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Sex Segregation and Glass Ceilings: A Comparative Statics Model of Women's Career Opportunities in the Federal Government over a Quarter Century[1]

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A comparative statics model is utilized to examine mechanisms of gender inequality: gender distribution (skew), gender segregation (composition), occupational captivity, hierarchical ceilings, glass ceilings, and internal labor market (ILM) structure/network linkages. The analysis examines new linkages between sex segregation and glass ceilings; two elements of sex segregation—composition and captivity; and two elements of glass ceilings—pathways inside and outside one's original ILM. Gender-specific career trajectories were constructed to analyze women's career opportunities in 22 occupational ILMs in the U.S. federal government for two periods between 1962 and 1989, demonstrating how to extract career implications from much shorter periods of time. There is a very large differential effect by gender when staying within one's occupational ILM; however, when pathways that include changing ILMs are considered, women's opportunities to enter the top tier become almost equivalent to those for men in the second period.

INTRODUCTION

It has now been over 30 years since the passage of the Civil Rights Act of 1964 and yet the ceaseless efforts to bring women and minorities into the upper level of management in corporate America and government still

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fall far short. The same point may be said for equality in the workplace in general. Sex segregation, for example, has been extraordinarily stable relative to the dramatic changes in both composition of the labor force and occupational structure. Even in 1986, almost 60% of women who were employed would have had to change their occupational category to equalize the occupational distribution by gender (Jacobs 1989). The glass ceiling also remains intact; 97% of senior managers at the Fortune 1,000 industrial corporations are dominated by white males, and only 5% of the top managers at Fortune 2,000 industrial and service companies are women (U.S. Department of Labor 1995). These persistent findings lead us to ask how opportunities for women have in fact changed since the beginning of the civil rights era. With a new comparative statics model, we assess the degree to which opportunity structures for women in the labor market have changed over a quarter century from right before the passage of the first major civil rights act in this century and how such changes took place. Focusing on 22 detailed occupations within the U.S. federal government, we construct career trajectories of men and women in each of the occupations within the context of an organization and its internal labor markets (ILMs) and analyze how and to what degree opportunity structures for men and women in these occupations differ. We also examine the impact of four structural factors on women's career opportunities in each occupation—its female composition, its hierarchical structure, its degree of occupational captivity, and whether or not it has a glass ceiling. In brief, this analysis provides: (1) a model to assess the changing nature of job opportunities and the long-term career implications of such changes, (2) new linkages between sex segregation and glass ceilings in a wider scope of analyses than has generally been conducted, and (3) a first attempt at using this approach in assessing the changes in opportunities by gender, looking at professional, administrative, and technical jobs.

Evaluation of Changes in Labor Market Opportunities and Their Implications: Comparative Statics and Careers

How does one assess the nature of change, if any, in labor market opportunities for women?[2] Perhaps the most often used tactic has been to examine

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[2] Of course, this question is not limited to women but applies to an analysis of changing opportunities for any group of individuals.

the change in distributions over time. For instance, with respect to sex segregation in jobs, the primary strategy has been to analyze the trends in the sex distribution of job holders (see Beller 1984). A second tactic has been to examine the flows of workers rather than the end distribution. Thus, for example, one examines the extent of movement by women from female- to male-dominated jobs (see Rosenfeld 1984; DiPrete and Soule 1986). Each of these approaches complements the other. The first details the outcomes; the second examines critical aspects of the processes rendering the outcomes. As we show below, however, these two approaches, when used separately as is often the case, are unable to grasp an overall picture of gender inequality in the workplace or its underlying mechanisms, though each may shed light on a particular aspect of sex segregation or the glass ceiling. To incorporate both approaches and to capture the changes in opportunity structures of men and women, we utilize the career pathway structure (CPS) model (Stewman and Yeh 1991). The model constructs an average individual's entire career trajectory within an organization, that is, given the initial entry occupation and grade, how far and where he or she goes, from hire to exit, with the odds specified at each node. Our analysis is unique in two aspects. First, we use the constructed career trajectories as a theoretical metaphor for eliciting an actual labor market's operative opportunity structure. Second, taking advantage of the model's ability to construct *full*-career trajectories, we examine the implications of the existing opportunity structure from entry to final exit from the organization. In previous work (Stewman and Yeh 1991), there was no examination of heterogeneity within the occupational ILM of the organization, nor analyses of change in the opportunity structure over time. Thus, the comparative statics power of the model was not elicited. Here we address gender inequality across a substantial period of time with a particular focus on change in opportunity.

This article also builds on the work of DiPrete (1989), which was especially directed to ILM boundary crossings, a process generally not studied. It is a process, however, that we will show may take on increasing significance for gender inequality, especially in an era of economic globalization with its attendant organizational restructuring. Here, we include intraorganizational ILM boundary crossings, as well as intraoccupational ILM moves to derive the complete career trajectory within the organization. The analysis thus has implications for both sex segregation and glass ceilings within the organization.[3] The work also extends the time horizon another decade beyond that examined by DiPrete (1989), and it is in this period that the greatest changes for women occurred.

[3] The approach can also be extended to interorganizational moves (see Haveman and Cohen 1994), where the data are available.

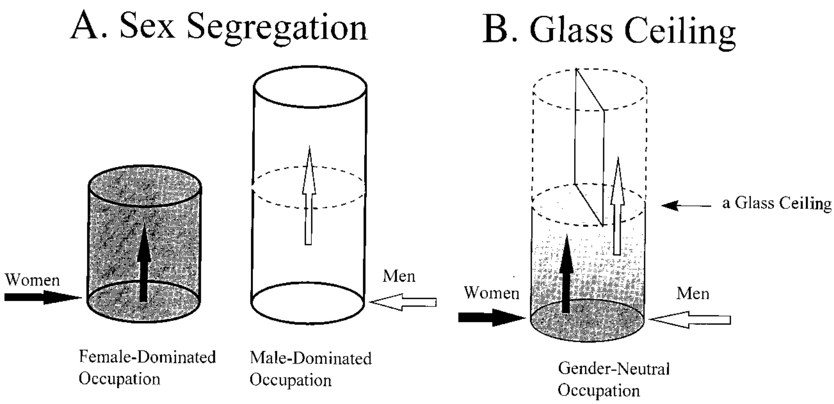

FIG. 1.—Sex segregation and glass ceiling

Sex Segregation and the Glass Ceiling

We argue that the concept of worker flows plays a crucial role in revealing critical dimensions of sex segregation and glass ceilings and in linking the two. It has been argued that sex segregation in jobs accounts for as much as one-third of the earnings gap between women and men (Treiman and Hartmann 1981). Petersen and Morgan (1995), using distributional data, looked at the significance of sex segregation for 705 blue-collar and clerical occupations, as well as for 10 administrative and professional occupations in determining wage and inequality; they report that among blue-collar and clerical jobs, about 40% of the existing gender differential in wages is explained by occupational segregation.[4] Here we probe further to look at the processes beneath the distribution for a set of occupations. At least two factors are involved—the lower pay and lower number of grades, or shorter career track, in female-dominated occupations and a lack of access to male-dominated alternative occupations with higher pay and higher number of grades, as schematically depicted in part A of figure 1. However, even if equal access to occupations with higher grades is attained to reduce skewed gender composition, an earnings gap would remain if there is a glass ceiling within these occupations (see part B of fig. 1). Thus,

[4] There are, however, wide variations in the estimates of the impact of occupational segregation on the gender wage gap, ranging from 0% to 40% (see Sorensen [1990] for a review of previous studies). In some recent studies (e.g., MacPherson and Hirsch 1995; O'Neill and Polachek 1993) the impact of occupational segregation, measured as the percentage of females, per se, was found negligent, while variables on work/skill-related occupational characteristics were found as a major factor for the narrowing of the wage gap.

there are two separable dimensions of notable importance—sex segregation across jobs and glass ceilings within jobs.

Occupational sex segregation has been one of the most commonly used indicators in examining gender inequality in the workplace, and various theoretical explanations for the cause and its persistence have been postulated (for reviews, see England [1984, 1994] and England and McCreary [1987]) though none has yet been empirically supported (England 1984). Tacitly assumed in these theories is that little, if any, mobility exists across gender-segregated occupations, thus implying gender as the cause of occupational segregation. However, a series of empirical studies (Corcoran, Duncan, and Ponza 1984; DiPrete and Soule 1986; DiPrete 1989; England 1982; Jacobs 1989; Rosenfeld 1983, 1984; Rosenfeld and Spenner 1992) identified the movement of women across occupations of different gender composition. Jacobs (1989), in his attempt to account for the paradox between the persistence of extremely low female composition in certain occupations and the influx of women into these occupations, proposed a theory of "revolving doors": women, though successfully moving into male-dominated occupations, are pressured to leave because of the existing institutional and informal social controls, thus leaving a skewed gender composition intact. Jacobs's (1989) reconciliation highlights both processual and distributional features in the theory of gender inequality in the workplace: the notion of flows of individuals across occupations and the gender composition of an occupation. We stress the importance of both the distributions and the flows that underlie such distributions. Accordingly, we propose to explicitly distinguish these two aspects of occupational segregation and define them independently. The distributional dimension, *gender composition,* refers to the percentage male or female in an occupation. The flow or processual dimension, which we define as *occupational captivity,* refers to the degree of closedness of an occupation—the degree to which flows of individuals do not move into and/or out of the specific occupation vis-a-vis all other internal occupations during a certain period of time *regardless* of the existing gender composition of the occupation.[5] It is thus possible that occupations with highly skewed gender compositions, as well as well-balanced ones, may have varying degrees of occupational captivity. When, however, both skewed gender composition and higher degrees of occupational captivity are jointly observed, clearly such jobs are sex segregated. We analyze both dimensions of sex segregation—composition and captivity.[6] Considering women's limited

[5] We are grateful to one of the *AJS* reviewers who coined the term *occupational captivity* to clarify the concept as well as to avoid unnecessary confusion surrounding occupational segregation and gender composition.

[6] Captivity can operate in two respects—as a disadvantage when internal opportunities are more limited, as is often the case for women, or as an advantage when internal

opportunity structures within a particular occupation, it becomes increasingly critical to ask if there exist avenues to other occupations in which they can advance their careers.

Glass ceilings are another major area in which sociologists and economists analyzing gender inequality in the workplace have focused (Morrison, White, and Velsor 1992; Davidson and Cooper 1992). Though the basic concept behind the term *glass ceiling* is the blockage of upward *mobility* of women, it has generally been analyzed based upon distributional data. Thus, the issue is "the representation of women" (Morrison et al. 1992, p. xii), and a conventional approach is to search for any women in the distributional data. While, as a metaphor, the glass ceiling conveys a strong connotation, as a means to measure women's career opportunities, it often lacks analytical leverage. In contrast, when the glass ceiling is actually measured by the mobility of individuals between different hierarchical levels, one recognizes that it has different levels of severity, or closedness, and thus the analyst can investigate the phenomenon as a matter of degree rather than as a dichotomy. In this study, we analyze glass ceilings using both measures.[7]

The concept of flows also enables one to link occupational segregation, specifically occupational captivity, and the glass ceiling, as well as to see the multidimensionality of the glass ceiling. At the organization level, with multiple occupations, the glass ceiling has two dimensions, that is, glass ceilings *inside* and *outside* the original occupation. Thus, the glass ceiling has a dimension of occupation and of organization. If women in a particular occupation are able to climb hierarchical ladders in the organization when they move out of the original occupation, while such career ladders do not exist for those who remain in the occupation, then changing occupations is the only way to enhance their careers. And here the issue of occupational captivity plays a critical role in determining such possibilities. Figure 2 provides a schematic view of the linkage between the two concepts. For women who face a glass ceiling, their prospects depend on the extent of captivity there. If they are in less captive occupations, they could reach higher positions by moving to other occupations that do not have a glass ceiling, whereas if they are in occupations with high captivity, such outside opportunities are virtually nil.

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opportunities are more numerous, as in occupations with greater ranks at the top, as is more often the case for men. We would also expect for there to be differences in the extent of internal entry and exit for such jobs—less entry, more exit and more entry, less exit. In short, asymmetry in flows into and out of one occupation would often be the case. In this article, our focus is primarily on outflows, where such restrictions or captivity result in disadvantages for women.

[7] That is, "0" or "1" and, if not "0," the percentage crossing the barrier.

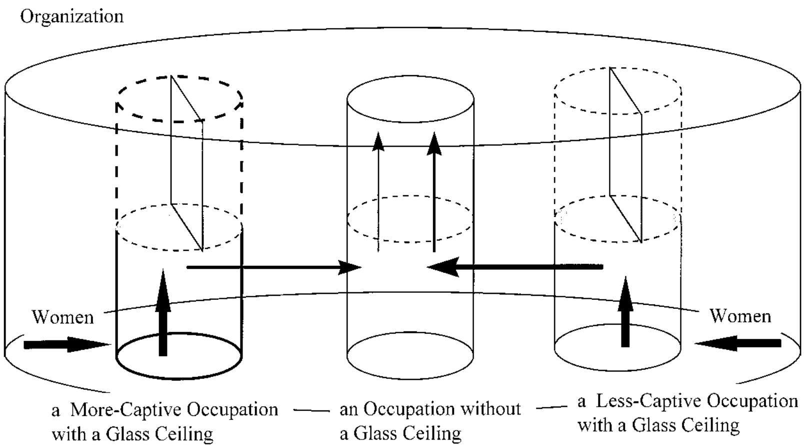

FIG. 2.—Occupational captivity–glass ceiling linkage

Organizations and ILMs

The emphasis of our analyses is in the context of organizations and ILMs. The issues of gender inequity in the workplace, from glass ceiling to sexual harassment, are organizational phenomena, though it may be possible to generalize the problems over a particular occupation or industry. For example, Blau (1977) demonstrated that even where occupational distributions aggregated across firms were not extremely skewed by gender, if one examines the same data at the organizational level, many such occupations were relatively all male or female. Bielby and Baron (1984) found similar results for the entire state of California. Furthermore, Petersen and Morgan (1995) reported that for blue-collar and clerical jobs as much as 89% of the gender wage gap was accounted for by occupation-establishment segregation, compared to 40% by occupational segregation only, underscoring the importance of organization in examining the problem.

Institutional economists and organizational sociologists have further pointed to the significance of ILMs as an organizational phenomenon underlying job segregation. That is, while Petersen and Morgan (1995), Bielby and Baron (1984), and Blau (1977) pointed out the importance of the external boundaries of organizations for job segregation, ILM theorists go further and postulate multiple ILMs within such organizations (e.g., Doeringer and Piore 1971; Althauser and Kalleberg 1990) with a major premise that such ILMs are basically self-contained or segregated. For instance, Doeringer and Piore (1971) postulated that organizations consist of a set of largely independent or isolated mobility clusters (the set of jobs within which an individual is usually promoted, demoted, or transferred, once he/she has entered one of its ports from the outside). Thus, internal flows, as well as external entry flows, are conceptualized, but there are boundaries segregating the internal flows. In short, there are external boundaries where entrants come into distinct ILMs and internal boundaries for these ILMs within the organization, keeping workers segregated.[8] Here we depart from the most prevalent version of ILM theory with an analogy to the discussion on occupational sex segregation. Just as discussions of sex segregation based on gender composition (distribution) implicitly assume no movement between occupations, ILM theorists have generally assumed little or no movement between ILMs within a firm. We hold no such assumption, allowing both independent and interdependent mobility clusters. Thus, one may examine the degree of independence or isolation of an ILM. In this article, we will show that weights based on relative frequency of flows (e.g., the "main paths" of ILMs) are not as important as outside routes to other ILMs for women's access to the top tier.

