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Hiring Selection

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Introduction

Three decades after their inception, many Affirmative Action programs have fallen short of full implementation and lack enthusiastic endorsement by public and private employers (Cherry, 1991; Fiscus, 1992; U.S. Commission on Civil Rights, 1977, 1981a). The reasons for the delayed success of these programs are numerous and confounded, and some, such as racial prejudice, may defy elimination in a single generation (U.S. Commission on Civil Rights, 1981b). However, delayed implementation may also be due to the practices used to generate hiring recommendations. Particularly at federally-funded institutions, personnel officers, in their efforts to achieve racial and sexual balance, are required by law to use methods prescribed in the original Affirmative Action directives (Boisseau and McKay, 1980; Cronback, Yalow, and Schaeffer, 1980; Haertel, 1984). As we describe later, current methods for policy assessment use inefficient population parameters to evaluate minority frequencies during the stages of the hiring process. Moreover, since the recommendations resulting from such evaluations can be vague and subjectively interpreted, it is not surprising that efforts to implement Affirmative Action policies have proceeded slowly and sparked protests of discrimination by minority and majority groups alike (American Society for Personnel Administration, 1982; Blumrosen, 1981; Cherry, 1991; Fullinwider, 1980; Greenwalt, 1979).

The goal of this chapter is to provide a method for measuring the effects of hiring practices on the frequencies of minorities in public institutions. Our method eliminates subjectivity and uses direct and consistent population parameters to describe the entire hiring process. Moreover, our mode of analysis is useful for identifying the *relative* efficacy of Affirmative Action practices in achieving policy goals at different stages of the hiring process, as well as among hiring

processes within and between institutions. Like currently used procedures, our method decomposes the hiring process into a series of selection events including (1) application, (2) candidate selection, (3) offers, (4) acceptances, (5) transfers, (6) promotions, (7) resignations, and (8) terminations. Unlike current procedures, however, our method compares the *relative* frequency of each minority in the employee population to the frequencies of *all* other employed minority groups for each selection event. Because the relative rates completely define the total change in the composition of the pool, this approach permits the movement of different minorities through the hiring process to be individually assessed in relation to Affirmative Action goals. Moreover, by partitioning the effects of the hiring process into a series of events, the magnitude and direction of each event on the Affirmative Action goal can also be readily assessed.

The criterion for measuring success at meeting Affirmative Action goals is change in the minority or gender composition of the employee pool. However, for any observed change, there may be several distinct causes that are difficult to clearly identify. Our method identifies the *relative importance* of each selection event to the entire hiring process. Thus, our method provides a practical means for identifying the stage or stages in the hiring process at which hiring practices succeed or fail, in relation to one another and to overall Affirmative Action goals. By identifying these crucial stages of the hiring process, our method assists in identifying the actual causes for changes in the composition of the employee pool. For any institution with limited resources, decisions must be made concerning resource allocation to each stage in the hiring process. Our method provides a means of evaluating the *relative efficiency* of different patterns of allocation with respect to Affirmative Action goals (it also provides a means of making standardized comparisons *among institutions*, but this topic will be taken up in a later chapter).

Natural Selection and Hiring Selection

Our approach has its theoretical and empirical precedents in the methods evolutionary biologists, and plant and animal breeders use to examine the effects of natural and artificial selection on populations of organisms (Arnold and Wade, 1983; Crow, 1958; Endler, 1985; Lande and Arnold, 1980; Price, Grant, Gibbs, and Boag, 1984; Wade and Arnold, 1980). Thus, our approach uses a precise and well-established methodology for examining the movement of minorities through the hiring process. The relative selection approach, as used by biologists, identifies individuals by their possession of two physical characteristics, *phenotype* and *fitness*. The former characteristic is any aspect of morphology, physiology, or behavior; the latter characteristic is the ability to survive and reproduce relative to the population average. When this approach is extended to the analysis of Affirmative Action policies, phenotype corresponds to *minority status*,

whereas fitness corresponds to the *relative rate* with which members of a given minority move through one event in the hiring process to the next.

To understand natural selection, biologists examine the relationship between phenotype and fitness across a population of organisms. By identifying the fitness of particular phenotypes relative to other phenotypes, biologists can calculate the change in the frequency of each phenotype between two selection episodes, as well as changes in the frequencies of phenotypes across several selection events. Birds with shorter wings, for example, may survive storms better than birds with longer wings and thus become represented in a poststorm population in relatively higher frequencies than they were in the prestorm population. Consistently higher success of short-winged birds over several episodes of selection within a lifetime, moreover, leads to greater representation of this phenotype in the population overall (Lande and Arnold, 1980). By analogy, the successful movement of a particular minority through the stages of the hiring process (e.g., application, interviews, offers and acceptances of positions) leads not only to a higher frequency of this minority from one hiring stage to the next, but also to a higher frequency of the minority in the total employee population, a specific goal of Affirmative Action policy. The relative selection approach permits quantification of these and related processes.

Biologists recognize that natural selection can act with different intensity or even in different directions on the same phenotype at different stages in a life cycle. Because strong selection at one episode may counter or even reverse the effects of weaker selection at several other episodes, a relative selection approach permits better understanding of the nature and outcome of selection over the entire life cycle. It also permits different studies of natural selection at different life stages to be compared with one another. Moreover, by identifying the magnitude of selection in each episode with respect to the total force of selection, this approach permits identification of the possible causes or agents of selection. Thus, in biological studies, an episode of selection in which short-winged birds experienced high relative fitness could indicate that the population suffered the effects of a storm, or some other factor that disproportionately removed long-winged birds. Similarly, an episode of selection in which the fitness of short-winged birds is relatively low could indicate that some selective agent specific to short-winged birds disproportionately removed them from the population. Application of a relative selection approach to the practice of Affirmative Action policies in a similar way permits identification of the success with which minorities move from one stage of the hiring process to the next, and assists in identifying the reasons specific hiring practices are or are not successful.

Using two examples, we will illustrate our approach to estimating the relative rates of movement by minorities through different hiring events. We will refer to the method of examining hiring events using a relative selection approach as *hiring selection.* These examples will also show how our approach is useful in analyzing *any* similar process in which individuals apply for, are accepted into, and

progress through circumstances with limited numbers of available positions (e.g., individuals applying for bank loans, placement of families in neighborhoods, students entering and progressing through high schools or universities, senior citizens applying for extended health-care benefits or insurance). The first example will examine the relative rates at which male and female applicants for positions proceed through events in the hiring process at a hypothetical institution. The second hypothetical example will consider the rates at which members of five socially defined groups (White, African-American, Hispanic, Native American and Asian/Pacific Islander) receive promotions, leave their jobs, or are terminated.

We will first review the methods currently used by universities and corporations to assess their Affirmative Action efforts. This will provide a basis for comparison with our approach. We will then use the specific examples described earlier to demonstrate that the hiring selection approach (1) uses consistent population parameters to examine events in the hiring process, (2) is less sensitive to small population sizes than current methods, (3) assists in identifying possible causes for observed hiring patterns, (4) can detect discrimination at each of a series of events as opposed only to the end result, and (5) is more easily interpretable than current methods used for achieving compliance with Affirmative Action legislation.

Current Assessment Methods in Affirmative Action Programs

Federal Guidelines

In 1978, the Equal Employment Opportunity Commission (EEOC) adopted the Uniform Guidelines on Employee Selection Procedures (*Federal Register,* 1978; see Benokratis and Feagin, 1978; Fiscus, 1992; Thompson and Christiansen, 1983; Weatherspoon, 1985 for reviews of events and legislation leading up to this document, as well as subsequent court cases testing its validity). These guidelines established a "rule of thumb," also known as the "four-fifths-" or "80% rule" (Weatherspoon, 1985), designed to avoid adverse impact of hiring procedures on minorities. The rule states that adverse impact exists when ". . . the selection rate for minority applicants is less than 80% of the selection rate for majority applicants," wherein the *selection rate* equals the ratio of individuals in the current pool of candidates to individuals in the previous pool of candidates: This is the federal definition of job discrimination.

