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Prestige Matters: Wage Premium and Value Addition in Elite Colleges†

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This paper provides evidence that graduates of elite public institutions in India have an earnings advantage in the labor market even though attending these colleges has no discernible effect on academic outcomes. Admission to the elite public colleges is based on the scores obtained in the Senior Secondary School Examinations. I exploit this feature in a regression discontinuity design. Using administrative data on admission and college test scores and an in-depth survey, I find that the salaries of elite public college graduates are higher at the admission cutoff although the exit test scores are no different. (*JEL* I23, I26, J24, J31, O15)

Quality of college education can significantly influence students' enrollment decisions and governments' investment decisions, which in turn can affect the skill base of an economy. Hence, determining the returns to quality of higher education is important. Limited credit markets, uncertain labor market conditions, and acute information asymmetries in developing countries make the need to understand the returns to college quality even more compelling. Better quality (elite) educational institutions attract the very best students, and the graduates of such institutions are often observed to have better labor market outcomes. However, whether such institutions result in improvement in learning outcomes and, hence, a higher return in labor markets, is unclear.

This paper provides causal estimates for returns to attending prestigious colleges. Using admission data and uniform administrative exit test scores data from India, I show that there is no evidence of improvement in learning outcomes measured by test scores at the margin of admission. However, using an in-depth, in-person survey, I demonstrate that there is a wage premium for attending elite colleges. This reputation effect could explain why elite colleges are able to remain selective and attract the best applicants despite the lack of an effect on test scores. This is an

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important finding as it highlights that there can be a wage premium even if there is no value addition in test scores because of signaling or networking effects.

Estimating the returns to college quality is empirically challenging. The unobserved individual traits that influence admissions decision may also affect labor market outcomes. I use the features of the Indian college admissions for general education to circumvent this problem. Public colleges in India are very prestigious and therefore attract the best students. Numerous media reports and popular press stories indicate these graduates receive high wages. Average comparisons of common college exit test scores also show these students outperform their private counterparts. The admission procedure to public colleges makes this setting ideal for examining the returns to attending such colleges. Public colleges admit students based on a cutoff of the students' scores on the Senior Secondary School Examinations.[1] Hence, I use a regression discontinuity design for identification. I compare the outcomes of students who attend public or private colleges in a narrow margin around the admission cutoff.

I obtained admission data from colleges and university exit exam performance data from the university and matched these administrative datasets to analyze performance on test scores. I find that the educational outcomes of public college students who were on the margin of the admission cutoff do not differ from those of the students who barely missed the cutoff and thus attended private colleges.

I collected a unique dataset for these college graduates using a survey with details about labor supply, employment history, and college learning experiences. Despite no evidence of value addition in test scores, graduating from a public college provides a premium in the labor market. My regression discontinuity design estimates reveal a positive effect of attending public colleges on wages. My findings are robust to a variety of specifications, bandwidth choices, kernel choices, empirical models, and treatment effect bounds for nonrandom selection.

By studying effects of elite colleges on test scores and wages, this paper combines two growing strands of research in a novel way. The first strand studies the effects on wages but not test score growth, knowledge, or skill formation. Employing a variety of methods, this body of research estimates the returns to selective colleges with mixed evidence (Brewer, Eide, and Ehrenberg 1999; Dale and Krueger 2002; Black and Smith 2004; Long 2008; Hoekstra 2009; Li et al. 2012; Dale and Krueger 2014; MacLeod et al. 2017; Ge, Isaac, and Miller 2018). While some of the studies discern an overall positive earnings effect (Brewer, Eide, and Ehrenberg 1999; Black and Smith 2004; Hoekstra 2009; Li et al. 2012; MacLeod et al. 2017) others only find it for a subpopulation (Dale and Krueger 2014; Ge, Isaac, and Miller 2018). Most of these studies feature the United States, where college exit tests are not uniform and there is no standardized assessment. Hence, these studies are not able to compare exit test scores to shed light on whether there is improved learning at these institutions.

[1] Senior Secondary School Examinations are the equivalent of high school exit tests in the United States. Technical education colleges such as medicine and engineering use different centralized tests for admission.

Separately, a growing body of work estimates the effects of selective schools and colleges on educational outcomes.[2] A salient common finding in most of these papers is that at the margin, elite schools and colleges do not impact the school/college exit test scores (Clark 2010; Abdulkadiroğlu, Angrist, and Pathak 2014; Bui, Craig, and Imberman 2014; Lucas and Mbiti 2014).[3] However, none of these studies shed light on labor market outcomes such as wages.

This paper makes an innovative contribution to this growing literature that examines the consequences of attending elite educational institutions on education and labor market outcomes. The papers discussed above have attempted to identify the effects of elite schools/colleges for educational outcomes or returns to such schools/colleges both in developing and developed countries. This paper provides the first evidence of attending such educational institutions resulting in a wage premium despite no effects on learning outcomes. Signaling or networking can potentially explain this conundrum. The features of the Indian higher education context enable me to study the effect on both college exit test scores and earnings. The Indian higher education system produces the largest pool of skilled labor in the world. Hence, it is important to understand the returns to college quality in such a context. There are many developing countries with similar labor market frictions and higher education systems where these results are directly relevant. More broadly, my findings highlight that elite colleges may provide signaling and networking opportunities that can influence earnings. Admission to elite colleges raises access to leadership positions and the probability of being in the top income brackets significantly (Zimmerman 2019). Moreover, such gains accrue to males who attend high-tuition private high schools. Insofar as the economically disadvantaged are unable to afford elite schools and colleges, this can perpetuate and widen economic inequality and make it more enduring.

