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## External Labor Markets and the Distribution of Black Scientists and Engineers in Academia

With each step in an academic career, from high-school graduation to promotion to full professor, there are progressive decreases in the representation of African Americans (National Science Foundation [NSF], 1988a, 1999). In the mid-1990s African Americans comprised 12% of the total population, 11% of the labor force, and 10% of those enrolled full-time in undergraduate programs, but they held less than 5% of the full-time faculty positions in four-year colleges and universities (U.S. Department of Education, 1997). Although black students are earning an ever expanding share of baccalaureate degrees granted in the United States, most fields show only minuscule improvements in their sparse representation among graduate degree recipients (Bowen & Rudenstine, 1992). In the sciences and engineering, black scholars comprised only 2.4% of the faculty in four-year institutions in 1995, just under 2% of those with tenure, and only 1.3% of the full professors (NSF, 1999). Because of the crucial role that black faculty play in the recruitment and retention of black students, their severe underrepresentation among faculty has widespread implications at most postsecondary institutions (Blackwell, 1987, 1988).

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Factors at all stages of the educational pipeline have been blamed for the small and, in some fields, shrinking black doctoral labor supply and the relative scarcity of black faculty. Possible barriers include the public schools' failure to address the needs of minority children, inhospitable college campuses, a post-*Baake* retreat from recruiting black students for graduate programs, some states' recent abandonment of affirmative action in college and graduate admissions, and reductions in financial aid as the costs of graduate education escalate (Blackwell, 1988; Brazziel, 1988; Comer & Haynes, 1991). These barriers at early stages in the educational pipeline have also been linked to the subsequent underrepresentation of black faculty (Epps, 1989; Menges & Exum, 1983; Moore, 1988). But the very scarcity of black faculty has complicated efforts to collect representative data that would clarify how the academic labor market operates for black scholars. Until recently, many empirical studies of the impact of race on faculty careers have been limited to anecdotal evidence (e.g., Sutherland, 1990), or single disciplines (e.g., Kulis, 1992). As nationally representative studies have begun to appear, they increasingly disaggregate the data to contrast the status of black faculty across scholarly fields and institutional types (Astin, Antonio, Cress, & Astin, 1997; Russell & Fairweather, 1991; U.S. Department of Education, 1997). Detailed institutional and disciplinary breakdowns appear to be crucial in understanding black college faculty, because they are employed disproportionately in historically black institutions and two-year colleges and are concentrated in a few scholarly fields.

This article examines how black faculty careers are shaped by an interplay of disciplinary and labor supply forces at work within academic science and engineering. Specifically, we investigate whether, and how, the external labor market in academia affects the locations where black college faculty find employment in the sciences and engineering. After reviewing conceptual frameworks that describe stratification processes in academic labor markets, we consider evidence of important factors that influence where black academics secure work. By identifying factors that facilitate or impede the hiring and retention of black faculty, we hope to enhance our understanding of the status of racial equity in academia and inform debates about how to increase racial diversity in higher education.

### *Theoretical Perspectives on Academic Labor Markets*

Academic labor markets have been conceptualized as governed by three broad sets of factors (Breneman & Youn, 1988; Fairweather, 1995; Hansen, 1986; Winston, 1994). The first set views academia as increas-

ingly dominated by a national labor market for faculty, with institutions of all types and missions vying to attract scholars trained at prestigious research universities. Continuing scarcities of academic job opportunities may add momentum to the emerging national labor market by encouraging job applicants to be geographically mobile while searching for the most prestigious positions available nationwide. The second approach emphasizes how deeply internalized values and norms, often reflecting informal prestige and status hierarchies in academia, become institutionalized through graduate training and disciplinary cultures. These values ultimately shape the scholarly characteristics and behaviors that are desired and emulated by faculty, departments, and institutions. Differences in institutional mission become subordinated to the pull of these institutional forces (Blau, 1973; Fulton & Trow, 1974; Jencks & Reisman, 1968). Our approach is more in line with a third view, that institutions compete for faculty labor but within segmented markets. This more structural view of academic labor markets sees institutions operating within local, regional, and national markets simultaneously, each occupying positions of relative advantage or disadvantage to factors governing the supply, demand and competition for academic labor (Breneman & Youn, 1988). Previous research on external labor markets in academia has uncovered numerous macro-level influences on faculty careers, among them the number of postsecondary institutions in an area, which influences the density of opportunities for faculty hiring (Marwell, Rosenfeld, & Spilerman, 1979); the degree of competition among colleges and universities to hire potential faculty (Szafran, 1984); the proximity of hiring institutions to leading doctorate-producing graduate schools (McGinnis & Long, 1988); and regional differences in starting salaries (Turner, Myers, & Cresswell, 1999).

External labor market factors that may affect black faculty recruitment specifically include scarcities of black doctoral recipients, growth or contraction in demand for doctoral recipients within their fields of training, competition among institutions for their services, and the availability of more lucrative non-academic employment for those with advanced degrees in their field. Geography may play a critical role because of the regional and urban concentration of the black populace and of historically black colleges. Although the labor market for faculty is often assumed to be national in scope, a black scholar's decision to apply for and accept faculty positions may be influenced by desires to remain close to (or to return to) a community of origin and by lifestyle considerations that favor the presence of a sizable black community in the vicinity of the institution. The segmented labor market approach predicts that an institution will have more or less success in attracting and

retaining black faculty in particular scholarly specialties depending on the availability of black scholars within the field and the institution's position within the external market for black faculty labor.

This study extends the investigation of external labor markets to largely unexplored areas. Building on previous work that identified the size of the local black population and the regional location of an institution as strong predictors of the presence of black sociologists in academia (Kulis, 1992; Kulis & Shaw, 1996), we determine whether or not these arguments generalize to other disciplines and further delineate the ecological effects by examining the racial composition of localities as a factor affecting the recruitment and retention of black faculty. Unlike previous studies, we also closely gauge the labor supply of black doctoral recipients in specific fields and investigate whether this factor accounts for variations among disciplines in the representation of black faculty. Further, we distinguish purely disciplinary from labor supply effects by measuring African Americans' representation among doctoral recipients in the major subfields of science disciplines. Based on our findings, we conclude that the academic labor market is racially segmented by ecological factors and by field of training, but less so for more recently appointed faculty members.

### *External Labor Markets and Black Faculty*

#### *Doctoral Labor Supply*

The number and proportion of black doctoral recipients is arguably a powerful and immediate constraint on the hiring of black faculty, especially in fields where the supply is small and/or shrinking. The number of African Americans receiving graduate degrees increased dramatically in the 1970s, fell throughout the mid-1980s, then recovered and grew in the early 1990s (American Council on Education, 1994). The number of black doctoral recipients dropped sharply in the 1980s, by 22% overall and by 44% among black men (American Council on Education, 1989; Jackson, 1991). Despite such fluctuations, in recent decades the fraction of all graduate degrees awarded to African Americans has remained relatively steady, but at a level that is only one-third of their share of the population. African Americans comprised 4.2% of all graduate students in 1972 and 4% in 1984 (Blackwell, 1987) and still earned only 3.7% of all the doctorates awarded to U.S. citizens in 1992 (Bowen & Rudenshtine, 1992). Behind the unchanging pattern of severe black underrepresentation lies a major shift in gender composition. Black women's share of all black doctorates has grown steadily to about 60%, whereas men continue to predominate among doctoral recipients from other racial and

ethnic groups (American Council on Education, 1994). Moreover, during recent periods when the “pipeline” for black academics narrowed or stalled, doctorates awarded to Latinos and Asian Americans have increased appreciably (Mickelson & Oliver, 1991).

The reasons for these shifts have not been firmly established. The expansion in black graduate degrees in the 1970s followed the implementation of affirmative action programs, and the subsequent contraction coincided with the dismantling or reduction in federal student financial aid programs in the early 1980s. Blackwell (1987) suggests that the loss of black males in graduate school probably reflected a fallout much earlier in the educational pipeline, but Bowen and Rudenstine (1992) pinpoint the drop-off to the transition from college to graduate school. It may also be tied to shifts in the types of advanced degrees sought by black students, with more of them gravitating to relatively lucrative business, health, law, and engineering professions and away from the sciences and education.