Supreme Court rulings in the early 1980s upheld the EEOC guidelines, with emphasis on the "bottom line" (i.e., favoring employment practices that *overall* had no adverse affect on the hiring and promotion of minorities; Benokratis and Feagin, 1978). However, the Court also ruled that certain testing procedures could discriminate against individuals despite employer compliance with EEOC

guidelines (Blumrosen, 1981, 1983). Most publications recommending procedures for achieving compliance now advise employers to review overall as well as individual events in their hiring processes for possible "discriminatory" practices, although this term is vaguely defined (American Society for Personnel Administration, 1982; Blumrosen, 1983; Koral, 1980). Computer programs and statistical procedures are frequently used to assist personnel officers in making hiring decisions that adhere to federal regulations (see below). However, compromises between the law and its interpretation in a case-by-case manner tend to erode the appearance of precision that computer and statistical procedures are designed to achieve. At present, "compliance" is often interpreted simply as a "good faith" approach to hiring practices that make "reasonable attempts" to meet Affirmative Action goals (B. McCloud, personal communication). Although these goals have become increasingly subjective and imprecise, the consequences of noncompliance with federal guidelines are severe; loss or retention of an institution's federal funding may hinge on a personnel officer's ability to meet them.

Assessment Methods

Two types of surveys are used by many university and corporate Affirmative Action programs to achieve compliance with federal regulations. The first is the Eight Factor Availability Analysis. This survey provides information by job category on the percentages of five specific minority groups that exist in the local or national population. This survey is used to make decisions about whether to draw employees from local or national pools, and whether training programs are or are not effective in assisting local minorities to gain employment. Although currently used to assess the effectiveness of Affirmative Action policies at some institutions, this approach has largely been replaced by a second method for achieving federal compliance and hence will not be considered in detail here.

This latter survey, the Adverse Impact Ratio Analysis, summarizes the numbers and proportions of male and female individuals by racial group (White, African-American, Hispanic, Native American, and Asian/Pacific Islander) that apply for, are interviewed, are offered positions, are hired, are promoted, resign, or are terminated for a particular job category, as well as the proportion of the total pool of individuals that each group contributes. The arrangement of the raw data permits examination of the frequencies of minorities within the pool after each selection event and provides useful direct information on the pool's composition. This method is the one often used to comply with the EEOC 80% rule (Haertel, 1984). However, the statistic used to interpret the frequencies of minorities and the one used in making hiring recommendations, the *adverse impact ratio*, or simply, the *impact ratio*, has several deficiencies that can lead to conclusions and practices of dubious merit or efficiency.

The Calculation of Adverse Impact Ratios

Adverse impact ratios are often used to identify the minority that would be most severely impacted by job discrimination in a job search, that is, the minority that is now represented in the existing employee pool and/or in previous job searches by the fewest individuals. This group is occasionally designated as the "most desired" minority (i.e., the minority that the institution is most interested in recruiting). Table 7.1 illustrates this process. Column 2 of the table shows the frequencies of Whites, African-Americans, Hispanics, Native Americans, and Asian/Pacific Islanders applying for positions at a hypothetical institution. This applicant pool may represent the numbers of individuals in either local or national areas. Column 3 shows the frequencies of these groups, and columns 4 and 5 show the numbers and frequencies of these groups in the current employee pool. In this example, Native Americans are the "most desired" minority because their frequency among the current employees (column 5) is zero. Differently put, because this minority has the smallest number of employed individuals, it is defined as being most adversely impacted by job discrimination.

As described earlier (and in more detail later), job searches consist of a series of selection events in which a pool of applicants is reduced by an individual or a search committee to a smaller pool of interviewees. This "selection pool" (B. McCloud, personal communication) is then reduced to a still smaller pool of individuals offered positions, which may then be reduced to an even smaller pool of individuals that accept job offers. Adverse impact analyses calculate for each minority the ratio of individuals in the current pool of candidates to individuals in the previous pool of candidates (i.e., the *selection rate* for the minority within each event in the hiring process). This selection rate is then compared with the selection rate for the majority group. If the ratio of these two selection rates exceeds 80% for the most desired minority through all selection events, federal compliance is met. Thus, since 9.1% of the Native American applicants and 2.1% of the White applicants for the position illustrated in Table 7.1 are invited to interview (impact ratio = 0.091/0.021 = 4.35), our hypothetical institution is

Table 7.1 Adverse Impact Ratio Analysis of Employees at a Hypothetical University

Minority (1)	Applicant Pool (2)	Freq. in App. Pool (3)	Employee Pool (4)	Freq. in Emp. Pool (5)	Interview Pool (6)	Interview Rate (7)	Impact Ratio (8)
White	1005	0.891	11	0.611	21	0.021	1.000
Af. Amer.	22	0.020	1	0.053	2	0.091	4.351
Hispanic	21	0.019	3	0.158	3	0.143	6.837
Na. Amer.	22	0.020	0	0.000	2	0.091	5.351
Asian/PI	58	0.051	4	0.211	1	0.034	1.650
Totals	1128	1.00	19	1.00	29		

in compliance with federal guidelines. In this example, in fact, all minorities are interviewed at rates greater than 80% of the interview rate for Whites (column 8, Table 7.1). Computer-assisted adverse impact analyses usually report (1) the female:male impact ratios, in which females are usually the "most desired" minority, and (2) the minority:White ratio within each sex, in which the "most desired" minority may vary as described earlier.

Difficulties with the Adverse Impact Ratio

The Effects of Variable Sample Size

The adverse impact approach does provide useful information on the numbers of individuals that move though the stages of the hiring process. Impact ratio analyses also provide information on which minority is represented by the fewest individuals, and thus which minority might be most actively recruited. Adverse impact ratios are calculated as if each selection event has an equivalent effect on the most desired minority (i.e., they are standardized against the selection rate for the majority group). This assumption is valid if the number of individuals in the majority group is large relative to all others and remains so throughout the hiring process. However, if selection rates for the majority group change among selection events, so may the magnitude of the impact ratio.

Most institutions hire relatively few new employees at any time, and the number of new employees belonging to the majority group may vary between hiring stages, especially when most desired minority status is recognized. To remain in federal compliance, an institution must maintain impact ratios equaling or exceeding 80% of the selection rate for the majority group throughout all selection episodes. When few individuals are interviewed and/or hired, this requirement can place considerable strain on job-search budgets and raise charges of reverse discrimination (see below). Sample sizes of candidates may also become skewed if members of the most desired minority do not apply for jobs or reject job offers. Thus, an institution may find itself in violation of federal guidelines despite its best recruitment efforts.

Table 7.2 shows the frequencies of individuals in the National Pool of candidates that applied for the position described in Table 7.1. Whereas the impact ratios calculated for the interview stage of the hiring process comply with federal guidelines (column 8, Table 7.1), impact ratios for the application stage of this process shows the frequencies of African-American and Hispanic applicants well below the required 80% (column 7, Table 7.2). As mentioned earlier, recent legislation has softened these regulations somewhat and currently requires only a "good faith" effort on the part of the hiring institution to meet EEOC guidelines. However, such good faith efforts, when based on flawed assumptions, may generate or perpetuate racial biases.