Several areas of import to extant ILM theory remain to be empirically investigated, some of which have been carefully articulated by Althauser (1989*a*) and Althauser and Kalleberg (1990). For instance, one such area includes the empirical or operational identification of mobility clusters. One of the criteria used by Althauser and Kalleberg (1990) to operationalize ILM mobility clusters was that of main paths to link a set of jobs (e.g., occupation x, grade y, to occupation w, grade z). In many cases, of course, the main path will show promotions within occupation and thus $x = w$. In others, however, the main path may link different occupations. Althauser and Kalleberg (1990) defined *main paths* between a pair of jobs as having a minimum 20% of flows, as measured in terms of the percentage of all internal outflows from the source job or all internal inflows into the sink job.[9] Both Spilerman (1986) and Althauser (1989*a*) also noted the importance of empirically examining the degree to which an organization's official or formal definitions of such mobility clusters differ from the main paths of actual careers. We will address this issue for our organization in the analysis section—at least as far as examining the pathways for women through the glass ceiling. We also concur that there needs to be such explicit rigorous criteria and a structural requirement of a high proportion of flows within an ILM. However, given the diversity of world-

[8] There are also important variations for job dynamics and job opportunities within each ILM. It was to such organizational labor markets that organizational demography was brought to bear (Stewman and Konda 1983). Also, for a complementary approach linking organizational ILMs and vacancy chains, see Pinfield (1995).

[9] Both *source* and *sink* terms are used as in graph theory, where *source* refers to the origin of a flow and *sink* to the destination.

wide ILMs, there remain wide arenas for specifying the range of ILM behavior, and we differ from Althauser and Kalleberg (1990) when they add criteria such as job duration and growth of skill/knowledge. Here we prefer the more general conceptualization initially developed by Kerr (1954) and Doeringer and Piore (1971). The latter not only specified independent mobility clusters as the primary form of ILM but also allowed rules for job bidding across the entire range of jobs in a firm, as well as rules for seniority as a mechanism to prompt job movement. In short, we argue that the more open view of ILMs, allowing considerable heterogeneity in forms, is preferable since it confronts neoclassical labor economics at the organizational boundary—where internal jobs are shielded from external competition. This distinction is paramount and provides a basis for new theoretical development whereby organization theory confronts economic theory such as that developed by Simon (1991) and prior to that by Carnegie School theorists in general (e.g., Allison 1971; March and Simon 1958; Cyert and March 1963; Simon 1979). It is also consistent with theorizing by Stinchcomb (1965), where new ILM forms may occur over time, with the founding of new cohorts or generations of organizations or technology (e.g., Kanter 1982). Equally important, it permits a substantial range of dynamics and variation in ILM forms to be specified. For example, while Doeringer and Piore (1971) utilized custom-based rules as a cornerstone for the metaphorical explanation of how ILMs evolved and persisted, they also underscored the rigidity of such rules. A quite recent thesis out of the Netherlands (Veen 1997), however, demonstrates considerable flexibility and dynamics in ILM rule structures. In short, in our view, as we will show, there is ample room for new theoretical and empirical specifications in ILM theory and such specifications have major implications for gender inequality.

The phenomenon of gender inequality in the workplace appears to be worldwide. However, theorists in Europe (Davidson and Cooper 1992) point to the United States as leading the way toward equality. Moreover, we postulate that one organization that should lead the effort of equalizing career opportunities of men and women is the federal government itself.[10] While Congress left the federal workers out of the 1964 Civil Rights Act, there were executive orders by President Johnson in 1965 and 1967 regarding implementing equal employment opportunity in the federal workforce and by President Nixon in 1969 requiring each federal agency to develop affirmative action programs. In addition, in the 1972 amendments to the

[10] However, as far as occupational segregation is concerned, when measured by the index of dissimilarity (Duncan and Duncan 1955), the level of occupational segregation found among federal civil service employees in General Schedule (GS) jobs parallels that for the U.S. economy as a whole (Lewis and Emmert 1986).

1964 act, government employees, including those in the federal workforce, were brought under the 1964 Civil Rights Act. Further, during the Carter administration, affirmative action was strengthened through the introduction of the Civil Service Reform Act of 1978, which required federal agencies to take affirmative action in recruiting, hiring, and promoting women and minorities. While we are not testing the proposition that the public sector should be more sensitive to gender equality than the private sector, we believe that in the present normative structure of the United States, this will be the case and thus start our examination of the dynamics of opportunity structure and gender by looking at the federal white-collar workforce over a quarter century. The time period is 1962–89, covering six U.S. presidents and multiple civil rights acts, including the most comprehensive one in U.S. history (the 1964 act).

In sum, within the above analytical framework, we examine how women's opportunity structures have changed over a quarter century, from 1962 to 1989, for an organizational labor market—the U.S. federal workforce in professional, managerial, and technical fields. The comparative statics model we propose allows us to compare the distributions of men and women *and* their flows between occupations. We examine the effects of (1) occupational gender composition, (2) occupational captivity, (3) hierarchical structures of occupations, and (4) glass ceilings on the careers of men and women. The model is discussed in detail in the following section.

CPS MODEL

This section discusses the CPS model (Stewman and Yeh 1991) but here applied in a setting allowing its comparative statics power to be elicited. We also describe the data that will be used for the current analysis and provide a couple of examples to demonstrate how the CPSs are derived.

Model

As noted above, the model allows one to construct an average individual's entire CPS within an organization. In obtaining this career trajectory, we first obtain pooled job shifts by concatenating the job-to-job movements of the entire occupation's population of external entrants for a given time period. We then focus on career entries in this occupation at a specific grade and utilize the pooled job shifts to derive the full-career trajectories, including the ending distribution that would occur if this opportunity structure remained constant. Thus, a major assumption of the model is that the conditions of the labor market remain constant for a given time period. When comparing two populations or a population in two time periods, the model yields both distributional and processual differences in the complete careers that would unfold within this labor market in the two respective time periods.

We shift the analytical focus both from labor market distributions of men and women and their career segments to their full-career trajectories under the operative labor market conditions of that time zone. The model uses the career as a vehicle for bringing labor market opportunities into a sequential and integrated whole and allows us to obtain the *full* implications for a career of a specific set of actual labor market conditions. To provide more clarity, we briefly compare our strategy to three other approaches. The first comparison is with a direct analysis of change by viewing age cohorts. One problem may be highlighted by considering a comparative analysis using real-time data to compare opportunities for the same age cohorts between the two periods. Thus, if one of the historical regimes is the current decade, no matter what data we use, the careers of the current younger cohort are incomplete. And, while a sequence of intergenerational researchers could wait until these careers are finished, the problem is created anew for the younger cohorts of the most recent generation of researchers. When the process is not in equilibrium, one strategy to deal with truncated data is to use comparative statics to analyze future implications of two or more current processes. It is this tactic that we use in this article.

Second, from a theoretical statics point of view, our approach somewhat resembles the life expectancy concept in demography or the human capital concept in economics. Each uses the current schedules to derive the future implications for the population as if one might live out that schedule. Using the most recent data provides better estimates than tracing a generation backward in time. It is by assuming the operation of "current conditions" that both of these theories in demography and economics concatenate adjacent age cohorts to construct life expectancy or expected incomes over the working lifetime. Our approach is similar in method—assuming "current conditions" or schedules are operative (in our case, opportunity structure), concatenation, and derivation of a synthetic construct. However, we use a different unit of concatenation for constructing career trajectories. Sequential job moves from the pooled job shifts are used to obtain the full-career trajectories, or *synthetic* careers, of a group of individuals. Specifically, we concatenate the two-point flows from job x to job y into a chaining sequence of flows from the initial entry port to the organizational labor market through the sequences of jobs until an exit is made from the organization. In this process, nonmoves are disregarded and hence the sequential opportunities are embedded in time.[11]

[11] Since movement and nonmovement are binary, by obtaining all moves from a given location, lack of movement is also known. Thus, e.g., if more women than men never

That is, real time behavior such as moving and not moving is not treated, but sequential ordering of all movements is incorporated. The data are from the current labor market, and the strategy, in effect, constructs the career that would unfold under these labor market opportunities. Thus, one obtains the flows and outcomes (distributions) implied by the current labor market from the beginning to the end of one's career. Through the use of this comparative statics metaphor, we freeze time and labor market opportunities but elicit the full-career stream that would unfold under this opportunity regime.

Third, we compare our approach to the existing models in career analyses. One type, already noted in demography and economics but here applied to career movement, is that of synthetic cohorts (see, esp., Spilerman 1977; Spenner, Otto, and Call 1982). A major distinctive feature of the CPS model includes its exclusive attention to the connectivities of jobs versus concatenation of cohorts. The approach also makes a radical departure from the majority of conventional career models that focus either on the duration of one's staying at a job (e.g., Felmlee 1982) or on individual heterogeneity (e.g., Halaby 1982; Skvoretz 1984; Sørensen 1977; Rosenbaum 1979, 1984), dealing with career segments. In our approach, full-career trajectories are *constructed* based on the population of existing job connectivities. Thus, these trajectories are synthetic under the existing labor market conditions. In contrast, career lines in other studies *are* actually observed career segments; however, because the construction of career lines requires vast amounts of longitudinal data, the obtained results are generally about incomplete careers. Our approach, however, does somewhat resemble that of Gaertner (1980), Althauser (1989*b*), and Althauser and Kalleberg (1990), who examined career lines based on job connectivities. Nevertheless, it differs from the latter set of analysts in several key aspects. First, in our approach, timing in the form of duration and stays (nonmoves) is omitted, while sequential ordering is retained, embedding the processes in real time.[12] This differs from Gaertner (1980), who retained stays, and Althauser and Kalleberg (1990), who omitted moves off the main career line and incorporated duration once main career

make a job shift, this is still captured by the model since it will show up in exits from that location. The relative odds of moving, initially and sequentially, are specified in the model. In effect, it is the time or timing that is omitted by attending only to moves. However, we generally think of mobility in terms of moves and nonmoves (stays), recording both, in time series data, and it is in this sense that nonmoves are disregarded. Conventional thinking of mobility mixes both mobility and timing. Here, instead, by attending solely to all moves, including the end move, we also know the lack of movement, or nonmoves.

[12] By *embedded in real time,* we mean that the actual timing of moves is omitted, while retaining the sequential order. For another such example, see White (1970*a*).

lines were identified. Second, we take into account *all* existing linkages across jobs and grades and do not use a threshold criterion, such as a threshold of traffic volume (e.g., Althauser 1989*b;* Althauser and Kalleberg 1990) or statistical significance of such volume (e.g., Gaertner 1980), to focus on "major" career lines. Third, since we include all the existing job linkages, the relative odds of movement along the pathway at *each* link, as well as the career-ending distribution, can be calculated. In contrast, in the approaches in Gaertner (1980), Althauser (1989*b*), and Althauser and Kalleberg (1990), because they disregard all nonmajor job links, neither the odds of getting to any internal location nor the specification of the locational distribution at which the career ends is available.

By collapsing the timing of career moves and retaining the connectivities of jobs, the CPS model preserves important relevant structural factors that influence individuals' career movements. While it does not differentiate between mechanisms prompting movements—vacancy based or seniority based—within an occupation, it does capture this joint impact since it utilizes all moves between jobs and grades, thus yielding not only the direction of flows but also the odds at each branch of the career path. Moreover, when concatenated into sequences, these directional odds yield the aggregate career trajectory of the present labor market. If we continue this concatenation process for all moves from the initial port of entry until one exits, we generate the CPS from beginning to end under the current labor market conditions. It is as if we are freezing the current opportunity structure in time and looking at its long-term consequences, using the theoretical concept of career as a metaphorical razor by which we may obtain a fully representative labor market slice, revealing its full implications in terms of opportunities for individuals. By constructing an average individual's entire CPS within an organization, the model also reveals the existing bridges connecting different ILMs, an important macro structure in examining organizational career mobility. When applied to gender, we are thus able to compare and contrast the career trajectories of men and women. When we further construct these career trajectories for different time periods, the resulting pathways reveal the manner and degree to which such opportunity structures have changed over time.

In the CPS model, we focus on an individual's movement from one position to another, represented by nonzero cells in the mobility matrix that captures all the job-to-job movements, rather than his or her staying at a particular position. In fact in the CPS model, all stays have been omitted—there are no stays.[13] The diagonal cells in the mobility matrix

[13] Our omission of job stays, or the duration of one's staying at a particular grade in an occupation, is not because we consider the duration trivial but because, as yet, no model is capable of simultaneously capturing both duration and connectivities of job

refer to moves within occupations only, and stays are not there. In this respect, the processes are embedded in time with the sequential order preserved. Thus, the model parallels that of the vacancy chain model of Harrison White (1970*a*) in which only moves by vacancies are recorded and one's interest is in the chain reaction. Here, correspondingly, only moves by persons are recorded, and our interest is the sequential nature of these moves from origin to exit, that is, the full sequential n-point process, which has been so difficult for career theorists to capture. These movements include moves to other jobs of the same type (e.g., transfers, reassignments), moves to different types of jobs (e.g., different occupation), moves to different hierarchical levels, and moves out of the organizational labor market. We will illustrate the equations of the model step by step:

1. Let n be the number of job classes for an organization. In the analysis to follow, a job class includes both hierarchical grade (e.g., GS13) and occupation (e.g., financial analyst job).
2. Let M be the internal n by n mobility matrix (e.g., a movement from a financial analyst, GS13, to a management analyst, GS14). This matrix M captures the direction and odds of movement. That is, the elements of M, m_{ij}, denote the probability that an individual who is in job type x and grade i moves to job type y and grade j in one move.
3. Denote M_0 an n-element column vector for the exit movements (e.g., financial analyst, GS13, to the outside of the organization). Similar to the mobility matrix M, the exit mobility vector M_0 captures the directionality of movement and the relative odds of such moves to the outside. The relationship between M and M_0 are such that $ML + M_0 = L$ where L is a column vector of ones.
4. If M is multiplied by itself, a distribution of expected internal moves is generated for the loci of the individual on the second move. The elements of this self-multiplied matrix, M^2, $m_{ij}^{(2)}$ represent the expected probability of a move from i (the entry port) to k on the first move, then from k to j on the second move (i.e., $i \rightarrow k \rightarrow j$). Here, k could be any job class, including i and j, but not an exit.
5. If we multiply M t times, M^t represents the individual's expected location after the tth move, with the sequential interconnections between jobs reflecting the underlying current labor market structure.[14]
6. Combining such a series results in the fundamental matrix $(I - M)^{-1,}$

for the full career (a sequential n-point problem). In the present study, we have thus focused on job connectivities.

[14] M^t is not a representation of the individual's location after t time periods, as is generally the case with Markov models.

where $(I - M)^{-1} = I + M + M^2 + M^3 + \ldots + M^t + \ldots$. The fundamental matrix $(I–M)^{-1}$ loses much of the cellular structure identifying the pathways, that is, it loses the destination of the specific link. However, it provides an estimate of the range of job nodes traversed and of the magnitude of occupancy per node due to the sequential property of career moves.

7. To obtain the pathway structure, or the origin *and* destination of the specific link, retaining the origin of the career, we now take, for example, the lth row of $(I - M)^{-1}$, denoted by O_l. The elements of the vector O_l, o_{li}, represent the expected number of career moves from job type x, grade i, given that one's career started in row l (job type m, grade n).
8. Diagonalizing the row vector O_l, we obtain a matrix, O_{l_D}. If we postmultiply O_{l_D} by the mobility matrix, M, we obtain the internal destinations, yielding the link missing from the fundamental matrix. The outcome is a square matrix, denoted by C_l. Thus, C_l represents (1) the linkage between job nodes, as indicated by a nonzero cell, (2) the relative magnitude of such linkages, given by the value of the cell, and (3) the career origin, l, for example:

   finance, GS9 → finance, GS11 → finance, GS13 → . . .;

   finance, GS9 → finance, GS11 → finance, GS14 → . . .,

   given a career origin at finance, GS9.
9. To obtain the career ending distribution vector denoted by C_{l0} we postmultiply O_{l_D} by the exit vector M_0. This generates a fourth element—the location of career exits from the labor market by career origin, for example:

   finance, GS9 → finance, GS11 → finance,

   GS13 → . . . → finance, GS17 → exit;

   finance, GS9 → finance, GS11 → finance,

   GS14 → . . . → personnel management, GS15 → exit,

   given a career origin at finance, GS9.

These equations are shown below:

$$C_l = O_{l_D} * M \tag{1}$$

$$C_{lO} = O_{l_D} * M_0 \tag{2}$$

where

C_l = $\{c_{O_xG_i,O_yG_j} | \text{career began in } l = O_mG_n\}$ where $c_{O_xG_i,O_yG_j}$ is the mean number of moves that an individual whose career began in job l (occupation m, grade n) will make from occupation x, grade i, to occupation y, grade j, during his or her career.

