Does the River Spill Over? Estimating the Economic Returns to Attending a Racially Diverse College

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Abstract

This paper evaluates the frequently argued but heretofore little-tested hypothesis that students receive tangible benefits from experiencing racial diversity in college. Using data on graduates of 30 selective universities, we find no significant link between racial composition and the post-graduation outcomes of typical White or Asian students. This result persists when we use major-level variation in racial composition with college and major fixed effects. While the results are consistent with the view that undergraduate diversity is irrelevant to postcollegiate outcomes, we find suggestive evidence that the lack of a significant estimated return may reflect persistent exposure to diversity before and after college combined with diminishing returns.

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"[T]he attainment of a diverse student body ... is a constitutionally permissible goal for an institution of higher education. ... The atmosphere of 'speculation, experiment and creation' - so essential to the quality of higher education - is widely believed to be promoted by a diverse student body."
–Lewis Powell, Regents of the University of California v. Bakke (438 U.S. 265, 1978, pp. 311-312, quoting Sweezy v. New Hampshire, 354 U.S. 234, 1957, p.263)

1 Introduction

For more than a quarter century, the belief that diversity contributes to the quality of undergraduate and graduate education has motivated court opinions and college policies regarding racial preferences in admissions.[1] Surprisingly, the social sciences have provided very little evidence to support or refute this claim. Such evidence would clearly be of great interest both to policy makers and to scholars conducting more general studies of the impacts of affirmative action in higher education. [2]

This paper contributes to the academic study of collegiate diversity first by translating Powell's hypothesis into economic terms. Building on the existing concept of human capital (Becker 1964), and inspired by Lazear's (1995) model of cultural assimilation, we introduce the concept of "diversity capital." We define diversity capital as a measure of an individual's ability to create surplus in interactions with individuals of different racial, ethnic, or socioeconomic backgrounds, whether ethnic, racial or socioeconomic. In this context, the beliefs articulated by Lewis Powell in 1978 translate into a hypothesis that a diverse student body contributes to diversity capital.

Although our model of the returns to collegiate diversity is simple, three potential biases complicate efforts to estimate it empirically. First, college racial composition may proxy for some other less easily observed component of education quality, including student ability. Second, exposure to diversity in college may correlate with exposure to diversity at other developmental stages. Fi-

[1]The most prominent recent example is the Supreme Court's 2003 rulings in the cases Gratz v. Bollinger and Grutter v. Bollinger. In these cases, the court upheld the use of racial preferences in admissions, so long as applicants receive "truly individualized consideration." Excluded from the set of legal practices was a policy at the University of Michigan which granted under-represented minorities a fixed number of points in an admission rating system. See Golden, D. "Colleges Cut Back Minority Programs After Court Rulings," *Wall Street Journal*, December 30, 2003, p.A1

[2]For example, Arcidiacono (2002) estimates a model of college applications, school acceptance and financial aid decisions, the choice of major, and earnings to simulate how affirmative action in admissions and financial aid affects expected earnings for blacks. However, he assumes that diversity plays no role in the education decision-making of Blacks or Whites. If diversity improves one's undergraduate education, estimates of the changes in decision-making due to the removal of affirmative action will be incorrect.

nally, individuals with greater degrees of exposure to diversity in college may sort into more diverse postgraduate settings. A priori, the net sign of these various biases is unclear.

Our empirical tests estimate the relationship between undergraduate diversity and postgraduate earnings and life satisfaction measures, using the College and Beyond data set.[3] The dataset includes both comprehensive institutional records on the cohort of students that entered one of 30 selective colleges in the fall of 1976, and a follow-up survey administered to a sample of the cohort in 1996. To address concerns that collegiate racial composition may be correlated with unobserved measures of peer or institution quality, we present the results of a number of specifications that examine the racial composition of cohorts at the major-by-college level, controlling for both major and college fixed effects. These specifications test whether engineering majors, for example, attain superior postgraduation outcomes when the cohort of engineering majors at their college is more racially diverse *relative to the college-wide average* than other cohorts of engineering majors. We also replace objective measures of racial composition with respondent's own subjective estimates of college's contribution to diversity capital in some specifications. To address concerns of correlation in exposure to diversity in different life periods, we employ both objective and subjective controls for a graduate's exposure to minorities before and after college.

Our most basic tests, presented in Section 4 below, consistently show that for the typical White or Asian student the return to experiencing greater diversity in college cannot be statistically distinguished from zero. We conduct further empirical tests to evaluate three explanations for this non-result. First, greater minority respresentation on campus may not translate into increased interracial interaction and diversity capital investment.[4] Our results employing subjective measures of diversity capital investment suggest that this does not fully explain the result. A second interpretation is that diversity capital is a false construct or merely irrelevant for the set of outcomes we consider. While this interpretation is ultimately difficult to falsify, we explore a third explanation: that the marginal returns to diversity experienced in any one life period decrease in the duration of

[3]Our focus on these outcome measures follows in part existing literature on college quality (Behrman et al. 1996; Behrman, Rosenzweig and Taubman, 1996; Brewer et al. 1999; Dale and Krueger 2002), as well as a growing strand of economics literature emphasizing ordinal measures of happiness (Clark and Oswald, 1994; Di Tella et al. 2001; Gruber and Mullainathan, 2002). The College and Beyond dataset is the same source used in Bowen and Bok's (1998) study of the impact of affirmative action and Dale and Krueger's (2002) analysis of the returns to attending a more selective college.

[4]Arcidiacono and Vigdor (2004) present evidence to support this interpretation

exposure to diversity, and that most students experiencing diversity in college accrue enough supplemental exposure in other life periods to render exposure in college irrelevant for adult outcomes. We find suggestive evidence supporting this hypothesis: we are able to measure a significant positive impact of collegiate diversity on postgraduate outcomes for White and Asian matriculants who attended high school in homogeneous states and did not encounter much racial diversity, according to their own self-reports, after college. The strongest evidence in this vein pertains to subjective job satisfaction measures, which suggests that the returns to diversity capital are workplace-oriented but accrue in predominantly non-pecuniary forms.