Table 7.2 Adverse Impact Ratio Analysis of Applicants for Positions at a Hypothetical University

Minority (1)	National Pool (2)	Freq. in Nat. Pool (3)	Applic. Pool (4)	Freq. in App. Pool (5)	Minority App. Rate (6)	Impact Ratio (7)
White	6416	0.80	1005	0.89	0.157	1.000
Af. Amer.	440	0.06	22	0.02	0.050	0.319
Hispanic	912	0.11	21	0.02	0.023	0.147
Na. Amer.	56	0.01	22	0.02	0.393	2.508
Asian/PI	176	0.02	58	0.05	0.330	2.104
Totals	8000	1.00	1128	1.00		

Creation of Bias by the Recognition of Most Desired Minority Status

Two types of bias can result from recognition of most desired status, (1) overrepresentation and (2) tokenism. Recall that Native Americans are the most desired minority in our example (Table 7.1, column 4). The hiring of a single Native American may seem to remedy this situation (Table 7.3, column 2), but it actually creates a paradox; Native Americans remain the most desired minority in the employee population (i.e., they are still most rare), yet this single hire means that the frequency of Native Americans at the institution exceeds the national frequency by sevenfold (Table 7.3). Hiring of two Native Americans removes this minority's most desired status, but further inflates their frequency among current employees and makes the institution vulnerable to charges of reverse discrimination by members of the majority (compare columns 3 and 5, Table 7.3, also see below). Moreover, African-Americans now become the most desired minority, and hiring individuals of this group in the next job search would lead to their overrespresentation as well.

Adverse impact analyses leading to hires of members the rarest minority can also create racial "tokens" within employee populations. Consider an employee

Table 7.3 Recognition of Most Desired Minority Status: Overrepresentation

Minority (1)	New Employee Pool (2)	Freq. in New Pool (3)	National Pool (4)	Freq. in Nat. Pool (5)
Whtie	11	0.550	6416	0.802
Af. Amer.	1	0.050	440	0.055
Hispanic	3	0.150	912	0.114
Na. Amer.	1	0.050	56	0.007
Asian/PI	4	0.200	176	0.022
Totals	20	1.000	8000	1.000

Table 7.4 Recognition of Most Desired Minority Status: The Unintegrated Employee Pool

Minority (1)	Applicant Pool (2)	Freq. in App. Pool (3)	Employee Pool (4)	Freq. in Emp. Pool (5)	Interview Pool (6)	Interview Rate (7)	Impact Ratio (8)
White	1005	0.891	19	1.000	21	0.021	1.000
Af. Amer.	22	0.020	0	0.000	2	0.091	4.351
Hispanic	21	0.019	0	0.000	3	0.143	6.837
Na. Amer.	22	0.020	0	0.000	2	0.091	4.351
Asian/PI	58	0.051	0	0.000	1	0.034	1.650
Totals	1128	1.000	19	1.000	29		

pool consisting entirely of Whites (Table 7.4). In a series of jobs searches, African-Americans, Hispanics, Native Americans, and Asians may each be recognized as the most desired minority because their frequency among employees is zero. If only minorities are hired with each successive hiring, most desired minority status shifts among the minorities until one position is held by each minority. Once this is accomplished, most desired status among minorities no longer exists. However, the frequencies of minority employees do not approximate their national frequencies (Table 7.5). Although the practice of identifying a most desired minority may not always be strictly applied, this component of adverse impact analysis, if used at all, can generate or maintain the employment patterns that Affirmative Action programs have sought to eliminate.

Reverse Discrimation

Opposition to Affirmative Action by members of majority groups has stemmed from charges that implimentation of these policies leads to hires and promotions of minorities at the majority's expense (Cherry, 1991; Fiscus, 1992; U.S. Commission on Civil Rights, 1977, 1981a). These charges are not without substance

Table 7.5 Recognition of Most Desired Minority Status: Tokenism.

Minority (1)	New Employee Pool (2)	Freq. in New Pool (3)	National Pool (4)	Freq. in Nat. Pool (5)
White	19	0.826	6416	0.802
Af. Amer.	1	0.043	440	0.055
Hispanic	1	0.043	912	0.114
Na. Amer.	1	0.043	56	0.007
Asian/PI	1	0.043	176	0.022
Totals	23	1.000	8000	1.000

if adverse impact ratios are calculated as described earlier. As will be described in more detail later, in addition to their use in examining the hiring process, adverse impact ratios may also be used to examine the distribution of promotions among existing employees. Consider the employee pool in Table 7.6. It shows Minority 5, Asian/Pacific Islanders, to be the rarest and thus the minority most likely to be impacted by promotion discrimination. The promotion rates for this group and for the majority group (Whites) are 1/20 = 0.05, and 26/926 = 0.028, respectively (rows 5 and 1, column 5, Table 7.6). Thus, the impact ratio for Minority 5 is 1.78 (row 5, column 7, Table 7.6), well above the 0.80 ratio required for federal compliance (as are the impact ratios for other non-White minorities, column 7, Table 7.6).

However, even after this selection event, Minority 5 is still rarest among promoted employees. Since the number of promotions is limited ($N = 35$), the only way to make the frequency of Minority 5 comparable to that of the other non-White minorities among promoted employees (African-American = 2; Hispanic = 3, Native American = 3) is to promote one additional member of this group and one fewer members of Minority 1, the majority group (Table 7.7). Federal guidelines are still met after this decision since the impact ratio is calculated us-

Table 7.6 Adverse Impact Ratio Approach to Analysis of Promotions, Part A

Minority (1)	Employee Pool (2)	Freq. in Emp. Pool (3)	Promot. Pool (4)	Minority Pro. Rate (5)	Freq. in Pro. Pool (6)	Impact Ratio (7)
White	926	0.84	26	0.028	0.74	1.00
Af. Amer.	31	0.03	2	0.065	0.06	2.30
Hispanic	75	0.07	3	0.040	0.09	1.43
Na. Amer.	49	0.04	3	0.061	0.09	2.18
Asian/PI	20	0.02	1	0.050	0.03	1.78
Totals	1101	1.00	35		1.00	

Table 7.7 Adverse Impact Ratio Approach to Analysis of Promotions, Part B

Minority (1)	Employee Pool (2)	Freq. in Emp. Pool (3)	Promot. Pool (4)	Minority Pro. Rate (5)	Freq. in Pro. Pool (6)	Impact Ratio (7)
White	926	0.84	25	0.027	0.71	1.00
Af. Amer.	31	0.03	2	0.065	0.06	2.39
Hispanic	75	0.07	3	0.040	0.09	1.48
Na. Amer.	49	0.04	3	0.061	0.09	2.27
Asian/PI	20	0.02	2	0.100	0.06	3.70
Totals	1101	1.00	35			1.00

ing the promotion rate for the majority group (Minority 1) as this ratio's denominator (Column 7, Table 7.7). However, the frequency of Whites in the promotion pool (0.71) is now 13% below their frequency among current employees (0.84). Thus, while impact ratio analysis shows this employer in compliance with federal guidelines, and having eliminated a "most desired" minority (by increasing the frequency of promotions within this group to match that of other minorities), members of the majority might ask whether reverse discrimination is occurring. Because they are standardized by the selection rate of the majority (which may vary from 0 to 1), impact ratios, while capable of detecting discrimination against minorities, are incapable of detecting whether the majority is currently represented at frequencies lower than their representation in previous stages. Differently put, impact ratios cannot detect reverse discrimination. We provide a method for detecting significant discrimination in Appendix 7.1 (*Note:* this method will be more informative if read after the text of this article).

