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The effects of role models on college graduation rates

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Abstract
Many believe that the presence of role models positively influences the behavior and success of students. We test one aspect of this contention by focusing upon the impact that Black, Asian, Hispanic, White and women role models have upon graduation rates at 176 four-year, public colleges. We find only limited evidence in favor of role model hypotheses as they relate to individual institutional graduation rates. A 1% increase in full-time Black faculty on a campus is associated with a .59% increase in the graduation rate of Black students on that campus, but we do not find strong results for any other student group. This suggests that we should be less sweeping and more evidence-based in our approaches to questions involving campus diversity.

Keywords Graduation rates · Role model hypotheses · Influence of role models on success · Universities

JEL Classification I23

1 Introduction

Many individuals believe that the presence of faculty role models not only influences the academic majors college students choose, but also stimulates their academic performance (Bayer and Rouse 2016). Decades ago, Verdugo (1995) offered a succinct version of the role model hypothesis through the lens of Hispanic students: "By role models is meant having Hispanics on campus who are in positions of status and power within and outside the institution. The belief is that if Hispanic students are able to see Hispanics in these kinds of positions, it will not only motivate them to remain in school

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and achieve academically, but it will also provide them with a group that is a natural sounding board for the many problems facing Hispanic students."

Ehrenberg (1995) organized a symposium that focused substantially on role models and concluded that the evidence in favor of these propositions was mixed. Boulware (2011) arrived at a similar conclusion: "the small body of studies on this topic contains methodological and conceptual inconsistencies and have not produced any consistent results or conclusions."

We offer fresh evidence on the influence of role models in higher education. However, in contrast to previous studies that have concentrated on the choices of individual students in specific academic majors, we adopt an alternative approach and focus upon institutional graduation rates. We address both racial/ethnic characteristics and gender.

Our focus on institutions rather than individual students allows us to sidestep some of the methodological problems that have plagued previous work, most prominent among them the self-selection biases that have corroded the ability of researchers to discern role model effects. To wit, most students have some capacity to choose the specific courses they will take and the professors who teach those courses. Further, they can drop courses. This has clouded results reported in most prior studies.

By no means do we provide the last word on the empirical validity of role model hypotheses. Nevertheless, our work pushes the ball down the field because we focus on the six-year graduation rates of specific racial groups (and women) and consider the possibility influences of faculty, student and citizen role models on those graduation rates.

Our empirical work is based upon a diverse sample of 176 four-year public institutions of higher education. We examine the six-year graduation rate of undergraduate students at each institution and seek to determine if the presence or absence of role models at each has an impact upon its graduation rates. The results are thought-provoking. Where Black[1] students are concerned, a 1.0% increase in the percentage of Black faculty on the typical campus evokes a .59% increase in that institution's graduation rate of Black students. However, we find no evidence to support a role model/support effect for the relative presence of Black students on a campus, or for the Black citizenry within that state. We present comparable evidence for Asian, Hispanic, White and female students. In general, we uncover only mixed evidence of the existence of role model effects.

2 Brief literature review

Until the mid-1990s, virtually all analyses of possible role model effects focused on K-12 education.[2] Elementary education teachers traditionally have been considered influential role models for young students. Spurred on by work centered at the School of Industrial Relations at Cornell University, researchers in the mid-1990s extended the coverage of the role model hypothesis to college undergraduates by examining the impact of the gender of college faculty members on students' choice of their major, the courses they opted to take, whether they completed a course, the grade they received, if

[1] We use the term Black because one of our major data sources, the *Chronicle of Higher Education*, uses the term Black rather than African-American to describe student and faculty in its data sets.

[2] See Jones and Dindia (2004) for a summary of this evidence.

they subsequently took additional courses in this discipline, and subsequent labor market outcomes (Canes and Rosen 1995; Rothstein 1995; Solnick 1995; Dynan and Rouse 1997; Robst et al. 1998; Robb and Robb 1999: Jensen and Owen 2000; Ashworth and Evans 2010; Rask and Bailey 2002; Butler and Christensen 2003; Bettinger and Long 2004, 2005; Sonnert et al. 2007; Hoffman and Oreopoulos 2009; Carrell and West 2010; Carrell et al. 2010).