The remainder of the paper is organized as follows. Section I provides background information about general education college education and admission rules. Section II discusses the data. Section III presents the estimation strategy. Section IV documents the results and the findings of robustness tests. I discuss selection concerns and related tests to allay these in detail in Section V. Section VI provides concluding remarks.

I. Background

A. *Public versus Private Colleges*

In India, general education colleges operate in all districts with the goal of making tertiary education accessible. The colleges account for about nine-tenths of undergraduate enrollments (Agarwal 2006), but these colleges are not allowed to confer a

[2] Cullen, Jacob, and Levitt (2006) exploit randomized school choice lotteries to show that elite schools did not improve student test scores in Chicago. Li et al. (2012) show that the learning outcomes did not improve in the Chinese provincial capitals.

[3] A few studies also find a positive effect on school outcomes (Jackson 2010, Park et al. 2010, and Pop-Eleches and Urquiola 2013). Long-term education outcomes have been studied by Clark and Del Bono (2016).

degree and must affiliate with a university to operate.[4] These do not offer technical majors like medicine or engineering and offer three-year degrees.

Each college has its own campus and infrastructure. Private colleges are managed privately. However, they may receive public funds ("private aided college"), or they may be totally self-financed ("private unaided college"). The private aided colleges can raise funds by charging higher fees and accepting donations from philanthropic or business groups. On the other hand, public colleges are managed and financed by the government. Public colleges cannot accept any private donations, and the state funds their maintenance and development expenses. In the sample, the private aided colleges receive public funds to meet their recurring expenditures (mostly teacher salaries) and charge much higher tuition than the government colleges. Although the teachers have to take the same University Grants Commission Exam to qualify for teaching positions in private colleges, they do not enjoy the same degree of job security as the government teachers. Their contracts differ from college to college and are negotiated with the private management. Private colleges also hire more adjunct teachers on short-term contracts than public colleges. In contrast, public colleges are managed and run by state employees. Teacher contracts are negotiated with the government and offer tenure security. The state funds public colleges' facilities and equipment, but private colleges (both aided and unaided) have to self-finance such expenditures. Private aided colleges can apply government aid only to pay teachers' salaries. Public colleges are considered very prestigious and students favor these over private colleges.[5] In the commerce major, students take classes in accounting, finance, statistics, taxation, business strategy, computing, and communication. In the field of science, biology, physics, chemistry, mathematics, computing, and communication subjects are offered. Liberal arts offer a variety of social science and humanities concentrations. The level of difficulty is comparable to undergraduate programs in the United States. On-campus recruiting is based on campus interviews followed by return visits to the firms. Career services are not very well functioning in these colleges. Career services are not funded by the state, and, hence, they are no better organized in public elite colleges; although, this may be specific to the sample district.

The graduates of these colleges participate in the local labor market. A major sector of employment is private business enterprises. As per the CEO of one of the firms in the sample, in the private sector, entry-level jobs pay anywhere between 15,000 rupees and 40,000 rupees. A major industry in this area is textiles, and it employs college graduates in departments such as accounts, taxes, finance, marketing, sales, production, procurement, quality control, IT, personnel management, HR, and exports. Due to a skill shortage in India, occupational sorting across colleges is limited in this sample.[6] But within an occupation/firm, employees are sorted into different tracks. The firm whose CEO permitted us to observe operations

[4] The University Grants Commission (UGC) Act—the UGC is the government body that regulates tertiary education—has a provision that prohibits any institution from awarding degrees unless it is established under an act of Parliament or is specially empowered to award degrees.

[5] For example, Presidency College in Calcutta, West Bengal has been an elite public college. It was converted into a university recently.

[6] See Azam (2010) for details.

sorts individuals into executive track and management track. The graduates in management track are given more challenging tasks. Management positions in various departments pay more. Employees of departments such as IT, MIS, International Marketing, and finance receive higher compensation.

B. *Public College Admissions*

Admission to general education public colleges (excluding technical education such as medicine or engineering, etc.) is determined on the basis of the students' performance on the Senior Secondary School Examinations taken in class XII.[7] Students cannot be admitted to college without at least passing this exam, but to be admitted to public colleges, their score must exceed a specified cutoff. This admission cutoff for public colleges is determined every year and varies by college and stream of education. Students who score above the cutoff are eligible for admission to public colleges. Although the colleges post a list of students who are offered admission to public colleges, the public does not know the admission cutoffs, and rules used to determine the cutoffs are kept confidential. Students apply to various colleges simultaneously as the admissions open in the spring. The admission decisions are made public in early fall, shortly before the start of the academic year. Colleges diligently follow admission rules. The percentage of students attending public colleges rises sharply from near 0 to above 90 percent around the admission threshold. Streams are declared in the penultimate year of high school, two years before the Senior Secondary School Examinations are taken. Hence, performance in the exit exams does not affect stream choice.

C. *Uniform College Exit Tests*

All students in colleges (private or public) affiliated with the same university take the same exit exams.[8] These exams vary by stream of education, but conditional on the stream, private and public college students study the same curriculum and take the same exit tests. These exams test for language competencies (English and regional language) and stream-specific competencies; for example, commerce students take tests in accounting, taxation, and so forth. The examinations for the affiliated colleges are conducted by the respective universities, which also set the course curriculum. The affiliated colleges only offer prescribed courses. Thus, conditional on the university and stream, I can compare the educational outcomes of students in public and private colleges because they take the same exit tests.

[7] Class XII is equivalent to high school grade 12, the last year of high school. All high schools in India must be affiliated either with one of the two national boards (Central Board of Secondary Education or Indian Certificate of Secondary Education) or with their state's regional board. The exit exams are conducted by school boards across India and are recognized nationally.

