How Public Funding Shapes Mobility at Access-Oriented State Comprehensive Universities

Colby King

Assistant Professor of Sociology

University of South Carolina Upstate

kingcr@uscupstate.edu

Christopher Robinson

Senior Data & Research Analyst

South Carolina Commission on Higher Education

crobinson@che.sc.gov

Abstract

With current uncertainty higher education institutions are facing during the COVID-19 crisis, understanding the outcomes of prior widespread reductions in state appropriations across higher education is even more crucial. This is particularly relevant for state comprehensive institutions, which are built to serve their regions, and to a lesser extent public research institutions. Many public higher education institutions are charged to enable broad access to quality higher education for the citizens of their region, a mission which is complicated by rising cost of college coupled with declining state funding. At the same time, growing public and political skepticism over the value of college has increased the need for higher educational professionals to better measure the social mobility higher education institution provide, especially for students form traditionally under-served populations.

Research demonstrates that social class inequalities are uniquely difficult to address in higher education, because while a college degree implies promises of opportunities and social mobility, it also imposes burdens and costs associated with changing racialized and gendered class positions and identities (Hurst, 2010; Warnock, 2014). Recently, several new models that rank how institutions support the social mobility of their students have been developed, such as Chetty et al.'s (2017) Mobility Report Cards and Education Reform Now's Social Mobility Elevator's model, to address this methodological issue. For our analysis, we revised one of these models, Hurst's (2019) social-mobility-focused Undergraduate Transformative Effectiveness Ratings Model (UTERM), to investigate social mobility outcomes for the under-served student population at public higher education institutions across South

Carolina, Georgia, Florida, North Carolina, and Virginia. Our findings show the percentage of federal loan recipients is a significant factor impacting social mobility rankings; however, we found less support for state as a group factor, leading us to conclude within-state variations in funding, demographics, and missions are likely more important to mobility than statewide factors. Finally, our findings raise a more critical question of whether social mobility ranking models are the appropriate method for measuring the transformational impact an institution provides to students from under-served populations.

Assessing Access to Social Mobility

Assessing how college outcomes differ between student groups has been a research and policy goal for some time. An American Council on Education Center for Policy Research and Strategy report from Esponisoa, Kelchen, and Taylor (2018) draws on data from the Equality of Opportunity Project to highlight how minority serving institutions (MSIs) function as pivotal institutions supporting social mobility for their students. A key finding in their report showed that, "Across all MSI types, four-year MSIs propel more students from the lowest income quintile to the top income quintile than four-year non-MSIs. Hispanic serving institutions (HSIs) in particular had a mobility rate three times that of non-MSIs (4.3 percent compared to 1.5 percent). The mobility rate at Asian American and Native American Pacific Islander-Serving Institutions (AANAPISIs), PBIs, and HBCUs was double that of non-MSIs," (iii).

In addition to evaluating outcomes based on institutional type, a growing amount of research has been undertaken in recent years to assess how outcomes differ across institutional types for similar student groups. One method being used to accomplish this goal is the development of ranking models attempting to provide comparative measures of targeted outcomes across broad groups of higher education institutions. A number of new models for ranking colleges and universities have been developed in recent years which specifically attempt to evaluate colleges and universities based on student social mobility outcomes.

One model is Education Reform Now's Social Mobility Elevators model (Murphy, 2020). They implemented a fairly stringent set of selection criteria for including institutions in their ranking, such as requiring that more than 50% of students with Pell Grants graduate within six years and that fewer than 6.9% of students default on their student loans within three years of entering repayment. Of the 614 institutions that make it into their ranking system, the top 10 ranks are dominated by institutions in California. They also find that "In some states, the most selective public institutions receive a disproportionately large percentage of the state funding even though less prestigious peers are doing a better job of promoting socioeconomic mobility," (Murphy, 2020).

While this model is informative, observers might wonder if systematic factors disproportionately benefit California institutions in this model. Since two of the index components of the model are related to loan repayment, California institutions may be elevated in the ranking because tuition and other costs for students are being reduced by California's relatively stronger public funding. As overall loan burdens are reduced, the success of Pell Grant recipients is improved. This is a great outcome for students but reflects more on the statewide higher education funding policy than on differences between the institutions being ranked. Another critique of this model is the short time frame used to construct the student outcome measure and how measuring educational mobility solely as the ability to reduce the debt acquired through education is a somewhat circular analysis. A more useful outcome measure would be a longer term factor like homeownership. With this factor, though, California institutions would be unlikely to have such high ranks because of the higher cost of housing compared to other states. This issue highlights one of our general concerns that ranking systems should make contextual adjustments for geographic location to avoid conflating state effects within institutional effects.

Differential outcomes in student debt levels and labor market returns between institutions in the same system are a real concern state policymakers should weigh as they shape their state systems. An October 2018 report by Julie Margetta Morgan and Marshall Steinbaum from the Roosevelt Institute highlights the importance of considering student debt levels and not just income outcomes when analyzing social mobility. In their report, they "represent the distribution of earnings, the distribution of student debt, and the distribution of student debt payments-to-income ratios as mathematical and graphical objects known as inverse cumulative distribution functions (CDFs)," (9). This allows them to note several issues that arise from student debt burdens. For example, they argue that their analysis highlights

> "the divide between the way that higher education experts talk about the value of a college degree and the way that Americans experience the outcomes of their educational attainment in the labor market. By focusing almost exclusively on the earnings premium, higher education experts view a college credential as something of certain value, as it provides substantial additional lifetime earnings" (12).

For example, Morgan and Steinbaum (2018) find that the distribution of student debt payment-to-income ratios is, "shifting out to encompass a larger share of Black households than it once did," and that, "the extent of extreme encumbrance with student debt is more acute for Black households than white." In simpler terms, larger incomes do not lead to better social mobility outcomes if they are coupled with higher debt burdens and, as their study indicates, debt burdens are not equitably distributed.

This echoes Seamster and Charron-Chenier's (2017) concern about predatory inclusion and education debt. Seamster and Charron-Chenier (2017) define predatory inclusion as the "process wherein lenders and financial actors offer needed services to black households but on exploitative terms that limit or eliminate their long-term benefits." They then show how predatory inclusion practices have contributed to how the amounts of educational debt taken on by Black students have increased substantially relative to whites and that the unequal growth in student debt is not attributable to differences in educational attainment across racial groups.

Morgan and Steinbaum (2018) also note that "there are many young adults who now have some student debt, whereas if they had been born in an earlier cohort, they likely would not, and studies have shown that these low-balance borrowers are most likely to default on their debt (Looney and Yannelis, 2016)." We wish to elevate this issue, because regional state universities are the schools in which a large portion of the group of low-balance borrower students are found (Henderson, 2009; Seceleanu, King, and Hegbloom, 2019). Small changes in state funding which would alleviate these low-balance debt burdens could dramatically reduce the likelihood of default among these borrowers. A policy brief from Tandberg and Laderm (2018) highlights how much state appropriations matter. Tandberg and Laderm (2018) drew on Webber's (2017) estimate to note that, "for every $1,000 per student cut in state appropriations, the average student would pay $257 more in tuition and fees," (2). This leads to the conclusion state appropriation cuts would disproportionately impact low-income students who are less able to take on additional tuition and fee cost.