Overall, we conclude that the evidence in favor of a positive link between collegiate diversity and the quality of undergraduate education is much weaker than the arguments of Supreme Court justices and other observers suggest. For the typical White or Asian college student, exposure to under-represented minority students in university classrooms has little bearing on their life after graduation. Our results may understate the returns to diversity for those students who proceed from college to the most racially heterogeneous settings; however even in these settings graduates appear to quickly acquire the skills they need on the job. If any students benefit from diversity in college, it is that small group of students for whom college represents their best opportunity to encounter persons of different races.

2 Existing Literature

The "widely believed" view that racial diversity improves the quality of education is based on astonishingly little empirical evidence. While some research has touched on the subject of classroom racial composition and the quality of education at the primary or secondary levels (Rivkin 2000, Hanushek et al. 2001, Hoxby 2000), none of these studies provide any evidence consistent with the hypothesis that racial diversity improves education. Indeed, most existing studies report adverse effects of racial or ethnic diversity on a host of outcomes (see, for example, Alesina et al. 1999; Alesina and La Ferrara 2000, 2001; Easterly and Levine, 1997; Gugerty and Miguel 2002; Vigdor 2004; see Arcidiacono, Vigdor and Aldrich 2003 for a notable exception). Previous work analyzing the impact of diversity in higher education has generally not focused on the outcome measures usually associated with the literature on college quality, such as postgraduate earnings, and has

relied primarily on correlational evidence (Bowen and Bok, 1998; Gurin 1999). Duncan et al. (2003) exploit random roommate assignment at one large public university to show that cross-racial exposure influences individual attitudes and friendship patterns; however the dataset used does not contain information on postgraduate outcomes.

The most noteworthy existing study of collegiate diversity and postgraduate outcomes, Black, Daniel and Smith (2001), reports a positive relationship between college percent black and earnings in the National Longitudinal Survey of Youth.[5] This finding holds under a number of specifications where the endogeneity of college choice is dealt with using selection on observables. While supportive of Lewis Powell's hypothesis at face value, two caveats should be attached to the Black, Daniel and Smith study. First, their analysis relies only on college-level variation in percentage black. Controlling for average SATs, a higher percentage black implies a more aggressive affirmative action program. With higher quality colleges having more aggressive affirmative action programs, a higher percentage black may be picking up the causal effect of an unobserved quality measure. Second, the study uses a broad sample of undergraduate institutions, including many less competitive institutions where affirmative action is not an issue (Kane 1998).[6] Our study addresses these two caveats by using sub-college level variation in racial composition, allowing the introduction of college fixed effects, and by focusing on a sample of highly selective institutions where affirmative action policies have a clear impact on overall racial composition.

3 Interpreting Powell: Diversity Capital

In the standard economic model of investment in education, each individual chooses to acquire additional education if the present value of expected future returns from their up-front investment exceed those available in other asset markets. These educational investments produce human capital (Becker, 1964) that then have a return in the labor market. Lewis Powell's argument that diversity promotes an "atmosphere of 'speculation experiment and creation... essential to the quality of higher education'" can thus be translated into a hypothesis that the effect of college education on an individual's stock of human capital depends on the degree of racial diversity at the university

[5] A more detailed explanation of their methodology is given in Black, Daniel and Smith (1997).

[6] The data source for the Black, Daniel and Smith (2001) study is National Longitudinal Survey of Youth.

where the education takes place. In this section, we develop this notion in a simple model that makes two assumptions beyond Powell's assertion. First, we assume that the component of human capital influenced by racial diversity is a distinct quantity, which we refer to as diversity capital. Second, inspired by Lazear's (1995) model of cultural assimilation, we assume that the returns to diversity capital accrue when individuals are forced to interact with persons of different racial backgrounds in the marketplace.

3.1 A model of diversity capital

Consider a two period model where in the first period an individual invests in skills and in the second period receives payoffs for the skills acquired. Let there be two ethnic groups. In the second period, all individuals share a common location with a fixed group composition. In the investment period, locations vary in their ethnic composition and individuals can choose their preferred level of across-group interaction. We ignore other human capital investments which serve only to complicate the model while not changing the substantive results. Interaction with members of the other ethnic group produces 'diversity capital', D, that has a return in the labor market. Consider an individual in the ith ethnic group. Let ${\gamma_j}^i$ be the fraction of individuals at first-period location j that are from the other group. The cost of acquiring k units of diversity capital is given by $c(k, {\gamma_j}^i)$, a function that is increasing in its first argument, decreasing in its second, and convex.[7]

The payoff for investing in diversity capital comes in the second period. In the second period individuals enter the marketplace. These interactions generate some level of surplus which is divided evenly between the two partners, labeled 1 and 2 respectively. When two members of the same ethnic group interact, per-person surplus is a constant which we normalize to one. When members of different group interact, the surplus depends upon the amount of diversity capital each individual possesses. This mapping is given by $f(D^1, D^2)$ where we assume that the ordering of the partners is not relevant: $f(D^1, D^2) = f(D^2, D^1)$. The function is increasing in both of its arguments, bounded

[7]The hypothesis that increasing collegiate diversity contributes to the formation of diversity capital hinges on the impact of increased diversity on interracial interaction. The effect of increasing the proportion of under-represented groups on interracial interaction might be muted if, for example, the share increase creates a "critical mass" of minority students who independently choose to self segregate, or if increasing the share of minorities on campus entails introducing a mismatch in ability levels or other factors predictive of individual sorting into cliques. Bowen and Bok (1998) present some evidence linking higher black share to the probability of interacting with blacks in college. Arcidiacono and Vigdor (2004) find this as well with respect to under-represented minorities in general.

below by zero, and bounded above by one.

In the second period individuals interact with N partners. The probability of an interaction occurring with a member of the other ethnic group in the workplace given that the individual is a member of the ith ethnic group is given by ${\gamma_w}^i$. The expected surplus for individual i in the second period who is a member of the majority group is then given by:

$$E_i(S) = \sum_{n=1}^{N} \left[(1 - {\gamma_w}^i) + {\gamma_w}^i E f(D_i, D_n) \right] \tag{1}$$

where the expectation is taken over the diversity capital of one's future partners. Conditional on the initial location, the individual's maximization problem is then:

$$\max_{D_i} \sum_{n=1}^{N} \left[(1 - {\gamma_w}^i) + {\gamma_w}^i E f(D_i, D_n) \right] - c(D_i, {\gamma_j}^i) \tag{2}$$

There are two things notice about the maximization problem above. First, all else equal, individuals would prefer to attend colleges with higher percentages of under-represented minorities as this lowers the cost of diversity capital. In an extended model where individuals sorted into first-period locations by paying a tuition-like rent, more diverse locations would command higher rents. Hence, that colleges compete for high representations of minority students is consistent with the model. Second, individuals will naturally under-invest in diversity capital. To see this, note that both the majority and the minority individual benefit when the other has more diversity capital. In the individual's maximization problem he does not take into account the positive externalities associated with his investment decision.[8]

The Powell hypothesis, then, is an argument that greater diversity in higher education is preferable for efficiency reasons. This stands in direct contrast to the traditional equity-based argument that diversity is preferable as restitution for past discrimination.

