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THE EFFECTS OF THE DRAWDOWN ON PROMOTION AND CAREER OPPORTUNITIES OF FEMALE OFFICERS

by

Donna M. Kaspar

March, 1995

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This thesis examines the promotion and career patterns of female officers in the Department of Defense (DoD) during the force reduction (1987-1994), focusing on the relationship between occupation and promotion as well as trends that may be of interest to personnel policy planners. Both cross-sectional and cohort data files are constructed and analyzed.

The study found dramatic increases in the representation of women within nontraditional occupations. At the same time, the distribution of women across occupations reveals a shift out of traditional, administrative fields into health care positions that have been historically filled by men. DoD women in nontraditional occupations had the highest rates of promotion. Non-technical occupations had the lowest promotion rates for both sexes. Logit models revealed no systematic trends in the significance of occupation by entry cohort, service, or gender. The data suggest that policies used to downsize the force have not adversely affected the promotion opportunities of women.

Further research is recommended to examine more fully the effects of the defense drawdown and changes in combat exclusion policies on the career opportunities of female officers. Because there may be significant gender differences in retention behavior, the relationship between retention and promotion should also be modeled.

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I. INTRODUCTION

The composition of the workforce changed irrevocably during the Second World War. The need to send millions of young men into battle created an employment vacuum in the factories and offices of the western world. Women were able to take advantage of these employment opportunities and provide a valuable contribution to the war effort. Many long-established social norms regarding the role of women began to change. Even though many women were displaced from the workforce when the soldiers returned, a trend of increasing participation in education and employment had been secured.

World War II was a turning point for the employment of women in the military as well. Manpower shortages opened the door for significant employment of servicewomen. In the post-war period, the Women's Armed Services Act of 1948 maintained limited opportunities for women in the Services. In 1967, a number of political and social concerns led to the passage of Public Law 90-130, which removed many restrictions on women in the military. This law also removed some restrictions on promotion of female officers. As a result of a Congressional Task Force in 1972, the Services began developing a plan to increase the number of women in all branches of the military. By 1977, all services met their goals of essentially doubling the number of women on active duty. The proportion of women in the military was raised to around 11 percent and remained at that level for the next fifteen years (House of Representatives Committee on Armed Services, 1992).

Since the middle of this century, there have been notable increases in the amount of formal education for women, to such an extent that women now represent over half of this country's bachelor's and master's degree graduates. Women's fields of study have also shifted from education and health care to business, computer science and engineering. The percentage of women in the fields of business, computer science, and engineering has grown substantially over the last twenty years while the percentage of women in health grew modestly and education only slightly. Much of this growth, however, is due to the fact that there are simply many more women in college now. Labor force participation

rates have also changed dramatically for women, nearly doubling between 1950 (33.9 percent) and 1992 (57.8 percent) (Ehrenberg and Smith, 1994).

A number of significant occupational issues (such as structure and organization of the work unit) and social issues have been associated with this growth in employment for women. One of the most widely publicized of these issues, especially in recent years, is the subject of equal opportunity. In particular, there has been an evolving concern for this subject in the areas of pay, career progression, and promotion opportunity. Today, federal laws as well as company policies are in place to guarantee the fair treatment of women in the workforce.

The military has attempted to ensure fair treatment for all qualified individuals through comprehensive equal opportunity and affirmative action programs. Policies have been written to guarantee fair hiring and promotion practices, and statistics are studied to identify trends and to monitor the levels of participation.

Concern about equitable opportunities for women continues to be a topic of interest. The issue becomes even more complicated in today's military as the force drawdown has reduced the number of active duty personnel by several hundred thousand. Numerous programs have been implemented to assist policymakers in achieving endstrength goals and in restructuring the force in terms of skills, seniority, and experience levels. These drawdown policies have been designed primarily to meet numerical objectives and to eliminate unnecessary billets and facilities.

Weaving together the defense downsizing goals with the concern about population representation and equal opportunity is difficult at best. The task is further complicated by the changes in policy concerning women in combat. Although there are additional job opportunities now available to women because of these changes, the focus here is on the effects of the specific policies and programs introduced to reduce and restructure the force. Whether or not these drawdown policies have had an unintended effect on women, specifically female military officers, is the subject of this study. This study further attempts to identify any significant changes in the service of women officers that may have occurred as a result of the force reduction.

A. SIGNIFICANT EVENTS IN THE HISTORY OF WOMEN IN THE MILITARY

Several studies, theses, reports, and articles have documented the history of women's participation in the military (Griffin, 1992; Norman, 1988; Norton, 1992; Nyary, 1991; Turner, 1991). Rather than repeating a thorough historical review, a few of the more significant events and evolution of attitudes are outlined below.

The first piece of significant legislation concerning women was approved by Congress on May 14, 1942. House Resolution (HR) 6293 created the Women's Auxiliary Army Corps, which authorized a strength of 150,000 and laid the groundwork for a women's corps in the other Services as well. On June 12, 1948, President Harry S. Truman signed the Women's Armed Services Integration Act, which admitted women into the Regular and Reserve military. This Act created a permanent place for women in the armed forces, but limited them to only 2 percent of the active military. Partially in response to manpower needs driven by the Vietnam War, the government lifted the 2 percent ceiling on women in February 1967 (Griffin, 1992 and Norman, 1988). But women's participation remained below that level for the next three years (Binkin, 1993).

The events of the seventies were framed by movements for equal rights and equal opportunities among the sexes. Women's participation in Reserve Officer Training Corps (ROTC) was approved for ten colleges and universities in February 1972. A year later, all ROTC units were open to women. On October 7, 1975, President Gerald R. Ford signed a law allowing women to be admitted to service academies (Norman, 1988). Finally, in 1978, women had the opportunity to be assigned to certain classes of Navy ships (Norton, 1992).

The final years of the 1980s saw a lot of "firsts" for women in the military. In 1988, the Navy selected its first woman for command of a squadron and command at sea; and the first woman command master chief was selected. This was also the year of the first woman Navy astronaut. In the following couple of years, women actually assumed command of squadrons and ships (Norton, 1992).

Along with all of the positive events surrounding the integration of women, the 1990s introduced a darker side of integration, as the press brought to light numerous accounts of sexual harassment in the military. The early part of the decade was plagued by headlines and stories of sexual harassment and sexual misconduct. Among these are accounts of the circumstances surrounding "Tailhook 1991," the repercussions of which spanned the newspapers and television networks for several years.

The invasion of Panama in 1989 and Operation Desert Storm in 1991 emphasized the contributions of women to the military and started to blur previous distinctions between combat and combat-support roles. These two events helped to fuel one of the prevailing controversies of the early 1990s: namely, military policies concerning women in combat. After months of debates, special studies, and Congressional hearings, many of the combat restrictions on women were removed in 1993, opening the door for women to serve in a number of new areas, with the notable exception of infantry, armor, submarine service, and other specialties. Although most previous restrictions have been lifted, much controversy still remains as the new policies and their implications continue to be questioned.

B. ASSUMPTIONS AND LIMITATIONS OF THE STUDY

Due to the fact that the force drawdown is relatively new and still on-going (as of March 1995), there is a limited amount of literature that encompasses all of the factors to be considered in this study. A lilterature survey found no previous studies that took into consideration all of the factors pertinent to this thesis. To develop a comprehensive report, the literature review had to be directed at separate categories of research, including promotion studies, statistics on women in the military, officer statistics, drawdown policies, and literature on the so-called "glass ceiling." Due to the narrowness of this topic and the lack of current studies on the subject, some of the research had to expand beyond the specific elements pertaining to the study. For example, although this thesis focuses on female military officers, some of the literature examined here includes studies of enlisted personnel as well as reports on women's careers in the civilian sector.

C. OUTLINE OF THE STUDY

As explained in the previous section, this study draws upon a variety of material to link together a number of different subjects as they relate to the focus of the research. Chapter II reviews studies on promotion, the "glass ceiling," and downsizing in general. It also briefly reviews other areas of concern for women, including the removal of combat exclusion laws and differences in perceptions of men and women on various subjects and policies. Chapter III discusses female representation and occupational trends. Chapter IV describes the methodology used in the promotion analysis. Chapter V discusses results of the statistical analysis. Finally, Chapter VI presents conclusions and gives recommendations for future research.

II. LITERATURE REVIEW

A. REVIEWING THE NUMBERS

Now that the defense downsizing has moved well toward its goal of 1.4 million active duty personnel, the aggregate statistics can be studied in a "before and after" framework. The total number of officers on active duty was reduced by 49,000 from fiscal year 1987 to 1993. This constitutes a 17 percent reduction in the officer corps coupled with a 9 percent reduction in warrant officers (DMDC, 1994).

Turning more toward the issue of gender, the drawdown reduced the number of male officers by 19 percent from fiscal 1987 to 1993, while the change for female officers amounted to a drop of less than one percent. The number of enlisted women on active duty fell by 12 percent. Including changes in the reserve components, officer corps, and civilian force, the reduction of women amounted to about 7 percent over the six-year period. This decrease of female employees was proportionately lower than the 18 percent drop experienced by the male portion of the Defense Department. In spite of the defense drawdown and overall reduction in the total force, individual components of women (officers, enlisted, active and reserve) indicate relative increases of 2 to 3 percent over the period (DMDC, 1994). This is partially explained by the expansion in the number of jobs just recently made available to women. Thus, as the force has been drawn down, numerous active duty billets have disappeared, for both men and women. But, at the same time, billets previously closed to women have been opened, and accession goals have increased considerably.

To achieve the force reductions required by the defense downsizing, the Services employed a number of programs to separate large numbers of personnel. These programs included voluntary separation incentives, special separation bonuses, 15-year retirement, selective early retirement, and other measures. Although personnel reductions were aimed at shrinking and less critical career fields, and overpopulated yeargroups, without apparent regard for how the downsizing might affect gender representation, it appears that the Defense Department, as a whole, has succeeded in meeting most of the downsizing goals

without radically changing the gender composition of the force. The empirical part of this study looks at each service individually, and focuses more on promotion and career opportunities for women than on overall representation.

B. PERCEPTIONS OF THE EFFECTS OF THE DRAWDOWN

The attitudes and perceptions of the personnel remaining on active duty pose a serious concern for military management. Effects of downsizing on survivors and the perceptions they carry with them are certainly areas that deserve attention here, as they have the potential to hamper retention and ultimately influence promotion opportunities. Survivors of a downsizing may tend to show less organizational commitment due to weakened confidence in the employee/organization relationship (Wong and McNally, 1994). This is very important to military leaders, as the Defense Department continues to reduce the numbers of its personnel. In fact, a large number of personnel in the active force of the mid-1990s are actually survivors of the ongoing drawdown. Wong and McNally suggest that this decreased commitment of the survivors has the potential to threaten effectiveness. Furthermore, they warn that the military is likely to lose many of its quality personnel when these survivors become fed up with the negotiations necessary to navigate a successful career.