C_{l0} = $\{c_{O_xG_i,0} | \text{career began in } l = O_mG_n\}$ where $c_{O_xG_i,O}$ is the relative odds that an individual whose career began in job l (occupation m, grade n) will end his or her organizational career with an exit at occupation x, grade i; that is, C_{l0} is the expected career end distribution for an individual whose career begins in l;

M = $\{m_{O_xG_i,O_yG_j}\}$ where $m_{O_xG_i,O_yG_j}$ is the probability that an individual will move to occupation y, grade j, in one move, given that he or she is in occupation x and grade i;

$(I - M)^{-1}$ = the fundamental matrix indicating the expected mean number of career moves from occupation x, grade i, given that the individual's career began in row l (occupation m, grade n);

O_{l_D} = diagonalization of the lth row of $(I - M)^{-1}$;

M_0 = $\{m_{O_xG_i,0}\}$ where $m_{O_xG_i,0}$ is the probability that an individual will exit the organization on the next move, given that he or she is in occupation x, grade i.

Data

The data used for the current analysis are a 10% random sample of all civilian white-collar employees of the U.S. federal government between 1962 and 1989. The original data, called the Federal Personnel Statistics Program for the years of 1962–72 and the Central Personnel Data File for subsequent years, are maintained by the U.S. Office of Personnel and Management (OPM) and contain the current personnel records for most agencies. Agencies update the files monthly, and the OPM annually draws a 10% sample based on the final digits of the workers' social security number (Lewis 1992). Thus, the sample is continuously updated to include 10% of all entrants as well as 10% of the initial total workforce in 1962. Because of its unique sampling method, the file allows one to track all of the individuals' career movements over time until their final exits from the federal government. It therefore covers an ongoing organizational labor market for over a quarter century.

In the government, the term *occupational series* refers to career lines and therefore corresponds formally to what Doeringer and Piore (1971) defined as an ILM.[15] An occupational series consists of a group of similar jobs with different levels of skill and responsibility. The occupational series usually extend over a number of grade levels. While there are multiple pay systems, most of the white-collar workforce is employed in GS or GS-equivalent pay systems, which consist of 18 grades, from GS1 to GS18. Moreover, in 1979 an associated senior executive service (SES) system was created, having grades SES 1–6 to cover the jobs in top level positions, generally equivalent or higher than GS16–GS18. In our analysis, both GS and SES hierarchical levels are included.

In addition, the occupational series are classified by the federal government into five principal categories, called PATCO (professional, administrative, technical, clerical, and other). For classifying a detailed occupational series into one of the five major categories, the entry-level qualifications and job characteristics common to all positions within a series are utilized (DiPrete and Soule 1986). In general, upper-level career lines are classified as professional or administrative; we refer to these as *high stack,* based on the existence of higher GS grades (GS12 and above) within the occupation. The lower-level career lines are classified as clerical or technical and are referred to here as *low stack.*[16] Figure 3 presents a schematic view of these occupations. The present analysis includes 22 of the detailed occupational series, from both high-stack and low-stack career lines, to examine differential impacts on individuals' careers for occupations with different hierarchical structures.

Illustrative Cases: Female Psychologists

In the main analysis, we will estimate CPSs for each gender per detailed occupation in two different periods, period 1 (1962–76) and period 2 (1977–89). The 27-year time frame was broken into these two basic periods since a major change was observed from the Carter administration onward in each of the major occupational ILMs.[17] Thus, for each detailed occupation we examine, four different pathway structures were generated—two different pathway structures for each gender per period—by

[15] Note particularly the *Handbook of Occupational Groups and Series of Classes* (U.S. Office of Personnel Management 1979, p. 1) in which part of the definition of such a series provides the following: "A series may be thought of as composed of steps in the most natural line of promotion."

[16] A few occupational series are classified as mixed low stack and high stack because they include a number of administrative, technical, and clerical positions.

[17] Some degree of this change is observed in the Ford presidency, but the overall pattern for all four major ILMs across levels appears to break the overall time frame into two periods 1961–76 and 1977–89. The major occupational ILMs include professional, administrative, technical, and clerical labor markets.

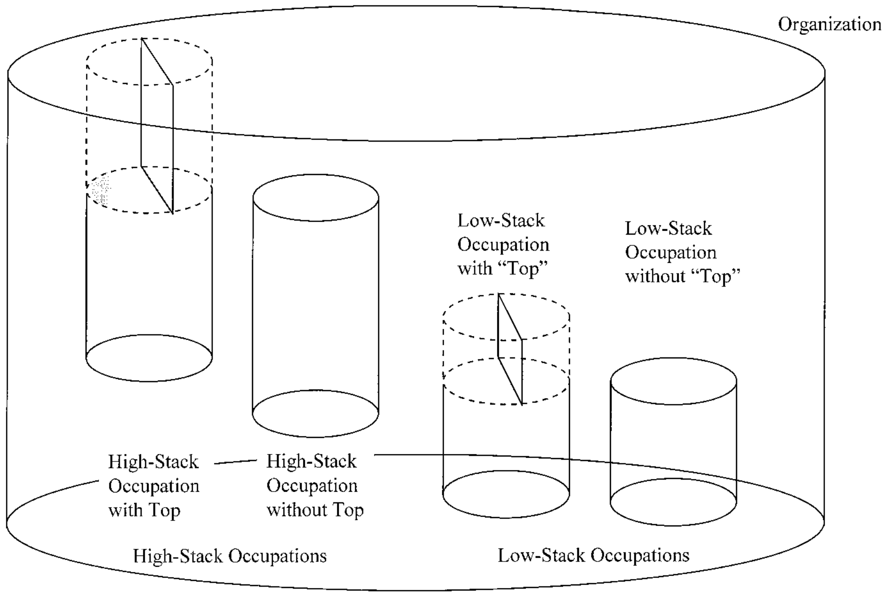

FIG. 3.—High- and low-stack occupations

using equations (1) and (2) including both C_l, the pathway, and C_{l0}, the end distribution (for career codes used in this analysis, see table 1). For illustrative purposes, we will now describe the derived CPSs for women who are psychologists in periods 1 and 2. These are provided in tables 2–4.[18] To enable greater facility in interpretation, each equation has been multiplied by 1,000. Thus, these data may be interpreted per 1,000 individuals who start at GS9. The actual external hires for the occupation at GS9 is 130 in period 1 and 220 in period 2. Thus, for example, to construct the model's expected values for the total population of female psychologists hired at GS9 for both periods, the values in tables 2–4 should be multiplied by 0.13 ($0.13 \times 1{,}000 = 130$) for period 1 and by 0.22 ($0.22 \times 1{,}000 = 220$) for period 2, respectively. Since this database is from a 10% sample, these numbers should then be multiplied by 10 for the organizational populations or 1,300 and 2,200 respectively.

As table 2 indicates, the career pathways for female psychologists who start at GS9 in period 1 are heavily concentrated in their occupation of origin. The table may be read from the left side rows (origin) to the right to

[18] The matrix for period 2 is too large to be published here as one table. A copy of the whole matrix as a single unit can be obtained from the authors upon request.

TABLE 1

Occupational Series Numbers and Occupation Titles

High Stack		Low Stack	
Series No.	Title	Series No.	Title
180	Psychology	332	Computer operation
185	Social work	404	Biological technician
212	Personnel staffing	621	Nursing assistant
403	Microbiology	644	Medical technologist*
510	Accounting	645	Medical technician
560	Budget analysis	802	Engineering technician
630	Dietitian and nutritionist	1152	Production control
861	Aerospace engineering	1311	Physical science technician
905	General attorney	1411	Library technician
1082	Writing and editing		
1320	Chemistry		
1410	Librarian		
1520	Mathematics		

Note.—All high-stack occupations are professional or administrative jobs. All but one of the low-stack occupations are technical jobs.

* Medical technologist is a professional occupation.

a given column (destination). Thus, for example, of the 1,000 psychologists starting out at GS9 (row 1), 923 move laterally at GS9, 462 are promoted to GS11, and 77 are promoted to GS12. Out of the 462 who move to GS11 (row 2), 301 are promoted to GS12 and 20 to GS13, while 60 move laterally at GS11. From GS12, 245 move to GS13 (row 3, col. 4), 62 then move from GS13 to GS14 (row 4, col. 5), and the same number move from GS14 to GS15 (row 5, col. 6). As seen, no women in the occupation could move above GS15. Since men in the same occupation, though very few, do rise above GS15 and make it to GS16 (a separate CPS for male psychologists, not shown here), we identify the existence of a glass ceiling between GS15 and GS16. Regarding mobility outside of the original occupation, 97 of the original 1,000 move to other professional jobs (rows 1–6, cols. 7–8); however, none of these 97 return (rows 7–8, cols. 1–6) to their original occupation and in fact leave the organization for good (rows 7–8, col. 11). Similarly, 20 psychologists move to administration and 77 move to technical occupations. Though having been able to move out of the original occupation, all these women leave the organization from their second occupations at the grade at which they came in, without developing their careers there, indicating their extremely limited opportunities in these occupations of destination in period 1.

Tables 3 and 4 display the career pathways for female psychologists

TABLE 2

CPS for Female Psychologists Starting at GS9, Period 1

	Psychologist						Professional		Administrative	Technical	
	1	2	3	4	5	6	7	8	9	10	Exit
Psychologist:											
1. GS9	923	462	77	0	0	0	77	0	0	77	308
2. GS11	0	60	301	20	0	0	0	20	20	0	100
3. GS12	0	0	180	245	0	0	0	0	0	0	164
4. GS13	0	0	31	218	62	0	0	0	0	0	172
5. GS14	0	0	0	0	0	62	0	0	0	0	0
6. GS15	0	0	0	0	0	0	0	0	0	0	62
Aggregation of moves			2,641				97		20	77	806
Professional:											
7. GS11	0	0	0	0	0	0	0	0	0	0	77
8. GS12	0	0	0	0	0	0	0	0	0	0	20
Aggregation of moves			0				0		0	0	97
Administrative:											
9. GS12	0	0	0	0	0	0	0	0	0	0	20
Aggregation of moves			0				0		0	0	20
Technical:											
10. GS11	0	0	0	0	0	0	0	0	0	0	77
Aggregation of moves			0				0		0	0	77

Note.—Total exits = 1,000.

TABLE 3

CPS for Female Psychologists Starting at GS9, Period 2
(Psychologist Matrix Only)

	1	2	3	4	5	6	7	8	9	10	11	12	13
Psychologist:													
1. GS7	0	16	0	0	0	0	0	0	0	0	0	0	2
2. GS9	31	123	61	368	31	0	0	0	0	0	0	0	0
3. GS10	0	31	0	31	0	0	0	0	0	0	0	0	0
4. GS11	0	15	0	138	359	0	0	0	0	0	0	0	0
5. GS12	0	0	0	76	128	251	6	0	0	0	0	0	0
6. GS13	0	0	0	0	62	148	68	0	0	0	0	0	0
7. GS14	0	0	0	0	0	7	74	22	0	0	0	0	0
8. GS15	0	0	0	0	0	0	7	22	7	0	0	0	0
9. SES1	0	0	0	0	0	0	0	0	0	7	0	0	0
10. SES2	0	0	0	0	0	0	0	0	0	0	7	0	0
11. SES3	0	0	0	0	0	0	0	0	0	0	0	7	0
12. SES4	0	0	0	0	0	0	0	0	0	0	0	0	0
13. Non-GS	0	0	0	0	0	0	0	0	0	0	0	0	1
Aggregation of moves						2,106							
Professional:													
14. GS7	0	0	0	0	0	0	0	0	0	0	0	0	0
15. GS9	9	0	0	9	0	0	0	0	0	0	0	0	0
16. GS11	0	0	0	0	0	0	0	0	0	0	0	0	0
17. GS12	0	0	0	0	0	0	0	0	0	0	0	0	0
18. GS13	0	0	0	0	0	0	0	0	0	0	0	0	0
19. GS14	0	0	0	0	0	31	0	0	0	0	0	0	0
20. Non-GS	0	0	0	0	0	0	0	0	0	0	0	0	14
Aggregation of moves						63							
Administrative:													
21. GS7	0	0	0	0	0	0	0	0	0	0	0	0	0
22. GS9	0	11	0	0	0	0	0	0	0	0	0	0	0
23. GS10	0	0	0	0	0	0	0	0	0	0	0	0	0
24. GS11	0	0	0	21	0	0	0	0	0	0	0	0	0
25. GS12	0	0	0	0	8	8	0	0	0	0	0	0	0
26. GS13	0	0	0	0	0	0	0	0	0	0	0	0	0
27. GS14	0	0	0	0	0	0	0	0	0	0	0	0	0
28. GS15	0	0	0	0	0	0	0	0	0	0	0	0	0
29. Non-GS	0	0	0	0	0	0	0	0	0	0	0	0	0
Aggregation of moves						49							
Technical:													
30. GS7	0	0	0	0	0	0	0	0	0	0	0	0	0
31. GS9	0	0	0	0	0	0	0	0	0	0	0	0	0
32. GS11	0	0	0	7	7	0	0	0	0	0	0	0	0
33. GS12	0	0	0	0	0	0	0	0	0	0	0	0	0
34. Non-GS	0	0	0	0	0	0	0	0	0	0	0	0	0
Aggregation of moves						14							
Other:													
35. GS13	0	0	0	0	0	0	0	0	0	0	0	0	0
36. GS14	0	0	0	0	0	0	0	0	0	0	0	0	0
Aggregation of moves						0							

Note.—Total exits for the matrix as a whole (psychologist, professional, administrative, technical, and other; tables 3 and 4) = 997. The sum does not add up to 1,000 due to rounding off.

who start at GS9 in period 2. One clear difference from period 1 is the size of the matrix (spanning two tables), or the size of the overall pathway structure, indicating the increased numbers of bridges between the original and other occupations, as well as increased opportunities within the occupation. Among the 1,000 psychologists starting out at GS9 (row 2), 123 move laterally at GS9 (col. 2), 61 are promoted to GS10 (col. 3), 368 move to GS11 (col. 4), and 31 move further up to GS12 (col. 5) while 31 are demoted to GS7 (col. 1). Among those who reach GS11 (row 4), 359 are promoted to GS12 (row 4, col. 5). From GS12, 251 move to GS13 (row 5, col. 6), 68 move from GS13 to GS14 (row 6, col. 7), and 22 move from GS14 to GS15 (row 7, col. 8). Very few rise above GS15. Only seven make it to SES 1 (row 8, col. 9). Once there, all seven climb to SES 4 (row 11, col. 12) before they exit (table 4, row 12, col. 37). Thus, in period 2, women are able to reach the top tier of the occupation, breaking the glass ceiling that existed in period 1.

With regard to outward mobility (table 4), 101 psychologists move laterally to other professional occupations (rows 1–13, cols. 14–20), and 116 move to administrative occupations (rows 1–13, cols. 21–29). More specifically, out of these 116 who move to management, 29 move from psychologist at GS12 (row 5, cols. 21–29) with moves as follows: 17 move laterally to management at GS12 (row 5, col. 25), 6 are promoted to administrative jobs at GS13 (row 5, col. 26), and the remaining six move downward to managerial occupations at GS9 (row 5, col. 22). Among these 116 women who left psychology for management, 49 eventually came back to the original occupation (table 3, rows 21–29, cols. 1–13) while 63 of those who left for other professional occupations came back to psychology (table 3, rows 14–20, cols. 1–13). Similarly, while 37 of the entering psychologists move to technical occupations (table 4, rows 1–13, cols. 30–34), 14 of them come back to the original occupation (table 3, rows 30–34, cols. 1–13). None from psychology directly move to the “other” occupation group (table 4, cols. 35–36).

In terms of where their organizational career ultimately takes women psychologists, the last column of table 4 provides the expected end distribution, C_{l0}. As column 11 in table 2 indicates, in *period 1,* 806 out of 1,000 female psychologists exit in their original occupation, 97 from other professional occupations, 20 from managerial occupations, and 77 from technical occupations. In *period 2,* 871 exit as a psychologist, while 14 exit from other professional occupations, 107 from other administrative occupations, and five from other technical occupations (table 4, col. 37).[19]

[19] These exit counts do not exactly add up to 1,000 because the numbers were rounded off. In the original matrices, the sum of the exit probabilities add up to “1” since each odd is calculated by rounding at the fourth decimal point.