[8]This argument also implies that efforts to measure the benefits of collegiate diversity by examining earnings or other measures of surplus may understate the true magnitude of benefits. So long as some positive fraction of the returns to individual diversity capital accrue to the possessor, however, the existence of private returns is a necessary and sufficient condition for the existence of social returns.

3.2 Complications

The model presented above suggests a simple strategy for testing the diversity capital hypothesis: simply regress earnings or some similar measure of surplus received after college graduation on a measure of collegiate diversity. In section 4 below, we pursue such a strategy. Before embarking on this task, however, we sketch three realistic extensions to the model that make the empirical implications considerably less clear.

First, it is reasonable to expect that individuals sort into one of multiple workplaces in the post-investment period, and that these workplaces may vary in their ethnic composition. Since per-interaction expected surplus is always (weakly) lower in diverse communities relative to homogeneous communities, any diverse community that exists in equilibrium must offer a greater number of interaction opportunities.[9] If homogeneous (or simply less diverse) communities also exist in equilibrium, it must be the case that the advantages associated with the most diverse communities are not sufficient to entice individuals with low diversity capital stocks to locate there.

Figure 1 illustrates the sorting that can be expected to occur in this scenario, by depicting an equilibrium with two communities, one homogeneous and one diverse. Diversity capital is measured on the horizontal axis; total expected surplus on the vertical axis. The slope of the lines S_H and S_D depict the returns to diversity capital in the homogeneous and diverse communities, respectively. In equilibrium, individuals with diversity capital stocks above D^* will locate in the diverse community, those with stocks below D^* will locate in the homogeneous community, and those with stocks exactly equal to D^* will be indifferent between communities. A regression that fits a single line to these data points will estimate a hybrid slope that overstates the returns to diversity capital in some communities and understates it in others. Thus, the first complication to estimation is that a single estimated regression parameter can potentially mask important heterogeneity in the returns to diversity capital. Since our data provide no information on respondents' workplace location, we cannot directly test the hypothesis that returns to diversity capital vary by community racial composition. In the final analysis, our point estimates may understate the returns to diversity capital in some communities.

[9] Alternatively, the model above could be modified to allow a premium for surplus gained in cross-group interactions or interactions in diverse cities.

Second, it is also reasonable to think that college represents only one of several possible investment periods in the typical graduate's lifespan. Exposure to ethnic diversity before or after college may be an effective substitute for exposure while in college. The impact of multi-period investment on estimates of the returns to investment in any one period depend on the degree of serial correlation in investment levels. If investment levels across time periods are positively correlated, we will overstate the mean returns to diversity capital.[10] If investment levels are negatively correlated, then we may observe individuals at points like A: with low observed levels of diversity capital but with surplus levels more commonly associated with the diverse community. The presence of data points such as A will bias our estimate of the mean impact of diversity capital downward.

In theory, this second problem could be avoided by controlling for diversity capital investments at other points in time. Unfortunately, our data source, the College and Beyond data set, offers little opportunity to observe the degree of exposure to diversity experienced before or after college. In general, the absence of datasets with extensive information on racial diversity at multiple points in the lifespan hinders most any effort to discern the true impact of collegiate diversity on postgraduate outcomes. Datasets that do offer some opportunity in this regard, such as the NLSY, lack the links to college administrative data which enable an exploitation of within-college variation in exposure to diversity. We use two admittedly imperfect measures of exposure to diversity at other points in a respondent's lifespan: the racial composition of the state where the respondent attended high school, and the respondent's own subjective estimate of the importance of interacting with people of different races in their life since college graduation.

A final complication, related to the second, is that diversity capital may exhibit diminishing returns. If individuals with significant diversity capital investments in college tend to accumulate stock in other periods as well, our estimates of the returns to diversity capital may understate the true expected return for the typical student. This understatement will be exacerbated to the extent that individuals with low stocks of diversity capital, hence higher returns to marginal investments other things equal, sort into homogeneous locations where the returns to diversity capital are low to begin with.

[10] For example, if investments in multiple periods are perfectly positively correlated, it is as though the horizontal axis in Figure 1 is mis-measured. What we refer to as a one-unit increase in diversity capital is actually a $n > 1$ unit increase, implying that if we estimate a slope coefficient of b the true impact of a one-unit increase in diversity capital on the outcome variable is b/n.

4 College Diversity and Earnings

To examine the impact of collegiate diversity on postgraduate outcomes, we employ the College and Beyond Data set, made available by the Andrew W. Mellon Foundation.[11] This data set contains information from two sources: administrative information a set of mostly selective undergraduate institutions, and survey responses collected from a sample of students who matriculated at those institutions in one of four cohorts. Our analysis focuses on the 1976 entering cohort, a group that was enrolled at the time of the Supreme Court's *Bakke* decision.[12] The administrative data include information on each matriculant's SAT scores, a student's major, and means of exit, whether graduation, transfer, or withdrawal.[13] All individuals in the administrative data were surveyed in 1996 with a response rate of around 80%. This survey provides information on many outcomes of interest such as earnings and life satisfaction.

To measure the degree of diversity in college, we use administrative data on the racial composition of a matriculant's cohort. In most of the empirical specifications below, we equate diversity with the percent of cohort members who belong to racial or ethnic groups that have been historically under-represented in college: African-Americans, Hispanics, and Native Americans.[14] We estimate the impact of increases in under-represented minority (URM) share on the postgraduate outcomes of White and Asian students, to determine whether there are true spillover benefits associated with attending a diverse college. As Figure 2 illustrates, there is a significant amont of variation in URM share across institutions: a significant number of White and Asian students in the 1976 entering cohort witnessed URM shares below 2%, while others experienced URM shares as high as 13%.

