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Russell Weinstein
University of Illinois at Urbana-Champaign and IZA

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IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

University Selectivity, Initial Job Quality, and Longer-Run Salary*

Using Baccalaureate and Beyond data, I study whether university quality, both absolute and relative to other universities in the region, affects earnings one and ten years after graduation, controlling for the individual's SAT score. One year after graduation, high SAT score students earn 12% less if their university's regional rank is worse by 35 places, conditional on absolute university quality. This effect disappears ten years after graduation. The results suggest initial job quality does not have long-run career effects. The results also confirm the initial importance of a university's regional rank, an often overlooked dimension of university quality.

JEL Classification: I23, I26, J31, D83

Keywords: labor market return to higher education, employer learning, statistical discrimination

Corresponding author:
Russell Weinstein
University of Illinois at Urbana-Champaign
School of Labor and Employment Relations
Department of Economics
504 E. Armory Avenue
Champaign, IL 61820
USA

E-mail: weinst@illinois.edu

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Equally productive individuals may begin their careers in vastly different jobs, earning different wages. These initial differences may be driven by differences in signal (race, education quantity, education quality), or in timing (labor demand when entering the labor market).[1] A crucial question is whether one's initial job has long-run career effects, or whether wages of equally productive individuals converge over time (regardless of initial job). If labor market history matters, this underscores the importance of assisting those whose initial job quality suffered from a low signal, or unlucky circumstances.

Previous theories have explained why initial job quality may affect long-run career trajectory. Oyer (2006) describes models in which initial job may affect future productivity and wages, including through impact on skill development, lifestyle and tastes, opportunity for influence, and the market's perception of the individual's ability. These models imply outcomes for similar individuals do not converge over time, and may diverge.

Alternatively, as individuals gain experience, the market may increasingly observe an individual's true productivity. This implies convergence in wages among individuals who differed in their initial job, either because of differences in signals or labor demand when entering the labor market (Farber and Gibbons 1996, Altonji and Pierret 2001).

I analyze whether labor market history matters for longer-run career trajectory, focusing on initial wage differences driven by university quality. Specifically, I test whether university quality affects wages one year after graduation,

[1]Initial differences driven by differences in signal would be consistent with statistical discrimination (Phelps 1972, formalized in Aigner and Cain 1977). Several papers study differences in outcomes based on demand when entering the labor market. These are discussed later in this introduction.

and whether this effect persists 10 years after graduation. There is growing attention to university differences in students' labor market outcomes. The US Department of Education College Scorecard incorporates post-graduation salaries (Executive Office 2017), as do new university rankings (e.g. Payscale (Payscale 2017)).

Rising tuition, along with these new initiatives, highlight the relevance of identifying causal relationships between university and post-graduation outcomes. If initial earnings differences persist in the long run, providing this information is especially important. This is the first paper to my knowledge looking at the medium-run labor market consequences of university selectivity for a sample of US workers.

Avoiding problems facing the previous literature, I compare graduates of equally selective universities, whose initial job may differ because of the university's regional rank. The university's regional rank is an important dimension of quality if labor markets are regional, and firms recruit from the most selective universities in their region. I identify the role of relative quality using dramatic differences in a university's regional rank conditional on absolute quality.

For intuition, consider Texas A&M and Pennsylvania State University, which have similar national ranks. For Texas firms looking to hire from the most selective universities in the region, Texas A&M will be near the top of their list. For firms in the Northeast looking to hire from the most selective universities in the region, Pennsylvania State University will not be near the top of their list given nearby highly selective Ivy League universities and lib-

eral arts colleges. As a result, we expect different types of firms recruiting graduates of Texas A&M and Pennsylvania State, and differences in initial wages. Alternatively, the same firms may recruit at these universities, but for different types of positions at the firm.

Weinstein (2016) shows evidence consistent with firm sorting across universities by regional rank. Prestigious finance and consulting firms are less likely to recruit at worse regionally-ranked universities, and initial earnings of high SAT students at these universities are lower, conditional on absolute university quality.

There are also examples of firms recruiting for multiple positions within the firm, and each position may value student ability differently. When recruiting, firms may choose to target the most selective universities in the region for higher-wage positions, and worse regionally-ranked universities for lower-wage positions.

As an example, the consulting firm McKinsey & Company recruits some college graduates for entry-level consulting positions, while recruiting others for non-consultant research positions. Anecdotally, there is some suggestion they recruit for entry-level consultants at the most selective universities in the region, while recruiting for non-consultant research analysts at selective Northeast universities, surrounded by even more selective universities (and thus not the best-ranked university in the region). In 2016, McKinsey hired Tufts graduates as non-consultant research analysts, while not hiring any Tufts graduates as entry-level consultants (Tufts 2017). In contrast, McKinsey recruits for entry-level consultants at University of Texas at Austin, which has

a worse US News ranking than Tufts, but has a better rank within its region (McKinsey & Company 2017a). In addition, McKinsey recruits for entry-level consultants at Harvard and MIT, which also have better regional ranks than Tufts (McKinsey & Company 2017b,c).

I test whether earnings eventually converge for observationally similar students, attending universities of similar absolute quality, who begin their careers at lower-paying jobs because their university's regional rank reduced access to high-wage firms or high-wage occupations within firms.

Using the Baccalaureate and Beyond 1993/2003, I find salaries of high SAT score students are 12% higher one year after graduation if they graduate from universities with better regional ranks, conditional on absolute university quality.[2] These short-run effects are of interest on their own given they highlight regional rank as an important dimension of university quality.

I find these initial earnings differences disappear by ten years after graduation. Initially, graduates of better regionally-ranked universities may have better access to higher-wage firms or occupations because of regional labor markets. Over time, graduates of worse regionally-ranked universities may gain access to the higher-wage firms or higher-wage occupations within their firms, as more work experience allows the market to learn their ability.

Differences in post-graduate degree attainment do not explain the results. There is some evidence that graduates of worse regionally-ranked universities are more likely to work at for-profit companies. Steeper earnings profiles at for-profit companies may explain the disappearing earnings difference.

[2]Weinstein (2016) showed this result using college graduates in 2008, using the Baccalaureate and Beyond 2008/2009 dataset.

Recent empirical papers have studied whether labor market history matters, also focusing on initial earnings differences driven by university quality (Araki, Kawaguchi, and Onozuka 2016, Bordon and Braga 2016, Hershbein 2013, Lang and Siniver 2011).[3] This literature generally finds initial earnings differences for similar individuals by university quality, followed by convergence in outcomes. In these settings, beginning one's career at a lower-paying job does not affect longer-run career trajectory. However, this literature is complicated by the possibility that students attending higher-quality universities may differ on unobservables, or may have acquired different human capital during college as a result of attending a more selective university. If either is true, the analysis compares longer-run outcomes of individuals who were not similarly productive at labor market entry.

The results contrast with studies of whether labor market history matters, when initial earnings differences are driven by labor demand at time of graduation (Kahn 2010, Oreopoulos, Von Wachter, and Heisz 2012, Oyer 2006). Labor market history does matter in this setting; graduates during recessions experience long-run wage and productivity effects.