Another ranking model focused on examining the impact of higher education institutions on the social mobility of their students is the Mobility Report Cards project from Opportunity Insights. In an NBER working paper, Chetty et al (2017) report the results of their analysis examining intergenerational income mobility across each college in the US using data on more than 30 million college students from 1999-2013.

Two of Chetty et al's (2017) key findings which are informative for our purposes here are that the proportion of students from families in the bottom quintile who reach the top quintile of earners varies dramatically across colleges. This variation is explained largely by the level of low-income access at each institution. They note that, "rates of bottom-to-top quintile mobility are highest at certain mid-tier public universities, such as the City University of New York and California State colleges," (i). The second finding particularly relevant here is that the proportion of students from low-income families fell sharply at colleges with the highest rates of bottom-to-top-quintile mobility between 2000 and 2011. While Chetty et al's (2017) note their descriptive analysis does not identify causal effects between colleges and their graduates' outcomes, their work is thorough and informative because it links individuals' childhood family income status to earnings at age 34, thereby providing a unique analysis based on individual level mobility data.

Although this is all informative, Chetty et al's (2017) work is constructed in part on data that is not publicly available and of limited usefulness to state policymakers seeking to apply in practice the ranking model by using income quintiles within their state as benchmarks, as opposed to the national quintiles used by Chetty et al. Another limitation of the Opportunity Insights Mobility Report Cards, which is noted in Delisle and Christensen's (2018) report from the American Enterprise Institute is that mobility rates for some multi-campus university systems are reported only by a single mobility rate for the whole system (7). Chetty et al. (2017) discuss this as a problem due to one data source listing some multi-campus systems under a single ID, making disaggregation impossible for these institutions in the analysis. Further, their analysis only considers income, and does not consider the role of education debt in impacting student social mobility outcomes as the other models discussed demonstrate is necessary for a full appreciation of how institution's shape student outcomes.

Our goal was to expand on an existing model measuring social mobility by adding a factor to account for differences in state appropriation. Hurst's Undergraduate Transformative Effectiveness Ratings Model (UTERM) was selected based on one of the author's prior familiarity with the work. Hurst's UTERM focuses on social mobility by assessing the economic returns from graduation weighted by a measure for traditionally under-served student groups. The under-served student factor in the model addresses three traditionally disadvantaged groups: race/ethnicity, gender, and income. In Hurst's paper outlining the UTERM, she explicitly discusses how the model was constructed so that elite schools which produce elite graduates would not rank at the top because they have not raised their students above their starting points. Hurst's critique of these institutions with high post-graduation outcomes but large populations of advantaged students is they are not engaged in transformative work but are primarily reproducing privilege.

Unlike other ranking models, Hurst's model attempts to reflect an institution's relative impact on mobility rather than absolute impact based on an external benchmark measure. To achieve this, Hurst constructed her outcome measure as the difference between a student's costs of attendance to their expected post-graduation income; therefore, the outcome measure is relative because both cost and post-graduation income are institutionally dependent. The transformational value of the model reflects how well the institution does at improving the social mobility of the under-served student population relative to the average outcome of graduates from that institution. To account for minority serving institutions whose ranks could be inflated by their large populations of under-served students but offer poor outcomes, Hurst added two adjustment factors which penalize institutions for low graduation rates and high loan default rates.

Hurst designed the UTERM to weight the transformational effect by an institution's percentage of under-served students. This weight is incorporated into the model through a Lack of Privilege (LOP) index which is constructed based on the student enrollments by race/ethnicity, gender, and low-income proxy measures. Our intention was to expand on Hurst's UTERM by adding the percentage of federal loan recipients to the model's lack of privilege index as an additional factor to capture low-income students and to test state appropriation per FTE as an alternative economic return measure. The percentage of federal loan recipients is important to test in the model because unlike other forms of aid, loans have to be repaid which depresses the immediate financial returns of borrowers relative to their peers. Students from low-income backgrounds may be further penalized by loan debt because without the family financial safety net available to their more affluent peers, their post-graduation opportunities may be constrained by an immediate need for income. We predict that the UTERM will penalize institutions with a higher population of loan recipients.

Using state appropriation per FTE as the economic return factor, instead of student cost as the original model, reframes the interpretation of the rankings system from a policy perspective by asking the question: which institutions provide the best outcomes for the tax payers of the state. Since funding for public institutions in South Carolina is no longer determined through a performance funding model, differences in levels of institutional influence may lead to differences in funding allocations. State appropriation per FTE student will be a valuable factor to test in the model because it introduces a measure of institutional influence for public institutions which could impact student outcomes. We specifically predict state appropriations per FTE to be a statewide factor influencing rank differences, which we test by comparing South Carolina institutions to public four-year institutions in other states.

Construction of the UTERM Model

Our original goal for testing the impact of adding state appropriations and federal student loan rates to the Undergraduate Transformative Effectiveness Ratings Model proved problematic for several reasons. First, Hurst developed the UTREM with data accessibility as a primary goal by pulling data from readily available public sources such as the Department of Education's College Scorecards. The College Scorecard data provides demographic rates for gender and race/ethnicity separately, meaning the original model double counts underrepresented minority women and biases the Lack of Privilege (LOP) index by weighting these students more than others. The other issue we had with using the College Scorecards is they only provide data for the most recent year, hindering replication of prior rankings as well as introducing bias from single year effects. Our solution was to use the full Integrated Postsecondary Education Data System (IPEDS) database to collect headcounts cross-tabulated by race/ethnicity and gender to avoid double counting underrepresented women and to collect three years of data to calculate averages for the model factors instead of using single year values. We chose to weight each year equally in averaging the data; however, using multiple years of data provides the additional benefit of assigning different weights to the years if desired.

The other issue we encountered was being unable to replicate the complete UTERM methodology because several intermediate calculation steps were omitted in the article. We reached out to Hurst about these steps but did not receive a reply, so we employed the calculation methods we felt were the most appropriate based on approximating the outcome values in the article. The first step we needed to revise was the SAT score factor. The UTERM uses the average SAT score in the Lack of Privilege index but does not explain how this average is calculated using the reported IPEDS values for the 75th and 25th percentile scores. We calculated the average SAT score as the mean of these two values. The second step we needed to revise was calculating average years to graduate. The UTERM uses average years to graduate but does not explain how this is calculated when IPEDS only reports 100%, 150%, and 200% graduation rates. We calculated the average years to graduate as a weighted average of these rates with 100% graduation rates weighted to 4 years, 150% graduation rates weighted to 6 years, and 200% graduation rates weighted to 8 years. Finally, we calculated the percentage of incompleters as 100 minus the 150% graduation rate.