Black students earning doctorates remain heavily concentrated in just a few fields, especially education, psychology, certain social sciences, and biology (NSF, 1988b, 1999; Sudarkasa, 1987). Education’s share of new doctorates awarded to black recipients remains quite large, even after shrinking from 59% in 1976 to 42% in 1995 (American Council on Education, 1994; NSF, 1999). Between 1985 and 1995 the number of black doctoral recipients in the sciences and engineering began to grow again, by 76% overall.<sup>1</sup> But with substantial corresponding increases among other racial groups as well, African Americans’ proportional representation in the entire pool of recipients barely budged, from 2.7% in 1985, to 2.4% in 1990, and 2.9% in 1995 (NSF, 1999). The entry of black scholars into many natural science fields still reflects acute problems of small numbers, both in proportional and absolute terms. Even in the early and mid-1990s, fewer than a dozen black PhDs graduated annually in the fields of physics/astronomy, geoscience, mathematics, and most branches of engineering. Of the 2,092 PhDs awarded in computer science throughout the 1980s, African Americans earned only 14, less than one percent.<sup>2</sup> These figures provide sobering support for the argument that African Americans’ underrepresentation on college faculties is foremost a problem of labor supply (Blackwell, 1988; Carter & Wilson, 1991; Thomas, 1992).

The constricted black doctoral pipeline has also fed a growing perception, mostly supported anecdotally, that scarcities of black doctoral recipients heighten competition to attract them to college faculties (Chandler, 1988; Mommsen, 1974). Some scholars view recruitment efforts directed at minority scholars as creating a form of “musical chairs,” as

institutions attempt to hire black faculty away from each other (Mooney, 1989). The perceived scarcity of black scholars is seen as enhancing their prospects for upward mobility to successively more prestigious institutions and perhaps to more desirable work and salary conditions. But it is unclear whether colleges and universities actively vie for black scholars in general or focus on luring away a small number of highly visible black scholars, just as white faculty "stars" are aggressively courted (Magner, 1990). Whatever advantages black scholars may enjoy due to their small labor supply, these advantages do not apply universally, nor do they compensate for other career disadvantages. Unemployment and underemployment rates among black scientists are higher than those of their white counterparts, and black scientists are more likely to be employed outside their fields of training. Among scientists and engineers with doctorates, African Americans also earn less than whites (NSF, 1988a, 1999). These findings suggest that supply factors alone cannot fully account for the underrepresentation and employment status of black scholars.

### *Fields in Demand*

Variations among fields in black faculty representation may also reflect differences in the extent to which fields are growing or contracting. Expanding scholarly fields present employers with more potential candidates for faculty jobs and increase the range of available expertise. It is unclear, however, whether more choices of faculty candidates would typically help or harm minority scholars' chances of securing employment. On the one hand, black scholars in fields in higher demand might enjoy better odds of being considered for, and securing, faculty jobs. Studies of occupational crowding find less opposition to the entrance of minorities and women in the workplace when jobs are plentiful and demand for labor is high (Baron & Newman, 1989). An expanding "pie" helps neutralize political resistance to the entrance of historically excluded groups, because minorities and women can be hired without compromising the numerical or proportional dominance of white men. In work settings that are downsized or stagnant, attempts to alter the composition of the workforce are more threatening to those in control. On the other hand, fields with an expanding number of doctoral recipients might exceed demand for their services and increase competition for available jobs. A key consideration here is that doctoral production within a field is not perfectly responsive to fluctuations in demand for doctoral labor (Ehrenberg, 1991). Rapidly expanding fields may simply expand opportunities for white men. Growth neither guarantees that minorities will get the jobs, nor that they will get the most desirable ones.

Growing fields may thus provide better entree to black scholars seeking entry-level or nontenure-track appointments without redressing racial inequities in tenure and promotion.

### *Employment Outside Academe*

The black academic labor supply is also subject to attrition in the move from graduate school to jobs in nonacademic sectors. At the same time that shrinking cohorts of black doctoral recipients decreased their availability in faculty applicant pools, interest in more lucrative nonacademic careers among minority doctoral recipients grew (Brazziel, 1988; Brown, 1988). Among other enticements, nonacademic employers often offer highly trained workers substantially higher salaries than those found in academia. Doctoral recipients are increasingly likely to seek and find employment outside academia, from around half in the mid-1970s to around two-thirds by the late 1980s (NSF, 1988b, 1999). Opportunities for nonacademic employment, however, are far more readily available in some fields of training than in others. Black doctoral recipients are generally concentrated in fields that offer fewer nonacademic employment options, such as education, social sciences, and biology (excluding health sciences), and are most sparsely represented in those with the most nonacademic job opportunities—and perhaps the most lucrative ones—physical sciences and engineering. In existing data that compare the employment sectors occupied by black versus white doctoral scientists and engineers, many fields are highly aggregated, and no one pattern dominates (NSF, 1999). In mathematics, computer science, the physical sciences, and engineering, black scientists and engineers work more often in colleges and universities than their white counterparts, but they work less often in academia than comparable whites do in the biological and social sciences (NSF, 1999). Their nonacademic alternatives also differ, with African Americans more concentrated in government jobs and less concentrated in business and industry than white counterparts working outside academia.

### *Race and Region*

Regional variations in the representation of black faculty can be expected for numerous reasons, most obviously because of the heavy concentration of the black population in the Southeast. This region might be both a major point of origination and destination for black doctoral recipients. Regional constraints also operate in the competition for academic jobs. There is considerably less geographic mobility from graduate school to first academic position than would be expected if academic jobs were filled from a nationwide pool of applicants that matches appli-

cants and departments according to the prestige of their doctoral credentials (Hargens, 1969; McGinnis & Long, 1988). Doctoral recipients take first positions disproportionately in proximity to the institution granting their degrees, and the migration that occurs is more longitudinal than latitudinal, perhaps reflecting moves up and down the east and west coasts. As black academics increasingly earn degrees from prestigious graduate schools, they might be drawn to positions nearby these schools, mostly located outside the Southeast, in the Boston to Washington corridor, Great Lakes region, and Pacific states.

Krieg (1993) detected a contrary trend of “return migration” to the South among highly educated black professionals. The magnitude of this trend remains unclear, however, and it is unknown whether it applies to black doctorate holders specifically. Although they do not track corresponding destinations, Turner, Myers and Creswell (1999) report that, compared to other regions, Midwestern states have been “exporting” higher proportions of their black doctoral recipients to jobs elsewhere. But they suggest that, rather than returning to an actual or figurative “home,” the source of the attraction to other regions is higher starting salaries for faculty outside the Midwest.

### *Historically Black Institutions*

The most potent historical force in higher education for African Americans—historically black institutions (HBIs)—is also closely associated with regional patterns. About three-fourths of the four-year HBIs are located in the Southeast, and most of the remainder are in states bordering that region.<sup>3</sup> HBIs have played a very large, although generally decreasing role in the postsecondary education of black Americans (Hill, 1985). In 1950, 90% of all the baccalaureate degrees earned by African Americans were awarded by HBIs, but that share declined to 29% in 1994 (American Council on Education, 1994; NSF, 1999). The direct role of HBIs in the graduate education of African Americans is even smaller, with HBIs granting less than 10% of all the doctorates awarded to African Americans between 1987 and 1991 (Ehrenberg & Rothstein, 1994). But the indirect role of HBIs in black graduate education remains quite substantial. HBIs were once the baccalaureate origins of most black professionals, granting more than two-thirds of the undergraduate degrees of black physicians, lawyers, and judges (Conyers & Epps, 1974; Jordan, 1975). Even with increasing numbers of black doctoral recipients earning graduate credentials at predominantly white schools, many still carry undergraduate degrees from HBIs with them (Blake, 1987; Leggon & Pearson, 1997; Solorzano, 1995). The proportion of black doctoral recipients with baccalaureate origins in HBIs has

declined from 72% in 1958 (Jay, 1971) to 40% in recent years (Ehrenberg & Rothstein, 1994). The decreases have been steeper among black doctoral scientists and engineers, from two-thirds having undergraduate degrees from HBIs in 1978 (Pearson and Pearson, 1985) to a third or less in the early 1990s (Ehrenberg & Rothstein, 1994).

The continuing viability of HBIs in African Americans' science education is apparent in substantial increases in the absolute number of degrees granted by HBIs in recent years, both at the baccalaureate and graduate levels and in science and engineering as well as other fields (NSF, 1999). Although only a third of HBIs offer graduate degrees and only six grant PhDs., their graduate enrollment in science and engineering graduate programs increased by one-third from 1985 to 1995, paralleling a 50% increase in the number of science and engineering baccalaureate degrees they granted (NSF, 1999). HBIs have long been viewed as providing crucial advantages and enhancing the educational outcomes of black students. Indeed, movement of more black students into predominantly white institutions and HBI's declining share of black baccalaureate degrees surfaced as a possible reason for the decline in black doctorates in the 1980s (Jackson, 1991). Compared to black undergraduates at predominantly white institutions, those at HBIs are more likely to graduate, have higher educational aspirations and more positive self images, and report feeling better adjusted socially, less alienated, and more satisfied with faculty involvement (Allen, W. A., 1987; Pascarella & Terenzini, 1991). Ehrenberg and Rothstein (1994), however, question whether the advantages that HBIs confer persist that strongly after graduation. They show that black students from HBIs enjoy neither higher salaries nor higher occupational prestige than their counterparts from non-HBIs, and they are no more likely to go on to earn advanced degrees. Among black students who do go on to graduate school, those with baccalaureates from HBIs are also less likely to receive doctorates from major research universities or selective liberal arts colleges (or later to secure faculty jobs in these institutions), and they are more likely to get their doctorates and first jobs from HBIs.