Finally, the results imply immediate returns to college graduates' ability (SAT score), conditional on graduating from one of the most selective universities in the region. There are no returns to SAT score upon graduation

[3]Earlier papers focused on screening based on years of education, rather than university quality. These papers generally find evidence consistent with initial differences followed by convergence (Lang and Kropp 1986, Bedard 2001, Farber and Gibbons 1996, Altonji and Pierret 2001). Lange (2007) shows that employers learn worker productivity quickly. A related literature empirically tests whether incumbent firms have more information about their own workers' productivity than the market (Acemoglu and Pischke 1998, Gibbons and Katz 1991, Kahn 2013, Lang and Weinstein 2016, Schoenberg 2007).

for graduates of worse regionally-ranked universities, though these returns increase over time. While SAT scores are in theory immediately observable by firms, Weinstein (2016) suggests that in practice they are only observed if the firm has chosen to recruit at the student's university. As a result, graduates of universities attracting higher-wage firms may initially earn more than graduates with the same SAT at universities not attracting these firms.

These results are not entirely inconsistent with immediate returns to AFQT for college graduates (Arcidiacono, Bayer, and Hizmo 2010). However, the important distinction is that only the best regionally-ranked universities facilitate immediate returns to ability, rather than all universities.

1 Data

To analyze whether there are longer-run effects of graduating from a worse regionally-ranked university, conditional on national rank, I use the restricted-access Baccalaureate and Beyond (BB) 1993/2003. These datasets are made available by the US Department of Education, National Center for Education Statistics. BB 1993/2003 is a survey of college seniors in 1993, who are surveyed again in 1994, 1997, and 2003 after they have graduated. Approximately 11,190 individuals are included in the BB 1993/2003.[4]

I combine these data with university-level data from IPEDS and the US News and World Report. Because IPEDS does not have SAT scores of incoming students in 1993, the US News data is especially important. I use the

[4]In order to protect confidentiality of respondents, all sample sizes are rounded to the nearest ten.

1993 US News and World Report rankings, which were published in September 1992.[5] This aligns with the time at which firms are making recruiting decisions for the 1993 graduating class. From the US News data I obtain the 25th and 75th percentile of test score distributions, the midpoint of these percentiles, and the share of students in the top 10% of their high school class. I obtain the following university characteristics in 1993 from IPEDS: number of Bachelor's degrees awarded, in-state and out-of-state tuition, whether the university is public, and highest degree offered.

In the US News data, some universities report the 25th and 75th percentile of the combined SAT-Verbal and Math distribution, while others report the percentiles of the ACT Composite distribution. I convert these ACT composite scores to combined SAT-Verbal and Math scores using Marco, Abdel-fattah, and Baron (1992). Because some universities report only the average/midpoint of their test score distribution, and not the percentiles, I use the former to rank universities regionally, with regions defined using a community detection algorithm as in Weinstein (2016) (Appendix Figure 1). These regions are arguably reflective of the firm's relevant labor market, as they are inferred from finance and consulting employer recruiting strategies. For robustness, I use Bureau of Economic Analysis (OBE) Regions.

If labor markets are regional, then firms may seek to hire from the most selective universities in each region. This will yield differences in outcomes for students at equally selective universities, given dramatic differences in regional

[5]The SAT scores in the 1993 rankings pertain to incoming freshmen in Fall, 1991. While these scores do not perfectly align with the scores of those graduating in 1993, they are likely highly correlated. In addition, firms may use the 1993 US News Rankings, or a multi-year average, to make recruiting decisions.

rank across region. Figure 1 graphically shows the difference in regional rank for universities with the same average SAT score. For universities where the average SAT score is 1000, regional rank in the South is about 15, 20 in the Midwest and West, and 60 in the East. I analyze whether this difference in regional rank affects salary immediately after graduation and ten years later, controlling for university quality.

Effects should be largest for moderately-selective universities. The most selective universities do not have dramatically different regional ranks (Figure 1). The least selective universities will have unattractive regional ranks in any region, and as a result will be farther down the priority list of high-wage firms regardless of region. In contrast, moderately-selective universities may be among the best universities in some regions and as a result attract high-wage firms. In the East, these universities will not be among the most selective in the region, and so will not attract these firms. Table 1 shows considerable overlap across region in the number of high SAT score students at moderately-selective universities.

For high-SAT students at moderately-selective universities, the average regional rank of the university is much better outside the East (by approximately 30 places). In 1994, these graduates in the East have lower average salaries (by approximately \$700 to \$1050 dollars, or approximately 2 to 3%) than those in the Midwest and South, and higher salaries than those in the West. As Figure 2 shows, this positive differential outside the East increases dramatically with the quality of the university.

The second panel of Table 1 shows that by 2003, salaries of graduates in

the East are higher than those in other regions (except the West). These results are consistent with employers initially relying on a signal (relative to other universities in the region), but the market learning about ability over time (enabling promotion within firms or mobility to higher-wage firms). The regression analysis in the next section will formalize these descriptive findings and allow these differences to vary by student SAT.

Figures 2 and 3 show results from a linear regression of Ln(Salary) on university average SAT in 1994 and 2003, in the East and outside the East. For this plot, I include in the regression only individuals in the main sample with SAT score at or above the 50th percentile (1050). The results suggest that immediately after graduation, high SAT score graduates outside the East who attend moderately-selective universities earn more than those in the East. This difference increases in university quality over this range. By 2003 this difference in earnings has decreased substantially (Figure 3).

2 Empirical Strategy

The primary question is whether the university's regional rank affects earnings ten years after graduation, controlling for university quality and the individual's SAT score. Ten years after graduation, individuals may have had very different career and educational trajectories, possibly affected by the university's regional rank. This paper studies whether despite, or because of, these different trajectories, individuals with similar SAT scores, who went to universities of similar quality, have similar earnings ten years after graduation,

regardless of their university's regional rank. To understand whether the market learns ability immediately or gradually, I study whether there were earnings differences by regional rank in 1994 (immediately after graduation) among the individuals who were employed in 2003.

High test score students will arguably be hurt most by a worse regional rank. These are the students who could be hired by higher-wage firms if they had attended a better regionally-ranked university. I thus interact regional rank with SAT.

I include individuals in a given year if they were less than or equal to 25 at the time they received their Bachelor's degree, worked at least 40 hours a week at only one job in one of the 50 US states, with non-missing earnings of at least $5 an hour (2006 dollars), and were not enrolled in a university program.[6] To be included in the 1994 sample, these conditions must be true for these individuals both in 1994 and in 2003. I exclude individuals in 1994 if they had a graduate degree by 1994. To be included in the 2003 sample, I do not place any restrictions on employment or enrollment in 1994.

I estimate regressions of the following type:

$$\begin{aligned} Ln(Salary_{ijt}) &= \alpha_0 + \beta_1 SAT_i + \beta_2 AvgSAT_j + \beta_3 RegRank_j \\ &\quad + \beta_4 RegRank_j * SAT_i + \beta_5 RegRank_j * Y2003_t \\ &\quad + \beta_6 RegRank_j * SAT_i * Y2003_t + \beta_7 Y2003_t \end{aligned} \tag{1}$$

[6] I also require that the individual's legal state of residence in 1993 was one of the US States, in order to control for differences in wages across states, which would affect interpretation of the 1991 family income variable.

$$+X_{it}\gamma + Z_{jt}\delta + u_{ijt}$$

The variable $Salary_{ij1994}$ is the annualized salary, based on the April 1994 employer, of individual i who attended university j. The variable $Salary_{ij2003}$ denotes salary at the time of the interview in 2003. The variable SAT denotes the individual's SAT score, or ACT score converted to an SAT score, while $AvgSAT_j$ is the average or midpoint of the SAT distribution at university j. $RegRank$ denotes the rank of university j within its region. The variable $Y2003_t$ is an indicator for year 2003.