The racial identities of faculty seldom were considered. Nor did these studies allow for the possibility that that fellow students might serve as role and support models as well as faculty. Boulware (2011) summarized these studies by observing that despite their contributions, the fundamental questions concerning role models remained unresolved. For every study that concluded there was some type of role model effect at work in higher education, there was another that asserted that such an effect was insignificant.

A promising methodological alternative to the previous studies has arisen, however, that relies upon the use of randomized trials and natural experiments to generate evidence. Carrell et al. (2010) utilized data from the United States Air Force Academy, where the custom is to assign students randomly to professors. This allowed Carrell et al. to bypass most self-selection effects.[3] They found female students earned higher grades and were more likely to pursue STEM-oriented majors if they had been taught by female faculty. Fairlie et al. (2014) arrived at a similar conclusion concerning minority students at a community college. Kofoed and McGovney (2018) examined randomly assigned mentors at the United States Military Academy and found small, but significant evidence that those being mentored subsequently were more likely to choose the military specialty of their mentors.

Porter and Serra (2017) randomly selected beginning economic class sections at Southern Methodist University and then introduced into those class sections carefully chosen female role models who were highly knowledgeable and presumably charismatic. They found that female students so exposed were more likely to pursue economics as a major, though male students were not. Left unexamined was the question of how the same students would have responded to highly knowledgeable, charismatic male role models.

The randomized trials and natural experiments just cited do not provide evidence concerning graduation rates. Still, they represent promising ways for researchers to avoid the self-selection biases and specification problems that are present when individual student data are used.

3 Model, data, and empirical results

Assume that for financial and other reasons that institutions wish to maximize their graduation rates. Plausibly, they might do so by: (1) admitting students with superior academic qualifications; (2) admitting students who do not face financial problems that might deter their studies; (3) reducing the net price, after grants, that students must pay in order to attend; (4) obtaining more general fund tax support from their states so that

[3] The random assignment of students to classes eliminates the possibility of students self-selecting particular class sections and specific instructors; however, this does not prevent students from dropping a course. It may be, however, that the dropping courses at a military academy occurs less often than on conventional campuses.

they have the potential to provide a more resource rich education; and, (5) expending a higher proportion of their funds on student services designed to coax students to become more connected to their home campus.[4] Among additional factors that influence graduation rates, but which institutions have little or no influence over in a typical six-year time frame, are their missions and locations.

The 176 four-year public institutions in our sample represent a diverse sample consisting of 71 flagships, 67 regional state colleges and universities, and 38 urban institutions that are neither flagships nor regionals.

Our six-year graduation rate (SIXYRGRAD) for each institution is the percent of first-time freshmen who entered an institution in 2008 and subsequently earned a baccalaureate degree at the same institution by 2014. These graduation rates come from the U.S. Department of Education's College Navigator (https://nces.ed.gov/collegenavigator/?s=all).

To capture student qualifications and the rigors of the admissions process, we utilize two variables: the percent of freshmen applicants who were admitted (PCTAD) as reported by the College Navigator, and the Brookings Institution's SAT/ACT composite mathematics scale (BROOKMATH).[5] Student financial circumstances are measured in two ways: the College Navigator's percent of undergraduates receiving a Pell Grant (PCTPELL), and the St. Louis Federal Reserve's (https://fred.stlouisfed.org) reporting of real median household income in the state in which the institution is located (REALMEDHHINC).[6]

We consider the possible impact of the price of each institution's undergraduate education upon graduation rates by utilizing the College Navigator's average net price paid annually by an in-state undergraduate student (REALNETPRICE). We take account of possible effects of state support on the graduation rates of each institution by means of a Delta Cost Study variable (https://deltacostproject.org/delta-cost-data) recording each institution's general fund tax support per 100 full-time equivalent students (REALSTATESUPPFTE). The extent of support services provided to students may influence graduation rates and we seek to capture this possibility by means a Delta Cost Study variable that measures the percent of each institution's education and general budget spent on student services (STUDSERVPCTEG).