We encountered two additional calculation problems related to scaling the model outputs. The size of the scores produced by multiplying the LOP index with the economic returns was larger than the values presented in Hurst's article and difficult to interpret. To scale our values down to the range of values presented by Hurst we divided the product of the LOP and economic returns by 10,000. Hurst determined the scaling of the two adjustment factors (percent incompleters by 20 and cohort default rate by 13) by testing different values and selecting the ones that "could differentiate between similar institutions without undercutting the main strength of UTERM" (91). Other than adjusting the adjustment factor to the scale of the scores, we did not have a statistical reason for assigning specific weights to these factors, so we chose to weight each factor the same and then multiply their sum by 10 to scale the value to the unadjusted scores range.

Data

In spirit of the UTERM we used only publicly available data from three sources: the National Center for Education Statistics Integrated Postsecondary Education Data System, the Federal Student Aid official cohort default rate database, and PayScale. Our primary focus was on public four-year institutions in South Carolina. We intended to create a comparison dataset by matching peer institutions through the IPEDS Data Feedback Report, however, this methodology was unsuccessful because we could not find mutual agreement between peer institutions for all SC institutions. Using data published in the South Carolina Commission on Higher Education 2019 Statistical Abstract (Table 1.11), we determined public four-year institutions in Georgia, Florida, North Carolina, and Virginia were valid comparison states because first-time undergraduates from each state enrolled in all the four-year public South Carolina institutions (Virginia was the only exception with no student enrolled at USC-Beaufort). The starting dataset size was 118 institutions; due to data availability and institutional criteria, the final dataset contained 70 institutions with complete data.

Data was collected from IPEDS through the NCES Datacenter by selecting all public four-year institutions in each five states. Due to IPEDS categorization, this process returns some two-year institutions IPEDS classifies as four-year institutions because the institutions now award bachelor's degrees. Carnegie classifications were used to remove two-year institutions from the dataset. Data was collected from the following IPEDS surveys: 12-month enrollment, admissions and test scores, student financial aid and net price, graduation rates, and finance. The most recent three years of data that aligned across all surveys was used; for this report the years included were 2016/17, 2017/18, and 2018/19. All intermediate calculations (such as state appropriation per FTE) were done by year before being averaged.

Description of Institutions in South Carolina and Comparison States

There is considerable diversity among South Carolina's public four-year institutions which range from a nationally recognized research institution, historically black universities, a military academy, and even one of the oldest colleges in the United States. Demographically the public four-year institutions range between a 95.6% underrepresented minority undergraduate population to 20.2% (66.8% mean) and from 80% of first-time, full-time undergraduates receiving Pell grants to 23% (38.2% mean). Unlike other states, most of the public four-year institutions in South Carolina operate independently; the University of South Carolina is the only system in the state and consists of the flagship campus, three four-year regional campuses, and four two-year regional campuses.

While total state appropriations have rebounded since the 2011/12 fiscal year to pre-recession levels, the data shows higher education funding as a percentage of state general fund revenue has continued to decline (2019 Statistical Abstract). Furthermore, South Carolina has pursued a student aid policy of merit-based programs over need-based programs. Data for the 2018/19 academic year shows a little over $3.82 in merit-based aid was distributed to students for every $1 dollar of need-based aid (2019 Statistical Abstract). These combined policy decisions raise the important question of how responsive SC institutions can be in expanding access to traditionally under-served student groups.

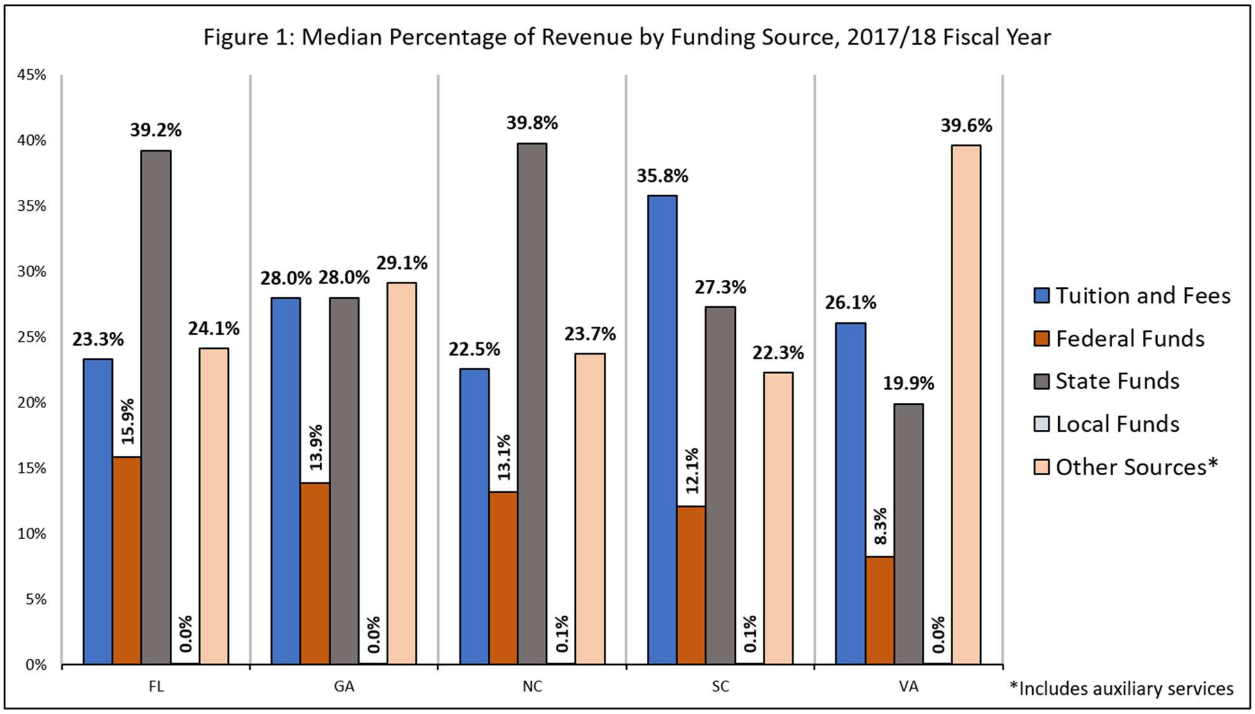

Figure 1 shows the 2017/18 fiscal year median percentages of total revenue by funding source for the five states in our study. While no revenue source accounted for more than 50% of total revenue, four states, FL, NC, SC, and VA, had a single revenue source noticeably higher than the others, GA was the only state where this was not the case. In SC the largest revenue source was tuition and fees, in FL and NC the largest revenue source was state funds, and in VA the largest revenue source was Other. This data indicates one impact of state funding policy on the institutions in our study is a difference in revenue streams.

In terms of performance funding policy, Rosinger et al (2020), show both GA and SC lack statewide performance funding models. While FL, NC, and VA all have statewide performance funding models, NC policy only applies to two-year institutions. For our study, this means FL and VA have state appropriation funding policies similar to each other and different from GA, NC, and SC. However, the lack of statewide performance funding policies in GA, NC, and SC does not indicate these states have similar funding policies, as shown by the different revenue percentages in Figure 1.