Some of this sentiment was present even in 1990, in the early stages of the force restructuring. At that time, an Army Career Satisfaction Survey was conducted with nearly 60 percent of the officers responding. In an analysis of the comments, job security, force reduction, career opportunities, and promotions emerged as the primary themes (Connelly and Phillips, 1992). Several comments addressed insecurity and loss of trust in the "system." Many officers discussed their frustration in the slow, strung-out method of reducing the force, and how this translates into months upon months of unnecessary uncertainty (Connelly and Phillips, 1992).

Relating this topic to the issue of gender, Hay (1992) used the same Army Career Satisfaction Survey to analyze gender and ethnic differences in career intentions and attitudes. Except for Black soldiers, Hay found no differences in the confidence ratings

given by men and women for promotion opportunities and interest in serving in a smaller army. However, women were consistently less confident than men in the effectiveness of the selection system and in the ability of the Army to retain the best soldiers and maintain a quality force. Furthermore, women were less confident than men in the Army's ability to protect benefits, and women were more convinced that they would be offered the option of an early out. In general, the survey showed that, compared with men, women are more pessimistic about their employment status and future careers in the Army (Hay, 1992).

In the section reserved for comments, several remarks revolved around the issue of promotion. Some found uncertainly and frustration in the promotion process, undefinable criteria for promotion, concern about the effect of reduced promotion on careers, and effects on morale when promotion boards are used instead of involuntary separation (Hay, 1992).

Many of the concerns noted above were underscored in a 1993 report by the Army Research Institute. The authors studied why female captains eligible for promotion chose a monetary incentive to leave the Army rather than accept an appointment to the rank of major. Although many factors were considered in making the decision, realities as well as perceptions came into play regarding current conditions and future policies. Long-term career and promotion opportunities were considered as were current limitations concerning job assignments. Eighty percent of those interviewed indicated that the force downsizing had influenced their decision to leave (Steinberg, Harris and Scarville, 1993).

A survey conducted by Government Executive magazine in 1989 revealed a slightly more positive air about women's attitudes and perceptions. The survey was limited to female senior officers, grades 0-5 through 0-7, in all branches of the armed forces. Although over one-half of the respondents felt they had been denied jobs or promotions based on their gender, and most felt that women were not advancing fast enough, 80 percent felt that the military treats women as well or better than their counterparts in federal civilian or private agencies. More than 50 percent said their jobs were "exciting" while another 35 percent found their jobs "satisfactory" (Sherwood, 1989).

It should be noted, however, that these results were gathered months before the initiation of the drawdown, and that the survey was directed at successful female officers who had essentially already "made it" to the military's more senior ranks.

C. ANTICIPATION OF POSSIBLE PROBLEMS

The drawdown of the late post-Cold War period has brought to light new concerns that were not considered by the military during previous force reductions. The Department of Defense has faced drawdowns following other wars in recent history, but never before has there been such concern over gender representation and women's opportunities. Recall that when the U.S. was withdrawing troops from Vietnam, the representation of women in the post-war armed forces was not an issue of importance to policymakers. Indeed, as late as 1972, four years after the 2 percent ceiling was lifted, the proportion of women in the military still hovered at around 2 percent of the force (Binkin, 1993).

Career progression for military women has emerged as a real concern only in the last decade. Even before the onset of the current drawdown, concerns of policy makers, political leaders, and military officials have prompted studies to determine whether the career development and promotion opportunities for women were similar to those for men. A 1989 GAO report explored these questions. While recognizing several factors that might impede women's career progression, the report, nevertheless, found similar promotion rates between the sexes between 1986 and 1988 (GAO, 1989).

Concern over how the current drawdown might affect women in uniform is partially rationalized by a previous study that examined how women were affected by reductions-in-force (RIFs) in eight civilian agencies. The results of this study could easily be generalized to similar reductions in military endstrength. The GAO examined eight federal agencies that experienced RIFs in 1982 and found that women were adversely affected by the outcomes. In general, women were overrepresented among employees affected, specifically in separations and in downgrades. Based on historical trends, the study also predicted that women were separated at a higher rate than would have been

expected through normal attrition. The study also pointed out two structural barriers in laws regarding federal civilian employees that tend to adversely affect women. Seniority and veteran's preference are powerful shields against RIFs. Since women generally have less seniority than men, and far fewer women than men have veteran's preference, they are left essentially unprotected in times of workforce reductions (GAO, 1985).

In addition, the Defense Advisory Committee on Women in the Service (DACOWITS), an appointed body, has been especially busy since the later part of the 1980s studying related issues. During the early stages of the drawdown, DACOWITS recognized the potential for problem areas that might put at risk many of women's recent, hard-fought gains (Willis, 1990). Their concern has prompted high-level attention toward the impact of the force restructuring on women.

In January 1994, in response to DACOWITS queries, the Secretary of Defense requested information from all of the Services on how the restructuring plans would affect occupational areas where women were highly concentrated, and the potential impact of these changes on career opportunities for women. The Navy's response indicated that the downsizing would not adversely affect career opportunities in the surface and aviation communities. In both cases, however, the positive responses about the drawdown were based on the repeal of combat exclusion laws. The analysis estimated that command opportunities at the 0-5 level for female surface warriors would grow from 16 to 113 by fiscal 1997; for aviators, the number of squadrons opened to women was expected to increase from 42 to 200. Although the total number of squadrons were expected to decrease to 150 by the end of the drawdown, present indications are that women in these squadrons will be limited only by their current relatively low inventories; that is, there are presently more slots for women than there are qualified women available to fill them. The same is true for 0-5 command opportunities in the surface warfare community (Secretary of the Navy, 1994).

The Navy's General Unrestricted Line (GenURL) Community, on the other hand, is expected to be directly affected by the drawdown. Due to Base Realignment and Closure (BRAC) decisions, three commands at the 0-5 level and eleven executive officer

billets will be eliminated. Additional base closures will eliminate thirteen major shore commands (Secretary of the Navy, 1994). These have traditionally been a primary source of female billets. Since the GenURL is a predominantly female community, these and further actions could have noticeable effects on opportunities for women who carry this career specialty.

One report managed to address the drawdown without referring to the repeal of combat exclusion laws and the consequent change. This Army study found increases in the percentages of female Army officers from 1991 to 1993, three of the years with the biggest force cuts. The numbers indicated a relative gain of 0.7 percent for female Army officers over the three-year period. Senior Army officials apparently expressed extraordinary satisfaction with these results (Tice, 1994).

D. IMPLICATIONS AND EFFECTS OF THE "GLASS CEILING"

Closely tied to the topic of promotion is the issue of the so-called "glass ceiling." The glass ceiling refers to a type of barrier that inhibits promotion of some individuals into the senior ranks of an organization. The term is very effective in painting a picture of a person at a certain level, looking up the promotion ladder, but not being able to ascend to the higher rungs. The individual can see through the glass ceiling to the upper levels, but cannot break through the institutional barrier. Usually applied to women or minorities, it has received much attention recently as organizations investigate imbalances and inequities in promotion to, and representation in, high-level positions.

Previous research has investigated the causes of this phenomenon as applied to women, and has largely centered around individual factors and stereotypical biases (Dugan, et al., 1993; GAO, 1989; Naff, 1994). In a study of women's advancement in the federal civil service, Naff (1994) focuses on these individual factors and breaks them down into several elements as predictors of career advancement. These predictors include experience, education, willingness to relocate, time devoted to job, and children. The fact that men generally have accumulated more years of service, and have more education than women shows that women may simply not be as competitive as men for promotion to

higher grades. However, the study still found that men received more promotions than women with the same amount of service (equally qualified), when education and entry grade were controlled (Naff, 1994).

The analysis takes an interesting twist when evaluating the effects of the latter three elements. Willingness to relocate, time devoted to job, and the effects of children can be studied from two different angles: male biases and personal choices. Much attention is focused on the biases of men toward these particular aspects as they apply to female employees. Reports have shown that managers often make unwarranted assumptions, concluding that women would not be willing to relocate, that they are not able to put in additional hours, and that children necessarily inhibit working mothers' flexibility and dedication to the job (Naff, 1994). These stereotypes can even emerge in subjective portions of performance evaluations, where certain words and phrases found in men's reports have been found to enhance their promotion opportunities over those of women (Thomas, Holmes, and Carroll, 1983).

Systematic barriers are another restraining factor mentioned in the literature on career progression (GAO, 1989; Dugan, et al., 1993; Naff, 1994). These barriers include assignment policies, career paths, and local job-placement practices (GAO,1989); and the lack of networks and mentoring systems for women that are so crucial for advice and career guidance (Dugan, et al., 1993).

Stereotypes, biases, and systematic barriers are still a problem in dealing with promotion equity. However, the fact that women make conscious, personal choices about which jobs to take or apply for is often ignored. In some cases, women may have limited their own promotion opportunities by being less willing to relocate (Naff, 1994). Further, many women choose and prefer traditionally-female occupations for their career. Even though these specialties have sometimes been shown to have lower promotion rates, the choices impose limits on the number of high-ranking positions available to women by virtue of the structure of the occupational community. Thie (1982) recognizes propensity of women to enlist in a certain service or occupation as an area that deserves more study and debate. It is touched upon briefly in the next section.

E. REMOVAL OF COMBAT EXCLUSION POLICIES AND THE SHIFT TOWARD MORE TECHNICAL OCCUPATIONS

A study of women's promotion opportunities in the modern military cannot overlook the impact of the changes in legislation regarding combat exclusion policies. Along with the force drawdown, one of the biggest policy decisions affecting all military personnel came about as the Services were still trimming their totals and shaping their ranks. In November 1993, the Combat Exclusion Law was repealed by Congress, removing legal restrictions which previously prevented women from serving in any combat position. Army assignment rules still generally exclude women from the combat branches of infantry, armor and field artillery (Jowers, 1994). The Navy, on the other hand, has seen a wide expansion in the types of jobs open to women. Women now deploy on combatants and in mobile construction battalions, and fly combat aircraft, all assignments that used to be closed to their gender. While some limitations still exist, the policy has nevertheless opened the door for women to pursue a much wider range of military specialties.

One of the major arguments against combat exclusion maintained it inhibited advancement for women by not allowing them to serve in key, career-enhancing jobs that would make their records more competitive with those of men. Many believed that the policy kept them from reaching the senior ranks in their services, ranks which were dependent on holding the very jobs that were not available to them (Kitfield, 1994). Jowers (1994) substantiates this belief by noting that the Army's senior leaders have traditionally been drawn from the combat arms branches. Although the repeal of the combat exclusion law has been debated for years and is an event not directly tied to the force reductions, the timing of this milestone in the middle of the defense drawdown heightens its importance in this study of personnel trends and events of the last eight years.

