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Accounting for Institutional Variation in Expected Returns to Higher Education

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Abstract: This study leverages human capital theory to identify the correlates of expected returns on investment in higher education at the level of institutions. We leverage estimates of average ROI in post-secondary education among more than 400 baccalaureate degree conferring colleges and universities to understand the correlates of a relatively new metric of institutional ROI. Results indicate that a diverse undergraduate student body, high graduation rate, and public university status are strong, positive, and robustly associated with institutional ROI. The model accounts for more than 70% of inter-university variation in ROI, suggesting that the factors we have identified are among the most important correlates of institutional ROI. We discuss the policy implications of these findings for institutions of higher education in the context of institutional rankings and a rapidly evolving education landscape, giving special attention to student body characteristics colleges

and universities.
Keywords: higher education; return on investment; university characteristics; human capital; educational policy

Contabilización de la variación institucional en los retornos esperados a la educación superior

Resumen: Este estudio aprovecha la teoría del capital humano para identificar los correlatos de los rendimientos esperados de la inversión en educación superior a nivel de las instituciones. Aprovechamos las estimaciones del retorno de la inversión (ROI) promedio en la educación post-secundaria entre más de 400 títulos de bachillerato que otorgan a facultades y universidades la comprensión de los correlatos de una métrica relativamente nueva del ROI institucional. Los resultados indican que un cuerpo diverso de estudiantes de pregrado, una alta tasa de graduación y el estatus de universidad pública son sólidos, positivos y están robustos asociados con el ROI institucional. El modelo representa más del 70% de la variación interuniversitaria en el ROI, lo que sugiere que los factores que hemos identificado se encuentran entre los correlatos más importantes del ROI institucional. Discutimos las implicaciones de política de estos hallazgos para las instituciones de educación superior en el contexto de las clasificaciones institucionales y un panorama educativo en rápida evolución, prestando especial atención a las características del cuerpo estudiantil de los colegios y universidades.
Palabras-clave: educación superior; retorno de la inversión; características de la universidad; capital humano; política educativa

Contabilização da variação institucional em retornos esperados à educação superior

Resumo: Este estudo aprovou a teoria do capital humano para identificar os correlatos de rendimentos esperados da cultura de investimento em educação superior. Aprovechamos as estimativas do retorno da inversão (ROI) na educação pós-secundária entre mais de 400 títulos de bachillerato que otorgam faculdades e universidades a comprensão dos correlatos de uma métrica relativamente nova do ROI institucional. Os resultados indicam que um corpo diverso de estudantes de pregrado, uma alta taxa de graduação e o estatus da universidade pública son sólidos, positivos e estão robustos associados com o ROI institucional. O modelo representa mais do 70% da variação interuniversitaria no ROI, o que sugere e os fatores que foram identificados entre os correlatos mais importantes do ROI institucional. Discutimos as implicações de política de estes salões para as instituições de educação superior no contexto das finanças e um panorama educativo em breve, prestando especial atenção às características do corpo estudantil das escolas e universidades.
Palavras-chave: educación superior; retorno da inversão; características da universidade; capital humano; política educativa

Introduction

Investigations of return on investment (ROI) in higher education have produced an empirical evidence to help scholars and policy makers understand the mechanisms that produce variation in student returns on investment in higher education. This body of scholarship closely tracks to rising interest among the general public, higher education policy makers, and scholars in the *financial* return on college education. To date, much of the ROI scholarship in higher education has investigated student-level ROI, which seeks to understand why two students, making similar investments in education, vary in the long-term benefits (returns) to investment. Research in this tradition has, for example, examined how institutional choice affects student ROI (e.g., Black & Smith, 2006; Brewer, Eide, & Ehrenberg, 1999; Long, 2010; Thomas, 2000; Zhang, 2005), the degree to which choice of major affects variation in ROI (e.g., e.g., Altonji, Blom & Meghir, 2012; Davies & Guppy, 1997; Fitzgerald & Burns, 2000), and which student-level characteristics influence student's ROI (e.g., Andrews & Lovenheim, 2012; Budig & England, 2001; Daniel, Black, & Smith, 1995; Fox, 1993; Hout, 2012; Hout, 2012; Kochhar, Taylor & Fry, 2011; Long, 2010; Monks, 2000; Pascarella & Terenzini, 2005; Thomas & Zhang, 2005). We know far less about the characteristics of institutions of higher education that produce systematic variation in student ROI.

The gap in our understanding of the determinants of ROI at the level of institutions represents a missing piece in the larger puzzle of rising education costs and the economic benefits of a college degree. One reason for the student-centric focus of prior ROI-research is that data on individuals is either readily available or easily obtained using surveys. Lack of ROI data at the level of colleges and universities has made it difficult to evaluate empirically the mechanisms that influence institutional ROI and, in turn, account for inter-university variation in average returns to student investment in higher education. Recent efforts by several organizations to develop ROI metrics allows for new investigations at the level of institutions. Two notable ranking programs include one sponsored by the US Department of Education and another developed by *PayScale*, a private compensation firm. Of the two, *PayScale*'s ranking of colleges and universities by ROI[1] has attracted considerable attention in the popular press and among universities, owing to its extensive data.

Before IHEs craft policies in response to financial rankings (as they have with other institutional rankings indices; Ehrenberg, 2005; Meredith, 2004; Monks & Ehrenberg, 1999), it is critical to consider the validity of such rankings and the mechanisms that produce inter-university variation in ROI. As yet, however, there is scant evidence concerning institutional ROI.

The purpose of the present study is to identify the student-body and institutional attributes that produce systematic variation in institutional ROI. IHEs have considerable control over a) the composition of their student body's and b) institutional policies that directly and indirectly affect student's ability to find gainful, high-quality employment following graduation. IHEs have far less control over the labor market itself, including the characteristics of college graduates that firms target when making hiring and compensation decisions or larger, macro-economic conditions such as prevailing wages and demand for labor. The labor market is not blind to the race, sex, and

[1] When we reference *PayScale*'s measure of institutional ROI we do not mean to assert that their measure accurately captures an institution's true ROI. Instead we mean an 'institution's ROI as measured by *PayScale*.' We simply assert that since *PayScale*'s measure already appears to have achieved a taken-for-granted status among many in the lay public and among many university administrators, it is important for researchers to investigate the factors impacting an institution's ranking, and the possible implications of a reliance on the metric for variety institutional outcomes.

socioeconomic background of workers and many firms target graduates based on these and related non-market considerations, such as the prestige of degree-granting institution and perceptions of institutional quality. Also, well-documented is that wage inequality among college graduates is strongly influenced by factors such as choice of major and local (e.g. state, region) labor market conditions. If we are to evaluate IHEs according to alumni ROI, it is important to understand whether ROI metrics capture real differences in IHEs ability to deliver the expected returns on investment in higher education or if such differences merely reflect back onto IHEs the inequalities embedded in the American labor market. Put another way, if ROI rankings are an error-prone measure of labor market inequalities, IHE's may suffer an ROI ranking 'penalty' for graduating non-traditional and under-represented students and for conferring degrees that do not map onto high-income occupations. If so, administrators attuned to ROI rankings might alter recruitment and admissions policies to better align their student profiles with non-market considerations embed in the labor market (Meredith, 2004; Monks & Ehrenberg, 1999). They might also reduce or eliminate degree programs associated with lower earnings without considering the larger societal benefits of such training programs. Growing evidence that institutional response to IHE rankings sometimes have unintended negative consequences give us reason to expect similar policy responses (and consequences) to ROI metrics (e.g., Clarke, 2007; Ehrenberg, 2005; Farrell & Der Werf, 2007; Machung, 1995; McDonough et al., 1998).

We leverage human capital theory to identify a large number of covariates theorized to account for ROI in higher education and we measure their bivariate and multivariate correlations with a newly available measure of institutional ROI. We propose that mechanisms at the level of students, institutions, and states stand to influence IHE-level variation in ROI. In the present research, we use a nested modelling strategy to consider a large number of these mechanisms. We also draw attention to several negative externalities associated with a reliance on such rankings. Our investigation breaks new, exploratory ground and we expect that future research will augment, enhance, and otherwise expand on the work present here. We welcome and encourage additional research to understand the mechanisms that produce variation in ROI at the level of institutions.

Background

Return on Investment in Higher Education

Seventy percent of students graduate with student debt and the average debt is roughly $30,000. Student debt is not only high but also growing: Debt levels increased 4% from 2014 to 2015 (The Institute for College Access and Success, 2016). The financial costs to attend college raise legitimate questions about student returns on investment in higher education and which universities are best equipped to deliver high ROI.

Despite rising skepticism among the public, research shows that average returns to a baccalaureate degree are positive, exceed those associated with a high school diploma, and that the gap between the earnings for high school graduates and those with a bachelor's degree continues to grow. Carnevale and Cheah (2015) report that the college wage premium over a high school diploma has risen from 52% to 54% for experienced college graduates and from 78% to 83% for recent college graduates. In contrast, earnings among experienced workers with high school diplomas ages 35 to 54 declined from $37,000 to $36,000 since 2009. Recent labor market entrants with a high school diploma have also seen their earnings decline.