Ehrenberg and Rothstein (1994) point out that black undergraduates from HBIs may subsequently undertake graduate degrees and get faculty jobs in HBIs for numerous reasons that have not been sorted out: differences in ability and type of training compared with their non-HBI counterparts, inadequate recruitment of HBI undergraduates by graduate programs in major research universities, discrimination against black students, and a desire to continue their education and career in an environment supportive of minority concerns. Faculty at HBIs recognize their unique institutional setting and generally perceive it as advanta-

geous for their careers. Black faculty in HBIs report being attracted to better working conditions (e.g., longer probationary periods, more certain prospects of tenure, better salary), the special mission of the college, and a desire to assist African Americans (Harvey & Williams, 1989). They also experience significant isolation from white faculty in their localities and in their fields (Thompson, 1973) and less support for research and scholarly development (Diener, 1985). HBIs were the principal source of employment for black faculty until the 1970s (Freeman, 1976). Although some scholars suggested that HBIs experienced a "brain drain" as black faculty were lured away to white institutions (Mommson, 1973; Morris, 1972), Allen (1991) concluded that black faculty in HBIs actually received few job offers, that salary offers were not particularly enticing, and that a high proportion of the offers were from other HBIs. As with their contribution to black postsecondary degrees, the role of HBIs in black faculty employment has decreased but remains substantial, signaling a particularly salient form of segmentation in the academic labor market for African Americans. We address some of the unanswered questions about this unique segment of academia. First, to what extent do regional differences in the presence of black faculty stem from the location of so many HBIs in the Southeast and from states bordering that region? Second, how does the hiring of black faculty in HBIs compare to non-HBIs that are located in proximity to large black populations? Third, do HBIs continue to be a major career destination for more recent cohorts of black faculty as they have been for their predecessors?

### *Black Populations and Black Faculty*

A longstanding and widely accepted hypothesis in the race relations literature is that increases in the relative size of the black population exacerbate racial intolerance and discrimination by increasing whites' sense of economic threat (e.g., Allport, 1954; Blalock, 1967; Fossett & Kiecolt, 1989; Frisbie & Neidert, 1977; Pettigrew, 1957; Wilcox & Roof, 1978). The strength of this relationship varies by region and may be largely confined to the South (Giles, 1977). At the same time, large black communities can amass the political and economic influence to challenge the dominant power structure and improve economic prospects for resident African Americans (Eisinger 1982; Reich 1971), particularly in the public sector (Boyd, 1994). The presence of a sizable black local population might then induce black workers to relocate or remain in particular cities or counties. Even if whites are more intolerant of African Americans in areas like the South (Wilson, 1987), the effect on black migration may be mitigated by the presence of larger propor-

tions of black residents. Further, because residents of large urban areas are generally more tolerant of racial diversity than rural residents (Jackman, 1978), African Americans may find cities with large black populations particularly desirable, independent of their proportional share of the local population.

As the black population of the United States has become more concentrated in metropolitan areas outside the South, opportunities for black faculty to take up positions in proximity to large black populations have expanded in recent decades. However, decisions to locate or remain in these areas will be conditioned by the realities of increasing residential segregation by race in most metropolitan areas. Massey and Denton (1988) find that residential assimilation is only a viable option for African Americans in the upper middle class or for those with both high education and income. Moreover, when African Americans do move to the suburbs, segregation is reduced, but it remains quite high compared to other minority groups, particularly in metropolitan areas with large black populations. Although black segregation shows considerable persistence from city to suburb, the most promising evidence of black suburbanization and residential integration comes from smaller cities in the West containing relatively few African Americans, proportionally (Massey & Denton, 1988). Although the economic and educational resources of black faculty enhance their residential options, trends for African Americans overall suggest that their residential movements are disproportionately toward large cities with large black populations and, increasingly, toward black suburbs (Frey, 1992; O'Hare & Frey, 1992).

The salience of the relative and absolute size of the black population might be heightened by the social psychology of "tokenism," a situation faced by many black professionals. Individuals who are the sole or one of very few representatives of a minority group have been found to be subject to extreme performance pressures at work. The majority group tends to have polarized expectations and a heightened awareness of token co-workers and scrutinizes their performance unusually closely (Kanter, 1977). Tokenism also exaggerates the perception and salience of individual characteristics that are consistent with stereotypes of the minority group (Pettigrew & Martin, 1987). When African Americans are tokens in predominantly white settings, as they are in many college departments, assumptions of incompetence (Heilman & Herhily, 1984) and personal dissimilarity (Kanter, 1977) can negatively impact performance (Rosenthal & Rosnow, 1969). The ambivalence that results from treatment as a token may lead to career choices aimed at avoiding these negative social psychological experiences (Pettigrew & Martin, 1987). The paucity of African Americans in many doctoral programs and acad-

emic departments raises the possibility that the negative consequences of token status are amplified as black academics proceed along a career path. Thus, certain regions of the country and cities with sizable black populations may be more desirable career destinations for black faculty, because token status can be minimized in social situations and professional arenas.

### *Disciplinary Cultures*

Another way that the academic labor market may be segmented is along disciplinary lines. Differences in the cultures of scholarly fields (Becher, 1989; Knorr-Cetina, 1981; Kunda, 1992) may affect the integration of racial minorities and women and moderate the impact of other external labor market forces. Variations across disciplines in the representation of black faculty may simply mirror differences in their production of black doctoral recipients, fluctuations in demand for doctoral level labor across fields, or differences in the availability of nonacademic employment. The racial composition of various fields may also be differentially affected by geographic constraints on the location of black faculty and the geographic availability of faculty openings. After accounting for these other external labor market factors, will differences among fields in the representation of black faculty disappear, attenuate, or rearrange in new patterns? Which scholarly disciplines appear able to attract and retain higher proportions of their black doctoral recipients within faculty positions? Persisting disciplinary patterns may suggest areas of specialization within the academic labor market that are most, and least, attractive to prospective black faculty members and identify disciplines that are relatively more successful in nurturing the educational and career progress of black scholars.

### *Individual and Institutional Level Factors*

In addition to macro-level external labor market factors, racial differences in the distribution of college faculty may reflect forces operating at the institutional and individual level: differences in the mission, goals, and structure of postsecondary institutions and differences in the educational background of scholars of different races. Three particularly pertinent factors have been documented in prior research: differences in institutional type (research, doctoral, comprehensive, liberal arts), the scholarly reputation of the faculty members' doctoral credentials, and the amount of work experience beyond the doctorate. Studies have noted that black scholars typically have doctoral degrees and faculty positions from less prestigious institutions and have been relatively excluded from informal scholarship and research networks (Bacon, 1974; Caplow &

McGee, 1958; Exum, 1983; U.S. Department of Education, 1997). Expectations that black candidates will be unable to enhance an institution's prestige and research eminence may play a major role in racial patterns in hiring. Search processes that depend on recommendations from eminent professors and the reputation of doctoral programs place black PhDs at relative disadvantage in the academic job market (Mickelson & Oliver, 1991). Although we do not attempt here to determine whether this kind of "statistical discrimination" takes place, we do address whether racial patterns in the placement of postsecondary faculty persist after controlling for the prestige accorded to the departments that granted their doctorates. We also control for differences in the work experience accumulated by black and white scholars, which has implications for their career stages and progress toward tenured positions.

### *Methodology*

Our analysis is based principally on a subset of respondents to the 1989 Survey of Doctoral Recipients (SDR). This representative survey of the U.S. doctoral-level labor force has been conducted biennially since 1973 for the National Science Foundation and other federal agencies. The SDR profiles the academic careers of doctorate holders in detail, with large oversamples of minorities. Each two-year wave of the SDR adjusts the original sampling frame by adding new doctoral recipients (drawing upon data from the annual Survey of Earned Doctorates) and dropping those who received the doctorate more than 42 years earlier. The SDR sample is stratified by field and year of the degree, by sex, race/ethnicity, and citizenship. We use only the science and engineering portion of the 1989 SDR, and only those employed as full-time or part-time faculty members in four-year colleges or universities in 15 fields: agriculture, anthropology/archeology, biology, chemistry, computer science, geosciences (geological, marine, and atmospheric), economics, engineering, health sciences (mostly audiology, speech pathology, epidemiology, and public health), mathematics, physics/astronomy, political science, psychology, sociology, and a collection of applied social science fields that we group together (area studies, communications, criminology, demography, public affairs, urban studies). Because of small numbers of black respondents in the SDR within some fields, we also group together certain allied disciplines in results that contrast the representation of black scholars across fields. One grouping combines the physical (physics/astronomy, chemistry) and geosciences, and another joins mathematics and computer science. All results in this article are weighted to correct for the SDR's oversampling of minorities and

women, reflecting the 1989 U.S. population of science and engineering doctoral-level faculty in four-year colleges and universities.