The row vector X_{it} consists of characteristics of individual i in year t. These include an indicator for male, white, black, hispanic, dependent at the time of the 1993 college interview, family income for the 1991 calendar year (parental for dependents). I include the log of the 1990 average wage of bachelor's degree recipients 25-34 years old living in the state of legal residence at the time of the 1993 interview, as well as this same variable for high school graduates (to control for differences in wages across states, which would affect interpretation of the 1991 family income variable).

For $t = 1994$, X further includes the log of the average wage in 1990 of bachelor's degree recipients 25-34 years old living in the respondent's state at the time of the 1994 interview (to control for differences in wages across states in 1994). For $t = 2003$, X includes the log of the average wage in 2003 of bachelor's degree recipients 25-34 years old living in the respondent's state at the time of the 2003 interview. The average wage by state in 1990 is constructed from the 1990 US Census (Ruggles et al. 2015), while the average

wage by state in 2003 is constructed from the American Community Survey (Ruggles et al. 2015).

The row vector Z_{j1993} consists of university characteristics, including the total number of Bachelor's degrees awarded in 1993, the share of students who were in the top 10% of their high-school class (based on US News Ranking in 1993), the 25th and 75th percentile of the SAT/ACT score distributions (where ACT scores are converted to SAT scores) (based on US News Ranking in 1993), in- and out-of-state tuition in 1993, and indicators for whether the university is public and whether it offered a doctoral degree (in 1993). It further includes interactions between $AvgSAT_j$ and SAT_i, $Y2003$, and SAT*$Y2003$.

I estimate heteroskedasticity-robust standard errors and standard errors clustered at the university level. I report the heteroskedasticity-robust standard errors since these are larger than the clustered errors.

The empirical strategy implies some individuals are in the sample in 2003, but not in 1994 possibly because of unemployment or graduate school enrollment in 1994. Long-run earnings differences by regional rank may vary from short-run differences simply because of the additional individuals in 2003.

For robustness, I compare long-run and short-run earnings differences among the same individuals. The disadvantage of this strategy is that graduating from worse regionally-ranked universities may affect initial unemployment or graduate school enrollment. If these affect long-run earnings (or are more likely among positively or negatively selected individuals), then earnings differences in 2003 will be biased by omitting these individuals, if they are employed by 2003. Consider the possibility that individuals graduating from worse

regionally-ranked universities are more likely to be unemployed after graduation. If employed by 2003, but their career was negatively affected by the initial unemployment, we will not see this negative, long-run effect of regional rank by restricting to individuals who were employed in 1994.

3 Results

The first column of Table 2 shows that controlling for the student's SAT score, and average SAT score at the university, higher SAT score students are initially hurt by a worse regional rank. For an individual scoring 1180 on the SAT (75th percentile) graduating from a university with regional rank worse by 35 places (a relevant difference based on Figure 1), salary in the year following graduation is lower by 12% (row 8). The coefficients on $RegRank$ and $RegRank * SAT$ are jointly significant at the 1% level (row 5). This specification does not include other university characteristics to facilitate comparing the effect of regional rank versus absolute quality ($AvgSAT$).

The results show that if two universities have the same regional rank, but one has a higher average SAT score, this does not affect salary after graduation (the coefficients on $AvgSAT$ and $AvgSAT * SAT$ are not jointly significant) (rows 10 and 11). For example, conditional on the individual's SAT score, graduates of the fourth-ranked university in the East, which has an average SAT score of 1306, do not earn significantly more than graduates of the fourth-ranked university in the Southeast, which has an average SAT score of 1125.

The negative effect of regional rank among high SAT students disappears

by 2003. For an individual scoring 1180 on the SAT (75th percentile) graduating from a university with regional rank worse by 35 places, salary ten years following graduation is lower by 1.4% (relative to the initial effect of 12%), and this is not statistically significant from zero (row 9). The interactions $RegRank * 2003$ and $RegRank * SAT * 2003$ are jointly significant at the 5% level (row 6).

This is consistent with a model in which employers initially screen on relative rank. However, earnings converge over time as the market learns ability. Individuals starting in lower-wage jobs are either promoted within the firm to higher-wage occupations, or move to higher-wage firms or higher-wage occupations at other firms.[7]

Results are very similar when including many measures of university quality (Table 2, Column 2). Interpreting the coefficient on $AvgSAT$ is now more difficult given I also control for other measures of absolute university quality.

The negative coefficient on $RegRank * SAT$ (row 2) also implies the return to an individual's SAT score decreases as the university's regional rank worsens. At worse regionally-ranked universities, high SAT students are less differentiated from low SAT students, whereas the opposite is true at better regionally-ranked universities. This is consistent with the findings in Lang and Siniver (2011), who argue firms have less information or do not use the information at less selective universities. The finding is inconsistent with Arcidiacono, Bayer, and Hizmo (2010) who find that information about ability

[7]Results using the sampling weights of the survey are similar. Sample size is reduced by approximately 40 individuals who have a weight of zero because they did not respond to both the 1994 and 2003 surveys.

(AFQT scores) is available to employers for college graduates.

This could be explained by high-wage firms hiring from the best-ranked universities in the region. At these universities they may screen applicants to identify the best workers. If this is correlated with SAT score, then higher-SAT students at these universities will earn more than lower-SAT score students. At worse regionally-ranked universities, there may be lower return to SAT scores if high-wage firms are not recruiting the high SAT students there.

The positive coefficient on $RegRank * SAT * 2003$ suggests that by 2003, SAT is no longer less important for earnings at worse regionally-ranked universities.

3.1 Sensitivity Analysis

Sample Selection

Differences in unemployment by regional rank could bias the results by leading to differentially selected samples. I estimate regression (1) with the dependent variable an indicator for whether the individual is unemployed. I restrict the sample to individuals with nonmissing SAT scores who were at most 25 at the time of receiving their bachelor's degree.[8] There is no statistically significant difference in the likelihood of unemployment by regional rank.

If selection into graduate school immediately following a Bachelor's degree varies by the university's regional rank, controlling for the university's quality, this could also bias the results. I estimate regression (1), with the dependent

[8]I further include only those with nonmissing average state wages in 1994 and 2003, and observations in 1994 with unemployment nonmissing in 2003 (to be consistent with the main specification).

variable an indicator for graduate enrollment or graduate degree in 1994. Controlling for individual characteristics and absolute university quality, regional rank is not correlated with the decision to attend graduate school immediately after graduation (Table 3, Column 2). These findings suggest the earnings results are unlikely biased by a selected sample immediately after graduation.

Mechanisms Explaining Convergence Other than Employer Learning

While there are no differences in immediate enrollment in graduate school, there may be differences in enrollment within 10 years of obtaining a bachelor's degree. If graduates of worse-regionally ranked universities are more likely to attend graduate school at some point after their bachelor's degree, this may explain why regional rank's effect disappears. I estimate regression (1), with the dependent variable an indicator equal to one if the individual had obtained a postgraduate degree by 2003. Controlling for individual characteristics and absolute university quality, regional rank is not correlated with obtaining a graduate degree by 2003 (Table 3, Column 3). This suggests the results are not explained by students in the East compensating for the negative effects of a worse regional rank by attending graduate school. The results of the principal specification (Table 2) are also unchanged when excluding individuals with postgraduate degree attainment by 2003 (not shown).