In relation to state scholarship and financial aid programs, data from the SREB (2016) indicates FL, GA, and SC are similar to each other with policies of either all merit-based or predominantly merit-based aid programs. NC and VA both have predominantly need-based aid programs. In summary, based on these financial data points, SC does not appear to share the same higher education funding policy as any other state in our study. In fact, none of the states align across these funding practices, suggesting funding policy is likely to lead to greater variation in ranking differences between states than within states.

Based on prior economic downturns, most notably the 2008 Recession, we expect higher education funding to be impacted by the current COVID-19 pandemic beyond the end of the crisis. We have already seen an expansion of federal funds through the CARES Act which led to contentious public debate over existing institutional inequities and resulted in later extensions restricting institutions with large endowments from accessing funds (Murakami 2021). Furthermore, the CARES Act provided flexibility in how states could allocate the money with Higher Education being only one possible direction. A recent report by the Lumina Foundation (2020) highlights the different approaches state's used in allocating Governor's Emergency Education Relief (GEER) funds to support higher education during the pandemic indicating different policy priorities related to higher education. What is less clear is the long term impact of COVID-19 on recurring state funding allocations. There have been calls from education advocates to use this crisis as an opportunity to address existing inequality in higher education by enacting targeted funding policies (Orphan 2020); however, given that the legislative cycles in many states are just now resuming, it is still unclear what lasting impacts the pandemic will have on state higher education funding.

Construction of the Ranking Models

Table 1: UTERM Construction

	Original Model	***Revised Model***	***Data Source***
Lack of Privilege Components	% Female Students		IPEDS
	% black, Hispanic, Native American, & Pacific Islander		IPEDS
		% black female, black male, Native American female, Native American male, Pacific Islander female, Pacific Islander male, Asian female, white female, more than two races female	IPEDS
	Admission rate	Admission rate	IPEDS
	% Pell Grant Recipients	% Pell Grant Recipients	IPEDS
	SAT (distance of average score from perfect score)		IPEDS
		Mean difference scores for 25th percentile SAT & ACT scores	IPEDS
		% Federal loan recipients	IPEDS
Adjustment Factors	Federal Loan Default Rate	Federal Loan Default Rate	US DOE
	Incompleters at 200% Time	Incompleters at 200% Time	IPEDS
Economic Outcome Factors	Net Price	Net Price	IPEDS
	Average Time to Graduate	Average Time to Graduate	IPEDS
	Median Mid-Career Salary	Median Mid-Career Salary	PayScale
		State Appropriations per FTE	IPEDS

Calculating the UTERM scores involves four main steps with a series of intermediate steps to calculate individual factors. Table 1 shows an overview of the model factors and where they belong in the three main components. The federal loan default rate and mid-career salary were the only data we collected outside of IPEDS. The first step of the UTERM is calculating the Lack of Privilege Inventory (LOP) which is comprised of the percentage of underrepresented minority students, the percentage of Pell Grant recipients, the admission rate, and the percentage for the difference of the mean standardized test score from a perfect score. These percentages are summed together to calculate the LOP with each component equally weighted.

The percentage of Pell Grant recipients was calculated using the reported headcount for Pell Grant recipients over the reported financial aid cohort headcount. The admissions rate was calculated using the reported number of admitted students over the reported number of applicants. Hurst discounted the admissions rate by 50% but we did not have a theoretical justification for the discount, so we included the admissions rate as reported.

The original UTERM double counted female minority groups in the LOP, to avoid this we calculated the percentage of students cross tabulated by race/ethnicity and gender using the 12-month enrollment headcounts. The underrepresented group value in our LOP was the sum of the enrollment percentages for American Indian males, American Indian females, Asian females, Black males, Black females, Hispanic males, Hispanic females, Native Hawaiian males, Native Hawaiian females, Two or More Race females, and white females.

The original UTERM only used mean SAT scores in the LOP calculation, we chose to include ACT scores and weight the measure by the percentage of test takers in each category. To calculate this value, the reported 25th and 75th percentile scores were averaged. Next the difference of the average from a perfect score was calculated using 1600 for the SAT and 36 for the ACT. This difference was then converted into a percentage of the perfect score. Finally, the percentage differences for each test were weighted by the percentage of test takers and summed to calculate a single test score measure.

The second UTERM step is calculating the economic return value. First the cost of college is measured as the reported net price in IPEDS multiplied by the average time to graduate. Data from the graduation rates survey is used to calculate the average time to graduate based on the first-time, full-time bachelor's cohort. Average graduation time was calculated using the number of graduates at 200% time as the number of total graduates to calculate the proportion of graduates graduating within 100% program time, 100% to 150% program time, and 150% to 200% program time. Average time to graduation was calculated as the sum of the 100% program time proportion weighted by 4, 100% to 150% program time proportion weighted by 6, and the 150% to 200% program time proportion weighted by 8.

The next part of calculating the economic returns is calculating the payout of college as the average time to graduate multiplied by the institutional mid-career salary for graduates with Bachelor's only reported in PayScale. The original UTERM model multiplied mid-career salary by 5 but there was no theoretical reason stated for why 5 was selected so we opted to use average time to graduation which results in the cost of college and the payout being measured in the same time frame. Finally, economic return is calculated by subtracting the cost of college from the payout.

The third UTERM step is calculating the raw UTERM score by multiplying the economic return with the LOP then dividing by 10,000. The original article does not specify dividing the product of these components by 10,000; however, not dividing the value produces numbers larger than the reported scores so we chose to divide by 10,000 to scale our raw scores to the range of values reported by Hurst.

The fourth UTERM step is adjusting the raw score to account for non-transformative college outcomes using an adjustment factor. The two non-transformative outcomes considered are the federal loan default rate and percentage of incompleters. We used the three-year average for the loan default rates reported by the Federal Student Aid Office of the Department of Education; the most recent years available were for the 2016, 2015, and 2014 fiscal years. The percentage of incompleters was calculated as 100 minus the 200% time graduation rate. These two percentages were summed together and then multiplied by 10 to scale the measure appropriately with the unadjusted UTERM score. We chose to weight these factors equally even though Hurst did not because she did not provide a strong theoretical or statistical justification for her weights. The final adjusted UTERM score is calculated by subtracting the adjustment factor from the raw UTERM score.

We tested adding two factors to the UTERM, percentage of students with federal loans and the amount of state appropriations per FTE. The percentage of students receiving federal loans was calculated from the reported headcount of federal loan recipients over the financial aid cohort, which is the same base used to calculate the Pell Grant rate. State appropriations per FTE student was calculated by first calculating total FTE as the sum of reported undergraduate FTE, graduate FTE, and doctors of professional practice FTE. Next reported state appropriations were divided by total FTE.

The percentage of federal loan recipients was added to the LOP as another factor indicating low-income students. State appropriations per FTE is incorporated into the economic return in two ways to generate different models. First state appropriations per FTE is substituted for the student-based college cost in the economic return calculation. This method shifts the outcome of the UTERM from measuring the economic return relative to students and their parent’s expenses to measuring economic return relative to state expenses. The second method subtracted state appropriations per FTE from the payout calculations along with the college cost. This method shifts the outcome of the UTERM to measure the economic return as a reflection closer to the total cost of the degree; although it is not the total cost because Federal expenses and other state based aid are not included.