Research also indicates that wages vary by choice of college, choice of major, and by the characteristics of students themselves (Carnevale & Cheah, 2015; Hout, 2012; Oreopoulos & Petronijevic, 2013; Tamborini, Kim, & Sakamoto, 2015). Choice of major is among the most

important for explaining between-college variation in the salaries of college graduates (e.g., Schneider, 2010). As Carnevale, Cheah, & Hanson (2015, p. 1) note,

> In some sense, deciding what to major in is more important than deciding whether to attend college. Over a lifetime, the average difference between a high school and college graduate's wages is $1 million, but the difference between the lowest-and the highest-paying majors is $3.4 million. Over a career, a Bachelor's degree in petroleum engineering pays $4.8 million, while a Bachelor's degree in early childhood education pays $1.4 million.

These findings highlight the financial implications of choice of college and major for long-run earnings and give reason for students to consider these and related factors when evaluating the payoff of investment in college. Students and their families are looking for additional information to help them navigate the high-stakes of college education. This has fueled interest in two newly developed metrics that evaluate institutions on ROI, include one sponsored by the U.S. Department of Education and another developed by a private-sector compensation firm.

Institutional Rankings

The ranking of IHEs on a wide range of dimensions has a long tradition and the popularity of IHE rankings persists (e.g. *U.S. News*, *Barron's*, *Peterson's*, *Fiske*, *Princeton Review*). Parents, students, and councilors pay attention to and use rankings in making their application and enrollment decisions (Hossler & Foley, 1995; McDonough et al., 1998). Institutions often view college rankings as both indicators and sources of prestige (Ehrenberg; 2005; O'Meara, 2007). While we acknowledge that IHE leaders necessarily consider many factors when making decisions such as admissions selectivity, resource investments in education and student services, and student attributes that determine the demographic makeup of their incoming classes, a growing body of evidence indicates that IHEs alter their business practices for the express purpose of improving their position in various ranking systems (Sharkey & Bromley 2015). In fact, some institutions develop rankings-specific goals, at times including such goals in departmental, college, and university strategic plans (Ehrenberg, 2005; Espinosa, Crandall, & Tukibayeva, 2014). Responding to rankings such as these is a well-documented phenomenon (Campbell, 1976) that can have direct and indirect consequences for students.

How institutions respond to rankings can impact the racial composition of incoming cohorts, student acceptance rates, the share of accepted low-income students, the average SAT scores of incoming students, and institutional spending patterns, to name a few (e.g., Clarke, 2007; Ehrenberg, 2003; Espinosa, Crandall, & Tukibayeva, 2014; Farrell & Van Der Werf, 2007**;** Machung, 1995; McDonough et al., 1998; Meredith, 2004; Monks & Ehrenberg, 1999; O'Meara, 2007; Shin, Toutkoushian, & Teichler, 2011). A key point here is that institutional rankings, including reputation, quality, and financial rankings, are often accepted by both the lay public and IHE administrations as representing real quality differences between IHEs, or as factors which might contribute to the perception of IHE quality, notwithstanding the questionable methods employed in many ratings metrics. For many university administrators, IHE rankings represent real social phenomena that warrant adjustment to university policies and practices (Espinosa, Crandall, & Tukibayeva, 2014; O'Meara, 2007).

In this research, we evaluate one such financial ranking index, *PayScale*, due to its rapid ascension within the IHE ranking industry and the extensiveness of its data. *PayScale*'s ROI rankings have been widely distributed and garnered significant attention among both news organizations and higher education scholars (e.g., Adams, 2013; Carey, 2011; Heller, 2013; *Huffington Post*, 2013; Mangan, 2013; O'Shaughnessy, 2013). Often, the *PayScale* rankings are portrayed as objective

measures of reality, garnering such headlines as: "These U.S. Colleges and Majors Are the Biggest Waste of Money" (Thompson, 2014). In fact, *Forbes*, *The Daily Beast*, and *The Chronicle of Higher Education*, to name a few, now utilize the *PayScale* ROI data as critical metrics in their institutional rankings and information tools (Noer, 2012; *The Chronicle of Higher Education*, 2013; *The Daily Beast*, 2013). The recent inclusion of measures of ROI in the Department of Education's college information system perpetuates what some observers argue is a growing emphasis on the economic value of college at the expense of non-market benefits (Carlson, 2013). For these reasons, we argue that rigorous investigation of the *PayScale* ROI index is warranted. Apart from the limitations of the *Payscale* data, which we discuss later, we view it as a useful index to develop a fuller understanding of the determinants of variation in ROI across institutions of higher education and a benchmark against which to gauge findings from research based on other institutional ROI metrics. And further, previous research has shown that the earnings data contained in the Department of Education's College Scorecard database is highly correlated with the *PayScale* data across matched schools (Kulkarni & Rothwell, 2015), suggesting that the statistical associations reported below would be broadly similar for the Scorecard data, though future work will need to confirm this assertion.

Theoretical Framework

Human capital theory posits that investments in human capital will yield significant individual and societal returns (Becker, 1993; Bowen, 1977). The central idea of human capital theory is that observed variation in post-graduation earnings by level of education reflects returns to individuals' rational investment in education. Mincer's (1974) pioneering work on the economic returns to education operated from an expanded human capital framework. Prior to Mincer, researchers attempted to tie education to earnings without accounting for other important human capital investments such as post-school investments. Mincer's earnings function has formed the cornerstone of research meant to predict returns to education and explain income inequality in the United States. Recent extensions of Mincer's work that relax key model assumptions to account for uncertainty, taxes, tuition, nonlinearity in schooling, and inseparability of schooling and work experience have further extended the explanatory power of the human capital framework (Heckman, Lochner, & Todd, 2003). Others have explored the relationship between institutional type, race, major, level of education, and earnings outcomes (e.g., Altonji, Blom, & Meghir, 2012; Bowen, 1977; Pascarella & Terenzini, 2005; Sanders & Taber, 2012; Thomas & Zhang, 2005). Most recently, postsecondary researchers have extended the traditional view of human capital theory to include the wider social, economic, and policy context in which colleges and universities operate (Perna, 2006).

Although human capital theory was formulated to explain individual-level differences in ROI, the strong linkage between the earnings of college graduates and institutional differences in the earning potential of their alumni suggest the theory can be leveraged to gain traction on the mechanisms influencing institutional variation in ROI. In his study of the determinants of student-level variation in ROI, Thomas (2000) used multi-level models that allowed him to decompose total ROI variation into an individual-level and an institution-level component. That work, which was based on surveys of recent college graduates, produced two important findings that are germane to our own investigation. First, Thomas (2000) showed that IHE-level variation in ROI was substantial and systematic, and second, student-level attributes were able to account for a sizable portion of inter-IHE variation in ROI.

We posit that variation in *institutional* ROI is primarily a reflection of economic inequalities embedded in the labor market itself, owing to the fact that institutional ROI is derived from the aggregation of individual-level, alumni data. Insofar as the labor market unequally confers wages according to a person's age, race, sex, socioeconomic background, type of degree, or university reputation, we expect that institutional ROI will similarly vary by these same characteristics when

they are aggregated into student body attributes of IHEs. Socioeconomic and demographic attributes of individuals and student choice of major are known to account for variation in labor market outcomes such as returns to educational investment. It is, for example, well-established that engineers earn more than social workers and that net of other factors, wages vary by sex and race. The literature on the determinants of economic inequality suggest that variation in the composition of the student body is a key source of institutional variation in ROI. IHEs with large female or minority enrollments might suffer an ROI 'penalty', while those conferring a large number of engineering degrees are likely to be higher ranked on economic outcomes.

One reason for caution in simply extending expectations from individual-level ROI data to data aggregated at the level of institutions involves what is referred to as the atomistic/individualistic fallacy (Alker, 1969). Researchers expose themselves to risk of the atomistic fallacy when they draw inferences about a group from information about the individuals comprising the group. The related and more widely known ecological fallacy occurs when inferences about individuals are based on observations of groups (Robinson, 1950; Selvin, 1958). Research on the individualist and ecological fallacies shows that aggregating data from a lower level (e.g. alumni ROI data) into higher-level measures (e.g. institutional ROI) changes the unit of analysis and the field of social action. What determines student ROI might be different than what determines institutional ROI because of exposure to different mechanisms, which raises the possibility that what predicts individual-level ROI either a) does not influence institutional ROI, or b) influences institutional ROI, but differs from the individual-level association with respect to either magnitude or direction. Mindful of these concerns, we next consider the student body compositional factors and institutional attributes that give rise to differences in ROI.

Compositional Factors

Student ability. Prestigious universities are able to attract a relatively larger share of high-quality students, as measured by standardized test scores such as the ACT and SAT (Cook & Frank, 1993; Geiger, 2002). Student test scores have been operationalized at two-levels of analysis in prior research: At the individual level as a measure of student ability/academic potential and at the organizational level as an indicator of institutional quality (e.g., Davies & Guppy, 1997; Fox, 1993; Long, 2010; Paglin & Rufolo, 1990; Thomas & Zhang, 2005; Zhang, 2005). In both cases, test scores were significant predictors of student ROI and/or post-graduation earnings (Davies & Guppy, 1997; Fox, 1993; Long, 2010; Paglin & Rufolo, 1990; Thomas & Zhang, 2005; Zhang, 2005). Studies of institutional quality that have investigated the relationship between SAT scores (among other measures of selectivity and quality) and graduates' earnings find a positive relationship between graduate earnings and test scores (Black & Smith, 2004, 2006; Dale & Krueger, 2002, 2014; Long, 2008, 2010). Because results vary by student characteristics such as race/ethnicity and student background, it is necessary to cleanse student test scores of other student attributes that also influence ROI (Dale & Kruger, 2014).