[11] We omit observations from historically black colleges as affirmative action is not relevant at these schools. Moreover, our focus on White and Asian students would leave us with very few observations from these institutions.

[12] Other cohorts available in the C&B data set include the classes entering in 1951 and 1989. We omit the 1951 cohort since minority enrollment were universally small at that point in time. We omit the 1989 cohort sine the 1996 follow-up survey found a significant fraction who had not yet completed their post-graduate education in 1995.

[13] For most institutions, the administrative data represents the entire entering cohort. For the remainder, the data comprise a nonrandom sample of the student body. Weights are provided to adjust for this sampling. A complete list of institutions represented appears in Table A1 in the appendix.

[14] Alternative operationalizations of diversity, such as using the fraction of African-American students in the cohort or a Herfindahl-style fractionalization index, yield similar results in all empirical exercises reported below.

4.1 Basic Results

Table 1 presents a test of the diversity capital hypothesis in its most basic form, analyzing the relationship between the racial composition of a male graduate's college and his earnings as an adult.[15] The dependent variable in each specification is the logarithm of earned income in 1995. This variable is reported in ten categorical intervals in the C&B data set; we use the midpoint of each interval as the estimate of income except for topcoded individuals, for whom we assign a value equal to 112.5% of the topcode.[16] While respondents with zero earnings are not separately identified from those with positive earnings in the lowest category, our results are not sensitive to changes in the interpolated income value. Both specifications control for cohort average SAT scores, and the respondent's own SAT scores as reported by the institution.

In the first regression, the effect of URM share is positive but very imprecisely estimated. The relatively large standard error reflects the small number of independent observations on institutional racial composition in this sample. [17] Taken at face value, the coefficient suggests that a 1% increase in the share of under-represented minorities at a university increases the earnings of White and Asian matriculants by 0.5%. The other matriculating cohort characteristics in this regression, mean SAT math and verbal scores, are small in magnitude and also statistically insignificant. Individual SAT scores are comparably stronger predictors of postgraduate earnings. Consistent with Arcidiacono (forthcoming), we find a split effect of a graduate's own SAT scores: higher math scores predict higher earnings, but higher verbal scores predict lower earnings.

[15]Selecting the sample on the basis of labor force participation rather then gender yields similar results. If we use no sample selection criteria whatsoever, estimating the model using the entire 1976 cohort, we do obtain a significant (at the 5% level) positive effect of college-level URM share on earnings when we control for gender and whether a worker was in the no-profit sector government sector, or self-employed. Further analysis shows that this effect operates entirely through the female labor force participation decisions. We choose not to emphasize this result for several reasons. First, the result disappears when using only full-time workers. The practice of limiting the sample when estimating earnings equations is essentially universal in the labor economics literature. Dale and Krueger, for example, limit their estimation to full-time employees. Second, we have a no a priori reason to expect that diversity capital effects would demonstrate themselves entirely through female labor force participation effects. Third, this effect appears only in our college-level analysis; introduction of institution and major fixed effects eliminates the result. The relative fragility of the result, along with the high likelihood that it represents selection on hours of work, lead us to discount it.

[16]This is the same imputation method used by Dale and Krueger (2002). Changing the treatment of topcoded income does not substantively influence the results. Some sample members, who received a pilot survey instrument, have income reported in nine categorical intervals. We use a similar imputation strategy for these respondents.

[17]In further specifications below we adopt two strategies to exploit finer variation in racial composition: using major-level variation in racial composition and using self-reported data on collegiate contributions to diversity capital. These strategies generally succeed in reducing the magnitude of standard errors; they do not, however, produce statistically significant coefficients.

Some variation in earnings may reflect compensating differentials that in turn reflect variation in workplace amenities. We have multiple strategies to circumvent this issue, including the examination of job satisfaction measures rather than earnings in section 4.6 below. In Table 1, we address this concern by adding some simple controls for workplace characteristics: whether an individual works in the non-profit sector, for the government, or is self-employed. As the table's second column indicates, each of these factors is associated with significantly lower earnings, suggesting that these types of jobs offer amenities desirable to individuals on the margin between choosing these jobs and positions in the for-profit sector. Inclusion of these factors reduces the magnitude of the negative coefficient on the SAT Verbal score; high SAT Verbal scores appear to be associated with occupational choices that do not pay as well. The estimated effect of institution URM share increases, consistent with a scenario where exposure to minority students increases the likelihood that matriculants opt for lower-paying jobs outside the for-profit sector. The estimated URM share effect continues to be statistically insignificant, however. At face value, the point estimate suggests that a one-percentage-point increase in URM share increases earnings by roughly 0.7%.

A frequent criticism of studies linking college quality to postgraduate outcomes is that students of high unobserved ability tend to sort into schools with high observed quality, as measured by peer test scores or any other measure. The result of this sorting is an upward bias in estimates of the relationship between college quality and positive outcomes.[18] To the extent that diversity increases college quality, a similar criticism can be levied against the strategy we outline above. Our strategy for circumventing this criticism rests on the assumption that the dimension of college quality we are interested in, namely racial diversity, can vary significantly within a university. Once students matriculate at an undergraduate institution, their curricular choices have a significant impact on the racial composition of their classrooms. Table 2 illustrates this within-school variation by listing the URM share for different majors at three universities in the College and Beyond sample. Each of the three listed universities has an overall URM share between 10 and 13 percent. Although the universities look quite similar in terms of the diversity experienced by undergraduates, further

[18]Recent literature has sought to eliminate this bias either by modeling the college choice process (Brewer et al. 1999, Arcidiacono forthcoming, Arcidiacono 2002), comparing the outcomes of twins who attended different colleges (Behrman, Rosenzweig and Taubman, 1996), comparing outcomes of individuals accepted to a similar set of colleges but making different choices within that set (Dale and Krueger 2002), using instrumental variable techniques (Behrman et al. 1996), or by modeling selection on observables (Black, Daniel, and Smith 1997).

examination reveals that students' classroom diversity experience varies considerably across majors. White and Asian political science majors at Colleges B and C, for example, have a very high share of URM classmates, while political science majors at College A experience a URM share very close to the university average. Psychology or sociology majors at College B exhibit a URM share more than twice the university average, while those at Colleges A and C fall very close to their respective averages. Finally, students majoring in physics, chemistry or geology at Colleges B and C have very few, if any, URM classmates, while such majors at College A have a relatively large share of blacks, Hispanics, and Native Americans in their courses. This within-college variation in racial composition presumably leads to significant differences in the probability of interracial interaction within colleges.[19] As Figure 3 illustrates, within-major URM shares were below 5% for about half of all White and Asian students, but reached as high as 30% for others.

