the years, as was the case for CSU-Fullerton and San Diego State University

During the same period, the average CEI scores for the UC campuses remained relatively stable within the range of Θ=.18 (FY2007) and .11 (FY2011), indicating that UC schools on average have retained more or less equally balanced functions among instruction, research, and public service over the years. Nevertheless, as demonstrated in Figure 12 there were individual cases, e.g., UC Merced and UC Santa Cruz, which experienced rapidly changing spending composites as measured by the spending share within the UC system.



In contrast to the cases of the public system of higher education in the State of California, several campuses of both SUNY and CUNY systems have come to place varied weights on chosen missions among instruction, research, and public service. In particular, the average CEI scores for the CUNY campuses rose from Θ=.19 in FY2002 to Θ=.36 in FY2014. As demonstrated by the example of Medgar Evers College whose public service role more than tripled with a dramatic increase in the spending share among the CUNY senior colleges, some branch campuses began to stand out by "concentrating" on certain functions while reducing or retaining the others. In contrast to the case of Medgar Evers College, some other campuses such as Hunter College at the same time came to take more equally balanced ratios of relative spending power in all three functions.

Finally, the SUNY campuses, though the increase in the average CEI score as a system was not as notable as the trend found for the CUNY system, also exhibits a gradual shift within the system with some individual campuses acquiring operational funds in chosen areas of institutional functions rather than building institutional strengths with three functions equally supported. As of FY2014, the SUNY system consisted of campuses with much more unequally distributed functions than the UC system schools as indicated by the much higher average CEI score Θ=.50 as opposed to the average of Θ=.13 for the UC system. It is important to note, however, that these public systems of higher education are quite different in their founding missions and visions as well as funding schemes by governmental support systems.

Conclusion

Based on the analysis of a purely theoretical model, our study predicted how the diversity in the market of higher education institutions could be influenced by the method of public appropriations granted to individual colleges and universities (Abe and Watanabe 2012c). The result demonstrated that a performance-based funding scheme (*i.e.*, tying funding to institutional performance), which is perhaps the most typically implemented funding method in contemporary systems of public higher education, does not enhance functionally differentiated environments for universities and colleges, and that it rather has the opposite impact in terms of enhancing functional diversity. As Bell (2008) describes, the California system does not use the performance-based scheme at the state-wide level or performance contracting (*i.e.*, funding in exchange for a specified service or level of performance).

Alternatively, Abe and Watanabe (2012c) proposed an "incentive-based" funding scheme to further enhance the functional differentiation among universities. A prototype of this incentive scheme is documented in the case where W. Ann Reynolds, who was hired in 1990 from California State University to take the position of CUNY's system-wide chancellor, "used her power of the purse to distribute an extra $15 million to colleges that scaled back academic programs" (Gumport and Bastedo 2001). It would then be of our great interest to examine whether and how the various results found for different systems of public higher education in the State of California and the City of New York, as evidenced in this paper, are directly or indirectly related to these legislative and historical facts.

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