TABLE 4

CPS for Female Psychologists Starting at GS9, Period 2 (Professional, Administrative, Technical, and Other Matrix)

	Professional							Administrative									Technical					Other		
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Exit
Psychologist:																								
1. GS7	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
2. GS9	0	31	31	0	0	0	0	0	31	0	0	0	0	0	0	0	0	31	0	0	0	0	0	460
3. GS10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. GS11	0	0	0	0	0	0	0	0	0	0	23	8	0	0	0	0	0	0	0	0	0	0	0	107
5. GS12	0	0	0	12	0	0	0	0	6	0	0	17	6	0	0	0	0	0	0	6	0	0	0	87
6. GS13	0	0	0	0	0	19	0	0	0	0	0	12	6	0	0	0	0	0	0	0	0	0	0	130
7. GS14	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	44
8. GS15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
9. SES1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10. SES2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11. SES3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12. SES4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
13. Non-GS	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
Aggregation of moves				101								116							37			0		871
Professional:																								
14. GS7	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15. GS9	0	9	9	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16. GS11	0	0	0	45	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17. GS12	0	0	0	21	54	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0
18. GS13	0	0	0	0	43	43	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0
19. GS14	0	0	0	0	0	93	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20. Non-GS	0	0	27	0	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Aggregation of moves				426								32							0			0		14

Administrative:																								
21. GS7	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22. GS9	0	0	0	0	0	0	0	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0
23. GS10	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24. GS11	0	0	0	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	21
25. GS12	0	0	0	8	0	0	0	0	0	0	0	40	24	0	0	0	0	0	0	0	0	8	0	24
26. GS13	0	0	0	0	11	0	0	0	0	0	0	0	33	22	0	0	0	0	0	0	0	0	0	11
27. GS14	0	0	0	0	0	0	0	0	0	0	0	0	0	51	102	0	0	0	0	0	0	0	51	0
28. GS15	0	0	0	0	0	0	0	0	0	0	0	0	0	51	0	51	0	0	0	0	0	0	0	0
29. Non-GS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51
Aggregation of moves				19								471							0			51		107
Technical:																								
30. GS7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	5
31. GS9	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	11	0	21	0	0	0	0	0
32. GS11	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	7	0	0	0	0	0	0
33. GS12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
34. Non-GS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aggregation of moves				0								18							50			0		5
Other:																								
35. GS13	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0
36. GS14	0	0	0	0	0	0	0	0	0	0	0	0	0	51	0	0	0	0	0	0	0	0	0	0
Aggregation of moves				0								59							0			0		0

NOTE.—Total exits for the matrix as a whole (psychologist, professional, administrative, technical, and other; tables 3 and 4) = 997. The sum does not add up to 1,000 due to rounding off.

This end distribution is used later in the analysis of glass ceilings to estimate what percentage of individuals reached the top inside as well as outside the occupation. In period 1, no women in psychology reached the top tier either inside or outside the occupation. In period 2, 0.7% of women (seven in SES4 in psychology) reached the top tier within the occupation while none reached the top tier outside the occupation.[20] Thus, overall, less than 1% of women reached the top tier in period 2.

For the analysis of occupational segregation in terms of occupational captivity, the percentage of individuals moving out of the occupation is calculated by dividing the number of individuals leaving the occupation by 1,000 (base population) plus the number of individuals moving back to the initial occupation from outside. For instance, in period 1, the percentage of women in psychology moving out was $194/(1{,}000 + 0) = 0.194$ or 19%. The 194 consists of 97 moving from psychology to other professional jobs, 20 to management, and 77 to technical occupations. Since no one who left for other occupations came back to psychology, the denominator remains 1,000. In period 2, the percentage moving out for women in psychology was $254/(1{,}000 + 126) = 0.226$ or 23%. The 254 consists of 101 moving from psychology to other professional jobs, 116 to other managerial occupations, and 37 to technical occupations. The 126, which are added to the original 1,000 in the denominator, are from those returning back to psychology from other occupations: 63 from professional occupations, 49 from management, and 14 from technical occupations. In the same way, for each of the remaining 21 detailed occupations, CPSs are generated for each gender in two different periods in the analysis to follow.

ANALYSIS

We selected 22 occupations for the current analysis based primarily on three criteria: occupational gender composition, hierarchical structure, and the number of women in the occupation (see table 1 for a list of the occupations). First, occupations were selected to cover a wide range of gender composition, from extremely male-dominated (female composition 10% or less) to female-dominated (female composition 90% or more), as well as gender-neutral occupations. A change in an occupation's gender composition between the two periods was also considered. Thus, we examined whether a given occupations' change in gender composition was sufficiently large enough to move the occupation from one level to another

[20] For the total population of female psychologists, the expected number would be $7 \times .22 \times 10$ or 15.4.

TABLE 5

OCCUPATIONS BY HIERARCHICAL STRUCTURE, GENDER COMPOSITION, AND CHANGE IN GENDER COMPOSITION ACROSS PERIODS

Level of Gender Composition (% Female)	High-Stack Period 1	High-Stack Period 2	Low-Stack Period 1	Low-Stack Period 2
1. 0–19	180	180	802	802
	510	510	1152	1152
	861	861		
	905			
	1320		1311	
	1520			
2. 20–39		905		
		1320		1311
		1520		
	403	403	404	404
	560		332	
3. 40–59		560		332
	185	185	645	645
	212			
	1082		621	
4. 60+		212		621
		1082		
	630	630	644	644
	1410	1410	1411	1411

NOTE.—All high-stack occupations are professional or administrative. All but one of the low-stack occupations are technical. See table 1 for a mapping of occupational series numbers to occupational title.
* Medical technologist is a professional occupation.

among the four levels of gender composition (%female) in table 5. In each level in the table, we selected at least one occupation with no change and one with sufficient compositional change to place it in a higher level. In other words, we are assured of having both those experiencing relatively smaller increases in female composition and those with relatively large increases at each 20% threshold. Second, we varied hierarchical opportunities in terms of the highest grades within the occupation. Using the highest tenth percentile of an occupation's grade distribution as a cut-off point for GS level, we obtained what we refer to as *high-stack* and *low-stack* occupations. Among high-stack occupations, the 10-percentile grade is located between GS11 and GS15, while among low-stack occupations, it ranges between GS5 and GS9. Third, we selected occupations that had at least 900 women in the workforce (90 in the 10% sample) in any given year.[21] A supplementary criterion, used in conjunction with either gender composition or hierarchical structure, was functionally related occupations—that is, a functionally related area such as microbiology and biological technician, both of which are working in the biological area but at different (hierarchical) levels.

Variations in the first two criteria, gender composition and hierarchical structure, are shown in table 5. The information in the first and third columns (period 1) include two dimensions: four levels of gender composition and two types of hierarchical opportunities. For period 2, there are still two hierarchical dimensions (cols. 2 and 4), but for each hierarchical stack, there are occupations with a change in the level of gender composition between the two periods and occupations with no gender composition change. These combinations create 14 different groups (indicated by the blank space between rows in table 5), for each of which one occupation was selected. Three additional occupations were selected, matching a high-stack occupation to a low-stack occupation within a broad functional area (new additions indicated in parentheses). These were aerospace engineering (new) and engineering technician, chemistry (new) and physical science technician, and librarian and library technician (new). These additions include two professional high-stack occupations (aerospace engineering and chemistry) and one technical low-stack occupation (library technician). Another match-based addition, keyed to functional area, paired high-stack occupations while varying gender composition.[22] This was psychology (new) and social worker. In short, four additional occupations were selected based on functional relations, while also varying either the hierarchical dimension or gender composition. The last four occupations were selected primarily to help balance specific conditions.[23] They are dietitian and nutritionist in high-stack occupations at level 4, mathematics in high-stack occupations that move from level 1 to level 2, writing and editing in high-stack occupations that move from level 3 to level 4,

[21] There were 100 professional, administrative, or technical occupations meeting this criterion. From these 20 were selected. The two exceptions included in our data were psychology and aerospace engineering with 760 and 570 female workers, respectively, in 1988.

[22] In the original 14 occupations selected, one pair of functionally related low-stack occupations, medical technician (level 3) and medical technologist (level 4) already existed, as well as one pair of functionally related high-stack occupations, accounting (level 1) and budget analysis (changing from level 2 to level 3). Additionally, one pair of functionally related occupations matching low- and high-stacks existed—microbiology and biological technician on level 2.

[23] In three of the cases the selections also extend the functional range of occupations.

and production control in low-stack occupations at level 1. Mathematics was added to balance high-stack occupations at level 1 that did not change, yielding comparable numbers of occupations experiencing gender changes with those having no change. The dietitian and nutritionist occupation was added to help balance the numbers between high-stack occupations at level 1 that do not change as well as low-stack occupations at level 4. Writing and editing provides a greater balance between high-stack occupations that change from level 1 to level 2 and high-stack occupations that change from level 3 to level 4, depicting gender composition change at both the low and high ends of the composition dimension within high-stack occupations. Finally, production control was added to provide balance with the high-stack occupations at level 1, varying hierarchical level.[24] For most of the table, there are either one or two occupational ILMs. For high-stack occupations at level 1 that do not change and for high-stack occupations that move from level 1 to level 2, there are three occupations, two of which were added for matching purposes. In brief, the sampling was strategic—to select a wide variation of occupations while strategically varying gender composition and its change as well as hierarchical distribution.

In addition to the high-stack, low-stack hierarchical dimension, the selections also resulted in a further hierarchical spread within each of these two ranks—occupations with grades at the top and those with no grades at the top, thus, having a hierarchical ceiling within both the high and low stacks. This variation was not planned but is fortuitous nevertheless, yielding yet further hierarchical variation. The strategic sampling scheme adopted here is consistent with that suggested in Stewman and Konda (1983)—sampling on structures. Due to the sizes, it is not for statistical purposes, in the normal sense of significance testing, that each condition was given at least one occupant. Rather, by varying structural dimensions that have been theoretically postulated to affect women's opportunities, we enlarge the theoretical scope of the model (see White [1970*b*] for a view on development of new models on theory vs. statistical testing). Overall, there are 13 professional/administrative occupations in the high-stack group and nine occupations in the low-stack group—eight are technical and one professional.

For simplification purposes in reporting results, the existing 18 or more GS/SES grades were collapsed into four hierarchical levels including top (GS16–GS18 and SES 1–6), upper middle (GS12–GS15), lower middle (GS9–GS11), and bottom (GS1–GS8). For analyzing the low-stack occupations, we converted upper middle into "top" and lower middle into

[24] These occupations were also at the low end of gender composition where tokenism has been postulated to operate.

"middle" because the occupations lack grades in the organization's top levels (see fig. 3). In the estimates of the model and to construct the CPSs, all 24 grades (GS1–GS18, SES 1–6) were used.

The objectives of the analysis are to identify gender differences in opportunity structures as represented by sex segregation and glass ceilings, to assess the size of such differences and their changes over time, and to identify structural factors that may account for the observed gender gap and therefore might be used in planning and policy formulation to improve the situation. More specifically, we examine gender composition and also analyze the degree of occupational captivity, measured by the amount of flows of individuals leaving the occupation. The height of the grade levels within the occupation represents its hierarchical structure. We also investigate the glass ceiling in three different ways: first under the ordinary distributional dichotomy within the occupation; second, by turning the analytical perspective outside the occupation to consider the possible ceiling outside the occupation but within the organization, thus examining the phenomenon in conjunction with occupational captivity; and third, by incorporating the flows of individuals going beyond the glass ceiling to more accurately measure the degree of change in opportunity structures. Both occupational captivity and glass ceiling are analyzed across a range of gender compositions and hierarchical structures. The analysis includes the following three components: a brief examination of gender composition and the hierarchical ceiling of the occupation for the two periods; an examination of a glass ceiling in terms of flows of individuals to the top tier within and outside the occupation for the two periods and changes in the flows between the two periods; and an examination of occupational captivity by gender in terms of the outflows per occupation, hence attending to overall magnitude of outside opportunities. We conduct these analyses on high- and low-stack occupations, separately, taking into account the impacts of occupational stack height and gender composition. In addition, we provide a brief analysis of the outside pathways that enabled women to break the glass ceiling when they left their initial entry occupational ILM.

High-Stack Occupations

By using the CPS model, we first categorize 13 high-stack occupations presented in table 6 into two groups, grade at the top (GAT) and no grade at the top (no-GAT) groups, in terms of flows into the top GS grades. The seven GAT occupations, which have opportunities to reach the top within one's initial entry occupation, include aerospace engineering, accounting, general attorney, psychology, chemistry, mathematics, and budget analysis. The remaining six no-GAT occupations, which lack such inside oppor-

TABLE 6

GENDER COMPOSITION: HIGH-STACK OCCUPATIONS

Occupation	% Female Period 1	% Female Period 2	% Difference between Periods 1 and 2
GAT:*			
Aerospace engineering	.99	3.41	2.41
Accounting	7.29	16.01	8.73
General attorney	7.94	23.52	15.58
Psychology	13.41	19.29	5.88
Chemistry	15.08	20.88	5.80
Mathematics†	. . .	22.90	3.88
Budget analysis	36.58	53.21	16.63
No GAT:			
Mathematics†	19.02	. . .	. . .‡
Microbiology	28.45	35.83	7.38
Social work	45.29	46.09	.80
Personnel staffing	51.82	65.80	13.98
Writing and editing	56.93	62.76	5.83
Librarian	74.35	76.22	1.88
Dietitian and nutritionist	96.51	96.17	−.34
Average:			
Overall	34.90	41.70	6.80
GAT	13.55	22.75	9.20§
No GAT	53.20	63.81	10.62§

* GAT means the occupation has jobs in grades GS16 and above.
† The occupation has top only in period 2, i.e., new jobs were created at the top within this occupational ILM in period 2.
‡ See mathematics under GAT section.
§ These values are the difference of the averages for periods 1 and 2.

tunities, consist of microbiology, social work, personnel staffing, writing and editing, librarian, and dietitian and nutritionist.[25]

Female composition.—Table 6 also presents the female composition of each high-stack occupation. In period 1, the female composition among the high-stack occupations is on average 35%, ranging from 1% to 97%. Most GAT occupations have significantly lower (less than 20%) female composition, with an average of 14%; in contrast, no-GAT occupations

[25] In period 1, mathematics had no opportunities to the top, but new jobs were created at the top in period 2. Thus this occupation has an evolving hierarchical structure. Hence, to be precise, there were six GAT occupations in period 1 and seven in period 2, and seven no-GAT occupations in period 1 and six in period 2. In the discussion above, we are referring to an occupation having opportunities to the top (GAT) in either period.

have a substantially high female percentage, averaging 53%. Between the two periods, women's representation increased in all occupations but one. As a result, in period 2 the average female composition among the GAT, no-GAT, and the overall high-stack occupations increased to 23%, 64%, and 42%, respectively. The average increase in female representation among GAT occupations (9%) is nearly as large as that among no-GAT occupations (11%), and significant increases (14%–16%) in the female composition are observed in some occupations in both the GAT and no-GAT groups. Thus, increased female representation is occupation specific, and occurs at both GAT and no-GAT levels.

Glass ceiling by end distribution and percentage ending in the top.— One of the properties of the CPS model is that it yields the expected end distribution of a career for a person starting in a given occupation at a specific grade under the specific labor market conditions in a given period. Therefore, the number of individuals who end their careers at a certain level, say the top, indicates the magnitude of moves to and subsequent exits at that level. In turn, no flows to the top by either gender indicate the existence of a *hierarchical ceiling* (no GAT), whereas flows by one gender and not the other indicates the existence of a *glass ceiling.* Further, when the glass ceiling is analyzed in terms of inside and outside the occupation, the former indicates the existence of an *occupational ILM* glass ceiling while the latter indicates an occupational-organizational glass ceiling—that is no outside routes to the top throughout the organization for individuals starting careers in that specific occupational origin. Table 7 summarizes the existing hierarchical and glass ceilings within and outside of the occupations for individuals starting at GS9 in each high-stack occupation by period. In the table, yes indicates flows of individuals into the top while no indicates that no such flows exist.