Family background. College graduates from low-income families earn less than graduates from high-income families, net of controls for differences in other factors associated with post-college earnings (Andrews, Li, & Lovenheim, 2012; Blanden, Gregg, & Macmillan, 2007; Davies & Guppy, 1997; Monks, 2000; Restuccia & Urrutia, 2004; Thomas & Zhang, 2005). Taken together, our review of the literature suggests that share of low-income students will be negatively correlated with IHE ROI, net of other factors.

Non-traditional students. We also consider whether non-traditional students, here defined as share of students over the age of 25, impact institutional ROI. Non-traditional students often have more life-experience and labor market experience (on account of their age) than students who

enter college directly from high school. These benefits may be attenuated by age discrimination, of which non-traditional students are at greater risk of experiencing. At least one study has found that delaying postsecondary education mutes the expected ROI (Elman & O'Rand, 2004), leading us to expect a negative association between non-traditional student share and ROI.

Race. Of particular concern for higher education policy is consistent evidence of lower earnings by black and Hispanic college graduates than their white counterparts; a finding that holds at every level of educational attainment.[2] According to the 2000 Census, white Americans with a bachelor's degree earned an average of $55,781 annually, while black and Hispanic Americans with the same level of education earned $14,500 and $13,500 less, respectively. More recent data from the Pew Research Center paints an even bleaker picture. Household wealth—defined as assets minus debts—for the typical black and Hispanic household was $5,677 and $6,325, respectively, in 2009 compared to $113,149 in the average white household during the same period (Kochhar et al., 2011). Black and Hispanic college graduates are also more likely to be unemployed than white graduates (U.S. Department of Labor and U.S. Bureau of Labor Statistics, 2011).

While black individuals are less likely to attend selective institutions despite being qualified to attend, they are more likely to graduate when they attend the most selective or prestigious institutions to which they qualify (Bowen, Chingos, & McPherson, 2009; Roderick, Nagaoka & Moeller, 2009). Even at prestigious universities, however, black students suffer a race penalty in the labor market, which may effectively neutralize the labor market advantage of attending an elite school (Gaddis, 2015).

Still, black and Hispanic Americans appear to benefit from negative selection, where those least likely to graduate from college stand to benefit the most from it (Brand & Xie, 2010). By some estimates, the increased earning potential among underrepresented minority students that can be attributed to college graduation exceeds that of white Americans (Barrow & Rouse, 2005; Brand & Xie, 2010; Long, 2010). However, black and Hispanic Americans have not yet closed the race gap in first year, annual, or lifetime earnings (Hout, 2012; Kochhar et al, 2011). We hypothesize that black and Hispanic student enrollments will be negatively associated with institutional ROI, holding other factors constant (Andrews & Lovenheim, 2012).

We also consider the impact of Asian share of student body on institutional ROI. Here we anticipate a positive relationship between the share of Asian students and institutional ROI. Asian college graduates in the United States have incomes that closely match white college graduates and often report higher household wealth than white Americans report (Kochhar, et al, 2011; U.S. Census, 2011). We expect that Asian enrollments will be associated with higher institutional ROI, ceteris paribus.

Gender. Sizable wage disparities also exist between women and men (Budig & England, 2001; Daniel, Black, & Smith, 1995; Fox, 1993; Hout, 2012; Long, 2010; Monks, 2000; Pascarella & Terenzini, 2005; Thomas & Zhang, 2005). By one estimate, women experience an earnings penalty of up to 11%, net of other factors (Thomas & Zhang, 2005). Similarly, Daniel, Black, and Smith (1995) and Long (2010) also find that positive returns from higher education are larger for men than for women. This leads us to posit that female enrollments are negatively associated with institutional ROI, c*eteris paribus*.

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[2] We use the term 'black' rather than African American because the aggregate data we analyze only identifies student in this way. Since we cannot differentiate between African Americans, Caribbean migrants, migrants from continental Africa, and the broad range of other peoples who self-identify as 'black' in these data, we are not able to make finer distinctions between racial and ethnic groups.

Choice of major. Among the most important ways that student body composition varies is with respect to the distribution of conferred degrees. Recent application of human capital theory to the returns to college education finds that choice of major is a significant predictor of future occupation, which, in turn, has a direct impact on post-graduation earnings (e.g., Altonji, Blom & Meghir, 2012; Davies & Guppy, 1997; Fitzgerald & Burns, 2000; Fox, 1993; James et al, 1989; Simpson, 2001; Thomas & Zhang, 2005).[3] Pascarella and Terenzini (2005) caution that failure to account for academic field of study could lead researchers and IHE administrators to wrongfully attribute graduate earnings to institutions rather than to a student's field-of-study preferences. For example, the STEM field degrees of science, technology, engineering, and mathematics yield higher starting salaries than degrees in the humanities and education. We hypothesize that share of degrees in high-earning fields such as engineering and science will be positively correlated with institutional ROI and that degrees in low-earning fields such as the humanities will be negatively correlated with ROI.

To summarize, we operationalize compositional characteristics of IHEs on six dimensions, including, student ability and background, non-traditional composition of enrolled students, race, sex and field of study. Student quality is here operationalized using the average of the 25th to 75th percentile SAT scores and student background is measured as the percentage of students receiving need-based federal aid in the form of Pell grants.[4] Share of student body receiving Pell grants allows us to partial out the influence of disadvantaged background (i.e. poverty) from student ability, as measured by SAT scores. The ability of prestigious schools to selectively admit exceptionally high ability students from low-SES backgrounds further suggests the need to consider student ability net of family background. Non-traditional students is operationalized as share of undergraduates over the age of 25. We measure racial composition of student body using the share of Asian, black, and Hispanic students and gender using female share of student body. Field of study is measured using the share of degrees awarded in business, engineering, humanities, and science, respectively. Detailed descriptive statistics on these and related variables are reported in Table 1.

Institutional Factors

The composition of incoming cohorts of students is one area in which IHEs have considerable room to craft institution-specific policies that directly or indirectly affect institutional ROI. Another class of attributes identified by human capital theory as it relates to financial returns on investment in higher education are the characteristics of the institutions themselves. IHE characteristics such as research intensity, selectivity, public/private status, and institution-specific patterns of expenditure have previously been shown to influence alumni returns to education.

Institutional quality. Human capital theory views the link between IHE quality and student ROI as a resource advantage that high quality institutions leverage to make strategic investments in the human capital development of their students (Thomas & Zhang, 2005). IHE quality has been measured in a number of ways, including with subjective measures of reputation and objective measures of institutional selectivity such as SAT scores, faculty salaries, and tuition and fees (Black & Smith, 2006; Brewer, Eide, & Ehrenberg 1999; Long, 2008, 2010; Thomas, 2000; Zhang, 2005). The validity of these measures has been called into question (e.g., Kuh & Pascarella, 2004; Pike, 2004) and we tend to share this skepticism. However, because the public does not fully share our

[3] See Altonji, Blom and Meghir (2012) for a comprehensive discussion of human capital investments, college major, and labor market outcomes.

[4] IPEDS only reports SAT scores at fixed thresholds such as the 25th percentile, the 75th percentile and so forth. We used the average of the 25th and 75th percentile to get as close as possible to the 'average' student SAT score.

skepticism and administrators are responsive to institutional quality metrics, we consider several of these measures in the present research. Regarding SAT scores as a measure of IHE quality, it is true that prestigious colleges and universities are able to attract high-ability students and a large literature on credentialing speaks to this vein of research. Still, it is our view that SAT scores are first and foremost a measure of student ability, especially in conditional models that account for more direct measures of IHE quality. Several other university characteristics that may function as indicators of IHE quality among prospective students and that have previously been shown to correlate with higher ROI are research intensity, being a private university, and being a highly selective university (Daniel, Black, & Smith, 1995; Fox, 1993; James et al, 1989; Monks, 2000; Schneider, 2010; Thomas 2000; Thomas & Zhang, 2005).

We measure institutional reputation using peer assessment data from the 2010 *U.S. News* college rankings survey. We identify research intensive and private universities with dummy variables (1= research; 1=private). We operationalize institutional selectivity using admission rates. While not an explicit measure of institutional quality, we also consider how size of student body affects IHE ROI, an institutional attribute previously found to influence school choice and individual ROI (Thomas, 2000). Large schools that produce many graduates have more salient 'brands' and hiring managers are more likely to be aware of large, visible schools. Size of institution is measured using the full-time equivalent (FTE) undergraduate enrollment. We expect that measures of institutional quality will be positively correlated with ROI.

Institutional policies. Among the many factors we have discussed, few are more directly within the control of IHEs than the policies they enact and education programs they administer. How an institution invests resources in student outcomes and what kinds of training programs institutions develop represent areas where IHEs have considerable influence over post-graduation outcomes such as earnings. Institutions that invest relatively more resources into academic and student support services are expected to yield relatively higher labor market placements and higher starting salaries for their graduates. We consider institutional expenditures on academic support, instruction, research, and student services, adjusted to full-time equivalent student enrollment.