The results could be explained by differential selection into employment at for-profit employers. This may be an endogenous response to labor market opportunities based on the university's regional rank, and so I did not include it as a sample restriction. To see whether this explains the results, I estimate

an additional specification including only individuals working at for-profit employers in 1994 and 2003. The differential effects in 2003 approach statistical significance at conventional levels, with p-value = .104. The magnitudes continue to suggest initially negative effects of graduating from a worse-regionally ranked university, which disappear over time (not shown).

Additionally, I estimate the main specification where the dependent variable is an indicator for working at a for-profit employer. I find that high SAT score students from worse regionally-ranked universities are more likely to work at for-profit employers both in 1994 and 2003 (Table 3, Column 4). However, the effect of regional rank is not jointly significant in either of these years. If the earnings profile is steeper at for-profit employers, this could explain the initial, then disappearing, negative effect of graduating from a worse-regionally ranked university.

Individuals from worse regionally-ranked universities in the Northeast may move to other regions where their university would be relatively more selective. This would suggest that convergence is not due to employer learning, but to search and mobility. The decision to leave the region is clearly endogenous; however, it would also be concerning to see that the convergence disappears when conditioning on remaining in the same region.

I estimate (1) including only those individuals who were living in the same region in the year after graduation and ten years after graduation. Nearly 80% of individuals in the main sample remain in the same region. The standard errors are slightly higher likely because of the decrease in sample size. However, the results are largely unchanged, and still strongly suggest convergence by

2003 (Table 2, column 3).

I did not include undergraduate major as an explanatory variable in (1) since this also may be an endogenous variable. Students at worse regionally-ranked institutions may choose different majors knowing they will have reduced access to particular firms (because of the regional rank disadvantage). As a robustness check, I construct nine groups of majors and include indicators for major group in the regression.[9] The results are largely unchanged (Table 2, column 4).

While there are no differences in enrollment in graduate school by regional rank, there may be differences in type of graduate degree. If individuals from worse regionally-ranked universities attain graduate degrees associated with higher salaries, this may explain eventual convergence. In addition, length of enrollment will differ across graduate degrees, and this will affect years of work experience by 2010. I include indicators for highest degree attained, and because of the sample restriction this is equal to a Bachelor's degree for every individual in 1994. As an alternative, I control for the length of time out of the labor force since 1997 (not employed and not looking for work). I set this variable to zero for every individual in 1994. Including these controls also has little effect on the results (Table 2, columns 5 and 6).

I check for differences in the effects between males and females by allowing for interactions between $RegRank$, SAT, $Y2003$, and $Male$ (Appendix Table 4). The terms for the differential effect for males in 1994 ($RegRank * Male$,

[9]These groups include (1) uncodable, (2) Humanities, (3) Social/Behavioral Science, (4) Life Sciences/Physical Sciences/Math/Computer and Information Sciences/Engineering, (5) Education, (6) Business Management, (7) Health, (8) Vocational/Technical and Other Technical/Professional, (9) Missing.

$RegRank * SAT * Male$) are not jointly significant, and neither are the terms giving the male differential of the differential 2003 effect ($RegRank * 2003 * Male$, $RegRank * SAT * 2003 * Male$).

Conditional on university quality, higher SAT students at worse regionally-ranked universities are not any more likely to have had more jobs or employers since 1997 than students at better regionally-ranked universities (not shown).

Robustness

For robustness, I limit the sample to individuals who are in the main sample in both 1994 and 2003. The results are very similar to the main specification, suggesting initially negative effects of a worse regional rank that disappear over time (Appendix Table 1).

Estimating the main specification using the Bureau of Economic Analysis (OBE) Regions (combining New England and the Mideast) yields similar results (Appendix Tables 2 and 3).[10] While the coefficients on regional rank are not jointly significant, the magnitude of the linear combinations for high-SAT students are very similar. Using the OBE regions, there is some evidence that high SAT score students attending worse regionally-ranked universities are more likely to have enrolled in graduate school in 1994. There is less evidence than in the main specification that high-SAT score individuals at worse regionally-ranked universities are more likely to work at a for-profit employer.

[10]Because there are more OBE regions, there is more variation in the relevant difference in regional rank for a given average SAT score. Appendix Figure 2 shows that for a university with average SAT score around 1000, the difference in regional rank between the East and the Southwest and Rocky Mountains is approximately 45. Between the East and the other regions, this ranges from approximately 25 to 35. Appendix Tables 2 and 3 continue to evaluate the coefficients for a regional rank difference of 35.

4 Conclusion

I study whether labor market history matters for longer-run career trajectory, focusing on initial differences due to university quality. This is the first paper of which I am aware that studies how university quality affects earnings in the short- and medium-run for US graduates. I avoid issues in the previous literature by comparing graduates of universities of similar absolute quality, but different regional ranks.

Controlling for the individual's SAT score and many measures of absolute university quality, I find initial earnings are 12% lower if graduating from a worse-regionally ranked university, among high SAT students. However, these effects disappear ten years after graduation. The results are consistent with the literature that labor market history does not matter for future earnings conditional on ability, when initial differences are due to years of education or university quality. However, the results contrast with findings that labor market history matters when initial differences are due to demand when entering the labor market. Finally, the results highlight the initial importance of a university's regional rank for labor market outcomes, an overlooked dimension of university quality.

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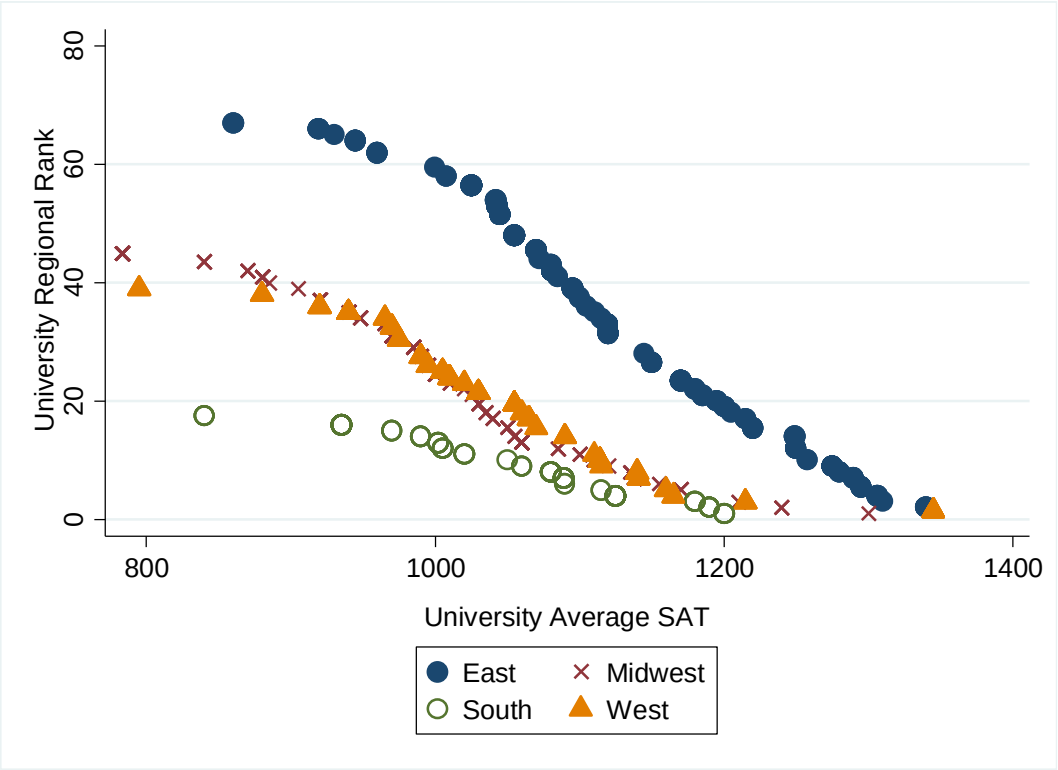
Figure 1: Differences in Regional Rank by University Average SAT Score



Note: This figure is a scatterplot of university regional rank by the university's average SAT score, for universities attended by individuals in the sample. See text for details and region definitions (based on the community detection algorithm).