Other Computational Difficulties

As mentioned, if sample sizes are small, the computational accuracy of the impact ratio may be affected by use of the *absolute* rate at which members of each minority move from one selection event to the next (i.e., the number of individuals in event $n + 1$ divided by the number of individuals in event n). Furthermore, whereas this value provides information on the frequencies of different minorities *within* a selection event, it does not provide information necessary for calculating minority frequencies in the *subsequent* selection event. Since each selection event is considered independently, there is no way to examine the relative effect of each event on the overall frequency of minorities among newly hired employees. As mentioned, computer programs are used by many Affirmative Action officials to calculate adverse impact ratios. However, since many of these algorithms were designed for use by large corporations, they are usually incapable of calculating impact ratios when cohorts are small (i.e., fewer than ten individuals; B. McCloud, personal communication). Thus, in addition to its tendency to create biases, the adverse impact ratio method is extremely sensitive to small sample sizes. Many institutions, even relatively large ones, hire only a few new employees per department per year, making impact ratios inefficient tools for implementing Affirmative Action policy.

Hiring Selection

In response to these problems, we advocate use of the *hiring selection* method for examining movement of individuals between stages during the hiring process. As mentioned, the hiring selection method estimates the *relative selection rates* of minorities at each stage in the total hiring process. As will be shown, the hiring selection approach provides precise, consistent, and easily in-

terpreted statistics for assessing the success of Affirmative Action practices, avoiding the difficulties that arise when minority selection rates are compared with those of the majority (as required by the 80% rule). Furthermore, the hiring selection method reveals the relative importance of each selection event in generating the final frequencies of minorities in the employee pool. This feature allows institutions to evaluate where to place their efforts at implementing Affirmative Action policies in the series of events that constitute the hiring process.

The Hiring Process I: Application Through Acceptance

The hiring selection approach is similar to the adverse impact approach in two ways: (1) Stages in the hiring selection process are identified (e.g., application, interviews, offers, etc.); and, (2) the numbers of individuals that move from one stage to the next are clearly presented. However, unlike adverse impact ratio analysis, the hiring selection approach makes no statements about the acceptability or desirability of existing minority utilizations or frequencies. The hiring selection approach provides a way to visualize the movement of individuals belonging to particular groups through selection stages relative to each other, and relative to previous selection events. Thus, the hiring selection approach, unlike those presently in use, examines population parameters directly and reduces opportunities for subjective policy interpretations.

Stage 1: Application

Consider first a situation in which a company advertises a position. A university, for example, may wish to hire faculty members in a particular department. In this example, as for most university faculty searches, a national applicant pool exists consisting of individuals with a Ph.D. degree in the relevant area. National pools of applicants are available from many sources, but for university faculty, this information is most readily available in the *Chronicle of Higher Education* or in publications of the National Research Council (Congress of the U.S. Office of Technology Assessment, 1985). Like the first phase of adverse impact analysis, only the gender of individuals to be hired will be considered. The hypothetical national pool in Table 7.8 reflects the actual relative frequencies of male and female Ph.D.'s in many academic fields. To assist notation we will refer to each category as a "minority" regardless of the numbers of individuals it contains, even though in this example, men are more numerous in the national pool than women.

In column 1 of Table 7.8, each minority category is listed. The numbers of each minority in the national applicant pool, m_i, are listed in the second column (m_1 = the number of male Ph.D.'s; m_2 = the number of female Ph.D.'s). The frequency of each minority in the national pool, p_i, is equal to the number of each

Table 7.8 Relative Selection Approach to Analysis of Hiring Selection: Application

Minority (1)	National Pool m_i (2)	Freq. in Nat. Pool P_i (3)	Applicat. Pool m'_iA_i (4)	Minority App. Rate a_i (5)	Relative App. Rate p'_i (6)	Freq. in App. Pool (7)	Impact Ratio (8)
Male	8000	0.80	91	0.0114	1.20	0.96	1.000
Female	2000	0.20	4	0.0020	0.21	0.04	0.175
Totals	10000	1.00	95			1.00	
Avg. App. Rate:				0.0095			

minority divided by the total size of the national pool:

$$p_i = (m_i)/(\Sigma m_i). \qquad \textbf{(Equation 1)}$$

These frequencies are given in column 3 of the table.

Not all of the persons in the national pool apply for academic positions at the university; thus the frequency of a minority in the university applicant pool may be different from that in the national pool. In Table 7.8, the hypothetical number of individuals in each minority group that apply for positions at the university is listed in column 4. The *application rate* of minority *i*, A_i, is the number of individuals of that minority in the application pool divided by the number of individuals in the national pool. Thus, the application rate for men is calculated as

$$A_1 = 91/8{,}000 = 0.0114, \qquad \textbf{(Equation 2)}$$

and the application rate for women is calculated as

$$A_2 = 4/2{,}000 = 0.002. \qquad \textbf{(Equation 3)}$$

Although application rates are used in adverse impact analyses, they are not useful for calculating the frequency of a minority in the university applicant pool. This is because they reflect only the proportion of that minority in the national pool that applied for academic positions at the university. To calculate the frequency of a minority in the applicant pool, we need to know the *relative application rate*, a_i, which is defined as the application rate, A_i, divided by the average application rate. The average application rate (Table 7.8) can be calculated in two ways: (1) as the sum of the products of columns 3 and 5 (i.e., $\Sigma[p_i][A_i] = 0.0095$), or more simply, (2) the ratio of the column 4 to column 2 totals (i.e., 95/10,000 = 0.0095). Dividing the entries in column 5 by the average application rate, 0.0095, gives the desired relative application rates, a_i, in column 6. In our example, women have a relative application rate of 0.21, a value much less than one. This

means that they are not applying for the position in proportion to their relative numbers in the national pool. It also means that if an Affirmative Action goal is to be met by hiring women, then at some other stage or group of stages in the hiring process, the relative selection rate must exceed the ratio of the expected application to the observed application rate. In this case, the required hiring selection rate for future stages in the hiring process is 1.00.21, or 4.76.

If we know the relative application rate (a_i) and the frequency of a minority in the national pool (p_i), we can calculate the frequency of a given minority, p'_i, in the university applicant pool. These values for men and women applicants are given in column 7 of Table 7.8, and in general are calculated as,

$$p'_i = [p_i][a_i]. \qquad \textbf{(Equation 4)}$$

In addition to permitting calculation of minority frequencies in the applicant pool, the relative application rate provides a simple parameter against which recruitment goals may be assessed. The relative application rate represents the frequency with which members of a particular minority apply for positions at the university *relative to the average frequency with which members of all minority groups apply.* Thus, whenever a relative application rate is *greater than 1,* it indicates that a minority is applying in greater numbers than expected from their representation in the national pool, namely, $p'_i > p_i$. When this number is *less than 1,* members of this minority are not applying to the university in proportion to their national frequencies and consequently, $p'_i < p_i$. When the relative application rate is *equal to 1,* the members of the minority are applying to the university in proportion to their national frequency. A primary goal of most Affirmative Action programs at the application stage is for p'_i to equal p_i (i.e., for relative rates of all minorities to equal 1).

Consider Table 7.8 again. In this example, women are *not* applying to the university at the rate expected based on their frequency in the national pool (column 6, row 2). There are several possible explanations for this result, all of which may be acting simultaneously: (1) The university's job advertisements may not be reaching qualified female applicants; (2) the university's advertisements may be reaching these applicants, but these notices may not have the same relative selling power as those of other universities; (3) the university may be perceived by female Ph.D.'s as providing an unfavorable academic environment for women; (4) the university's geographic location or the university itself may be considered unattractive by qualified female applicants. Other explanations are possible as well, such as (5) prejudicial advertising for the position, or (6) job announcements that favor local over national applicants. These same explanations could also be proposed to explain why the relative number of male applicants exceeded their national frequency in this job search.