Also germane to this study is the fact that women have been shifting toward more non-traditional jobs in the military since the end of the draft. In 1972, less than 10 percent of military women held non-traditional jobs, compared with 45 percent in 1984

(Rogers, 1991; Eitelberg, 1988; Binkin and Eitelberg, 1986). Yet the number of women in traditional jobs is still rather high. Currently in the Navy, 30 percent of the female officers are nurses, and 61 percent of enlisted females work in administrative or medical fields (Fletcher, McMahon, and Quester, 1994). But the repeal of the combat exclusion law still leaves many wondering whether or not broadened opportunities in non-traditional combat-related fields appeal to women (Fletcher, McMahon and Quester, 1994). Although this question is raised primarily with respect to female enlistees, one should also examine whether women officers will seek to enter jobs that are still considered by many as being out of the norm for their gender.

The issue of self-selection and career opportunities has come up with respect to promotion rates for women during the 1990s. Many career paths were closed to women throughout the bulk of the drawdown. However, many of the women in traditional occupations would still have chosen these typically-female jobs even if more non-traditional or combat-related positions were available. Many women who join the military are simply more attracted to administrative, support types of billets (Fletcher, McMahon, and Quester, 1994). Thus, the removal of combat restrictions may not necessarily mean that large numbers of military women will flock to the new opportunities.

F. TRANSITION OF THE NAVY'S GENERAL UNRESTRICTED LINE COMMUNITY

Another major policy change affecting female officers, specifically Naval officers, is the transition of the Navy's General Unrestricted Line (GenURL) community from the Unrestricted Line (URL) to the Restricted Line (RL). Approximately 7 percent of the Navy's officers are members of the RL Community. This community includes officers who specialize in the areas of intelligence, cryptology, public affairs, oceanography, and other narrowly-defined fields.

The URL Community employs around 52 percent of the Navy's total officer population. The URL is composed of six main areas, the largest of these being aviation and surface, which together account for over 75 percent of the community. The rest of

the community is made up of officers in submarines, special warfare, special operations, and the GenURL (Bavier, 1994).

The GenURL drew a lot of attention in 1994. This community, which currently makes up 7 percent of the URL, is predominantly female. These officers are trained in shore station management, recruiting, communications, or a number of other career fields, and are stationed at shore facilities throughout the world.

Amid much controversy over the role of the GenURL in the future, the decision was made to redesignate members of the community from URL to RL officers. Four distinct specialty areas were identified that offer career continuity for most of the affected officers. It was determined that the specialized nature of the education and experience of these members warranted development of a separate community to achieve equitable promotion opportunity with URL officers of more generalized experience.

One of the most significant effects of this transition is separation of GenURL from the rest of the URL community. In the past, GenURL officers competed with members of the URL for promotion slots and certain shore billets. Past research has indicated that differences in career paths and experiences tended to work against GenURL officers (mostly female) when their records were compared to other URL officers (mostly male). The argument was that women were essentially penalized because they had not held certain key, career-enhancing assignments, even though they were restricted by law from holding many of these positions considered essential for promotion in the URL (Thomas, Holmes and Carroll, 1983). This transition to the RL will put the GenURL in a separate, competitive, promotion category effective January 1, 1995, and allow for a billet base that reserves jobs strictly for members of the new community.

In the past, the GenURL promotion rate has always been close to, but usually lagged behind, the URL average promotion rate. With this new plan, community leaders expect the promotion rates for the new community to stay close to those of the URL and staff corps.

G. THE PROMOTION PROCESS

The promotion system has evolved a great deal since 1948, when the Women's Armed Services Act limited the number of women to 2 percent of the active duty force and placed restrictions on promotions of women by limiting the number of high-ranking female officers. At the time, only one full colonel was authorized per branch, and women were not allowed into the flag ranks at all (Nyary, 1991).

In 1981, the Defense Officer Personnel Management Act (DOPMA) changed the promotion process into the familiar system that the military uses today. DOPMA standardized career lengths, set promotion opportunities, defined flow points, and identified minimum years in grade (YIG). These factors, plus the number of vacancies and authorized officer endstrength, combine to determine the number of officers eligible for promotion (Werkhaven, 1993).

DOPMA also imposed limits on the number of officers in the controlled grades (0-4, 0-5, and 0-6). The Secretary of Defense actually prescribes the size of the control grades for each service within DOPMA constraints (Werkhaven, 1993).

The military promotion system is a vacancy-driven process whereby the number of personnel selected for promotion is contingent upon the number of openings in the next higher grade. These vacancies are created when officers leave the system through any number of means, including attrition, resignation, and retirement.

Promotion in the military is highly competitive, due to the limitations imposed by DOPMA and the hierarchical, pyramid-like structure of the officer corps. Hence, there are always more persons vying for promotion than there are vacancies in the next higher grade. Promotion is also considered a reward in that pay and responsibility increase, and members who fail to be promoted are eventually eliminated from the system. Because of the competition and significance surrounding the event, promotion statistics are an area of interest for military management and manpower analysts concerned with promoting the best persons while monitoring personnel representation.

H. REVIEW OF PROMOTION RESEARCH

Due to a rather limited amount of published research on female officer promotions, this section of the study is expanded to encompass studies covering both genders. A wide variety of promotion studies are reviewed to gain an understanding of the frameworks and methodologies used for analyzing the event.

One of the most common topics of research in this area involves predicting promotion based on various demographic characteristics, experience, and performance. Many such studies use multivariate regression analysis to model the event. Parish III (1979), Cady (1984), Long (1992), Fletcher (1978), and Cymrot (1986), as cited in North and Smith (1993), all used a variety of demographic characteristics as explanatory variables to predict the probability of promotion. Some of these studies found that promotion is related to commissioning source, possession of advanced degrees, and having served in command or executive billets. Other factors that were found to affect promotion included number of location changes, professional military education, personal awards, broken service, technical college majors, number of sea tours (for Navy), and billet history. In some cases, age, and marital status had an impact and in others they did not. Only in Cymrot (1986) was gender found to be significant and this was only at the 0-4 level.

To explain promotion to captain and major in the Marine Corps, North and Smith (1993) used a bivariate probit model with sample selection. Their model takes into account the correlation between retention and promotion, correcting for the possible selection bias introduced because not all officers stay until they are in zone for 0-4. They found accession source and occupation to have the largest effect on promotion to captain. Blacks and other minorities, and personnel who were single at the time of accession, faced lower probabilities of promotion to captain, while age and gender had no effect. For promotion to major, accession source remained a factor as did marital status. Age at accession became a factor influencing promotion, while race and occupation were no longer associated to promotion at this level. Gender was not associated with the probability of promotion to captain or major (North and Smith, 1993).

In studying the effects of graduate education on officer productivity, Cymrot (1986) used promotion as one of three indicators of productivity and measured the relationship between graduate education and promotion. He found that graduate education increased productivity by having a positive effect on promotion. Using multivariate logit models, he targeted a number of the same explanatory variables mentioned above, including age, sex, race, time-in-rank, service continuity, and occupational designator. Through the time-in-rank variable, he found that the shorter time spent in the previous rank, the more likely the current promotion. He also found that unrestricted line officers were more likely to get promoted to 0-4 than staff or restricted line officers; above that level, staff officers were less likely to get promoted. As expected, length of service was found to be positively associated with promotion, as was age. Race and gender did not significantly influence promotion probabilities, except at the 0-4 level, where males were more likely than females to be promoted (Cymrot, 1986).

Another body of promotion studies analyze various data using simple bivariate statistics. Most of these research efforts concentrate on promotion rates over fiscal years, year groups, or "milestone periods" (Werkhaven, 1993), and report changes in rates of promotion over time and between demographic categories, occupations, or designators. One such study looked at three corps of Air Force personnel in health-related areas. Two of these corps were male-dominated and one was female-dominated. A variety of descriptive statistics revealed overall lower promotion opportunities to field-grade ranks for the female group. Bivariate regression also revealed a positive correlation between promotion and retention rates (Kenyon, 1989).

The Kenyon study may be compared to a recent thesis that examined the factors influencing promotion for female Naval officers across communities. Officers in the GenURL community, which is primarily composed of women, were found to be less likely to be promoted than officers in other communities (Reed, 1991). Although the Reed study does not focus on the overwhelmingly female orientation of the GenURL, it forms an interesting parallel to the analysis of Air Force communities described earlier.

The GenURL had lower chances of promotion as compared to other communities composed of a smaller proportion of women and larger proportion of men.

In a broader sense, however, other data show that women have generally been promoted at rates comparable to those of men since the beginning of the All Volunteer Force (AVF). Pang (1983), for example, used six cohorts (1973-1978) of female officers and enlisted personnel to track the advancement of these groups over time. To model "progress" (promotion), he compared the "cumulative grade achieved by comparative groups of men and women over time." He found promotion rates for both female officers and enlisted personnel similar to those of their male peers, and also guardedly speculated that similar trends could be expected to continue into the future. In a demographic profile of the Department of Defense workforce, comparing 1987 and 1993 data, the Defense Manpower Data Center (DMDC) found relatively constant promotion rates for all active component officers between the two years. This analysis, however, was for the overall promotion rate for men and women combined, using an aggregate of all four services. The analysis section of this thesis examines whether this seemingly constant overall promotion rate was perhaps a result of increases in male promotions at the expense of female advancement.

I. RESEARCH QUESTIONS

The goal of this thesis is to determine whether promotion rates of men and women have differed during the downsizing years. The reason to think the downsizing may have affected women differently is that available positions for officers may have declined the most in occupational areas where women have traditionally been concentrated (shore-based billets in the Navy, for example). On the other hand, the opening of combat-related occupations to women and continuing improvements in equal opportunity would tend to move women into previously male-dominated occupations with historically higher command opportunities and promotion rates. The null hypotheses to be tested are that: (a) there are no observable differences in promotion rates between men and women once

other productivity-related characteristics have been controlled; and (b) the downsizing has *not* differentially affected the career progression of women and that of men.

III. TRENDS IN FEMALE REPRESENTATION AND OCCUPATIONAL DISTRIBUTION

A. DESCRIPTION OF DATA: OFFICER MASTER FILES

The data used in this research were provided by the Defense Manpower Data Center (DMDC) in Monterey, California. The data cover all services. Two specific types of data sets were used in the analysis: officer master files and officer cohort files. Cohort files are necessary for tracking officers to their promotion points and properly specifying prediction models. They are described more thoroughly in the next chapter.

The other type of files, officer master files, are used to capture year-by-year snapshots of the officer inventories. Cross-tabulations using occupation, gender, service, and paygrade are of particular interest in setting the stage for further multivariate analysis in Chapter V.