In Table 3 and subsequent results, we redefine our measures of peer group racial composition and SAT scores at the major-by-college level.[20] This strategy presents the additional advantage of creating more variation in the independent variable of interest, which leads to smaller estimated standard errors. In these specifications, we control for college- and major-specific fixed effects which eliminate from consideration all variation in earnings associated with college- or major-specific factors. [21]

[19]Some justification for this presumption is found from the 1989 cohort of the College & Beyond. We do not use this cohort in our life outcome analysis because the follow-up survey was done while many students were enrolled in graduate programs. This data set does, however, ask more detailed questions about where inter-racial interactions occur. The possible responses included class or study groups, dorm or roommates, playing sports, parties and other social activities, and other extra-curricular activities. Individuals could mark as many response as were applicable. By far the most common response was that the interactions occurred in the class or study group. Arcidiacono and Vigdor (2004) study the 1989 cohort in detail, examining whether individuals have preferences for racial diversity.

[20]Since the menu of majors varies across institutions, and certain majors may display a high degree of correlation in substance, we recode each student's major into one of eleven groups. The eleven categories are: (1) natural sciences (physics, chemistry, and geology), (2) biology and related fields such as plant or animal science, (3) engineering, computer science and math, (4) psychology, sociology, and related social sciences, (5) humanities, including history, philosophy, classics, and area studies, (6) economics, (7) political science, (8) language and literature, (9) arts, architecture, and communication, (10) business, (11) education and other professionally oriented majors. The choice to keep certain categories separate, such as economics and business, was driven by a desire to prevent any individual category from representing a disproportionate share of the overall sample. Our results are not sensitive to the categorization of majors, or to the complete disaggregation of majors. Roughly 754 observations are missing information on college major and are therefore omitted from the analysis.

[21]This estimation strategy can be considered suspect if the marginal students in all universities tend to gravitate towards certain "easy" subjects, and if these subjects vary across institutions. Presuming that under-represented minority students are disproportionately represented in the pool of marginal students, and that student quality is not adequately captured by the controls we employ in our regressions, such a pattern would bias us towards finding a negative effect of minority share on later outcomes. To check whether such within-institution sorting might occur, we used data on White and Asian students to regress URM share on institution fixed effects, major fixed effects, and student math and verbal SAT scores. This regression shows that White and Asian students in high-minority majors

Within institutions, White and Asian students enrolled in majors with a disproportionate share of under-represented minorities showed no tendency to earn more than their colleagues in comparatively homogeneous majors. The point estimates on URM share within a student's major are negative and insignificant. There is some evidence, however, of peer influence on post-graduate outcomes: within-major peer math SAT scores have a significant positive impact on earnings.[22] The individual-level covariates continue to display the patterns of significance first observed in Table 1. Overall, the basic evidence shown in Tables 1 and 3 offers no support for the Powell hypothesis. If two White or Asian students with identical SAT scores choose institutions or majors with differing racial composition, their predicted earnings conditional on postgraduation labor market sector choice are essentially identical.

4.2 Incorporating multi-period investment in diversity capital

When we observe two otherwise identical White or Asian students selecting institutions or majors with different minority representation, this may provide information about the exposure to diversity the students experienced prior to college, or the degree of diversity the student will go on to witness after graduation. As noted in section 3.2 above, this serial correlation in diversity complicates efforts to determine the impact of college-era diversity capital investments on earnings. In Table 4, we address the issue of serial correlation in diversity by controlling for the best measures of pre- and post-college interracial exposure available in the College and Beyond dataset. For the pre-college period, we use information on the location of respondents' high schools to control for the share of under-represented minorities in the state where the respondent graduated from high school, based on 1980 Census information. State-level racial composition is admittedly quite coarse considering the degree of heterogeneity in racial composition across regions of states, however states are the only level of geographic identification available for a majority of C& B respondents.[23]

have significantly lower verbal SAT scores than White and Asian students in comparatively homogeneous majors. While verbal SAT scores are not significant positive predictors of earnings and other postgraduate outcomes in our analysis below, this does indicate the potential for correlation between URM share in a student's major and unobserved ability. Our prior belief is this bias would be less severe than the bias arising from selection across institutions in our sample, suggesting that estimates of URM share effects should be more positive (or less negative) in the major-level analysis. As the results below indicate, this pattern holds in some but not all cases.

[22]Recall that these specifications control for institution and major-specific fixed effects, which assuage many concerns regarding peer characteristics proxying for unobserved ability or institutional characteristics.

[23]Not all C& B institutions reported information on high school location, thus some observations are dropped from the analysis. Ten institutions (out of 30) report the information on high school zip code for a majority of applicants.

For the post-college period, the C& B survey offers no locational information that might be used to construct an objective measure of exposure to diversity. Instead, we employ a subjective alternative based on responses to a survey item asking how important the "ability to work effectively and get along well with people from different races/cultures" has been in matriculants' "life since college." Responses vary along a five-point scale, with a response of one indicating "not at all important" and a response of five indicating "very important." Roughly 42% of White and Asian respondents answer in category 5; another 33% respond in category 4. The remaining 25% of White and Asian respondents are arrayed across the remaining categories, with the vast majority in category 3.[24] We take this variable as a measure of exposure to diversity after college, coding responses as category 5, category 4, and category 3 or below.

Controls for exposure to diversity before and after college have very little impact on the estimated relationship between college-level URM share and earnings. Comparing coefficients in Tables 1 and 4, the URM share coefficient is identical. Comparing coefficients in Tables 3 and 4 reveals a very slight decrease in the major-level URM share effect, consistent with the hypothesis that college-era investments in diversity capital are predictive of further investments in other periods. Interestingly, the high school-era URM share variable displays a positive coefficient in both specifications, attaining 10% significance level in the first specification, which omits institution and major-level fixed effects. The estimated impact of post-collegiate exposure to diversity on earnings is universally small and insignificant. Finally, other covariates related to peer and individual SAT scores and sector of employment display signs and significance patterns similar to those reported in earlier tables.