Like hiring selection analysis, adverse impact analysis permits assessment of selection rates for men and women applicants. Since men are the majority group

at the university, the impact ratio for women is obtained by dividing the application rate for women by the application rate for men, thus, $^{0.002}/_{0.0114} = 0.175$. This value is less than 0.80, suggesting, like results obtained by the hiring selection method, that women are applying for the position at the university in smaller numbers than men. However, interpretation of this value other than its magnitude relative to 0.80 (i.e., is federal compliance met or not) is difficult, since the scale of the impact ratio is standardized relative to the majority group, instead of relative to the average application rate for both groups. Thus, the frequency with which both men and women apply for the position relative to their frequency in the national pool is not clearly shown, a difficulty that will be more apparent in the second example when selection rates for more than two minorities are shown.

Impact ratio analyses do not reveal the effort in hiring practices necessary to counter this initial effect of a low application rate by women, because each stage of the hiring process is considered as an isolated event. The hiring selection method provides this useful information. Relative selection rates may also be partitioned, permitting selection events occurring within the institution to be isolated from those occurring outside of it. Inexact information on the composition of the national pool of candidates, for example, may generate misleading information about relative application rates. However, such inaccuracy affects only calculations for this stage of the hiring process. Relative selection rates for subsequent stages will remain unchanged.

Stage 2: Interviews

A second selection process occurs when departmental search committees screen the pool of applicants and decide on a short list of candidates that will be invited for interviews. In Table 7.9, the constituents of the applicant pool and their frequencies are repeated from Table 7.8 as columns 1–3. Of the 95 total applicants, 15.8% (12 men + 3 women; 15⁄95 = 0.158) are selected for interviews as shown in column 4. The *interview rate* for each minority, S_i, shown in column 5, is

Table 7.9 Relative Selection Approach to Analysis of Hiring Selection: Interviews

Minority (1)	Applicant Pool m'_i (2)	Freq. in App. Pool p'_i (3)	Interv. Pool m''_i (4)	Minority Int. Rate S_i (5)	Relative Int. Rate s_i (6)	Freq. in Int. Pool p''_i (7)	Impact Ratio (8)
Male	91	0.96	12	0.132	0.84	0.80	1.00
Female	4	0.04	3	0.750	4.75	0.20	5.68
Totals	95	1.00	15			1.00	
Avg. Int. Rate:				0.158			

equal to the number of individuals from that minority asked to interview, divided by the total number of individuals in that group applying for positions. Recall that interview rates are the values Affirmative Action officials currently use to assess each minority's impact ratio. Since male faculty members outnumber female faculty (as is true for most college campuses), women are considered the "most desired" minority. Three of the four women who applied for the position are invited for interviews, thus, the interview rate for women, S_2, is $\frac{3}{4} = 0.75$. Since 12 of 91 men were interviewed, the interview rate for men, S_1, is $\frac{12}{91} = 0.132$ and the impact ratio is $\frac{0.75}{0.132} = 5.68$. Women are being interviewed at a rate greater than 80% of the interview rate for men, well within federal Affirmative Action guidelines.

The hiring selection method reaches a similar conclusion, but it provides additional, useful information as well. Interview rates and impact ratios reflect only the proportion of applicants from a particular minority that are invited to interview. To obtain the frequency with which individuals of a particular minority are invited to interview, *in proportion to the average frequency with which all minorities are invited to interview,* we must calculate the *relative interview rate.* The relative interview rate for each minority, s_i, shown in column 6 of Table 7.9, is given by dividing each interview rate, S_i, by the average interview rate ($\frac{15}{95} = 0.158$). These values allow us to calculate the frequency, p''_i, of each minority in the interview pool as

$$p''_i = [p'_i][s_i]. \qquad \textbf{(Equation 5)}$$

Since the frequency of each minority in the applicant pool, p'_i, is a function of that minority's relative application rate and its frequency in the national pool, the frequency of each minority in the interview pool can also be expressed as the product of (1) the frequency of women in the national pool, p_i, (2) their relative application rate, a_i, and (3) their relative interview rate, s_i, or

$$p''_i = [p_i][a_i][s_i]. \qquad \textbf{(Equation 6)}$$

Thus, the frequency of women invited to interview is given by

$$p''_2 = [0.042][4.75] = [0.20][0.21][4.75] = 0.20. \qquad \textbf{(Equation 7)}$$

As with the relative application rate, the relative interview rate provides information on the frequency with which members of a particular minority are invited to interview, *in proportion to their representation in the applicant pool.* After two stages in the hiring process, the relative interview rate of 4.75 for female applicants almost compensates for the low relative application rate of 0.21 in its effect on the frequency of women in the interview pool (note the relative values in column 6 of Tables 7.8 and 7.9). In short, despite a low relative application rate,

women are being invited to interview for positions in much greater numbers than expected based on their frequency in the applicant pool. This result is similar to the one obtained by the adverse impact analysis, but it is more precise since *movement* of each minority through the hiring process is assessed in relation to *movement* by all other groups, not simply in relation to the majority group.

Here we have an example of compensation occurring across stages in the hiring process, which may be understood by examining the product of the relative selection rates at the component stages. In this case, $[a_i][s_i]$ equals [0.21][4.75], or 0.9975, a value very close to 1 despite the large numerical difference between a_i and s_i. When multiplied by the frequency of women in the national pool, p_i = 0.20, as shown in Equation 7, the frequency of women in the interview pool equals the frequency of women in the national pool, $p''_i = 0.20$. Thus, as with individual relative selection rates, when the product of the relative rates is *less than 1*, the combined effects of the stages of hiring selection leads to a lower frequency of a minority in the employee pool than is found in the national pool. When the product of the relative rates is *greater than 1*, the combined effects of hiring selection leads to a higher frequency of a minority in the employee pool than is found in the national pool. When the product of the relative rates is approximately *equal to 1*, the frequency of a minority in the employee pool will be equal to its frequency in the national pool as shown earlier. In our example, interview practices are being used to diminish the effects of unsuccessful "advertising" practices combined with a low application rate by women. Thus, although women are interviewed at a high rate, in fact no net favoring of women has occurred.

As in the previous stage of the hiring process, the hiring selection approach also allows additional questions to be addressed. Affirmative Action officials might wish to know, for example, why the relative interview rate for female applicants is so much greater than 1 (i.e., why the frequency of women interviewed is so much greater than their relative frequency in the applicant pool). Several simultaneously acting causes for this observation are possible, including the fact that (1) the applicants from this group are highly self-selected and only individuals with exceptional qualifications have applied for faculty positions; (2) the university has lowered its standards in order to interview a larger frequency of this minority; (3) the university has included additional information in its selection policy that requires closer inspection of applicant qualifications, and this minority scores exceptionally high in this format. This valuable information is not available simply by comparing impact ratios with the 80% rule.

Stage 3: Offers

After candidates have interviewed, a third stage in the hiring process occurs when departments and search committees decide to offer positions to certain interviewees. In Table 7.10, the interview pool and their frequencies are repeated

Table 7.10 Relative Selection Approach to Analysis of Hiring Selection: Offers

Minority (1)	Interview Pool m''_i (2)	Freq. in Int. Pool p''_i (3)	Offer Pool m'''_i (4)	Minority Off. Rate O_i (5)	Relative Off. Rate o_i (6)	Freq. in Off. Pool p'''_i (7)	Impact Ratio (8)
Male	12	0.80	3	0.250	0.63	0.50	1.00
Female	3	0.20	3	1.000	2.50	0.50	4.00
Totals	15	1.00	95			1.00	
Avg. Off. Rate:			0.400				

from Table 7.9 as columns 2 and 3. Of the 15 total interviewees, 40% (3 men and 3 women; 6/15 = 0.40) are offered academic positions as shown in column 4. The *offer rate,* O_i shown in column 5, is calculated in a way analogous to the previously described application and interview rates. Thus, O_i is equal to the number of individuals from minority i that are offered positions, divided by the total number of candidates from that minority group. Since all of the women interviewed are offered positions, the adverse impact method now shows that the offer rate for women (1.0) exceeds that of men (0.25) by a factor of four.