The officer master files are cross-sectional files that offer point-in-time snapshots of the officer community. Files for the years 1987-1994 were provided by DMDC, and allow for a study of the effects of the drawdown throughout this critical eight-year period. The period includes the peak year in military manpower in 1987, and the main drawdown years of 1992-1994. The files provide various demographic data for all officers on active duty each year. These data allow a preliminary study of the distribution of officers by paygrade, gender, occupation, and other dimensions for three periods: before the drawdown, the early drawdown, and the late drawdown. This type of trend analysis is useful in revealing any significant changes in representation or occupational distributions by gender that may have occurred during the course of the drawdown. It should be noted that the drawdown has not been completed as of March 1995. However, the major reductions of the officer corps have been taken, with much smaller decreases yet to be accomplished.

B. DATA RESTRICTIONS

Files are available for each year from 1987 through 1994. Some restrictions are imposed on the officer populations that reduced the size of the files and directed attention to the officer groups most relevant to this study. For example, several observations are eliminated for Coast Guard officers, who are not DoD employees, and for Warrant Officers of all services. Also, observations with gender coded as "unknown" are deleted. Finally, the files for each year had a relatively small number (approximately 1 percent each year) of officers with an occupation coded as "unknown." These observations are also deleted. Column 2 of Table 1 shows the full inventory of officers on active duty for each year in the DMDC files while Column 3 shows the number remaining after imposing the necessary restrictions. The restrictions reduced the files by 7 to 10 percent, depending on the year. It is assumed that the deletions did not alter the population distribution in any systematic manner. Table 1 shows the number of active duty officers has fallen by about 18 percent since the 1989 peak of 309,665.

Table 1. Number of Officers in Officer Master Files, 1987-1994, Before and After Restrictions

OMF (fiscal year)	Total Number of Officers	Restricted Number of Officers
1987	307,795	288,300
1988	304,973	285,431
1989	309,665	283,531
1990	303,711	277,224
1991	297,872	271,050
1992	280,901	255,240
1993	264,551	239,176
1994	253,273	228,495

Source: Derived from data provided by Defense Manpower Data Center.

C. DEFINITIONS OF DOD OCCUPATIONAL CODES

An occupational coding structure is used by the Defense Department to group similar occupations and to allow comparisons across services. The DoD Occupational Conversion Index converts all service occupations into nine occupational categories. There are also three different types of occupation *codes* defined in the index. Duty Occupation Codes are used to identify the area in which the officer is currently working. Primary Occupation Codes reflect the area in which the officer was trained. Secondary Occupation Codes identify additional education, experience, and qualifications (Assistant Secretary of Defense, 1993).

Army officers are categorized into the DoD occupation codes based on specialty skill identifiers (SSIs), which identify requirements of the billet and the qualifications of the officer. Air Force officers are classified based on Air Force Specialty Codes (AFSCs). Military Occupational Specialty (MOS) information is used to convert Marine Corps officers' specialties into the DoD categories. Naval officers are assigned to the DoD occupation categories in one of three ways, depending on the type of occupation code (duty, primary, or secondary). Duty Occupation Codes use Navy Officer Billet Classification (NOBC) information to classify the officers into DoD occupational categories. Primary Occupation Codes are assigned using Navy designators and Additional Qualification Designators (AQDs). Secondary Occupation Codes are based on the most current subspecialty code.

Although there are numerous subgroupings within each broad occupational category, for the purposes of this study, only the nine general (1-digit) categories are used. Both the Officer Master Files and the Cohort Files employ the DoD occupational codes. Following is a list of the nine (1-digit) occupational categories along with a description of the various components. The information is summarized from the DoD Occupational Conversion Index (Assistant Secretary of Defense, 1993).

Category 1. General Officers and Executives. This category includes all occupations where the officers are of General or Flag rank. Full colonels (0-6) from the Marine Corps are also classified in this group.

Category 2. Tactical Operations Officers. Included in this category are aviators and other aircrew officers, ground and naval arms officers, ship commanders, and warfare-related specialists.

Category 3. Intelligence Officers. This area encompasses intelligence and counterintelligence officers, including those involved in the gathering, analysis, and interpretation of general and communications intelligence. Cryptologists are also included here.

Category 4. Engineering and Maintenance Officers. This category includes civil engineers and architects; electrical, communications, aviation, and ordnance engineers and maintenance officers; ship construction and maintenance officers; and safety, chemical, automotive, and survey officers.

Category 5. Scientists and Professionals. This area includes meteorologists, biological scientists, lawyers, chaplains, psychologists, operations research analysts, and social workers.

Category 6. Health Care Officers. This category includes physicians, dentists, nurses, veterinarians, therapists, optometrists, pharmacists, biomedical scientists, and health services administration officers.

Category 7. Administrators. This category is made up of training administrators; manpower and personnel managers, administrators, and analysts; comptrollers; budget, finance, and accounting officers; data processing and computer systems officers; information officers; law enforcement and security officers; and recreation, band, and special services officers.

Category 8. Supply, Procurement and Allied Officers. This occupational category includes supply, transportation, procurement, and production officers; and housing, food service, exchange, and commissary officers.

Category 9. Non-Occupational. This category includes patients, students (for example law, medical, and flight students), and other trainees or officers not occupationally qualified.

The Occupational Conversion Index identifies occupations more specifically by breaking down these nine categories into a number of 2-digit sub-categories called occupational groups. The second digit further defines the occupational specialties within the main category. There are a total of sixty-four 2-digit groups among the nine general areas. The appendix shows how the nine main occupational areas are broken down into occupational groups.

Although data is available on the individual groups in each area, it is beyond the scope of this thesis to examine the behavior of all of the various groups in each category. This study uses only the nine (1-digit) DoD occupational codes which offer the broadest, most general definitions for classifying occupations in each service.

D. PRELIMINARY DATA ANALYSIS

A few simple cross-tabulations of data on the Officer Master Files reveal a variety of tables reflecting the demographic composition of the officer corps each year. Table 2 displays the number (in panel a) and percentage (in panel b) of female officers by service for fiscal years 1987 through 1994. The figures show that the total number of female officers in DoD has decreased over the eight-year period in all services except the Navy, where their number has grown from 7,195 in 1987 to 7,847 in 1994. However, the sizes of the reductions have been very small, less than one thousand in all cases; thus, it is not surprising that the bottom half of the table shows a systematic, year-by-year increase in the *percentage* of female officers for the combined services. The proportion of DoD officers that were women grew from 11.0 percent in 1987 to 12.5 percent in 1991, even though the number of officers fell. That figure grew to 13.6 percent by 1994. The proportion of female officers in the Marine Corps is the lowest of all services and has not changed over the 1987-1994 period. At the same time, the proportion of female

officers in the Air Force increased the most, rising from 11.8 percent in 1987 to 15.2 percent in 1994, which was also the highest proportion among all services.

Table 2. Number and Percentage of Female Officers by Service, 1987-1994

a. Number

Fiscal Year	Army	Navy	Marine Corps	Air Force	All Services
1987	11,215	7,195	602	12,642	31,654
1988	11,359	7,324	601	12,899	32,185
1989	11,746	7,449	622	13,403	33,220
1990	11,914	7,779	596	13,331	33,620
1991	11,935	7,888	594	13,323	33,740
1992	11,238	8,150	548	12,683	32,619
1993	10,631	8,113	532	12,252	31,528
1994	10,337	7,847	529	12,322	31,035

b. Percentage

Fiscal Year	Army	Navy	Marine Corps	Air Force	All Services
1987	12.0	10.4	3.2	11.8	11.0
1988	12.3	10.5	3.3	12.3	11.3
1989	12.8	10.7	3.4	12.9	11.7
1990	13.3	11.2	3.3	13.3	12.1
1991	13.5	11.6	3.3	13.8	12.5
1992	13.8	12.3	3.2	14.0	12.8
1993	14.2	12.8	3.2	14.6	13.2
1994	14.3	13.2	3.3	15.2	13.6

Source: Derived from data provided by Defense Manpower Data Center

Table 3 shows women as a percentage of commissioned officers by paygrade, 1987-1994, for all services combined. Although the total *number* of women officers was lower in 1994 than in 1987 (bottom row), the figures show that women now make up a larger proportion of the officer corps than they did in previous years. This larger overall proportion is also reflected across paygrades. This pattern is seen to continue when the data are examined by service in Tables 4 through 7. The only areas where this trend does not hold are for paygrade 0-1 in the Army (Table 4), where the proportion of women falls over the years from 19.4 to 17.9 percent, and in the Marine Corps (Table 6), where the percentage of women falls slightly in paygrades 0-2 and 0-3.

Table 3. Women as a Percentage of Total DoD Officers by Paygrade, 1987-1994

Pay-grade	1987	1988	1989	1990	1991	1992	1993	1994
0-1	15.7	15.1	15.3	15.1	15.6	16.0	16.5	17.0
0-2	14.3	15.2	15.3	15.5	15.4	15.2	15.3	16.2
0-3	12.8	12.8	13.2	13.8	14.0	14.1	14.3	14.5
0-4	8.3	9.3	10.1	11.0	11.7	12.6	13.3	13.6
0-5	4.3	4.6	5.4	6.1	6.9	7.8	8.6	9.6
0-6	2.2	2.5	2.6	2.8	3.1	3.6	4.3	4.8
0-7 to 0-10	1.9	1.7	1.3	1.6	1.8	2.3	1.9	2.4
All Grades:								
Percent	11.0	11.3	11.7	12.1	12.5	12.8	13.2	13.6
Number	31,654	32,185	33,220	33,620	33,740	32,619	31,528	31,035

Source: Derived from data provided by Defense Manpower Data Center.

Table 4. Women as a Percentage of Army Officers by Paygrade, 1987-1994

Pay-grade	1987	1988	1989	1990	1991	1992	1993	1994
0-1	19.4	18.2	17.4	17.4	18.0	17.5	17.7	17.9
0-2	16.8	17.3	17.2	17.9	17.9	17.9	17.7	18.3
0-3	13.3	13.5	14.3	15.0	15.0	15.2	15.6	15.1
0-4	8.6	9.7	10.3	10.8	11.4	12.5	13.0	13.7
0-5	4.6	4.8	5.9	6.7	7.4	8.6	9.4	9.7
0-6	2.3	2.4	2.8	3.0	3.4	4.0	5.1	5.4
0-7 to 0-10	2.0	2.0	1.0	1.5	1.0	2.2	1.7	1.8
All Grades:								
Percent	12.0	12.3	12.8	13.3	13.5	13.8	14.2	14.3
Number	11,215	11,359	11,746	11,914	11,935	11,238	10,631	10,337

Source: Derived from data provided by Defense Manpower Data Center.

Table 5. Women as a Percentage of Navy Officers by Paygrade, 1987-1994

Pay-grade	1987	1988	1989	1990	1991	1992	1993	1994
0-1	11.3	11.1	11.5	12.4	13.8	16.4	16.9	15.0
0-2	11.8	11.8	11.1	11.1	11.5	12.5	14.8	16.3
0-3	12.6	12.5	12.4	12.6	12.6	12.9	13.2	13.6
0-4	10.3	11.1	11.7	12.5	12.9	13.0	13.0	13.4
0-5	5.4	5.9	6.7	7.4	7.9	9.3	10.4	11.5
0-6	2.8	2.9	2.9	3.3	3.6	4.0	4.4	5.3
0-7 to 0-10	2.3	1.5	1.5	1.9	2.7	2.7	1.7	2.7
All Grades:								
Percent	10.4	10.5	10.7	11.2	11.6	12.3	12.8	13.2
Number	7,195	7,324	7,449	7,779	7,888	8,150	8,113	7,847

Source: Derived from data provided by Defense Manpwer Data Center.