In period 1, all seven no-GAT occupations, by definition, have no opportunities to the top for either gender within the initial occupation. In addition, they also lack outside opportunities. Thus, individuals in these occupations are stuck and neither staying within nor leaving the original occupation provides a chance for moving to the top. Even in period 2, none of the six no-GAT occupations has either inside or outside opportunities that are available to both genders, indicating the prevailing influence of occupational origins on career opportunities of individuals.[26] However, in three of the six cases, an outside route to the top did open for one gender.

In contrast to the no-GAT occupations in which *hierarchical* ceilings

[26] The reason for the change in the number of no-GAT occupations is that in period 2, jobs were created at GS16 and above for mathematics. Thus, this series moved into the GAT group, leaving six no-GAT occupational ILMs in period 2.

TABLE 7

End Distribution of Careers: Glass Ceiling at the Top among High-Stack Occupations

Occupation	Inside Opportunities to Top				Outside Opportunities to Top			
	Period 1		Period 2		Period 1		Period 2	
	Women	Men	Women	Men	Women	Men	Women	Men
GAT with glass ceiling:								
1520	. . .	. . .	no	yes	. . .	. . .	yes	yes
510	no	yes	no	yes	no	no	yes	yes
861	no	yes	no	yes	no	yes	no	yes
1320	no	yes	no	yes	no	yes	no	yes
560	no	yes	no	yes	no	yes	yes	yes
180	no	yes	yes	yes	no	yes	no	yes
GAT with no glass ceiling:								
905	yes	yes	yes	yes	yes	yes	yes	yes
No GAT:								
1520	no	no	. . .	. . .	no	no	. . .	. . .
403	no	no	no	no	no	no	no	no
630	no	no	no	no	no	no	no	no
1082	no	no	no	no	no	no	no	no
185	no	no	no	no	no	no	no	yes
212	no	no	no	no	no	no	yes	no
1410	no	no	no	no	no	no	yes	no

are ubiquitous, the GAT occupations present a prevalence of a glass ceiling in both periods, indicating women's limited opportunity structure. For inside opportunities, women face a glass ceiling in five out of six GAT occupations in period 1 and five out of seven in period 2, while such ceilings do not exist for men in any such occupation in either period. Even in the occupation having newly created inside opportunities in period 2 (mathematics), women did not benefit from them, instead facing a glass ceiling. Women also face limited outside opportunities in period 1; in only one out of six GAT occupations (vs. five out of six for men) could women reach the top via the outside routes. In period 2, outside opportunities are created for women in three additional occupations, but those in the remaining three still lack outside opportunities. When both of the inside and outside routes are examined for the GAT occupations, women could reach the top in only two out of 12 available routes in period 1 (vs. 11 out of 12 for men) and six out of 14 in period 2 (vs. all 14 for men). Though improved in terms of available routes, women's opportunities are still less than half of those of men. When combining the results of the no-GAT and GAT occupations, for their outside opportunities, women could reach the top in one out of 13 occupations in period 1 and six out of 13 in period 2, whereas for men, it was in five in period 1 and eight in period 2. Thus, the gender gap for outside opportunities narrowed considerably. The same could not be said for inside opportunities. Women could reach the top in one out of 13 occupations (vs. six for men) in period 1 and two out of 13 (vs. seven for men) in period 2. Clearly, the greatest chances for women, particularly those in occupations with a glass ceiling, are in outside routes, escaping blocked inside opportunities.

While gender-specific career end distributions indicate the existence of a glass ceiling above which no women could go, they do not provide information regarding magnitudes of flows of individuals or degree of closure of the ceiling. In this section, we examine the odds of reaching the top for men when there is a glass ceiling and the relative odds between women and men when there is no such ceiling for women. The numbers are again calculated using the CPS model, with the assumption that individuals start their careers at GS9.

For the high-stack occupations for each period, tables 8 and 9 provide the percentage of individuals that would reach and exit at the top within the initial occupation (table 9) and overall (inside and outside combined; table 8) for women, men, and total women and men. In period 1, on average a mere 2% of individuals among the high-stack occupations could reach the top. Zero flows in the columns among all the no-GAT occupations in period 1 again indicate the lack of both inside and outside opportunities to the top. While 4.6% of individuals in the GAT occupations on average could reach the top, the occupation-specific odds to the top varies widely from 1% to 12%. A relatively higher chance of careers ending at the top exists for general attorney and chemistry. In terms of the gender difference, 5% of men in the GAT occupations, compared to 2% of women, on average could reach the top. In five out of the six occupations that have opportunities to the top, men have a higher odds of reaching that level than women. Gender difference is particularly large (6% or more) in chemistry and budget analysis. An exception is general attorney; not only is this the only occupation in which women could reach the top, but it also provides women better opportunities (15%) than men (11%).

In period 2, overall opportunities to the top among the high-stack occupations increased slightly with the percentage reaching the top still less than 3%. Among the seven GAT occupations, about 4.5% of individuals still reach the top, a slight decrease from the level in period 1. While opportunities to the top substantially increased in aerospace engineering and mathematics, those in general attorney and chemistry significantly declined. Between the two periods, the percentage reaching the top for women increased by almost 2% compared to a decline of 0.6% for men,

TABLE 8

Glass Ceiling by End Distribution for High-Stack Occupations: Overall (Inside and Outside)

Occupation	Women		Men		Total		Gender Difference*		Change between Periods 1 and 2		
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Women	Men	Total
GAT:											
861	.00	.00	2.60	6.10	2.57	5.92	−2.60	−6.10	.00	3.50	3.34
510	.00	10.30	2.70	2.50	2.51	3.75	−2.70	7.80	10.30	−.20	1.24
905	14.60	3.80	11.30	6.30	11.56	5.70	3.30	−2.50	−10.80	−5.00	−5.86
180	.00	.70	1.60	1.20	1.39	1.11	−1.60	−.50	.70	−.40	−.29
1320	.00	.00	6.80	1.80	5.78	1.42	−6.80	−1.80	.00	−5.00	−4.36
1520	. . .	12.30	. . .	8.00	. . .	8.99	. . .	4.30	12.30	8.00	8.99
560	.00	3.30	5.70	5.70	3.59	4.43	−5.70	−2.40	3.30	.00	.84
No GAT:											
1520	.00	. . .	.00	. . .	.00	. . .	.00	. . .	. . .†	. . .†	. . .†
403	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
185	.00	.00	.00	.60	.00	.32	.00	−.60	.00	.60	.32
212	.00	1.40	.00	.00	.00	.92	.00	1.40	1.40	.00	.92
1082	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1410	.00	2.20	.00	.00	.00	1.67	.00	2.20	2.20	.00	1.67
630	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Average:											
Overall	1.12	2.62	2.36	2.48	2.11	2.63	−1.24	.14	1.49	.12	.52
GAT	2.43	4.34	5.12	4.51	4.57	4.47	−2.68	−.17	1.91‡	−.60‡	−.10‡
No GAT	.00	.60	.00	.10	.00	.49	.00	.50	.60‡	.10‡	.49‡

* Women − men.
† See 1520 under GAT section.
‡ These values are the difference of the averages for periods 1 and 2.

TABLE 9

GLASS CEILING BY END DISTRIBUTION FOR HIGH-STACK OCCUPATIONS: INSIDE

	Women		Men		Total		Gender Difference*		Change between Periods 1 and 2		
Occupation	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Women	Men	Total
GAT:											
861	.00	.00	.80	2.60	.79	2.52	−.80	−2.60	.00	1.80	1.73
510	.00	.00	2.70	.50	2.51	.42	−2.70	−.50	.00	−2.20	−2.09
905	6.10	2.30	6.40	4.60	6.38	4.05	−.30	−2.30	−3.80	−1.80	−2.33
180	.00	.70	.80	1.00	.70	.94	−.80	−.30	.70	.20	.25
1320	.00	.00	5.80	.30	4.93	.24	−5.80	−.30	.00	−5.50	−4.69
1520	...	.00	...	.20	...	.15	...	−.20	.00	.20	.15
560	.00	.00	1.10	.80	.69	.38	−1.10	−.80	.00	−.30	−.32
Average:											
GAT	1.02	.43	2.93	1.43	2.67	1.24	−1.92	−1.00	−.59†	−1.50†	−1.42†

* Women − men.
† These values are the difference of the averages for periods 1 and 2.

resulting in a significant reduction in gender difference in period 2; 4.3% of women and 4.5% of men could reach the top among the GAT occupations. In fact, when GAT and no-GAT occupations are combined, women have a slightly higher odds of reaching the top. Improvement in women's opportunity structure is certainly not a uniform phenomenon and the occupation-specific gender gap widely varies from −6% to +8%. Needless to say, in aerospace engineering and chemistry, women still do not have opportunities to move up to the top, facing a glass ceiling. Overall, however, there is near equity. A closer look at the routes involved, however, suggests a critical feature of this phenomenon.

In table 9, we observe that, over a quarter century, inside opportunities for women in the GAT occupations changed in two ways: first, an additional route opened in psychology; second, overall odds of getting to the top shrank. We also note that the impact of decreases in overall inside opportunities occurred equally for men and women. For both genders, the odds to the top were cut by half from the level of period 1; hence the relative gender difference favoring men remained constant—at 3 to 1. It matters greatly whether one analyzes overall (inside and outside) or inside occupational ILM opportunities. It clearly is of substantial consequence for the individuals involved since, for women, lack of movement out of the entry point occupation generally means hitting a glass ceiling, in contrast to the opportunities for men. When one takes into account those who left their initial occupation (table 8), overall chances of getting to the top were 1 to 1, though considerable variation existed across occupations.[27] These findings have major implications for career structures and behavior, as well as for human resource policies. In sum, in period 2 women's opportunity structures substantially improved to the level comparable to those for men, primarily due to exceptionally high increases in outside opportunities in selected occupations, while inside opportunities for women are still severely limited. A substantially large increase in outside opportunities in accounting and mathematics suggests that when outside opportunities became available in these occupations, women were able to take better advantage of the opportunities than were men. As was argued elsewhere (Stewman and Konda 1983), job creation is one of the major factors for individuals' career advancement. Thus, when individuals of special skills, for example financial management and mathematics in the current case, become needed in other types of occupations, this, in fact, creates new internal opportunities for these individuals to move into. And it seems that the greater the creation of such internal outside opportuni-

[27] Tables A1 and A2 provide specific data for the outside chances for high- and low-stack occupations. One may obtain these results from tables 8–9 and tables 13–14 by subtracting table 9 from table 8 and table 14 from table 13.

ties, the easier it is for individuals of minority groups who are in the "right place" to move into them, advancing their careers.[28]

The discovery of the route to the top from accounting, however, revealed two facets—(1) the magnitude in table 9 was short-lived and involved a structural change and (2) the gateway to the top closed after the structural change. In 1982, the accounting series (510) was split into two occupational series: accounting (510) and auditing (511). During the brief period in which this evolution occurred, women moved from accounting to auditing at multiple grades. The model indicates that many of these moves will result in careers at the top in the new occupational series, auditing. An important question then remained as to whether this entree was a one-shot affair or whether women could reach the top via 511 once the job series split was complete. The model was used to examine complete career trajectories during the evolution period versus those without the opportunity set during the evolution time zone. The results indicate that the window of opportunities via this pathway opened only briefly, during the short period of job evolution. For those women who took advantage of these opportunities, there is no longer a glass ceiling. For those women coming later, however, after the evolution was complete, this gateway has closed and there is no longer an outside access route to the top.

Occupational captivity.—We have identified that, among the high-stack occupations, a substantial breakthrough in women's careers took place when they moved outside the initial occupation. Therefore a significant question is the degree to which they are able to move to other occupations. Table 10 provides the percentage of careers having such moves. We refer to these intraorganizational moves across occupations as internal exits and will focus on internal exit (captivity) rates. The rates are calculated using the CPS model with the same assumption that individuals would start their careers at GS9.

First, we examine occupational captivity for all individuals. For both genders combined, in period 1, the internal exit rates among the high-stack occupations range from 5% to a massive 64%, averaging 33%. The rates for most occupations range from 15% to 50%. In eight of the 13 high-stack occupations, the internal exit rates are greater than 25%, and in five of these occupational ILMs, nearly 50% or more of the individuals leave their initial occupation. When arranged in ascending order, these occupations are categorized into two groups: the high-captivity group with an average internal exit rate of 18% (dietitian and nutritionist, psychology, librarian, general attorney, social work, microbiology, and chem-

[28] In short, by *right place* we mean differential growth on the demand side in specific skills "demanded" and differential selection on the supply side of minorities who have such high-demand skills.

TABLE 10

INTERNAL EXITS BY PERIOD AND GENDER: HIGH-STACK OCCUPATIONS

OCCUPATION	Period 1 Women	Period 1 Men	Period 1 Total	Period 2 Women	Period 2 Men	Period 2 Total
GAT:						
861	50.00	53.21	53.17	48.03	49.34	49.30
510	29.56	39.94	39.21	67.75	66.99	67.11
905	31.42	14.89	16.21	14.87	11.41	12.24
180	19.40	12.08	13.03	22.22	23.23	23.04
1320	24.22	30.23	29.33	33.78	28.18	29.35
1520	...	...	...	65.39	56.23	58.34
560	28.68	57.76	47.00	44.00	56.05	49.67
No GAT:						
1520	40.84	51.24	49.26	...	...	...
403	25.57	27.33	26.84	32.07	36.00	34.59
185	2.80	34.98	20.50	15.85	23.97	20.24
212	57.17	71.79	64.19	55.77	64.33	58.68
1082	56.90	52.75	55.11	36.72	63.93	46.78
1410	10.97	24.79	14.56	21.00	25.09	21.98
630	4.64	.00	4.50	14.76	19.10	14.93
Average:						
Overall	29.40	36.23	33.30	36.32	40.30	37.40
GAT	30.55	34.69	32.99	42.29	41.63	41.29
No GAT	28.41	37.55	33.57	29.36	38.74	32.87

istry) and the low-captivity group with an average internal exit rate of 51% (accounting, budget analysis, mathematics, aerospace engineering, writing and editing, and personnel staffing). In period 2, this dichotomy is still observed with an average internal exit rate of 22% for the first group and 55% for the second group. Using the following measure, captivity rate = [1 − (internal exit rate)], the high-captivity group's captivity rate is about 80% whereas that of the low-captivity group is about 50%. In short, in the first group, the odds are four out of five of remaining versus fifty-fifty in the second group.

These generally high rates of intraorganizational mobility and a rather wide variation across occupations indicate that the notion of an independent ILM, originally proposed by Doeringer and Piore (1971), is not an accurate description of many organizational labor markets at least on three accounts. First, white-collar occupation-based ILMs are more interdependent, as Osterman (1984), DiPrete (1989), and Stewman (1995) have shown, rather than rigid independent structures in which most individuals' careers start and end. Second, the captivity rates vary greatly from one occupation to another, suggesting the diversity of occupational ILMs, even in a single organizational or in a major occupational labor market (i.e., professional). Third, the vast exodus of individuals to other occupations within an organization indicates the existence of other *internal* entry ports that receive these individuals. Moreover, these internal entry ports are not located at the bottom but instead are in the middle or even near the top of the "new" occupations.[29] Thus, the original notion of limited numbers of ports of entry from outside, mainly at lower grades of the occupation, needs major revision for white-collar ILMs, also taking into account such internal entry ports. We also note that most of the movement of individuals in these occupations is either from a professional ILM to another professional ILM, or from a professional ILM to an administrative ILM, or from one administrative ILM to another administrative ILM, corresponding with previous findings on movements of individuals across occupational ILMs (Stewman 1995). In brief, while the shielding of job opportunities from the outside is certainly operative as Doeringer and Piore (1971) postulated, ILM theory needs revision for the internal structures, at least for white-collar occupational ILMs.