This result may be welcomed by the university, but an impact ratio of 4.0 for offers extended provides little insight into how well or poorly women are being recruited overall. The offer rate reflects only the proportion of candidates from a particular minority group that are offered positions compared to the proportion of candidates from the majority group that receive offers, and only for the offers stage of the hiring process. We must calculate the *relative offer rate* to determine the frequency with which individuals of a particular minority are offered positions *relative to the frequency with which offers are extended among the all of the minority groups.* The relative offer rate for each minority, o_i, shown in column 6, is calculated as in the previous selection episodes, by dividing each offer rate, O_i, by the average offer rate (6/15 = 0.40). As in the previous two selection episodes, the product of relative offer rate and the frequency of each minority in the interview pool allows us to calculate the frequency, p'''_i, of each minority, i, in the offer pool as

$$p'''_i = [p''_i][o_i]. \qquad \textbf{(Equation 8)}$$

Since the frequency of each minority in the interview pool is a function of (1) the relative offer rate, (2) the relative interview rate, (3) the relative application rate, and (4) the frequency of each minority in the national pool, the frequency of each minority in the offer pool may also be expressed as

$$p'''_i = [p_i][a_i][s_i][o_i]. \qquad \textbf{(Equation 9)}$$

Once again, as shown in column 6 of Table 7.10, the relative offer rate of 2.50 for women compared to 0.63 for men compensates for the relatively low frequency of women in the national pool of candidates as well as in the application pool for positions at the university (note the magnitude of the relative rates among selection events for men and women applicants; $[a_1][s_1][i][o_1]$ = [1.20][0.84][0.63] = 0.635, whereas $[a_2][s_2][o_2]$ = [0.21][4.75][2.50] = 2.494). Thus, despite their different frequencies in the national pool of applicants, the frequencies of men and women offered academic positions at the university are now equal. The reasons why the relative frequencies of men and women in the offer pool have the values they do are likely to be the same as described earlier for the interview pool, although a fourth reason, such as a university policy that requires that equal numbers of applicants of both genders be considered when positions are filled, is also possible. It must be noted that whether this policy is in fact practiced by search committees, or for that matter, whether any or all of the possible explanations for the relative frequencies of male and females applicants are true, is neither revealed nor recommended by this method.

Stage 4: Acceptances

The last selection process for this example occurs when candidates offered positions accept or reject their offers. As in previous selection episodes, the frequency of a minority among the newly hired faculty may differ from its frequency in the offer pool. Table 7.11 summarizes this final stage of the hiring process, and following the form of tables describing previous selection episodes, the number of individuals of each minority in the offer pool, as well as their frequencies, are repeated from Table 7.10 in columns 2 and 3. The number of individuals from each group accepting positions is shown in column 4, with their *acceptance rate*, C_i, shown in column 5 (C_i = the number of individuals from minority i that accept positions, divided by the number of individuals from that group that were offered positions). As before, note that it is the *relative acceptance rate* of a minority, c_i, that is most useful in determining the fraction of that

Table 7.11 Relative Selection Approach to Analysis of Hiring Selection: Acceptances

Minority (1)	Offer Pool $\tilde{m}_i$ (2)	Freq. in Off. Pool $\tilde{p}_i$ (3)	Accepts. Pool $\tilde{\tilde{m}}_i$ (4)	Minority Acc. Rate C_i (5)	Relative Acc. Rate c_i (6)	Freq. in Acc. Pool $\tilde{p}_i$ (7)	Freq. in Nat. Pool p_i (8)	Impact Ratio (9)
Male	3	0.50	2	0.667	1.33	0.67	0.80	1.00
Female	3	0.50	1	0.333	0.67	0.33	0.20	0.50
Totals	6	1.00	3			1.00	1.00	
Avg. App. Rate:					0.500			

minority that is represented among the newly hired faculty. Similarly, note that c_i measures the frequency with which members of a particular minority group accept job offers *relative to the frequency with which offers are accepted by all minority groups.* The relative acceptance rate, c_i, is equal to the acceptance rate, C_i, divided by the average acceptance rate. Following the same form as described earlier, the frequency of each minority, *i,* among the new faculty is

$$p''''_i = [p'''_i][c_i] = [p_i][a_i][s_i][o_i][c_i]. \qquad \textbf{(Equation 10)}$$

Applying this formula, the frequency of new male faculty at the university is calculated as

$$p''''_1 = [0.80][1.20][0.84][0.63][1.33] = 0.67 \qquad \textbf{(Equation 11)}$$

and the frequency of new female faculty at the university is calculated as

$$p''''_2 = [0.20][0.21][4.75][2.50][0.67] = 0.33 \qquad \textbf{(Equation 12)}$$

as shown in column 6 of Table 7.11

The relative acceptance rate by women in this example is less than 1 (0.67). Consequently, their representation among the new faculty at the university is lower than their representation in the pool of individuals to which offers are made. As in other selection episodes, there are several possible explanations for this result, including the following: (1) Offers made by the university are not as competitive as those from other universities; (2) the academic or social environment at the university is viewed as unfavorable by female job candidates; (3) the lifestyle represented by the geographic location of the university or the university itself was not viewed favorably by women. In fact, the same reasons for a low relative application rate may also be responsible for a low relative acceptance rate. This suggests that Affirmative Action resources spent addressing the cause of a low relative application rate might also result in improved acceptance rates, which could have multiplicative or synergistic effects in achieving Affirmative Action goals. As in each of the previous episodes of selection, the relative selection method does not provide an explanation for *why* a relative rate should take a certain value. However, the magnitude of relative selection rates does reveal *where* in the hiring process minorities *might* experience discrimination (i.e., when $[a_i][s_i][o_i] < 1$), as well as measure the successful impact of Affirmative Action policies (when $[a_i][s_i][o_i] > 1$).

Summary of Hiring Process I

In using the hiring selection method to analyze the path from job application to the hiring of new faculty members, we can see that it helps to identify where in

the complex process of selection a university's recruitment of minorities succeeds or falters. If an institution has a limited amount of time or financial resources, it may help to identify the stage of the hiring process at which resources are best placed. In the example just given, the relative application rate of 0.21 by women for academic positions at this hypothetical university suggests that administrators might question whether publicity about its programs is reaching appropriate sources of female applicants. The high values for relative interview (4.75) and offer rates (2.50) suggest that it is at this stage in the hiring process that Affirmative Action practices are having their greatest effect, and that it is probably not necessary for administrators to revise their screening procedures. On the other hand, these values could make search committee decisions vulnerable to charges by male candidates that discrimination against men has occurred (see above).

Despite the high relative interview and offer rates, the relative acceptance rate by women is somewhat low (0.67), suggesting that the search committee might interview women who decline job offers in order to understand how more competitive offers or a more attractive academic environment might be provided. However, if the questionnaire reveals that the geographic location or some other feature of the university, beyond the control of university administrators, is responsible for the low acceptance rate by women, the university could choose to focus on improving relative application rates. In this case, low relative application and acceptance rates by women applicants are being counteracted by high relative interview and offer rates. Thus, whereas the national frequency of female Ph.D.'s in the applicant pool is 0.04 (column 7, Table 7.8), the frequency of women among newly hired faculty members is 0.33 (column 7, Table 7.11). This means that the university is hiring women in greater numbers than expected based on their frequency in applicant pool as well as their frequency in the national pool of Ph.D.'s (0.20), despite the fact that more men than women were hired. This increase in the number of women represents considerable success by the university in increasing the number of women represented on its faculty.