Table 2: Means for UTERM Model Factors
Standard Deviations

		State				
		FL	GA	NC	SC	VA
Lack of Privilege Components	*Admissions Rate*	52.3% 10.4%	64.4% 16.8%	61.6% 16.0%	64.6% 11.2%	70.9% 19.5%
	Difference from Highest Possible Score of the Mean SAT/ACT	31.0% 6.6%	42.2% 10.9%	37.4% 11.5%	39.2% 12.2%	31.8% 10.5%
	Pell Recipients	37.5% 10.4%	44.1% 16.3%	43.0% 16.3%	38.2% 16.4%	27.9% 18.7%
	Federal Loan Recipients	42.4% 12.2%	53.6% 14.6%	57.8% 13.5%	58.1% 13.1%	49.5% 15.6%
	Underrepresented Minority Groups	70.9% 10.5%	72.6% 13.0%	70.5% 14.6%	66.8% 18.1%	59.7% 15.2%
Adjustment Factors	*Federal Loan Default Rate*	4.7% 2.0%	9.0% 4.5%	7.5% 4.2%	6.4% 3.8%	5.1% 4.8%
	Incompleters by 200% Program Time	36.4% 13.7%	53.0% 17.3%	41.5% 15.5%	44.2% 15.3%	31.3% 17.3%
Economic Return Components	*Average Time to Graduate (in years for BA cohorts)*	5.02 0.44	5.39 0.37	4.94 0.38	4.83 0.34	4.69 0.37
	Net Price	$12,587.33 $1,686.28	$13,419.31 $2,871.07	$11,402.67 $3,360.66	$16,820.12 $2,908.15	$17,324.19 $3,022.26
	Average Mid-Career Salary	$88,945.45 $6,052.33	$84,066.67 $15,124.70	$82,337.50 $10,959.62	$85,372.73 $11,643.12	$96,900.00 $14,683.74
	State Appropriations per FTE	$10,276.49 $5,289.20	$7,141.45 $5,257.66	$12,886.58 $6,137.03	$3,607.45 $2,082.58	$7,639.02 $2,259.42
Number of Institutions		11	18	16	11	14

Table 2 shows the means and standard deviations of the factors used in calculating the UTERM. The difference in means between the five states is less than 20% on the Lack of Privilege index components, but there are larger differences between states on the two adjustment factors. State appropriations per FTE has the largest difference with North Carolina allotting almost four times more funding per FTE student than South Carolina.

Figure 2: UTERM Model Factor Correlations

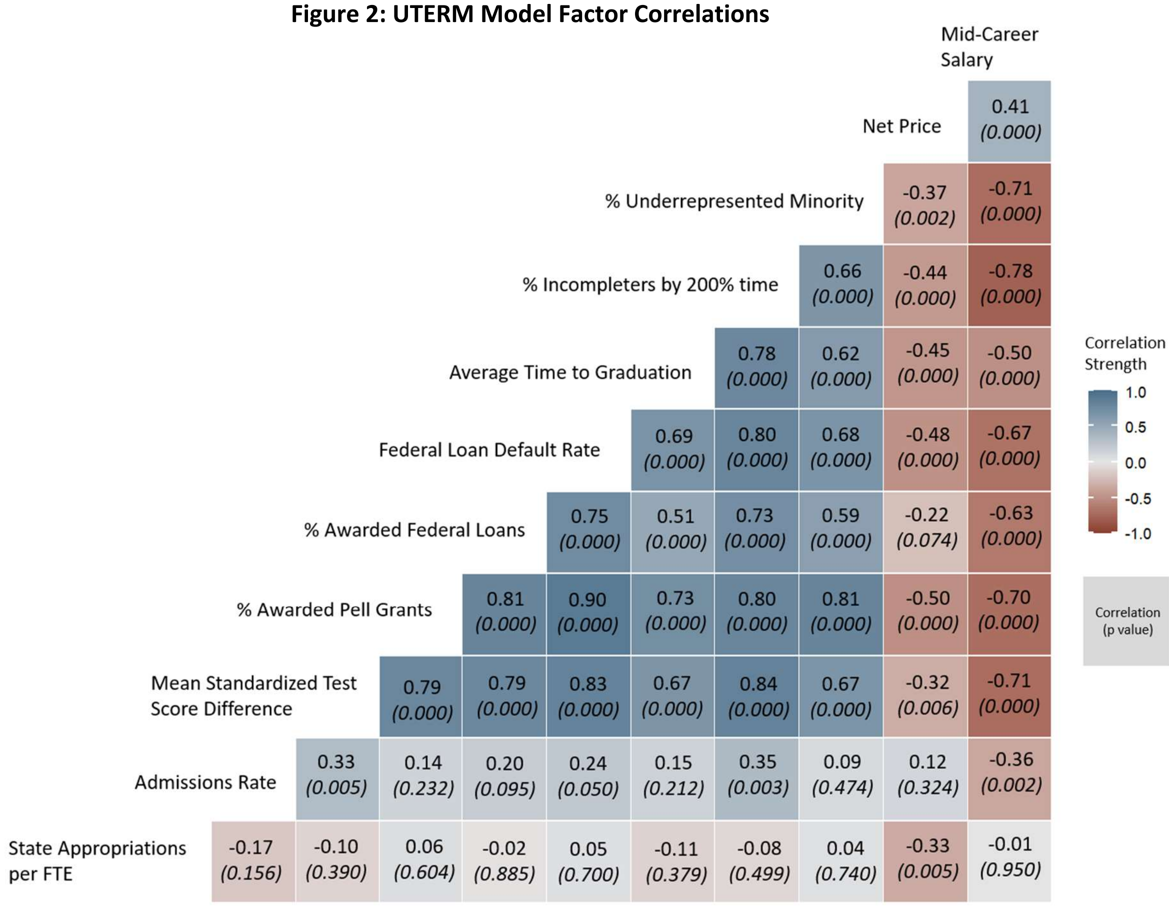

Figure 2 shows the correlation matrix for the UTERM factors. The majority of LOP and adjustment factors have significant correlations above 0.50 in strength. The exception is admissions rate which is weakly correlated with all of the other factors. It is notable that net price and mid-career salary are negatively correlated with the LOP and adjustment factors (except admissions rate) and positively correlated with each other. This supports the value of the overall model by suggesting the disadvantaged groups the model is attempting to capture are both more likely to attend a lower cost institution and receive a lower financial return on their college investment. Finally, it is interesting state appropriations per FTE is weakly correlated with every factor and only significantly with net price. Considering the range of state appropriation per FTE shown in Table 2, this finding suggests the impact of state funding is less likely to vary within states than between them.

