From Flagship to Firm: Employer Sorting and the Organizational Returns to College

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Abstract

Why do some colleges generate substantially higher earnings returns for their graduates than others? To explain educational returns, economists and sociologists have focused on education's productivity-enhancing and occupational-sorting components. Both mechanisms center on factors that shift individuals across occupational and pay boundaries within organizations, while treating employers as interchangeable settings. Instead, I argue that much of education's value comes from college-to-employer linkages that shape access to high-paying workplaces. To test this, I assemble a novel US linked employer-employee earnings dataset merged with academic records. Firm placement accounts for much of colleges' value-added. Occupational and skill-based sorting account for approximately half of colleges' firm advantages; repeated college–employer recruitment relationships and spatial access to local employer ecologies explain much of the remaining variation. A college's value-added is not simply an internal feature of the institution, but a relational outcome shaped by its position in the broader organizational structure of the labor market.

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1 Introduction

Direct pipelines between specific colleges and employers have long been a staple feature of the American school-to-work transition. In the 1950s, the CIA targeted Ivy League college campuses in order to recruit the "best and the brightest",[1] while from the 1970s, select firms in law and management consulting became increasingly desired career destinations for graduates of top colleges (Granfield, 1992). McKinsey founder Marvin Bower was even so committed to recruiting Harvard Business School graduates that he established a fellowship program in his name at the school (Lemann, 1999), and the company soon had full-time employees tasked with recruiting from just this one university. Still today, significant shares of graduates from top private colleges land at a remarkably narrow set of employers operating in a narrow set of sectors (Davis and Binder, 2019; Townsend, 2023).

Yet the vast literature on the economic returns to specific colleges - or "college value-added" - largely abstracts away from employers themselves. This work convincingly shows that the exact college a student attends is a strong determinant of later earnings, with sizable premiums attached to particular institutions, including, but not limited to, state flagships (Hoekstra, 2009; Zimmerman, 2014; Goodman et al., 2017; Mountjoy and Hickman, 2021; Ciocca Eller, 2023; Bleemer, 2022; Chetty et al., 2023; Mountjoy, 2024). What remains less understood is why attending different colleges translates into such divergent labor market outcomes.

Two theoretical perspectives dominate explanations of college value-added. Human capital explanations for educational returns focus on education's productivity-enhancing effects, with workers paid wages corresponding to their marginal contribution (Becker, 1962). By contrast, longstanding sociological accounts emphasize the ways in which education acts as a sorting device into lucrative occupations (Bowles and Gintis, 1976; Parkin, 1979; Bills, 2003; Domina et al., 2017; Collins, 1979), where mechanisms of social closure - such as credentialing through the formal education system - bolster the economic value of degrees and certifications (Weeden, 2002; Weeden and Grusky, 2012).

While these frameworks highlight important mechanisms, both center on education-induced sorting across occupational and pay boundaries within an organization, rather than across organizations. This perspective yields a picture of the labor market in which firms play little independent role: education generates advantage by cultivating skills or by facilitating access to occupational rents, but not by sorting graduates into higher-paying employers. Yet recent decades have seen rising earnings inequality

[1] https://www.muckrock.com/news/archives/2018/jan/26/cia-college-tour-campus-protest/.

among workers performing similar tasks within the same occupation and with the same skills. Working at an employer that pays above or below the market return to individual characteristics has become an increasingly important driver of earnings differences between workers (Card et al., 2013; Song et al., 2019; Wilmers and Aeppli, 2021). But while the consequences of firm-level sorting are well documented, the role of the college in sorting individuals into particular firms remains understudied. Insofar as colleges systematically sort their graduates into different employers, college value-added could partly reflect access to different types of employers.

To explain educational returns, I bridge the literature on college value-added with research on the changing organizational structure of American pay inequality. I argue that college value-added partly operates through access to organizational rents: firms differ in the wage premiums they generate and share with workers, and colleges systematically differ in the firms they make reachable to their graduates. Prior work documents credential screening and elite college–employer pipelines (Ho, 2009; Rivera, 2011; Davis and Binder, 2019; Chetty et al., 2023), but we know less about how broadly colleges structure employer destinations, how much these destinations affect earnings, or how much they contribute to college value-added.

Answering these questions is challenging: survey data containing respondents' educational histories typically lack employer identifiers, while linked employer-employee datasets usually lack detailed postsecondary histories and pre-college characteristics necessary to construct measures of college value-added. I overcome these obstacles by assembling a unique linkage of administrative employer–employee pay records and postsecondary and high school academic records for recent public 4-year college completers in a US state.[2] Because these data track workers as they move across employers, I am able to separate earnings into components explained by a worker's overall characteristics versus by a worker's employer. I then use the firm components to isolate the portion of college value-added attributable to firm sorting. By focusing on the public 4-year college sector – a sector which serves a major segment of US college-goers – I expand discussion of exclusively elite college-to-firm pipelines to the role of employers in shaping education's value more broadly.

A small but growing literature has begun to connect educational returns to employer heterogeneity more directly. Ost et al. (2026) show that both field-of-study and institutional premia among young graduates are more strongly related to firm-specific wage components than to individual-specific wage components. Similarly, Pan (2025) finds that a substantial share of the returns to associate degree completion operates through employment at higher-premium firms. But because the data employed in

[2]I anonymize the focal state throughout this paper to comply with my data use agreement governing my use of the state's administrative data.

these studies lack detailed information on pre-college characteristics as well as occupations and other employment outcomes, they leave open to what extent education-based firm advantages are selection-driven, and how college-specific employer advantages are produced. I build on these insights by studying how public four-year colleges sort graduates into firms net of the characteristics of these students, and by decomposing these firm-sorting advantages into occupational, organizational and spatial channels.

I examine the role of employers in explaining educational returns in three ways. I begin by examining to what extent 4-year public colleges sort graduates into different types of employers, and how much this employer sorting accounts for college value-added. Next, I examine how colleges' firm advantages overlap with more conventional skill- and occupation-based explanations of educational returns. Finally, I ask what drives these sorting effects by adjudicating among several possible mechanisms: whether high-premium firms magnify the returns to human capital and occupational attainment; whether sorting is concentrated in college-to-firm pipelines, defined as repeated hiring relationships between specific campuses and employers; or whether it reflects geographic sorting into local labor markets where high-premium firms are concentrated.

I document several findings. First, colleges' firm advantages are pronounced. The Flagship channels its graduates into employers whose pay premiums are 13% higher than those employing College 7 graduates. Colleges 2–4 similarly increase graduates' access to higher-paying employers, with employer pay premiums 7–10% higher than those for College 7 graduates. These firm advantages are sizeable especially when compared with firm premium gaps across demographic groups. Firm sorting is also a powerful mechanism underpinning college value-added. Absent firm sorting, earnings differences across college graduates would fall by half. Firm sorting also accounts for a full half of the total earnings effects of graduating from the Flagship - the college with the largest earnings returns. Importantly, college firm advantages can arise through different pathways. Complementarities between college training, occupations, and firm production systems account for a large share of certain colleges' firm advantages, but smaller parts of others'. For the Flagship in particular, repeated college–employer hiring relationships explain a significant portion of its firm sorting effect. Campus recruitment data show how these pipelines can play out: high-premium firms concentrate recruiting activity at a small set of colleges, while other institutions have fewer repeated connections to such employers. Spatial access to local employer ecologies is also a powerful process leading to differences in firm placement across campuses.

Together, these findings contribute a sociological approach to educational returns that emphasizes the organizational underpinnings of schooling's value. A college's value-added is not simply an internal feature of the institution, nor shaped exclusively

by macro-level dynamics such as skill supply and demand; rather, it is a relational outcome shaped by its position in the broader organizational structure of the labor market. Efforts to reduce inequality in the returns to higher education must therefore attend not only to instructional quality or educational programs, but also to the structure of recruitment and hiring relationships that connect colleges to high-premium employers.

2 College value-added

An immense body of work across sociology and economics has shed light on the importance of the type and quality of an individual's education on their life chances. This work has examined both "vertical" dimensions of educational attainment, or differences in how far individuals progress through the educational system (Card, 1999; Hout, 2012; Meghir and Rivkin, 2011; Posselt and Grodsky, 2017), as well as "horizontal" dimensions of educational stratification – qualitative differences among individuals with the same nominal level of schooling (Lucas, 2001; Gerber and Cheung, 2008; Reimer and Thomsen, 2019). Among college graduates, the most commonly studied form of horizontal stratification is field of study (Altonji et al., 2016; Kim et al., 2015; Kirkeboen et al., 2016). In this paper, I focus on another especially consequential form of horizontal stratification: an individual's degree-granting institution.

Due to constraints on sample size in survey data, studies of institutional effects on labor market outcomes often categorize institutions based on broad categories of differentiation, such as college selectivity, measured by the average SAT score of incoming freshmen (e.g., Loury and Garman, 1993, 1995; Bowen and Bok, 1998), or through composite measures comprising resource inputs (e.g., Brewer et al., 1999; Carnevale and Rose, 2004). Early studies found important earnings premiums to college selectivity (Brewer et al., 1999; Loury and Garman, 1995), although studies that leverage more plausible causal designs have yielded mixed results, with some finding selectivity returns (Borgen and Mastekaasa, 2018; Bleemer, 2022; Manski and Wise, 1983) and others finding none (Dale and Krueger, 2002, 2011).

More recent studies have leveraged the larger sample sizes available with administrative data to examine returns to individual institutions, rather than exclusively across broad categories—typically referred to as "college value-added." These studies, often leveraging cutoffs in admission thresholds and other exogenous identification strategies, have found that the specific institution one attends has meaningful effects on educational and earnings outcomes. In particular, studies have found that flagship attendance yields a significant wage advantage (Hoekstra, 2009; Zimmerman, 2014; Goodman et al., 2017), but even among non-flagship goers, research has consistently

shown that degree-granting institution is a strong determinant of earnings prospects (Mountjoy and Hickman, 2021; Ciocca Eller, 2023; Bleemer, 2022; Chetty et al., 2023; Mountjoy, 2024). For example, in the University of California and California State University systems, Bleemer (2022) finds that among students admitted to both UC Riverside and Humboldt State, those who enroll at Humboldt State earn $17,000 less in their early thirties than those who enroll at UC Riverside.

2.1 Explaining college value-added

What factors underlie these college earnings effects? Understanding the sources of college value-added is critical not only for explaining educational stratification, but also for assessing how public higher education can better serve its public-good mission (Labaree, 1997). Public higher education in the United States has long been justified by a democratic commitment to expanding educational and economic opportunity. Public flagships, in particular, have been celebrated as providing "an uncommon education for the common man."[3] In this sense, the underrepresentation of disadvantaged students at high-return flagships is an important barrier to intergenerational mobility (Grodsky, 2007; Reardon et al., 2012; Witteveen and Attewell, 2017; Chetty et al., 2020).

Yet expanding disadvantaged students' access to high-return flagships alone is unlikely to exhaust the mobility potential of public higher education. Most public college students do not attend flagship campuses; they enroll in regional universities and other broad-access public institutions. A broader mobility strategy therefore requires understanding not only which colleges generate higher earnings returns, but why they do so. If college value-added arises from instructional quality, curricular offerings, career services, employer pipelines, or geographic access to high-wage labor markets, then identifying these mechanisms is essential for assessing which features of high-return public colleges could be strengthened elsewhere in the higher education system.

The comparatively small quantitative literature that does address this question focuses overwhelmingly on human capital-based explanations: attending a particular college may be productivity-enhancing (Becker, 1962, 1964). Colleges differ significantly on characteristics such as expenditure per student, tuition costs, faculty salaries, and student-to-faculty ratios, with more selective colleges typically possessing greater resources (e.g. Behrman et al., 1996; Dale and Krueger, 2002; Thomas and Zhang, 2005; Hoekstra, 2009; Zhang, 2012). These factors have been shown to most directly predict completion rates (e.g. Gansemer-Topf and Schuh, 2006), but resource disparities may also shape long-term labor market outcomes by affecting the quality and efficacy

[3] James B. Angell, president of the University of Michigan from 1871 to 1909.

of skill development that employers value (Behrman et al., 1996; Dale and Krueger, 2002). In an extreme case, colleges may even differ in the type of knowledge they impart (Biasi and Ma, 2022). Even if schooling does not increase human capital directly, employers may use schooling to screen applicants, faced with imperfect information about potential productivity (Stiglitz, 1975).

Yet the economic value of education is shaped not only by its skill-production role but also by its credentialing and sorting functions (Bourdieu, 1973; Collins, 1979; Bowles and Gintis, 1976; Bills, 2003; Domina et al., 2017). The classic status-attainment tradition established education as a critical mediator between social origins and occupational destinations. Blau and Duncan (1967) showed that educational attainment plays a key role in shaping occupational attainment, while Featherman and Hauser (1978) extended this framework to examine educational achievement, occupational achievement, and earnings. In this line of work, education matters because it channels individuals into more or less advantaged positions in the occupational structure.

Credentialist and closure accounts offer a more conflictual account of this sorting process. From this perspective, education yields wage premiums not simply because it imparts superior knowledge, but because educational credentials regulate access to advantaged positions in the labor market (Bills, 2003; Domina et al., 2017; Collins, 1979, p. 452). Bowles and Gintis (1976) argued that educational institutions channel students into distinct strata of the labor force, while Collins (1979, p. 9) described education as "an artificial device for monopolizing access to lucrative occupations." Much of this work emphasizes occupational closure. The creation and enforcement of credentialing and licensing regimes—for example, requirements that individuals hold particular degrees, licenses, or formal certifications in order to practice a skill—can regulate access to occupations, restrict labor supply, and generate rents for occupational incumbents and holders of the requisite credentials (Weeden, 2002; Weeden and Grusky, 2012; Abbott, 1988). Consistent with this view, educational credentials that are more tightly linked to narrow occupational destinations are associated with higher earnings, suggesting that credentials can shape pay by restricting access to advantaged labor-market positions (Bol et al., 2019).

This allocative view of education also builds on older institutionalist accounts of colleges. Kamens (1971) described colleges as institutional "charters," whose structural linkages into the occupational world help allocate graduates to major social statuses. Similarly, Meyer (1977) emphasized that educational organizations such as colleges operate not only by producing skill, but by conferring institutional classifications that organize access to social and economic positions. Later work also showed how prestigious college attendance shapes professional careers and managerial attainment (Tinto,

1984; Useem and Karabel, 1986). Beyond structural linkages between colleges and specific occupational and economic groups, a college's internal organization can play an important role in occupational sorting. Colleges differ quite radically in their educational missions and curricular offerings - one need only think of the contrast between a liberal arts college, an engineering institute, a regional teacher-training institution or polytechnic - and a flagship research university. These differences matter not only because they mechanically link graduates to particular professions and industries but because curricular differences are outward-facing signals of a college's position in the broader social order (Kamens, 1971).

3 Limitations of skill and occupational explanations of college returns

These perspectives differ in their accounts of why education pays. Human capital models emphasize the internal resources of colleges that may increase student productivity, while sociological explanations emphasize colleges' external linkages to the social and, in particular, occupational structure. Both accounts center the ways in which schooling shifts individuals across occupational and pay boundaries within the organization, while giving less attention to how education may also sort individuals across organizational boundaries (see Figure 1, top panel).

These emphases are well motivated. The dominant explanation of overall educational returns, such as the growing wage gap between BA and non-BA holders, rests on the idea that skill-biased technological change has increased demand for college-educated workers as the supply of such workers has failed to keep pace (Acemoglu and Autor, 2011; Autor et al., 2020). Wage gaps across fields of study among BA holders can also be understood partly from a skill perspective — majors provide bundles of skills with different payoffs (Kinsler and Pavan, 2015; Kogan et al., 2021; van de Werfhorst, 2002) — as well as in terms of the occupational destinations that licensing arrangements and closure processes facilitate.

But despite their importance for explaining the payoff to broad educational categories, such as BA versus non-BA attainment, and to fields of study, there are several reasons to broaden their scope when it comes to explaining college value-added. Most plainly, college resource inputs, which are often treated as the institutional features most directly tied to colleges' human-capital effects, only partly correlate with college value-added. A focus on resources is not unwarranted: one direct consequence of greater institutional resources may be higher on-time graduation rates, an important predictor of later earnings (Bowen and Bok, 1998; Kane, 1998; Horn, 2006; Bound and

Turner, 2011; Brand and Halaby, 2006; Ciocca Eller, 2023). Yet differential BA completion rates across colleges cannot completely account for their earnings differences (Mountjoy and Hickman, 2021). Similarly, linkages between colleges and occupations are important, but they do not exhaust the allocative role of colleges. Hiring decisions for particular occupational roles are made within organizational contexts, where employers vary in their recruiting routines, screening criteria, and understandings of merit. A rich qualitative literature documents how elite employers interpret college pedigree in ways that shape whether applicants are considered desirable and culturally compatible (Ho, 2009; Rivera, 2011, 2015). What remains less clear is how these employer-side processes aggregate into college-level earnings returns.

This organizational context matters because firms are not neutral containers for jobs and occupations. Research spanning sociology and economics has shown that some firms pay consistently higher wages than others, even to employees performing similar types of work. While scholars have documented substantial wage differences across employers for decades (Slichter, 1950), firm-based sources of compensation have become an increasingly important source of earnings differentiation in the United States (Groshen, 1991; Abowd et al., 1999). Today, where one works, rather than only what work one performs, accounts for up to one third of overall earnings inequality (Song et al., 2019; Wilmers and Aeppli, 2021). These pay differences partly reflect firms' organizational characteristics, such as R&D intensity (Barth et al., 2016), management practices (Osterman, 2006; Bender et al., 2018; Bloom et al., 2021), and job-specific task allocations (Hackman and Oldham, 1976; Deming and Kahn, 2018; Wilmers, 2020; Oldham and Hackman, 2010; Ranganathan, 2023); these differences allow some firms to generate productivity and accumulate resources beyond what individual workers could generate as independent market actors (Rosenfeld, 2021). In turn, these organizational advantages create rents that can be shared with workers in the form of above-market pay. Highly productive "superstar" firms in technology and professional services offer exceptionally high compensation, while subcontractors and firms in retail pay substantially less (Autor et al., 2020; Krippner, 2012).

Together, these limitations of existing explanations and the growing importance of firm-based wage inequality suggest the need to broaden accounts of college value-added beyond human capital accumulation and occupational sorting. I build on the institutional insight that colleges derive value from their structural connections to the labor market, but extend this logic from occupations to organizations. In the labor markets described by Meyer (1977) and Kamens (1971), the economic value of schooling was understood to flow largely through the occupational and professional positions to which credentials granted access. Colleges allocated students to recognizable occupational positions, and those positions carried different rewards, often irrespective

of one's employer. In contemporary labor markets, however, advantaged destinations are not only occupational but also organizational. In this sense, colleges may operate as charters into organizations, much as they have long been understood to operate as charters into prestigious occupations.