We utilize several role model variables based on the ethnic and gender composition of the faculty, the student body, and the state in which the institution resides. The percentages of full-time faculty at an institution that are Black, Asian, Hispanic, White, or Female (FACPCTBLACK, FACPCTASIAN, FACPCTHISP, FACPCTWHITE, FACEPCTFEMALE) were obtained from the *Chronicle of Higher Education*.[7] The percentages of the student bodies of an institution that are Black, Asian, Hispanic, White, or Female (STUDPCTBLACK, STUDPCTASIAN, STUDPCTHISP, STUDPCTWHITE, STUDPCTFEMALE) come from the College Navigator. Finally,

[4] A significant literature exists that suggests the degree of involvement of a student on a campus is positively correlated with that student's academic performance, persistence and graduation.

[5] See S. Kulkarni and J. Rothwell, "Beyond College Rankings: A Value-Added Approach to Assessing Two- and Four-Year Schools," Brookings Foundation (April 29, 2015), www.brookings.edu/research/beyond-college-rankings-a-value-added-approach-to-assessing-two-and-four-year-schools.

[6] All financial variables are valued in terms of 2016 prices.

[7] Race, Ethnicity, and Gender of Full-time Faculty at More Than 3700 Institutions." *Chronicle of Higher Education,* www.chronicle.com/interactives/faculty-diversity.

the percentage of the state's population that is Black, Asian, Hispanic, or White (STATEPCTBLACK, STATEPCTASIAN, STATEPCTHISP, STATEPCTWHITE) was obtained from the U.S. Census.[8]

Finally, the institutional mission and location is captured by several dummy variables. We identify regional institutions (REGIONAL) by means of a 0,1 dummy variable where 1 = regional. Urban institutions (URBAN) are similarly represented with 1 = urban.[9] Flagship institutions are the excluded institutional category.

Our cross-sectional model in Eq. (1) seeks to explain the six-year graduation rate of student group "j" at institution "i." for each ethnicity or gender (j = Black, Asian, Hispanic, White, or Female).

$$\begin{aligned} SIXYRGRAD_i^j = {} & \beta_0 + \beta_1 REGIONAL_i + \beta_2 URBAN_i + \beta_3 PCTADM_i \\ & + \beta_4 BROOKMATH_i + \beta_5 PCTPELL_i + \beta_6 REALMEDHHINC_i \\ & + \beta_7 REALNETPRICE_i + \beta_8 REALSTATESUPPFTE_i + \beta_9 STUDSERVPCTEG_i \\ & + \beta_{10} FACPCT_i^j + \beta_{11} STUDPCT_i^j + \beta_{12} STATEPCT_i^j + \varepsilon_i \end{aligned} \tag{1}$$

The hypothesized coefficients the β_i's, are as follows: β_1, β_2, β_5, $\beta_7 < 0$ and β_3, β_4, β_6, β_8, β_9, β_{10}, β_{11}, $\beta_{12} > 0$. The white noise error term is given by ε_i. Table 1 presents the results from the above cross-section model(s).

Column A of Table 1 reports the regression results in which the dependent variable is the six-year institutional graduation rate for Black students. We utilize White's (1980) correction for heteroskedascity.

Two of the three "role model" coefficients are statistically significant at the .05 level (two-tailed tests). The coefficient on the FACPCTBLACK variable tells us that a 1 % increase in the percent of full-time Black faculty on a campus generates a .59% increase in the graduation rate of Black students on that campus.[10] This is notable support for the role model hypothesis and suggests that the relative presence of Black faculty makes a difference in the academic achievement and graduation of Black students.