Table 6. Women as a Percentage of Marine Corps Officers by Paygrade, 1987-1994

Pay-grade	1987	1988	1989	1990	1991	1992	1993	1994
0-1	3.9	4.4	4.6	4.4	3.8	3.4	4.0	5.9
0-2	3.4	3.3	3.4	3.3	4.1	3.4	3.3	2.8
0-3	3.8	3.6	3.8	3.7	3.5	3.4	3.0	2.8
0-4	2.5	2.7	2.7	2.9	3.2	3.4	3.3	3.3
0-5	1.8	1.6	1.7	1.6	1.5	2.2	2.6	2.8
0-6	1.3	1.8	1.6	1.6	1.7	0.9	1.0	1.3
0-7 to 0-10	2.9	2.9	2.9	0	0	2.9	2.9	4.4
All Grades:								
Percent	3.2	3.3	3.4	3.3	3.3	3.2	3.2	3.3
Number	602	603	622	596	594	548	532	529

Source: Derived from data provided by Defense Manpower Data Center.

Table 7. Women as a Percentage of Air Force Officers by Paygrade, 1987-1994

Pay-grade	1987	1988	1989	1990	1991	1992	1993	1994
0-1	19.6	19.9	19.2	18.4	18.7	18.6	18.6	20.7
0-2	16.9	18.6	20.9	21.0	19.8	18.8	19.4	19.1
0-3	13.7	13.8	14.1	14.9	15.5	15.6	15.9	16.4
0-4	7.5	8.8	10.2	11.4	12.5	14.1	15.4	15.7
0-5	3.7	4.0	4.7	5.4	6.5	6.9	7.6	9.1
0-6	1.9	2.3	2.3	2.6	2.7	3.2	4.2	4.5
0-7 to 0-10	1.2	1.2	1.2	1.8	2.5	2.0	2.0	2.3
All Grades:								
Percent	11.8	12.3	12.9	13.3	13.8	14.0	14.6	15.2
Number	12,642	12,899	13,403	13,331	13,323	12,683	12,252	12,322

Source: Derived from data provided by Defense Manpower Data Center.

The next series of tables focuses on occupation and provides information for each year (1987-1994) to identify shifts and trends that occurred during the drawdown. Tables 8 through 12 show the percentage distribution of officers among the DoD occupations. (Thus, for each year, the distribution sums to 100 percent.) These tables show the relative size of each occupational category and indicate changes in the size of the various categories over the course of the drawdown. The distribution of all DoD officers is shown in Table 8. These data indicate that Tactical and Administrators categories were shrinking through the drawdown while the Health and Intelligence fields were growing. These trends are also observed in Tables 9 through 12, as each service is examined individually.

Table 8. Percent Distribution of Officers (all Services) by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	*	0.6	0.6	0.6	0.6	0.6	0.7	0.9
Tactical	*	42.3	41.7	41.3	41.1	40.5	40.0	39.0
Intel	*	4.3	4.4	4.4	4.5	4.6	4.7	4.9
Eng & Maint	*	12.1	12.2	12.0	11.9	11.6	11.5	12.1
Sci & Prof	*	4.6	4.7	4.9	5.0	4.8	4.9	4.9
Health	*	15.1	15.4	16.0	16.4	17.4	18.2	18.6
Admin	*	7.5	7.2	7.1	7.1	7.0	6.8	6.7
Supply	*	8.2	8.4	8.4	8.5	8.7	8.8	8.7
Non-occ	*	5.3	5.4	5.3	5.0	4.8	4.5	4.3
Total	*	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Derived from data provided by the Defense Manpower Data Center.
*Occupation data not available for Navy and Air Force in 1987.

Table 9. Percent Distribution of Army Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5
Tactical	44.6	45.3	43.7	42.3	41.9	41.1	39.6	39.4
Intel	5.6	5.9	6.2	6.2	6.3	6.4	6.7	7.0
Eng & Maint	10.8	9.6	10.3	10.1	9.8	9.3	9.8	9.9
Sci & Prof	3.7	3.7	3.8	4.5	4.7	3.8	3.9	3.9
Health	18.5	19.0	19.3	20.0	20.2	21.9	22.8	22.8
Admin	7.2	6.9	6.7	6.9	6.8	6.5	6.3	6.2
Supply	8.9	9.1	9.6	9.6	9.9	10.5	10.3	10.3
Non-occ	0.2	0	0	0	0	0	0	0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Derived from data provided by the Defense Manpower Data Center.

Table 10. Percent Distribution of Navy Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	*	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Tactical	*	40.4	41.2	41.3	41.1	40.9	41.1	39.8
Intel	*	3.0	3.0	3.1	3.1	3.2	3.3	3.5
Eng & Maint	*	9.0	8.9	9.0	9.0	9.1	9.3	9.8
Sci & Prof	*	3.8	3.8	3.7	3.7	3.8	3.9	4.0
Health	*	16.1	16.2	16.8	17.5	18.2	19.0	20.0
Admin	*	5.9	5.8	5.6	5.5	5.5	5.4	5.2
Supply	*	6.7	6.8	6.6	6.8	6.6	6.4	6.4
Non-occ	*	14.6	14.0	13.6	13.0	12.4	11.3	10.9
Total	*	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Derived from data provided by the Defense Manpower Data Center.
*Occupation data not available for Navy in 1987.

Table 11. Percent Distribution of Marine Corps Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	3.8	3.8	3.8	3.9	3.8	4.0	4.2	4.3
Tactical	53.6	53.8	52.4	52.0	52.4	52.5	53.5	53.0
Intel	3.0	3.2	3.3	3.2	3.1	3.1	3.3	3.5
Eng & Maint	7.4	7.4	7.4	7.2	7.0	6.6	6.4	6.4
Sci & Prof	2.9	2.9	3.0	2.9	2.7	2.8	2.8	2.8
Health*	0	0	0	0	0	0	0	0
Admin	7.3	7.0	7.0	7.0	6.9	6.6	6.6	6.4
Supply	11.1	11.3	11.3	12.3	12.2	11.8	11.5	11.3
Non-occ	11.0	10.6	11.9	11.6	12.0	12.7	11.8	12.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Derived from data provided by the Defense Manpower Data Center.
*The Navy provides health care for the Marine Corps.

Table 12. Percent Distribution of Air Force Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	*	0.3	0.3	0.3	0.3	0.3	0.4	1.0
Tactical	*	38.9	38.3	38.5	38.2	37.4	36.9	35.4
Intel	*	4.0	4.0	4.0	4.1	4.2	4.2	4.4
Eng & Maint	*	17.1	17.1	16.5	16.6	16.3	15.8	16.8
Sci & Prof	*	6.3	6.4	6.5	6.6	6.9	7.1	6.7
Health	*	13.7	14.1	14.8	15.3	16.1	17.0	17.6
Admin	*	9.0	8.7	8.5	8.5	8.5	8.2	8.2
Supply	*	7.8	7.9	7.8	7.8	8.1	8.6	8.5
Non-occ	*	2.9	3.2	3.1	2.5	2.0	1.9	1.5
Total	*	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Derived from data provided by the Defense Manpower Data Center.
*Occupation data not available for Air Force in 1987.

The following group of tables is similar to the previous series except it begins to focus specifically on females. Tables 13 through 17 show the percent distribution of female officers by DoD occupation for 1987-1994. Table 13 displays the data for all services combined. The largest changes over the eight-year period occurred in the Health and Administrators occupations. The distribution of female officers in health-related fields grew from 42.9 to 47.3 percent between 1988 and 1994, while the distribution of female officers in administrative fields dropped from 18.9 to 15.4 percent. These trends continue to hold when each service is analyzed individually. Health occupations drew a larger distribution of female officers, while the percent distribution of females in administrative occupations dropped off. This statistic is most profound in the Navy

(Table 15), where the distribution of female officers in administrative occupations dropped by about one-quarter, from 34.8 percent in 1988 to 25.1 percent in 1994.

The Army and Marine Corps (Tables 14 and 16) show similar trends in two other occupational areas. Both of these services show a decline in the percentage of women officers in tactical fields and an increased percentage in intelligence-related fields. The Army also shows the largest decrease of women in Supply.

Aside from Health and Administrators, the Air Force statistics show the most stability in the distribution of women officers. As seen in Table 17, only slight shifts occurred in the occupational distribution of female officers from 1988 to 1994.

Table 13. Percent Distribution of Female Officers (all Services) by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	*	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Tactical	*	7.4	7.3	7.1	7.4	7.4	7.4	7.4
Intel	*	5.9	5.9	5.8	5.8	5.6	5.4	5.6
Eng & Maint	*	10.7	10.8	10.5	10.3	9.7	9.7	9.9
Sci & Prof	*	3.4	3.6	3.8	4.0	4.1	4.3	4.3
Health	*	42.9	42.9	44.0	44.1	45.7	47.0	47.3
Admin	*	18.9	18.2	17.8	17.3	17.1	16.3	15.4
Supply	*	9.4	9.6	9.3	9.3	8.8	8.4	8.4
Non-occ	*	1.4	1.6	1.7	1.7	1.7	1.6	1.7
All Occupations:								
Percent	*	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	*	32,168	33,161	33,479	33,595	32,520	31,406	30,874

Source: Derived from data provided by Defense Manpower Data Center.
*Occupation data not available for 1987 Navy and Air Force Officers

Table 14. Percent Distribution of Female Army Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	0	0	0	0	0	0	0	0
Tactical	6.9	7.3	6.6	6.0	6.2	6.3	6.0	6.1
Intel	6.8	7.0	7.3	7.3	7.2	6.9	6.9	7.3
Eng & Maint	11.6	11.2	11.6	11.6	11.4	10.6	10.9	11.0
Sci & Prof	1.9	2.0	2.1	2.2	2.8	2.5	2.7	2.8
Health	45.0	45.8	46.1	47.2	47.2	49.8	51.2	50.5
Admin	13.1	12.6	12.2	12.0	11.5	11.1	10.4	10.4
Supply	14.5	14.1	14.2	13.7	13.7	12.9	12.0	12.0
Non-occ	0.2	0	0	0	0	0	0	0
All Occupations:								
Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	11,207	11,344	11,697	11,783	11,799	11,150	10,548	10,245

Source: Derived from data provided by Defense Manpower Data Center.