From the point of view of the sources, or origin, of these moves, we now look at these captivity rates by gender. In period 1, the percentage of women moving out ranges from 3% to 57%, averaging 29%; hence a captivity rate of 71%. When listed in rank order in terms of captivity rates, the occupations are divided into five categories: (1) traditional female occupations (social work, dietitian and nutritionist, and librarian); (2) occupations in science (psychology, chemistry, and microbiology); (3) non–scientific/engineering professional occupations (budget analysis, accounting, and general attorney); (4) math and engineering occupations (mathematics and aerospace engineering); and (5) administrative-professional occupations (personnel staffing and writing and editing). For men, the internal exit rates range from 0% to 72%, averaging 36%, yielding a captivity rate of 64%.[30] Among men, a clear-cut categorization is not observable in terms of occupational ILMs, as observed among women. On average men's captivity rates are 7% less than those of women, but no consistent patterns exist in the gender differentials across occupations. Among the seven occupations in which substantial gender differences are observed, general attorney is the only occupation with a captivity rate for women (69%) less than that for men (85%), underscoring the captivity–glass ceiling linkage since women had a significantly higher—nearly twice

[29] These career moves generally involve lateral movements and promotions.

[30] Due to the small number of males in dietitian and nutritionist, the obtained figure may not accurately represent this gender.

as large—percentage reaching the top via the outside route than did men.[31]

In period 2, women's internal exit rates range from 15% to 68%, averaging 36%, or a captivity rate of 64%.[32] Thus, on average, the rates for women in period 2 are equivalent to those for men in period 1. For men, the percentage moving out of their original occupation ranges from 11% to 67% with an average rate of 40% (captivity rate of 60%). In all occupations, gender difference in the captivity rates is reduced to about 4%. In the previous subsection, in period 2, we found women could reach the top via outside routes from the following occupations: accounting, mathematics, budget analysis, personnel staffing, general attorney, and librarian. Table 10 shows that four of these six occupations have lower captivity rates among the occupations examined.[33] Noteworthy is that women in the occupations with the lowest captivity rates (32% in accounting and 35% in mathematics) also yield the highest odds of ending their careers at the top (10% and 12%, respectively; see table 8). Furthermore, if we compare shifts in captivity and in outside opportunities to the top for women, additional evidence of a linkage between the two is shown. That is, women in all three occupations (accounting, mathematics, budget analysis) with a large decrease in captivity rates and a moderate captivity rate (60%–70%) to start with, were able to break the glass ceiling.[34] In general, women did not get to the top in occupations in which the captivity rates had virtually no change, small to moderate decreases, or relatively large decreases from a captivity rate at 95% or higher. In only two of eight occupational ILMs did women find routes to the top in these circumstances. Also, the two occupations in which the captivity rates increased substantially, either experienced a decrease in opportunities to the top (general attorney) or still face a glass ceiling (writing and editing). In sum, in general, outside routes were necessary but not sufficient for breaking the glass ceiling. However, when the full set of these outside routes experienced large increases in the volume of traffic from the origin ILM, given

[31] This may be seen by subtracting the values in table 9 from those in table 8. It is $(14.60 - 6.10) = 8.50$ for women and $(11.30 - 6.40) = 4.90$ for men.

[32] Note that the internal exit rate in period 2 for psychology is 22.2 vs. that given in the psychologist examples in the "Illustrative Cases" section, where it is 22.6. This difference is due to a higher precision in digits for all tables; it is thus due to rounding differences and for this example there is a difference of 4 per 1,000, due to rounding.

[33] An exception is aerospace engineering, which also has low captivity rates but no outside route to the top for women.

[34] For accounting, the drop in captivity rate was also related to the job evolution discussed in the prior subsection. Thus, it may have been short-lived. Nevertheless, the window in which it occurred was sufficient to enable women at that place, at that time, to break the glass ceiling.

a moderate captivity rate to start with, then it appears that these conditions were sufficient.

In this analysis, we have identified an important occupational segregation–glass ceiling linkage and an especially important organizational policy for leveling the playing field by gender. Without these internal outside opportunities, glass ceilings remain overwhelmingly intact. These findings are consistent with prior findings on gender inequality—namely, that one of the paramount factors underlying the wage gap by gender is sex segregation. Here, we probed further and have identified conditions under which decreases in occupational captivity led to breaking the glass ceiling.

Low-Stack Occupations

In this section, we conduct a similar analysis on the nine low-stack occupations in which one's career movement within the occupational ILM would end no higher than the upper middle (GS12–GS15). The occupations include engineering technician, production control, physical science technician, biological technician, computer operation, nursing assistant, medical technician, medical technologist, and library technician (see table 5 for the mapping of the occupations). All but one are technical occupations while medical technologist is professional. Because these occupations lack the original top (GS16 and above), the previously specified four hierarchical levels for analyzing opportunity structures are redefined among the low-stack occupations: the original upper middle (GS12–GS15) is defined as the *top;* the original lower middle (GS9–GS11) as *middle;* and the original bottom (GS1–GS8) remains the *bottom.*[35] This conceptualization remains congruent with that of the original glass ceiling theorists (Morrison, White, and Velsor 1992) who stressed possible glass ceilings at different relative levels.

The low-stack occupations, displayed in table 11, are categorized into two groups in terms of the existence of flows to the top by using the CPS model: There are five GAT occupations with a top tier within the occupation (engineering technician, production control, physical science technician, computer operation, and medical technologist), and four no-GAT occupations without such opportunities (biological technician, nursing assistant, medical technician, and library technician).[36]

[35] It is important to note that the top in the low-stack analysis is different from the top in the high-stack analysis of the preceding sections.

[36] In period 1, computer operation had no opportunities to the top, but new jobs were created at the top in period 2. Thus, this occupation has an evolving hierarchical structure, in the manner of that of mathematics in the high-stack group analyzed above.

TABLE 11

GENDER COMPOSITION: LOW-STACK OCCUPATIONS

OCCUPATION	% FEMALE Period 1	% FEMALE Period 2	% DIFFERENCE BETWEEN PERIODS 1 AND 2
GAT:*			
Engineering technician	.03	.08	.05
Production control	.06	.20	.14
Physical science technician	.18	.21	.03
Computer operation†	. . .	.44	−.10
Medical technologist	.66	.66	.00
No GAT:			
Biological technician	.26	.36	.10
Computer operation†	.34	. . .	. . .‡
Nursing assistant	.46	.62	.16
Medical technician	.49	.55	.06
Library technician	.81	.88	.07
Average:			
Overall	.37	.44	.08
GAT	.23	.32	.09
No GAT	.47	.60	.13

* Top for these low-stack occupations means the occupation has jobs in grade GS12–GS15.
† The occupation has a top only in period 2, i.e., new jobs were created at the top within this occupational ILM in period 2.
‡ See computer operation in GAT section.

Female composition.—Table 11 also presents the female composition among the low-stack occupations. In period 1, the gender composition of these occupations varies from 3% to 81% with an average of 37%. In period 2, the overall average female composition in these ILMs increased by 7% to 44%. While female representation increased in all but medical technologist, the rate of increase varies somewhat (2%–16%) from one occupation to another. As observed among the high-stack occupations, substantial increases in female composition (10% or more) are observed in both GAT and no-GAT occupations. On average, however, the female composition among the no-GAT occupations increased by 12% from 47% to 60%, whereas in the GAT occupations, the increase was 8% from 23% in period 1 to 32% in period 2.

Glass ceiling by end distribution and percentage ending in the top.—Table 12 summarizes for each period the existing ceiling between the top and middle tiers for individuals starting in each low-stack occupation at GS5. The no-GAT occupations by definition have hierarchical ceilings and therefore lack inside opportunities to the top. In contrast to no-GAT

TABLE 12

End Distribution of Careers: Glass Ceiling at the Top among Low-Stack Occupations

	Inside Opportunities to Top				Outside Opportunities to Top			
	Period 1		Period 2		Period 1		Period 2	
Occupation	Women	Men	Women	Men	Women	Men	Women	Men
GAT with glass ceiling:								
332	. . .	. . .	no	yes	. . .	. . .	yes	yes
1311	no	yes	no	yes	no	yes	yes	yes
1152	no	yes	yes	yes	no	yes	yes	yes
GAT with no glass ceiling:								
644	yes	yes	yes	yes	yes	yes	yes	yes
802	yes	yes	no	yes	yes	yes	yes	yes
No GAT:								
332	no	no	. . .	. . .	yes	yes	. . .	. . .
1411	no	no	no	no	no	no	yes	yes
621	no	no	no	no	no	yes	yes	yes
645	no	no	no	no	no	yes	yes	yes
404	no	no	no	no	yes	yes	yes	yes

occupations in the high-stack group, here, four out of five of the no-GAT occupations have outside opportunities to the top even in period 1. While women's opportunities to reach the top are limited in period 1 (two out of five occupations for women, compared to four out of five for men), substantial change occurred in period 2—both genders could now reach the top in all no-GAT occupations.[37] Thus, in terms of the existence of outside opportunities, women and men are equal for these no-GAT occupations in period 2.

For the GAT occupations, in period 1, men in all four occupations have inside opportunities, but women could only reach the top in two; thus those in the remaining two face a glass ceiling. Similarly while men in all four occupations could reach the top via outside routes, women again lack such outside opportunities in two of them. Among the paths to the top, either outside or inside, women could take only four, compared to all eight for men in period 1. Perhaps more important, even in period 2, inside opportunities for women in the GAT occupations remain limited; in only two of five occupations could women reach the top, compared to all five

[37] In period 2, new jobs were created at the top in computer operation and thus the no-GAT group is reduced from five to four ILMs.

for men. While the glass ceiling is broken in production control, it remains intact in physical science technician, is reinstalled in engineering technician, and is newly created in computer operator. Thus, for women in these GAT low-stack occupations, inside opportunity structures did not improve between the two periods. In contrast, outside opportunities are now open for both women and men in all five occupations.

In sum, when we combine the findings from both GAT and no-GAT occupations in period 2, women can now reach the top in all nine outside paths, comparable to men. In contrast, in period 1, in only four out of nine occupations did women have such outside opportunities, compared to eight out of nine for men. However, if women stay within the initial occupation, in only two out of nine occupations (vs. five for men) could women reach the same level even in period 2. In sum, as with the case among high-stack occupations above, glass ceilings within the entry occupations have remained largely intact; it is outside opportunities that have substantially changed for women in the low-stack occupations. Being able to move to other occupations is therefore critical for the women in occupations in which comparable career advancement from within is blocked due to a glass ceiling.

We now go beyond the existence of glass ceilings to address the degree of closure of the ceiling by examining the odds of individuals reaching the top in the low-stack occupations. The derivations are obtained using the CPS model with the assumption that individuals start their careers at GS5. Table 13, provides the percentage of individuals that would exit at the top, overall (inside and outside) by gender. Significantly large opportunities (10%–12%) exist in these occupations, compared to those (2%–2.5%) in high-stack occupations. Further, in general, the GAT occupations have much higher opportunities to the top than the no-GAT occupations, as might be expected; the average percentage reaching the top among GAT and no-GAT occupations are 15% and 9% in period 1 and 15% and 4% in period 2, respectively.

In period 1, gender differentials are substantial in both GAT and no-GAT occupations. The gender-specific percentage ending in the top is 5% for women and 16% for men in the GAT occupations, and 3% for women and 13% for men in no-GAT occupations. In seven out the eight occupations that have opportunities to top, men have a higher percentage reaching the top. The gender gap is particularly large in occupations with large opportunities (production control, physical science technician, computer operation, and biological technician), in which opportunities for women do not exist at all or are less than one-third of those of men. An exception is engineering technician in which both men and women have relatively high and comparable opportunities. The gender difference is also near zero in medical technologist.

TABLE 13

Glass Ceiling by End Distribution for Low-Stack Occupations: Overall (Inside and Outside)

Occupation	Women		Men		Total		Gender Difference*		Change between Periods 1 and 2		
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Women	Men	Total
GAT:											
802	13.00	11.50	17.50	10.70	17.37	10.76	−4.50	.80	−1.50	−6.80	−6.60
1152	.00	16.60	17.90	14.40	16.83	14.84	−17.90	2.20	16.60	−3.50	−1.99
1311	.00	18.00	22.80	18.30	18.70	18.24	−22.80	−.30	18.00	−4.50	−.46
332	. . .	19.20	. . .	22.90	. . .	21.27	. . .	−3.70	7.70	−17.90	−9.57
644	6.90	6.40	5.90	10.30	6.56	7.73	1.00	−3.90	−.50	4.40	1.17
No GAT:											
332	11.50	. . .	40.80	. . .	30.84	. . .	−29.30	. . .	. . .†	. . .†	. . .†
404	3.90	5.40	13.00	4.50	10.63	4.82	−9.10	.90	1.50	−8.50	−5.81
621	.00	.60	3.40	1.30	1.84	.87	−3.40	−.70	.60	−2.10	−.97
645	.00	4.50	6.20	4.50	3.16	4.50	−6.20	.00	4.50	−1.70	1.34
1411	.00	8.30	.00	3.00	.00	7.66	.00	5.30	8.30	3.00	7.66
Average:											
Overall	3.92	10.06	14.17	9.99	11.77	10.08	−10.24	.07	6.13	−4.18	−1.69
GAT	4.98	14.34	16.03	15.32	14.86	14.57	−11.05	−.98	9.37‡	−.71‡	−.29‡
No GAT	3.08	4.70	12.68	3.33	9.29	4.46	−9.60	1.38	1.62‡	−9.36‡	−4.83‡

* Women − men.
† See 332 under GAT section.
‡ These values are the difference of the averages for periods 1 and 2.

In period 2, the substantial gender differentials observed among the GAT occupations in period 1 are virtually eliminated. On average, women's opportunities *increased* by 9% while those for men *decreased* by 1%. Particularly in production control and physical science technician, women's opportunities were created from zero to a level equivalent to those for men (17%–18%). In computer operation, men's odds in reaching the top was reduced by 18%, while those of women's increased by 8%, to 19%. In engineering technician in which both women and men experienced a reduction in the opportunities to the top, the amount of decrease for women is less than one-quarter of that for men.[38] As a result, a large gender gap that existed in period 1 in most occupations is eliminated: except for computer operation and medical technologist, the gender gap (women—men) is either within a range of 1% or women now have a higher percentage reaching the top. The percentage reaching the top in GAT, no-GAT, and the entire set of low-stack occupations for women is 14%, 5%, and 10%, respectively, compared to 15%, 3%, and 10% for men. Thus, as far as the average percentage ending in the top is concerned, women's opportunity structures in the low-stack occupations have become equal to those for men.

A great difference in outcome is observed when we look only at inside occupational ILM opportunities. Table 14 provides the percentage of careers ending at the top within the low-stack occupations. Since no-GAT occupations do not have inside opportunities, we focus only on the GAT occupations. We first note that compared to the relatively large overall opportunities to the top among the low-stack occupations (see table 13), their inside opportunities are substantially small, comparable for those among the high-stack occupations. In period 1, occupation-specific opportunities to the top among the four GAT occupations for both genders combined vary from 1% to 4%, with an average of 2.8%. Women's opportunity structures are further limited: compared to 3% of men, only 1% of women, on average, could reach the top. The gender difference is particularly large (5%) in physical science technician in which men monopolize the entire set of opportunities to the top. Also in engineering technician, women's odds are about one-third of those of men. In medical technologist, the only other occupation in which women could reach the top, their inside opportunities are slightly (0.6%) higher than those for men. In period 2, again in only two occupations could women reach the top from inside—in medical technologist, where the odds have reversed and now favor men, and production control, in which women's opportunities in-

[38] The only exception to this trend is medical technologist in which the gender differential has increased by almost doubling the percentage of reaching the top for men from 6% to 10% while keeping that for women constant.

TABLE 14

GLASS CEILING BY END DISTRIBUTION FOR LOW-STACK OCCUPATIONS: INSIDE

Occupation	Women		Men		Total		Gender Difference*		Change between Periods 1 and 2		
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Women	Men	Total
GAT:											
802	1.40	.00	3.80	3.40	3.73	3.13	−2.40	−3.40	−1.40	−.40	−.60
1152	.00	8.60	1.10	4.40	1.03	5.24	−1.10	4.20	8.60	3.30	4.21
1311	.00	.00	4.90	1.40	4.02	1.11	−4.90	−1.40	.00	−3.50	−2.91
332	. . .	.00	. . .	.90	. . .	.50	.00	−.90	.00	.90	.50
644	2.60	1.20	2.00	2.20	2.40	1.54	.60	−1.00	−1.40	.20	−.86
Average:											
GAT	1.00	1.96	2.95	2.46	2.79	2.30	−1.56	−.50	.96†	−.49†	−.49†

* Women − men.
† These values are the difference of the averages for periods 1 and 2.