Policies provide insights into the effectiveness of IHEs in meeting their core mission to provide training and confer degrees. Thus, graduation rates (when considered in conditional models) are another important factor that broadly captures the net effect of the several policies, programs, and resource investments that administrators enact. Graduation rates are thought to influence ROI through their effect on future earnings (Andrews et al, 2012; Black & Smith, 2006). When graduation rates are adjusted for student inputs, they are viewed as a reasonable proxy for how well an institution serves the students it enrolls (Scott, Bailey, & Kienzl, 2006).

Contextual Factors

Contextual factors such as prevailing wages, unemployment rates, and demand for specialized degrees have been shown to impact institutional performance and the benefits derived from college completion (Volkwein & Tandberg, 2008). Because many graduates turn first to their local labor market for employment (Perry, 2001), we expect between-state variation in labor market conditions to affect ROI, net of student and institutional factors. For present purposes, we consider state-level characteristics as 'nuisance factors' which we net out of our models using random effects regression. We encourage future research to give detailed consideration to the many time-varying state-level factors that influence institutional ROI.

Data and Methods

Dependent Variable

Our dependent variable comes from the *PayScale* "Return on Investment Data Package" (*PayScale,* 2012). *PayScale* is an online salary, benefits, and compensation information firm that uses surveys to collect a wide range of financial, education, and labor market data. The *PayScale* national survey, which collects millions of salary profiles, is the world's largest online salary survey and database.

The sample used by *PayScale* to calculate institutional estimates of ROI was restricted to full-time U.S. workers, paid either hourly or by an annual salary, who had completed a bachelor's degree at the time of the survey, in this case, by 2009, and had not earned any degree beyond a baccalaureate degree (e.g. MA, JD, PhD). Therefore, self-employed workers such as artists, small business owners, and writers, for example, were not included in the study, nor were those with advanced degrees. Based on respondent self-reports of degree granting institution, *PayScale* linked respondent data from their employee survey to IHE data drawn from the IPEDS database.

To calculate ROI estimates by IHE, *PayScale* utilized data on total earnings, excluding equity benefits and/or other benefits such as healthcare benefits and retirement savings accounts.[5] They then used IPEDS financial data to calculate the average cost of successful completion of a bachelor's degree in either four, five, or six years at each IHE, net of the cost of student tuition (restricted to in-state tuition in our sample), fees, on-campus room and board, and books and supplies. After adjusted for these costs by share of graduates completing their degree in either four, five, or six years, *PayScale* also adjusted for deferred earnings, defined as wages foregone by choosing to attend college and calculated as the difference between the median pay for a 2010 college graduate and the weighted median pay for a high school graduate. This is the estimated average student investment to attend each IHE. *PayScale* also adjusted cost to account for federal aid. From these data, *Payscale* published aid-adjusted annualized estimates of ROI for more than 600 U.S. institutions of higher education.[6] This is our dependent variable, which can be interpreted as an estimate of the average, annualized expected return on education net of financial aid and adjusted for initial investment (e.g. tuition, fees).

PayScale's rankings, and institutional ROI measures in general, have come under recent criticism, with questions being raised about the validity and generalizability of the data (see Heller, 2013). To address this concern, *PayScale* routinely compares their sample with similar national-level data collection programs such as the U.S. Census and the Bureau of Labor Statistics, and reports no systematic bias in their data when comparing information for workers with similar traits. *PayScale* reports, for example, that samples sizes of data for each institution in their database is proportional to the actual size of the schools (Bardaro, 2012) and that when matched on a wide range of student attribute data contained in *Integrated Postsecondary Education Data System* (IPEDS), the correlation between the *Payscale* data and IPEDS data for the same set of schools is 0.85. *PayScale* reports similarly high agreement to the IPEDS data on share of students by degree field (Bardaro, 2012).

PayScale does not release their respondent level data, which precludes independent validation of the original survey data. Researchers at the Brookings Institution compared the *PayScale* earnings data to similar earnings data from the American Community Survey and concluded that "the

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[5] The *Payscale* data do skew slightly younger and more white-collar than the U.S. workforce, which is to be expected since their sample only includes college graduates (Bardaro, 2012).

[6] Branch campuses are included when they appear in each of the *PayScale*, IPEDS, and *U.S. News and World Report* data sets.

correlation between bachelor's degree holders from *PayScale* and median salaries by major for workers in the labor force from the Census Bureau is 0.85 across 158 majors matched between the two databases" (Rowell & Kulkarni, 2015, p. 9). The *PayScale* data have also been shown to strongly correlate with ROI measures derived from different samples, methods, and ranking organizations such as the LinkedIn employee earnings data (Rowell & Kulkarni 2015). These findings give us reason to believe *PayScale* ROI data are reasonably accurate measures of college and university ROI. Advantages of the *PayScale* data over the College Scorecard data are that the College Scorecard data only report earnings for students that received federal aid, which means that data on roughly one-half the college student population is excluded from the College Scorecard database. The College Scorecard data also do not distinguish between main campus and branch campuses, instead aggregating all branches.

Although the *PayScale* data are not an error-free measure of institutional ROI—like similar measures, they contain errors of measurement and errors attributable to poor coverage (Groves, 2004)—they still warrant investigation for three reasons. First, the general public believes ROI is important and that it is one of the factors they should consider when evaluating schools. Second, higher education decision-makers believe these rankings matter. Members of the general public and administrators often act in ways that suggest they accept the *PayScale* index as an accurate reflection of objective reality. The same can be said about the other institutional rankings (Hossler & Foley, 1995; McDonough et al., 1998; O'Meara, 2007). Insofar as any rank ordering of IHEs is accepted as true by a large segment of society, it has the potential to influence the beliefs and behaviors of individuals and organizations (Campbell, 1976; Sharkey & Bromley 2015), suggesting that ROI rankings are a source of cultural and institutional change in higher education (Campbell 1976). And third, until better data become available, the *PayScale* data allow us to develop models and test hypotheses concerning the determinants of institutional ROI.

We caution against generalization of our results to other populations such as U.S. workers or all degree holders or to other measures of institutional ROI. Our data are limited to alumni who completed their degree and to colleges and universities that award the baccalaureate degree. We expect that results might be different if two-year colleges were considered or if part-time workers or advanced degree earners were factored into institutional ROI. Future research should explore alternate measures of institutional ROI, but for present purposes, limiting ourselves to full-time workers with a terminal baccalaureate degree and to baccalaureate degree-granting institutions allows us to more closely approximate like-with-like comparisons.

Independent Variables

We use 2010 data for all reported independent variables in order to calibrate our data with the *PayScale* ROI data. Except for the *U.S. News* reputational data, all compositional and institutional data were drawn from IPEDS, the most comprehensive source of institution level data on U.S. IHEs. IPEDS is a compilation of a large number of institutional surveys, most of which are administered annually. Cleaning and matching the *PayScale* and independent variables data, coupled with the removal of a small number of influential observations (n=19), resulted in listwise complete measurements for 441 IHEs, nearly all of which are main campuses, as opposed to branch campuses.[7] Distributional analysis of the independent variables showed that several were highly skewed. To facilitate hypothesis testing, these variables were log-transformed and are duly noted in

[7] Branch campuses that did not have complete data were not included in the analytical sample. In a few instances main campuses' financial data also reflect the finances of a number of their branch campuses. This fact does not appear to impact our results; however, it does represent a limitation of the IPEDS data.

the reported results. Our descriptive statistics, list of variables, and data sources are reported in Table 1.

Table 1
Descriptive statistics and data sources

Measures	Mean	Std. Dev.	Min	Max	Source
Dependent variable					
Net ROI with aid (%)	10.6	1.8	5.7	17.5	*PayScale*
Compositional factors					
SAT average (25-75th percentile)	1086	121.0	580	1445	IPEDS
Pell grant (% of students receiving)	28.6	11.1	6.0	74.0	IPEDS
Non-traditional students (%)	16.3	12.1	0.1	76.4	
Asian students (%)	5.2	6.7	0.0	49.0	IPEDS
Black students (%)	10.6	15.6	0.0	95.0	IPEDS
Hispanic students (%)	6.9	8.0	0.0	64.0	IPEDS
Female students (%)	55.9	7.7	25	100	IPEDS
Business degrees (%)	20.1	9.1	0.0	65.4	
Engineer degrees (%)	5.0	7.9	0.0	61.3	IPEDS
Humanities degrees (%)	10.9	6.5	0.0	56.7	IPEDS
Science degrees (%)	8.4	5.0	0.0	36.3	IPEDS
Institutional factors					
Admission rate (%)	66.4	16.7	11	100	IPEDS
Private college/university	0.34	0.5	0.0	1.0	IPEDS
Reputation	2.9	0.5	1.8	4.7	*US News & World Report*
Research college/university	0.26	0.4	0.0	1.0	IPEDS
Full-time equivalent (FTE) undergraduate enrollment	8.9	0.8	7.2	10.9	IPEDS
Expenditures per FTE, Academic support ($)	2.1	1.3	0.5	7.6	IPEDS
Expenditures per FTE, Instruction ($)	2.8	5.0	0.0	44.7	IPEDS
Expenditures per FTE, Research ($)	9.4	4.8	3.1	36.9	IPEDS
Expenditures per FTE, Student services ($)	2.4	1.5	0.3	9.8	IPEDS
Graduation rate (%)	58.0	16.5	11	96.0	IPEDS

Note: Reported descriptive statistics are based on listwise complete data (n=441).