In our analysis the individual-level SDR faculty data have been matched with external labor market characteristics of their employing institutions, fields of training, and their doctoral origins. Matched geographic information includes regional location—whether the faculty member's institution is located in a Southern state (a dummy variable)—and two measures of the presence of black residents in the local area—the number of African Americans (in thousands) and the percentage of black residents in the 1990 Census. For institutions located in a Standard Metropolitan Statistical Area, or within 25 miles of one, we use local population figures for the SMSA. For institutions located farther outside SMSA boundaries, county figures are used as measures of local populations. In instances where SMSAs are parts of larger Consolidated Metropolitan Statistical Areas, we record black population figures for the constituent MSA only. To obtain a better fit in multivariate analyses, we transform the variable gauging the absolute size of the local black population by taking the natural log of the number of thousand black residents. Faculty employed in historically black colleges or universities are contrasted with all others through the use of a dummy variable (Hill, 1985).

Measures of the labor supply of black doctoral recipients have also been matched to each faculty member's SDR data record, using data from the Survey of Earned Doctorates (SED), an annual compilation of information about all new doctoral recipients in the United States. From multiple annual waves of the SED we calculate the percentage of black doctoral recipients among all doctoral recipients within each SDR faculty member's scientific field or subfield over the period from 1976 through 1988. In many science and engineering disciplines the representation of black doctoral recipients varies sharply from one subfield to another. To account for this variation we calculate subfield breakdowns of the black doctoral labor supply within agriculture, biology, chemistry, earth/environmental sciences, engineering, health sciences, physics/astronomy, and psychology. The initial group of 15 fields is thus further divided into 51 subfields. For example, we distinguish the racial composition of clinical psychology from that of experimental psychology, as well as chemical engineering from industrial engineering, and botany from zoology. Other examples of subfield breakdowns include soil science versus forestry in agriculture, physics versus astronomy, organic versus inorganic chemistry, geology versus marine sciences, algebra versus probability/statistics, and epidemiology versus speech pathology in the health sciences. Except for psychology, faculty in the social sciences are not broken down by subfield, because these breakdowns are

not reported in the SED data, reflecting less well established subfield boundaries. Faculty working in "applied social science" fields are assigned the racial composition for doctoral recipients in their own field (communications, demography, etc.). We also employ a measure of nonacademic employment opportunity (the percentage of doctoral level workers employed outside academia in each of the 15 fields), based on published estimates using SDR data (National Science Foundation 1988b) and U.S. Census data on doctoral level scientists (Bellas, 1994).

Several aspects of our analytical approach are unusual or unique in studies of academic labor markets and of minority faculty, especially the use of matched geographic and doctoral labor supply contextual data. The matched data sources (1990 U.S. Census and multiple SED waves) constitute censuses rather than samples. By using SED data for 12 years immediately preceding the collection of the SDR faculty data, annual fluctuations in the small number of black doctoral recipients are smoothed out, and the resulting labor supply measure mirrors labor market conditions for faculty at different career stages. Another advantage of the virtually complete SED data is that measures of the black doctoral labor supply are reliable even within the subfields of major disciplines. The SDR data on individual faculty to which they are matched, however, come from a sample that, although large, has certain limitations. The 1989 SDR has a respectable 55% response rate to a mail questionnaire with two follow-ups, comparable to other national samples of college faculty (U.S. Department of Education, 1997). The oversampling of minority doctoral recipients helps ensure that they are represented in substantial or, at least, reflective numbers within every major science and engineering discipline. The size and representativeness of the SDR sample also ensures that it encompasses the full range of baccalaureate-granting institutions. Although the SDR is not stratified by type of employer, the respondents in our analysis work in a large heterogeneous array of colleges and universities, encompassing 1,125 of the nation's 1,378 baccalaureate-granting institutions (Carnegie Foundation for the Advancement of Teaching, 1987).<sup>4</sup> Still, the sample we use systematically excludes large portions of black faculty in academia, including those in two-year institutions, those earning their highest degree in fields outside science and engineering, and those without a doctorate. Compared to the parts we examine, many of the excluded corners of the academic labor market are those where black faculty are somewhat better represented (U.S. Department of Education, 1997). These limitations need to be remembered to assess the applicability of our findings to the academic labor market overall.

Our analysis strategy begins with aggregate comparisons by field of

the representation of black scholars in the doctoral labor supply, among entry-level and more senior faculty, by region, and by the racial composition of local communities. We also examine racial differences in age, work experience, and career attainment by field, again using aggregate comparisons. We conclude with a test at the individual level of analysis of various multivariate models that predict the institutional and geographic locations of black faculty. Here we attempt to clarify the individual and collective roles of various external labor market factors on the racial distribution of faculty and control for possible racial differences in individual educational and career backgrounds.

**Results**

In the 12 years before 1989, less than 2% of the doctorates awarded in the natural sciences, mathematics, computer science, and engineering went to black recipients, and only about 4% in the health, social and behavioral sciences (Figure 1). Black underrepresentation is typically even more pronounced among SDR faculty, especially among those with tenure. In all fields except biology, black scholars are less well represented among tenured faculty than among the field's doctoral recipients, often by a substantial margin. In many fields, black faculty are also more poorly represented in untenured faculty roles than in the doctoral supply.

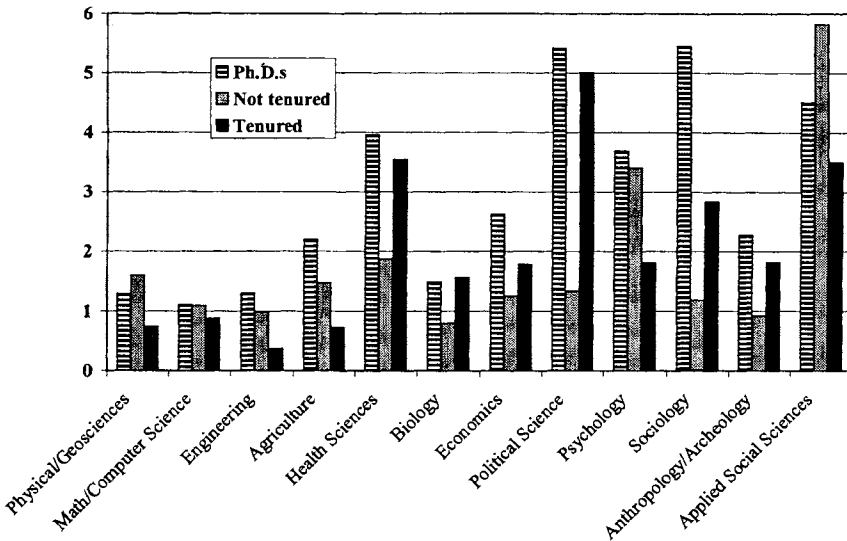


FIG. 1. Percent Black Among Doctoral Recipients and Faculty by Field and Tenure

However, in half of the fields, black faculty are represented at slightly higher levels among untenured faculty than in the doctoral pools. The severity of these discrepancies between faculty and doctoral recipient representation does not line up neatly along the divide between natural and social sciences, or between pure and applied fields (Figure 2). For example, the disciplines where black faculty appear slightly better represented in untenured faculty positions, proportionally, than in the doctoral supply include the physical/geosciences (mostly a reflection of trends in chemistry), engineering, and applied social sciences. Relative to their doctoral labor supply, black faculty appear most severely underrepresented in sociology and political science, science fields with the highest proportion of black doctorates. There is also great variability within clusters of allied fields. Among the life sciences black scholars are represented at similar levels among faculty and doctoral recipients in both an applied (health sciences) and a pure (biology) field, but in agriculture black faculty are acutely underrepresented. Despite these variations and the very modest size of most of the discrepancies, an overall pattern remains: although black faculty are somewhat overrepresented in untenured faculty positions in some disciplines, they are almost always at least as severely underrepresented in tenured positions.