[8] Colleges can be spread in different districts, whereas the universities with which they affiliate are centrally located in some district headquarter. I compare test scores on uniform university exams across colleges.

II. Data

The data used in the analysis are collected from several different sources. I obtained administrative data from colleges in a district in North India and the university with which they were affiliated. This included admission records and uniform college exit test scores. Then I collected data on college experiences and postcollege labor market outcomes using an in-person survey.

A. *Administrative Data*

I obtained admissions records for public and private colleges. These records include the Senior Secondary School Examination scores, age, gender, place of residence, board of secondary education, stream of study, and father's occupation. The college exit test scores were obtained from the affiliating university. I matched these admission records and college exit test scores using a unique roll number assigned to each student. Institutional details on admission cutoffs were obtained from the colleges. The sample included admission cohorts from 1999 to 2002.[9] These colleges are the top choices among the students in the district for general education. The private colleges are the alternative college choices that students go to if they do not get admitted to public colleges.

The general education colleges do not offer professional degrees like law or medicine. In general, migration out of district for higher education is low. Students do not migrate out of their district to attend general education colleges.[10] Private colleges offer merit scholarships, which ensures that students around the cutoff who apply to college attend either public or private colleges. As a further test, I collected the applications of students who applied but did not get into the public colleges for the 2002 cohort. I verified that these students had indeed attended colleges.[11]

B. *Survey Data*

I conducted a detailed follow-up survey of these students in 2011–2012. I did not survey graduates from rural areas in the follow-up survey due to cost considerations. Of the 1,981 individuals whom the survey tried to locate, 1,506 students (76 percent) were successfully surveyed.

The in-person interview-based survey asked detailed questions about labor market participation. I obtained data on employment history, duration of each employment, occupation, type of organization worked for, type of industry, and salary per month.

[9] I also got this data for the 1998 cohort, but this cohort's addresses and phone numbers were not available. Hence, I could not survey them and do not include them in the test score analysis.

[10] According to the Census of India, of the 32.9 million migrant males in the country, only 6 percent migrated for education, and this includes technical education such as engineering and medicine. Among the 64.5 million migrants, only 1.3 percent migrated for education. The majority (around 65 percent) of the women migrated for marriage.

[11] The dropout rate from private and public colleges near the admission cutoff is similar, and the observable characteristics of the students are no different. Neither Senior Secondary School Examination scores nor father's occupation influence dropout decisions very close to the cutoff; hence students with different abilities and socioeconomic backgrounds are equally likely to drop out on either side of the cutoff.

Salary information was elicited as a categorical variable. The categories included rupees in the following amounts: 5,000 or less, 5,000–10,000, 10,000–15,000, 15,000–20,000, 20,000–30,000, and greater than 30,000. Demographic information such as marital status and number of children was also ascertained. As per the ILO, in 2011–2012 in India, the nominal average daily wage for the regular urban workers with higher degrees (than secondary school) was 735 rupees for males and 492 rupees for females. A 26-day work month would imply a monthly salary of 19,110 rupees for males and 12,792 rupees for the females.[12] An urban male worker with a high school diploma would earn roughly 8,242 rupees on the average. Thus, our average male respondent is likely to fall in the fourth bracket, and the average female respondent is likely to be in the third bracket.

Wage data have three shortcomings. First, I do not observe the data for all of the college graduates in the sample. This is because the survey success rate is 76 percent. Second, there are missing values for the variable because of unemployment or unwillingness to report. Third, I was only able to elicit this variable as a categorical response.[13] The first two issues can bias the estimates. I address this selection problem and its implications for my results in detail in Section V. For the categorical variable, I show the estimates using the midpoints of the bins.[14]

Of the 1,506 respondents, 748 individuals are either self-employed or earn a salary. Those who are either self-employed or earn a salary are considered employed for the purpose of the analysis. Other possible choices include being a student, being unemployed and looking for work, being unemployed and not looking for work, home production, and other. In the sample of successfully located respondents, 40 percent are homemakers, and 99.04 percent of these individuals are women. Among the formally nonemployed, 79 percent are engaged in home production. Among the employed, 458 out of 748 individuals report their salary, and 439 observations have nonmissing data for background characteristics.

C. *Summary Statistics*

The main sample of analysis comprises individuals who are either self-employed or earn a salary and have reported their salaries.[15] Table 1 provides summary statistics by college type.

The average Senior Secondary School Exam score for the public college graduates is 72.8 percent, whereas the average for the private college graduates is 61.8 percent. The difference of 10.9 percent is statistically significant at the 1 percent significance level. These averages reveal that the public colleges are more selective and attract better students. The university-wide college test scores are higher for the public

[12] The wages for urban male and female regular workers with highest levels of education increased by 73 percent and 69 percent, respectively, from 1993–1994 to 2011–2012.

[13] In a pilot, I observed very low response to the question about salary, and the survey organization suggested using categories, which resulted in marked improvement in response rate.

[14] Selection bias can result from selection into the sample, selection into employment, and selection into reporting the salary. The implications of selection issues for the results and robustness tests performed to address these issues are discussed in detail in Section V.

[15] I excluded the students admitted to public colleges based on affirmative action reservation quotas for lower castes. There are very few such students attending private colleges.