Results

Table 3 shows the eight versions of the UTERM we constructed and tested. The models are separated into three groups based on the economic return component used and with the percentage of federal loan recipients being the distinguishing element between models within each group. We constructed and tested raw score models for the original model to ensure the model was constructed correctly by comparing the raw scores to the adjusted scores. Since the adjusted scores are the final scores, we did not feel it necessary to construct them for the other two model groups.

Table 3: UTERM Variations Tested

	Student Economic Returns	*State Economic Returns*	*Combined Economic Returns*
Raw Score	Raw Hurst score		
Raw Score & Federal Loan Rate	Raw Hurst score with federal loan rate added to LOP		
Adjusted Scores	Adjusted Hurst score	Adjusted score with state economic return factor	Adjusted score with both economic return factors
Adjusted Scores & New Factors	Adjusted Hurst score with federal loan rate added to LOP	Adjusted score with state economic return factor and federal loan rate added to LOP	Adjusted Score with both economic return factors and federal loan rate added to LOP

Non-parametric statistics were used to test the inclusion of the percentage of federal loan recipients and state appropriation per FTE factors because the UTERM is a ranking model meaning the score produced by the model for an individual institution lacks statistical meaning by itself and only derives meaning through relative comparisons with the scores for other institutions. We tested the inclusion of our factors using a series of nine Wilcoxon paired-sign rank tests to determine if the additional factors produced rankings that were statistically different between models. We ran six Kruskal-Wallis tests on the six main UTERM variations to assess if state was a significant group factor impacting the variation in institutional ranks. Finally, we used Kendall Tau correlations to assess the relationship between our two additional factors to the scores of the six main models.

All of the Wilcoxon paired-sign rank tests returned p-values less than 0.000 and indicate the addition of the percentage of federal student loan recipients in the LOP and state appropriations per FTE in the economic returns are significantly different from the original UTERM. Each new factor was tested separately in three tests comparing the models with new factors against variations of the original model. The final three tests compared models with both additional factors against models with the federal loan rate added to the LOP.

The Kruskal-Wallis tests assessed whether state was a significant group factor in the differences between institution ranks. Six tests were run based on the main models tested in the paired tests. The outcomes indicate state was significant at a conventional level ($p < 0.05$) only for the two models where state appropriations per FTE alone was used to calculate economic returns. This suggests funding policy aimed at improving mobility for under-served groups by adjusting state appropriations alone is unlikely to be as impactful as policy which adjusts state appropriations and other factors.

Table 4: Significance Test Outcomes

Wilcoxon Paired-Sign Rank Test

	X 1	*X 2*	*Output*
Addition of Federal Loan Rate	Raw Hurst Score	Raw Hurst Score with Federal Loan Rate added to LOP	p < 0.000
	Raw Hurst Score with Federal Loan Rate added to LOP	Adjusted Hurst Score with Federal Loan Rate added to LOP	p < 0.000
	Adjusted Hurst Score	Adjusted Hurst Score with Federal Loan Rate added to LOP	p < 0.000
Addition of State Appropriations per FTE	Adjusted Hurst Score	Adjusted Score with State economic return	p < 0.000
	Adjusted Hurst Score	Adjusted Score with both economic return factors	p < 0.000
	Adjusted Score with State economic return	Adjusted Score with both economic return factors	p < 0.000
Both Additional Factors	Adjusted Hurst Score with Federal Loan Rate added to LOP	Adjusted Score with State economic return and Federal Load rate added to LOP	p < 0.000
	Adjusted Hurst Score with Federal Loan Rate added to LOP	Adjusted Score with both economic return factors and Federal Load rate added to LOP	p < 0.000
	Adjusted Score with State economic return and Federal Load rate added to LOP	Adjusted Score with both economic return factors and Federal Load rate added to LOP	p < 0.000

Kruskal-Wallis Tests	*Output*
Adjusted Hurst Score	p = 0.0721
Adjusted Hurst Score with Federal Loan Rate added to LOP	p = 0.1618
Adjusted Score with State economic return	p = 0.0371
Adjusted Score with State economic return and Federal Load rate added to LOP	p = 0.0498
Adjusted Score with both economic return factors	p = 0.0748
Adjusted Score with both economic return factors and Federal Load rate added to LOP	p = 0.1030

Figure 3 shows the institutional changes in rank between the three adjusted models with the federal loan rate included in the LOP. Only one institution has the same rank in all three models. Georgia and South Carolina institutions appear more clustered than Florida, North Carolina, and Virginia institutions, but they are not very tight clusters. Overall, no clear state based patterns emerge in the graph; all five states have institutions that increase and decrease in rank across all three models. Not seeing clear state based trends in the data is not surprising given the outcomes of the Kruskal-Wallace tests which showed state was not a significant group factor in the models that used student cost in the economic return measure.