Figure 2: Initial Salary (1994) for High SAT Graduates, by University Region and Average SAT

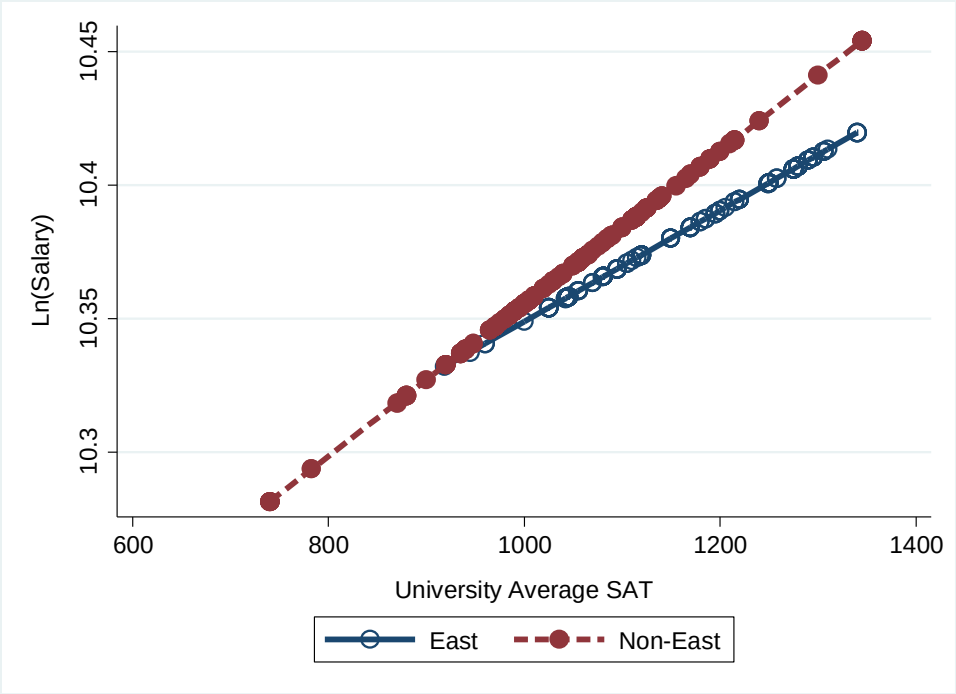
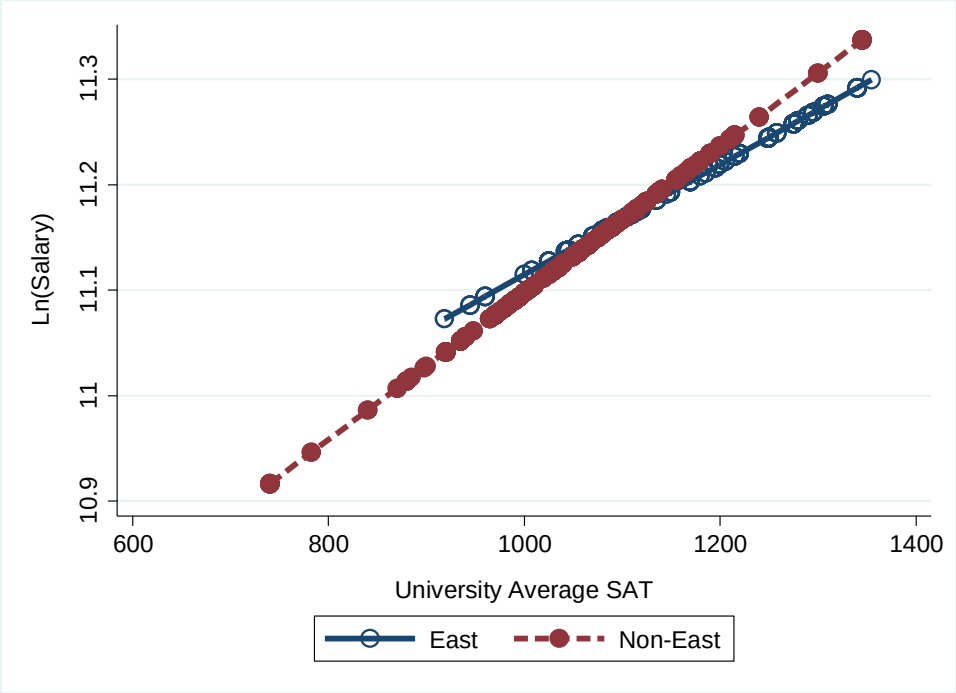


Figure 3: Medium-Run Salary (2003) for High SAT Graduates, by University Region and Average SAT



Note: Plots show fitted results from a regression of Ln(Salary) on university average SAT score, for individuals in the main regression sample with SAT scores at or above the 50th percentile (1050). I estimate separate regressions for students graduating from universities in the East and outside the East, and also separate regressions for 1994 and 2003. See text for details.

Table 1: Summary Statistics

University Region:	East	Midwest	South	West
		1994		
# Students	290	220	120	190
Share of Students with SAT ≥ 1050	0.61	0.41	0.44	0.49
Share of Students with SAT ≥ 1050, University Average SAT ϵ [1025, 1185]	0.34	0.21	0.23	0.26
Average Regional Rank if SAT ≥ 1050, University Average SAT ϵ [1025, 1185]	39.5 [11.1]	11.7 [4.8]	5.7 [2.2]	14.0 [5.2]
Average Salary if SAT ≥ 1050, University Average SAT ϵ [1025, 1185] (2006 dollars)	34,079 [14,082]	34,781 [14,702]	35,128 [11,196]	33,234 [11,905]
		2003		
# Students	590	420	250	390
Share of Students with SAT ≥ 1050	0.64	0.45	0.43	0.50
Share of Students with SAT ≥ 1050, University Average SAT ϵ [1025, 1185]	0.31	0.24	0.23	0.29
Average Regional Rank if SAT ≥ 1050, University Average SAT ϵ [1025, 1185]	38.3 [10.6]	11.2 [4.5]	6.2 [2.2]	14.2 [5.1]
Average Salary if SAT ≥ 1050, University Average SAT ϵ [1025, 1185] (2006 dollars)	79,957 [39,384]	79,243 [46,922]	77,879 [38,054]	83,902 [41,931]

Note: This table contains sample characteristics for graduates of universities in the East, Midwest, South, and West. There are additional individuals in the sample who do not attend university in these regions. Regions are defined using a community detection algorithm. See text for details.