TABLE 1—SUMMARY STATISTICS BY COLLEGE TYPE

	Public		Private		
	Mean	SD	Mean	SD	Difference
Salary	4.67	1.40	3.50	1.50	1.18
Senior Secondary School Exam scores	72.80	7.60	61.80	9.00	10.90
Central board of secondary education	0.32	0.46	0.20	0.40	0.12
Age at starting college	18.00	0.88	18.05	0.92	0.05
Father's occupation					
Government service	0.09	0.30	0.07	0.26	0.02
Labor in unorganized sector	0.06	0.23	0.08	0.27	0.02
Professional	0.03	0.18	0.06	0.25	0.03
Service in formal sector	0.38	0.46	0.27	0.44	0.10
Agriculture	0.07	0.26	0.07	0.25	0.01
Business	0.24	0.43	0.32	0.47	0.08
Admission year					
1999	0.22	0.41	0.21	0.41	0.01
2000	0.34	0.47	0.24	0.43	0.09
2001	0.22	0.41	0.26	0.44	0.03
2002	0.21	0.4	0.27	0.44	0.06
Male	0.57	0.50	0.27	0.44	0.31
Stream					
Commerce	0.22	0.41	0.26	0.44	0.04
Liberal arts	0.56	0.50	0.46	0.50	0.1
Science	0.21	0.40	0.26	0.44	0.05
College exit test scores	1,302.80	275.97	1,218.83	269.00	84.00
Observations	190		249		

colleges by 84 points, and again are statistically significant at the 1 percent significance level.[16] A naïve comparison of these test scores would indicate better educational outcomes for students attending public colleges and would be attributed to better learning environments in these colleges. But because these colleges are highly selective, this difference can be a result of selection. In my analysis, I carefully ascertain this by comparing the outcomes of students at the margin of admission. We also observe that the public college students have higher earnings on the average. This again warrants a closer examination, as this too could result from selection of high-ability students into public colleges.

In this overall sample, we see that the characteristics of the students vary by college type. However, I do not rely on the entire sample for identification. I use a small bandwidth around the cutoff threshold for the analysis. Online Appendix Table 1 provides summary statistics in the -5 to $+5$ interval of the Senior Secondary School Exam scores around the admission cutoffs. This table shows the individuals are similar on observable characteristics in narrow intervals around the cutoff.

[16]This difference varies by stream and is highest for liberal arts.

III. Estimation Strategy

A. *Empirical Specification*

I employ a regression discontinuity (RD) design to estimate the effect of attending public colleges on wages. Since admission to public colleges is based on a deterministic rule of Senior Secondary School Exams, I am able to compare outcomes across students with similar expected productivity (or ability) who are on the margin of the admission cutoff and, hence, attend public or private colleges due to small differences in their Senior Secondary School Examination scores. The application lends itself to a sharp design, and the empirical model is as follows:

$$Y_i = \alpha X_i + \beta \, Public_i + f(S_i) + e_i, \tag{1}$$

where Y_i is the outcome variable including salary and college exit test scores; X_i is a vector of individual characteristics including own demographics and family characteristics; $Public_i$ is an indicator variable that takes the value of 1 if the individual attends a public college, and 0 otherwise; β is the parameter of interest, and it indicates the effect of attending public colleges on the outcomes; and $f(S_i)$ is a function of the Senior Secondary School Exam scores S_i. Robust standard errors are reported.

B. *Sensitivity Analysis*

I use both parametric and nonparametric estimation procedures. For the parametric specifications, I use different specifications of control functions: linear, quadratic, and cubic. For the nonparametric estimation, I follow Hahn, Todd, and Van der Klaauw (2001) and use local linear regressions to estimate the left and right limits of the discontinuity, where the difference between the two is the estimated treatment effect. Bandwidth choice can also influence results, and no widely accepted guidelines exist for choice of bandwidth. Therefore, for nonparametric analysis, I vary the bandwidth and show results for several choices. I also show results for the optimal bandwidth proposed by Imbens and Kalyanaraman (2012). Finally, I use both triangular and rectangular kernels to show the results are not sensitive to the choice of the kernel.

IV. Results

Public colleges indeed follow admission rules. Figure 1 plots the average number of students who attended public colleges in bins of normalized Senior Secondary School Exam scores. This figure clearly demonstrates that there is a sharp rise in the percentage of students who attended public colleges around the cutoff. The percentage rises from near 0 to around 90 percent. Hence, in this setting, I can employ an RDD estimation procedure to estimate the effect of elite public colleges on college and postcollege outcomes, including salaries.

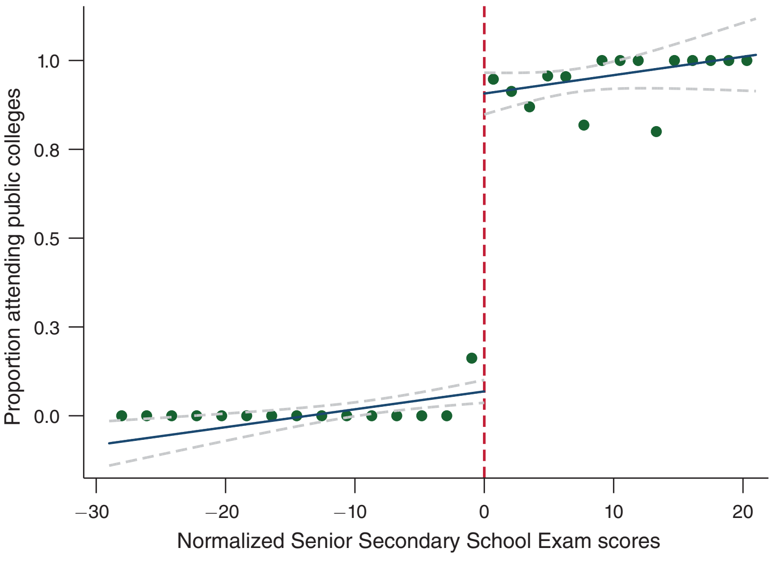

Figure 1. Discontinuity in Attending Public Colleges

Note: The figure plots (i) a scatterplot of the conditional means of public college attendance in bins of normalized Senior Secondary School Exams with 15 bins used on each side of the admission cutoff, (ii) linear best fit on either side of the cutoff (solid lines), and (iii) the confidence intervals (dashed lines).