To some degree, the acute absence of black faculty in tenured positions reflects the fact that they are often at earlier stages of their careers

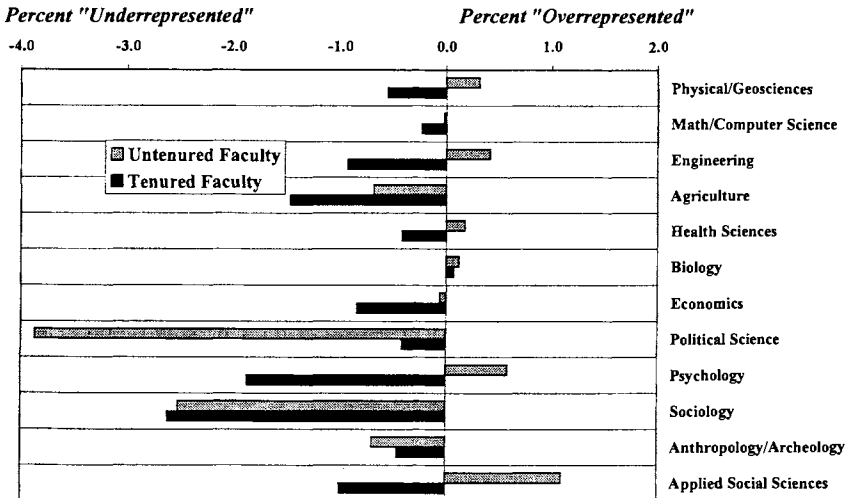


FIG. 2. Difference Between Percent Black Among Faculty and Doctoral Recipients by Field and Tenure

than their white counterparts. Black scientists and engineers in the SDR have an average of four and a half fewer years of post-PhD experience and are one and a half years younger than white scientists overall (Table 1). The racial experience gap is particularly large in some of the natural sciences (agriculture and the physical/geosciences) and in engineering. Although most fields also have a corresponding racial age gap, it is generally much narrower than the post-PhD experience gap. That is an indication that black PhDs either enter doctoral programs at later ages and/or take longer to complete degrees than their white counterparts. In fact, in some fields where black faculty have significantly less work experience—health sciences, mathematics/computer science, and political science—they are older on average than their white counterparts, although not significantly so. Also, in the two fields where black faculty are significantly older than whites—biology and economics—they do not have significantly more work experience. Fewer years of work expe-

TABLE 1  
Means for Selected Variables, by Discipline and Race

Field	Race	<i>N</i>	Age	Years Beyond PhD	Academic Rank <sup>a</sup>
Physical & Geosciences <sup>b</sup>	Black	59	41.6***	10.6***	1.80***
	White	2327	47.6	17.7	2.13
Mathematics & Computer Science	Black	47	47.1	12.2***	2.13
	White	1631	46.4	16.0	2.13
Engineering	Black	32	43.2***	10.0***	1.92***
	White	1032	48.1	16.7	2.23
Agricultural Science	Black	24	41.0***	7.4***	1.70***
	White	749	47.5	16.3	2.15
Health Sciences	Black	80	48.5	9.70***	2.03
	White	822	47.3	12.3	1.92
Life Science	Black	91	49.0***	14.8	2.08
	White	1893	46.4	15.6	1.99
Economics	Black	16	50.6***	16.7	2.39**
	White	345	47.6	15.8	2.19
Political Science	Black	27	49.2	14.2***	2.29
	White	285	48.6	16.0	2.23
Psychology	Black	112	43.7***	10.4***	1.44***
	White	968	47.0	15.4	2.09
Sociology	Black	39	48.4	12.3***	2.01
	White	312	48.6	15.0	2.14
Anthropology/ Archeology	Black	12	43.5**	8.6***	1.68*
	White	183	47.2	14.4	2.02
Applied Social Sciences	Black	95	44.6***	8.5***	1.75***
	White	649	47.7	13.7	2.03
<i>All Disciplines</i>	Black	634	45.8***	11.4***	1.90***
	White	11205	47.4	15.9	2.11

<sup>a</sup>Coding of academic rank: Full Professors = 3, Associate = 2, Assistant = 1, Others = 0.

<sup>b</sup>Includes physics, astronomy, chemistry, earth, environmental, atmospheric, and marine sciences.

Significant difference between means for African Americans and whites at \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

rience can translate into less time in faculty positions and less progress up the ladder of academic rank. Black faculty lag significantly behind white counterparts in academic rank only in fields where they have at least 5 years less work experience on average. Conversely, in fields where the racial gap in experience is widest—agriculture, physical/geosciences, engineering, anthropology/archeology, applied social science, and psychology—there is a significant gap in academic rank, with black faculty members falling a third or more of a step in rank below their white colleagues, on average. A number of fields with significant, although smaller, racial gaps in experience do not have significant racial gaps in rank: mathematics/computer science, health sciences, political science and, sociology. Economics stands apart as the only field where black faculty occupy a higher average rank than their white colleagues, but they are also generally older as well.

Another powerful factor in the severe underrepresentation of black faculty is their geographic distribution (Figure 3). When SDR faculty are sorted by region and by the absolute and proportional size of the local black population, it is clear that black scientists are more likely to be found in the Southeast and mid-Atlantic states and in cities or counties with sizable black populations. The range of black faculty representation across regions is confined to a very narrow band, but varies significantly from less than 1% of the science and engineering faculty in Rocky Mountain states, to more than 3% in the Southeast. But much of the concentration of the black population in the Southeast appears to be a function of their employment in historically black institutions. When results are restricted to non-HBI faculty, as indicated by the striped bars in Figure 2, black faculty appear about as numerous, proportionally, in the mid-Atlantic, Great Lakes, and Pacific states as in the Southeast. Even in non-HBIs, however, black faculty remain much better represented in areas with larger numbers and proportions of black residents.<sup>5</sup> Black faculty are extremely scarce—one in every 200—in areas with small black populations, whether defined in absolute (less than 10,000 black residents) or proportional terms (less than 3% black).

Table 2 examines the joint contribution of these disparate factors—disciplinary, labor supply, geographic, and individual career attainments—to the locations of black scientists and engineers in academia. A series of multivariate logistic regression equations estimates the odds that the occupant of a particular faculty position is African American,<sup>6</sup> based on the disciplinary field of the position and the location of the employer. In the first equation fields are distinguished as dummy variables with biology as the omitted reference group. As previously seen in Figure 1, the disciplines divide along a natural science-social science con-

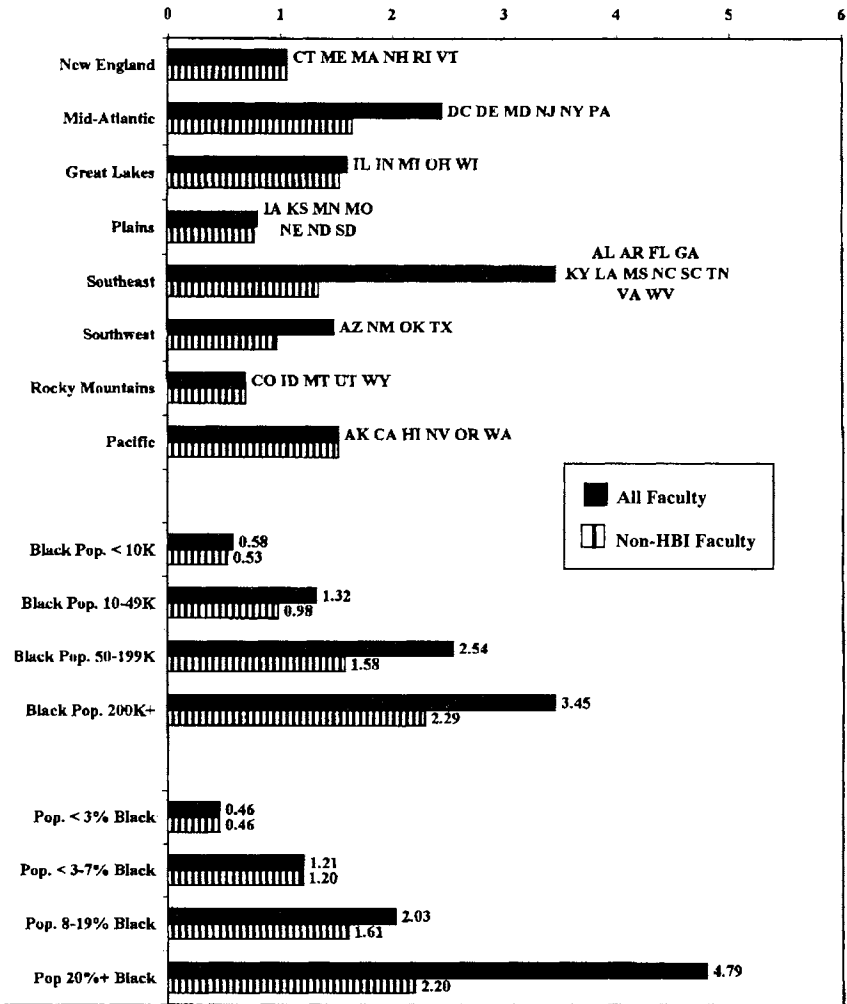


FIG. 3. Percent Black Among Faculty by Region and the Absolute and Proportional Size of the Local Black Population

tinuum, with physical/geosciences, mathematics/computer science, engineering, and agriculture generally less likely than biology to have black faculty, as indicated by odds ratios below 1.0, and the social sciences typically more likely. The second equation then controls for the proportional representation of African Americans among the field's or subfield's doctoral recipients in the previous 12 years. This equation suggests how much the labor supply of black doctoral recipients constrains their representation on college faculties. The odds ratio indicates that each 1% increase in the black doctoral labor supply improves the