Table 2: Short- and Medium-Run Effects of Regional Rank on Annualized Salary

	(1)	(2)	(3)	(4)	(5)	(6)
Y =Ln(Salary)						
University's Regional Rank						
(1) (Regional Rank/100)	1.249***	1.193**	1.098**	1.146*	1.185**	1.197**
	(0.471)	(0.475)	(0.559)	(0.594)	(0.594)	(0.598)
(2) (Regional Rank/100)*(SAT/1000)	-1.356***	-1.305***	-1.202**	-1.250**	-1.299**	-1.309**
	(0.457)	(0.458)	(0.533)	(0.578)	(0.578)	(0.582)
(3) (Regional Rank/100)*2003	-1.538**	-1.504**	-1.432**	-1.463**	-1.451**	-1.513**
	(0.623)	(0.623)	(0.727)	(0.719)	(0.720)	(0.724)
(4) (Regional Rank/100)*(SAT/1000)*2003	1.566***	1.532**	1.521**	1.487**	1.486**	1.538**
	(0.607)	(0.605)	(0.708)	(0.700)	(0.701)	(0.705)
P-value from Joint Test of:						
(1) and (2)	0.004	0.006	0.033	0.054	0.039	0.041
(3) and (4)	0.033	0.036	0.069	0.098	0.095	0.087
(1), (2), (3), (4)	0.018	0.029	0.120	0.155	0.129	0.121
Effect of Regional Rank Disadvantage of 35 places for 75th percentile SAT score						
1994	-0.123***	-0.121***	-0.108**	-0.115**	-0.122**	-0.122**
	(.04)	(.042)	(.045)	(.051)	(.051)	(.051)
2003	-0.014	-0.015	0.013	-0.013	-0.016	-0.016
	(.036)	(.038)	(.046)	(.037)	(.037)	(.037)
University's Average SAT						
(AvgSAT/100)	0.091	0.054	0.076	0.055	0.045	0.054
	(0.067)	(0.075)	(0.088)	(0.089)	(0.089)	(0.089)
(AvgSAT/100)*(SAT/1000)	-0.095	-0.077	-0.105	-0.071	-0.069	-0.079
	(0.061)	(0.063)	(0.072)	(0.077)	(0.077)	(0.078)
(AvgSAT/100)*2003	-0.028	-0.020	-0.138	-0.019	-0.019	-0.028
	(0.090)	(0.090)	(0.106)	(0.100)	(0.100)	(0.101)
(AvgSAT/100)*(SAT/1000)*2003	0.063	0.058	0.182*	0.055	0.052	0.067
	(0.082)	(0.082)	(0.097)	(0.091)	(0.091)	(0.091)
Other University Characteristics	No	Yes	Yes	Yes	Yes	Yes
Restrict to Same Region in 1994 & 2003	No	No	Yes	No	No	No
Additional Controls	None	None	None	BA Major	Highest Degree	Years OLF Since 1997
Observations	2660	2660	2060	2660	2660	2650
R-squared	0.442	0.445	0.458	0.458	0.456	0.449

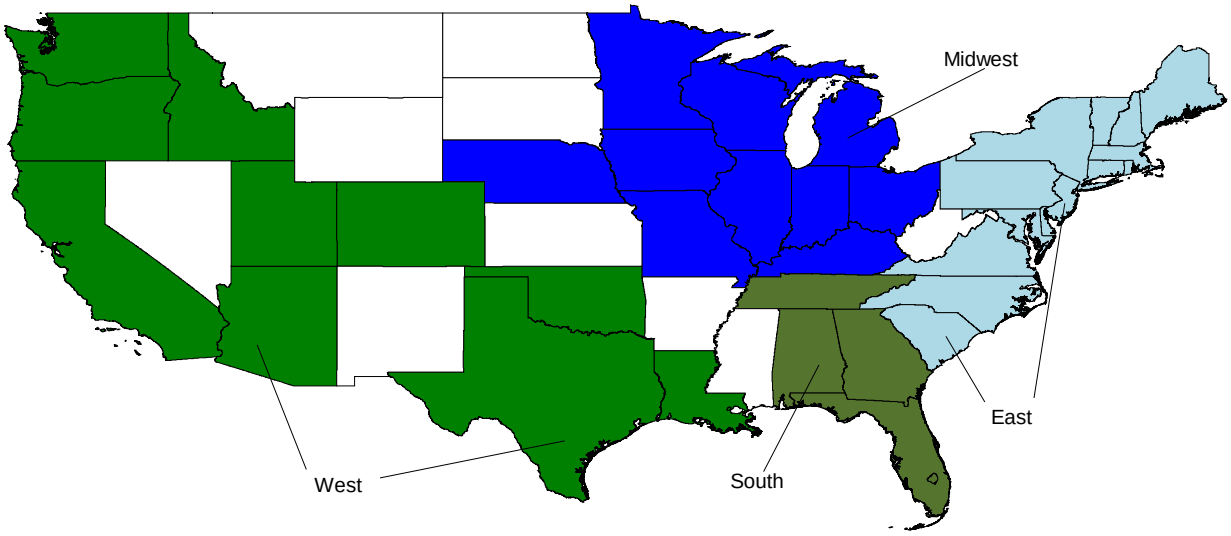
Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. See paper for full list of control variables and sample restrictions. The 75th percentile SAT score is 1180. I include indicators for major field in column (4); these fields include (1) uncodable, (2) Humanities, (3) Social/Behavioral Science, (4) Life Sciences/Physical Sciences/Math/Computer and Information Sciences/Engineering, (5) Education, (6) Business Management, (7) Health, (8) Vocational/Technical and Other Technical/Professional, (9) Missing. In column (5) I include indicators for highest degree. These include bachelor's degree, post-baccalaureate certificate, master's degree, post-master's certificate, first-professional degree, and doctoral degree. This variable equals one for every respondent in 1994. In Column 6, I include years out of the labor force since 1997 (not working and not looking for work). This variable is zero for every respondent in 1994.

Table 3: Short- and Medium-Run Effects of Regional Rank on Employment and Enrollment

	(1)	(2)	(3)	(4)
	Unemployed	Graduate Enrollment, 1994	Post Graduate Degree, 2003	For-Profit Employer
University's Regional Rank				
(1) (Regional Rank/100)	0.271	-0.257	-0.035	-1.208*
	(0.192)	(0.428)	(0.466)	(0.658)
(2) (Regional Rank/100)*(SAT/1000)	-0.217	0.135	0.005	1.183*
	(0.176)	(0.422)	(0.452)	(0.632)
(3) (Regional Rank/100)*2003	-0.093			0.146
	(0.289)			(0.798)
(4) (Regional Rank/100)*(SAT/1000)*2003	0.037			-0.109
	(0.272)			(0.768)
P-value from Joint Test of:				
(1) and (2)	0.207	0.391	0.953	0.173
(3) and (4)	0.530			0.953
(1), (2), (3), (4)	0.400			0.051
Effect of Regional Rank Disadvantage of 35 places for 75th percentile SAT score				
1994	0.005	-0.034		0.066
	(.012)	(.043)		(.051)
2003	-0.012		-0.01	0.072
	(.019)		(.044)	(.04)
University's Average SAT				
(AvgSAT/100)	0.033	0.037	-0.007	0.002
	(0.027)	(0.077)	(0.080)	(0.098)
(AvgSAT/100)*(SAT/1000)	-0.021	-0.036	-0.021	0.012
	(0.023)	(0.060)	(0.062)	(0.086)
(AvgSAT/100)*2003	-0.006			0.041
	(0.039)			(0.111)
(AvgSAT/100)*(SAT/1000)*2003	0.002			-0.033
	(0.034)			(0.101)
Observations	5,780	1770	1780	2650
R-squared	0.057	0.034	0.094	0.075