On the other hand, the coefficient on STUDPCTBLACK not only is negative, but also is statistically significant at the .05 level. A 1 % increase in the percent of Black students on campus leads to a .36% decline in Black student graduation rates on that campus. At first glance, this may seem a perverse result, but could be explained by freely chosen student social relationships. As the number of students in a specific racial group on a campus increases from zero, the students in that racial group may voluntarily segregate themselves socially and residentially (DeRuy 2016; Anonymous 2017). Such students may seek safe spaces where they need not worry about discrimination. Or, they may prefer the company of friends who have similar tastes for food and music,

[8] Data USA, United States Census, State Population Totals and Components of Change: 2010–2017, https://www.census.gov/data/tables/2017/demo/popest/state-total.html. The percentage of the state's population that is female was not used in modeling female graduation rates.

[9] The Office of Management and Budget of the United State Government defines metropolitan and micropolitan statistical areas, https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/bulletins/2017/b-17-01.pdf.

[10] It is possible that the inclusion of part-time faculty would change our results. However, racial data on part-time faculty are not widely available on an institutional basis.

Table 1 Cross-section regression models

	Column A Black	Column B Asian	Column C Hispanic	Column D White	Column E Female
CONSTANT	**90.51** **(5.79)[a]**	**98.91** **(6.73)[a]**	**93.10** **(7.82)[a]**	**83.31** **(5.10)[a]**	**113.36** **(7.63)[a]**
FACPCT	**0.594** **(2.79)[b]**	−0.083 (−0.24)	0.223 (0.35)	0.155 (1.55)	0.151 (0.74)
STUDPCT	**−0.356** **(−2.63)[b]**	**0.237** **(1.65)[c]**	0.0011 (0.01)	0.052 (0.95)	**−0.301** **(−1.73)[c]**
STATEPCT	0.154 (0.95)	0.047 (0.13)	−0.0278 (−0.22)	−0.011 (−0.14)	
REALNETPRICE	0.000178 (0.44)	**0.001** **(2.60)[b]**	0.00011 (0.35)	0.0003 (1.11)	0.00018 (0.60)
PCTPELL	0.003 (0.02)	0.07 (0.40)	−0.103 (−0.72)	−0.99 (0.64)	0.013 (−1.07)
REALMEDHHINC	0.00021 (1.38)	−0.00024 (−1.57)	0.0001 (1.03)	0.000005 (0.47)	0.000007 (0.65)
BROOKMATH	**5.71** **(2.23)[b]**	3.72 (1.42)	**4.82** **(2.16)[b]**	**4.99** **(2.44)[b]**	**4.94** **(2.44)[b]**
PCTADMIT	**−0.662** **(−8.28)[a]**	**−0.459** **(−5.70)[a]**	**−0.535** **(−8.17)[a]**	**−0.524** **(−8.33)[a]**	**−0.507** **(−8.44)[a]**
STUDSERVPCTE&G	−0.472 (1.57)	−0.346 (−1.19)	−0.232 (0.97)	−0.087 (−0.39)	−0.204 (0.91)
REALSTATESUPPFTE	**−0.00062** **(−2.51)[b]**	**−0.0006** **(2.25)[b]**	**−0.00036** **(−1.69)[c]**	**−0.0004** **(−2.33)[b]**	**0.0005** **(2.67)[b]**
REGIONAL	−4.099 (−1.20)	−4.69 (−1.40)	−3.92 (−1.42)	−2.64 (−1.04)	−3.81 (−1.49)
URBAN	−4.272 (−1.40)	2.66 (0.85)	−3.09 (−1.24)	0.324 (0.14)	−2.42 (−1.06)
R^2	0.472	0.364	0.483	0.515	0.509
Adjusted R^2	0.434	0.317	0.445	0.479	0.476
Overall F-statistic	12.16 [0.00][a]	7.74 [0.00][a]	12.69 [0.00][a]	14.43 [0.00][a]	15.48 [0.00][a]
Number of observations	176	176	176	176	176

t-statistics are given in parentheses with probability values in brackets. Significance levels denoted as follows: [a] (1%), [b] (5%), and [c] (10%). Regression models estimated via ordinary least squares with White's correction for heteroskedasticity. Bold face type signifies coefficient estimates significant at a least the 10% level

or perhaps wish to be near fellow students who provide support for their points of view. Speaking broadly, they seek ease and comfort (Walton and Cohen 2011; Gannon 2018).