TABLE 2

Logistic Regression Predicting Whether Faculty Member is Black (odds coefficients)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Excluding HBIs	Untenured Faculty	Tenured Faculty
Physical & Geosciences	0.679 ***	0.784 **	0.767 **	0.771 **	0.893	0.889	0.907	1.021	1.023	0.775
Mathematics/Computer Sci.	0.603 ***	0.577 ***	0.711 ***	0.700 ***	0.885	0.787 *	0.686 ***	0.642 ***	0.598 ***	0.814
Engineering	0.547 ***	0.589 ***	0.542 ***	0.544 ***	0.684 ***	0.702 **	0.679 ***	0.779 *	1.055	0.327 ***
Agriculture	0.634 ***	0.538 ***	0.553 ***	0.488 ***	0.527 ***	0.686 **	0.623 ***	0.780	0.623 **	0.679 *
Health Sciences	2.469 ***	1.563 ***	-1.615 ***	1.576 ***	2.187 ***	1.892 ***	1.616 ***	1.854 ***	1.475 **	1.837 ***
Economics	1.293 **	1.024	1.292 **	1.272 *	1.445 ***	1.241 *	1.217	1.369 *	1.599 **	1.054
Political Science	2.586 ***	1.079	1.589 ***	1.478 ***	1.514 ***	1.439 **	1.239	1.280	0.474 ***	1.566 **
Psychology	1.755 ***	1.080	1.120	1.174	1.533 ***	1.411 ***	1.338 **	1.457 ***	1.725 ***	0.977
Sociology	1.832 ***	0.755 **	1.098	1.186	1.469 ***	1.404 **	1.227	1.612 ***	0.975	1.495 *
Anthropology/Archeology	1.096	0.925	1.106	1.273	1.916 ***	1.774 ***	1.648 ***	2.061 ***	1.088	2.406 ***
Applied Social Sciences	1.027 ***	1.280 **	1.547 ***	1.623 ***	1.767 ***	1.533 ***	1.312 **	1.737 ***	1.599 ***	1.139
% Black: 1976-88 PhDs		1.264 ***	1.228 ***	1.227 ***	1.198 ***	1.202 ***	1.213 ***	1.228 ***	1.236 ***	1.186 ***
% Change: # PhDs 1976-88			1.004 ***	1.005 ***	1.005 ***	1.005 ***	1.003 ***	1.002 **	1.002 **	1.004 ***
% in Nonacademic Job			1.004	1.004	1.005	1.002	1.003	1.008 **	1.006	1.001
South <sup>a</sup>			2.589 ***	2.589 ***	1.056	0.873 **	0.844 **	0.872 *	0.423 ***	1.359 ***
Historically Black Institution					60.016 ***	44.687 ***	42.552 ***		48.712 ***	39.412 ***
Local Population: % Black					1.013 ***	1.013 ***	1.013 ***	1.001	1.041 ***	1.002
Local Black Population (LN)					1.233 ***	1.233 ***	1.233 ***	1.270 ***	1.106 ***	1.323 ***
Research I, II					1.318 ***	1.614 ***	1.409 **	1.614 ***	1.409 **	1.536 ***
Doctoral I, II					1.252 *	1.565 ***	1.440 **	1.565 ***	1.440 **	1.233
Comprehensive I, II					1.352 ***	1.838 ***	1.192	1.352 ***	1.192	1.679 ***
R's Doctoral Program Rating					0.922 ***	0.878 ***	0.875 ***	0.922 ***	0.875 ***	0.960 *
Post-PhD Work Experience					0.955 ***	0.958 ***	0.955 ***	0.958 ***	0.975 ***	0.944 ***
Log Likelihood $\chi^2$ (d.f.)	1171 (11)	1547 (12)	163 (14)	2553 [15]	7308 (16)	8020 (18)	8489 (23)	2253 (23)	2989 (23)	5767 (23)
Pseudo $R^2$ ( $\gamma$ )	0.39	0.43	0.40	0.54	0.67	0.67	0.71	0.56	0.64	0.74
N	13101	13101	13101	13101	13101	13101	13101	12781	5877	7224

\*  $p < 0.05$ . \*\*  $p < 0.01$ . \*\*\*  $p < 0.001$ .<sup>a</sup>Southern states defined as AL, AR, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV

odds that a black faculty member holds the position by about 26%. Net of the effect of doctoral labor supply, however, the most pronounced disciplinary variations no longer conform to the natural versus social science divide. The physical/geosciences, mathematics/computer science, engineering, and agriculture retain their positions as the fields least likely to have black faculty compared to biology, even after adjusting for their smaller supplies of black doctoral recipients. But after adjusting for the doctoral labor supply, most of the social sciences are no longer distinguishable from biology, and odds of a black faculty appointment in sociology drop significantly below those in biology. Moreover, independent of the black doctoral labor supply, two applied fields emerge as most likely to employ black faculty: health sciences and applied social sciences. This suggests that certain fields are more successful than others in drawing their black doctoral recipients into faculty positions.

The remaining equations in Table 2 gauge the extent to which black faculty are more or less likely to be found in growing fields, in those with more nonacademic job opportunities, and in different geographic locations. The third equation shows that black faculty are slightly more likely to be found in fields and subfields where the number of PhDs is expanding, and in fields where proportionally more PhD recipients take nonacademic jobs. These factors add very little in predicting where black scientists get academic jobs, but they do change some of the disciplinary patterns. When we control for expansion and contraction of the PhD pool, sociology is once again indistinguishable from biology. Controlling for nonacademic job opportunities increases the coefficients for economics and political science to a level of statistical significance.

Regional patterns are modeled in the fourth equation, which distinguishes all other regions from the South, an area encompassing the Southeastern states from Figure 3 as well as neighboring states with sizable black populations: Delaware, Maryland, Oklahoma, and Texas. The tremendous concentration of black faculty in the South is reflected in the very large odds coefficient showing that faculty positions in Southern colleges and universities are about 2.5 times more likely to be held by African Americans than those in other regions. Except for small increases in the size of the coefficients for psychology and anthropology/archeology, controlling for region leaves other effects virtually unchanged. The fifth equation demonstrates that the Southern advantage in employing black faculty is due largely to the presence of historically black institutions in the region. Of the 61 HBIs employing faculty in our sample, 44 are in Southeastern states, 7 in the mid-Atlantic, 6 in the Southwest (5 in Texas), 3 in the Great Lakes, and 1 in a Plains state. After controlling for whether or not a position is within an HBI, the

South is no longer distinguishable from other regions in predicting the locations of black faculty. The sixth equation shows that the odds that black faculty hold appointments increase with both the proportional and absolute size of the local black population. Those odds go up by only 1% for each 1% increase in the black community's share of local population, and by nearly a quarter with each exponential jump in the absolute number of black residents, from 20 to 50 to 150 to 400 thousand. Moreover, after controlling for black population size, the South has *lower* odds than other regions of having African Americans in faculty positions.

The seventh equation controls for institution type and for individual career backgrounds. Research I and II universities, other doctoral-granting institutions, and comprehensive institutions granting master's degrees are all more likely to have black scientists and engineers in faculty positions than liberal arts colleges, the omitted reference category.<sup>7</sup> And here the improvement in odds is substantial, by a factor of a quarter to a third. The last two predictors control for the tendency of black faculty to have earned degrees from less prestigious doctoral programs and to have less work experience beyond the doctorate than their white counterparts.<sup>8</sup> However, none of these institutional and individual controls changes the basic pattern of results from the previous equations. That is an indication that the distinctive disciplinary, labor market, and geographic locations of black faculty are not due to their employment in particular kinds of institutions or to their career preparation and background. Our results also remain essentially the same when we control for other institutional variables not presented here, such as sponsorship (public, private, religious), size (number of faculty), student enrollment, the share of revenues from endowed sources, and external research funding.