Source: Based on author's calculations from administrative records data

A. *Value Added—Effects on Test Scores*

I test if the college exit test scores of the marginal students in public colleges are higher than the private counterpart for this sample and report the results in Figure 2. This figure shows the average scores in bins of the normalized Senior Secondary School Exam scores (using 15 bins on either side) along with the linear regression function and the confidence intervals. We do not discern a discontinuity in the test scores. Rather, the function looks smooth at the cutoff. It is worth noting, as explained in Section IC, the students on the left and right of the admission cutoff take identical college exit exams even though they attend different types of colleges.

I show the results from a parametric regression discontinuity design analysis in Table 2. Each cell reports the results from a separate standardized regression. Column 1 reports results from the full sample. Column 2 restricts the sample to a 15-point interval of the normalized Senior Secondary School Exam scores around the admission cutoff. Column 3 restricts the sample to a 10-point interval, and column 4 to a 5-point interval. The first row uses a linear control function of the Senior Secondary School Exam scores. The second row uses a quadratic, and the third row uses a cubic. All regressions control for precollege demographic characteristics including gender, year of admission to college, age at entering college, stream of study, board of Senior Secondary Education, and father's occupation.

I do not see an effect of public college attendance on college exit test scores. The estimates are negligible and insignificant at conventional significance levels. For the

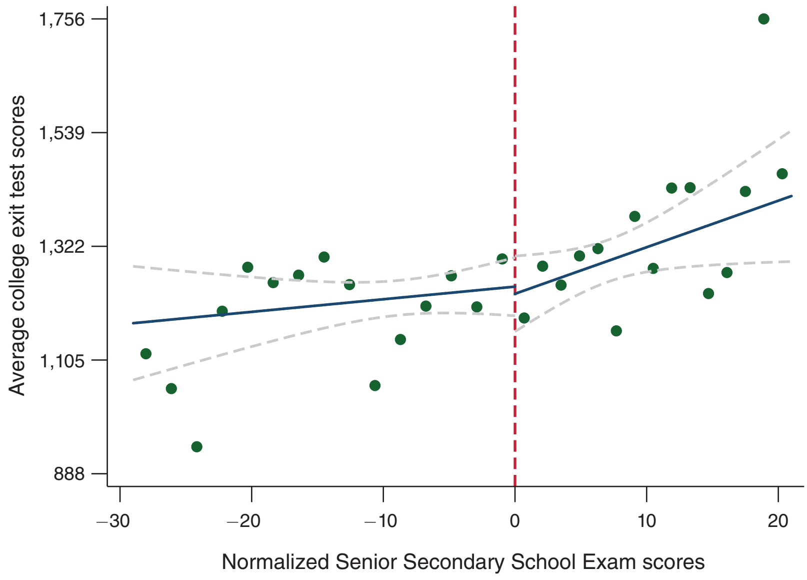

FIGURE 2. CONTINUITY IN COLLEGE EXIT EXAM SCORES AT THE PUBLIC COLLEGE ADMISSION CUTOFF

Note: The figure plots (i) a scatterplot of the conditional means of college exit test scores in bins of normalized Senior Secondary School Exams with 15 bins used on each side of the admission cutoff, (ii) linear best fit on either side of the cutoff (solid lines), and (iii) the confidence intervals (dashed lines).

Source: Based on author's calculations from administrative records data

5-point interval reported in column 4, the confidence interval with the linear control function is [−0.23 to 0.15], and with a cubic control function it is [−0.2 to 0.17].[17] These confidence intervals contain 0, so the effects are statistically insignificant. Effects outside the range of −0.2 to +0.17 of a standard deviation can be rejected with this sample.

B. *Training, Occupation, and Sector*

Public colleges can affect labor market outcomes by affecting choice of occupation, sector, and any other training. I use the survey questions and examine whether public college attendance affects if students (i) acquire a diploma (training certificate), (ii) earn a postgraduate degree, (iii) enter professional specialization, or (iv) study or work abroad. I also examine whether the students who attend public college are more likely to be in rewarding jobs such as tertiary-sector jobs or skilled occupations. I test whether they are employed in public enterprises and whether they have a higher job turnover. Table 3 reports the results from a parametric analysis in

[17] One concern might be that the college exit tests do not capture differences in learning. Students just memorize the material by rote learning, expecting what the exam will ask, and thus the college exit exam scores are no different in public versus private colleges. In the survey, the students were asked if they learned anything in college. Online Appendix Figure 1 shows that self-assessment of learning in college is positive and increases with the Senior Secondary School Exam scores.

Table 2—Parametric RD Estimates of the Effect of Public Colleges on College Exit Test Scores

	Dependent variable: College exit tests z-scores			
	Full sample	15-point interval	10-point interval	5 point-interval
Senior Secondary School Exam scores	(1)	(2)	(3)	(4)
Linear control function	−0.03	−0.03	−0.08	−0.04
	(0.07)	(0.07)	(0.08)	(0.09)
Quadratic control function	−0.07	−0.06	−0.11	−0.06
	(0.07)	(0.07)	(0.08)	(0.09)
Cubic control function	−0.03	−0.04	−0.08	−0.016
	(0.07)	(0.07)	(0.08)	(0.09)
Observations	439	384	309	167

Notes: Dependent variable, the z-scores of the college exit test scores, is computed by subtracting the mean and dividing by the standard deviation of the sample. Demographic controls include gender, year of admission in college, age at entering college, stream of study, board of education for Senior Secondary school, and father's occupation. Robust standard errors are reported in parentheses. Public college is an indicator equal to 1 if the individual attended public college and 0 if the individual graduated from a private college.