Analysis Strategy

Our primary focus is the factors over which IHEs have some level of control, but the data and prior research (Rowell & Kulkarni 2015; Zaback, Carlson, & Crellin, 2012) show considerable state-level variation in returns to higher education. After adjusting for financial aid, for example, the average ROI of IHEs in Delaware was 13.1%, while the average ROI across measured IHEs in Arkansas was 9.8% (see figure 1, panel b). We deployed random effects regression models with robust standard errors to account for unmeasured, time-invariant characteristics of states and within-state clustering of errors among IHEs. This strategy allowed us to directly measure compositional and institutional factors, while also accounting for within-state dependence among IHEs. In unreported analysis, we also estimated: a) OLS models with robust standard errors and state-level dummy variables and b) fixed effects models, also with robust standard errors. Model parameters, including coefficients and standard errors, were substantively equivalent, but a Hausman test showed that the random effects model was preferred over the fixed effects model.

The random effects regression equation (1) models IHE-specific predictions of ROI (Y_{ij}) as a function of the mean ROI (β_0), a vector of covariates ($\beta_1 x_{ij}$) and measurement error partitioned into a between-state term (u_{ij}) and a within-state term (ε_{ij}). Note that the equation includes the subscript, *j*, which identifies states, and an additional term, α_i, that captures all stable characteristics of universities. Thus, IHEs (*i*) are nested within states (*j*) and we are able to hold constant a large number of unmeasured, invariant factors that may be associated with variation in ROI across IHEs.

$$Y_{ij} = \beta_0 + \beta_1 x_{ij} + \alpha_i + u_{ij} + \varepsilon_{ij} \quad (1)$$

We remind readers that statistical models based on observational data such as those used in this research are unable to identify causal mechanisms. The nature of our data (cross-sectional and institutional) do not allow us to fully rule out alternative explanations. Therefore, the results we present here should not be interpreted as causal relations, but rather, as *associations* between the dependent and independent variables.

Results and Discussion

Descriptive Analysis

Descriptive analysis of these data reveal substantial variation in ROI across U.S. colleges and universities (see Figure 1, panel a). Leading institutions have annualized ROI values in excess of 15%, while lagging institutions have ROI values below 7%. Variation in ROI is patterned by state, where, for example, the average ROI among IHE's in Delaware, Virginia, Wyoming, Utah, and Arizona is equal to or greater than 12% (Figure 1, panel b). The average ROI of IHEs in states such as Arkansas, Hawaii, South Dakota, and Alabama is below 10%. Such state level variation is also patterned by region, where all but three southern states (South and North Carolina and Virginia) have an average ROI value at or below the sample mean, compared to 12 non-Southern states with average ROI above the mean.

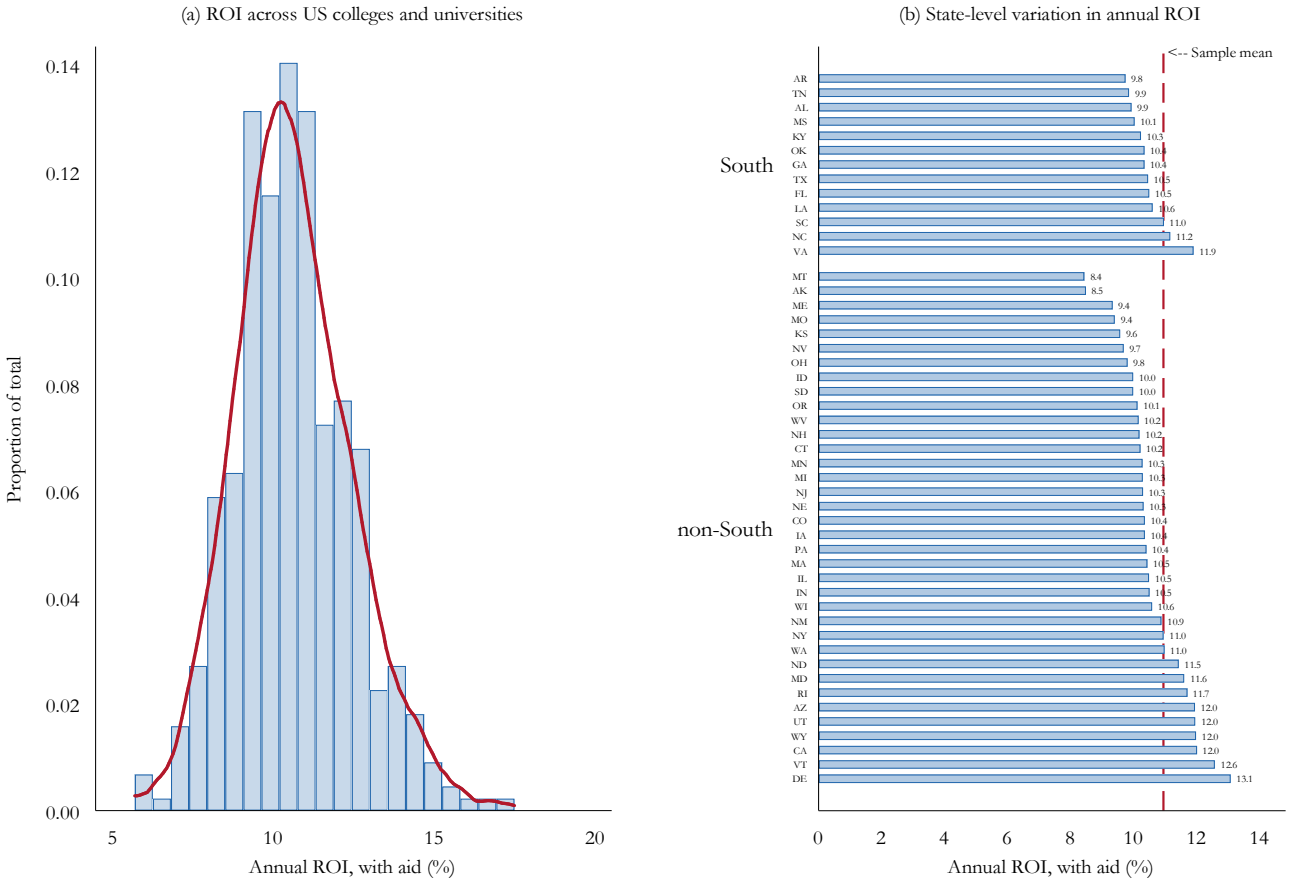

Figure 1. Distribution of average returns to investment in higher education (ROI) across U.S. colleges, universities, and states

Note: ROI estimates the average annualized returns to investment in higher education of graduates from each institution, adjusted for financial aid and costs (e.g. tuition, fees). Line in panel a is the kernel density estimate. State bars are sorted by ROI. *N*=441.

Inspection of select attributes of the highest and lowest ROI schools in our samples (reported in Table 2), show that low-ROI schools share a number of common characteristics. In terms of the student-body composition, the lowest ranked IHEs in our study have a disproportionally high share of minority, non-traditional, and low-income students (as indicated by the share of students receiving Pell grants). None of the top-ranked schools listed in Table 2 had Pell grant rates in excess of 35% of the student body, compared to an average of 53% among the lowest ranked schools. Expenditures on instruction per full-time student (FTE) was greater than $10,000 in all of the top-ranked schools, but exceeded $10,000 in only two of the bottom ranked schools. Another feature of IHEs that varied considerably by the top and bottom ranked schools was graduation rates: each of the top 10 schools had graduation rates in excess of 75%; all but one of the lowest ranked schools (Cedarville University) had graduation rates below 50%. Five of the 10 lowest ranked IHEs were private universities, while none of the 10 highest ranked IHEs were private schools. These differences provide some indication as to the correlates of ROI and foreshadow results of the multivariate analysis that we report and discussion below.

Table 2
Select characteristics of highest and lowest ranked colleges and universities

		ROI (%)	Black (%)	Pell Grants (%)	Non-trad (%)	Enginr. degrees (%)	Grad Rate (%)	FTE Expend Instruct. ($1000s)	Private	Southern State
Highest (ranked) IHEs										
(1)	U of Virginia-Main Campus	17.5	8	11	7	11	93	14.6	No	Yes
(2)	Georgia Institute of Technology-Main Campus	16.5	6	16	4	57	79	11.5	No	Yes
(3)	College of William and Mary	16.1	7	11	2	0	91	11.6	No	Yes
(4)	U of North Carolina at Chapel Hill	15.3	11	18	5	0	85	24.7	No	Yes
(4)	North Carolina State University at Raleigh	15.3	8	20	10	23	73	12.0	No	Yes
(6)	U of California-Berkeley	15.2	4	32	6	11	90	15.0	No	No
(6)	Texas A&M -College Station	15.2	3	19	3	16	80	14.5	No	Yes
(8)	U of California-San Diego	15	2	40	7	12	84	17.6	No	No
(9)	U of California-Los Angeles	14.7	4	34	6	7	89	30.7	No	No
(10)	U of Florida	14.6	10	28	5	12	82	14.8	No	Yes
Lowest (ranked) IHEs										
(432)	Norfolk State University	7.2	88	60	26	7	31	7.2	No	Yes
(434)	Grambling State University	7.1	88	67	16	3	30	6.1	No	Yes
(434)	Jackson State University	7.1	95	74	39	5	47	7.3	No	Yes
(434)	Friends University	7.1	9	40	51	0	35	5.2	Yes	No
(434)	Lee University	7.1	4	31	12	0	48	5.4	Yes	Yes
(437)	Cedarville University	6.9	2	22	2	7	70	10.1	Yes	No
(438)	Texas Southern University	6.8	89	69	29	3	11	9.8	No	Yes
(439)	Clark Atlanta University	5.9	90	65	4	1	43	7.1	Yes	Yes
(440)	Chicago State University	5.8	85	72	56	0	14	10.4	No	No
(441)	Lindenwood University	5.7	9	30	32	0	44	3.1	Yes	No

Note: Rankings are based annual ROI, adjusted for aid and cost. Data are listwise complete and represent the colleges and universities included in reported analysis.