4 Firm sorting and college value-added

I argue that this organizational allocation contributes meaningfully to college value-added. Colleges may systematically differ in their sorting effects into lower- and higher-paying firms for at least three reasons (see Figure 1, bottom panel). First, certain colleges may equip graduates with skills valued by higher-paying firms or channel them into occupations that are disproportionately located in such firms. Second, pipelines between colleges and *specific* employers may systematically channel graduates from different colleges into different workplaces. Third, geographic sorting may facilitate access to higher-paying employers by concentrating graduates in labor markets where high- or low-premium firms are located.

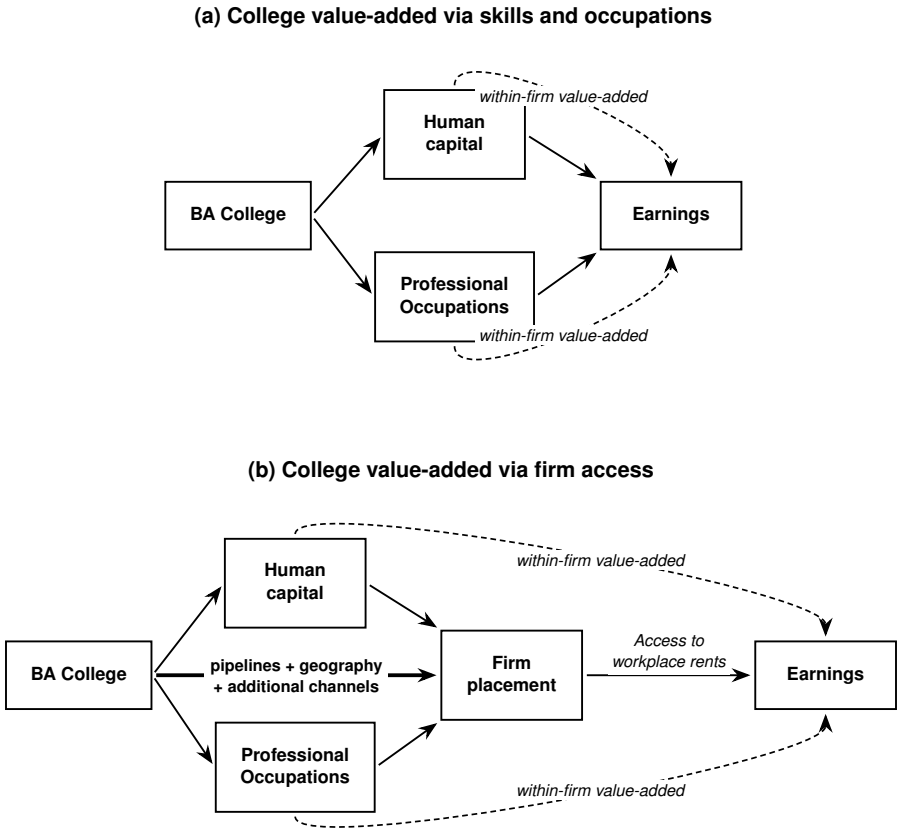


Figure 1: Two Accounts of College Value-Added: Sorting Within Organizations (most existing work) versus Across Organizations (this article)

4.1 Complementarities between college skills, occupations, and firms

College-induced sorting across employers is not mutually exclusive with skill-based or occupational sorting. Indeed, firm sorting could partly operate through these more familiar channels. Colleges may not simply raise graduates' general productivity; instead, they may channel graduates into skill bundles and occupational pathways that are especially valuable inside particular kinds of firms. Scholars have long emphasized that human capital does not generate value in isolation but, rather, depends on how workers' skills are combined with organizational capabilities and task structures (Lepak

and Snell, 1999; Chadwick and Dabu, 2009). In this sense, college-produced human capital may be more valuable in some organizational settings than in others.

This channel is especially important in contemporary labor markets because occupational and workplace advantages have increasingly consolidated. High-wage workers are increasingly sorted into high-wage firms, and high-paying workplaces are increasingly organized around high-paying occupations (Rajan and Wulf, 2006; Song et al., 2019; Wilmers and Aeppli, 2021). As more profitable firms have shed lower-paid organizational functions, high-paid software engineers have become concentrated in high-premium firms, while lower-paid IT technicians and support workers have become concentrated in low-premium firms (Wilmers and Aeppli, 2021).

These patterns suggest that colleges could affect firm placement by shaping the skills students acquire and the occupations they enter. To the extent that colleges sort individuals into different fields and occupations – whether through curricular differences or structural networks with occupational groups (Kamens, 1971) – they may also mechanically sort graduates across high- and low-paying employers. For example, colleges that specialize in fields directly valued by high-wage firms, such as engineering, finance, or computer science, may reinforce graduates' access to high-premium firms. Importantly, even if these mechanisms begin with differences in what colleges teach or make occupationally accessible, the resulting earnings payoff is not simply a return to skill or occupation. High-premium firms assemble groups of highly skilled workers in high-status occupations, creating organizational settings in which workers can receive earnings advantages beyond what their individual skills or occupations would command in the external labor market (Tomaskovic-Devey and Avent-Holt, 2019).

Colleges may also cultivate broader forms of human capital that matter for hiring into high-premium firms. More prestigious or better-resourced colleges may develop stronger analytical reasoning, communication skills, or access to frontier knowledge (Biasi and Ma, 2022). If higher-paying firms privilege these capacities in hiring and recruitment decisions, then graduates from colleges that cultivate these may perform better on employment tests, craft stronger applications, or interview more effectively. Firm sorting may therefore arise not only because colleges channel students into different occupational destinations, but also because they produce skills that help graduates access higher-paying employers within the same broad occupation or field.

4.2 Pipeline hiring

A second source of organizational allocation comes from structural connections between colleges and *specific* employers. A large literature in management science documents the ways in which firms repeatedly draw from particular labor sources (Brymer et al.,

2014). Firms face high search costs and information asymmetries when hiring in external labor markets, where it is difficult to discern a worker's true fit or productivity before hire (Stigler, 1962; Spence, 1973; Stiglitz, 1975; Bills, 2003). Rather than relying exclusively on the "spot" labor market, firms may develop a mixture of hiring pipelines: recurring relationships with external labor sources that help them identify potential workers (Brymer et al., 2014, 2019).

College–firm pipelines are one such relationship. Prior hiring flows reduce uncertainty by creating expectations about what type of worker an individual from a particular college will be like (Kristof-Brown et al., 2005; Breaugh, 2008; Zottoli and Wanous, 2000). Pipelines between specific colleges and employers are especially useful given heightened search costs for early career roles: recent college graduates have limited employment histories and fewer observable records of workplace performance. Degree-granting institution serves as a shorthand for expected productivity and fit (Thurow, 1975; Rivera, 2015; Neely, 2022). For example, degrees from better-resourced or more selective institutions may be seen as evidence of differential college value-added (Deming et al., 2016), or as a proxy for underlying ability (Rivera, 2011; Brymer et al., 2014). Firms also have incentives to return to labor sources that previously yielded successful hires.

While pipelines are typically discussed in terms of strategic purposes to overcome search frictions, pipelines at resource-rich firms may additionally reflect efforts to protect existing advantages via social exclusion (Josefy et al., 2023). Sociologists have long recognized that groups attempt to monopolize advantages by excluding outsiders (Parkin, 1979; Collins, 1979; Murphy, 1988). When incumbents at resource-rich firms are themselves class privileged, managers may select culturally similar workers to facilitate social cohesion and reinforce existing rent-sharing arrangements (Fligstein and Fernandez, 1988; Burawoy and Wright, 1990; Weeden and Grusky, 2014; Tomaskovic-Devey and Avent-Holt, 2019): educational pedigree signals information not just about skill, but also class background and social fit (Ho, 2009; Rivera, 2011, 2012). As a result, closure can exclude graduates of less favored institutions from high-premium firms, analogously to the way that occupational licensing can exclude workers who lack particular certifications or licenses (Weeden, 2002).

Pipeline hiring can systematically sort workers from different colleges into high- or low-paying firms. On the one hand, assuming that most firms prefer candidates with more elite or selective credentials, then the highest-resource firms that can offer the highest pay have a greater chance of obtaining those workers, and spend resources recruiting at a narrow set of highly selective institutions (Rivera, 2015; Davis and Binder, 2019). On the other hand, lower-paying firms may economize on search by repeatedly drawing their employees from colleges that are more likely to yield hires. Streib (2023)

notes, for example, that less prestigious employers sometimes avoid the highest-ranked universities altogether, judging such recruitment "not financially sensible". Firms requiring occupation-specific training may also concentrate recruiting on colleges that specialize in these skills, which can compound these pipeline effects (for example, colleges that specialize in healthcare and teaching might attract lower-paying firms than those that specialize in engineering or business).

Beyond direct advantages in terms of screening and recruitment (Moss-Pech, 2025), more broadly, pipeline hiring can shape the informational environment and applicant search behaviors. Anticipating exclusion, graduates may deliberately target firms in their pipeline rather than risk rejection from other firms (Pager and Pedulla, 2015). Meanwhile, recruitment facilitates information sharing about firm-specific cultures and hiring practices, enabling candidates to craft stronger applications (Moss-Pech, 2025). Campus recruitment can also shape student ambition more broadly by producing localized status systems that define which jobs are prestigious or appropriate (Meyer, 1977; Clark, 1972; Binder et al., 2016). For example, Binder et al. (2016) note that college freshmen at elite universities arrive on campus largely unaware of potential career paths, but an almost cult-like campus culture soon cements around the elite firms that advertise at campus events (see also Granfield, 1992). These processes may contribute to a broad prestige hierarchy, funneling students from more selective institutions into higher-premium firms and graduates from regional colleges into lower-paying employers. Finally, pipeline hiring can become self-reinforcing over time. As pipelines homogenize the employee base at a given firm, alumni networks can help stabilize these via referrals and in-group preferences for certain colleges (Garcia et al., 2008; Brymer et al., 2019).

4.3 Geographic sorting

Beyond skill, occupation, and pipeline-hiring advantages, colleges may also confer geographic advantages that facilitate employment at higher-paying firms. Firms in large metropolitan areas are disproportionately likely to be innovative and human-capital intensive, and they often offer higher wages even for workers performing the same occupation (Beggs and Villemez, 2001; Moretti, 2012; Manduca, 2019). At the same time, colleges may differentially concentrate their graduates in particular geographic areas. Many college graduates end up clustered in a small number of labor markets. For elite colleges, this concentration often reflects migration to major metropolitan destinations, while graduates of less selective colleges are more likely to work near the institution they attended. For example, Conzelmann et al. (2025) find that 49% of Ivy League graduates live in the three metropolitan areas of New York, San Francisco, and

Boston.

This sorting may reflect the social organization of the post-college job search. Graduates often choose post-graduation job locations where they, or their universities, have existing social, professional, or institutional connections, because those connections make the job search more tractable and increase the likelihood of finding employment (Manduca, 2024). To the extent that more selective colleges concentrate graduates in dense, high-wage metropolitan labor markets, part of the firm sorting effect of these colleges may operate through geography.

4.4 Additional channels

The above factors are not mutually exclusive. The firms recruiting at different campuses have a unique occupational composition, which may channel graduates into different types of jobs. Employers that establish pipelines with certain campuses may also do so partly because of geographic proximity. My focus on these three factors also does not preclude other ways in which colleges may sort students into high- versus low-paying employers. For example, a broader range of firms, even without direct pipelines to the college, may screen on certain colleges in the hiring process - be it for reasons of human capital or cultural matching (Friedman and Laurison, 2020; Rivera, 2012). Certainly, audit studies show that employers call back candidates with less selective college credentials at lower rates (Gaddis, 2015), especially for higher paying employers (Deming et al., 2016). Further, referral networks between college peers can lead to expanded career opportunities (Fischer et al., 2023; Zimmerman, 2019), and campus career centers can be differentially effective at cultivating high-paying opportunities for their students even beyond direct pipelines. Colleges with robust career services may procure partnerships with prestigious employers in select industries, such as the Corporate Partnership Programs documented by Davis and Binder (2016). While especially concentrated at large, research-oriented universities, such partnerships are also found across a sizeable number of less selective state universities (Davis and Binder, 2016). Disentangling these additional processes is difficult with linked administrative data of the type used in this study, but future work drawing on job application and firms' screening decisions on individual applicants would provide ripe ground for adjudicating between these additional mechanisms.

5 Background and data

I evaluate the role of organizational allocation in explaining college value-added in the context of one US state's public 4-year college sector. Per the terms of my data use agreement, I keep the identity of the state and institutions anonymous. I therefore refer to the setting as Summit State and use generic institutional labels. The seven four-year universities comprise a flagship research university (the "Flagship"), several branch campuses and a large state R1 university (Colleges 2-4) and several regional universities (Colleges 5-7). Focusing on a system outside the context of highly selective private colleges, but where meaningful differences in institutional prestige still exist, offers a clearer perspective on the role of employers among colleges which serve a large portion of the college-bound population.

Linking college students to firms and pay presents a methodological challenge, since traditional survey data typically do not contain employer identifiers, while linked employer-employee datasets tend to lack granular information on workers' educational histories. To overcome this challenge, I perform a unique linkage of three administrative datasets covering recent high school graduates in the state: (1) high school academic records; (2) detailed information on postsecondary attainment, and (3) longitudinal records on earnings and employer affiliations for a substantial portion of the state's workforce. Together, repeated observations on both individuals and firms enable a decomposition of earnings into worker and firm-specific pay effects and an adjudication of the role of firm sorting in explaining returns to different degrees.

The employer-employee data come from the state's Unemployment Insurance (UI) program, which requires nearly all employers to submit quarterly reports on employee wages and hours. These reports cover most private, local, and state public-sector workers and include consistent longitudinal employer identifiers, along with basic employer characteristics such as industry (NAICS code), location, and employment counts. In recent years, employers have also reported occupation codes for each employee as part of their UI quarterly filings. Notably, several groups - self-employed, federal employees, and active-duty military - are not covered. Education records come from the State Education Research Center (SERC). Second, postsecondary files include enrollment, course-level GPA, credits, degree attainment, institution attended, and financial aid filings. Third, high school records provide GPA, school attended, and demographic characteristics (e.g., gender, race/ethnicity, disability status, and free and reduced price lunch [FRPL] eligibility).

I construct a school-year panel of public 4-year college graduates linked to their primary employer. Each worker-school-year observation spans fiscal quarter 3 through quarter 2 of the following year. My main outcome is annualized earnings in school

years 2023-2024, and adjusted to 2024 (financial year) dollars using the CPI-U. I focus on this recent period of earnings because it also coincides with employers' reporting of occupation codes for employees, which is critical for examining the degree of overlap between firm and occupational sorting. Because my postsecondary data end in 2021, in practice, this means examining graduates' wages between 3 and 14 years since BA completion, pooling across these cohorts. Annual wages are calculated from observed quarterly earnings, and workers with multiple jobs are assigned to the employer where they received the largest share of their compensation, provided they are observed at their primary employer for at least two quarters in any given school year.[4]

I link these employer-employee data to postsecondary records from Summit State's public colleges. Postsecondary files provide information on institution attended, GPA, credits, degree attainment, and financial aid. To ensure that education is complete before analyzing wages, I assign to each individual their highest credential attained. If a student obtains multiple BA credentials in any given year, I attach to that student an in-state public degree if obtained, followed by a public or private 4-year out of state degree. If a student obtains multiple in-state BAs in a given year, I follow a rank ordering (flagship > other public universities > regional colleges) to capture potential institutional signaling effects. Students who pursue graduate education are retained in the sample, but their degree attainment is coded using this rank ordering; in this way, graduate study is treated as endogenous to BA completion. Finally, I link individuals to high school transcript records, containing information on high school GPA and demographic characteristics.

In additional analyses, I also draw on two additional data sources. The first is data from career fair registration files for five of the Summit State universities.[5] These data list each organization that attended their on-campus career fairs between 2018 and 2024. After removing non-employing organizations (typically, universities and professional schools recruiting into their own graduate programs) and matching employers across the five, I obtain a set of approximately 3,000 unique employers attending on-campus career fairs over this period. The second is workers' pay reviews posted on the job review website Glassdoor.com, which provides a measure of firms' average pay. I link these employers in the career registration files to Glassdoor employers using a combination of fuzzy and hand-matching.

My core sample consists of Summit State high school graduates who subsequently

[4]I drop worker-firm observations with missing information on these attributes, and also assign a unique NAICS and location code to each employer per year. I also exclude from my analyses the small number of students working in firms operating in the Mining, Quarrying, and Oil and Gas Extraction industry (NAICS 21).

[5]I was unable to obtain registration information for two of the universities in my sample.

earned a bachelor's degree from a public four-year institution in Summit State between 2008 and 2021 and had positive UI-covered earnings in the relevant post-graduation period.[6] Table 1 presents descriptive statistics for the core sample used in my analyses ($N = 89,305$). Among 4-year BA graduates in Summit State, there is meaningful heterogeneity in pre-college characteristics by BA institution. For example, graduates from the state Flagship have the highest final high school GPA (3.62), while those graduating from Colleges 6 and 7 have the lowest (3.26 and 3.19, respectively). The proportion of graduates who were ever on free and reduced price lunches also differs considerably across colleges, with the lowest rates at Colleges 4 and 5, as well as the flagship, and the highest at Colleges 3 and 7. There is notable variation in labor market outcomes by institution. Graduates of the flagship are twice as likely as College 7 graduates to work in large firms, and almost three times as likely to work in the state's Primary Metropolitan Area. In contrast, students from regional colleges such as College 7 and College 6 are more likely to work in smaller firms located outside the Primary Metropolitan Area.

Table 1 also shows that there is substantial earnings variation by BA institution. Students who graduate from College 7 have the lowest average earnings and work at firms that pay the least.[7] Flagship graduates stand out, earning on average .4 log points more than College 7 graduates, and obtaining a firm with a pay premium that is .18 log points higher than that attained by College 7 graduates. This is followed by Colleges 2 and 4, with raw earnings premiums of .25 and .22 log points, and raw firm premiums of .16 and .09 log points, relative to College 7. The raw gap in earnings between BA graduates from different colleges is in fact larger than the raw gap in earnings between College 7 graduates and non-BA holders (leftmost column), but graduating from even the least selective public college is associated with considerably higher earnings compared with not obtaining a BA degree. Interestingly, though, College 7 graduates do not work at employers with higher pay premiums than non-BA holders. This suggests that the earnings advantage of graduating from even the least selective public four-year college (relative to not obtaining a BA) operates through within-firm earnings gains, while differences across BA institutions reflect sorting into higher- or lower-paying firms.