Table 3—Parametric RD Estimates of the Effect of Public Colleges on Training, Occupation, and Sector (in the 5-Point Interval)

	Diploma	Postgraduate degree	Professional specialization	Studied or worked abroad
Public college	0.03	−0.14	−0.16	−0.01
	(0.09)	(0.1)	(0.1)	(0.03)
p-value	0.34	0.17	0.128	0.71
Observations	156	157	159	159
	Tertiary sector	Skill occupation	Public sector	Number of jobs held
Public college	0.005	0.07	0.12	−0.18
	(0.08)	(0.08)	(0.09)	(0.15)
p-value	0.9	0.4	0.17	0.3
Observations	159	159	158	146

Notes: Demographic controls include gender, year of admission in college, age at entering college, stream of study, board of education for Senior Secondary school, and father's occupation. Robust standard errors are reported in parentheses. Public college is an indicator equal to 1 if the individual attended public college and 0 if the individual graduated from a private college. Number of observations varies from 167 due to missing outcome variables in the survey data.

a −5 to +5 window around the admission cutoff. None of these factors are statistically different from 0. These attributes do look fairly comparable across the private and public college graduates near the admission cutoff.[18] Using the Benjamini and Hochberg (1995) false discovery rate procedure for testing the significance of these 8 outcomes, I find that all of these are jointly statistically insignificant at the 5 percent significance level.

[18] Some of these features may be measured imprecisely.

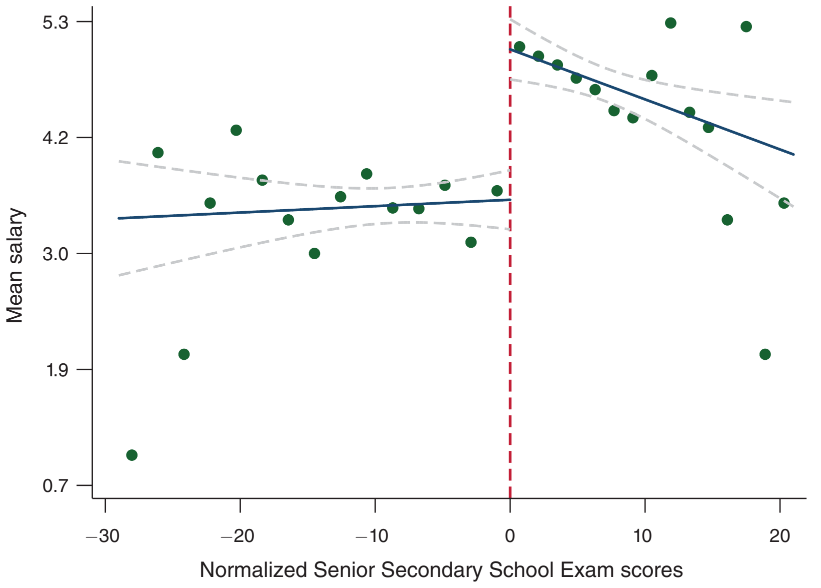

FIGURE 3. DISCONTINUITY IN REPORTED SALARY AT THE PUBLIC COLLEGE ADMISSION CUTOFF

Note: The figure plots (i) a scatterplot of the conditional means of the reported salary in bins of normalized Senior Secondary School Exams with 15 bins used on each side of the admission cutoff, (ii) linear best fit on either side of the cutoff (solid lines), and (iii) the confidence intervals (dashed lines).

Source: Based on author's calculations from self-reported survey data

C. *Wage Premium—Effect on Salary*

Figure 3 plots the figure analogous to Figure 2 for the average salary in the bins of normalized Senior Secondary School Exam scores. Unlike test scores, salary exhibits a jump at the admission cutoff for public colleges. Online Appendix Figure 2 plots the local polynomial regression functions estimated on either side of the cutoff using the optimal bandwidth proposed by Imbens and Kalyanaraman (2012) as a sensitivity check.

These graphs provide prima facie evidence of an elite college wage premium. I formally test the hypothesis and report the results in Table 4 (using the midpoint of the categories as the values).[19]

The results from the parametric regression discontinuity analysis analogous to that used for Table 2 are summarized in this table. Each cell reports the public college coefficient from a separate regression. The results are remarkably similar across all these specifications and statistically significant at the 1 percent significance level. The estimated effect (column 3, cell 1) is economically large. The standard deviation of the constructed salary is 11,109.8 rupees for the sample used to estimate this

[19] The last category, 6, is censored as it corresponds to salary greater than 30,000 rupees. I use 40,000 as the value for this category. This is approximately double the mean salary for college-educated men based on ILO 2009 estimates of daily earnings (see Section IIB for details).