Model Results

Table 3 reports regression coefficients and standard errors as follows: Column one reports the bivariate relationship between ROI and each independent variable (model 1); columns 3 and 4 report the joint-effects of all compositional and institutional variables, respectively, and column 4 reports model parameters for a fully specified model that includes all compositional and institutional variables. [8]

Bivariate Correlations

With few exceptions, the bivariate correlations align with expectations from prior research. Except for share of humanities degrees and Hispanic share of students, all compositional coefficients were statistically significant and in the expected direction: SAT scores (+), Pell grants (-), non-traditional share (-), Asian share (+), black share (-), female share (-), business degrees (-), engineering degrees (+), and science degrees (+). Bivariate correlations for institutional factors largely conformed to our expectation that high-quality institutions have above average ROI, with one exception: In these data, private university status had an unconditional, negative correlation with IHE ROI, which runs counter to prior research (see, for example, Thomas, 2000). Targeted investments in areas such as student learning and instruction are positively correlated with ROI, though academic support expenditures was not statistically significant.

Multivariate Correlations

The composition of the student body that IHEs assemble have substantial bearing on the aggregate return on investment of their graduates. Collectively, variables measuring student body attributes explain 59% of the variation in ROI across more than 400 American IHEs (column 2). When measures of student body composition were jointly estimated, changes in association between ROI and student body variables over the bivariate correlations were often substantial. Net of other student body attributes, coefficients for five variables that were statistically significant in the bivariate models, including SAT scores, non-traditional students, black share of student body, and share of degrees in business and the humanities were no longer significant. After controlling for other student body characteristics, the negative effect of student background decreased by 63% and the gender coefficient decreased by 77%. Adjusting for other student body attributes, the coefficients increased for Asian students (350%), engineering (217%) and science degrees (220%). Results in column 2 show that holding constant many other attributes of student body composition, share of STEM degrees is positively correlated with ROI, but awarding humanities and business degrees are not. Minority student body share, here measured by share of black and Hispanic students, is unrelated to IHE ROI once other factors, such as choice of degree, family background, and student ability, are held constant.

High quality, effective institutions (e.g. graduation rates) that make relatively large, strategic investments in student outcomes tend to have higher ROI scores than lower quality institutions making fewer investments (column 3). Collectively, variables measuring institutional characteristics accounted for 66% of inter-university variation in annual ROI. Four variables that showed a robust, statistically significant correlation with ROI were private institutions, graduation rates, student body size, and expenditures per FTE on instruction. After controlling for other measures of institutional quality, private schools deliver, on average, a roughly 1.2% lower annual return on investment than

[8] Inspection of variance inflation factors (VIF) offered no evidence of significant multi-collinearity among the variables.

public schools. A 1% increase in graduation rate was associated with a 0.076% increase in expected ROI. Column 3 results also indicate that after controlling for many other institutional variables, neither university reputation nor selectivity were related to ROI in these data.

Column 4, which reports joint estimates for all compositional and institutional factors, indicates that coefficients for just seven of 21 variables were beyond chance occurrence. Student compositional factors that were robust to the presence of other covariates included engineering and science degrees (+), non-traditional and Asian share of student body (+), and female share of student body (-). Institutional variables that were robust to the presence of other covariates in the full model included graduation rates (+) and private research university status (-). In combination, compositional and institutional variables explained 75% of the variation in ROI.

We can draw several conclusions from these model results. First, and perhaps not surprisingly, IHEs that award a large share of degrees in STEM fields such as engineering and science produce higher average returns to student investment in higher education and this return is robust to the presence of a large number of controls. Although differences in ROI by major are well-documented in student-level studies (e.g., Thomas & Zhang, 2005), our analysis, based on different data, reached the same conclusion using an institutional measure.

Second, the data suggest that student body diversity is not itself associated with lower institutional ROI, once other factors are held constant. On the contrary, the enrollment of non-traditional, black, and Hispanic students is a net positive to institutional ROI, though only in the case of non-traditional students was the correlation significant. If the unconditional negative coefficients for black and Hispanic student share was capturing a 'race' effect, then we would expect the correlations to remain negative and significant in the presence of other variables. Instead, once we accounted for other characteristics of student body composition, the coefficient for minority student slope was eliminated or reversed. Results offer empirical support to the minority student selection hypothesis, whereby black students tend to under match with quality IHEs (Bowen et al, 2009; Roderick et al, 2009). These findings should give pause to college diversity skeptics, at least on financial grounds, since the data show generally positive, conditional returns to students who attend racially diverse schools.

Third, the inclusion of compositional and institutional control variables reduced the correlation between ROI and female share of student body by more than 70%. While still negative and statistically significant, the correlation is far less consequential to expected returns on investment in education than a number of other factors. Future research is needed to further understand the mechanisms by which the gender composition of student body influences institutional ROI, but we propose a least one avenue that warrants further investigation. In unreported analysis, we included an additional term that measured the interaction between female share and engineering degrees: the interaction term was significant and negative. Further investigation pointed to engineering schools and engineering intensive IHEs, which appear to magnify the twin effects of lower female earnings and higher engineering degree earnings, relative to investment in higher education.

Fourth, university efforts to recruit the brightest and richest of students, here measured by SAT scores and share of students with Pell grants, do not appear to translate into higher institutional ROI. Neither correlation was robust to the presence of additional control variables. This is important because there is a perception that SAT scores are a powerful and reliable indicator of student quality (Grissmer, 2000), which, in turn, is believed to enhance ROI. If it were purely an issue of student 'quality', the SAT score would have remained positive and statistically significant even in the presence of other control variables. This scenario was not born out in the data.

Fifth, in terms of student returns, investments in student services, research activities, instruction, or academic support do not appear to have a meaningful effect on ROI. Our model

results indicate that a better way to ensure that student investments in higher education yield meaningful returns is to maintain a laser focus on graduation rates. Policies, programs, and strategic investments aimed at maintaining or enhancing graduation rates is a promising area for administrators interested in improving their institutional ROI ranking. Institutions with high graduations are far more likely to be found at the top of the ROI rankings than those that fail to see their students through to graduation. It is possible that targeted investments have indirect effects on ROI by way of higher graduation rates, but further research is needed to know if this is the case.

These findings highlight a larger point, which is that traditional measures of institutional quality such as reputation, selectivity, and being a research university have little relationship with *PayScale* institutional ROI rankings, once other factors are conditioned out of the models. A simple scan of the published *PayScale* rankings would tell the opposite story and lead to faulty assumptions.

Table 3.
The correlates of institutional returns to investment in higher education (ROI), random effects regression

	(1)	(2)	(3)	(4)
	Bivariate Corr	Compositional	Institutional	Comp + Inst
Compositional factors				
SAT average (25-75th perc)	0.009***	0.002	..	-0.001
(se)	(0.001)	(0.001)	..	(0.001)
Pell grant (% receiving)	-0.087***	-0.032*	..	-0.013
(se)	(0.012)	(0.014)	..	(0.012)
Non-traditional student share (%)†	-0.069***	-0.162	..	0.266*
(se)	(0.005)	(0.109)	..	(0.118)
Asian student share (%)†	0.150***	0.675***	..	0.438***
(se)	(0.030)	(0.173)	..	(0.108)
Black student share (%)†	-0.043***	0.087	..	0.145
(se)	(0.009)	(0.148)	..	(0.120)
Hispanic student share (%)†	-0.011	0.077	..	0.206
(se)	(0.009)	(0.124)	..	(0.118)
Female student share (%)	-0.120***	-0.028**	..	-0.024*
(se)	(0.019)	(0.011)	..	(0.010)
Business degrees (%)†	-0.048***	-0.202	..	0.028
(se)	(0.008)	(0.146)	..	(0.118)
Engineering degrees (%)†	0.106***	0.336***	..	0.300***
(se)	(0.019)	(0.077)	..	(0.060)
Humanities Degrees (%)†	-0.044***	-0.120	..	-0.097
(se)	(0.011)	(0.093)	..	(0.106)
Science degrees (%)†	0.152***	0.486***	..	0.215*
(se)	(0.018)	(0.109)	..	(0.108)

Table 3. (cont.)
The correlates of institutional returns to investment in higher education (ROI), random effects regression