Table 15. Percent Distribution of Female Navy Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	*	0	0	0	0	0	0	0
Tactical	*	4.2	4.6	4.8	5.1	5.4	5.7	5.8
Intel	*	3.3	3.4	3.3	3.3	3.3	3.3	3.7
Eng & Maint	*	3.0	3.2	3.4	3.5	3.6	4.0	4.3
Sci & Prof	*	3.3	3.5	3.6	3.8	3.8	3.7	4.0
Health	*	44.6	43.8	44.7	45.2	46.4	47.8	49.2
Admin	*	34.8	33.9	32.4	31.0	29.7	28.1	25.1
Supply	*	3.5	3.6	3.6	3.7	3.6	3.8	3.8
Non-occ	*	3.4	4.0	4.2	4.4	4.2	3.7	4.2
All Occupations:								
Percent	*	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	*	7,323	7,439	7,769	7,880	8,143	8,106	7,841

Source: Derived from data provided by Defense Manpower Data Center.
*Occupational data not available for 1987 Navy officers.

Table 16. Percent Distribution of Female Marine Corps Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	1.5	1.8	1.8	1.7	1.7	1.3	1.3	1.7
Tactical	5.0	5.2	4.5	4.2	4.0	4.0	4.1	4.2
Intel	6.5	6.0	6.0	6.0	6.1	6.6	7.5	7.4
Eng & Maint	9.0	11.0	10.5	11.1	11.1	10.8	10.6	10.7
Sci & Prof	4.7	4.7	4.8	4.4	4.7	5.5	5.8	4.9
Health*	0	0	0	0	0	0	0	0
Admin	41.3	36.9	36.0	38.3	35.4	37.0	36.4	33.8
Supply	18.3	20.9	21.7	24.3	23.2	20.9	20.3	19.6
Non-occ	13.8	13.6	14.8	10.1	13.8	13.9	13.9	17.7
All Occupations:								
Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	601	602	622	596	594	546	531	526

Source: Derived from data provided by Defense Manpower Data Center.
*The Navy provides health care for the Marine Corps.

Table 17. Percent Distribution of Female Air Force Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	*	0	0	0	0	0	0	0
Tactical	*	9.4	9.6	9.5	10.0	9.8	9.8	9.6
Intel	*	6.3	6.2	5.9	5.9	5.7	5.4	5.4
Eng & Maint	*	14.6	14.4	13.7	13.3	12.7	12.3	12.6
Sci & Prof	*	4.7	4.9	5.2	5.2	5.8	6.0	5.8
Health	*	41.4	41.7	42.7	42.7	43.5	44.9	45.3
Admin	*	14.5	14.0	13.6	13.6	13.5	12.6	12.6
Supply	*	8.1	8.3	8.1	8.1	7.9	7.9	7.8
Non-occ	*	1.0	1.1	1.2	1.1	1.0	1.1	0.8
All Occupations:								
Percent	*	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	*	12,899	13,403	13,331	13,322	12,681	12,221	12,262

Source: Derived from data provided by Defense Manpower Data Center.
*Occupation data not available for 1987 Air Force Officers.

The overriding trend in the occupational distribution data involves the fields of Health and Administrators. In each service, the percent distribution of female officers in health care increased over the course of the drawdown while the percent distribution of female officers in administrative areas decreased. These findings, combined with the data on changes in category size, show women shifting toward fields which are growing and away from fields which are declining. The decrease in women in administrative occupations continues to be in line with previous research and predictions. This decrease in administrative officers appears to be offset by the increase in health professionals. However, keeping in mind that the health occupations encompass physicians, dentists,

optometrists, pharmacists, and biomedical scientists, as well as nurses and health services officers, this finding should not necessarily be viewed as a trade-off between two traditional roles.

The tables above showed how women were distributed across the DoD occupations. The next five tables (Tables 18 through 22) show women as a percentage of commissioned officers by occupation. (The complement of each entry is the percentage of officers in the occupational category who are men.) The data cover the same eight years, and are displayed first for all services combined, followed by tables for each separate service.

Table 18 shows the combined data for all services. One of the largest percentage increases in female officers occurred in the category of Scientists and Professionals, where the proportion of women grew from 8.4 percent in 1988 to 12.1 percent in 1994. There was also relative growth in the percentage of women officers in the Tactical, Engineering and Maintenance, Health, and Administrators categories. On the other hand, Supply and Intelligence fields did not experience much change. Similar trends are shown in Table 19 for the Army, with the biggest difference being the substantial decrease in the proportion of women in the supply category (from 19.6 to 16.6 percent).

For the Navy, Table 20 shows consistent growth in all occupational categories. Data for the Marine Corps in Table 21 show steady increases in the fields of Engineering and Maintenance, and Scientists and Professionals, while the percentages of women in the Tactical category remained fairly steady over the years. Female officers in Supply began at 5.3 percent, grew to 6.5 in 1990 and fell back down to 5.7 by 1994. The Administrators and Intelligence categories also showed fluctuations.

Air Force statistics (Table 22) again show large increases in the percentage of women officers in Scientists and Professionals occupations. These percentages grew from 9.2 in 1988 to 13.2 in 1994. Female representation in administrative occupations also grew substantially from 19.7 percent in 1988 to 23.4 percent in 1994. Other fields posted steady growth, while the Intelligence area showed fluctuation through the years and steadied at 18.9 percent in 1994.

Table 18. Women as a Percentage of Officers (all Services) by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	*	1.1	1.0	1.1	1.2	1.1	1.0	1.0
Tactical	*	2.0	2.1	2.1	2.2	2.3	2.4	2.6
Intel	*	15.4	15.8	16.0	16.1	15.6	15.2	15.6
Eng & Maint	*	10.0	10.3	10.7	10.8	10.7	11.0	11.2
Sci & Prof	*	8.4	9.1	9.4	10.0	11.0	11.4	12.1
Health	*	32.0	32.7	33.4	33.5	33.6	34.1	34.5
Admin	*	28.5	29.5	30.3	30.5	31.4	31.8	31.5
Supply	*	12.9	13.4	13.5	13.6	12.8	12.7	13.1
Non-occ	*	3.0	3.5	3.8	4.3	4.5	4.7	5.4
All Occupations:								
Percentage	11.2	11.3	11.7	12.2	12.5	12.8	13.2	13.6
Number	31,302	32,168	33,161	33,479	33,595	32,520	31,406	30,874

Source: Derived from data provided by Defense Manpower Data Center.
*Occupation data not available for 1987 Navy and Air Force officers.

Table 19. Women as a Percentage of Army Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	1.0	1.0	0.5	0.7	0.5	1.1	0.8	0.9
Tactical	1.9	2.0	1.9	1.9	2.0	2.1	2.1	2.2
Intel	14.5	14.8	15.2	15.8	15.6	14.9	14.5	15.0
Eng & Maint	12.9	14.4	14.4	15.4	15.7	15.7	15.8	15.9
Sci & Prof	6.0	6.6	7.2	6.7	8.0	9.1	9.7	10.2
Health	29.3	29.8	30.6	31.5	31.6	31.5	31.9	31.7
Admin	21.9	22.3	23.1	23.3	22.9	23.5	23.4	24.1
Supply	19.6	19.0	18.9	19.1	18.7	17.0	16.5	16.6
Non-occ	16.9	33.3	33.3	50.0	33.3	0	0	0
All Occupations:								
Percent	12.1	12.4	12.8	13.4	13.5	13.8	14.2	14.3
Number	11,207	11,344	11,697	11,783	11,799	11,150	19,548	10,245

Source: Derived from data provided by Defense Manpower Data Center.

Table 20. Women as a Percentage of Navy Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	*	0.8	0.8	0.8	1.2	1.2	0.8	1.3
Tactical	*	1.1	1.2	1.3	1.4	1.6	1.7	1.9
Intel	*	11.6	11.9	11.9	12.3	12.8	12.8	13.9
Eng & Maint	*	3.5	3.9	4.3	4.6	4.9	5.5	5.8
Sci & Prof	*	9.0	10.0	10.9	11.8	12.4	12.2	13.0
Health	*	29.1	29.0	29.7	30.0	31.3	32.2	32.6
Admin	*	62.0	63.3	65.1	65.9	66.8	66.3	64.1
Supply	*	5.5	5.7	6.2	6.4	6.7	7.4	8.0
Non-occ	*	2.5	3.1	3.5	3.9	4.2	4.2	5.1
All Occupations:								
Percent	*	10.5	10.7	11.2	11.6	12.3	12.8	13.2
Number	6,853	7,323	7,439	7,769	7,880	8,143	8,106	7,841

Source: Derived from data provided by Defense Manpower Data Center.
*Occuption data not available for 1987 Navy officers.

Table 21. Women as a Percentage of Marine Corps Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	1.3	1.6	1.6	1.4	1.5	1.0	1.0	1.3
Tactical	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3
Intel	6.9	6.1	6.1	6.3	6.5	6.8	7.3	7.1
Eng & Maint	3.9	4.8	4.8	5.1	5.3	5.2	5.3	5.5
Sci & Prof	5.2	5.2	5.5	5.0	5.9	6.3	6.8	5.8
Health *	0	0	0	0	0	0	0	0
Admin	18.2	17.1	17.3	18.0	17.2	17.8	17.6	17.5
Supply	5.3	6.0	6.5	6.5	6.3	5.6	5.7	5.7
Non-occ	4.0	4.2	4.2	2.9	3.9	3.5	3.8	4.7
All Occupations:								
Percent	3.2	3.2	3.4	3.2	3.3	3.1	3.2	3.3
Number	601	602	622	596	594	546	531	526

Source: Derived from data provided by Defense Manpower Data Center.
*The Navy provides health care for the Marine Corps.

Table 22. Women as a Percentage of Air Force Officers by Department of Defense Occupation, 1987-1994

DoD Occupation	1987	1988	1989	1990	1991	1992	1993	1994
General	*	0.6	0.6	0.9	1.3	1.0	1.0	0.6
Tactical	*	3.0	3.2	3.3	3.6	3.7	3.9	4.1
Intel	*	19.3	20.0	19.9	20.0	19.3	19.0	18.9
Eng & Maint	*	10.5	10.9	11.0	11.1	10.9	11.4	11.4
Sci & Prof	*	9.2	10.0	10.7	10.8	11.7	12.3	13.2
Health	*	37.1	38.1	38.4	38.5	37.9	38.5	39.2
Admin	*	19.7	20.7	21.3	22.0	22.2	22.5	23.4
Supply	*	12.7	13.6	13.8	14.2	13.6	13.4	14.0
Non-occ	*	4.2	4.3	5.3	6.2	7.0	8.1	7.6
All Occupations:								
Percent	*	12.3	12.9	13.3	13.8	14.0	14.6	15.2
Number	*	12,899	13,403	13,331	13,322	12,681	12,221	12,262

Source: Derived from data provided by Defense Manpower Data Center.
*Occupation data not available for 1987 Air Force Officers.