[6] In order to ensure comparability across analyses that require non-missing firm location information, I define an individual to have observed earnings only if the individual has non-missing information on employer attributes, such as industry and location. In practice, this reduces the sample trivially, by just over 200 individuals.

[7] I formally describe the process of estimating firm pay premiums in the following section. I normalize firm pay premiums with respect to the average firm effect in the Accommodation and Food Services sector, such that the average pay premium by college can be interpreted as the difference relative to the average firm effect in this sector.

As with any earnings data from a given state, I am unable to track activity outside of Summit State. Conzelmann et al. (2025) find that, across the US, 67% of a state's graduates are employed in-state. Fortunately, Summit State also has one of the lowest out-migration rates of any US state (Aisch et al., 2014). Rates of observed in-state UI coverage also do not differ dramatically across colleges, with 63% of Flagship graduates observed in the state's UI records compared with 68% of College 7 graduates (though, notably, Colleges 2 and 3 have higher rates of in-state observation). That the Flagship is more likely to place graduates into jobs out of state would not invalidate my conclusions about the importance of firm sorting insofar as graduates who work out of state disproportionately enter larger and higher-paying firms (Cobb and Lin, 2017; Wilmers et al., 2025). I return to this limitation in the conclusion.

6 Methodology

My analysis proceeds in two steps. The first step exploits the longitudinal nature of my linked employer-employee earnings data - specifically, the fact that I observe workers as they move across different employers over time. I leverage these longitudinal earnings data and tools from labor economics [an AKM model (Abowd et al., 1999)] to decompose individuals' total earnings into a fixed component ("person effects"), as well as a component deriving from firm of employment ("firm effects"). The estimated firm effects give me a continuous measure of firms' pay premiums. These estimated firm effects capture persistent pay differences between employers, for workers performing the same work, but are not in themselves informative about the role of firm sorting in explaining college value-added. For example, there could be large pay differences between employers even if colleges themselves do play a role in systematically sorting graduates into different types of employers. Therefore, in the second step, I use these firm premiums as an outcome variable to gauge to what extent firm placement accounts for college value-added.

6.1 Earnings decomposition

In the first step, I assume that the (log) earnings paid to worker i in year t is generated by the following model:

$$\ln y_{it} = \alpha_i + Z_{it}^{\top}\beta + \psi_{F(i,t)} + \epsilon_{it}, \tag{1}$$

where α_i is an individual fixed effect, Z_{it} is a vector of time-varying controls (including year fixed effects), $F(i,t)$ is an index function that maps worker i to their

Table 1: Mean Values of Individual Characteristics, Academic Metrics, and Labor Market Outcomes by BA Status and BA College

	No BA	College 7	College 6	College 5	College 4	College 3	College 2	Flagship	All 4-year
Female	0.47	0.58	0.56	0.59	0.54	0.56	0.53	0.54	0.56
Black	0.05	0.03	0.03	0.02	0.03	0.08	0.05	0.03	0.03
Hispanic	0.17	0.13	0.12	0.06	0.11	0.10	0.08	0.07	0.09
White	0.65	0.77	0.76	0.80	0.77	0.52	0.51	0.54	0.68
English first lang.	0.84	0.88	0.89	0.94	0.90	0.77	0.72	0.78	0.85
HS GPA	2.60	3.26	3.19	3.38	3.34	3.18	3.19	3.62	3.39
Ever homeless	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Ever FRPL	0.51	0.32	0.27	0.17	0.24	0.39	0.31	0.25	0.25
Ever SPED	0.13	0.02	0.03	0.02	0.01	0.02	0.03	0.01	0.02
Ever ELL	0.06	0.03	0.03	0.01	0.02	0.07	0.06	0.03	0.03
College GPA	–	3.37	3.25	3.19	3.25	3.30	3.39	3.33	3.28
First-term credits	–	12.16	12.17	12.32	12.19	12.12	12.69	12.99	12.46
First-term credits att.	–	14.17	13.95	13.72	14.01	13.15	13.68	14.37	14.01
Works in PMA	0.35	0.24	0.44	0.49	0.42	0.58	0.66	0.63	0.50
Multi-establishment firm	0.31	0.28	0.25	0.27	0.26	0.34	0.29	0.29	0.28
Firm >1,000	0.45	0.54	0.57	0.55	0.57	0.60	0.60	0.61	0.58
Firm >10,000	0.17	0.15	0.16	0.20	0.22	0.27	0.31	0.33	0.24
Log earnings	10.70	10.99	11.08	11.08	11.21	11.14	11.25	11.39	11.20
Firm premium	0.35	0.35	0.38	0.41	0.44	0.46	0.51	0.53	0.45
P(earnings observed)	0.58	0.68	0.70	0.66	0.64	0.71	0.73	0.63	0.66
N	267,947	8,152	10,273	15,664	20,812	4,207	4,995	25,202	89,305
Firms	39,756	3,242	4,086	5,469	6,645	1,865	2,083	6,445	16,457

Notes: "PMA" refers to the state's Primary Metropolitan Area. "All 4-year" pools graduates across the six colleges for which I estimate college value-added, as well as the reference college (College 7). "No BA" refers to Summit State high school graduates between 2005 and 2015 who did not receive any BA degree by 2023/2024. Sample sizes are analytic sample sizes, conditional on observed earnings and non-missing covariates.

employer in year t, $\psi_{F(i,t)}$ is the firm-specific wage premium, and ϵ_{it} is an error term that captures idiosyncratic shocks. The $\psi_{F(i,t)}$ terms are my focal parameters. Firm effects can be interpreted as capturing the extent to which employer j pays its workers a pay premium, in excess of the wage we would expect on the basis of their own characteristics alone. I treat person effects primarily as controls to help estimate the firm effects, though I additionally use them as a proxy for human capital in some analyses that follow.

Importantly, the firm effects in Equation (1) are only identifiable within "connected sets" of workers that are linked by worker mobility across firms (Abowd et al., 2002). A connected set is a network of firms linked together by observed worker mobility: two firms belong to the same set if there is a chain of workers moving between them over time. Because fixed effects are only identified relative to one another, estimates from separate sets cannot be compared on the same scale. I therefore restrict estimation of Equation (1) to the "largest connected set", which yields a single, internally consistent scale of firm effects. Appendix B provides further details.

I then apply these estimated firm effects to my sample of public college graduates, attaching the estimated firm effect corresponding to the firm at which that individual was employed in the year in which I examine earnings. I use this sample for my main empirical analyses to estimate causal effects of college graduation via and net of firms.

I use this model to estimate firm effects rather than an approach which jointly estimates firm and college effects (such as with traditional mediation analysis) because it adjusts for patterns of selection into firms that are unobserved by the researcher. If workers differ in time-variant productivity not captured by pre-college control variables, the person effect (α_i) parameters absorb this variation. The model does, however, assume away any time-varying unobserved confounders that may predict both firm selection and wages.

6.2 Firm sorting and college value-added

In the second step, I use the firm effect attached to each individual to parse out the role of employer sorting in educational returns. Let $\mathcal{J} = \{\text{College 7}, \ldots, \text{College 2}, \text{Flagship}\}$ denote the set of 4-year public colleges in Summit State; Y denote an individual's earnings in 2023-2024, and let M denote an individual's employer in these years. I use potential outcomes notation to refer to counterfactual quantities under graduation from different colleges. Specifically (suppressing subscripts i), I use $Y(j)$ to denote an individual's potential earnings were they to obtain a BA from college $j \in \mathcal{J}$ (possibly contrary to fact). To quantify the role of firm sorting in explaining colleges' returns, we need estimates of how earnings outcomes would change

if students graduated from different colleges (college value-added). I define college value-added to be the average treatment effect of receiving a BA from college j relative to receiving a BA from College 7 (the college with the lowest raw earnings return in the state):

$$\text{ATE}^Y(j) = \mathbb{E}[Y(j) - Y(\text{College 7})]. \tag{2}$$

In Appendix G.1, I present results from an alternative definition of college value-added, defined in terms of an individual's first college attended. These results are substantively similar to those I present in the main text. To assess the role of firm sorting in explaining college value-added, I use the "nested" counterfactual $Y(\text{College 7}, M(j))$. Intuitively, this quantity represents the earnings advantage an individual would gain over their co-workers if they obtained a BA from College 7, but were employed at the type of firm that College j would yield access to. To assess the importance of firm sorting in explaining college value-added, we can decompose college value-added as:

$$\underbrace{\text{ATE}^Y(j)}_{\text{College value-added}} = \underbrace{\mathbb{E}[Y\Big(j, M(j)\Big) - Y\Big(\text{College 7}, M(j)\Big)]}_{\text{Within-firm value-added}} + \underbrace{\mathbb{E}[Y\Big(\text{College 7}, M(j)\Big) - Y\Big(\text{College 7}, M(\text{College 7})\Big)]}_{\text{Value-added via firm sorting}}.$$

The core quantity of interest here is the "Value-added via firm sorting" component. To identify this quantity, I exploit the fact that the earnings decomposition in Equation (1) implies a firm's pay premium is the same for all employees at the firm. In Appendix C, I show that this allows us to write the "Value-added via firm sorting" component as the treatment effect of each college on a worker's firm's pay premium. Therefore, estimating college value-added and the role of firm sorting in this value-added requires estimating two treatment effects: the ATE of college j relative to College 7 on earnings, and the ATE of college j relative to College 7 on a worker's firm premium.[8]

Directly estimating each of these quantities would require quasi-experimental variation in who attends each college (for instance, discontinuities in admissions cutoffs). Unfortunately, the data for such an exercise was not made available to me for this study, and would in any case only enable estimating value-added for the one college

[8] I assume that the employer fixed effects estimated via Equation 1 are measured with negligible error, given the full-population nature of the UI data. Uncertainty estimates then come from uncertainty in estimation of average treatment effects. Kline (2024) further shows that downward bias resulting from failing to account for correlation between estimated firm effects can outweigh the upward bias attributable to treating firm effects as random draws from a super population.

that did impose a cutoff in the period I examine. I therefore take an observational value-added approach, consistent with previous approaches to value-added (e.g. Chetty et al., 2020; Bleemer and Quincy, 2025). To do this, I make a selection-on-observables assumption, which assumes that there is no unobserved confounding effect of each college on within- and between-firm earnings conditional on covariates X. To make this assumption more plausible, I leverage the administrative registries to compile a large battery of pre-college and college-level covariates. These include basic demographic variables (gender, race, age, high school test scores), pre-college characteristics such as FRPL status, whether English was the primary language spoken at home, and disability status, first term credit attainment, college GPA, as well as high school fixed effects.[9]

Under this assumption, these treatment effects can be estimated using the standard identification formula for the ATE (see Appendix C). In my main analyses, I use OLS to estimate these treatment effects, i.e.

$$\mathbb{E}[Y \mid A = j, X] = \alpha + \sum_{j \neq \text{College 7}} \beta_j \, \mathbb{I}(A = j) + \gamma' X \tag{3}$$

with College 7 as the reference category. Under this specification, a college's value-added can be read off as β_j. Estimating this model using firm premium as the outcome yields the effect of college j on a worker's firm premium, or the amount of college value-added explained by firm sorting. To assess the sensitivity of the results to this modeling assumption, in Appendix D I implement a machine-learning estimation strategy which relaxes the linearity assumption in Equation 3. This approach yields substantively similar results.

The drawback of a selection-on-observables approach is that students may select into different colleges based on unobserved characteristics that also predict earnings. Nevertheless, two pieces of evidence support this approach. First, recent work shows that selection explains only a small share of earnings differences between college-goers from different institutions (Bleemer and Quincy, 2025). Relatedly, Bleemer (2022) finds that across the California state system, observational estimates of colleges' value-added strongly correlate with quasi-experimental estimates of value-added leveraging waitlist designs. Second, because I am interested in firm sorting as a mechanism of college value-added, rather than just in college value-added per se, to violate conclusions about

[9]Note that my main specifications do not include controls for a worker's field of study, in keeping with prior work on college value-added, which treats field of study as endogenous to an institution (Hoekstra, 2009; Zimmerman, 2014; Goodman et al., 2017; Mountjoy and Hickman, 2021; Mountjoy, 2024). Nevertheless, in Appendix G.2, I show results that additionally control for field of study. These results are substantively similar to those I present here.

the importance of this mechanism would require unobserved variables that predict BA college to be more strongly associated with employer placement than with earnings within the organization. Such a phenomenon could be possible if, for example, cultural attributes that predict one's BA college more strongly predict firm placement than they do within-firm earnings. As I show in Appendix E, however, observed characteristics appear to be more strongly associated with within- than between-firm earnings. Finally, to address concerns about the role of unobserved selection, I also implement a sensitivity analysis which, under certain modeling assumptions, shows the results to be robust to unobserved confounding.

7 Results

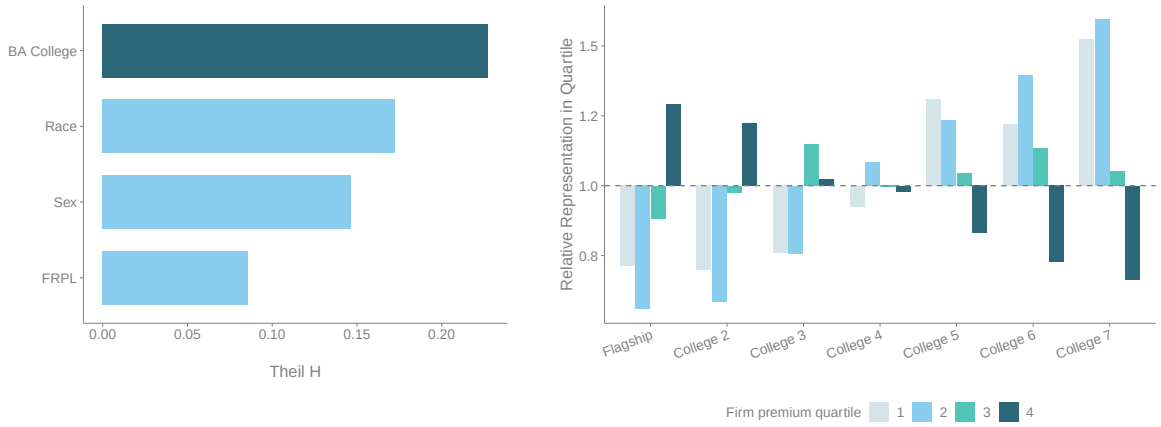
7.1 Descriptive results: firm segregation across colleges

I begin by asking whether graduates from different colleges work at different employers. To measure this sorting, I compute Theil's H indices for firm segregation by BA institution among college graduates. This index captures how informative a person's employer is for predicting the college from which that person graduated. If graduates from all colleges were spread evenly across firms, knowing a worker's employer would provide no information about an individual's college, and the index would be zero. By contrast, higher values indicate that graduates from different colleges are concentrated in different workplaces.

Figure 2 plots Theil indices for firm segregation by BA college as well as for race, gender and a measure of class background, among college graduates. Firm segregation by college is pronounced, with a Theil index of .23. Importantly, this is larger than the equivalent segregation across firms by racial groups, sex and class background. Given that graduates from different colleges are highly segregated across employers, how do these patterns of segregation map onto the types of employer at which graduates from each college work? To answer this question, I classify each employer by the quartile of its firm premium. Figure 2 shows the employment in each quartile relative to the total composition of the BA workforce. A value above 1 indicates that a college is over-represented in that quartile, relative to what we would expect under random sorting, and a value below 1 indicates that the college is under-represented in that quartile. Flagship graduates are disproportionately clustered in top-paying employers, and highly under-represented in the lowest-paying firms, as are graduates from College 2. By contrast, graduates from Colleges 3 and 4 are more evenly split among employers with different pay premiums, and College 5-7 graduates are disproportionately

clustered in lower-paying employers. These descriptive patterns establish that college graduates are systematically distributed across higher- or lower-paying employers. To be sure, these raw differences may reflect both the causal effects of colleges and the characteristics of students who select into them. I therefore next turn to estimates of college value-added that adjust for students' characteristics.

Figure 2: Left Panel: Firm Segregation by College, Race, Gender, and Class Background. Right Panel: Representation of Each College's Graduates Across Firm-Premium Quartiles. (Theil Index)



7.2 Firms and college value-added

I motivated this study as an attempt to explain college value-added: or the earnings differences associated with obtaining a BA degree from different colleges, net of the characteristics of the students of those colleges. The study of college value-added presupposes that colleges do yield earnings differences. Is this the case in Summit State?

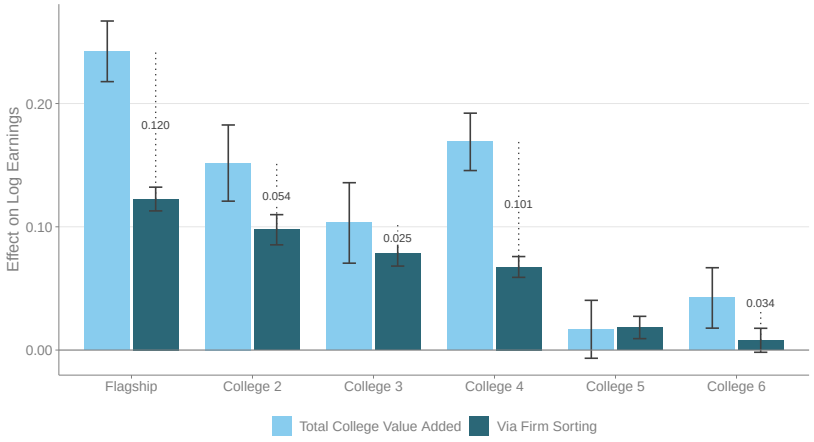
Figure 3 (light blue bars) plots the treatment effects of attaining a BA degree from different Summit State colleges, relative to obtaining a BA from College 7. A BA from the state's flagship campus yields an average increase in earnings of .24 log points (27%). Beyond the flagship, Colleges 2 and 4 yield an earnings premium of 16% and 18%, respectively, and College 3 provides a smaller, but still sizable, payoff of 10%, relative to College 7. By contrast, Colleges 5 and 6 provide small earnings gains relative

to College 7.[10]

Do colleges with high earnings premiums overall also facilitate access to higher-paying employers? The dark blue bars in Figure 3 address this question by plotting the effect of BA attainment from college j, relative to a BA from College 7, on firm premiums. A BA from the state Flagship yields access to the highest-paying employers: graduates from the Flagship work at employers paying 13% more than graduates from College 7. This is followed closely by Colleges 2-4. By contrast, the employers of College 5 and 6 graduates pay similar amounts to those of College 7 graduates. Notably, a college's firm advantage broadly tracks its institutional selectivity. The Flagship sorts its graduates into the highest-paying employers, and the selective Colleges 2-4 also provide strong firm sorting advantages relative to the regional, and less selective, Colleges 5-7. These college firm sorting effects are notable because of their size compared with firm advantages across other commonly studied dimensions of stratification, in particular, across demographic groups. For example, in the contemporary US labor market, Aeppli (2026) finds that the unconditional gap in firm pay premiums between Black and White, and Hispanic and White, workers, respectively, to be .07 and .04 log points. Relatedly, examining the growing gender pay gap in earnings in the US, Barth et al. (2021) find a gender pay gap in firm premiums among college graduates that grows from approximately .025 log points at age 30 to .1 log points at age 45.