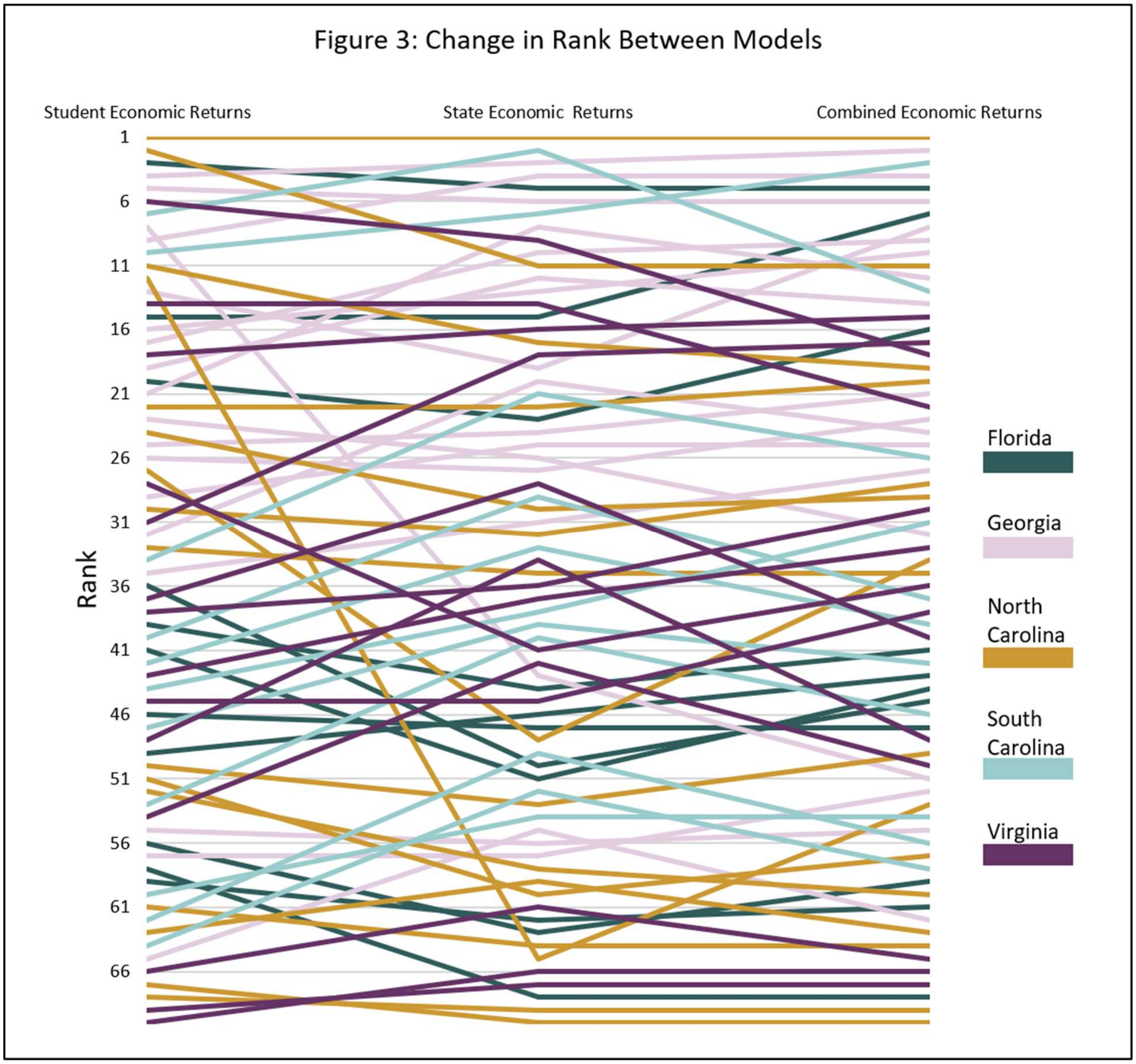

Table 5 shows the Kendall Tau correlations for percentage of federal loan recipients and state appropriations per FTE with the six main models. We predicted adding federal loan recipients to the model would penalize institutions, but the data shows a positive correlation with the scores. In hindsight this outcome makes more sense because the model was designed to penalize institutions with large percentages of advantaged students.

Table 5: Kendall Tau correlations

	% Federal Loan Recipients	*State Appropriations per FTE*
Adjusted Hurst Score	*tau* = 0.3068 p = 0.0002	*tau* = 0.0377 p = 0.6446
Adjusted Hurst Score with Federal Loan Rate added to LOP	*tau* = 0.4112 p = 0.0000	*tau* = 0.0393 p = 0.6301
Adjusted Score with State economic return	*tau* = 0.3217 p = 0.0000	*tau* = -0.2108 p = 0.0099
Adjusted Score with State economic return and Federal Load rate added to LOP	*tau* = 0.4046 p = 0.0000	*tau* = -0.2157 p = 0.0083
Adjusted Score with both economic return factors	*tau* = 0.2555 p = 0.0012	*tau* = -0.1826 p = 0.0205
Adjusted Score with both economic return factors and Federal Load rate added to LOP	*tau* = 0.3432 p = 0.0000	*tau* = -0.1826 p = 0.0254

The interpretation of the relationship of state appropriations per FTE to the final scores is more nuanced. The relationship is positive but non-significant in the two models without state appropriations per FTE as a component. The relationship is negative and significant in the remaining four models. This seems to suggest institutions with a higher rate of state appropriation per FTE are less transformational than other institutions. This outcome makes sense if funding policy allocates money based on prior success, which could be a result of performance funding models. However, the non-significance of the two models without state appropriations per FTE in the model indicate the relationship itself may be spurious.

In conclusion, our analysis results were a mixed bag. While the Wilcoxon paired-sign rank tests showed the models with our additional factors were significantly different from the original model, the Kendall Tau correlations and data in Figure 3 suggest the additional factors may only be adding statistical noise. In the end the results raise a larger issue of whether the UTERM model is actually measuring social mobility as claimed.

Limitations

Hurst discussed how the use of PayScale data as the sole economic outcome factor is a serious limitation of the model. While we agree this is a problem with the model, we contend a larger issue of the UTERM is the mis-alignment of time periods caused by combining cross-sectional datasets rather than using a longitudinal dataset. Under the UTERM methodology, the current demographics of an institution are combined with the current graduation rates and current mid-career salary data. This methodology is problematic given individuals reporting mid-career salary are matched to a college environment 10 to 15 years after their graduation. Graduation rates are also being mapped to current institutional characteristics that may differ from the institution experienced by the graduation cohort.

Without using cohort data, it is unclear if the model is actually measuring transformation because the input factors and outcomes are being collected from different student populations. Graduation cohorts can be matched to the institutional demographics of the entry date using the IPEDS database but it is not possible to align the PayScale data to a cohort because information on the respondents is not available. A better approach to relying on publicly available data would be to use a state longitudinal data system that tracks students from k-12 to the workforce. This would provide a clearer measure of the transformative effects of an institution by matching graduation and economic outcomes at the individual level.

Table 6: Comparison of Reported Median Income for Bachelor's Holders

State	*PayScale Median Mid-Career Salary*	*ACS Median Individual Earnings in Past 12 Months**	*Difference*	**ACS Median Individual Earnings in Past 12 Months* for Some College or Associate's Degree only**
Florida	$88,945	$46,380	$42,565	$33,334
Georgia	$84,067	$54,692	$29,375	$35,172
North Carolina	$82,338	$49,295	$33,043	$33,982
South Carolina	$85,373	$49,131	$36,242	$32,980
Virginia	$96,900	$60,105	$36,795	$39,440

* In 2018 inflation adjusted dollars.

The main issue with using PayScale as the only outcome measure for the UTERM is the opaqueness of the dataset. Table 6 compares the median mid-career salaries from Table 2 to median 12 month earnings data for Bachelor's holders only from the Census ACS survey. Table 6 shows the differences in reported incomes between sources range from $29,375 to $42,565 higher for the PayScale data compared to the ACS data. This suggests several underlying issues with using the PayScale data. First, the respondents in the PayScale survey are not representative of the average bachelor's holder in these states. This is problematic if the model is assessing the performance of four-year state institutions many of which have missions to produce graduates that work within the state. Second, the respondents to the PayScale survey may not be employed in the states they graduated from. This is problematic because the cost of living difference may lead to overestimation of the economic return factors in the model if college cost is linked to lower cost of living areas than where graduates end up in. Third, selection bias in respondents may be skewed towards higher paid graduates. This is problematic because the model is then not accurately capturing the transformational impact to the average graduate. It is likely all of these issues are factors with this data making it problematic as the sole outcome measure.

Discussion and Policy Implications

We began this project believing in the utility of ranking systems but after building and testing multiple versions of the UTERM have come to question the value of ranking models in general. Furthermore, we also identified two key flaws in the UTERM versions we assessed: the scores lack inherent meaning as measures of transformation and rank orders consistently changed between models.

The first issue with the UTERM model is the most serious flaw with the models we examined here. The scores generated by the models we tested only have value as comparative measures to other institutions and no substantive value on their own. Knowing Florida Atlantic scored 84.92 does not provide any information about the institution related to its transformative impact on students. Knowing Florida Atlantic ranks 20th while Kennesaw State ranks 21st provides the interpretation that Florida Atlantic is more transformative than Kennesaw State, but also raises the question: is the difference of one rank substantial? Ultimately this example reveals that even though a ranking system is a quantitative measure supported through statistical tests, the substantive value of the ranks actually rests entirely on the theoretical framework of the model.