The coefficients in Table 4 represent our best estimates of the mean population effect of minority representation in college on postgraduate earnings.[25] The absence of a significant effect could reflect several things. First, minority representation on campus might not translate directly into interracial contact (Arcidiacono and Vigdor, 2004). Second, for the typical student the marginal impact of interracial contact in college might pale in comparison to the impact of contact at other points in the lifespan, when under-represented minorities are not so under-represented. Finally, the entire

[24] About 1% of White and Asian respondents answer in category 1, about 5% answer in category 2.

[25] Recall from section 3.2 above that the mean effect may mask substantial heterogeneity: in particular, the returns to diversity capital in particularly diverse communities may significantly exceed the mean effect. Nonetheless, the absence of a significant mean effect implies that the typical White or Asian matriculant experiences no benefit from selecting a diverse set of collegiate peers.

concept of diversity capital could itself be mythical or merely irrelevant to the determination of labor market earnings. In the following subsections, we present empirical tests of these competing explanations.

4.3 Alternative measures of collegiate investment in diversity capital

The College and Beyond survey asks matriculants to provide their own subjective estimation of the contribution that their undergraduate experience made to their "ability to work effectively and get along well with people from different races/cultures." This hypothesized ability conforms relatively well to our conceptualization of diversity capital. We will therefore use responses to this survey item as an alternative measure of the impact of college-era experiences on diversity capital. Responses to this survey item were quite varied: among White and Asian respondents, about one-fifth gave response 5, indicating that their undergraduate experience contributed "a great deal" to their diversity capital. About one-quarter gave responses 3 and 4, one-sixth gave response 2, and one-twelfth gave response 1, indicating that their undergraduate experience contributed nothing to their diversity capital.[26]

Minority representation within a student's major is a significant predictor of this subjective diversity capital investment measure, but it explains only a small fraction of the variance in the measure.[27] Thus, it seems plausible that minority representation within a student's institution or major would be a very imprecise indicator of an undergraduate's diversity capital investment. Table 5 tests whether the subjective measure of diversity capital investment provides a different picture of the impact of interracial contact on earnings. Table 5 reports the coefficients on a set of categorical variables representing the various response categories for the diversity capital investment question. Also included in the specification are the set of control variables used in Table 4, except major-level URM share.

The results in the first regression in Table 5 suggest that there is a significant positive return to collegiate investments in diversity capital. Respondents who indicated that college contributed "a great deal" to their diversity capital earn 10% more than respondents who report that college

[26] About 1% of respondents answered "uncertain"; these respondents are dropped from the analysis in this section.

[27] In an ordered probit regression, major-level URM share has a positive coefficient with a p-value of 0.065, controlling for institution and major fixed effects. The pseudo-R^2 for this specification is 0.013.

contributed nothing. Point estimates suggest that earnings increase monotonically with subjective estimates of college's contribution to diversity capital.

While these estimates control for a number of important determinants of earnings, including college and major fixed effects, it is reasonable to be concerned that subjective estimates of college's contribution to diversity capital are correlated with respondent's opinion regarding other aspects of their college education. Particularly successful respondents may feel, rightly or wrongly, that their college contributed a great deal to every component of their human capital. Fortunately, the College and Beyond survey instrument collects subjective estimates of the impact a respondent's college had on 14 other personal qualities that can be considered components of human capital. Among these personal qualities are the ability to form and retain friendships, the ability to write clearly and effectively, and the ability to think critically. As with the diversity capital variable, responses vary along a five-point scale and are entered into regression analysis categorically.

The second regression reported in Table 5 reflects the inclusion of categorical controls for respondents' subjective estimates of their college's contribution to these fourteen other components of human capital. The pattern of results on the diversity capital variables is reversed relative to the first specification. Respondents who reported that college contributed a great deal to their diversity capital now report 10% lower earnings than respondents who reported that college contributed nothing to their diversity capital.[28]

While these results certainly support the view that diversity capital is not a relevant determinant of earnings relative to other forms of human capital, a good deal of caution should accompany their interpretation. When answering these questions, respondents may implicity compare the degree of diversity capital they accrued during college with the amount received at other stages in life. Respondents who experienced a great deal of interracial interaction in college may report that college contributed little to their diversity capital if they also experienced such interaction before and after college. Conversely, respondents who received their only interracial exposure as an undegraduate may report that college contributed a great deal to their diversity capital, even though their overall

[28]Among the 14 other components of human capital, several exhibit a significant relationship with earnings. The human capital components contributing positively to earnings include competitiveness, leadership abilities, the ability to work cooperatively, the ability to work independently, the ability to have a good rapport with people holding different beliefs, and the ability to form and retain friendships. Human capital components contributing negatively to earnings, aside from diversity capital, include knowledge of a particular field/discipline, the ability to write clearly and effectively, religious values, the ability to adapt to change, and the ability to communicate well orally.

stock is quite low.

Even allowing for these cautions in interpretation, the results in Table 5 suggest that a disconnect between minority representation and interracial interaction on campus cannot explain the lack of a positive link between diversity and earnings. There is no evidence in these results to suggest that undergraduates who interacted extensively with minorities experience later returns to these interactions.

4.4 Diminishing returns to diversity capital investments

In Table 4 above, we introduced measures of interracial contact in multiple periods to account for the possibility of serial correlation in exposure to diversity, and hence the potential for omitted variable bias in the estimation of returns to college-era diversity capital investments. In this section, we test the further hypothesis that interracial exposure in any one period reduces the estimated return to exposure in other periods. This hypothesis would arise in a model where diversity capital does not depreciate and is transformed into surplus at a decreasing rate. Over time, as individuals accumulate capital, the estimated relationship between investments in any one period and surplus will decrease.

This model suggests that the returns to diversity capital investments in any one period will be greatest for those individuals with limited accumulation in other periods. To test this hypothesis, we introduce interaction terms into the Table 4 specifications. The results of this estimation are reported in Table 6. While no coefficients attain statistical significance in this particular specification, the overall pattern is consistent with the hypothesis and also with further specifications reported in sections 4.5 and 4.6 below. Specifically, the main effects of interracial exposure in high school and college are positive and relatively large in magnitude; main effects on the postgraduate subjective interracial contact variables are generally quite close to zero; interaction terms are almost all negative. Taken at face value, these estimates suggest that the returns to interracial contact at any one point in time are most positive for those indivduals with little exposure to diversity in other periods.