In summary, the occupational category of Scientists and Professionals showed the largest percentage increases for women in all services, while Health and most other occupations had moderate growth over the 1987-1994 period. These data support the previous research by showing that women are becoming a larger percentage of the "professionals" and other specialists, serving in occupations that were previously considered nontraditional.

Historically, women have been attracted to administrative occupations and positions in health care as Rogers (1991), Eitelberg (1988), and Binkin (1993) have found. The reason for this is partly attributable to choice (Fletcher, McMahon and Quester, 1984; and GAO, 1989) and partly due to service restrictions on the employment of women in combat-related areas (GAO, 1989 and Binkin, 1993). The trends revealed in this section

are in line with current literature, suggesting that women are moving away from typically female occupations and going into more nontraditional fields (Rogers, 1991; Eitelberg, 1988; Binkin and Eitelberg, 1986).

E. TRENDS IN HEALTH CARE OCCUPATION GROUPS

The increase in the percentage distribution and representation of women in Health Care deserves further examination. Since the area encompasses a variety of health care professionals, it is unclear whether observed trends represent a shift toward traditional or non-traditional fields. It is impossible to address the issue without focusing on the more specific occupational groups that further define the various health occupations. Table 23 shows the six occupational groups in Health Care, and the representation and percentage distribution of DoD female officers in each group in 1988 and 1994.

Previous tables indicated that Health is a growing occupation. While female representation and distribution in Health Care expanded over the past eight years, nursing, the most traditionally female specialty in this area, is the only occupational group showing a decline in female representation and distribution. These data suggest that, as women are becoming a larger part of the Health field, they are moving away from traditionally female jobs and toward the mostly male-dominated professions of physician, dentist, biomedical services officer, and health administrator.

Table 23. DoD Female Representation and Percent Distribution by Health Care Group, 1988 and 1994

Health Care Groups	Representation 1988	Representation 1994	Percent Distribution 1988	Percent Distribution 1994
Physicians	12.5	16.0	11.9	15.0
Dentists	6.7	10.6	2.4	2.9
Nurses	75.6	73.7	70.8	63.1
Veterinarians	11.7	22.3	0.4	0.6
Biomedical	20.8	27.5	6.8	8.0
Health Admin	14.5	20.5	7.6	11.0

Source: Derived from data provided by the Defense Manpower Data Center.

F. SUMMARY

The preliminary data analysis revealed some interesting trends regarding occupational distribution of women in the different services, particularly the drop in percentage of female Administrators and the tendency of moving toward nontraditional jobs in the category of Scientists and Professionals. The Health Care profession continues to encompass a larger percentage of the female officer corps. Whether this is due to women's propensity for the health profession, or if this category should even be considered "traditional" is beyond the scope of this thesis. These preliminary findings, however, provide a point of focus for the examination of the promotion models to follow by drawing attention to the occupations of Administrators, Scientists and Professionals, and Health Care Professionals.

IV. METHODOLOGY FOR PROMOTION ANALYSIS

A. DESCRIPTION OF DATA: OFFICER COHORT FILES

As mentioned earlier, cohort files are necessary for estimating multivariate models of promotion. A cohort file follows key variables from a member's entry into the military through the subsequent years of his or her career. For example, the 1977 officer cohort contains observations for all Fiscal Year 1977 officer accessions, and matches data from the following years (1978 through 1994) on all of the new entrants. There is also a record for those officers who have left the military at some time during this period. This type of longitudinal file is ideal for tracking the career paths of specific cohorts of officers and determining promotion outcomes at various promotion points.

The data used in this portion of the analysis include three officer cohorts for years 1977, 1980, and 1983. Promotion outcomes throughout the years of the drawdown are tracked with these cohort data in an attempt to study the effects of the drawdown on the promotion opportunities of various groups. Several variables that may have an effect on career progression and promotion are examined. These include: gender, race, occupation, source of commission, prior service, and graduate education. The analysis focuses on whether statistically significant differences exist in promotion between female and male officers, and whether these differences changed at different stages of the drawdown. In addition, occupation is closely studied to determine if an officer's occupation has a significant effect on his or her promotion or career progression.

B. DEVELOPMENT OF MULTIVARIATE PROMOTION MODEL

The Cohort Files described previously are used to develop the multivariate model for predicting promotion. All cohorts contain the same variables. Each variable is observed year by year and assigned its corresponding value for each year through 1994.

The analysis is limited to promotion to 0-4 only. Promotion to 0-2 and 0-3 does not involve the degree of competition found at the 0-4 level. Promotion to 0-4 represents the first significant "choke point" for junior officers. At this point, the military's

hierarchical, pyramid structure begins to take shape as the pool of eligible officers considerably outnumbers the available vacancies at the next level.

1. Restrictions, Assumptions and Limitations

The data were restricted to officers who entered the military as an O-1, hence eliminating most direct commissions and warrant officers. This restriction was necessary to allow modeling promotion to any particular grade of a homogeneous entry cohort. Those who receive direct appointments may enter at higher paygrades and thus not be "in-zone" at the same time as the bulk of the same year group.

Promotion in the military is centered around promotion zones, whereby promotion rates are typically established and given in terms of officers being "below-zone," "in-zone," or "above-zone." Promotion zones were not available in the data that were used; therefore, some assumptions had to be made as to when an officer was in fact considered in-zone and appearing before a selection board. For promotion to 0-4, the bottom of the promotion zone was assumed to be five years after promotion to 0-3. Members leaving the service prior to this yearmark were collectively grouped as 0-3 losses, resigning prior to the 0-4 board. Members who stayed beyond 0-3 plus five years were considered in-zone, and became the basis for the calculation of the promotion rate.

The occupation variables are constructed from the Duty Occupation Codes. As explained in Chapter 3, the Duty Occupation Code indicates the occupation for which an officer was trained, most likely reflecting initial education and assignment. Primary and Secondary Occupation Codes are also available, identifying the officer's current occupation and other qualifications. However, the former option is used because it is likely that the occupational designator or MOS in which the member was trained would be the one used to separate officers eligible for promotion into separate competitive categories.

To determine an officer's occupation, the field for each officer's occupation was checked year-by-year until the officer was assigned one of the 1-digit DoD occupational codes. The first occupational code assigned to an officer is the one used in this analysis, regardless of whether or not the occupation ever changed through the years. Only officers

with an "unknown" occupation from accession through 1994 were assumed to be "unknown" and assigned an occupational code of 0. Observations with occupational codes 0 (unknown), 1 (General and Executive Officers), and 9 (non-occupational) were discarded. General and Executive Officers also were omitted because it is unusual to find 0-4's in this advanced occupational category. The original number of observations for the 1977 cohort was 25,335. In the 1980 cohort there were originally 29,434 observations. The total number of observations remaining in the 1977 and 1980 cohorts after the restrictions were imposed were 14,909 and 18,848, respectively.

The 1983 cohort is used only for analyzing Navy data. Because the Navy has a quicker time to promotion than the Army, Marine Corps, or Air Force, it is the only service for which most eligible officers can possibly be promoted within the time frame imposed by the cohort entry year (1983) and the end of available data (1994). That is, the 1983 cohort data for the non-Navy services is severely right censored.

2. Dependent Variable

Due to the dichotomous nature of the dependent variable, a logit model is used. Because of the structure of the cumulative distribution function on which this model is based, the logit model restricts the probability of the outcome to be between 0 and 1. The event to be modeled is the occurrence of promotion to 0-4. The event either occurs or it does not. That is, an officer is either promoted to 0-4, or not promoted. Hence, the dependent variable for the promotion model (PROM4) is a binary yes/no variable: PROM4 = 1 if the officer is promoted to 0-4, and PROM4 = 0 if the officer is not promoted to 0-4. Promotions are identified through the end of 1994, the last year of data available for this study. Thus, any officers in the 1977 cohort not promoted within seventeen years, or any officer in the 1980 cohort not promoted within fourteen years will be coded as not promoted. The promotion period shrinks to eleven years for the 1983 Navy-only cohort.

3. Explanatory Variables

The variables chosen to explain promotion to 0-4 were based on previous research and various hypothesized relationships. The explanatory variables include both dummy (binary) variables and continuous variables.

a. Dummy variables

Dummy variables are used in regression analysis to indicate the presence or absence of a particular attribute. These variables are qualitative in nature since they cannot be given a quantitative, scalar value (Gujarati, 1988). The variables described below are coded as dummy variables, equal to 1 when the attribute is present, and 0 when the attribute is not present.

FEMALE is coded to 1 when the officer is female and to 0 when the officer is male.

ETHNIC is used to group Blacks, Hispanics, and other minorities into one category. ETHNIC = 1 when the officer is a member of a minority group and ETHNIC = 0 when the officer is White.

POSTGRAD indicates whether or not the officer had a graduate degree or higher at the time of the 0-4 board. POSTGRAD = 1 indicates possession of a graduate degree, while 0 indicates no degree.

ACADEMY and ROTC are dummy variables used to identify the source of commission. The variables are coded to 1 if that was the accession source and 0 if it was not. Officers commissioned through OCS are the base case for these variables.

MARRIED = 1 if the officer is married, and 0 otherwise. The base case for this variable is single members and those no longer married, that is, separated, divorced, or widowed.

PRIORSVC is a variable constructed to indicate whether or not the officer previously served in the military. This includes prior enlisted service or previous service as an officer. If years of service in the year of accession is greater than one, then the officer is considered to have prior military service.

All variables for identifying an officer's occupation are also dummy variables, coded to 1 if the member is in that occupation, and coded to 0 if the member is not. The occupation variables are renamed as abbreviations of the nine DoD occupational categories described in the previous chapter. These variables include ADMIN for Administrators, INTEL for Intelligence Officers, ENGMAINT for Engineering and Maintenance Officers, SCIPROF for Scientists and Professionals, SUPPLY for Supply Officers, and HEALTH for Health Care Officers. Officers in the Tactical category form the base case for the occupation variables.

b. Continuous variables

Continuous variables are quantitative variables that can be identified by some measurable means. Unlike dummy variables, these variables are not limited to values of 0 and 1, but can be given values anywhere along a designated continuum.

CHILDREN was constructed from a field that did not distinguish between dependents being children or a spouse. It is assumed that one dependent indicated a spouse, two dependents indicated a spouse and one child, three dependents indicated a spouse and two children, etc.

ENTRYAGE is used to capture the member's age upon accession. This variable has a meaningful range of 21 through approximately 35 when entry age limitations restrict an individual's ability to enter the military.