The use of the percentage of Pell Grant recipients in the Lack of Privilege factors illustrates this issue. This factor is used as a proxy for low-income students. While our goal was to test additional factors in the model and not theoretically evaluate the components of the existing model, some research (Delisle 2017) has questioned the use of Pell Grants as a proxy for low-income students. This factor, however, is not independent from institutional aid policy which may create different levels of need for federal loans between institutions for students from the same family income background. It is not inconceivable that in seeking student diversity an affluent institution might cover more of the educational cost of low-income students negating their need to receive Pell Grants; this policy would reduce the LOP score of the institution, not because the institution is serving less low-income students, but because the institution is actively negating these students disadvantage and these activities would not be captured by the indicators.

The use of Pell Grants as a measure for transformational impact, then, adds statistical noise to the model because it does not measure the intended concept. Furthermore, it is unclear how our additional measure of federal loan recipients improves on the ability of the UTERM to capture low-income students without an explicit measure of low-income students to compare against. Adding the percentage of federal loan recipients to the LOP may simply be double counting low-income students or it may be capturing additional students but it is not possible to distinguish between the two without knowing the true number of low-income students. As Gorard (2010) argues, constructing an ordinal measure is not the same as measuring an explicit thing.

The shifting rank orders is another example of the general problem with the rank-model approach to measuring the abstract concepts these models work to assess. The shifts in ranks between institutions across the models may indicate true changes in the transformative impact these institutions have under different considerations or they could be statistical noise. Again, without an explicit a priori measure of transformational impact, it is not possible to distinguish between the two.

Another issue with the UTERM is the built-in penalty against elite institutions. The problem arises because of how the model uses general measures rather than specific measures; i.e. the graduation rates used are measures of the entire student body, as opposed to graduation rates for the under-served groups the LOP measures. Comparing Clemson University, a nationally ranked research university focused on STEM programs, to Francis Marion University, a small teaching university with a diverse student body, illustrates this point. The reported mid-career salary for Clemson is $106,700 and the calculated student economic return is $20,910. The reported mid-career salary for Francis Marion is

$77,600 and the calculated student economic return is $17,131. The average rank for Clemson across our variations of the UTERM was 56.5; while the average rank for Francis Marion was 8.8, meaning the models indicate Francis Marion has a larger transformative impact than Clemson even though it provides a lower economic return. Given this situation, what is the best post-secondary education decision for a black male high school graduate deciding between these two institutions?

It is possible for black males to have higher graduation rates at Clemson than Francis Marion, but that fact would be masked by the UTERM's use of averages. A better approach would be to construct multiple UTERM ranks based on group specific data. For example, one model would rank institutions based only on input and outcome data for black males. This would provide our fictional student with better data to compare their expected outcomes between Clemson and Francis Marion. This would also eliminate the bias against elite institutions based on the size of the underrepresented student population and allow for elite institutions to be ranked favorably if they are providing better outcomes for targeted student groups. Another advantage to this approach would be that it would allow an institution to apply the UTERM internally to assess if the same level of transformation is achieved by all student groups.

In a competitive funding landscape, we recognize that these ranking systems are potentially useful policy tools because they provide an objective measure to distribute limited funds and are simple models to construct for addressing complex issues. For example, increasing state level postsecondary attainment is a policy goal being adopted by many states, including South Carolina. A ranking system assessing improvements in the graduation rates of under-served groups could be developed to distribute a limited pool of funds as an incentive to improve completion rates for these students. Theoretically, the members of the target population at all institutions could benefit if each institution competes to improve their rank.

The major drawback to this type of policy approach, though, is illustrated by the No Child Left Behind policy. Under NCLB the institutions that needed the most assistance tended to receive lower scores and thereby received less funds creating a negative feedback cycle. However, reversing the funding flow, so that the lowest ranked institutions receive the most funds, could lead to an equally unproductive system whereby institutions actively remove support systems for the targeted groups to receive more funds. This thought exercise illustrates how the utilization of ranking systems in policy should be carefully evaluated before being implemented.

One final consideration is that ranking systems ignore institutional diversity by creating a standard measure in an organizational field with differing institutional missions. The comparison between Clemson and Francis Marion is again illustrative of this point, as factors leading these institutions to have different outcomes and ranks are driven partly by the different institutional missions. As a nationally ranked research institution, Clemson is focused on producing nationally competitive graduates in STEM fields. As a small comprehensive teaching institution, Francis Marion is focused on producing competitive graduates within its regional job market. Of course, there are differences in the transformative impact on students and these institution's students' social class mobility. These differences, though, are at least in part by design because they are the result of different institutional missions. Ranking systems might better strive to more directly measure differences in outcomes and treat such contextual differences in a neutral way.

While this means that the specific models we have examined here have serious limitations in their potential usefulness for policymakers, we do recognize that the development of these ranking models have highlighted student social class mobility and transformation as important institutional characteristics. Students and their families are often keenly aware of the importance of the transformative power of higher education, and the development of these models which attend to their concerns reflects that the institutional characteristics these models are working to measure have been underappreciated by at least some policymakers. In an ideal world with better data available, a simple model which developed a class mobility and reproduction map of student outcomes across each institution, in the style of Laurison, Dow, and Chernoff's (2020) Sankey diagrams, would address student concerns and be informative for others involved in higher education. Unfortunately, the accessibility data with which we can build models does not have the information needed for such maps.

While these models have substantial limitations, they have accomplished a goal of raising awareness and scrutiny over the ways in which institutions support, or not, student social mobility, and reduce risk for students from low-income backgrounds. These models also highlight the transformative power of lower-cost institutions, including regional comprehensive universities. Our examination here reveals that relatively small investments from state's into their state systems to reduce costs for the students for whom a college degree could be transformative would relieve much of their risks of default (Tandberg and Laderm (2018); Webber, 2017; and Morgan and Steinbaum (2018). Furthermore, as Kelchen and Webber (2018) highlight, many state policymakers are increasingly concerned with keeping young, well-educated adults within their state. Students at regional state comprehensive universities are also more likely to remain in the institution's region after graduation, compared to students graduating from other types of universities.

In conclusion, there are real limitations to using ranking systems in public policy because the ranks do not necessarily hold substantive value while the system engenders organizational behaviors which end up perpetuating inequalities. Hurst envisioned the model as a useful alternative for students and their parents to the dominant U.S. News and World Reports rankings. The example between Clemson and Francis Marion makes this claim doubtful as the UTERM rankings does not make it clear an under-served student deciding between the two institutions should go to the higher ranked Francis Marion instead of Clemson.

Our suggestions for policy applications of the UTERM is to use the model as a tool to identify institutions for targeted programs rather than as a tool for systemwide funding decisions. We recommend constructing variations of the model for each group of interest, rather than using aggregate factors like the LOP, and to use group specific measures for factors like graduation rates and post-graduation income rather than average measures.

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