[10]Qualitatively, my estimate of the effect of a BA from the flagship on earnings is broadly similar to those presented by Hoekstra (2009), who uses a regression discontinuity design to estimate the economic return to attending the flagship relative to students' fallback options as between 19% and 24%.

Figure 3: Total College Value-Added and Value-Added via Firm Sorting



Note: Light blue bars show the total value-added of each college (i.e., the effect of a BA degree from each college relative to College 7, net of controls); dark blue bars show the amount of value-added explained by firm sorting. The dotted lines and annotations (the difference between the light and dark blue bars) capture within-firm value-added.

How much do these firm-placement effects contribute to college value-added? Under the additive earnings model in Equation 1, the effect of one's college on firm premiums is the portion of the earnings effect mediated by between-firm sorting. Firm sorting accounts for a full half of the Flagship's value-added. It also accounts for two thirds of College 2's value-added and three quarters of College 3's value-added. By contrast, within-firm earnings differences play a larger role for College 4 and College 6. Firm sorting also accounts for a large share of the variation in value-added across Summit State colleges. Removing the firm-sorting component reduces the range of value-added across colleges by half: from .24 log points (the difference between graduating from the Flagship and from College 7) to .12 log points. Further, comparing the variance of total college value-added (light blue bars in Figure 3) with the variance of college value-added net of firm sorting (difference between light and dark blue bars in Figure 3) shows to what extent firm sorting would also reduce the overall variation in college value-added: absent firm sorting, this variation would fall by two thirds.

To gauge how important students' selection into different colleges might be for altering these conclusions, in Appendix E I undertake two exercises. First, I show how successively controlling for observed characteristics attenuates both total college value-added and value-added explained by firm sorting. Second, I implement a sensitivity analysis. Importantly, for the colleges with the largest earnings returns, the degree of attenuation is less pronounced for value-added via firm sorting than for total college value-added. For example, while the flagship log earnings gap (relative to College

7) falls by .15 log points after adjusting for selection, the flagship firm premium gap (relative to College 7) falls by only .06 log points. This implies that characteristics that predict BA graduation are more strongly associated with within-firm earnings gains, rather than with earnings gains which result from cross-firm sorting. The sensitivity analysis also suggests that selection on unobserved characteristics would have to be much larger than on observed characteristics to undermine the conclusions about the role of firm sorting.

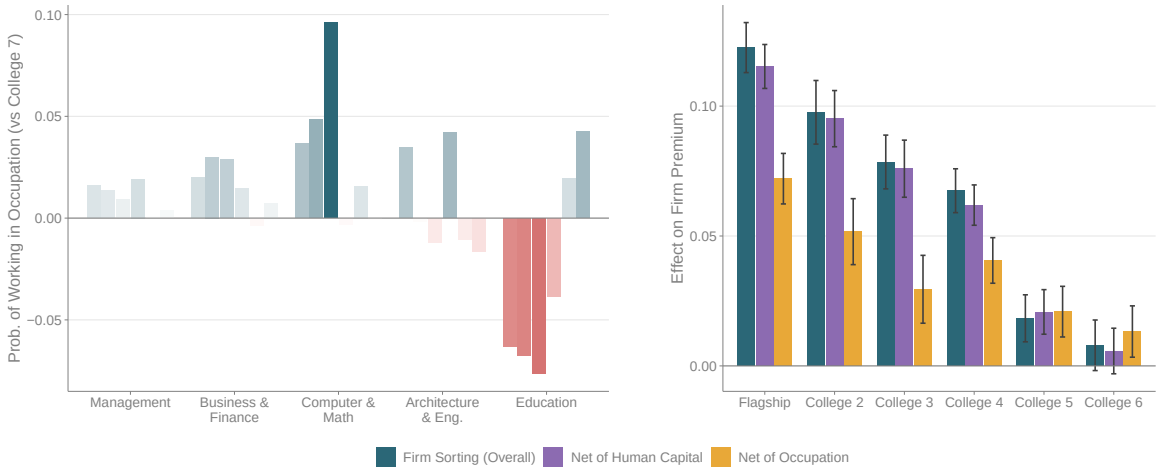
7.3 Overlap with skill-based and occupational sorting

The previous section showed that firm sorting is an important driver of college value-added. What perpetuates these firm advantages?

As noted in the opening sections, firm sorting effects of colleges are not mutually exclusive with skill-based and occupational sorting. Over the past 20 years, workplaces have become increasingly segregated in terms of workers' skills and jobs. High-paying firms are increasingly composed of high-paying occupations and high-skilled workers (Song et al., 2019; Wilmers and Aeppli, 2021). At the same time, prior research documents both the skill-enhancing and occupational sorting effects of colleges. In this way, complementarities between college training and firm production systems could lead to occupation and skill-based sorting that drives certain colleges' firm advantages. In this section I test this hypothesis.

I examine these possibilities using two sets of measures. First, to test the role of skill-based sorting, I use estimated "person effects" from Equation 1 as a summary measure of workers' earnings capacities across employers, following recent approaches to measuring skill-based matching between workers and firms (Gerard et al., 2021). These person effects are not pure measures of skill or human capital; instead, they reflect a composite of human capital and a variety of other factors, including cultural capital, networks, and professional status markers (Tomaskovic-Devey and Avent-Holt, 2019). Nevertheless, they are useful because they capture an individual's tendency to gain an earnings advantage over their co-workers, regardless of where they work. Second, I use Standard Occupational Classification (SOC) codes reported by employers to examine whether college effects on firm premiums are mediated by occupational destinations. To estimate how much of a college's firm advantages remain net of these channels, I decompose the effect of a BA degree from college j relative to College 7 on firm premiums into a component explained by human-capital or occupational sorting and a residual component that persists net of those channels. To do this, I regress each individual's firm effect on their BA college, net of all control variables, and additionally adjust for a worker's occupation and person effects in turn.

Figure 4: Skill Complementarities: Human Capital and Occupational Sorting



Note: The left panel shows college effects on occupational attainment, measured as the change in the probability of working in each of the sample's major occupational groups relative to College 7, net of all control variables; blue bars denote occupational groups in which a college is over-represented relative to College 7 (the reference category), and red bars denote under-representation. In the left panel, within each occupation group the six bars are ordered, left to right: Flagship, College 2, College 3, College 4, College 5, College 6 (College 7 is the reference). The right panel shows each college's effect on the firm pay premium relative to College 7, overall and after adjusting for human capital (purple bars) and occupation (yellow bars); the difference between the two captures the share of the firm-sorting advantage explained by occupational sorting. Human capital is measured as the worker-specific earnings component ("person effect") estimated from Equation 1, a summary of worker skill net of employer pay premiums.

The right panel of Figure 4 reports the results. The dark blue bars show the total firm sorting effect of each college, as in Figure 3, while the purple bars show the portion that remains net of person effects. Skill-based sorting explains little of the firm-sorting advantages associated with Summit State's colleges. Firm advantages for all colleges remain almost identical after adjusting for person effects.[11]

By contrast, occupational sorting accounts for more of colleges' firm-premium effects. Importantly, the portion explained by occupational sorting differs dramatically across colleges. The yellow bars in the right panel of Figure 4 show that occupational sorting explains approximately one-third of the firm premium to the Flagship and College 4, half of the firm-sorting advantage of College 2, and almost two-thirds of the firm-sorting effect of College 3.

This overlap with occupation reflects that colleges in Summit State do in fact produce meaningful differences in occupational attainment. The left panel of Figure 4

[11]The reason for this is because person effects are only weakly predictive of firm premiums. Net of one's BA college and pre-college covariates, a one-log-point increase in person effects (equivalent to moving from the 10th to 93rd percentile in the person effects distribution) is associated with only a .076 log point increase in a worker's expected firm premium.

shows that the starkest differences appear in education professions: graduating from the Flagship or Colleges 2–4 substantially lowers the probability of working in education. At the same time, the Flagship and Colleges 2–4 channel graduates into computer and mathematics occupations and, to a lesser degree, into business and finance occupations. College 3's sorting effects, in particular, appear to be driven primarily by sorting graduates into computer and mathematics professions - increasing the chance of working in this field by almost 10 percentage points, relative to College 7 graduates.

7.4 Pipeline hiring

The large remaining firm sorting effects reflect the fact that Summit State Colleges systematically sort graduates into higher-paying firms *within* occupational groups. What explains these residual firm sorting advantages? I next test whether firm-sorting advantages are organized through pipeline college-to-employer ties. I define a college-specific pipeline employer as a firm that repeatedly hires from a given college across multiple hiring years and for which that college is the firm's most frequent source of hires.

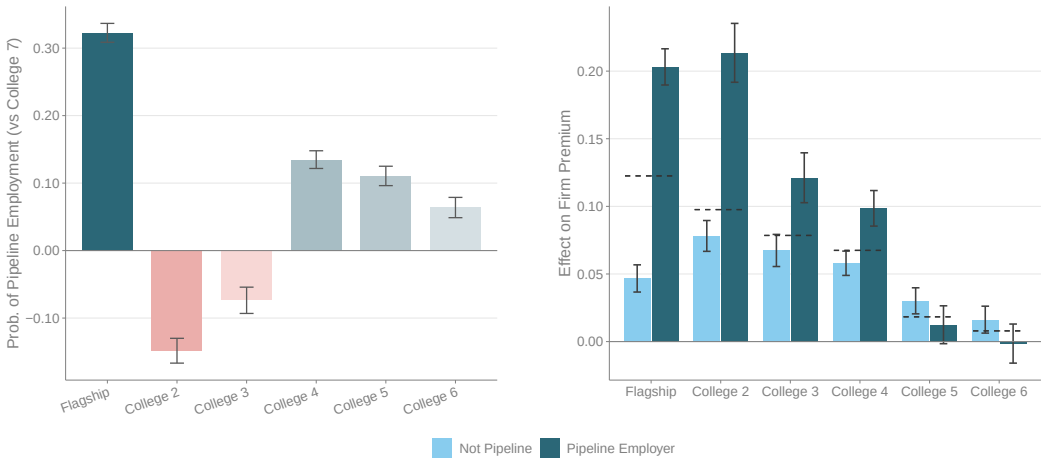
Graduates' employment is highly concentrated in repeated college–firm relationships, as shown in the left panel of Figure 5. Overall, 41% of Summit State graduates work at an employer that has repeatedly hired from their BA college. Pipeline employment is especially prevalent among Flagship graduates: the left panel of Figure 5 shows that Flagship graduates are 32 percentage points more likely to work at a pipeline employer than College 7 graduates (with a baseline chance of 30% of working at a pipeline employer). By contrast, graduates from Colleges 2 and 3 are less likely to work for a pipeline employer.

The right panel of Figure 5 shows the consequences of pipeline employment. Here, I regress an individual's firm effect on their BA college (with control variables) interacted with an indicator for whether that individual is employed by a pipeline employer. The dark blue bars show the firm advantage for each college (relative to College 7) among graduates working at a pipeline employer, while the light blue bars show the firm advantage for each college (relative to College 7) among graduates not working at a pipeline employer. The total firm advantage of each college is shown by the dashed line.

Colleges' firm-sorting advantages are heavily concentrated among pipeline employers. In particular, Flagship and College 2 graduates working at a pipeline employer work at firms with pay premiums 23% higher than those of otherwise similar College 7 graduates; whereas that difference is reduced substantially among non-pipeline employers (to 5% and 8%, respectively). A similar pattern is true for graduates from Colleges 3 and 4, although the differences are less pronounced. Interestingly, pipeline hires from

Colleges 5 and 6 work at employers paying less than pipeline hires from College 7, while College 5 and 6 graduates working at non-pipeline employers earn more. This is consistent with the fact that pipelines can both funnel selective college graduates into higher-paying firms, and channel less selective graduates into lower-paying employers.

Figure 5: Pipeline Hiring



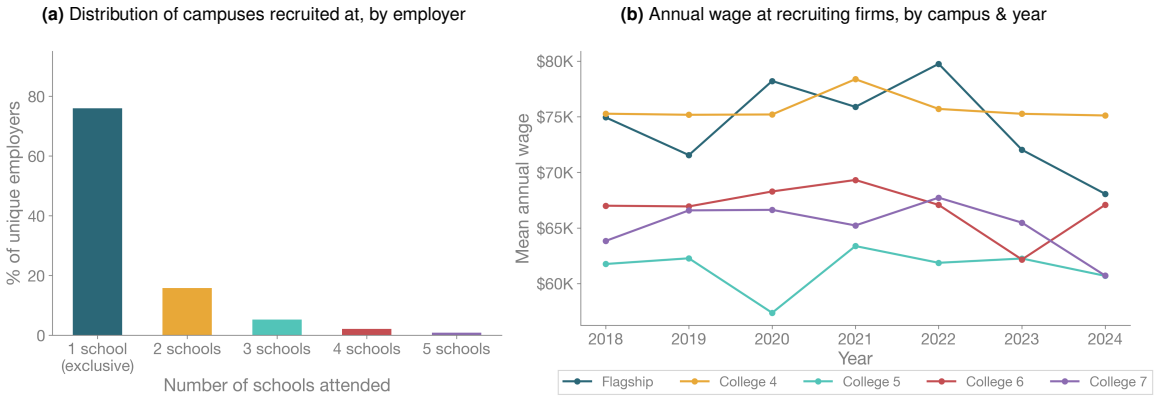
Note: The left panel shows college effects on working for a pipeline employer, relative to College 7, net of all controls; blue bars denote colleges more likely than College 7 (the reference category) to place graduates at a pipeline employer, and red bars denote a lower likelihood. A pipeline employer is defined as a firm that repeatedly hires from a given college across multiple years and for which that college is the firm's most frequent source of hires. The right panel shows each college's effect on the firm pay premium relative to College 7, separately for graduates at a pipeline versus a non-pipeline employer; the dashed line marks the overall firm-sorting effect.

To provide additional evidence for the importance of pipeline hiring, I leverage an additional data source: career-fair registration data covering five of the Summit State universities over 2018–2024. The left panel of Figure 6 shows the distribution of employer cross-campus reach. Recruitment relationships are remarkably concentrated: 76% of the roughly 3,000 unique employers that registered for a Summit State career fair over this period appeared at only one campus, and another 16% appeared at just two. Fewer than 3% of recruiting employers maintained relationships with four or more campuses. Rather than spreading recruiting effort across the state's institutions, the typical employer forms a tie to a single campus.

The right panel of Figure 6 shows the mean annual wage of employers recruiting at each campus over time. The Flagship consistently attracts recruiters paying substantially higher wages than the other campuses: across the 2018–2024 window, the mean annual wage of employers recruiting at the Flagship hovered between $72,000 and $80,000, compared with roughly $60,000–$68,000 at the regional campuses. This

recruiter-wage gap is durable across years. While I am unable to directly link the recruitment data to the administrative data on students' employment destinations, together, these two patterns are consistent with the idea that high-premium employers recruit selectively, and that repeated channels of hiring and recruitment account for a large portion of colleges' firm-sorting advantages.

Figure 6: Career-Fair Recruitment Patterns at Summit State Campuses



Note: The left panel shows the distribution of employers' cross-campus reach—the number of Summit State campuses at which each recruiting employer registered over 2018–2024. The right panel shows the mean annual wage of employers recruiting at each campus over time. Data are career-fair registration records for five campuses, linked to Glassdoor earnings data.

7.5 Geographic sorting

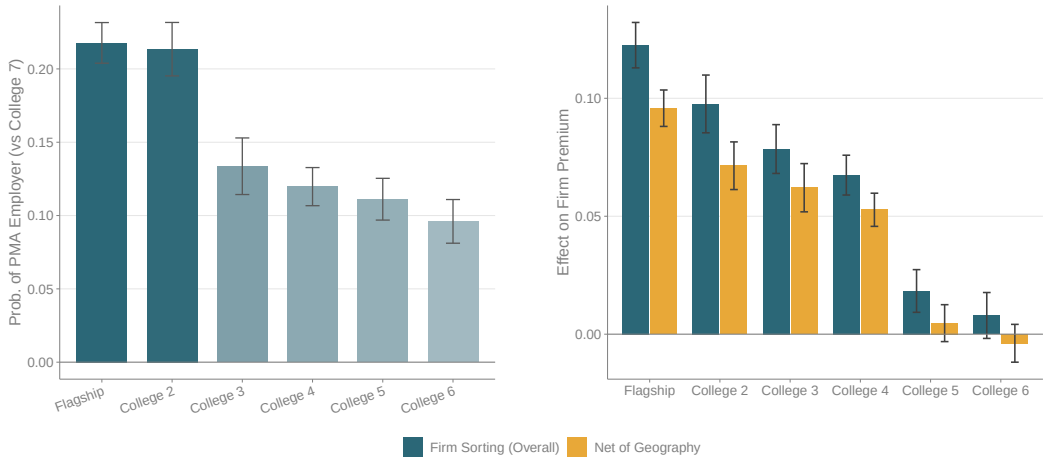
Beyond occupational sorting and pipeline hiring, graduates of more selective colleges may gain access to higher-paying firms simply by working in different places. Firms in large metropolitan areas are disproportionately innovative and human-capital intensive, and they tend to pay more even for the same work (Moretti, 2012); if selective colleges concentrate their graduates in such labor markets, part of their firm-sorting advantage would operate through geography.