TABLE 15

INTERNAL EXIT RATES BY PERIOD AND GENDER: LOW-STACK OCCUPATIONS

OCCUPATION	PERIOD 1			PERIOD 2		
	Women	Men	Total	Women	Men	Total
GAT:						
802	46.22	38.62	38.84	39.24	28.58	29.44
1152	81.45	63.08	64.19	41.36	56.60	53.55
1311	18.00	45.93	40.90	38.80	42.60	41.81
332	. . .	. . .	. . .	53.98	50.81	52.21
644	10.00	24.00	14.76	12.00	18.00	14.04
No GAT:						
332	60.73	64.61	63.29	. . .	. . .	. . .
404	30.48	32.18	31.74	18.95	19.96	19.60
621	18.65	30.75	25.18	44.06	23.12	36.10
645	21.69	37.48	29.74	29.65	32.95	31.14
1411	27.15	48.41	31.19	31.13	42.61	32.51
Average:						
Overall	34.93	42.78	37.76	34.35	35.03	34.49
GAT	38.92	42.91	39.67	37.08	39.32	38.21
No GAT	31.74	42.68	36.23	30.95	29.66	29.84

creased from 0% to 9%. While women's opportunities have on average nearly doubled to 2%, compared to 2.5% for men in period 2, thus significantly reducing the average gender difference, the actual increase was observed only in production control. Among the remaining three occupations, women still face a glass ceiling.

In sum, we have confirmed that the major changes in opportunity structures observed in table 13 took place outside the original occupations. Given the different gender composition and hierarchical structures within these low-stack occupations, this uniform increase in women's outside opportunity structures suggests the impact of organizationwide affirmative action policies for gender. These programs seem particularly effective when women leave their original occupations. For outside routes, the changes are consistently in favor of women, regardless of the overall direction of shift in outside opportunities. In contrast, when women remain in the original occupations, the impact of such policies seems small.

Occupational captivity.—Given the above findings, once again it is clear that for women it is crucial to have opportunity structures with gateways or bridges that lead to other occupations with a higher ceiling. Table 15 displays the gender-specific internal exit rates among the low-stack occupations in the two periods.

In period 1, the overall (total) internal exit rates for the low-stack occupations range from 15% to 64% with an average of 38%, or a captivity rate of 62%. On average, the GAT occupations have slightly lower (3%) captivity rates than the no-GAT occupations, reflecting the difference between the two groups in terms of the size of outside opportunities. For women, the percentage moving out from their original occupation ranges from 10% to 81%, averaging 35%, compared to those for men, where the range is from 24% to 65%, averaging 43%. The captivity rates were thus 65% and 57%. Men have a substantially lower captivity rates (10% or more) in about half of the occupations (five out of nine). In only production control are women's captivity rates significantly lower than that of men.

In period 2, the overall internal exit rates range from 14% to 54%, averaging 35% (captivity rate: 65%). While these rates for the no-GAT occupations on average decreased by 4% to 30%, those for the GAT occupations only slightly decreased by 1% to 38% in period 2. Despite the overall wide variation across occupations, the captivity rates for men in this period increased in all occupations, whereas those for women were split with decreases in five ILMs and increases in only four. Overall, these resulted in virtual equality in occupational captivity rates by gender for both the GAT and no-GAT occupations—women's captivity rates for the GAT and no-GAT occupations are 63% and 69% respectively, compared to 61% and 70% for men.

Once again we have confirmed the important captivity–glass ceiling linkage that we observed among the high-stack occupations. Without the internal outside opportunities, women's opportunities are severely limited with glass ceilings remaining overwhelmingly intact. When outside opportunities are taken into consideration, women's opportunities to the top are as great as those for men in period 2.[39] We also identified the importance of internal outside opportunities for those whose careers are limited because of the existing hierarchical ceilings within the occupation. Thus, in the case of no-GAT occupations, outside opportunities are critical for *both women and men* to develop their careers beyond the limited opportunity structures available from within. These findings clearly suggest the importance of creating new bridges linking occupations, in addition to maintaining the existing ones, as a means to effectively and probably more expediently enhance individual career opportunities.

Nature of Outside Opportunities

Given the current theorizing of career opportunities as largely embedded within the occupational ILMs of organizations, the findings above clearly

[39] Though speculative, it appears that an internal exit rate threshold of 30% is generally necessary in low-stack ILMs and an internal exit rate threshold of 40% in high-stack ILMs.

point to the significance of "roads less traveled," or "roads not readily perceived" by most organizational and occupational theorists, nor perhaps even by many of the managers within these organizations. Clearly, what we have been analyzing is an organizational labor market with shielding of job opportunities from the outside, a fundamental postulate of ILM theory. On the other hand, most of extant ILM theory would not have predicted the current findings. Thus, we now briefly propose to answer the following two questions: (1) If the predominant paths for breaking the glass ceilings are outside the original ILM, do they involve a relatively narrow band of occupations, a much wider band, or are they random? and (2) What is the institutional nature of these internal outside pathways to the top? That is, to what extent are they on the main paths or "major" career lines of operative ILMs, given that they are not on the organization's formally defined ILMs or job ladders? Since the predominance of breakthroughs occurred in period 2, we examine all 15 successful outside routes to the top in the period, including six in the high-stack occupations (accounting, general attorney, mathematics, budget analysis, personnel staffing, and librarian) and all nine in the low-stack occupations.

To address the first question, table 16 presents a list of destination occupations for each of the high- and low-stack occupations, using two dimensions: (1) direct versus indirect linkages of the career-origin occupation with the outside occupation at which the glass ceiling was broken, and (2) whether the outside occupation was functionally related (F), other administrative (A), or other professional (P). The numbers in brackets to the right of the career-origin occupation denote the total number of outside pathways from the occupation, with the values after the colon representing the number of direct and indirect routes, respectively. In three cases there were more than one indirect route taken (indicated by an asterisk on the linkages); in all three, the number of such indirect paths was two. An example of an origin occupation utilizing both direct and indirect routes is biological technician, having 11 direct and four indirect routes. The 11 direct paths include six routes to functionally related occupations within the occupational group of biological science (occupational series numbers in the 400s), three administrative occupations (334, 1412, and 2152) and two other professional occupations—psychology and chemistry.[40] The four indirect paths involve one in biological science (forestry), two administrative occupations, and one other professional occupation

[40] The U.S. Office of Personnel Management (1979) defines an occupational group as a set of functionally related occupational series and denotes these groups by the numerical digits at the level of 100 or higher, e.g., 201–299 refers to the 200 group (personnel), 301–399, to the 300 group (administrative), and 401–499 to the biological science group. These are referred to in table 16 by F_{100}.

TABLE 16

WOMEN'S UPWARD CAREER ENDING VECTORS ACROSS THE GLASS CEILING

Origin Occupations	Destination Occupations: Categories	Destination Occupations: Direct	Destination Occupations: Indirect
High stack:			
Accounting (P 510 [1:1,0])	F_{100}	Auditing (P 511)	
General attorney (P 905 [1:1,0])	A	Program management (340)	
Mathematics (P 1520 [1:0,1])	P		General engineering (801)
Budget analysis (A 560 [1:1,0])	A	Program analysis (345)	
Personnel staffing (A 212 [1:0,1])	F_{100}		Personnel management (201)
Librarian (P 1410 [1:1,0])	A	Miscellaneous administration and programs (301)	
Low stack:			
Computer operation (T 332 [3:1,2*])	F_{100}	Computer specialist (A 334)	Computer specialist (A 334)*
Biological technician (T 404 [15:11,4])	F_{100}	General biological science (P 401)	Forestry (P 460)
		Microbiology (P 403)	
		Entomology (P 414)	
		Botany (P 430)	
		Genetics (P 440)	
		Wildlife biology (P 486)	
	A	Computer specialist (334)	Environmental protection specialist (28)
		Technical information service (1412)	
		Air traffic control (2152)	Contract and procurement (1102)
	P	Psychology (180)	General physical science (P 1301)
		Chemistry (1320)	

Medical technologist (P 644 [12:7,5])	F_{100}	Consumer safety (P 696)	General health science (P 601)
			Health system specialist (P 671)
	F_P	General biological science (P 401)	General biological science (P 401)
		Microbiology (P 403)	
		Chemistry (P 1320)	
	A	Administrative officer (341)	Intelligence (132)
		Management analysis (343)	Computer specialist (334)
		Air traffic control (2152)	
Engineering technician (T 802 [9:7,2])	F_{100}	Civil engineering (P 810)	
		Mechanical engineering (P 830)	
		Electronics engineering (P 855)	
		Biomedical engineering (P 858)	
		Aerospace engineering (P 861)	
	A	Air traffic control (2152)	
	P	Soil conservation (457)	Industrial hygiene (690)
			Computer science (1550)
Production control (T 1152 [5:3,2])	F_{100}	Industrial specialist (A 1150)	Operations research (P 1515)
	F_P	Inventory management (A 2010)	
	A	Miscellaneous administration and programs (301)	Communications management (391)
Physical science technician (T 1311 [18:8,10*])	F_{100}	General physical science (P 1301)	General physical science (P 1301)*
		Health physics (P 1306)	Health physics (P 1306)
		Geophysics (P 1313)	
		Chemistry (P 1320)	
		Geology (P 1350)	
		Oceanography (P 1360)	
	A		Computer specialist (334)
			Administrative officer (341)*
			General arts and information (1001)
	P	Industrial hygiene (690)	Industrial hygiene (690)
		Electronics engineering (855)	General engineering (801)
			Mechanical engineering (830)

TABLE 16 (*Continued*)

Origin Occupations	Destination Occupations		
	Categories	Direct	Indirect
Library technician (T 1411 [7:4,3])	F_{100}	Librarian (P 1410)	Technical information services (A 1412)
		Technical information services (A 1412)	
	A	Computer specialist (334)	Miscellaneous administration and programs (301)
			Logistics management (346)
	P	Education and vocational training (1710)	
Nursing assistant (T 621 [3:1,2])	F_{100}	Nurse (P 610)	
	A		Security administration (80)
			Logistics management (346)
Medical technician (T 645 [3:1,2])	F_{100}		Health system specialist (P 671)
	A		Visual information (1084)
	P/T	General physical science (P 1301)	

Note.—P = professional; A = administrative; T = technical; F_{100} = functionally related to the same occupational series group, grouped by hundreds; F_P = functionally related even though it is not within the same group of a hundred. The nos. in brackets after "origin occupations" denote outside pathways from the occupation. The no. before the colon indicates the total no. of pathways; the first no. after the colon indicates direct routes; and the second no. after the colon indicates indirect routes. The total of outside pathways = 81; the total of direct routes = 47; the total of indirect routes = 34.

* These occupations had multiple indirect paths. In all cases the no. of such paths was 2.

(general physical science). A direct route indicates that the women moved directly from the origin occupation to the occupation listed (e.g., P 403 microbiology). In this case, the move through the glass ceiling is either on the move into microbiology *or* more generally within microbiology, after a shift from biological technician at a yet lower grade level. An indirect path indicates that an incumbent starting in a biological technical job moves to one or more other occupations prior to the occupation listed, in which they moved to the top. For example, a functionally related indirect route involved the following moves: 404 → 486 → 460 into the top. Another case that does not involve functionally related occupations has the following moves: 404 → 18 → 28, or from biological technician to safety management, and finally to environmental protection specialist into the top. Overall there are 47 direct and 34 indirect routes, for a total of 81 outside pathways to the top. Thus, about 60% of the routes are direct and the remaining 40% are indirect. The consequences for the type of linkage seems to depend upon whether it is a high-stack or low-stack occupation. In the former case, three of four of the direct routes are to other administrative jobs (outside the functional area), whereas none of the high-level indirect routes were to other administrative jobs. In contrast, for the low-stack jobs, the direct routes to the top are 3 to 1 in favor of functionally related jobs versus administrative jobs; when the route is indirect, however, the odds are even between functionally related and administrative jobs.

Among the high-stack occupations, two of the six or 33% of the occupations of destination are functionally related to the original occupation. These two cases involve both a direct and an indirect route; the direct route includes women in accounting moving to auditing within the 500 group, while the indirect route involves women in personnel staffing moving to general management and then back into personnel management. Additionally, three of the six or 50% of the high-stack outside opportunities are to other administrative jobs, while only one in six or 17% are to other professional jobs. Thus, the destination band seems very narrow, with over 83% of the opportunities either in a functionally related occupational ILM or in an administrative ILM, indicative of opportunities in managing the organizational ILM. The band of outside routes is also quite narrow in terms of the number of total possible outside paths. In this organization, there are a total of 273 professional and administrative occupational ILMs. The total number of outside paths taken per origin occupation is but one, less than 1% of the total possible paths—a very narrow corridor.

The lower part of the table presents the vectors of destination occupations for the low-stack occupations. Overall, the dominant paths are functionally related to the original ones—about one-half of women moved to such occupations. A general pattern of occupational change is a movement from a technical occupation to either an administrative occupation or a professional occupation in a particular field in which more specific knowledge/skills to perform the tasks are required. That is, the destination occupations are either in the same functional group or functionally related though in a different functional group. A typical example includes women in engineering technician moving to a series of specified fields of engineering including civil engineering, mechanical engineering, and so forth, and women in production control moving to industrial specialist or inventory management.[41] An additional 29% of the gateways are into other administrative ILMs. Thus, once again, over 80% of the outside pathways are either to functionally related or administrative jobs. If we also ask what number of outside routes provide access to the top relative to all possible outside routes, the number for low-stack occupations ranges from three to 18, or from 1% to 7%, again a narrow band.[42] In short, the findings on women's outside upward career vectors from both high- and low-stack occupations indicate that their career movements are far from random. In terms of the functional linkage, they either move to a very limited number of occupations within the occupational group (grouped by numbers in the same hundreds, i.e., 400s) or to new occupations in which their acquired skills and knowledge are useful in performing tasks. The major difference between the high- and low-stack occupations is the nature of career change. While women in the high-stack group take a value-added approach—they change their occupation in a way so that they directly apply their acquired skills/knowledge to a new occupation—those in the low-stack occupations take an approach of ramification—they develop their careers by focusing or narrowing their fields of expertise. Where neither approach is used, women move into administrative ILMs.

To address the second question, regarding the extent to which the pathways to the top for women are on the major paths or main career lines of operative ILMs, we utilize both the inflow and outflow criteria or thresholds suggested by Althauser and Kalleberg (1990) for establishing a job-to-job ILM pathway link for all 15 occupations in table 16. That is, does the flow represent 20% of all the total internal inflows or outflows?

[41] In this case, we have included a production-related job as functionally related even though it is not within the 1100 group. Similarly for medical technologist, we have also included chemistry, microbiology, and general biology, denoted by F_P rather than F_{100}.

[42] Here we have included multiple routes—direct and indirect (single and multiple) per occupation—for the numerator but only a single route per occupation for the denominator and hence the percentage given is conservative. If we simply doubled the denominator by allowing direct and indirect routes, the percentages would halve.

Since we have thus far utilized the organization's formal delineation of ILMs as our ILM system boundaries, we wish to empirically examine how many of the routes to the top which we had identified as ILM boundary crossings using formal rules would hold up under an operative behavioral ILM criterion. We examine both the inflows and outflows. Of the 81 occupation–grade specific linkages that yielded outside access to the top, only one meets the ILM outflow threshold, while eight meet the inflow criteria, thus yielding nine possible main path links to the top. For the remaining 72 occupational links, none were main ILM paths. Hence, overall, 72 out of 81 of the interoccupational pathways to the top, or 89% of these routes were *not* on main ILM paths. Moreover, one specific occupational ILM (biological technician) accounted for six of the nine main paths. Thus, for the remaining 14 occupations there were only three main paths out of the 66 possible ones;[43] hence, generally around 95% of the outside routes to the top for women were *not* on main ILM paths. Even taking into account the most prevalent linking occupational ILM (biological technician), the outside gateways to the top for women generally involve moves between occupational ILMs. More specifically, using this particular criterion for operative ILMs, which is quite rigorous, an ILM theorist focusing only on the main paths would miss almost 90% of the gateways to the top for women. Hence, ILM theory is not only pertinent for structuring intra-ILM movement, which has been a main feature from its onset, but now we must also permit revisions to the theory, whereby important moves take place between occupational ILMs, off the main paths, weighting not only the relative frequency of travel *on* main paths but also the potential payoffs *off* these main paths. For women in this study, it is these roads less heavily traveled that lead through the glass ceiling.