	(1)	(2)	(3)	(4)
	Bivariate Corr	*Compositional*	*Institutional*	*Comp + Inst*
Institutional factors				
Admission rate (%)	-0.036***	..	-0.005	-0.002
(se)	(0.007)	..	(0.005)	(0.004)
Private institution	-0.625**	..	-1.170***	-1.392***
(se)	(0.227)	..	(0.255)	(0.293)
Reputation	1.883***	..	0.139	-0.044
(se)	(0.169)	..	(0.198)	(0.133)
Research university	2.380***	..	0.134	0.116
(se)	(0.151)	..	(0.201)	(0.150)
Size of student body/FTE†	1.127***	..	0.439*	-0.124
(se)	(0.103)	..	(0.172)	(0.127)
Exp/FTE, Academic support ($)	0.050	..	0.024	-0.070
(se)	(0.082)	..	(0.109)	(0.074)
Exp/FTE, Instruction ($)	0.197***	..	0.055**	0.014
(se)	(0.027)	..	(0.017)	(0.015)
Exp/FTE, Research ($)	0.166***	..	-0.019	-0.020
(se)	(0.020)	..	(0.026)	(0.021)
Exp/FTE, Student services ($)	0.500***	..	0.026	0.008
(se)	(0.048)	..	(0.055)	(0.044)
Graduation rate (%)	0.076***	..	0.071***	0.086***
(se)	(0.006)	..	(0.007)	(0.010)
Intercept	..	9.518***	2.798	7.483***
Model R^2	..	0.590	0.663	0.752

Note: * $p<0.05$, ** $p<0.01$, *** $p<0.001$ Dependent variable is annualized ROI, adjusted for aid and costs. Models derived from random effects regressions to account for state-level variation in ROI. Robust standard errors employed. Expenditures variables were rescaled to (expend/1000) to facilitate interpretation of coefficients. † identifies log transformed variables. *N*=441.

Which factors matter most for explaining inter-IHE variation in ROI? To answer this question, we report standardized coefficients (betas) derived from column 4 of table 3 in the form of an 'effect tree' (Figure 2). Standardized coefficients are listed in ascending order of absolute size, such that the weakest correlations are at the top of the tree and the strongest correlations are at the bottom. Graduation rates (.792) had the largest conditional correlation with institutional ROI, followed by private university status (-0.365). Asian (0.189), engineering (0.182), and non-traditional student shares (0.120) also had relatively large effect sizes. From a policy perspective, if university administrators wish to improve their ranking on the *PayScale* ROI list, our analysis indicates that attention to graduation rates, increases in STEM degree conferrals, and diversifying the student body will bring the largest gains. Of course, these are conditional results that assume IHEs are able to enroll similar quality students and that graduates enter uniform labor market conditions (similar wages and employment rates, for example). This also assumes that the only, or at least the primary, outcome that matters for a college education is earnings. We are not advocating for such a narrow definition of 'returns' to investment in higher education.

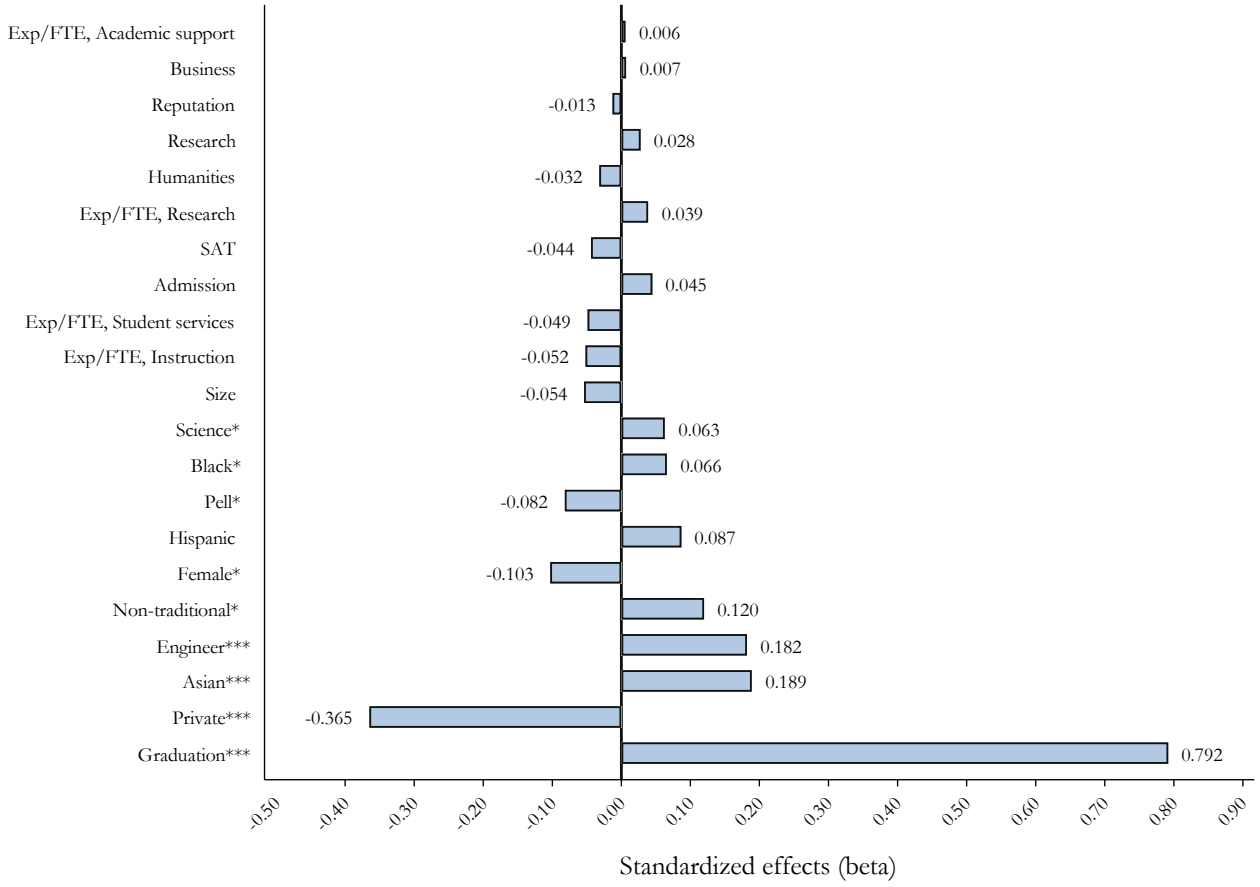

Figure 2. Conditional, standardized effects
Note: Standardized effects (betas) are derived from Table 3, Model 7. Asterisks denote significance levels (* $p<0.05$, ** $p<0.01$, *** $p<0.001$.)

The accuracy of the model in reproducing the observed values of ROI can be seen in Figure 3, where we regressed the observed values of ROI on predicted values derived from the full model (model 4 of table 3). Figure 2 also identifies a number of schools that either under-performed or over-performed, relative to the model prediction, which we defined as schools with an absolute deviation from their predicted ROI in excess of 2%. Insofar as ROI is a positive attribute of universities, 10 schools, spanning the full spectrum of the ROI distribution (low, medium, and high ROI values), stand out. In our sample of 441 schools, the University of Virginia not only had the highest observed ROI, but also the largest positive deviation from the model prediction. The College of William and Mary, UNC Chapel-Hill, Washington and Lee University, Brigham Young University, and Louisiana Tech University each had above average ROI and better than expected ROI, based on the variables accounted for in our models. Among schools with below average ROI, NC Central University, McNeese State University, Florida A&M University, and Winston-Salem State University also substantially outperformed the model expectations. Future research that investigates the policies, programs, and other factors at these and similar 'over-performing' schools to understand the causes of above average ROI values, net of factors we have measured in the present research, might provide further insights into the mechanisms that enhance institutional ROI. Similar investigations of schools that performed worse than model predictions is another promising area of future research. Some internal college and university practices that warrant further consideration include how career counseling, internships, and job placement programs impact an institution's *PayScale* ROI score (e.g., Day & Cruzvergara, 2014). Another would be to investigate whether college and university practices such as financial aid programs and faculty and student engagement, which have been shown to positively impact graduation rates, indirectly improve institutions' *PayScal*e rankings (e.g., Bowen, Chingos, & McPherson, 2009; Kuh, et al, 2011). While this current study was unable to examine such questions, future research, utilizing different data, might undertake such investigations.