Colleges in Summit State do differ sharply in where their graduates work. Table 1 showed that only 24% of College 7 graduates work in the state's Primary Metropolitan Area (PMA), compared with 63% of Flagship graduates. To be sure, some of these differences reflect the types of students graduating from different colleges. Yet the left panel of Figure 7 shows that pronounced employment location differences across college graduates remain even after adjusting for a broad set of pre-college controls

and high school fixed effects. Flagship graduates (as well as graduates of College 2) are over 20 percentage points more likely to be employed in the state's PMA than College 7 graduates. Given that these models control for high school fixed effects, they also adjust for any tendency for students to return to their area of upbringing post-graduation, by comparing students growing up in the same geographic area. Because the primary metro area concentrates many of the state's highest-paying firms, this geographic divergence is a plausible route to high-paying employment.

To gauge the importance of this mechanism, I ask how much of each college's firm-sorting advantage is accounted for by geographic sorting by regressing an individual's firm premium on their BA college, controls, and an indicator for whether the employee's firm is located in the state's primary metropolitan area (PMA). Figure 7 shows that geography explains a small but non-trivial share of each college's firm advantage: controlling for location reduces the firm-sorting advantages of the Flagship and of Colleges 2-4 by 20-30%; by contrast, geographic sorting explains the full firm sorting advantage of College 6. As with occupation and pipeline hiring, geography moves graduates toward higher-paying labor markets.

Figure 7: Spatial Ecologies



Note: The left panel shows college effects on working in the state's primary metropolitan area, relative to College 7, net of all controls; blue bars denote colleges more likely than College 7 (the reference category) to place graduates in the primary metropolitan area, and red bars denote a lower likelihood. The right panel shows each college's effect on the firm pay premium relative to College 7, overall and after adjusting for employment location; the difference captures the share of the firm-sorting advantage explained by geographic sorting.

7.6 Multivariate results

One drawback of the preceding analyses is that they considered each mechanism one at a time. Yet, different explanations for how colleges sort workers into different types of firms are likely correlated and therefore share explanatory power. For example, pipeline hiring may overlap with both occupational sorting and geographic sorting if firms in particular industries and with particular occupational compositions target particular schools with field-specific training, or if employers recruit at geographically proximate schools. To understand the overall contribution of these factors to college-based firm sorting, I estimate a series of multivariate linear regressions in Table 2.

I begin by regressing firm premiums on BA college and the controls I include in the previous analyses (Model 1). I then add controls for occupation and person fixed effects (Model 2). Model 3 adds an interaction between BA college and pipeline employment, such that the remaining coefficient captures the firm sorting effect among graduates who do not work at a pipeline employer. Finally, I add an indicator for whether a graduate works in the state's primary metropolitan area (Model 4).

Together, occupation and human capital (Model 2) account for 41% of the Flagship's total firm-sorting advantage. Of the remaining .07 log point firm advantage, pipeline employment (Model 3) absorbs a further 60%; and geographic sorting explains nearly all of what still remains (Model 4), leaving a statistically insignificant unexplained component of .001. Together, the three mechanisms account for essentially all of the Flagship's firm-sorting advantage. The decomposition also reveals how the underlying channels differ across colleges. For College 2, skill-employer complementarities (occupation and human capital) explain 47% of the baseline gap, while for College 3, complementarities are even more important (64% of the baseline). Pipelines and geography fully explain the remaining amounts of College 2 and 3's firm advantages. College 4's advantages are the most evenly divided between the mechanisms: complementarities explain about 40% of the college's baseline advantage, pipelines 30% of the remainder, and geography 47% of what remains—leaving a small but statistically significant 22% remaining of College 4's advantage net of these mechanisms.

Table 2: College firm-premium gap: combined mechanism analysis

	Model 1	Model 2	Model 3	Model 4
Flagship	0.123^{***}	0.072^{***}	0.027^{***}	0.001
	(0.005)	(0.005)	(0.007)	(0.007)
College 2	0.098^{***}	0.052^{***}	0.038^{***}	0.008
	(0.006)	(0.007)	(0.008)	(0.008)
College 3	0.078^{***}	0.028^{***}	0.020^{*}	0.007
	(0.005)	(0.007)	(0.008)	(0.008)
College 4	0.067^{***}	0.041^{***}	0.026^{***}	0.015^{*}
	(0.004)	(0.005)	(0.006)	(0.006)
College 5	0.018^{***}	0.022^{***}	0.023^{***}	0.008
	(0.005)	(0.005)	(0.006)	(0.006)
College 6	0.008	0.014^{**}	0.010	0.000
	(0.005)	(0.005)	(0.007)	(0.006)
Control variables	✓	✓	✓	✓
Occupation		✓	✓	✓
Person effects		✓	✓	✓
Pipeline employer			✓	✓
Primary metro area				✓

Note: OLS regressions of the firm pay premium on college of BA (reference category: College 7). All models include the same baseline controls—demographics, academic performance in high school and college, and high-school fixed effects—and sequentially introduce mediators. Model 1 reports the baseline firm-sorting effect conditioning only on these controls; Model 2 adds occupation (5-digit SOC fixed effects) and person effects (human capital); Model 3 adds pipeline employment; and Model 4 adds an indicator for employment in the primary metropolitan area. SEs in parentheses. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

8 Conclusion

Colleges do not simply teach; they also act as powerful sorting devices (Kerckhoff, 1976; Domina et al., 2017). While it has long been recognized that the relationship between education and earnings may vary across "occupations, communities...and labor markets" (Bills, 2003, p.457) this variation is often abstracted from employers themselves. In this paper, I have argued that a consequential, yet under-appreciated, dimension of this sorting is across workplaces.

Drawing on a novel linked employer-employee dataset for recent college graduates in a US state, I find stark firm advantages for more selective colleges in the state. A degree from the Flagship or Colleges 2–4 increases graduates' employer pay premiums by 7–13% relative to College 7. Firm sorting also accounts for a substantial share of college value-added across the state's 4-year institutions. In particular, half of the earnings premium associated with graduating from Summit State's flagship public university, relative to a lower-ranked regional university, is explained by differences in access to higher-premium firms. Crucially, these patterns persist even after accounting for the characteristics of graduates from these different colleges. The magnitude of these college-based firm advantages is notable when compared with firm-premium gaps across demographic groups in the broader US labor market. This implies that college is itself a consequential axis of organizational stratification comparable in magnitude to firm-premium gaps documented across major demographic cleavages. Complementarities between college training, occupations, and firm production systems account for part of these firm advantages, playing a significant role for some colleges and a smaller role for others. For the Flagship in particular, repeated college–employer hiring relationships explain a significant portion of its firm sorting effect, and geographic sorting into high-wage labor markets plays a supplementary role across all colleges.

These findings carry several theoretical and policy implications. Theoretically, they suggest that models of educational returns must place greater emphasis on employer behavior and organizational sorting. First, this shifts attention from allocation within the organization to across organizations. Existing work on school-to-work transitions stresses the importance of individual-level attributes such as skills or linkages between schooling and occupational groups (Witte and Kalleberg, 1995; Robst, 2007; DiPrete et al., 2017; Bol et al., 2019; Quadlin et al., 2021; Cassidy and Gaulke, 2024). In labor markets characterized by large firm wage premiums, however, desirable positions are as much determined by pay and occupational differences within a firm as they are by organizational differences between firms: similar workers in similar occupations may receive different rewards depending on whether they work in high- or low-premium firms. Second, the results broaden the meaning of college quality. A college's value-

added is not simply an internal feature of the college—better teaching, better peers, or better completion supports—nor shaped exclusively by macro-level dynamics such as skill supply and demand. It is also partly relational: shaped by its position in the broader organizational structure of the labor market. Third, that the importance of firm sorting for value-added differs across colleges – and that, in turn, the mechanisms underpinning colleges' firm advantages differ in their salience – also suggests that educational quality is not a single institutional attribute. Instead, colleges are better understood as a differentiated set of organizational bridges into the labor market. This echoes longstanding organizational perspectives on colleges as complex and decentralized institutions, in which student outcomes are produced through the contingent interaction of partly autonomous inputs rather than through a single campus-level "quality" factor (Cohen et al., 1972; Ciocca Eller, 2023).

From a policy perspective, the results suggest that efforts to reduce postsecondary wage gaps are likely to be unsuccessful if they focus only on increasing degree completion or improving instructional quality. Certainly, some colleges appear to generate firm advantages by channeling graduates into occupations and skill bundles valued by high-premium firms, and relevant levers may include curricular program capacity and access to high-return fields. But I also show that a significant portion of the returns to different colleges operates net of skill and occupational advantages. While ensuring that all colleges impart students with skills for the workforce is surely an important goal, such an approach will not fully address earnings disparities if graduates of different institutions continue to face unequal access to higher-paying firms. Colleges thus have a role to play beyond the classroom: strengthening career services, alumni networks, and employer partnerships can help ensure that the skills students acquire become convertible into better labor market outcomes. Expanding connections between regional colleges and high-wage employers, and investing in career-services infrastructure that targets a broader range of firms, may materially change graduates' labor-market trajectories.

At the same time, structural constraints - including employers' entrenched preferences for certain credentials and firm-based practices of social closure - limit what colleges can achieve without broader labor market reforms. Prior research suggests that recruiting at Hispanic-serving institutions and historically Black colleges and universities can increase the racial diversity of the managerial workforce over time (Dobbin et al., 2015), while internships may help employers overcome biased or incomplete beliefs about candidates' abilities (Sterling and Fernandez, 2018). Similarly, high-paying firms could broaden access by building sustained recruitment relationships with regional colleges. Narrowing college wage gaps will therefore require not only strengthening college inputs, but also reshaping the organizational pipelines through which employers

decide where talent is found.

There are several important limitations to my analyses. First, while the data provide rare granularity linking students to their educational and employment histories, they are limited to one state's public college system and to relatively early career outcomes. Early firm placement is important for long-term earnings (Arellano-Bover, 2024), but the relative importance of firm sorting may change as workers accumulate experience, move across employers, and advance along internal career ladders. To the extent that between-firm and within-firm earnings trajectories evolve differently for graduates of different colleges, my analyses may mischaracterize the long-run contribution of firm sorting to college value-added.[12]

Second, my estimated earnings returns exclude a large number of individuals who obtain out-of-state employment. To the extent that out-of-state employment is concentrated in higher-premium opportunities, and that such employment is more common among more selective college graduates, these patterns could downwardly bias my estimates of firm-based mediation. Conversely, if missing out-of-state employment includes lower-paid jobs or weak labor-force attachment, the direction of bias is less clear.

Finally, the relative importance of firm advantages for college value-added may be specific to Summit State's institutional and labor-market context. Summit State has a relatively small number of public four-year institutions, a clear hierarchy between the flagship and regional colleges, and a primary metropolitan labor market that concentrates many high-premium employers. In states with weaker flagship hierarchies or less geographically concentrated high-wage employment, college–employer pipelines and geographic sorting may play different roles. Cross-national variation in wage-setting institutions and firm pay premia may also affect the scope for college-based firm sorting: where firms differ more in pay, there is more room for colleges to generate earnings differences through employer placement; where employer wage premia are more compressed, this channel may be less consequential. While the importance of employers for workers' earnings in Summit State reflects the general bifurcation of employment by firm across the US, and indeed across many industrialized countries more generally (Song et al., 2019; Tomaskovic-Devey et al., 2020), comparative research across states and countries is therefore an important next step for understanding when employer sorting amplifies or attenuates the mobility-enhancing role of higher education.

Still, the broader implications are clear: firm sorting is a major, under-recognized contributor to educational returns. As labor markets grow more unequal and as returns to firm affiliation continue to rise, the stakes of organizational sorting are only likely

[12]Preliminary analyses suggest some waning of the relative importance of firm sorting in later career years (see Appendix F). This pattern appears to be driven by increasing within-firm returns to the flagship over time, rather than by an attenuation of colleges' firm advantages.

to deepen. In the short run, firm assignment shapes wage gaps. In the long run, it likely shapes career trajectories, wealth accumulation, geographic mobility, and even health outcomes. Early access to higher-premium firms may compound advantages over time, while exclusion from such firms constrains upward mobility for graduates of less selective colleges. If policymakers and educators are serious about using higher education as a tool for reducing inequality, they must attend not only to the supply side of skills as taught in colleges but to the organizational interface between schools and firms. Recognizing this interface - and acting to reshape it - may be a powerful lever to reduce inequalities in the college-to-work transition.

Appendices

A Further Details on Sample Construction

A.1 Data

Linked employer-employee data come from the state's employment department, obtained from employer wage reports filed through the state's Unemployment Insurance (UI) program. Specifically, I obtain quarterly earnings and hours worked from school years 2005:Q1 to 2024:Q4 for nearly all private-sector, nonfederal public, and local government workers covered under the state's Unemployment Insurance (UI) system, representing a substantial share of the state's civilian labor force.[13] Employers submit quarterly wage reports to the employment department on each employee's wages and hours worked, as well as a (quarterly) summary file on employer characteristics including industry (North American Industry Classification System - NAICS - code), location of firm, and total counts of employees for each month. Employers can be either firms or establishments, depending on whether they operate exclusively in Summit State or across multiple states.[14] The data are organized at the employee-employer-quarter level, meaning an individual may appear multiple times within a quarter if employed by more than one firm. I discuss the process of attaching a single employer to each person year in detail below. A crucial component of these data is that they contain longitudinal employer identifiers that are consistent across years.[15]

A.2 Data Construction

In this section, I provide further details about the construction of my earnings panels. First, for all panels, I begin by imputing missing hours based on an imputed wage rate for the contiguously employed, and drop all observations with negative wage values in a given year-quarter. If the worker has missing, zero, or negative income in a given

[13]Nearly all employers with employees are required to participate in the UI Program if they pay wages to employees, regardless of the dollar amount. Participation includes registering with the state and submitting quarterly reports, and is not contingent on a worker filing a UI claim. It is these quarterly reports that I use. Several classes of worker are not reported in state UI records. These include self-employed workers and business owners, church employees, as well as federal employees, such as US Postal Service (USPS), federal civilian employees, and active duty and retired military.

[14]I use the terms "firm" and "employer" interchangeably to refer to a person's place of employment. Technically, within the sample, the employer is the set of establishments operating in Summit State under a given owner. In the event that the company only operates inside Summit State, the employer is the firm; for companies that have registered addresses outside the state, the employer is an establishment, or set of establishments. For companies operating solely in Summit State and with only one address, the firm is the establishment.

[15]Mergers, acquisitions, liquidation, changes in ownership and other types of restructuring will result in a new employer identification code.

quarter, I assume the worker is unemployed or working out of state, If the respondent has zero reported hours but positive income, I use that individual in the sample (that is, I assume that the employer failed to report the hours of that worker, or that these were wages earned in one quarter but paid in another). If a worker has no reported hours in a given quarter, I classify hours - and therefore the worker's wage rate - as missing, but still use the observation to construct annualized earnings. For each calendar quarter, I then identify each worker's *primary employer* as the firm from which they earned the largest share of their total earnings, and annualize wages from their primary employers, so long as the worker is observed at the firm for at least two consecutive quarters in a given year. These earnings and wage variables, and the corresponding employer, are the basis of my primary analysis. I then annualize the remaining quarterly earnings and hours within each calendar year, conditional on the worker having at least two consecutive quarters of employment with the same primary employer in that year. Annual earnings, hours, and hourly wage rates are computed using this cleaned panel. The resulting unit of observation is the *worker-year*, defined by the worker's relationship with their primary employer in a given school year.

I link these earnings data to individuals' estimated firm premiums, which I obtain from a separate linked employer–employee panel. An employment spell is defined as a sequence of at least five consecutive quarters during which a worker remains employed by the same primary employer. To avoid measurement error from job transitions or partial employment, I drop the first quarter of each spell (which may reflect mid-quarter job starts) and the last two quarters (which may capture separation-related wage fluctuations). Together with the fact that I keep only an individual's primary employer in a given wage quarter (i.e. that with the largest income share) a record will be dropped if an employer is an individual's primary source of income in one quarter, but if the individual is still observed at that employer in the following quarter but that employer is no longer the individual's primary income source (or if the person skips a quarter at an employer before returning). Essentially, this means that an individual must have begun an employment spell before the second quarter (inclusive) in order for that spell to count as an observation in the year. Similarly, when a given employment spell ends, leaving the employer must occur in the fourth quarter, otherwise that spell will not be counted as an observation for a given wage year.[16]

I next impose a series of sample restrictions on this panel. First, I exclude workers

[16]For instance, if a person is employed at employer j for 20161, 2, 3,4, 20171, 2, 3. They have over 4 quarters for that spell so part of the spell is kept: 20162, 20163, 20164, 20171. If this is the primary income source in all years, I end up assigning the employer and the total or annualized wages from the employer in 2016, but the person will have no observed wages in 2017 because there is only one quarter observed at the employer (which does not meet the inclusion threshold of two wage quarters in a given year at the primary employer.)

who appear with more than nine employers in a calendar year. I also drop workers with annual earnings below $4,270 or with an hourly wage rate less than or equal to $3 (both in 2022 dollars). To eliminate outliers in hours worked, I restrict the sample to workers with between 400 and 4,800 annual hours, to workers with strictly fewer than 10 employers over the period 2005-2024, and drop employers with fewer than 5 workers observed over the full period.

Second, I filter wage observations according to the following exclusion criteria, to determine when an individual completes their education. First, for high school graduates never observed in the postsecondary enrollment or awards files, I take all years following high school graduation (that is, in the school year following high school graduation onwards). If an individual is observed to complete a postsecondary degree (in or out of state), I take all person earnings years following the last credential attained sub BA award (inclusive) that an individual attained, ignoring graduate awards (again, taking wage observations only beginning the school year following award attainment). Finally, for college stopouts (i.e., those who at some point enrolled in college but did not complete it), I define an individual to be stopped out if they are observed as a college enrollee in year 5, and no longer observed as a college enrollee in any subsequent years $t, t+1, ..., T$. For individuals who stop out and re-enroll, I only take earnings for that individual following their final enrollment spell. Note that while high school graduates and NSC completers will not feature in my estimation sample for college returns, they can be used to increase precision for estimating the employer effects. Together, these restrictions ensure that I make firm inferences from individuals' earnings (i) only once an individual has completed their formal schooling, and (ii) not based on either a partial quarter of employment or in the quarters either before or during job loss.