Table 4—Parametric RD Estimates of the Effect of Public Colleges on Salary

	Dependent variable: Reported salary (midpoint of the bins for the categorical variable)			
	Full sample (1)	15-point interval (2)	10-point interval (3)	5-point interval (4)
Parametric estimates				
Linear control function	8,102.8	7,762.4	7,216.7	8,849.8
	(1,510.6)	(1,616.7)	(1,759.5)	(1,989.6)
Quadratic control function	8,342.6	7,858.3	7,255.8	8,583.5
	(1,537.3)	(1,644.1)	(1,772.5)	(1,967.2)
Cubic control function	8,595.0	8,001.2	7,239	8,708.4
	(1,601.4)	(1,675.6)	(1,803.7)	(2,021.1)
Observations	439	384	309	167

Notes: Demographic controls included are gender, year of admission in college, age at entering college, stream of study, board of education for Senior Secondary school, and father's occupation. Robust standard errors are reported in parentheses. Public college is an indicator equal to 1 if the individual attended public college and 0 if the individual graduated from a private college.

table. The effect size is almost 0.7 of a standard deviation, although the magnitude should be interpreted with caution because of the salary data limitations discussed previously.

In online Appendix Table 2, I report the results from a nonparametric regression analysis by way of sensitivity tests. Each cell reports the public college coefficient from a separate local linear regression. Here, I show the results for a triangle and a rectangular kernel. In the absence of clear rules regarding what bandwidth to use, I show the results for a range of bandwidths. Column 1 uses a bandwidth of 10, column 2 uses 7.5, column 3 uses 5, and column 4 uses the optimal bandwidth proposed by Imbens and Kalyanaraman (2012). These results show a positive and statistically significant effect of public college attendance on salary. The results are not sensitive to the choice of the kernel or bandwidth.

The full sample IV estimate using the midpoint salary data, where I instrument public college attendance with eligibility to attend (Senior Secondary School Exam scores > the admission cutoff), is 10,928.17 rupees with a standard error of 1,936.381. As with other approaches, this estimate is highly statistically significant at the 1 percent significance level, indicating that public college graduates receive a wage premium in labor markets.

D. *RD Diagnostics*

The admission rules used to determine the cutoffs are only known internally, and the tests are evaluated externally using a double-blind method. Hence, little scope exists for manipulation of Senior Secondary School Exam scores. I present evidence from the McCrary density test to highlight that the students do not manipulate their Senior Secondary School test scores. The results are shown in online Appendix Figure 3. The distribution of the normalized Senior Secondary School Exam scores on the left and right of the discontinuity are similar and exhibit no jump around the cutoff.

Another possible concern might be that the background characteristics of the individuals vary around the cutoff. This concern can lead to the spurious attribution of treatment effects to treatment when the results are caused by these other variables that exhibit a jump near the discontinuity. Online Appendix Table 1 shows that the control variables including demographic characteristics and family background are similar in the -5 to $+5$ interval of Senior Secondary School Exams scores around the public college admission cutoff.

In order to address the fact that there are numerous predetermined characteristics to test, I follow Johnston and Mas (2018) and create an index of the predicted income using all the available data on background variables. To construct the index, I regress salary on gender, age at college admission, year of admission, field of study, father's occupation, and the board of Senior Secondary School Exams in two different samples: the private colleges sample and the sample with normalized scores outside the 15 point interval. The index is the predicted salary from these two separate regressions.

In online Appendix Figure 4, I plot the mean values of the index by normalized Senior Secondary School Exam score in two separate panels based on the two separate samples used for constructing the index. Panel A is based on the prediction from a regression using the private colleges sample, while panel B is based on a sample outside the -15 to $+15$ point intervals of the normalized Senior Secondary School Exam scores. The smoothness of the index in both panels around the threshold of admission allays this concern. The index is small and statistically insignificant at the cutoff (coefficient of 0.08 with a t-stat of 0.91 in 5-point interval when the index is based on the private college sample). The lack of a discontinuity in the index bolsters the RDD findings and rules out spurious attribution.

V. Implications of Selection

A. *Selection into the Survey*

As mentioned above, three main data problems may be a concern for selection. First, since the data are collected via a survey, selection into the sample could occur. However, the success rate of the survey does not differ among private and public college graduates. Online Appendix Figure 5 plots the regression functions of survey success rates on either side of the admission cutoff. Visually, the rates are comparable on the margin of admission. As the survey success rates are similar in public (treatment) and private (control) colleges, under monotonicity assumption, a comparison of treatment and control means is a valid estimate of the treatment effect (Lee 2009).[20] I also check whether correlates of survey success vary by college type in a 5-point interval of normalized Senior Secondary School Exam scores around the admission cutoff. In online Appendix Table 3, I regress survey success on the background

[20] Monotonicity will imply attending public colleges cannot affect difficulty to locate respondents in both directions. That is, it cannot be that some public college graduates near the threshold are more difficult to trace than others.

characteristics of the individuals by college type in a -5 to $+5$ interval.[21] Based on the p-value from a Chow test of equivalence of the coefficients across the public and private colleges, older cohorts in private colleges are somewhat less likely to be found. Coefficients of other characteristics aside from "father employed in the informal sector" are statistically equivalent. While individuals whose fathers worked in the informal sector are less likely to be surveyed in either type of colleges, the likelihood of not finding them is higher in public colleges. However, a regression of salary (conditional on being employed) on these characteristics does not reveal a statistically significant correlation with father being employed in the informal sector. In addition, as the probability of finding the individual does not vary at the admission cutoff, the possibility of differential survey success rates leading to a bias seems unlikely.[22]

B. *Selection into Employment*

The second issue is that the salary is reported conditional on being employed. If public college attendance also affects the likelihood of employment, an increase in employment can influence salary. I examine whether having attended a public college affects the probability of the individual being employed. In online Appendix Table 4, I show the results from a parametric regression discontinuity analysis.[23] Public college attendance does not affect the probability of being employed in any of the specifications. Since probability of being employed is no different for public versus private college graduates in narrow intervals around the admission cutoff, the results are not biased by selection into employment.[24]

In online Appendix Table 5, I report the probability of employment by gender.[25] For males, the coefficient becomes negligible, changes sign, and remains statistically insignificant as the interval around the cutoff gets narrower. For females, however, the coefficient is stable in magnitude and positive albeit imprecisely measured as the interval is narrowed.[26]

C. *Selection into Reporting the Salary*

There is selection into reporting the salary. Not every employed individual reported their salary. Online Appendix Table 7 shows that there are differences in

[21] Survey success is 1 if I successfully traced and surveyed (matched) the individual and 0 if I was not able to locate (unmatched) the individual.