The last three equations of Table 3 are restricted to certain subgroups of faculty: those not in historically black institutions, those without tenure, and those in tenured positions. The first of these demonstrates that our results are not due to unique cultures or special institutional arrangements that characterize HBIs. When all faculty employed in historically black institutions are excluded from results, the pattern of effects is nearly identical to the previous equation that included them. One small effect—of the local black population's proportional size—drops to insignificance, as does the differentiation of agriculture from biology. But clearly the pattern of disciplinary and geographic effects is in the same general direction and magnitude in non-HBIs as for all institutions combined.

The final two equations, however, show that there are sharp differences in effects as well as some marked similarities for untenured and

tenured faculty. Because small numbers prohibit an estimation of the equations for nontenure-track faculty alone, they are combined here with tenure-track faculty into an untenured group. Among the similar effects for both those with and without tenure, several are noteworthy. There are much better odds of finding tenured and untenured black faculty in the health sciences than in biology, and much lower odds in agriculture, net of all other effects. Better black representation in the field's doctoral labor pool also contributes to better faculty representation in tenured and untenured positions, although more strongly for untenured jobs. Black faculty representation among both the tenured and untenured is also slightly higher within expanding fields, and it is dramatically higher in HBIs. Certain other factors, however, distinguish the separate locations of black faculty in untenured and tenured positions. In the social sciences black faculty are relatively more of a presence among tenured faculty in political science, sociology, and anthropology/archeology, whereas among the untenured they are found more often in economics, psychology, and applied social sciences. Among the tenured, black faculty are most severely underrepresented in engineering, whereas among the untenured they are scarcest in political science and mathematics/computer science.

The geographic locations of untenured and tenured black faculty differ as well. Controlling for HBI status and the size of the local black population, black faculty are much more likely to be found in tenured positions in the South than in other regions, but they are more likely to occupy untenured positions in regions outside the South.<sup>9</sup> Tenured black faculty are also found much more commonly in localities with very large black populations, but, net of this effect, the proportional representation of black residents is not a significant factor. Untenured black faculty, however, are found more often in areas with higher absolute and proportional numbers of black residents.

### *Discussion*

The places where black scholars ultimately find employment are determined by a complex mix of individual choices and opportunities across a long educational and occupational pipeline, by institutional and organizational structures and priorities in academia (Kulis & Shaw, 1996; Kulis, Chong, & Shaw, 1999), and by the external labor market forces that are the focus here. Black faculty may locate in an institution because of the recruiting efforts and working conditions of the employers they consider, because they were born or educated nearby, or because the area suits their family, lifestyle, or ideology. African Americans ne-

gotiate complex issues of racial identity and acculturation in making these choices, guided by subtle signs that they are welcome or not (Mickelson & Oliver, 1991; Pettigrew & Martin, 1987). Although we have no direct evidence how black scholars weigh these considerations, findings in this article suggest that their career choices are shaped by external market forces. Without examining longitudinal data on individual choices of specialties, graduate schools, type of employment (e.g., academic, government, industry), and employer locations, we can only infer the processes that underlie the racial distributions we document in this article. With our data it is also difficult to determine precisely whether the locations of black faculty are the same for those starting new careers as for those who entered the academic labor market decades ago. Some inferences can be made, however, by examining how our models operate differently for faculty with and without tenure. Most untenured black faculty in our sample are relatively new to the professoriate, with an average of six years of postdoctoral work experience, whereas most of the tenured black faculty have at least a decade more experience beyond the doctorate. To conclude, we highlight major findings and their limitations, raise possible explanations for them, and suggest some policy implications.

Efforts by government agencies and disciplinary societies to increase the number of African Americans receiving doctoral degrees seem well placed in light of our finding that black faculty appointments are closely linked to black representation among doctoral recipients in the same field or subfield. According to our estimates, small increases in the black doctoral labor supply would substantially enlarge the presence of black faculty on college campuses. Holding other factors constant, the representation of black faculty members would double if the black share of earned doctorates increased by 2.5%. This seemingly modest goal will not be easily attained, however, given current trends in doctoral production, nor would its attainment guarantee that black faculty would be better represented in all disciplines, types of faculty positions, institutions, localities, and regions. Beyond the constraints of the small black doctoral labor supply, our results show that black and white faculty move within somewhat different segments of the academic labor market.

Black science and engineering faculty remain regionally concentrated in Southern states for several reasons. Most historically black institutions are located there, and a substantial fraction of black faculty are still employed by HBIs. Indeed, in the Southeast a large majority (63%) of black faculty in our sample are in HBIs, compared to only 2% of white faculty in the same region. In addition, black residents are better represented in both proportional and absolute numbers in Southeastern local-

ities than in most other areas of the country. Regional locations are sharply different for black faculty at different career stages, however. Our results show that after controlling for the locations of HBIs across regions, *untenured* black faculty are no more likely to be employed in the South than in other regions, and after further controlling for the size of the local black population, they are more than twice as likely to be found in other regions than in the South. In essence this means that non-HBIs in the South are no more or less likely to have untenured black faculty than non-HBIs in other regions. But untenured black faculty are actually more likely to be found in localities outside the South with large black populations than in Southern locales with black populations of the same size.<sup>10</sup> *Tenured* black faculty still remain disproportionately concentrated in the South even after controlling for the locations of HBIs and holding constant the size of local black populations. This may be a sign that career destinations of black academics have changed substantially for newer cohorts. If there is a trend toward "return migration" of younger black scholars to the South it seems to be contrary to much stronger movements into regions outside the South. It is also possible that the different regional patterns for tenured and untenured black faculty are at least partly due to fewer obstacles to obtaining tenure in Southern institutions, or even to regional differences in academic salaries (Turner, Myers, & Cresswell, 1999).

Although both untenured and tenured black faculty are still far more likely to be found at HBIs than non-HBIs, HBIs have become a less common career destination as barriers to employment in predominantly white institutions have weakened. Prospects for social as well as professional interaction with other African Americans are no longer restricted to areas with HBIs, but our results indicate that black faculty continue to be especially likely to secure positions where social ties to other African Americans can be readily established and maintained, in areas with sizable black populations. Although we do not know if black faculty are remaining near or are migrating to these areas, black communities appear to be crucial in career decisions that increasingly lead black faculty to accept minority status in mostly white academic units in exchange for greater professional opportunities. For untenured black faculty, both the size and proportion of the local black population seem to be pertinent considerations. For those with and without tenure, however, absolute size has more impact than proportional size. A very large black population may be important because it helps ensure that prospective black faculty members can locate a viable black middle class in the area. Although our data do not indicate why black faculty move to or remain in these areas, they suggest that institutions that are not in proximity to

large black communities face significant challenges in recruiting black faculty.

Unlike studies of college faculty that find little variation in the representation of African Americans by groups of fields or organizational types (U.S. Department of Education, 1997; Russell & Fairweather, 1991), we detect appreciable differences by scientific field and institutional type. These differences, which may only be apparent when fields are left distinct rather than grouped into broad categories, provide additional clues to the processes through which black faculty enter mostly white institutions. On first examination the presence of African Americans on the faculty seems to mirror their presence among doctoral recipients; they are relatively more numerous in the social sciences than in the natural sciences and engineering. Some of the largest disciplinary variations disappear after controlling for each field's or subfield's black doctoral supply, but others then emerge, and these fail to line up neatly along a natural science—social science continuum. After further controlling for other labor market factors, the health sciences emerge as fields that have much higher odds of employing black doctoral recipients in faculty positions, whereas agriculture, engineering, and math/computer science have especially low odds. Is there something distinctive about the fields that stand at the extremes of our findings?

The health sciences may be unusual because they are centered in medical school environments that have been at the vortex of legal and social controversies over affirmative action. The intense scrutiny surrounding medical school admissions over the last 25 years has perhaps generated a higher level of awareness of the presence of discrimination and more determined support for its elimination. At the same time, vigorous and successful application of affirmative action has dramatically diversified the racial composition of medical students. It may also have transformed medical school culture in ways that have affected faculty employment. Another unusual factor is that, unlike most other sectors of academia, medical school faculties expanded between 1980 and 1990, providing far more opportunities to incorporate newcomers than other fields (Association of American Medical Colleges, 1992). It is unlikely that the results are due to racial differences in career paths that might lead more white than black doctoral recipients in the health sciences to opt for higher-paying nonacademic employment, because we control for this labor market factor.

At the other extreme, what explains the relatively poor rate at which African Americans with doctoral credentials secure academic jobs in math/computer science, engineering, and agriculture? One possibility is that African Americans in these fields have not achieved the "critical

mass” that may be necessary to overcome tokenism and isolation. With the exception of agriculture, these fields graduated only a handful of black doctoral recipients annually throughout the 1980s. In contrast, in biology, health sciences, and most of the social sciences, between 25 and 50 black doctoral recipients go on the job market every year. This may not constitute the “critical mass” of representation (15%) that some consider the minimum threshold to overcome tokenism in work settings (Etzkowitz, Kemelgor, Neuschatz, & Uzzi, 1994; Kanter, 1977; Tolbert, 1986), but it does create a professional environment where hundreds or thousands of black colleagues are potentially available for mentoring and networking. The relatively poor representation of black faculty in agriculture may be linked to the rural locations of many land-grant institutions, where faculty positions in this field are concentrated.