A.3 Assignment of Employers to Employer Characteristics

Assigning a consistent location and industry to each firm is essential for analyzing firm-level variation in wages and outcomes. However, the underlying administrative data present several challenges. Summit State does not require multi-industry and multi-site employers to break down their employment and wage data by site and industry. Even when employers do provide these breakouts, it is not clear which employees are working in which locations or industries. While only a very small number of firms in Summit State report data for multiple locations, according to the state's employment department, these firms account for approximately 30% of total employment. Additionally, location and industry reporting may be inconsistent across workers within the

same firm and year.[17]

To address these issues, I implement a rule-based procedure to assign each firm a single county and a single NAICS industry code per year (or, when this is not feasible, to explicitly flag the firm as multi-establishment). The procedure begins by determining the modal county and NAICS code for each firm-year. Then, at the firm level, I assign a unique location and industry as follows. If the firm appears in only one unique county (excluding "Multiple Counties"), I assign that county as the firm's location. If a firm is flagged as multi-establishment but consistently reports a single location, I retain that location. If a firm appears in multiple counties or reports both a specific location and "Multiple Counties," I assign it the label "Multiple Counties." I assign a single NAICS code for each firm-year.

To preserve as many observations as possible, I disregard missing values when more specific information is available. For example, if a firm appears in Jane County and as missing, I assign the firm to Jane County; similarly, if a firm appears with both a valid NAICS code and a missing code, I retain the non-missing value. Firms with no usable location or industry information across all associated workers are excluded from the analysis.

[17]Note in addition that the UI wage data reports only the location of the employer, and not where an individual employee is located.

B AKM Model Details

B.1 Model Results

The first column of Table B.1 presents summary statistics for the annualized linked employer-employee panel which I use to fit the AKM model (Equation 1 in the main text) among workers in the years following education completion - that is, after processing the quarterly records imposing the sample restrictions described in Appendix A. The left column shows summary statistics for the full annualized panel, while the right column shows summary statistics for the fully connected set. The employer effects are identified only within the "connected set" of employers that are linked by worker transitions between those employers, so the AKM estimation is necessarily restricted to the largest connected set of employers. This consists of 43 percent of employers in the full annualized panel, 70 percent of workers in the panel, and 81 percent of worker-year observations in the panel. Because identification of employer fixed effects comes from workers moving between primary employers, it is important to know how much mobility there is in the sample. The table shows that the largest connected set includes over half a million unique workers, and approximately 47% of those workers changed primary employer at least once during the panel 2005-2024.

I estimate the AKM model (Equation 1 in the main text) using the linked employer-employee panel. Table B.2 shows the resulting model fit (rightmost column) and implied earnings variance decomposition. Logged earnings is decomposed into five components: worker effects, firm effects, year effects, the covariance between worker and employer effects (sorting of workers and employers), and a residual.

The estimated variance of earnings for workers in Summit State is .39. Worker fixed effects explain the largest share of earnings variation, at 48%. Firm effects explain a smaller but still sizable share: approximately 20% of the variation in earnings. These shares are very similar to those estimated by prior authors using UI wage records in Summit State (redacted to keep the state anonymous).

Table B.1: Summary Statistics for the Full Sample of Workers and the Largest Connected Set (AKM Sample)

Statistic	Full Sample	Connected Set
Person-year observations	4,299,351	3,513,723
Unique individuals (SSNs)	1,045,164	737,983
Unique firms	159,520	69,093
Unique movers (2+ firms)	397,445	346,899
Mover observations	575,821	487,391

Table B.2: Variance Decomposition of Log Earnings

Variance Component	Raw Variance	Share of Total
Person Effect (Var(pe))	0.19	0.48
Firm Effect (Var(fe))	0.07	0.18
Person-Firm Sorting (2*Cov(pe,fe))	0.06	0.15
Firm-Covariate Sorting (2*Cov(fe,xb))	0.01	0.03
Residual (Var(res))	0.05	0.13
Total Variance of Log Earnings	0.39	1.00

C Proof of Mediation Under Additive Separability

In this section, I formally show that, under an additive separability assumption, the mediation of the average treatment effect (ATE) of college on earnings is equivalent to the ATE of college on firm pay premiums. As in the main text, let $A_i = j$ indicate that individual i obtained a BA from college j; let X_i denote pre-college covariates; let M_i denote the firm at which individual i is employed; and let Y_i denote log earnings. Assume the following nonparametric structural equation model (NPSEM) with independent errors governs the joint distribution of (X_i, A_i, L_i, M_i):

$$\begin{aligned} X_i &= f_X(\epsilon_{X,i}) \\ A_i &= f_A(X_i, \epsilon_{A,i}) \\ L_i &= f_L(X_i, A_i, \epsilon_{Z,i}) \\ M_i &= f_M(X_i, A_i, L_i, \epsilon_{M,i}) \end{aligned}$$

Additionally, assume that earnings for worker i in year t are generated according to the following model:

$$\ln y_{it} = \alpha_i + Z_{it}^{\top}\beta + \psi_{F(i,t)} + \epsilon_{it}, \tag{4}$$

where α_i is an individual fixed effect, Z_{it} is a vector of time-varying controls (including year fixed effects), $F(i,t)$ is an index function that maps worker i to their employer in year t, $\psi_{F(i,t)}$ is the firm-specific wage premium, and ϵ_{it} captures idiosyncratic shocks. To link this panel data model to the NPSEM, define Y_i to be the logged earnings for individual i in year t as $Y_i \equiv \ln y_{i,t}$, and let $M_i \equiv F(i,t)$. Equation (4) then implies a semi-parametric model for Y_i of the form:

$$Y_i = f_Y(X_i, A_i, L_i, \epsilon_{Y,i}) + \beta^{\top} Z_{i,t} + g(M_i), \tag{5}$$

where $g(M_i) = \psi_{F(i,t)}$ is the firm-specific wage premium faced by individual i, by construction. That is, additive separability in Equation (4) implies that Y_i is additively separable in $(X_i, A_i, Z_i, \epsilon_{Y,i})$ and the firm M_i.

Under ignorability for A_i on Y_i, the average treatment effect of graduating from college j relative to College 7 is:

$$\text{ATE}_{A \to Y} = \int_x \left[\mathbb{E}[Y_i \mid X_i = x, A_i = j] - \mathbb{E}[Y_i \mid X_i = x, A_i = \text{College 7}]\right] dP(x).$$

I aim to decompose this total effect into direct and indirect (mediated) components. Let $Y_i(a, m)$ denote the potential outcome under treatment a and mediator value m.

Then the ATE can be written as:

$$\begin{aligned}\text{ATE}_{A\to Y} = &\underbrace{\mathbb{E}[Y_i(j, M_i(j)) - Y_i(\text{College 7}, M_i(j))]}_{\text{Direct effect (net of firms)}} \\ &+ \underbrace{\mathbb{E}[Y_i(\text{College 7}, M_i(j)) - Y_i(\text{College 7}, M_i(\text{College 7}))]}_{\text{Indirect effect (via firms)}}.\end{aligned}$$

Under the above assumptions, we can write

$$\begin{aligned}&\mathbb{E}[Y_i(\text{College 7}, M_i(j)) - Y_i(\text{College 7}, M_i(\text{College 7}))] \\ &= \mathbb{E}[f_Y(X_i, A_i(\text{College 7}), L_i, \epsilon_{Y,i}) + \beta^\top Z_{i,t} + g(M_i(j))] \\ &-\mathbb{E}[f_Y(X_i, A_i(\text{College 7}), L_i, \epsilon_{Y,i}) + \beta^\top Z_{i,t} + g(M_i(\text{College 7}))] \\ &= \mathbb{E}[g(M_i(j))] - \mathbb{E}[g(M_i(\text{College 7}))] \\ &= \mathbb{E}_X\mathbb{E}[g(M_i(j))|A_i = j, X] - \mathbb{E}_X\mathbb{E}[g(M_i(\text{College 7}))|A_i = \text{College 7}, X] \\ &= \mathbb{E}_X\mathbb{E}[g(M_i)|A_i = j, X] - \mathbb{E}_X\mathbb{E}[g(M_i)|A_i = \text{College 7}, X] \\ &= \mathbb{E}_X\mathbb{E}[\psi_{F(i,t)}|A_i = j, X] - \mathbb{E}_X\mathbb{E}[\psi_{F(i,t)}|A_i = \text{College 7}, X].\end{aligned}$$

Therefore, under additive separability, the mediated effect of college on earnings through firm pay premiums is equivalent to the ATE of college on firm pay premiums. Note further that because of firm effect additivity, this decomposition is unique (that is, the reference category does not matter). In other words, $\mathbb{E}[Y_i(\text{College 7}, M_i(j)) - Y_i(\text{College 7}, M_i(\text{College 7}))] = \mathbb{E}[Y_i(j, M_i(j)) - Y_i(j, M_i(\text{College 7}))]$.

D Nonparametric treatment effects

In my main analyses, I use linear models to estimate the average treatment effect (ATE) of a BA from college j relative to College 7. This approach recovers the ATE when the conditional mean is linear in BA college and covariates,

$$\mathbb{E}[Y \mid A = j, X] = \alpha + \sum_{j \neq \text{College 7}} \beta_j \, \mathbb{I}(A = j) + \gamma' X, \tag{6}$$

with College 7 as the reference category. Under this specification the ATE reduces to the college coefficient, $\text{ATE}_j = \beta_j$; replacing the outcome with the firm premium ψ yields the effect of college j on firm pay.

To assess how sensitive the results are to this linearity assumption, I also implement a machine-learning estimator that relaxes it. Under no unobserved confounding given pre-BA covariates X, the ATE can be written as

$$\text{ATE}_j = \mathbb{E}_X[\, \mathbb{E}[Y \mid A = j, X] - \mathbb{E}[Y \mid A = \text{College 7}, X] \,] \, .$$

I estimate this quantity using its efficient influence function (EIF), which augments each conditional-mean estimate with an inverse-propensity correction. The EIF estimator of the ATE is the difference between these augmented estimators for college j and College 7:

$$\begin{aligned}\widehat{\text{ATE}}_j^{\text{EIF}} = \frac{1}{n} \sum_{i=1}^{n} \left\{ \hat{\mathbb{E}}[Y \mid A = j, X_i] + \frac{\mathbb{I}(A_i = j)}{\hat{\Pr}(A = j \mid X_i)} (Y_i - \hat{\mathbb{E}}[Y \mid A = j, X_i]) \right\} \\ - \frac{1}{n} \sum_{i=1}^{n} \left\{ \hat{\mathbb{E}}[Y \mid A = \text{College 7}, X_i] + \frac{\mathbb{I}(A_i = \text{College 7})}{\hat{\Pr}(A = \text{College 7} \mid X_i)} (Y_i - \hat{\mathbb{E}}[Y \mid A = \text{College 7}, X_i]) \right\},\end{aligned}$$

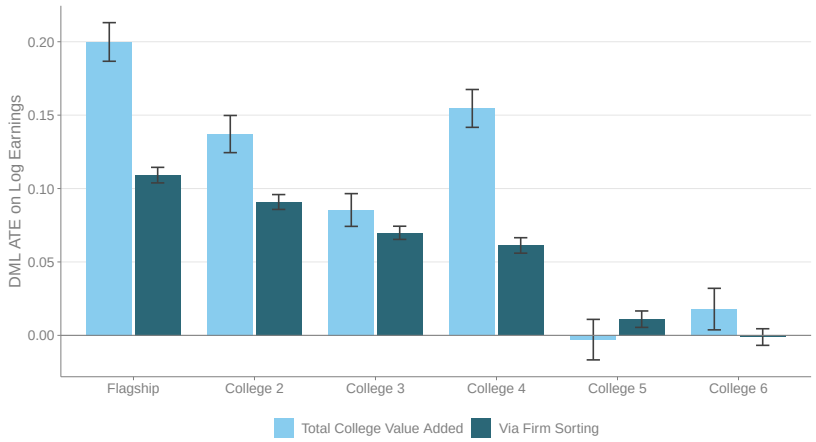
where $\hat{\mathbb{E}}[Y \mid A = j, X]$ and $\hat{\mathbb{E}}[Y \mid A = \text{College 7}, X]$ are estimated outcome regressions and $\hat{\Pr}(A = j \mid X)$, $\hat{\Pr}(A = \text{College 7} \mid X)$ the estimated propensity scores.

I fit these outcome regressions and propensity scores with linear and multinomial ridge regressions (depending on whether the outcome is continuous or categorical) and use $K = 5$-fold cross-fitting. In this procedure, the data are partitioned into $K = 5$ folds. Cross-fitting preserves the asymptotic efficiency of the EIF estimator even when using a nonparametric method like ridge regression. Specifically, for each fold $k = 1, \ldots, 5$, the nuisance functions are estimated on the training folds (excluding the current fold), and predictions are made on the held-out fold. This process ensures that each observation's EIF term is computed using nuisance estimates that are fit on independent data. The final ATE estimate is computed by aggregating EIF

contributions across all folds. Under this procedure, standard errors for $\widehat{\text{ATE}}_j^{\text{EIF}}$ can be obtained using the empirical variance of the estimated EIF. Asymptotically valid confidence intervals can then be constructed using the normal approximation.

The results, shown in Figure D.1, are highly consistent with those reported in the main text.

Figure D.1: Double/Debiased Machine Learning Estimates of College Effects on Log Earnings and Firm Premiums



Note: Cross-fitted EIF (DML) estimates of the effect of each college relative to College 7 on log earnings (total value-added) and on the firm pay premium (firm-sorting component).

E Sensitivity Analyses

In this section, I assess how robust my observational estimates of colleges' value-added is to unobserved selection. To begin with, I first trace how the estimated college gaps change as I successively add controls, separately for total college value-added (left panel) and for value-added via firm sorting (right panel). Model 1 includes no controls and recovers the raw gap relative to College 7. Model 2 adds college and pre-college characteristics–demographics, high-school performance, socioeconomic indicators (FRPL status, special-education, English-learner and homelessness status, and college GPA and credits). Model 3 further absorbs high-school fixed effects, so that identification comes from comparisons among graduates who attended the same high school.

Two patterns emerge. First, adding controls attenuates the gaps for every college and for both outcomes, consistent with positive selection into the higher-return colleges: students who enroll at and graduate from these institutions are positively selected on characteristics that independently predict earnings. Most of the attenuation appears in the move to the fully adjusted Model 3; the pre-college controls in Model 2 do comparatively little on their own, with the high-school fixed effects accounting for the bulk of the additional reduction.

Second, and more consequentially, for the colleges with the largest earnings returns, the firm-sorting component is more robust to these controls than the total gap. For the Flagship, the log-earnings gap relative to College 7 falls by .15 log points (from .39 to .24) once selection is accounted for, whereas the firm-premium gap falls by only .06 log points (from .19 to .12). The same ordering holds in absolute terms for Colleges 2 and 4. In other words, the characteristics that predict which students attain a BA at a particular college are more strongly associated with *within-firm* earnings gains than with the earnings gains that operate through sorting into higher-paying firms. This suggests that the portion of college value-added accounted for by firm sorting is comparatively less vulnerable to selection on observables.

To provide further evidence for the robustness of the observational value-added approach, I also implement a sensitivity analysis, following VanderWeele and Arah (2011). Let

$$\text{ATE}^{Y}(j) = \mathbb{E}[Y(j) - Y(\text{College 7})] \tag{7}$$

denote the average treatment effect of BA college on earnings Y relative to College 7 (i.e., college j's "value-added"). Note that the following sensitivity derivation equally applies to the portion mediated via firms, replacing Y with ψ.

Table E.1: College Value-Added with and without Controls

	Total College Value-Added			Via Firm Sorting		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Flagship	0.394^{***}	0.329^{***}	0.242^{***}	0.186^{***}	0.166^{***}	0.122^{***}
	(0.009)	(0.009)	(0.013)	(0.004)	(0.004)	(0.005)
College 2	0.255^{***}	0.252^{***}	0.152^{***}	0.162^{***}	0.147^{***}	0.098^{***}
	(0.013)	(0.013)	(0.016)	(0.005)	(0.005)	(0.006)
College 3	0.149^{***}	0.162^{***}	0.103^{***}	0.116^{***}	0.107^{***}	0.079^{***}
	(0.014)	(0.013)	(0.017)	(0.005)	(0.005)	(0.005)
College 4	0.220^{***}	0.211^{***}	0.169^{***}	0.094^{***}	0.086^{***}	0.067^{***}
	(0.009)	(0.009)	(0.012)	(0.004)	(0.004)	(0.004)
College 5	0.085^{***}	0.082^{***}	0.017	0.059^{***}	0.052^{***}	0.018^{***}
	(0.010)	(0.010)	(0.012)	(0.004)	(0.004)	(0.005)
College 6	0.091^{***}	0.093^{***}	0.042^{***}	0.033^{***}	0.028^{***}	0.008
	(0.011)	(0.010)	(0.013)	(0.004)	(0.004)	(0.005)
College & pre-college controls		✓	✓		✓	✓
High-school fixed effects			✓			✓

Note: OLS regressions of log earnings (left panel) and the firm pay premium (right panel) on college of BA (reference category: College 7). Model 1 includes no controls; Model 2 adds college and pre-college controls; Model 3 adds high-school fixed effects. SEs in parentheses. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Assume that there exists a binary unobserved confounder, U, for the treatment-outcome relationship, where $A \in \{0,1\}$ denotes BA college and Y denotes earnings. Let X denote the observed covariates. I parameterize the possible influence of U using two sensitivity parameters. First, define $\alpha = \mathbb{E}[Y|x,a,U=1] - \mathbb{E}[Y|x,a,U=0]$ to be the average difference in earnings associated with the unobserved factor U, holding fixed BA college and observed covariates, and $\beta = \Pr[U=1|x,A=1] - \Pr[U=1|x,A=0]$ to be the degree to which the prevalence of the unobserved confounder differs between college j graduates and graduates from College 7, conditional on observed covariates. I assume that (1) α does not depend on x or a, and (2) that β does not depend on x.