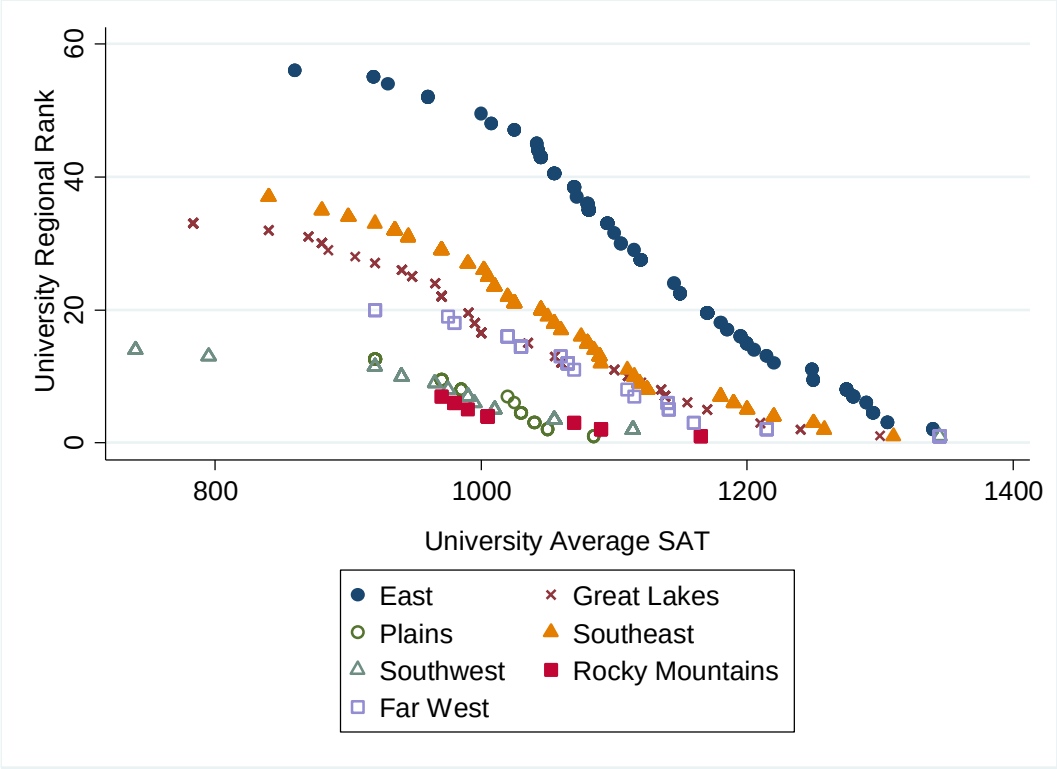
Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. See paper for full list of control variables. I use the 75th percentile SAT score from the main sample in Table 2 (1180). Consistent with the main specification, in Column (1) I restrict the sample to those no more than 25 when receiving the Bachelor's degree, nonmissing average state wages in 1994 and 2003, and observations in 1994 with unemployment nonmissing in 2003. In Column (2) the sample includes individuals in 1994 who are included in the main sample in 2003. In Column (3), the sample includes individuals in 2003 in the main sample. In Column (4), the sample includes individuals in the main sample, but whether the individual is at a for-profit employer is missing for some individuals.

Appendix Figure 1: Community Detection Regions



Note: These are the regions used in defining university regional rank, in the principal results of the paper. They are identified using a community detection algorithm and data on finance and consulting firm recruiting strategies. The algorithm identifies regions such that these firms are likely to recruit within but not outside the region. States in white are each in their own region. This is because these states had no recruiting firms or the only recruiting firms were from the same state and those offices were not the closest offices to universities in other states where the firm recruited. See Weinstein (2016) for details.

Appendix Figure 2: Differences in Regional Rank by University Average SAT Score, OBE Regions



Note: This figure is a scatterplot of university regional rank by the university's average SAT score, for universities attended by individuals in the sample. Region definitions are based on the Bureau of Economic Analysis OBE regions (combining New England and the Mideast). See text for details.

Appendix Table 1: Short- and Medium-Run Effects of Regional Rank on Salary, Employment, and Enrollment, Individuals in Sample in 1994 and 2003

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(Salary)	Ln(Salary)	Unemployed	Graduate Enrollment, 1994	Post Graduate Degree, 2003	For-Profit Employer
University's Regional Rank						
(1) (Regional Rank/100)	1.258***	1.245***	0.271	-0.639	-1.168*	-1.153*
	(0.476)	(0.481)	(0.192)	(0.438)	(0.603)	(0.660)
(2) (Regional Rank/100)* (SAT/1000)	-1.348***	-1.324***	-0.217	0.595	1.172*	1.127*
	(0.461)	(0.463)	(0.176)	(0.440)	(0.607)	(0.635)
(3) (Regional Rank/100)*2003	-1.712**	-1.703**	-0.092			-0.149
	(0.775)	(0.777)	(0.289)			(0.909)
(4) (Regional Rank/100)* (SAT/1000)*2003	1.737**	1.730**	0.036			0.253
	(0.745)	(0.744)	(0.272)			(0.873)
P-value from Joint Test of:						
(1) and (2)	0.007	0.010	0.209	0.312	0.151	0.207
(3) and (4)	0.056	0.055	0.527			0.700
(1), (2), (3), (4)	0.031	0.045	0.401			0.057
Effect of Regional Rank Disadvantage of 35 places for 75th percentile SAT score						
1994	-0.111***	-0.106**	0.006	0.02		0.058
	(.04)	(.042)	(.012)	(.04)		(.052)
2003	0.0005	0.006	-0.011		0.071	0.11**
	(.045)	(.048)	(.019)		(.061)	(.051)
University's Average SAT						
(AvgSAT/100)	0.099	0.070	0.033	-0.030	-0.103	0.056
	(0.067)	(0.079)	(0.027)	(0.067)	(0.106)	(0.102)
(AvgSAT/100)*(SAT/1000)	-0.098	-0.088	-0.021	0.034	0.087	-0.019
	(0.061)	(0.063)	(0.023)	(0.058)	(0.086)	(0.088)
(AvgSAT/100)*2003	0.005	0.006	-0.007			0.005
	(0.116)	(0.116)	(0.039)			(0.131)
(AvgSAT/100)*(SAT/1000) *2003	0.030	0.029	0.002			0.003
	(0.106)	(0.106)	(0.034)			(0.120)
Other University Characteristics	No	Yes	Yes	Yes	Yes	Yes
Observations	1750	1750	5780	870	870	1740
R-squared	0.490	0.497	0.057	0.024	0.117	0.082

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. I include individuals in the sample in both 1994 and 2003. See paper for details and full list of control variables. I evaluate coefficients at the 75th percentile SAT score for the main sample in column (1). Consistent with the main specification, in Column (3) I restrict the sample to those no more than 25 when receiving the Bachelor's degree, nonmissing average state wages in 1994 and 2003, and unemployment nonmissing in 1994 and 2003. In Column (4) the sample includes individuals in 1994, while in Column (5), the sample includes individuals in 2003. In Column (6), the sample includes individuals in the main sample, but whether the individual is at a for-profit employer is missing for some individuals.