In the case of Black students, they often come to their chosen institution with standardized test scores below the institutional average (Reeves and Halikias 2017). Further, on average, Black students also emanate from households whose incomes are below the average of their state and their campus and they are more likely to be Pell Grant recipients. These are real environmental circumstances that exert downward pressure on academic performances and plausibly diminish graduation rates if these students self-segregate.

State-level role model affects are minimal. The STATEPCTBLACK variable has a small positive sign, but is not statistically significant.

Three of the variables in the equation—NETREALPRICE, PCTPELL, and REALMEDHHINC—represent students' ability to pay. None of the coefficients on these variables is statistically significant, suggesting that cost and family financial circumstances are not critical to graduation. This may initially seem a puzzling result, but one must remember that the sample of students in this study represent individuals who already have chosen their institution and are in attendance. One would expect price differentials to influence which institution a student attends, but once he/she knows an institution's costs and decides to attend it, financial considerations already have been taken into account.

Two of the variables in the equation, BROOKMATH and PCTADMIT, represent the measured academic abilities of the students on each campus. Few would argue with the proposition that student who come to a campus with higher academic abilities are more likely to graduate. BROOKMATH is a Brookings Institution variable that recognizes that some institutions emphasize the SAT, while others the ACT. BROOKMATH is a combination index with a mean of 0 and a standard deviation of 1. A positive value indicates that the average SAT or ACT mathematics score of entering students on a campus is above the national average, while a negative value indicates a below national average score. For example, the BROOKMATH datum for Clemson University is 1.44, but is −.28 for South Dakota's Northern State University. In any case, both coefficients for the academic ability variables are statistically significant, with the PCTADMIT coefficient especially so. These are hardly surprising results. Students who come to college with strong academic abilities are more likely to graduate (holding other things constant).

A refrain sometimes heard on campuses is that students are more likely to identify with their institution, be retained, and graduate, if they become involved in student activities and/or take advantage of student services (Roberts and Styron 2010). Our results provide no support for this hypothesis. Indeed, the coefficient on the STUDSERVPCTEG variable is negative and barely misses being statistically significant at the .05 level. Why? Competition for funds often means that more student affairs spending results in less being spent on instruction (Desrochers and Hurlburt 2015). It might also be the case that student activities ultimately are not that influential and for students represent time away from academic pursuits. This may reduce their chances of graduating.

Another theme oft-sounded on campuses whose state funding has been reduced is that additional state funding would produce improved academic outcomes. At least where institutional graduation rates are concerned, we find no evidence of this. The coefficient on the REALSTATESUPPFTE variable is both negative and statistically significant. Why? More generous state support may be used to reduce faculty teaching loads, provide greater research support, and increase administrative overhead—factors that may change the culture on campus, have little to do with student graduation rates, and divert attention from undergraduates.

The coefficients for the two dummy variables, REG and URB, take on negative signs. The excluded dummy variable category is flagship institutions. The negative signs (neither statistically significant at the .05 level) suggest that holding all other variables constant, there are academic advantages associated with attending a flagship institution. This is mild evidence that the same student performs better at a flagship institution than at a regional institution or urban institution. Of course, it seems likely that unobserved factors are at work here. Consider, for example, that higher proportions

of students at regional and urban institutions hold jobs and have families than at flagship institutions. In addition, higher percentages of flagship university students live on campus than hold true at regional and urban institutions and on-campus living often has been connected to better academic performance (Hanover Research 2014). Thus, it is possible that what we are observing here is the result of non-academic characteristics of student bodies.

It is appropriate here to insert a caution: one should remember that the regression coefficients represent marginal changes from the average values of each variable. Consequently, one cannot use them to extrapolate the effects of much larger changes in any variable. Thus, while a 1 % increase in the percent of Black faculty on a campus may elicit a .59% increase in Black student graduation rates on that campus, it does not follow that a 20% increase in the percent of Black faculty would cause a 12% increase in Black student graduation rates.