The Hiring Process II: Promotion through Termination

Once individuals are hired, other processes continue to change the minority composition of the workforce. Faculty may be promoted or receive pay increases, other faculty may resign, retire, or have their contracts terminated. In addition to achieving racial and ethnic balance in the faculty workforce, Affirmative Action offices are also concerned that promotions, pay increases, resignations, and terminations be distributed in proportion to the frequency with which minorities are represented among the existing faculty pool. No matter what the relative rate of selection for a minority up to acceptance of an offer, net retention rates below 1.0 impede or even reverse the effects of Affirmative Action practices at hiring. Dif-

ferently put, if the net relative retention rate is less than 1.0, then a fraction of the Affirmative Action effort in hiring serves merely to keep the institution "running in place" with respect to Affirmative Action goals.

To demonstrate the use of the hiring selection method in such situations and to show how more than two minority groups may be simultaneously examined, consider the promotion process for faculty at this university. As in adverse impact analyses, employees will be separated by sex and by membership in one of five racial/ethnic groups. As in the previous example, the term *minority* will be used for all groups, regardless of the number of individuals that comprise a group. Also, to assist notation, rather than use m''''_i and p''''_i to indicate the number and frequency of existing employees, these values will be represented by m_i and p_i, the variables used in the previous example to describe the number and frequency of minorities in the national pool.

As in the previous example, each minority is listed in column 1 (Table 7.12). The numbers of each minority, m_i, in the current employee pool are listed column 4, and their frequency in the employee pool, p_i, is equal to the number of each minority divided by the total size of the employee pool:

$$p_i = (m_i)/(\Sigma m_i). \qquad \textbf{(Equation 1)}$$

These frequencies are given in column 5.

Not all of the persons in the employee pool receive promotions, thus, as in the previous example, the frequency of a minority in the promotion pool may be different from that in the current employee pool. The hypothetical number of individuals in each minority group that are promoted at the university are listed in column 6. The *promotion rate* of minority i, G_i, is the number of individuals of that minority in the promotion pool, m'_i, divided by the number of individuals of that minority in the employee pool, m_i. Thus, the promotion rate for African-American employees is calculated as

$$G_2 = 2/31 = 0.065. \qquad \textbf{(Equation 13)}$$

As has already been demonstrated, promotion rates alone are not useful for calculating the frequency of a minority in the pool of promoted employees. To calculate the frequency of a minority in the promotion pool, we need to know the *relative promotion rate*, g_i, which is defined as the promotion rate, G_i, divided by the average promotion rate. The average promotion rate is calculated as (1) the sum of the products of columns 5 and 7 (i.e., $\Sigma[p_i][G_i] = 0.032$), or (2) the ratio of the column 6 to column 4 totals (i.e., $35/1101 = 0.032$). Dividing the entries in column 7 by the average application rate, 0.032, gives the desired relative promotion rates, g_i, in column 8.

If we know the relative promotion rate (g_i) and the frequency of a minority in the employee pool (p_i), we can calculate the frequency of a given minority, p'_i, in

Table 7.12 Relative Selection Approach to Analysis of Promotions, Part A

Minority (1)	National Pool (2)	Freq. in Nat. Pool (3)	Employee Pool m_i (4)	Freq. in Emp. Pool p_i (5)	Promot. Pool m'_i (6)	Minority Pro. Rate G_i (7)	Relative Pro. Rate g_i (8)	Freq. in Pro. Pool p'_i (9)	Impact Ratio (10)	Discrim. Index S_d (11)
White	6,416	0.80	926	0.84	26	0.028	0.88	0.74	1.00	−1.59
Af. Amer.	440	0.06	31	0.03	2	0.065	2.03	0.06	2.30	1.04
Hispanic	912	0.11	75	0.07	3	0.040	1.26	0.09	1.43	−0.41
Na. Amer.	56	0.01	49	0.04	3	0.061	1.93	0.09	2.18	1.18
Asian/PI	176	0.02	20	0.02	1	0.050	1.57	0.03	1.78	0.46
Totals	8,000	1.00	1101	1.00	35			1.00		
Avg. Pro. Rate:			0.032							

Table 7.13 Relative Selection Approach to Analysis of Promotions, Part B

Minority (1)	National Pool (2)	Freq. in Nat. Pool (3)	Employee Pool m_i (4)	Freq. in Emp. Pool p_i (5)	Promot. Pool m'_i (6)	Minority Pro. Rate G_i (7)	Relative Pro. Rate g_i (8)	Freq. in Pro. Pool p'_i (9)	Impact Ratio (10)	Discrim. Index S_d (11)
White	6,416	0.80	926	0.84	25	0.027	0.85	0.71	1.00	−2.05**
Af. Amer.	440	0.06	31	0.03	2	0.065	2.03	0.06	2.39	1.04
Hispanic	912	0.11	75	0.07	3	0.040	1.26	0.09	1.48	−0.41
Na. Amer.	56	0.01	49	0.04	3	0.061	1.98	0.09	2.27	1.18
Asian/PI	176	0.02	20	0.02	2	0.100	3.15	0.06	3.70	1.73*
Totals	8,000	1.00	1101	1.00	35			1.00		
Avg. Pro. Rate:			0.032							

**$P = 0.02$

*$P = 0.04$

the university promotion pool. These values are given in column 9 of Table 7.12. and in general are calculated as.

$$p'_i = [p_i][g_i].$$

The relative promotion rate represents the frequency with which members of particular minority are promoted at the university *relative to the average frequency with which members of all minority groups are promoted.* Thus, as in the previous example, relative promotion rates that are *greater than 1* indicate that members of a particular minority are receiving promotions in greater numbers than expected from their representation in the employee pool. Relative rates of promotion *less than 1* indicate that members of a minority are not being promoted in proportion to their numerical frequency at the university, and relative promotion rates *equal to one* indicate that the members of a minority are being promoted in proportion to their frequency within the university employee pool.

Notice that despite their relatively small numbers in the employee pool (3%), the relative promotion rate of African-American employees is greater than 1 (2.03), whereas the relative promotion rate of Whites is somewhat less than 1 (0.88). There are several possible reasons for this result as described in the previous example, and the same type of results can be observed in the examples illustrated in Table 7.14 (Resignations) and in Table 7.15 (Terminations). It is of interest in these tables to examine the relative rates of resignations and terminations by minority. In Table 7.12, for example, despite a high rate of promotion for African-American employees, the relative rates of resignations and terminations for this minority are even higher. This finding could prompt administrators to interview these individuals as well as their supervisors to determine possible reasons for their loss from the system.

Table 7.14 Relative Selection Approach to Analysis of Resignations

Minority (1)	Employee Pool m_i (2)	Freq. in Emp. Pool p_i (3)	Res. Pool y_i (4)	Minority Res. Rate R_i (5)	Relative Res. Rate r_i (6)	Freq. in Res. Pool z_i (7)	Impact Ratio (8)
White	926	0.84	77	0.083	0.82	0.69	1.00
Af. Amer.	31	0.03	10	0.323	3.20	0.09	3.89
Hispanic	75	0.07	15	0.200	1.98	0.14	2.40
Na. Amer.	49	0.04	8	0.163	1.62	0.07	1.92
Asian/PI	20	0.02	1	0.050	0.50	0.01	0.60
Totals	1101	1.00	111			1.00	
Avg. Resignation Rate:					0.101		

Table 7.15 Relative Selection Approach to Analysis of Terminations

Minority (1)	Employee Pool m_i (2)	Freq. in Emp. Pool p_i (3)	Term Pool n_i (4)	Minority Term. Rate T_i (5)	Relative Term. Rate t_i (6)	Freq. in Term. Pool x_i (7)	Impact Ratio (8)
White	926	0.84	25	0.027	0.83	0.69	1.00
Af. Amer.	31	0.03	6	0.194	5.92	0.17	7.19
Hispanic	75	0.07	5	0.067	2.04	0.14	2.48
Na. Amer.	49	0.04	0	0.000	0.00	0.00	0.00
Asian/PI	20	0.02	0	0.000	0.00	0.00	0.00
Totals	1101	1.00	36			1.00	
Avg. Term. Rate:					0.033		

Examine again columns 5 and 9 in Table 7.12. In the case of Minority 4 (Native Americans), although the absolute numbers of these individuals on the university faculty are small (49/1101 = 0.04, column 5), the frequency of this minority among the promoted faculty is greater than their frequency in the employee pool (0.09, column 9), and overall the frequency of Native Americans at the university (4%, column 5) is greater than their frequency in the national pool of male Ph.D.'s (< 1%, column 2). Despite their relatively low absolute numbers among the faculty at the university, the university has been quite successful at hiring and promoting this minority. Here, a very small change in numbers represents a significant change in the representation of this group.