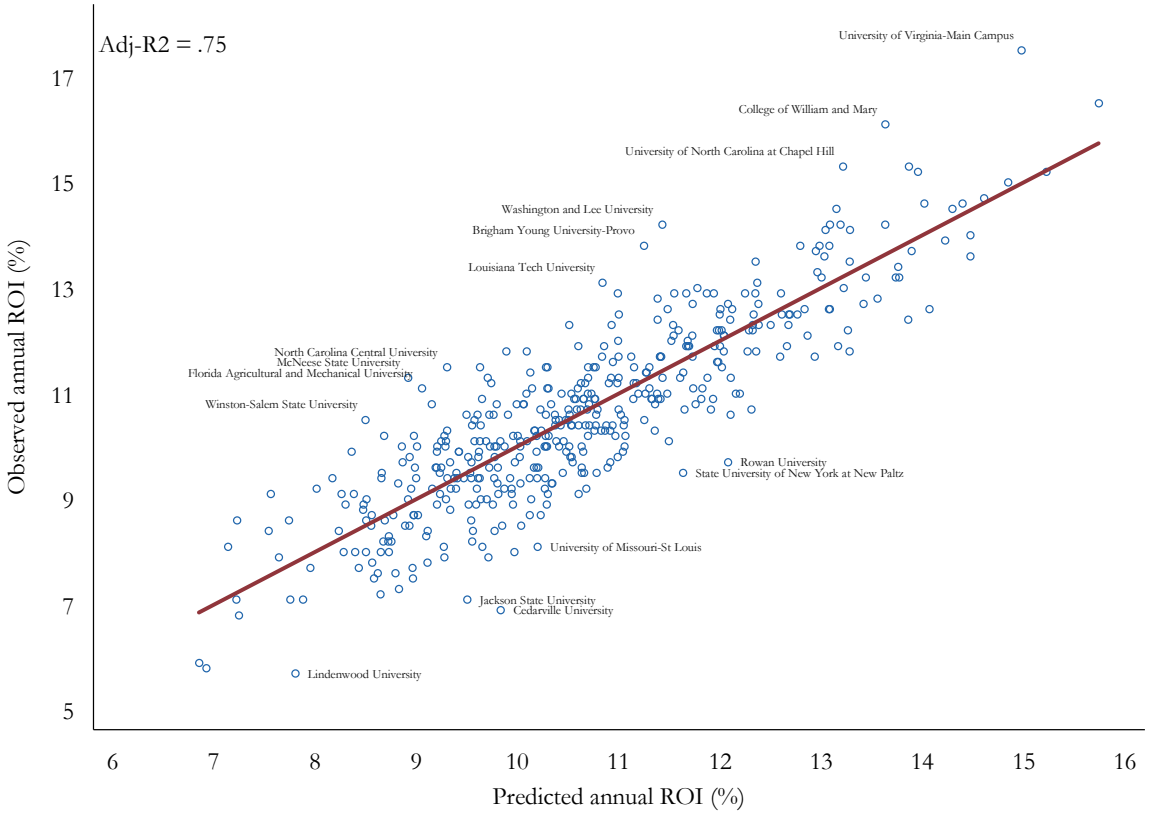

Figure 3. Relationship between observed and predicted ROI
Note: Predicted values are derived from Table 3, Model 7. Labeled schools identify top over and underperforming schools, measured as absolute different between observed and predicted ROI (<-2, >2).

Conclusions

This study proposed and tested a model of institutional variation in returns to higher education to account for a large number of variables theorized to influence institutional ROI. Using college rankings data on *PayScale's* institutional ROI in postsecondary education for 441 four-year colleges and universities, our analysis identified several variables that are associated with an institution's *PayScale* ROI ranking.

While previous research on ROI has focused on individual returns on investment in higher education, the work presented here is among the first that we are aware to explicitly analyze institutional ROI. Similar to past research on institutional rankings, our study complicates the ROI ranking. Institutional rankings are impacted by numerous factors beyond the simple metrics included in many rankings (Altbach, 2006; van der Wende, 2008). We found an unconditional negative association between under-represented share of student body and returns to education. After controlling for other factors, our analysis indicates that diverse student body is, in many respects, a net positive for ROI (or at least, not a net negative). These findings have important theoretical and practical implications and appear to provide additional support for Brand and Xie's (2010) negative selection hypothesis.

We also found that institutional ROI is more strongly associated with college graduation rates than any other variable we considered. In some ways, these data suggest competing conceptualizations of what it is that IHEs do. Do they *attract* good students or do they *produce* good students? IHEs placing heavy emphasis on student inputs and IHE rankings appear to believe that student quality determines institutional rank. IHEs that focus resources on education investments, student retention, and career placement appear to be somewhat more self-deterministic in their mission to educate students. Our results suggest that both IHEs and students would be better served by institutional policies focused on producing quality graduates from diverse backgrounds, rather than further investments aimed at attracting students with high SAT scores.

Our research offers potential explanations for *why* colleges vary in ROI. The unconditional correlations represent what is actually happening, while the conditional models simply point to the counterfactual conditions that would be necessary to achieve IHE parity in ROI. For example, it *is* the case that colleges with large shares of minority students have, on average, lower ROI than IHEs with few minority students, but this does not mean that the school itself delivers a lower ROI, since the labor market systematically underpays minorities. In the case of black students, it appears that black students disproportionally enroll in colleges with less favorable institutional characteristics (Brand & Xie, 2010). Our conditional models suggest a similar story for institutions that enroll an above average share of non-traditional students. This phenomenon is a critical policy issue with significant implications for long-term patterns of inequality in American society. Previous research shows that minority students perform better when they attend the most selective institutions to which they qualify (Bowen et al, 2009; Melguizo, 2010; Roderick et al, 2009) and that racial stratification by institutional selectivity is a durable feature of contemporary America (Massey et al, 2002). In light of these findings, our results should motivate institutional leaders and state and federal policymakers to think creatively about policies and practices that increase minority student enrollments while simultaneously improving retention and graduation rates. ROI rankings that fail to account for IHE variation in student profile wrongly attribute wage inequalities stemming from structural disadvantage in the labor market to IHEs in the form of relatively lower ROI scores.

Implications for Policy

This research points to several potentially rich applications to higher education policy. Institutional leaders must consider many factors when making policy decisions and are likewise potentially influenced by factors exogenous to the institutions they lead (Sharkey & Bromley, 2015). College and university rankings are one such outside influence. The widely documented influence of college and university rankings on IHE behaviors indicate that greater attention to the reliability, validity, and determinants of emergent IHE league tables such as the *PayScale* rankings is needed (e.g., Clarke, 2007; Ehrenberg, 2003; Espinosa et al, 2014; Farrell & Der Werf, 2007; Machung, 1995; McDonough et al., 1998; Meredith, 2004; Monks & Ehrenberg, 1999; O'Meara, 2007; Shin, Toutkoushian & Teichler, 2011).

The findings from our study suggest that these rankings ought not to be taken at face value. Institutional ROI is impacted by a number of factors, many of which are obscured by the *PayScale* metric. Some institutions have lower ROI scores not because they fail to deliver on their mission to educate and otherwise prepare students for the labor market, but rather, because they train students with characteristics that are penalized in the American labor market (e.g. race, sex, family SES) or at least unequally rewarded (e.g. teacher salaries *vis-a-vis* engineer salaries). Basing policy on raw rankings or unconditional associations might not be in the best interest of schools, students, or society. We think ranking *institutions* on concepts such as ROI are more useful when considered net

of factors such as the structural disadvantage that some groups experience and differences in the earnings of occupations.

Regarding potential applications for higher education policy and practice, we briefly discuss three such areas, including the enrollments of under-represented and non-traditional students, graduation rates, and state funding of higher education. These policy areas are prevalent within the higher education community and our findings should reinforce such efforts and give institutional leaders confidence that in pursuing such goals they stand to benefit from a *PayScale* ranking bonus.

All things equal, institutions do not appear to suffer a rankings penalty for enrolling underserved student groups, so long as the IHE is attuned to graduation rates and the distribution of degree-conferrals by occupational earnings. Between 2004 and 2014 enrollments of students age 25 and over increased by 16% (NCES, 2016). Students over the age of 25 now comprise 40% of undergraduate students in postsecondary education (Taliaferro & Duke-Benfield, 2016). These students represent a large and growing population and, according to our analysis, contribute to an ROI premium for institutions.

While Asian students enroll in postsecondary education at rates exceeding white students, black and Hispanic enrollment rates continue to lag (NCES, 2010). Current policies that warrant continued support might include affirmative action policies that allow for some level of preference for minority students in admissions decisions and institutional, federal, and state programs that seek to overcome the many barriers underrepresented students face throughout the college enrollment process (e.g., lack of awareness, inadequate advising, inadequate academic preparation, and cost). Examples of programs that address these barriers include federal programs such as GEAR UP, the Pell Grant, Upward Bound, and other similar state and institutional programs. However, many of these programs suffer from scarce resources and challenges with program implementation (Field, 2011; Harkin, 2012). At a time when legislative and judicial action is aggressively rolling back affirmative action laws and policies even in the face of the accumulated evidence of broad educational benefits to students (AERA, 2012), the results presented here provide additional empirical support for the preservation of such policies.

Institutional leaders and state policymakers concerned about their *PayScale* ROI ranking should re-evaluate policies and practices that influence graduation rates. Among the most important social goals of higher education is to facilitate social mobility of each new cohort of students. We propose that evaluation of schools according to ROI are most useful when considered after controlling for student background. To do otherwise would be to encourage regressive diversity policies. Financial aid, approaches to student advising, student employment, whether a student lives on campus, student and faculty engagement, and a host of other factors impact college graduation rates and are, to a greater or lesser extent, within the control of state policymakers and institutional leaders and faculty (e.g., DeAngelo et al, 2011; Kuh et al, 2011; Oseguera, 2005; Oseguera & Rhee, 2009; Scott, Bailey & Kienzl, 2006; Spradlin et al., 2010; Tinto, 2012; Titus, 2006a, 2006b; Ziskin, Hossler & Kim, 2009). Based on the results presented here, attention to student graduation rates is likely to yield higher dividends in institutional ROI than would attempts at increasing institutional reputation and other common indicators of institutional quality.

Finally, both descriptively and in our inferential models, public institutions tend to perform well on the ROI rankings. This may largely be due to the public subsidies they receive which help keep the cost of in-state student tuition low. In an era of decreased state appropriations to higher education, and a larger privatization movement (Lyall & Sell, 2006), efforts by lawmakers to maintain public subsidies, and to place downward pressure on tuition and fees, will likely have positive impacts on institutional ROI rankings, but more importantly, on the students who invest in higher education.

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