[22] The success rate of the survey is reasonably high.

[23] Nonparametric RD analysis shows the same results, which are available upon request.

[24] The majority of the nonemployed in the sample are women engaged in home production. In a $+5$ to -5 interval of Senior Secondary School Examination scores around the admission cutoff, the results are robust to the two extreme-case scenarios—all women engaged in home production would have earned the highest value for salary, and all women in home production would have earned the lowest level of salary observed in the data. Results are available upon request.

[25] The parametric estimation results are reported in the table. The two panels of online Appendix Figure 6 present the local linear regression results graphically.

[26] For the male sample, this concern is less relevant in light of these findings. However, I discern a wage premium for both males and females. The estimated effect on salary (conditional on employment and reporting) is reported separately for men and women in online Appendix Table 6. The estimated coefficient in a 5-point interval is much larger for men than for women, though it is economically large and statistically significant in both cases.

observable characteristics of the individuals who report their salaries versus those who did not. Individuals who report their salaries are marginally younger, took their Senior Secondary School Examinations from the central board of secondary exams, are males whose fathers are in business, and graduated from the commerce stream. If salary were missing at random, the results would be unbiased. However, given the differences in observable characteristics, salary information is not missing randomly. If the incomes of those who do not report are higher than average, which is likely, their underrepresentation in the public colleges near the cutoff can generate a downward bias. If, however, their incomes are lower than average, their underrepresentation in public colleges can generate an upward bias. Therefore, we need to examine whether they are underrepresented in the public colleges near the cutoff of admission. In an interval of -5 to $+5$ percentage points around the cutoff for admission, 24.8 percent of individuals in public colleges do not report their salary. However, for private colleges, this number is only 10 percent. Online Appendix Figure 7 shows that the probability of reporting salary jumps down in public colleges at the cutoff of admission. This finding suggests the bias is in fact attenuating the results.

I conducted a number of additional tests to verify that the increase in salary is not just attributable to lower reporting rates in public colleges. I imputed the salary of the individuals who did not report it based on the observable correlates of salary. I report the estimated effect on salary using this sample in online Appendix Table 8. The estimated effect on salary (midpoint of brackets) is qualitatively unchanged.

As there are more observations with missing values of salary to the right of the cutoff, the observed jump could be arising spuriously because of these missing data. The regression function would be continuous at the cutoff if the highest values on the left (in private colleges) are comparable to the lowest values on the right (in public colleges). I conduct a bounding exercise to assess the validity of this concern.

This exercise is as follows. I assess the difference in the share of observations with missing salary information (which is equal to 0.15). I ascribe to 15 percent observations on the right of the threshold in this bandwidth a salary equal to the mean of the top 15 percent observed salaries on the left of the threshold. Then I recompute the salary differential using the specification analogous to that in column 3 of Table 4. The estimated coefficient is 8,002.617 rupees with a standard error of 1,665.62 statistically significant at the 1 percent significance level. This coefficient is higher (albeit by a small amount) than the one reported in Table 4. This analysis is indicative of an attenuating bias if anything.[27]

Finally, I turn to a more formal estimation of Lee's bounds for the estimated effect. According to the procedure outlined by Lee (2009), the bounding procedure involves calculating trimmed averages of the private college salaries (trimmed by the percentile equal to the difference in the percentage of observations with missing salaries in public and private colleges). Taking the difference between the average salary in the public colleges and these trimmed averages yields the upper and lower

[27] A similar procedure is also adopted by Bharadwaj, Løken, and Neilson (2013) in addressing differential mortality in an RD setting in estimating the return to improved early life health care.

bound. Online Appendix Table 9 shows the bounds and the confidence interval for the estimated effect based on Imbens and Manski (2004).

For creating the bounds, I calculate the fraction of observations with missing salary in both public and private colleges for the full sample and the interval of 5 points around the cutoff. Online Appendix B provides details of the procedure. The confidence interval for the effect is fairly tight and does not contain 0. Lee's bounds are highly statistically significant. Neither confidence interval includes 0. From this analysis, I infer that in the labor markets, public colleges do yield a premium over private colleges in this context.

VI. Conclusion

Using a regression discontinuity design to address selection, this research demonstrates a substantial earnings advantage associated with public college attendance in India, although we observe no discernible effects of the type of college on learning outcomes. Three possible theories can explain these findings. Public colleges in India are prestigious and admit the best students. The first possibility is that the students attend prestigious institutions to signal their ability to prospective employers and distinguish themselves from other prospective employees. Therefore, firms use college type to statistically discriminate. This signal value of public colleges results in better wages. The second possible explanation is that the public college graduates have better alumni networks that help reduce information asymmetry and result in better labor market outcomes. The third explanation is that public college graduates have a network of friends holding important offices, and such relations warrant a premium in the labor market because they reduce the cost of doing business or result in direct or indirect rents to the firms. Ascertaining which of these three explanations are at play is an important avenue of future research.

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