5 Collegiate Diversity and Other Outcome Measures

Our use of earnings and education as outcome measures is driven by a view that the purpose of a college education, or any other investment in human capital, is to increase an individual's productivity in later periods. In competitive labor markets, higher productivity should translate into higher compensation, other things equal. It is possible, however, that individuals reap some benefit from exposure to racial diversity in college and receive these benefits outside of their earnings in the labor market. The mechanism for this benefit transmission may relate to workplace conditions or to aspects of life completely outside the labor market, such as increased utility from interacting with others in nonmarket settings, or from consuming goods and services most commonly associated with other cultures. Since earnings may be an imperfect measure of the total surplus enjoyed by respondents in our sample, we now focus attention on several alternative outcome measures.

5.1 Diversity capital and educational outcomes

Educational attainment is a common outcome measure used in the literature on peer and neighborhood effects (see, for example, Cutler and Glaeser 1997; Solon, Page and Duncan 2000). Although the educational attainment of individuals matriculating at selective colleges may excite relatively little interest from a policy perspective, Tables 7 and 8 present the results of probit regressions that examine two educational outcomes likely to influence an individual's productivity and career satisfaction. The models reported in Table 7 examine the likelihood of graduation. According to the institutional data files included in the College and Beyond database, roughly 15% of matriculants fail to graduate from their enrolling institution. The specifications in Table 8 consider the self-reported outcome of receiving a graduate or professional degree.[29] The entries in both tables have been rescaled to indicate the estimated marginal impact of a unit change in each independent variable when all covariates are set equal to their respective means.

The first specification in Table 7 mirrors the first specification in Table 3: URM share is measured at the major-by-college level, controls for a respondent's own SAT scores and those of his or her major cohort are included, although the coefficients are not reported in the table. College and

[29] Both sets of specifications use the entire sample, since it is possible to receive a graduate degree without graduating from the matriculating institution.

major fixed effects are also included. The sample in this case includes both male and female matriculants, the specification includes a gender dummy variable.[30] There is a negative but statistically insignificant relationship between URM share and the probability of graduation. The coefficient becomes slightly, but not significantly, more negative in the second column, where we introduce a control for high school URM share.[31] Introducing an interaction term between college major and high school state URM shares, in the third column, produces an intriguing, statistically significant set of results. The coefficients show that White and Asian matriculants originating in racially homogeneous states experience a 0.6 percentage point decline in the probability of graduation for every one percentage point increase in the share of under-represented minorities in their major. White and Asian matriculants from diverse states enrolling in homogeneous majors similarly exhibit lower graduation rates. The interaction effect is positive and significant, indicating that the negative effects of exposure to minorities is lower for matriculants originating in diverse states, and vice-versa. The point estimates suggest that for students selecting majors with a URM share of at least 6%, high school state racial composition is irrelevant, while major URM share is irrelevant for students originating in a state where the URM share was at least 37%.[32].

One interpretation of this result is that students fare poorly when there is a significant mismatch between their high school and college experiences. An alternative explanation is that students selecting into majors with high URM representation are of lower unobserved ability.[33] To coincide with these results, this pattern of selection would have to be most acute among students from racially homogeneous states.

The negative link between interracial contact and the probability of graduation is underscored in the final regression in Table 7, which uses subjective measures of collegiate contributions to diversity capital. Although only marginally significant from zero at best, and universally small in magnitude, these coefficeints suggest that the probability of graduation decreased in the amount of interracial contact reported by matriculants.

[30] Estimation on the sample of male matriculants yields comparable results.

[31] In these specifications we omit controls for interracial contact after college, since it is difficult to argue that experiences after college influence the probability of graduation.

[32] About 1% of White and Asian matriculants in the sample originate in states with URM shares at this level or above

[33] Recall the earlier note that White and Asian matriculants in high URM majors have significantly lower SAT verbal scores, controlling for college and major fixed effects.

Table 8, which replaces the dependent variable used in Table 7 but employs otherwise identical specifications, shows more, albeit inconsistent, evidence of a negative link between diversity and educational outcomes. There is a negative and marginally significant impact of major URM share on the probability of attaining a graduate degree when controlling for high school state URM share, but the interacted pattern shown in Table 7 does not hold in this case. As in the preceding table, there is evidence that educational outcomes worsen as self-reported estimates of collegiated diversity capital accumulation increase. Matriculants who reported that college contributed a great deal to their diversity capital were 6 percentage points less likely to attain a graduate degree than those who report that college made no contribution to their diversity capital.

Whether these results reflect a causal negative impact of diversity on education or selection of less able matriculants into racially diverse settings within institutions, the observed impact on educational attainment may be an important factor influencing our previous results related to earnings. To verify this, Table 9 presents the results of earnings regressions using samples conditioned on educational attainment. The first specification includes only those White and Asian matriculants who graduated and did not go on to earn any postgraduate degrees. Within this group, there is a positive and significant relationship between major-level URM share and earnings, at least for those matriculants that originated in homogeneous states. The overall array of coefficients closely resembles that shown in Table 6, with the exception that the main effects of college major and high school state URM share are larger in magnitude and statistically significant. The coefficient on the interaction of these two variables, while negative and large in magnitude, fails to attain statistical significance. At face value, the coefficients suggest that White and Asian graduates from homogeneous states, experience a 2.5% increase in earnings for every percentage point increase in URM share in their major. These effects dwindle to zero for graduates originating in the most racially diverse states. The effects also appear to be smaller for graduates who gained significant exposure to racial diversity after college.

The second regression in Table 9 examines the set of respondents who both graduated from their matriculating institution and attained a graduate degree. Within this subgroup, there is no evidence of any systematic relationship between racial diversity experienced at any life stage and earnings. The main effect of college major URM share, in particular, is very close to zero.

Hidden in these results is perhaps the best argument presented to this point in favor of the diversity capital hypothesis. Matriculants gain from exposure to diversity in college, particularly if they had little opportunity to experience diversity at other points in their life course. Only matriculants who actually graduate from an institution actually exhibit these returns; moreover those who go on to higher levels of education find that their return diminishes substantially.