Controlling for labor supply factors, black faculty are generally relatively well represented in each of the social sciences compared to most of the natural sciences. Academic job prospects for black scholars may be enhanced in the social sciences for a number of reasons. Most of the social sciences have academic specializations where race is researched or recognized as a central concept. These create legitimized areas of academic inquiry that are of particular interest to many black scholars. In most of the social sciences the gender composition has also become more balanced in recent decades, and the influx of women may increase the degree of sensitivity to racial and ethnic diversity as well. But the social sciences also differ in the degree to which black faculty are present at different career stages. Black faculty are especially well represented in tenured positions in anthropology/archeology, political science, and sociology, whereas in untenured positions their representation is highest in applied social sciences, economics, and psychology. Again, this may partly reflect trends in doctoral production where fields that have produced black scholars in substantial numbers for many years now have more black tenured professors, whereas fields witnessing more recent increases in black doctoral recipients have more black faculty in entry-level positions. Political science is the only social science field where black representation in untenured positions is sharply lower than expected from its doctoral supply. Perhaps these results are due to a situation where black students entered the field in greater numbers just as opportunities contracted sharply and competition for jobs became fierce. Between 1976 and 1988 black representation in the political science doctoral pool roughly doubled at the same time that the total number of doctorates dropped nearly by half. Whatever the causes, these trends demonstrate that more than an increase in the number or proportion of black doctorates is required to enlarge the presence of black faculty within a field.

We can only speculate about how academic labor markets operate in areas that our results exclude: faculty without doctorates, those outside science and engineering, and those in two-year colleges. The most striking differences in black faculty representation within the various fields of science and engineering may pale in contrast to their presence in education or fine arts, where black faculty representation is much higher (U.S. Department of Education, 1997). Because not all institutions offer such programs, faculty opportunities in agriculture, engineering, and health sciences may be far more limited than those in the humanities, both in number and geography. However, a wider examination of more fields and types of colleges seems more likely to amplify than to minimize the contrasts we found in black faculty representation among different segments of the academic labor market.

For policymakers who seek to increase the presence of black faculty in postsecondary institutions, our findings suggest important ways that the academic labor market operates differently for black scholars than for their white counterparts. First, we need to recognize that the black academic labor pool appears strongly directed toward large black population centers. Further research will be required to determine the mix of “pull” and “push” factors that produces this result. Is it attraction to areas where a sizable black population creates viable black social institutions and black residential communities? Or do persisting barriers to workplace and residential integration, and an accompanying sense of feeling unwelcome, draw black faculty away from some academic institutions and their surrounding locales? If there are strong forces attracting black faculty to certain areas, then greater integration of black faculty may require efforts to reproduce aspects of the working conditions and local environments found at HBIs. The alternative—mitigating the effects of pervasive residential segregation by race—poses an even more daunting challenge.

Second, differences among fields in the rate at which black doctoral recipients assume faculty positions cannot be attributed to the level of opportunity for nonacademic employment, which has a barely discernable influence on the odds that black faculty will hold faculty positions. Black scientists and engineers are not underrepresented because they have been lost to the nonacademic job market. Nor can their relative absence in some academic fields be attributed simply to an accumulation of educational and career disadvantages, such as enrollment in less prestigious doctoral programs that provide less effective introduction to informal networks of scholarship and “sponsored mobility” into academic careers. Although black scientists and engineers tend to have less prestigious doctoral credentials and less work experience beyond the doctor-

ate, controlling for these factors does not alter the pattern of black faculty underrepresentation across fields. Given these racial differences in background, it is surprising that black faculty in non-HBIs are found more often at research universities and other graduate institutions than in liberal arts colleges. Research into the reasons for this finding may reveal changes in institutional climate that are most helpful in promoting racial diversity among the faculty. We will also have to await future research to determine how external labor market forces compare to other important institutional and individual factors that shape the racial composition of college faculties. However, this study provides evidence that future research should attend to the constraints imposed by the small black doctoral labor supply in many fields and by racial differences in the geographic distribution of college faculty. In myriad interconnected ways, these external labor market forces are strongly implicated in the racial composition of postsecondary faculty.

### *Notes*

<sup>1</sup>This 1985–1995 expansion in the number of black doctoral recipients encompassed all science and engineering fields. The smallest growth occurred in economics (19%) and biology (59%), and the largest in engineering, agriculture and anthropology/archeology, where the number of black recipients more than doubled. In the remaining fields of science (physical, geoscience, math, computer, psychology, sociology, and political science) the number of black recipients increased by more than two-thirds (NSF, 1999).

<sup>2</sup>These statistics come from our analysis of data from the National Research Council's annual Survey of Earned Doctorates, which is based on reports filed by every graduate school in the United States about the doctoral degrees they granted in the prior year.

<sup>3</sup>HBI were founded in the late nineteenth century with the mission of ensuring educational opportunity for all African Americans, mostly emphasizing teacher training. Staffed mostly by white missionaries from northern states at their founding, HBIs acquired black administrators by the mid-twentieth century and today have integrated faculties where a third or more are not African American (American Council on Education, 1987; Hill, 1985). Despite popular characterizations, HBIs differ substantially in academic quality, financial position, student body composition, and faculty strengths (Williams, 1988). Most HBIs, and nearly all private HBIs are small, enrolling fewer than 3,000 mostly black students. Although about 60% are private institutions, about three-fourths of the students at HBIs attend public institutions (Ehrenberg & Rothstein, 1994). In the 1960s through early 1980s some HBIs were threatened by merger prospects, declining enrollment, poor fiscal conditions, and their small or nonexistent endowments (Garibaldi, 1984). More recent legal action in Southern states has increased pressure to racially integrate both predominantly white public colleges and public HBIs, raising new questions about HBIs' distinctive missions (Ehrenberg & Rothstein, 1994). Also, after observing a long-standing open door policy, HBIs have become more selective in admissions (Collison, 1991).

<sup>4</sup>The large number of institutions represented is important not only in capturing the range of institutions in which black faculty representation may vary systematically, but also in helping to sort out the relative impact of region, HBIs, and black populations on black faculty's academic locations. Our multivariate models have acceptable tolerance statistics that avoid multicollinear estimates.

<sup>5</sup>With one exception, there are statistically significant differences in the location of black faculty by region and by both the absolute and proportional size of the local black population. Regional differences are not statistically significant when the sample is restricted to faculty at non-HBIs. The same pattern of significant differences in location is found in crosstabulations whether we compare black faculty to all non-black faculty, as is shown in Figure 2, or contrast them with white faculty only.

<sup>6</sup>These logistic regressions predict whether or not a faculty member is African American. The vast majority of the non-black faculty are white (90.4%), and most of the remainder are Asian or Asian-American (7.7%), with few Hispanics (1.6%) or American Indians (0.2%). When we rerun results excluding these three non-black minority groups to predict whether a faculty member is black versus white, we obtain nearly identical results as in Table 2.

<sup>7</sup>These results for institution type obtain only after controlling for HBI status as well. Very few HBIs meet Carnegie definitions of Research or Doctoral institutions. Because so many black faculty scientists and engineers are located in HBIs, they tend as a group to be located toward the bottom of the Carnegie classification when HBI status is not controlled. However, in a subsequent equation which excludes HBIs, the odds are even stronger that black faculty will be employed in Research, Doctoral, and Comprehensive rather than in Liberal Arts institutions.

<sup>8</sup>Prestige of doctoral credentials is measured by National Research Council's rating of the scholarly reputation of the graduate program granting the respondent's doctorate (Jones, Lindzey, & Coggeshall, 1982), which we have matched to the SDR data. Work experience beyond the doctorate is measured directly in the SDR.

<sup>9</sup>When we use a more detailed regional breakdown in the equations (results not presented in Table 2), we find higher odds that black faculty occupy tenured positions in the Southeast than in the mid-Atlantic, Great Lakes, Plains, and Southwestern states, but not New England, the Rocky Mountain, or Pacific states. Among the untenured, however, there are poorer odds of finding black faculty in the Southeast than in each of the seven other regions.

<sup>10</sup>The multivariate results that control for HBI status and the size of local black populations should not be construed as indicating that the South is an unimportant career destination for untenured black faculty. The South has the most HBIs and a denser collection of cities with sizable black populations than any other region. But in comparing areas with the same HBI and black population characteristics across regions, untenured black faculty appear to be located more commonly outside than inside the South.

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