For a given treatment state a, the true counterfactual mean can be written as

$$\begin{aligned}\mathbb{E}[Y(a)] &= \int \sum_{u\in\{0,1\}} \mathbb{E}[Y \mid X=x, A=a, U=u] \Pr(U=u \mid X=x)\, dF_X(x) \\ &= \int \Big[\mathbb{E}[Y \mid X=x, A=a, U=1] \Pr(U=1 \mid X=x) \\ &\qquad + \mathbb{E}[Y \mid X=x, A=a, U=0] \Pr(U=0 \mid X=x)\Big]\, dF_X(x).\end{aligned}$$

However, because U is unobserved, an estimator that adjusts only for X will instead estimate

$$\begin{aligned}\mathbb{E}^*[Y(a)] &= \int \mathbb{E}[Y \mid X=x, A=a]\, dF_X(x) \\ &= \int \Big[\mathbb{E}[Y \mid X=x, A=a, U=1] \Pr(U=1 \mid X=x, A=a) \\ &\qquad + \mathbb{E}[Y \mid X=x, A=a, U=0] \Pr(U=0 \mid X=x, A=a)\Big]\, dF_X(x).\end{aligned}$$

The bias in the estimated mean potential outcome under treatment state a is therefore

$$\begin{aligned}\mathbb{E}^*[Y(a)] - \mathbb{E}[Y(a)] = \int &\Big[\mathbb{E}[Y \mid X=x, A=a, U=1] - \mathbb{E}[Y \mid X=x, A=a, U=0]\Big] \\ &\cdot \Big[\Pr(U=1 \mid X=x, A=a) - \Pr(U=1 \mid X=x)\Big]\, dF_X(x).\end{aligned}$$

Using the definition of α, this becomes

$$\mathbb{E}^*[Y(a)] - \mathbb{E}[Y(a)] = \alpha \int \Big[\Pr(U=1 \mid X=x, A=a) - \Pr(U=1 \mid X=x)\Big]\, dF_X(x).$$

The bias in the estimated average treatment effect $\text{ATE}^{Y*}(j)$ under selection on observables X alone is the difference between the bias in the treated and untreated potential-outcome means:

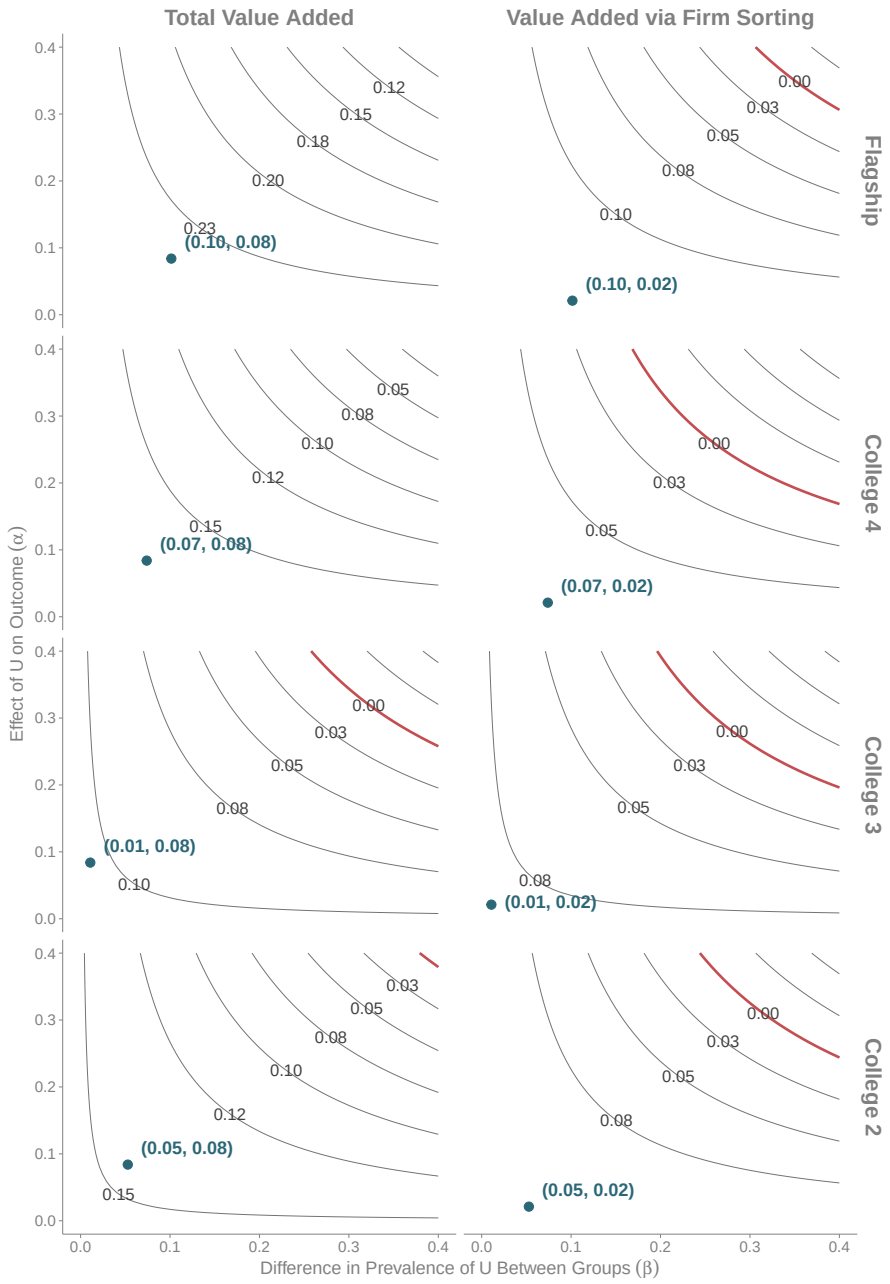
$$\begin{aligned}
&\text{Bias}(\text{ATE}^{Y*}(j)) \\
&\qquad = \{\mathbb{E}^*[Y(1)] - \mathbb{E}[Y(1)]\} - \{\mathbb{E}^*[Y(0)] - \mathbb{E}[Y(0)]\} \\
&\qquad = \alpha \int \Big[\Pr(U = 1 \mid X = x, A = 1) - \Pr(U = 1 \mid X = x, A = 0) \Big] \, dF_X(x) \\
&\qquad = \alpha \int \Big[\Pr(U = 1 \mid X = x, A = 1) - \Pr(U = 1 \mid X = x, A = 0) \Big] \, dF_X(x) \\
&\qquad = \alpha\beta.
\end{aligned}$$

The bias-adjusted ATE is therefore

$$\text{ATE} = \text{ATE}^* - \alpha\beta.$$

Figure E.1 plots contours of the bias-adjusted estimates associated with a range of potential values of α and β, for value-added estimates of the Flagship and Colleges 2-4. To benchmark these contours, I also show the values of (α, β) that would arise if the unobserved binary confounder U behaved like one of the observed binary confounders of the $A - Y$ and $A - \psi$ relationships: FRPL status. The original estimate of the ATE and of the portion mediated by firm sorting can be explained away by unobserved confounding only when both α and β are much larger than the sizes implied by this observed confounder. In particular, FRPL status is much more strongly associated with within-firm earnings gains, than with sorting across employers, associated with a .08 log point increase in within-firm earnings, but only a .02 log point increase in firm pay premiums. For example, in the case of the Flagship, the bias-adjusted estimate of the portion mediated via firm sorting would reduce to zero only when the unobserved confounder is over 15 times more predictive of employer pay than FRPL status.

Figure E.1: Sensitivity of the Value-Added Estimates to Unobserved Confounding (Flagship and Colleges 2–4)



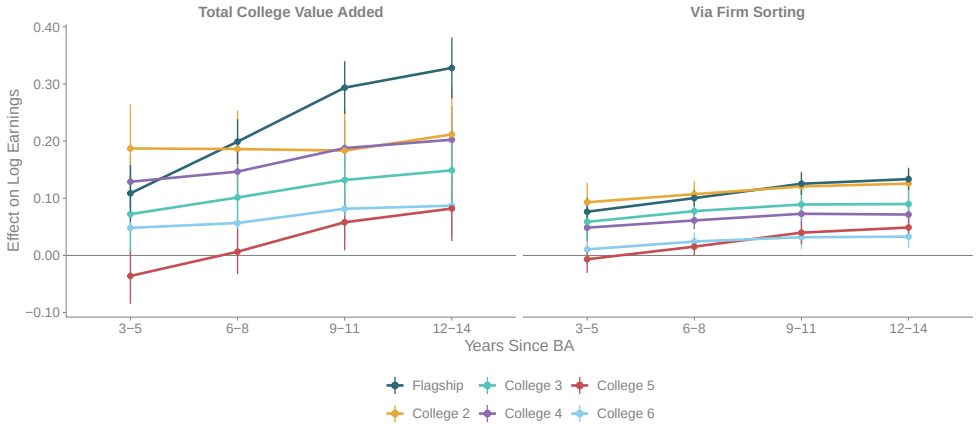
Contour plots showing bias-adjusted estimates for the ATE (left panel) and portion mediated by firm sorting (right panel). The two annotated points show values of (α, β) if the unobserved confounder U behaved like one of the observed confounders in the data (FRPL status), shown in blue.

F Effects by Years since Graduation

To trace how the college premium evolves over the career, I focus on earlier cohorts in my data (specifically, those who earned a BA degree before 2011) for whom I can observe a longer time horizon out of college. To do this, I construct an earnings panel (where each row represents a person-year observation) and interact BA college with dummies denoting 3-year periods since BA graduation.

The Flagship's value-added widens substantially over the career. In particular, while Flagship graduates earn .11 log points more than College 7 graduates 3–5 years since graduation, this advantage roughly triples 12–14 years out. The firm-sorting component also increases, but far more modestly. The growing within-firm portion of colleges' value-added could reflect several processes, including higher rates of promotion and opportunities for on-the-job skill training among Flagship attendees (cf. Tomaskovic-Devey et al., 2005), or continual human capital investment via graduate education. Indeed, Flagship graduates are more likely to obtain a graduate degree than College 7 graduates, and graduate education has large labor market returns (Altonji et al., 2016; Altonji and Zhong, 2021) that may be associated more with within-firm earnings advancement than with between-firm sorting. Colleges 3 and 4 show similar within-firm growth over the career, accompanied by smaller increases in their firm-sorting components. College 2 is the one exception—its total value-added is essentially constant between 3–5 and 12–14 years out.

Figure F.1: Total College Value-Added and Value-Added via Firm Sorting, by Years since BA

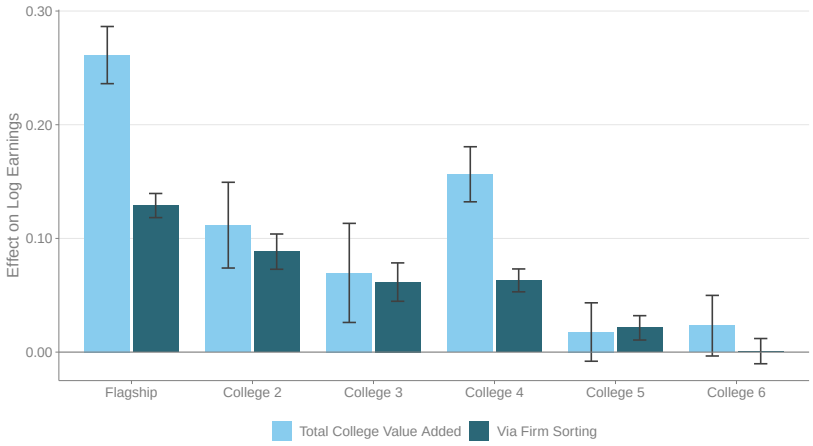


G Alternative Variable Definitions: Robustness Checks

G.1 College Attendance Effects

In the main text, I define college value-added to be the effect of graduating from that college on earnings. In this section, I re-estimate the main analysis but now defining college value-added in terms of an individual's first college attended (rather than in terms of BA-granting institution). Figure G.1 shows the resulting estimates of each college's total value-added and value-added via firm sorting. These results are substantively similar to those in the main text.

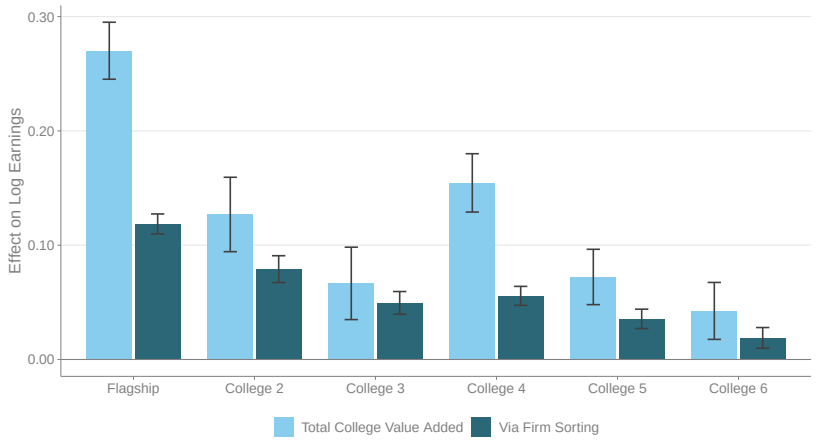
Figure G.1: Total College Value-Added and Value-Added via Firm Sorting (Attendance Definition)



G.2 Field of Study Control

In my main analyses, I do not include controls for a worker's field of study, in keeping with prior work on college value-added, which treats field of study as endogenous to an institution (Hoekstra, 2009; Zimmerman, 2014; Goodman et al., 2017; Mountjoy and Hickman, 2021; Mountjoy, 2024). To check the robustness of the results to this, here I re-estimate the main analysis adding controls for a worker's field of study. Figure G.2 shows the resulting value-added estimates and portions explained by firm sorting. For the high-return colleges, the point estimates shift only slightly, and the firm-sorting share of total value-added is preserved (though falling slightly for the Flagship to 44%). The clearest change is for College 5, whose near-zero main estimate rises once field of study is held fixed (total value-added increases from about .02 to .07 log points).

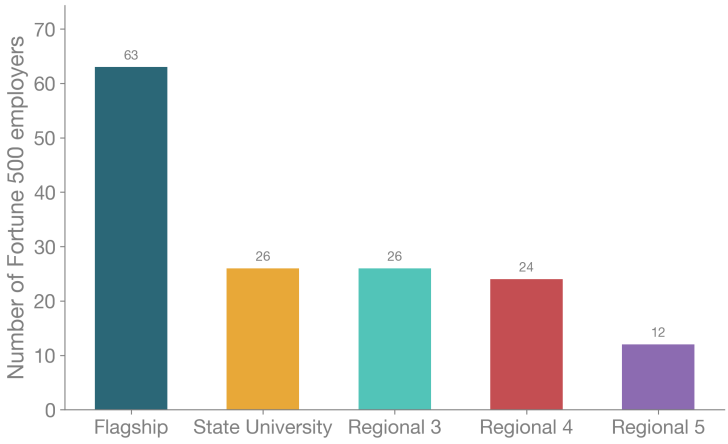
Figure G.2: Total College Value-Added and Value-Added via Firm Sorting (Field-of-Study Control)



H Further Figures

H.1 Fortune 500 Employer Presence at Summit State Campus Career Fairs

Figure H.1: Number of Fortune 500 Employers Recruiting at Each Summit State Campus, 2018–2024



Source: Summit State career-fair registration records, 2018–2024.

References

Abbott, A. (1988). *The System of Professions: An Essay on the Division of Expert Labor*. University of Chicago Press, Chicago.

Abowd, J. M., Creecy, R. H., and Kramarz, F. (2002). Computing person and firm effects using linked longitudinal employer-employee data. Technical report.

Abowd, J. M., Kramarz, F., and Margolis, D. N. (1999). High wage workers and high wage firms. *Econometrica*, 67:251–333.

Acemoglu, D. and Autor, D. (2011). *Skills, tasks and technologies: Implications for employment and earnings*, volume 4, pages 1043–1171. Elsevier.

Aeppli, C. (2026). Workplace segregation and the structure of American racial earnings inequality. Working paper.

Aisch, G., Gebeloff, R., and Quealy, K. (2014). Where we came from and where we went, state by state. New York Times.

Altonji, J. G., Arcidiacono, P., and Maurel, A. (2016). *The analysis of field choice in college and graduate school: Determinants and wage effects*, volume 5, pages 305–396. Elsevier.

Altonji, J. G. and Zhong, L. (2021). The labor market returns to advanced degrees. *Journal of Labor Economics*, 39:303–360.

Arellano-Bover, J. (2024). Career consequences of firm heterogeneity for young workers: First job and firm size. *Journal of Labor Economics*, 42:549–589.

Autor, D., Goldin, C., and Katz, L. F. (2020). Extending the race between education and technology. In *AEA papers and proceedings*, volume 110, pages 347–351. American Economic Association 2014 Broadway, Suite 305, Nashville, TN 37203.

Barth, E., Bryson, A., Davis, J. C., and Freeman, R. (2016). It's where you work: Increases in the dispersion of earnings across establishments and individuals in the United States. *Journal of Labor Economics*, 34:S67–S97.

Barth, E., Kerr, S. P., and Olivetti, C. (2021). The dynamics of gender earnings differentials: Evidence from establishment data. *European Economic Review*, 134:103713.

Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of political economy*, 70:9–49.

Becker, G. S. (1964). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. National Bureau of Economic Research, New York.

Beggs, J. J. and Villemez, W. J. (2001). Regional labor markets. In Berg, I. and Kalleberg, A. L., editors, *Sourcebook of Labor Markets*, pages 503–529. Springer.

Behrman, J. R., Rosenzweig, M. R., and Taubman, P. (1996). College choice and wages: Estimates using data on female twins. *The Review of Economics and Statistics*, pages 672–685.

Bender, S., Bloom, N., Card, D., Reenen, J. V., and Wolter, S. (2018). Management practices, workforce selection, and productivity. *Journal of Labor Economics*, 36:S371–S409.

Biasi, B. and Ma, S. (2022). The education-innovation gap. Technical report.

Bills, D. B. (2003). Credentials, signals, and screens: Explaining the relationship between schooling and job assignment. *Review of educational research*, 73:441–469.

Binder, A. J., Davis, D. B., and Bloom, N. (2016). Career funneling: How elite students learn to define and desire "prestigious" jobs. *Sociology of Education*, 89:20–39.

Blau, P. M. and Duncan, O. D. (1967). *The American Occupational Structure*. John Wiley and Sons.

Bleemer, Z. (2022). Affirmative action, mismatch, and economic mobility after California's proposition 209. *The Quarterly Journal of Economics*, 137:115–160.

Bleemer, Z. and Quincy, S. (2025). Changes in the college mobility pipeline since 1900. NBER Working Paper 33797, National Bureau of Economic Research.

Bloom, N., Ohlmacher, S. W., Tello-Trillo, C. J., and Wallskog, M. (2021). Pay, productivity and management. Technical report.

Bol, T., Eller, C. C., Werfhorst, H. G. V. D., and DiPrete, T. A. (2019). School-to-work linkages, educational mismatches, and labor market outcomes. *American Sociological Review*, 84:275–307.

Borgen, N. T. and Mastekaasa, A. (2018). Horizontal stratification of higher education: The relative importance of field of study, institution, and department for candidates' wages. *Social Forces*, 97(2):531–558.

Bound, J. and Turner, S. (2011). *Dropouts and diplomas: The divergence in collegiate outcomes*, volume 4, pages 573–613. Elsevier.

Bourdieu, P. (1973). Cultural reproduction and social reproduction. In Brown, R., editor, *Knowledge, Education, and Cultural Change*, pages 71–112. Tavistock, London.