This is the best argument available in the evidence to this point, but observers can certainly be forgiven for failing to find it a convincing one. In particular, the absence of a diversity capital effect for graduates with advanced degrees is quite puzzling. In the following subsection, we find some corroborating evidence in our analysis of subjective postgraduate outcome measures.

5.2 Diversity capital and satisfaction outcomes

In this section, we take advantage of two items asked of College and Beyond survey respondents, relating to their overall satisfaction with their job and life.[34] Responses varied along a five point scale: the highest response category in each case is "very satisfied," followed by "somewhat satisfied," "neither satisfied nor dissatisfied," "somewhat dissatisfied" or "very dissatisfied." Tables 10 and 11 report the results of ordered probit specifications that analyze these responses.

Table 10 considers the determinants of job satisfaction for White and Asian male respondents. The reported specifications mirror those in Tables 7 and 8, only the dependent variable and estimation technique vary. The first column illustrates that there is a positive, but insignificant, relationship between major-level URM share and job satisfaction, controlling for a standard set of individual characteristics, college and major fixed effects, and major-level average SAT scores. Introducing controls for exposure to diversity at other points in the life course reduces the magnitude of this coefficient by a small amount. Interestingly, the second regression also shows a positive and significant relationship between postgraduate exposure to diversity and job satisfaction.

Interacting the measures of exposure to diversity produces a coherent set of significant results.

[34]The use of ordinal satisfaction measures in economic research is neither unprecedented (Clark and Oswald, 1994; Di Tella et al. 2001; Gruber and Mullainathan, 2002) nor uncontroversial (Bertrand and Mullainathan, 2001). As stated above, our use of these measures is motivated primarily by the possibility that increases in individual productivity may not translate entirely into labor market earnings. Using measures of life satisfaction as well as job satisfaction also presents the possibility of measuring returns to individual utility that accrue through nonmarket interaction. Nonetheless, we are sympathetic to those skeptical of these survey measures and have taken pains to ensure that our interpretation of results acknowledges their potentially suspect nature

Exposure to diversity at any individual point, absent exposure at other points, predicts significantly greater job satisfaction. Moreover, an increase in exposure to diversity at one point in the life course significantly reduces the return to exposure at other points in the life course. The coefficients suggest that the benefits of college diversity are nullified for those students who experience significant exposure to diversity after college and attended high school in states where the URM share exceeded roughly one-quarter.[35]

The final regression in Table 10 utilizes the subjective measures of collegiate diversity capital investment in place of URM share. The estimates suggest a negative, but insignificant and non-monotonic, relationship between this subjective measure and job satisfaction. The contrast between these point estimates and the ones displayed in earlier specifications suggests that respondents who claim that college contributed a great deal to their diversity capital are truly revealing that they experienced little interracial contact at other points in their life.

The results in Table 11 replicate many of these findings using a measure of life satisfaction, rather than career satisfaction, as the depedent variable. These ordered probit specifications include both males and females, but otherwise mirror the methodology in Table 10. As in that table, the overall mean effect of major-level URM share on the outcome variable, whether controlling for URM exposure at other life stages or not, is not statistically distinguishable from zero. The strongest evidence of a link between collegiate URM exposure and life satisfaction is once again in the interacted specification. In this case, the main major-level URM share effect is not statistically significantly different from zero, but it is positive and of a relatively large magnitude. As in the previous table, the main effects of diversity exposure measures at other points in the life course are positive and significant. Interaction terms, though not always significant, are uniformly negative. Taken at face value, the point estimates suggest that greater exposure to under-represented minorities has a positive impact for those matriculants originating in high school states with URM shares below 10 to 15 percent

[35]The finding that those individuals with the greatest reliance on diversity capital as adults are those who benefit least from collegiate diversity is admittedly somewhat incongruous. For the college graduate who goes on to work in highly diverse environments such as inner-city schools, hospitals, or courtrooms, however, the effect of a substantial increase in collegiate URM share, say from 6% to 11%, most likely pales in comparison to the impact of extended periods in environments where the URM share may exceed 50%. An analogy may make this finding somewhat more intuitive. Suppose the question used to stratify the sample inquired not about the importance of racial diversity, but about the importance of economics to matriculants' life since college. For those individuals reporting that economics was "very important," we might expect to see little relationship between measures of individuals' exposure to economics as an undergraduate and later outcomes. Those individuals self-selecting into this group without much undergraduate exposure to economics most likely received considerable exposure at other points during their life course.

and without significant interactions with persons of different races after college.

6 Conclusions

Do White and Asian students benefit from the presence of under-represented minority students on campus or in the college classroom? Our best estimates in this paper suggest that the educational and post-graduation outcomes of the typical student are not significantly impacted by the racial composition of their university or their major within the university. Although these results are compatible with the hypothesis that exposure to diversity is irrelevant for life outcomes, our further analysis suggests another interpretation: that diversity in college is irrelevant for many students because they experience more significant interracial interactions at other stages in their life.

It is worth reiterating caveats that need to be attached to our analysis. First, our estimates may significantly understate the returns to diversity capital in particularly heterogeneous communities. They do reflect, however, the returns that can be expected by the typical White or Asian matriculant to a selective college. Second, data limitations force us to use imperfect measures of exposure to persons of different races before and after college. Finally, although there is a certain consistency in the pattern of results using different dependent variables and different subsamples, many of the coefficients we estimate attain at best marginal statistical significance. Even bearing these limitations in mind, the results point to a story that strikes us as quite sensible: exposure to diversity is important, but college is not the most important, let alone the only, place where this exposure takes place.

Should racial preferences in college admissions continue? While there will always be equity arguments for the proponents of affirmative action to fall back on, this study suggests that the claims of increased efficiency associated with campus diversity are overstated. Certain claims not directly tested in this study might strengthen the argument for diversity: the presence of externalities in the return to diversity capital, for example, or the possibility that the returns to diversity might increase as the share of under-represented minorities in society grows. The returns to diversity in college might also be greater for students in the years immediately following their graduation, before they have had an opporunity to accumulate diversity capital in postgraduate settings.[36] Overall,

[36]Indeed, this hypothesis could potentially explain the discrepancy between our results and those of Black, Daniel

though, it seems fair to say that the typical White or Asian college student who happens to choose a college or major with very little minority representation will not experience any significant personal disadvantage down the road.

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