Column B of Table 1 presents a regression for Asian students that is strictly comparable to that presented in Table 1 for Black students. Here, however, we find that there is no role model impact of Asian faculty on Asian student graduation rates, but there is a statistically significant impact of the presence of Asian students on Asian student graduation rates. There is no role model effect coming from the Asian citizenry in a state.

The coefficient on the REALNETPRICE variable in the Asian equation takes a positive sign. One doubts that Asian students prefer to pay higher prices, but they may self-select institutions whose costs are higher and financial aid prospects are lower. Once again, admissions tightness (PCTADMIT) and REALSTATESUPPFTE are statistically significant. All other coefficients except URB assume the same signs as in the Black equation, but none is statistically significant. Notably, however, the adjusted coefficient of determination (R^2) for this equation is only .317, substantially below the comparable statistics for the other student groups. There may be unobserved differences between Asian students (and their subgroups) and other student groups that we have not been able to capture in our estimating equation.

Column C of Table 1 presents a regression for Hispanic students that is strictly comparable to those presented for Black and Asian students. Hispanic here represents those students who identify as Latinos as well as they identify as Hispanic. Notably, none of the coefficients of the role model variables either is large or statistically significant. All other coefficients follow the patterns established for Black and Asian students.

Column D of Table 1 presents a regression for White students that is strictly comparable to those presented for Black, Asian and Hispanic students. These results also follow the patterns noted above.

Column E of Table 1 presents a regression for female students that is comparable to that presented the other student groups. The estimating equation for women students does not include a PCTSTATEFEMALE variable because there is little variation in it among the states and hence it has little impact on graduation rates. Interestingly, the while none of the role model coefficients attains statistical significance where women students are concerned, the STUDPCTWOMEN variable is negative and of large size. While the coefficient is not statistically significant at the .05 level, it would be statistically significant at the .10 level. Given that 57% of college students today are women (Marcus 2017), this suggests some version of the Law of Diminishing Returns could be at work with respect to the relative representation of women in co-educational, public university student bodies. All other coefficients imitate our previous results.

In summary, we created 14 test opportunities to demonstrate the presence of role model effects. In only one of the five cases involving faculty, this being FACPCTBLACK, did we find a statistically significant coefficient. In only two of the five cases involving students did we find statistically significant coefficients, and in one of those situations, involving Black students, the coefficient was negative. None of the coefficients involving the state representation of a student group was statistically significant and none came remotely close to being so.

Thus, we discover only limited evidence in favor of role model hypotheses as they relate to graduation rates. On the other hand, none of our adjusted R^2 statistics was greater than .479. This strongly suggests that unobserved student and campus circumstances play substantial roles in determining campus graduation rates.

4 Concluding remarks

Many believe that role models are critically important influences upon the behavior and performance of underrepresented and less powerful groups in society.[11] This belief is a recurrent theme in widely read higher education outlets such as the *Chronicle of Higher Education*. As one individual put it from the standpoint of students, "Seeing that there are people from similar situations who have made it makes all the difference" (Field 2017). Nevertheless, we find only limited evidence of such if graduation rates at public four-year colleges are the criterion. We hasten to note that graduation rates are only one possible measure of the effects of diversity and colleges and universities might benefit from diversity in many other ways.

Many institutions have made major resource commitments to support programs designed to increase faculty and student diversity and provide role models. In this vein, the University of Michigan announced an $85 million plan to promote diversity, equity and inclusion on its Ann Arbor campus (Jesse 2016). Michigan's program is far-reaching, and most would regard it as a noble effort to change the environment at that institution. Whether the program will have any noticeable impact on that institution's already admirable graduation rates of 80% for African-American students, 91% rate for Asian students, and 89% rate for Hispanic students (College Navigator 2018) is unclear.

A cautionary lesson to be drawn from our analysis is that campuses would do well to be more evidence-based as they discuss the impact of diversity on academic performance variables. The influence of diversity may vary in its impact depending upon which ethnic group is being considered and what aspect of performance is being examined. Our work suggests the need for additional research in this arena.

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[11] Myers (2016), for example, asserts with respect to flagship institutions, that students want the faculties of those institutions to be diverse and that student bodies should reflect the demographics of the areas they serve.

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