CONCLUSION

In sum, we find distinctive patterns of opportunity structures for women inside and outside their entry occupations: there are large differentials by gender within the occupational ILM of origin and near equality by gender when both inside *and* outside opportunities are considered. The key is therefore outside career routes within the organization. To date, the significance of these alternative outside pathways has been generally unrecognized (an exception is DiPrete [1989]). Perhaps this is due to attention on distributional data versus attention on the processes underlying careers and labor markets. It may also stem from sampling on limited occupations

[43] Eighty-one total paths less the 15 possible paths from biological technician leaves 66 pathways to the top from the remaining 14 career trajectories.

thereby losing data on the outside routes. These results have major implications for sex segregation theorists. To the extent that occupational captivity is high (opportunities outside one's occupation are nil), we face a much more severe problem as evidenced by the inside data. However, in this analysis the massive amount of movement outside the initial occupational ILM but within the organization suggests the possibility of much less job segregation in terms of captivity. It also indicates a wider framework to address gender inequality—one having an ILM network structure.

If we believe that the existing labor market conditions observed in period 2 will persist, women in many, if not all, occupations will have greater odds for reaching the top by leaving the initial entry occupation. And if so, the recent tremendous efforts by the federal government to establish and widen women's pipelines within occupations may not bring the expected outcome, at least in the short run. To increase women's representation at the top, an equally important area is to focus on setting up new feeder lines and maintaining, extending, and widening the existing number of bridges between occupations.[44] Also important may be to strategically bring in more qualified women in the fields that are in greater demand in other areas (occupations), as observed in the case of accounting, mathematics, and computer operation. Finally and important, we should not overlook the importance of the existing equal employment opportunity and affirmative action programs, particularly those implemented in the late 1970s, primarily because it appears that these programs did bring large increases in outside opportunities for women in period 2, thus substantially reducing the gap in opportunity structure. On the other hand, there are still occupations, particularly those in professional/administrative categories, in which women's inside opportunities are blocked almost as severely as they were about a quarter century ago. In this respect, such a micro-level analysis as the current one, based upon data with detailed occupations, may help responsible agencies to identify and target specific occupations for improving women's opportunities instead of indiscriminately applying remedial measures across occupations of different situations.

Are the results on outside routes historically specific? As to the specific occupation or the magnitude of change, the answer is, possibly. However, as to the continuity, we expect the importance of outside routes to remain a primary force in decreasing gender inequality. It may, in fact, with time

[44] Such bridge building also requires a substantial infrastructure of support—in the form of peer support, mentoring, training, and obtaining experience along the pathway.

also impact women's careers within their original occupation, opening doors there as well in order for managers to retain high performers. The pendulum may also swing back, in some cases, again closing outside routes. This, however, seems less likely than closure from within, when odds are low, as in the case of engineering technicians in this study (see table 14). Once the gate is open and safe passage has been made, it is far more difficult to close it. Moreover, there is not a single gate in many instances but several gates, again lowering the odds of multiple closures. In brief, as with global competition, there are more players and more opportunities. In this case, the player pool of those given consideration has expanded to include women, and the opportunities have not simply grown, but the opportunity set has expanded considerably—to those outside, the full set of which may include several orders of magnitude and, as noted, by multiple gateways. The model, when used across periods, as in this study, enables an analyst to capture the dynamics of opportunities and of the restructuring of organizations and their ILM structures. We think that it is important to visualize and to operationalize such dynamics in theories on organizations, ILMs, and gender inequality. In this respect, the present study offers a new avenue for this pursuit.

A case in which the gateway opening is more likely to be historically specific is where an occupational ILM subdivides into two ILMs. For example, accounting split into accounting and auditing. For the brief subperiod in which this evolution was occurring, women moved from accounting to auditing at multiple grades. Once the evolution stabilized, the gateways to the top closed.

To what extent were the gains by women at the expense of men? The results indicate that it depends on the nature of restructuring of job opportunities. In the high-stack jobs, for instance, overall opportunities to the top for the set of GAT occupations declined slightly (−.10), and thus women's gains of almost 2% were at the expense of men (a decline of .5%). Note, however, that given the demographic proportions at this time, larger gains by women were not reflected in equally large declines by men. As these proportions shift, if opportunities are relatively constant, as in this case, such gains by women would mean larger losses by men. A different case, however, is shown in the lower tier (no-GAT) occupations of the high-stack jobs. Here opportunities were increasing by almost .5% overall. Thus, both women and men gain. The .6% gain by women is much higher than that by men (.1%), but both gain in the case of an expanding opportunity set. Overall, therefore for the high-stack jobs, the gains by women (14.9%) did not result in declines by men (0.12%) due to an overall increase (.52%) in opportunities to the top.

In the low-stack jobs, the GAT occupations also experience an overall shift decline (−.29%). Here, the magnitude of gain by women is much higher than that of the high-stack jobs. It is 9.4%. The decline for men is less than 1% (−.71%), again reflecting the differential in the demographic base. Large gains, in this case by women, were offset by small losses by men. In the lower tier (no-GAT) jobs, however, the overall opportunity set declined much more, by almost 5%, and thus women's gains (2%) were offset by much larger losses by men (9%). Overall in the case of low-stack jobs, a net decline in the opportunity set is played out with a gain by women and a decline by men. The general story is, thus, that the outcomes for women and men depend on the nature of job restructuring and on the overall opportunity set. The relative gains and losses also depend on the relative size of the job-holding populations by gender. In the case of relatively higher losses by men, reactions of at least two kinds might be expected: (1) attempts to thwart new female incumbents and thus restore the imbalance, once again reducing future female selections and possibly increasing exits by women at the top as postulated by Jacobs (1989); or (2) increased exits by men, as hypothesized in Kanter's (1982) theory of opportunity-exit linkages. In fact, in a companion article, we find the support for the latter; losses in promotion rates by men are matched with higher exit rates, whereas increases in promotion rates by women coincide with decreased exit rates. Apparently, the revolving doors by gender have changed in their rate of revolution.

Two implications from the present study seem particularly important for future research: (1) the potential importance of roads not so widely traveled in the form of ILM networks and (2) the nature and form of occupational captivity and glass ceilings linkage. With respect to the former, at least three foci need to be investigated. First, to what degree do organizations permit mobility between these ILMs? Additionally, are such gateways equally open for women and men or for other minorities? Second, how does organizational restructuring and ILM restructuring affect the main and minor paths, as well as their linkage? Such research needs to look not only at organizational-external environment interactions but also at the dynamics of jobs (e.g., Pinfield 1995), of internal "rules" (e.g., Veen 1997) and of mobility routes or pathways. The restructuring of major corporations, and of organizations more generally, may involve the building of new roads and bridges or at a minimum the opening or closing of certain gateways for specific populations of workers, by skill or by demographic attribute. Third, given the recognition as to the magnitude of firm foundings and failures highlighted by organizational ecology, examination of mobility between firms (e.g., Haveman and Cohen 1994) in terms of main, minor, new, and "payoff" paths, seems especially promising. The routes may involve interorganizational occupational ILMs (e.g., Smith 1983) or possibly interorganizational interoccupational moves, with the latter again revealing new networks of ILMs.[45] Given the amount of restructuring of organizations that has taken place over the past several decades (if not most of this century), movement between firms as well as movement within firms is important to examine.

There are also important implications for future research from the second area noted above, glass ceilings and occupational captivity. First, given the recent debates on reexamination of affirmative action polices, which may result in possible changes in the policies, the 1990s and early years of the next century could be a critically important period for women in the federal workforce as well as for working women more generally. The results found here, in terms of shifts to gender equality, are based on a continuation of such policies. Moreover, given the proposals on "restructuring the government" by the Republican Congress as well as by the Clinton/Gore administration, we may expect substantial occupational redistributions as we move into the 21st century and beyond. In this domain, internal outside career routes would also take on increasing importance. Existing, as well as new, alternative outside routes, whether outside the initial occupations but within the organization, or outside the focal organization (e.g., Haveman and Cohen 1994), may become more traveled and more central.[46] The nature of restructuring and its effect on opportunities generally, and for women in particular, are extremely important topics for analysis—both theoretically and for policy. Moreover, the CPS model used in this analysis offers one strategy for viewing such effects—far earlier than most prior types of analyses, which require that we wait until larger segments of the careers unfold in real time. In cases such as AT&T in the 1970s, in which new bridges were created for college-educated women in clerical jobs to move into professional or managerial jobs, the present model could be used by the organization and/or the Equal Employment Opportunity Commission (EEOC) to assess alternative futures and evaluate "progress" toward stated "goals" or targets. The 1996–97 example of Texaco regarding its equal employment opportunity policies and race could also be evaluated from the 1996 baseline, and in terms of the implications of operative personnel policy changes implemented in 1997 and thereafter.[47]

[45] In the former case, the moves would be from one organization x, occupational ILM A to organization y, occupational ILM A. In the latter case, the moves would be from one organization x, occupational ILM A to organization y, occupational ILM B.

[46] In which case, some of these new routes might restructure ILMs, thus providing additional insight into the dynamics and evolution of ILMs, as well as into the dynamics of interorganizational moves.

[47] In 1994, a class action suit on behalf of 1,500 current and former black employees was brought against Texaco for racial discrimination in promotions and pay in-

Second, more general organizational restructuring may be evaluated in terms of implications for a firm's workers. For instance, one might examine the degree of change across an entire organization versus that in functional areas 1, 2, or 3, or in separate departments. What effect, if any, did the restructuring of the Department of Health, Education, and Welfare into the Departments of Education and Health and Human Services have on the career chances of women? Or is it merely a function of the occupational distributions? Another example is that of organizations creating a slimmer but parallel upper hierarchy of jobs in professional research for their top research and development personnel. Instead of either hitting a hierarchical ceiling on the research track or continued promotion by moving into management, the person's career could now advance in either management or continued research. This type of restructuring has been fairly common for engineers, software personnel, and research and development scientists in general. In this instance, the restructuring would involve occupational captivity and hierarchical ceilings and a new route permitting access to the top within the occupation (i.e., taking the lid off). The research could also evaluate the extent to which there was equal access through the new gateway or whether such branching affected the odds of women moving into management, the wider road.

Third, other types of job linkages might also be examined. For example, if job bidding is organizationwide and/or seniority based given sufficient skills or experience, then to what extent is occupational captivity a factor? How do policies regarding job rotation affect career chances? Where are the hierarchical venturis (e.g., Stewman and Konda 1983), hierarchical ceilings, or glass ceilings? International comparative research, especially involving Japan, would be productive here.

Fourth, linkage of the present model to the more commonly used career approaches could yield complementary insights. For instance, current career research generally is limited to truncated career segments. Where key segmented chances have been identified by career researchers, the present model could be used to study the implications of linking the new segments to the implied end points in terms of tier or level. Alternatively, use of the present model to identify critical bridges could then be extended by career segment analysis via deeper probes to examine the gateway in terms of (1) who moves, probing the heterogeneity, (2) rates of movement, to pinpoint duration effects, and (3) qualitative probes into the nature of the

creases. In 1997, after substantial pressure, arising from public news coverage of a newly released tape of a 1994 meeting of Texaco executives involving alleged racial remarks, the firm settled for $176 million. As part of the settlement, Texaco reached a five-year agreement with the EEOC for it to intervene and monitor the company's promotion of minorities and contracted a plan to increase hiring and career development of minorities. (See *Pittsburgh Post-Gazette* 1996*a,* 1996*b*.)

job and the staffing decisions by the employer and the employee selected (e.g., Pinfield 1995).

Finally, we note that in the form used here the model has implications for studying gender inequality in other organizations by simultaneously incorporating multiple mechanisms: gender distribution (skew), gender segregation (composition), occupational captivity, hierarchical ceilings, glass ceilings, and ILM structure/network linkages in terms of main paths and roads less traveled. Methodologically, the present study demonstrates how a researcher can extract the equilibrium career implications of organizational structure and personnel flows that are measured over much shorter periods of time.

TABLE A1

Glass Ceiling by End Distribution for High-Stack Occupations: Outside

Occupation	Women		Men		Total		Gender Difference*		Change between Periods 1 and 2		
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Women	Men	Total
GAT:											
861	.00	.00	1.80	3.50	1.78	3.40	−1.80	−3.50	.00	1.70	1.61
510	.00	10.30	.00	2.00	.00	3.33	.00	8.30	10.30	2.00	3.33
905	8.50	1.50	4.90	1.70	5.19	1.65	3.60	−.20	−7.00	−3.20	−3.54
180	.00	.00	.80	.20	.70	.16	−.80	−.20	.00	−.60	−.53
1320	.00	.00	1.00	1.50	.85	1.19	−1.00	−1.50	.00	.50	.34
1520	. . .	12.30	. . .	7.80	. . .	8.84	. . .	4.50	12.30	7.80	8.84
560	.00	3.30	4.60	4.90	2.90	4.05	−4.60	−1.60	3.30	.30	1.15
No GAT:											
403	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
185	.00	.00	.00	.60	.00	.32	.00	−.60	.00	.60	.32
212	.00	1.40	.00	.00	.00	.92	.00	1.40	1.40	.00	.92
1082	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1410	.00	2.20	.00	.00	.00	1.67	.00	2.20	2.20	.00	1.67
630	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Average:											
Overall	.65	2.38	1.01	1.71	.88	1.96	−.35	.68	1.73	.70	1.09
GAT	1.42	3.91	2.18	3.09	1.90	3.23	−.66	.83	2.50†	.90†	1.33†
No GAT	.00	.60	.00	.10	.00	.49	.00	.50	.60†	.10†	.49†

* Women − men.
† These values are the difference of the averages for periods 1 and 2.

TABLE A2

GLASS CEILING BY END DISTRIBUTION FOR LOW-STACK OCCUPATIONS: OUTSIDE

Occupation	Women		Men		Total		Gender Difference*		Change between Periods 1 and 2		
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2	Women	Men	Total
GAT:											
802	11.60	11.50	13.70	7.30	13.64	7.64	−2.10	4.20	−.10	−6.40	−6.00
1152	.00	8.00	16.80	10.00	15.79	9.60	−16.80	−2.00	8.00	−6.80	−6.19
1311	.00	18.00	17.90	16.90	14.68	17.13	−17.90	1.10	18.00	−1.00	2.45
332	. . .	19.20	. . .	22.00	. . .	20.77	. . .	−2.80	7.70	−18.80	−10.07
644	4.30	5.20	3.90	8.10	4.16	6.19	.40	−2.90	.90	4.20	2.02
No GAT:											
332	11.50	. . .	40.80	. . .	30.84	. . .	−29.30	. . .	. . .	. . .	. . .
404	3.90	5.40	13.00	4.50	10.63	4.82	−9.10	.90	1.50	−8.50	−5.81
621	.00	.60	3.40	1.30	1.84	.87	−3.40	−.70	.60	−2.10	−.97
645	.00	4.50	6.20	4.50	3.16	4.50	−6.20	.00	4.50	−1.70	1.34
1411	.00	8.30	.00	3.00	.00	7.66	.00	5.30	8.30	3.00	7.66
Average:											
Overall	3.48	8.97	12.86	8.62	10.53	8.80	−9.38	.34	5.49	−4.23	−1.73
GAT	3.98	12.38	13.08	12.86	12.07	12.26	−9.10	−.48	8.41†	−.22†	.20†
No GAT	3.08	4.70	12.68	3.33	9.29	4.46	−9.60	1.38	1.62†	−9.36†	−4.83†

* Women − men.
† These values are the difference of the averages for periods 1 and 2.

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