Bowen, W. G. and Bok, D. (1998). *The Shape of the River: Long-Term Consequences of Considering Race in College and University Admissions*. Princeton University Press, Princeton, NJ.

Bowles, S. and Gintis, H. (1976). *Schooling in Capitalist America: Educational Reform and the Contradictions of Economic Life*. Basic Books, New York.

Brand, J. E. and Halaby, C. N. (2006). Regression and matching estimates of the effects of elite college attendance on educational and career achievement. *Social Science Research*, 35:749–770.

Breaugh, J. A. (2008). Employee recruitment: Current knowledge and important areas for future research. *Human Resource Management Review*, 18(3):103–118.

Brewer, D. J., Eide, E. R., and Ehrenberg, R. G. (1999). Does it pay to attend an elite private college? cross-cohort evidence on the effects of college type on earnings. *The Journal of Human Resources*, 34:104–123.

Brymer, R. A., Chadwick, C., Hill, A. D., and Molloy, J. C. (2019). Pipelines and their portfolios: A more holistic view of human capital heterogeneity via firm-wide employee sourcing. *Academy of Management Perspectives*, 33(2):207–233.

Brymer, R. A., Molloy, J. C., and Gilbert, B. A. (2014). Human capital pipelines: Competitive implications of repeated interorganizational hiring. *Journal of Management*, 40(2):483–508.

Burawoy, M. and Wright, E. O. (1990). Coercion and consent in contested exchange. *Politics & Society*, 18:251–266.

Card, D. (1999). The causal effect of education on earnings. *Handbook of labor economics*, 3:1801–1863.

Card, D., Heining, J., and Kline, P. (2013). Workplace heterogeneity and the rise of west German wage inequality. *The Quarterly journal of economics*, 128:967–1015.

Carnevale, A. P. and Rose, S. J. (2004). Socioeconomic status, race/ethnicity, and selective college admissions. america's untapped resource: Low-income students in higher education. *Edited by RD Kahlenberg. New York: Century Foundation*.

Cassidy, H. and Gaulke, A. (2024). The increasing penalty to occupation-education mismatch. *Economic Inquiry*, 62:607–632.

Chadwick, C. and Dabu, A. (2009). Human resources management and the competitive advantage of firms: Toward a more comprehensive model of causal linkages. *Organization Science*, 20(1):253–272.

Chetty, R., Deming, D. J., and Friedman, J. N. (2023). Diversifying society's leaders? the causal effects of admission to highly selective private colleges. Technical report.

Chetty, R., Friedman, J. N., Saez, E., Turner, N., and Yagan, D. (2020). Income segregation and intergenerational mobility across colleges in the United States*. *The Quarterly Journal of Economics*, 135:1567–1633.

Ciocca Eller, C. (2023). What makes a quality college? re-examining the equalizing potential of higher education in the United States. *American Journal of Sociology*, 129(3):637–714.

Clark, B. R. (1972). The organizational saga in higher education. *Administrative science quarterly*, pages 178–184.

Cobb, J. A. and Lin, K.-H. (2017). Growing apart: The changing firm-size wage premium and its inequality consequences. *Organization Science*, 28(3):429–446.

Cohen, M. D., March, J. G., and Olsen, J. P. (1972). A garbage can model of organizational choice. *Administrative Science Quarterly*, 17(1):1–25.

Collins, R. (1979). *The Credential Society: An Historical Sociology of Education and Stratification*. Academic Press, New York.

Conzelmann, J. G., Hemelt, S. W., Hershbein, B. J., Martin, S., Simon, A., and Stange, K. M. (2025). Grads on the go: Measuring college-specific labor markets for graduates. *Journal of Policy Analysis and Management*, 44:741–763.

Dale, S. and Krueger, A. B. (2011). Estimating the return to college selectivity over the career using administrative earnings data. NBER Working Paper 17159.

Dale, S. B. and Krueger, A. B. (2002). Estimating the payoff to attending a more selective college: An application of selection on observables and unobservables. *The Quarterly Journal of Economics*, 117:1491–1527.

Davis, D. and Binder, A. (2016). *Selling students: The rise of corporate partnership programs in university career centers*, volume 46, pages 395–422. Emerald Group Publishing Limited.

Davis, D. and Binder, A. (2019). Industry, firm, job title: The layered nature of early-career advantage for graduates of elite private universities. *Socius*, 5:2378023119859711.

Deming, D. and Kahn, L. B. (2018). Skill requirements across firms and labor markets: Evidence from job postings for professionals. *Journal of Labor Economics*, 36:S337–S369.

Deming, D. J., Yuchtman, N., Abulafi, A., Goldin, C., and Katz, L. F. (2016). The value of postsecondary credentials in the labor market: An experimental study. *American Economic Review*, 106:778–806.

DiPrete, T. A., Eller, C. C., Bol, T., and de Werfhorst, H. G. V. (2017). School-to-work linkages in the United States, Germany, and france. *American journal of sociology*, 122:1869–1938.

Dobbin, F., Schrage, D., and Kalev, A. (2015). Rage against the iron cage: The varied effects of bureaucratic personnel reforms on diversity. *American Sociological Review*, 80(5):1014–1044.

Domina, T., Penner, A., and Penner, E. (2017). Categorical inequality: Schools as sorting machines. *Annual review of sociology*, 43:311–330.

Featherman, D. L. and Hauser, R. M. (1978). *Opportunity and Change*. Academic Press, New York.

Fischer, A., Gorshkov, A., Sandoy, T. M., and Walldorf, J. (2023). Peers, heirs and careers: Labor market effects of alumni networks. Mimeo.

Fligstein, N. and Fernandez, R. M. (1988). Worker power, firm power, and the structure of labor markets. *Sociological Quarterly*, 29:5–28.

Friedman, S. and Laurison, D. (2020). *The Class Ceiling: Why It Pays to Be Privileged*. Policy Press, Bristol.

Gaddis, S. M. (2015). Discrimination in the credential society: An audit study of race and college selectivity in the labor market. *Social Forces*, 93(4):1451–1479.

Gansemer-Topf, A. M. and Schuh, J. H. (2006). Institutional selectivity and institutional expenditures: Examining organizational factors that contribute to retention and graduation. *Research in higher education*, 47:613–642.

Garcia, M. F., Posthuma, R. A., and Colella, A. (2008). Fit perceptions in the employment interview: The role of similarity, liking, and expectations. *Journal of Occupational and Organizational Psychology*, 81(2):173–189.

Gerard, F., Lagos, L., Severnini, E., and Card, D. (2021). Assortative matching or exclusionary hiring? the impact of employment and pay policies on racial wage differences in Brazil. *American Economic Review*, 111:3418–3457.

Gerber, T. P. and Cheung, S. Y. (2008). Horizontal stratification in postsecondary education: Forms, explanations, and implications. *Annual Review of Sociology*, 34:299–318.

Goodman, J., Hurwitz, M., and Smith, J. (2017). Access to 4-year public colleges and degree completion. *Journal of Labor Economics*, 35:829–867.

Granfield, R. (1992). *Making Elite Lawyers: Visions of Law at Harvard and Beyond*. Routledge, New York.

Grodsky, E. (2007). Compensatory sponsorship in higher education. *American Journal of Sociology*, 112:1662–1712.

Groshen, E. L. (1991). The structure of the female/male wage differential: Is it who you are, what you do, or where you work? *Journal of Human Resources*, pages 457–472.

Hackman, J. R. and Oldham, G. R. (1976). Motivation through the design of work: Test of a theory. *Organizational behavior and human performance*, 16:250–279.

Ho, K. (2009). *Liquidated: An Ethnography of Wall Street*. Duke University Press.

Hoekstra, M. (2009). The effect of attending the flagship state university on earnings: A discontinuity-based approach. *The Review of Economics and Statistics*, 91:717–724.

Horn, L. (2006). Placing college graduation rates in context: How 4-year college graduation rates vary with selectivity and the size of low-income enrollment. postsecondary education descriptive analysis report. nces 2007-161. *National Center for Education Statistics*.

Hout, M. (2012). Social and economic returns to college education in the United States. *Annual review of sociology*, 38:379–400.

Josefy, M. A., Harrison, J. S., and Howard, M. D. (2023). Elite pipelines: How elite school ties are reflected in interfirm employee migration. *Journal of Management*, 49(5):1570–1600.

Kamens, D. (1971). The college "charter" and college size: Effects on occupational choice and college attrition. *Sociology of Education*, 44(3):270–296.

Kane, T. J. (1998). Racial and ethnic preferences in college admissions. *Ohio St. LJ*, 59:971.

Kerckhoff, A. C. (1976). The status attainment process: socialization or allocation? *Social forces*, 55:368–381.

Kim, C., Tamborini, C. R., and Sakamoto, A. (2015). Field of study in college and lifetime earnings in the United States. *Sociology of Education*, 88(4):320–339.

Kinsler, J. and Pavan, R. (2015). The specificity of general human capital: Evidence from college major choice. *Journal of Labor Economics*, 33:933–972.

Kirkeboen, L. J., Leuven, E., and Mogstad, M. (2016). Field of study, earnings, and self-selection. *The Quarterly Journal of Economics*, 131:1057–1111.

Kline, P. (2024). Firm wage effects. *Handbook of Labor Economics*, 5:115–181.

Kogan, L., Papanikolaou, D., Schmidt, L. D. W., and Seegmiller, B. (2021). Technology, vintage-specific human capital, and labor displacement: Evidence from linking patents with occupations. NBER Working Paper, National Bureau of Economic Research.

Krippner, G. R. (2012). *Capitalizing on crisis: The political origins of the rise of finance*. Harvard University Press.

Kristof-Brown, A. L., Zimmerman, R. D., and Johnson, E. C. (2005). Consequences of individuals' fit at work: A meta-analysis of person-job, person-organization, person-group, and person-supervisor fit. *Personnel Psychology*, 58(2):281–342.

Labaree, D. F. (1997). Public goods, private goods: The American struggle over educational goals. *American Educational Research Journal*, 34(1):39–81.

Lemann, N. (1999). The kids in the conference room: How McKinsey & company became the next big step. *The New Yorker*, pages 209–216.

Lepak, D. P. and Snell, S. A. (1999). The human resource architecture: Toward a theory of human capital allocation and development. *Academy of Management Review*, 24(1):31–48.

Loury, L. D. and Garman, D. (1993). Affirmative action in higher education. *The American Economic Review*, 83:99–103.

Loury, L. D. and Garman, D. (1995). College selectivity and earnings. *Journal of Labor Economics*, 13:289–308.

Lucas, S. R. (2001). Effectively maintained inequality: Education transitions, track mobility, and social background effects. *American journal of sociology*, 106:1642–1690.

Manduca, R. (2024). "I was open to anywhere, it's just this was easier:" social structure, location preferences, and the geographic concentration of elite college graduates. *Qualitative Sociology*, 47:153–185.

Manduca, R. A. (2019). The contribution of national income inequality to regional economic divergence. *Social Forces*, 98:622–648.

Manski, C. F. and Wise, D. A. (1983). *College choice in America*. Harvard University Press, Cambridge, MA.

Meghir, C. and Rivkin, S. G. (2011). Econometric methods for research in education. In *Handbook of the Economics of Education*, volume 3, pages 1–87. Elsevier.

Meyer, J. W. (1977). The effects of education as an institution. *American journal of Sociology*, 83:55–77.

Moretti, E. (2012). *The new geography of jobs*. Houghton Mifflin Harcourt.

Moss-Pech, C. (2025). *Major Trade-Offs: The Surprising Truths about College Majors and Entry-Level Jobs*. University of Chicago Press, Chicago.

Mountjoy, J. (2024). Marginal returns to public universities. NBER Working Paper 32296.

Mountjoy, J. and Hickman, B. R. (2021). The returns to college (s): Relative value-added and match effects in higher education. NBER Working Paper 29276.

Murphy, R. (1988). *Social Closure: The Theory of Monopolization and Exclusion*. Clarendon Press, Oxford.

Neely, M. T. (2022). *Hedged out: Inequality and insecurity on Wall Street*. Univ of California Press.

Oldham, G. R. and Hackman, J. R. (2010). Not what it was and not what it will be: The future of job design research. *Journal of organizational behavior*, 31:463–479.

Ost, B., Pan, W., and Webber, D. (2026). Institution, major, and firm-specific premia: Evidence from administrative data. Working paper.

Osterman, P. (2006). The wage effects of high performance work organization in manufacturing. *Ilr Review*, 59:187–204.

Pager, D. and Pedulla, D. S. (2015). Race, self-selection, and the job search process. *American Journal of Sociology*, 120:1005–1054.

Pan, W. (2025). Firm-specific pay premia and the returns to higher education: Evidence from community colleges. *Labour Economics*, 93:102685.

Parkin, F. (1979). *Marxism and Class Theory: A Bourgeois Critique*. Tavistock Publications, London.

Posselt, J. R. and Grodsky, E. (2017). Graduate education and social stratification. *Annual Review of Sociology*, 43:353–378.

Quadlin, N., Cohen, E. D., and VanHeuvelen, T. (2021). Same major, same economic returns? college selectivity and earnings inequality in young adulthood. *Research in Social Stratification and Mobility*, 75:100647.

Rajan, R. G. and Wulf, J. (2006). The flattening firm: Evidence from panel data on the changing nature of corporate hierarchies. *The Review of Economics and Statistics*, 88(4):759–773.

Ranganathan, A. (2023). When the tasks line up: How the nature of supplementary tasks affects worker productivity. *Ilr Review*, 76:556–585.

Reardon, S. F., Baker, R. B., and Klasik, D. (2012). Race, income, and enrollment patterns in highly selective colleges, 1982-2004.

Reimer, D. and Thomsen, J.-P. (2019). Vertical and horizontal stratification in higher education. In *Research Handbook on the Sociology of Education*, pages 308–328. Edward Elgar Publishing.

Rivera, L. (2015). *Pedigree: Elite reproduction in hiring*. Princeton University Press, Princeton, NJ.

Rivera, L. A. (2011). Ivies, extracurriculars, and exclusion: Elite employers' use of educational credentials. *Research in Social Stratification and Mobility*, 29:71–90.

Rivera, L. A. (2012). Hiring as cultural matching: The case of elite professional service firms. *American sociological review*, 77:999–1022.

Robst, J. (2007). Education and job match: The relatedness of college major and work. *Economics of Education review*, 26:397–407.

Rosenfeld, J. (2021). *You're paid what you're worth: And other myths of the modern economy*. Harvard University Press.

Slichter, S. H. (1950). Notes on the structure of wages. *Review of Economics and Statistics*, 32(1):80–91.

Song, J., Price, D. J., Guvenen, F., Bloom, N., and Wachter, T. V. (2019). Firming up inequality. *The Quarterly journal of economics*, 134:1–50.

Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, 87:355–374.

Sterling, A. D. and Fernandez, R. M. (2018). Once in the door: Gender, tryouts, and the initial salaries of managers. *Management Science*, 64(11):5444–5460.

Stigler, G. J. (1962). Information in the labor market. *Journal of Political Economy*, 70(5, Part 2):94–105.

Stiglitz, J. E. (1975). The theory of screening, education, and the distribution of income. *The American economic review*, 65:283–300.

Streib, J. (2023). *The Accidental Equalizer: How Luck Determines Pay after College*. University of Chicago Press.

Thomas, S. L. and Zhang, L. (2005). Post-baccalaureate wage growth within four years of graduation: The effects of college quality and college major. *Research in Higher Education*, 46:437–459.

Thurow, L. C. (1975). *Generating inequality*. Basic Books.

Tinto, V. (1984). Patterns of educational sponsorship to work: A study of modes of early occupational attainment from college to professional work. *Work and Occupations*, 11(3):309–330.

Tomaskovic-Devey, D. and Avent-Holt, D. R. (2019). *Relational inequalities: An organizational approach*. Oxford University Press.

Tomaskovic-Devey, D., Rainey, A., Avent-Holt, D., Bandelj, N., Boza, I., Cort, D., Godechot, O., Hajdu, G., Hällsten, M., and Henriksen, L. F. (2020). Rising between-workplace inequalities in high-income countries. *Proceedings of the National Academy of Sciences*, 117:9277–9283.

Tomaskovic-Devey, D., Thomas, M., and Johnson, K. (2005). Race and the accumulation of human capital across the career: A theoretical model and fixed-effects application. *American Journal of Sociology*, 111:58–89.

Townsend, B. (2023). Which company employs the most college graduates in your state?

Useem, M. and Karabel, J. (1986). Pathways to top corporate management. *American Sociological Review*, 51(2):184–200.

van de Werfhorst, H. G. (2002). Fields of study, acquired skills and the wage benefit from a matching job. *Acta Sociologica*, 45(4):286–303.

VanderWeele, T. J. and Arah, O. A. (2011). Bias formulas for sensitivity analysis of unmeasured confounding for general outcomes, treatments, and confounders. *Epidemiology*, pages 42–52.

Weeden, K. A. (2002). Why do some occupations pay more than others? social closure and earnings inequality in the United States. *American journal of sociology*, 108:55–101.

Weeden, K. A. and Grusky, D. B. (2012). The three worlds of inequality. *American Journal of Sociology*, 117:1723–1785.

Weeden, K. A. and Grusky, D. B. (2014). Inequality and market failure. *American Behavioral Scientist*, 58:473–491.

Wilmers, N. (2020). Job turf or variety: Task structure as a source of organizational inequality. *Administrative Science Quarterly*, 65:1018–1057.

Wilmers, N. and Aeppli, C. (2021). Consolidated advantage: new organizational dynamics of wage inequality. *American Sociological Review*, 86:1100–1130.

Wilmers, N., Tong, D., and Zhang, V. Y. (2025). Between-firm inequality and informal social relations. *American Journal of Sociology*, 130:1217–1262.

Witte, J. C. and Kalleberg, A. L. (1995). Matching training and jobs: The fit between vocational education and employment in the German labour market. *European Sociological Review*, 11:293–317.

Witteveen, D. and Attewell, P. (2017). Family background and earnings inequality among college graduates. *Social Forces*, 95:1539–1576.

Zhang, L. (2012). *Does quality pay?: Benefits of attending a high-cost, prestigious college*. Routledge.

Zimmerman, S. D. (2014). The returns to college admission for academically marginal students. *Journal of Labor Economics*, 32:711–754.

Zimmerman, S. D. (2019). Elite colleges and upward mobility to top jobs and top incomes. *American Economic Review*, 109:1–47.

Zottoli, M. A. and Wanous, J. P. (2000). Recruitment source research: Current status and future directions. *Human Resource Management Review*, 10(4):353–382.