Appendix Table 2: Short- and Medium-Run Effects of Regional Rank on Annualized Salary, OBE Regions

	(1)	(2)	(3)	(4)	(5)	(6)
Y =Ln(Salary)						
University's Regional Rank						
(Regional Rank/100)	0.421	0.350	0.859	0.386	0.355	0.349
	(0.535)	(0.533)	(0.585)	(0.778)	(0.778)	(0.783)
(Regional Rank/100)*(SAT/1000)	-0.572	-0.495	-1.005*	-0.556	-0.506	-0.492
	(0.528)	(0.524)	(0.572)	(0.753)	(0.753)	(0.757)
(Regional Rank/100)*2003	-0.593	-0.535	-1.127	-0.511	-0.581	-0.542
	(0.768)	(0.768)	(0.839)	(0.955)	(0.956)	(0.962)
(Regional Rank/100)*(SAT/1000)*2003	0.658	0.613	1.258	0.585	0.649	0.622
	(0.753)	(0.751)	(0.822)	(0.921)	(0.922)	(0.927)
P-value from Joint Test of:						
(1) and (2)	0.204	0.259	0.099	0.327	0.405	0.444
(3) and (4)	0.608	0.602	0.216	0.705	0.685	0.675
(1), (2), (3), (4)	0.473	0.586	0.302	0.608	0.693	0.763
Effect of Regional Rank Disadvantage of 35 places for 75th percentile SAT score						
1994	-0.089	-0.082	-0.111	-0.094	-0.085	-0.081
	(.05)	(.05)	0.053	0.064	0.064	0.065
2003	-0.025	-0.016	0.010	-0.031	-0.020	-0.014
	(.049)	(.051)	0.058	0.049	0.048	0.049
University's Average SAT						
(AvgSAT/100)	0.020	-0.017	0.077	-0.011	-0.026	-0.018
	(0.066)	(0.074)	(0.086)	(0.090)	(0.090)	(0.090)
(AvgSAT/100)*(SAT/1000)	-0.027	-0.012	-0.106	-0.014	-0.006	-0.014
	(0.061)	(0.061)	(0.070)	(0.078)	(0.078)	(0.078)
(AvgSAT/100)*2003	0.049	0.058	-0.116	0.057	0.052	0.050
	(0.091)	(0.091)	(0.104)	(0.103)	(0.103)	(0.103)
(AvgSAT/100)*(SAT/1000)*2003	-0.011	-0.017	0.158*	-0.018	-0.017	-0.008
	(0.083)	(0.082)	(0.095)	(0.092)	(0.092)	(0.093)
Other University Characteristics	No	Yes	Yes	Yes	Yes	Yes
Restrict to Same Region in 1994 & 2003	No	No	Yes	No	No	No
Additional Controls	None	None	None	BA Major	Highest Degree	Years OLF Since 1997
Observations	2,660	2,660	2,000	2,660	2,660	2,650
R-squared	0.441	0.444	0.448	0.457	0.455	0.448

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. See paper and Table 2 for full list of control variables, region definitions, and complete details. The 75th percentile SAT score is 1180.

Appendix Table 3: Short- and Medium-Run Effects of Regional Rank on Employment and Enrollment, OBE Regions

	(1)	(2)	(3)	(4)
	Unemployed	Graduate Enrollment, 1994	Post Graduate Degree, 2003	For-Profit Employer
University's Regional Rank				
(Regional Rank/100)	0.226	-0.300	1.210**	-1.188
	(0.218)	(0.591)	(0.598)	(0.864)
(Regional Rank/100)*(SAT/1000)	-0.160	0.506	-0.900	0.977
	(0.207)	(0.579)	(0.587)	(0.822)
(Regional Rank/100)*2003	-0.290			0.491
	(0.380)			(1.068)
(Regional Rank/100)*(SAT/1000)*2003	0.255			-0.245
	(0.357)			(1.015)
P-value from Joint Test of:				
(1) and (2)	0.221	0.147	0.010	0.224
(3) and (4)	0.728			0.357
(1), (2), (3), (4)	0.508			0.299
Effect of Regional Rank Disadvantage of 35 places for 75th percentile SAT score				
1994	0.013	0.104*		-0.012
	(.017)	(.055)		(.063)
2003	0.017		0.052	0.058
	(.025)		(.056)	(.053)
University's Average SAT				
(AvgSAT/100)	0.029	0.038	0.076	0.023
	(0.027)	(0.078)	(0.078)	(0.101)
(AvgSAT/100)*(SAT/1000)	-0.016	-0.015	-0.070	-0.017
	(0.023)	(0.062)	(0.060)	(0.087)
(AvgSAT/100)*2003	-0.019			0.056
	(0.041)			(0.116)
(AvgSAT/100)*(SAT/1000)*2003	0.016			-0.036
	(0.036)			(0.104)
Observations	5,780	1,770	1,780	2,650
R-squared	0.057	0.035	0.098	0.073

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. See paper for full list of control variables and region definitions. I evaluate coefficients at the 75th percentile SAT score of the main sample in Table 2. Consistent with the main specification in Appendix Table 2, in Column (1) I restrict the sample to those no more than 25 when receiving the Bachelor's degree, nonmissing average state wages in 1994 and 2003, and observations in 1994 with unemployment nonmissing in 2003. In Column (2) the sample includes individuals in 1994 who are included in the main sample in 2003. In Column (3), the sample includes individuals in 2003 in the main sample. In Column (4), the sample includes individuals in the main sample, but whether the individual is at a for-profit employer is missing for some individuals.

Appendix Table 4: Short- and Medium-Run Effects of Regional Rank on Annualized Salary, Differential Effects for Males

	(1)
	Ln(Salary)
University's Regional Rank	
(1) (Regional Rank/100)	1.664***
	(0.576)
(2) (Regional Rank/100)*(SAT/1000)	-1.889***
	(0.581)
(3) (Regional Rank/100)*2003	-0.777
	(0.830)
(4) (Regional Rank/100)*(SAT/1000)*2003	1.004
	(0.844)
(5) (Regional Rank/100)*Male	-0.700
	(0.946)
(6) (Regional Rank/100)*(SAT/1000)*Male	0.874
	(0.912)
(7) (Regional Rank/100)*2003*Male	-1.808
	(1.254)
(8) (Regional Rank/100)*(SAT/1000)*2003*Male	1.417
	(1.222)
P-value from Joint Test of:	
Effect of Regional Rank for Males	
1994: (1), (2), (5), (6)	0.005
2003 Differential: (3), (4), (7), (8)	0.030
2003: (1) through (8)	0.001
Differential Effect of Regional Rank for Males	
1994: (5) and (6)	0.293
2003 differential: (7) and (8)	0.105
2003: (5) through (8)	0.013
University's Average SAT	
(AvgSAT/100)	0.186**
	(0.091)
(AvgSAT/100)*(SAT/1000)	-0.202**
	(0.081)
(AvgSAT/100)*2003	-0.058
	(0.116)
(AvgSAT/100)*(SAT/1000)*2003	0.087
	(0.109)
(AvgSAT/100)*Male	-0.240*
	(0.135)
(AvgSAT/100)*(SAT/1000)*Male	0.216*
	(0.123)

	(1)
	Ln(Salary)
(AvgSAT/100)*2003*Male	0.005
	(0.181)
(AvgSAT/100)*(SAT/1000)*2003*Male	0.004
	(0.165)
Observations	2,660
R-squared	0.450

See paper for full list of control variables and complete details. Regression includes interactions between Male and AvgSAT, Regional Rank terms, as well as all other lower-level interaction terms. Regional rank is defined using community detection algorithm regions.