Conclusions

The hiring selection approach to documenting the movement of job applicants and employees through stages of the hiring and promotion process represents a significant advance over existing Affirmative Action methodologies. The hiring selection approach provides (1) a method for determining relative frequencies of racial/ethnic groups in the current workforce; (2) a method for assessing the effectiveness of recruitment, hiring, and promotion practices on individual minority groups relative to Affirmative Action goals; (3) a way to evaluate the effectiveness of changes in hiring practices; and (4) a means for quantitatively and qualitatively assessing the interaction of practices at different stages in relation to overall goals. The fact that the hiring selection approach does not provide subjective interpretation of the acceptability of particular relative selection rates could be viewed as one of our method's shortcomings, since existing methods do provide this sort of acceptability–unacceptability analysis. The lack of this type

of summary, however, makes our approach less likely to generate biases, as demonstrated earlier.

Our analysis shows the rate at which each group moves or does not move to the next selection event. This permits relative selection rates to be interpreted coherently relative to Affirmative Action goals. Relative rates can assist in identifying at what stage and to what degree employee movement patterns in the hiring and promotion process are impeding or promoting Affirmative Action goals. Moreover, the effects of certain stages *relative* to other stages can be critically important in the allocation of resources to hiring practices. In our examples, low relative application rates required compensating and higher relative selection rates at later stages in the hiring process. Administrators using our technique can thus justify their hiring and promotion decisions, and these decisions' attendant costs, in light of current needs for proportional representation with respect to race, gender, and ethnicity among members of the national workforce. Such methods for disclosure and implementation are likely to be endorsed by most citizens.

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Appendix 7.1

Detecting Significant Discrimination

How can significant discrimination be detected, against minorities as well as the majority? A relative selection rate that is *equal to 1* indicates that members of a group have moved through the current selection episode in proportion to their numbers after the previous selection episode. Observed relative selection rates that deviate significantly from 1 may be identified by examining the *standardized difference,* S_d, between the frequency of the minority in the previous pool of candidates, p_i, and the frequency of the minority after the current selection episode, p'_i, with N = the total number of individuals that move from one episode to the next. Thus,

$$S_d = (p'_i - p_i)/[p_i\,(1 - p_i)/N]^{1/2}. \qquad \textbf{(Equation 15)}$$

This statistic shows the number of standard deviations the minority's current frequency lies *above* (if the value is positive) or *below* (if the value is negative) their frequency after the previous selection episode (i.e., the effect that hiring of other minorities has on the relative hiring or promotion rates of the minority in question). When calculated in Table 7.12, values of S_d range from − 1.59 to 1.18, indicating that certain minorities were promoted at frequencies less than, as well as greater than, their frequency in the employee population. Such variation is likely to occur in every selection event since minority frequencies in the employee pool, p_i, (column 5) and in the promotion pool, p'_i (column 9), always sum to 1.0 (row 6, columns 5 and 9, Table 7.12). Thus, a slightly higher relative promotion rate for one minority will result in a slightly lower rate for other minorities. Whether these deviations represent *significant discrimination,* however, depends on the magnitude of the deviation for a given promoted population size.

For example, when calculated for the example in Table 7.13, the method shows the relative frequency of Whites in the promoted population to be 2.05

standard deviations *below* their relative frequency in the employee pool, whereas the relative frequency of Asian/Pacific Islanders in the promoted population is 1.73 standard deviations *above* their relative employee pool frequency. When these standardized differences are compared with a normal distribution of these values for this sample size ($N = 35$ promotions; Rohlf and Sokal, 1981), they fall significantly below and above the distribution's mean, with probability $P = 0.02$ and $P = 0.04$, respectively (Table 7.13). Significant hiring discrimination *in favor* of Asian/Pacific Islanders and *against* Whites has occurred. However, note too that both African-American and Native American employees were promoted in higher frequencies than their proportional representation in the employee pool (column 11, Table 7.13). Since the frequencies of minorities in the promoted population must sum to 1.0, significant reverse discrimination may be more likely to arise when several minorities are disproportionately promoted simultaneously.

Examination of standard deviations as a method for detecting evidence of discrimination was suggested by Haertel (1984), although this method compared observed and expected selection rates rather than the frequencies of minorities in between selection events. Moreover, this method did not explicitly provide a means for testing the significance of the deviation. The Supreme Court (*Castenada v. Partida,* 1977) has ruled that deviations of expected and actual selection rates exceeding two or three standard deviations are "suspect." However, the significance of a standardized difference may vary with sample size (note the denominator in Equation 15). Thus, it is useful to compare the standardized difference with a normal distribution for each sample as described earlier. Contrary to the ruling of the Court, a standardized difference calculated as described in Equation 15 that is less than or equal to -1.65 indicates significant discrimination with probability < 0.05 (Rohlf and Sokal, 1981).

Note that the values for S_d for each minority are reported in column 11 of Table 7.12 show no evidence of significant discrimination for any minority, despite the fact that members of the "most desired" minority (Asian/Pacific Islanders) are promoted at the lowest rate. This policy *makes sense,* since Minority 5 has the lowest frequency among employees. Yet despite a promotion rate that is numerically lower than that for other groups, the relative promotion rate for Asian/Pacific Islanders is 1.57, over 1.5 times greater than their frequency in the employee pool. Thus, the university's promotion policy is consistent with Affirmative Action.

Haertel (1984) proposed the use of 2×2 chi-square analysis to compare the observed and expected frequencies of minority and majority individuals from one stage of the hiring process to the next. Like impact ratio analysis, however, this method is limited to comparisons of frequencies across a single selection episode. Moreover, this approach establishes expected frequencies using a predetermined criterion (such as equal offer rates among minorities). Significance testing that is more consistent with the hiring selection approach is an $R \times C$ chi-

square test (or an R × C G-test; Sokal and Rohlf, 1981). This method tests the null hypothesis that the frequencies of all minorities remain proportionally equal across all stages of the hiring process. This method may be appropriate, however, only for situations with very large sample sizes, since cells containing zeros affect the power of this test. Furthermore, without elaborate subdivision of the frequency table, the source of significant deviations from the null hypothesis can be difficult to identify.

The methods just described are useful for placing familiar-looking confidence limits on recruitment, hiring, and promotion decisions. In general, however, the question of statistically testing the effectiveness of such practices is somewhat misguided when applied to a single institution. In such situations, the employee pool is not being estimated, since its accurate census is known. The pool composition is similarly not being estimated, since its composition can also be completely known. In a very real sense, then, any observed change in composition can be completely accounted for in terms of the relative rates and differences in sign of rate between stages. Moreover, rate differences between stages within an institution cannot be statistically compared, because each value is a datum. In this way companies or institutions are unlike natural populations for evolutionary ecologists and more like laboratory populations. The sample from nature provides only an estimate of the magnitude of selection processes. In contrast, the census from a laboratory population is subject only to measurement error and, in fact, is considered a datum itself in relation to characterizing nature.