4. A Priori Hypotheses

Based on the literature review and the results of previous studies, some hypotheses can be formed about the expected effect of each explanatory variable on the promotion event. FEMALE and ETHNIC are of particular interest. The literature suggests that women and minorities may lag in their promotion opportunities when compared with white men. This may be due to occupational crowding or to unintentional discrimination. These variables (FEMALE and ETHNIC) are both expected to decrease one's probability of being promoted. Those commissioned through any academy are expected to have a higher promotion probability than their counterparts who were commissioned through ROTC and OCS. This hypothesis is based on studies that found the Naval Academy a

positive factor in 0-4 promotions (studies cited in North and Smith, 1993). These expectations are extended to other service academies. As Cymrot (1986) concluded, officers with graduate degrees are expected to have a better chance at promotion. Based on previous research, marital status (North and Smith, 1993) and age (Cymrot, 1986) are also expected to have a positive effect on promotion. Finally, it is expected that officers in Health, Supply and Administrators categories would have lower chances of promotion compared to Tactical officers. Intelligence, Engineering and Scientists and Professional officers, being somewhat more technical, are expected to achieve promotion comparable to that of Tactical officers. Health, Supply and Administrators categories are considered the more non-technical areas. Tactical, on the other hand, is a very technical field. Furthermore, it is one of the most male-dominated occupations with regards to representation. The last hypothesis is based on a combination of these factors.

C. PREDICTING TIME TO 0-4

Another event that can be modeled from these data files is the *time* to promotion to 0-4. The same restrictions, assumptions, limitations, and explanatory variables that were used to model the actual promotion event (PROM4) are also used to model time to promotion to 0-4 (TIME4).

Unlike the logistic regression where the dependent variable was a dummy variable with only two outcomes, the dependent variable for predicting time to promotion is continuous. In this case, the event can be modeled using the ordinary least squares (OLS) estimating techniques.

A priori, women and members of any ethic group are expected to take longer be promoted to 0-4 while academy and ROTC graduates are expected to get promoted more quickly than OCS graduates. A postgraduate degree is expected to decrease time to promotion, as is being married and having prior service. Finally, Intelligence, Engineering and Maintenance, and Scientists and Professional Officers are expected to have a slightly quicker promotion time than officers in Health, Supply, or Administrators categories.

V. COHORT ANALYSIS

The cohort data files allow the study of promotion times and rates, and the specification and estimation of promotion models. Each of these areas is addressed in the following sections.

A. PROMOTION TIMES AND RATES

Table 24 shows the mean time to promotion to 0-4 for each service, and the overall DoD time to promotion by gender. The Navy clearly has the shortest promotion time to 0-4 among the services in each cohort, approximately 1-1/2 years sooner for both cohorts. It can also be seen that promotion times increased across the board in the 1980 cohort, whose promotion boards met during the early drawdown period. Men and women overall had similar times to promotion in both cohorts, with differences in the means of just slightly over a month. Analysis of promotion rates can also be found in studies by the Defense Equal Opportunity Management Institute (DEOMI) (Robinson and Prevette, 1992) and Rand (1994). However, comparisons with this study should be made cautiously, as different assumptions and limitations apply, especially in the construction of the 0-4 promotion zone.

Mean promotion times are further disaggregated in Table 25 by service and gender. T-tests were used to test for differences in means between the genders. For the Army and Marine Corps in the 1977 cohort, the t-tests indicated equal mean times to promotion for men and women at the .05 level of significance, while the Navy and Air Force both showed small differences. The 1980 cohort found the Navy, Marine Corps, and Air Force with equal times to promotion for men and women, as indicated by t-tests. Only the Army had slight differences.

Table 24. Mean Time (in years) to Promotion to 0-4 for each Service and by Gender, 1977, 1980, and 1983 Cohorts

Service and Gender	1977 Cohort	1980 Cohort	1983 Cohort
Army	12.0	12.0	*
Navy	9.6	10.1	10.4
Marines	12.2	12.2	*
Air Force	11.1	12.0	*
All Services:			
Women	11.1	11.5	*
Men	11.0	11.6	*

Source: Derived from data provided by Defense Manpower Data Center.
*Due to longer times for promotion to 0-4 for Army, Marines and Air Force, these figures are not available from the 1983 cohort.

Table 25. Mean Time (in years) to Promotion to 0-4 by Service and Gender, 1977 and 1980 Cohorts

	1977 Cohort		1980 Cohort	
Service	Men	Women	Men	Women
Army	11.9	12.0*	12.0	11.8
Navy**	9.6	10.1	10.2	10.3*
Marine Corps	12.3	12.1*	12.2	12.3*
Air Force	11.1	11.0	12.0	11.9*

Source: Derived from data provided by the Defense Manpower Data Center.
*T-tests indicate equal mean time to promotion for men and women.
**Navy 1983 cohort figures are 10.4 for both males and females.

Overall promotion rates to 0-4 for each service can be found in Table 26. The Navy has the highest promotion rate among the services and the Marine Corps has the lowest. A drop in promotion rates can be seen from the 1977 cohort to the 1980 cohort,

which again was affected by the drawdown. The drop in rates ranged from 6 to 11 percentage points. This trend did not hold for the Marine Corps, where the promotion rate actually rose from 66.2 percent to 66.9 percent.

Table 26. Promotion Rate (Percent) to 0-4 for each Service, 1977, 1980, and 1983 Cohorts

Service	1977 Cohort	1980 Cohort	1983 Cohort
Army	72.5	64.8	*
Navy	82.1	76.8	70.2
Marines	66.2	66.9	*
Air Force	77.1	66.9	*

Source: Derived from data provided by Defense Manpower Data Center.
*Due to longer times for promotion to 0-4 for Army, Marines and Air Force, these figures not available from the 1983 cohort.

Table 27 displays the promotion rates by service and gender. T-tests indicate that the Army had equal rates (at the .05 significance level) between men and women in both cohorts. For the Navy, in the 1977 cohort, the promotion rate of men (83 percent) exceeded that of women (76 percent). The disparity was practically eliminated in the 1980 cohort where the rates were 77 percent and 76 percent for men and women, respectively. The 1977 cohort trend was reversed in the 1983 cohort as female promotion outpaced male promotion by 6 percentage points. T-tests indicate these promotion rates for men and women are statistically equal in the 1980 and 1983 cohorts. In the Marine Corps, men had a higher promotion rate than women in the first cohort, but the rates evened out in the second cohort. T-tests, however, indicate that the promotion rates between men and women were equal for both cohorts. Finally, in the Air Force men had a higher promotion rate in the earlier group and women had a higher promotion rate in the later one. T-tests show the male and female rates are equal in the first cohort.

Table 27. Promotion Rates (Percent) to 0-4 by Service and Gender, 1977 and 1980 Cohorts

Service	1977 Cohort		1980 Cohort	
	Men	Women	Men	Women
Army	72	71*	65	64*
Navy**	83	76	77	76*
Marine Corps	66	59*	67	67*
Air Force	78	73*	66	72

Source: Derived from data provided by the Defense Manpower Data Center.
*T-tests indicate equal rates for men and women.
**Navy 1983 cohort figures are 69% and 75% for males and females, respectively.

Looking at promotion rates by occupation also offers some additional information. Actual representation and distribution of officers by occupation was discussed in Chapter 4 using the Officer Master Files.

Table 28 displays promotion rates by DoD occupation broken down by gender. Some of the lowest promotion rates were found in the Administrators and Supply occupations for both men and women in both cohorts. At the other extreme, women in the Tactical category had a higher promotion rate than women in any other occupational category before the drawdown in the 1977 cohort. The rate remained comparatively high (73 percent) during the drawdown. Women in Health occupations were the only group that experienced a higher promotion rate during the drawdown as compared with the pre-drawdown cohort. Men in Health fields also had relatively high promotion rates, and the highest of all occupations in both cohorts.

Table 28. Promotion Rates (Percent) to 0-4 by DoD Occupation, 1977 and 1980 Cohorts

DoD Occupations	1977 Cohort		1980 Cohort	
	Men	Women	Men	Women
Tactical	76	78	70	73
Intelligence	77	75	68	69
Engineering/Maintenance	77	72	66	70
Scientists/Professionals	78	74	64	72
Health	81	70	78	76
Administrators	73	72	63	69
Supply	72	71	63	61

Source: Derived from data provided by the Defense Manpower Data Center.

Note that persons who received direct appointments were eliminated from the data, thus removing doctors, dentists and several other traditionally male health care fields from the sample. With this in mind, it appears that men have the highest promotion rate in the particular Health occupations that may be considered nontraditional fields for them. Likewise, women are promoted at a very high rate in Tactical, an area that is nontraditional for them and in which they have the lowest representation.

B. LOGIT PROMOTION MODELS

Working with the two separate cohorts, one of the first tasks is to compare the two cohorts to see whether they behave differently or if the data could be pooled and studied with one regression. The log-likelihood ratio test can be used to examine differences when working with logit models. This test determined the calculated chi-squared statistic to be 187.57, which exceeds the critical value of 7.96 (at the .05 level of significance). These results indicate that the two cohorts should not be combined. Rather, they should be examined as two distinct groups, validating the efforts to run separate models for each cohort.

1. Promotion Models by Service

As explained in Chapter IV, models were developed to predict the probability of promotion based on various demographic and occupation variables. The 1977 cohort was taken as a pre-drawdown group and the 1980 cohort was used to study promotion during the drawdown. (A 1983 cohort is also used for the Navy only.) The models were run for each service. Results are displayed for each service in tables showing the estimated coefficient and level of significance. These are followed by tables showing the percent changes in promotion probability for variables with statistically significant coefficients. The probabilities were derived using the formula B(P)(1-P), where B is the coefficient estimate and P is the probability of promotion.

Results of the Army model can be found in Table 29. Interpretation of these results is found in Table 30. Army officers who had a graduate degree, went to the military academy, and were married had higher probabilities of promotion in both cohorts. Women were more likely than men to be promoted before the drawdown, as indicated in the results for the 1977 cohort. In the 1980 cohort, the coefficient of the female variable was no longer statistically significant. Administrators and Health occupational categories became significant in the 1980 cohort, indicating a 7.9 percent and 18.1 percent higher promotion probability, respectively, for officers in these fields. ENTRYAGE was the only variable with a negative coefficient, indicating reduced chances for promotion as the member's entry age increased. Table 30 indicates that being married and completing a graduate degree have the largest effect on the promotion probability.

Table 29. Logit Models for Promotion to 0-4 for Army Officers, 1977 and 1980 Cohorts

	1977 Cohort		1980 Cohort	
VARIABLE	Coeff.	Pr>chi-squared	Coeff.	Pr>chi-squared
FEMALE	0.400	.0293	-0.170	.2091
ETHNIC	-0.221	.0567	0.023	.8425
POSTGRAD	0.800	.0001	0.824	.0001
ACADEMY	0.479	.0074	0.380	.0052
ROTC	0.075	.5274	-0.037	.6763
MARRIED	0.943	.0001	0.843	.0001
CHILDREN	0.034	.7642	-0.120	.2579
PRIORSVC	-0.200	.0902	-0.108	.4908
ENTRYAGE	-0.049	.0347	-0.126	.0001
ADMIN	-0.165	.2332	0.346	.0192
INTEL	0.093	.6397	0.169	.3240
ENGMAINT	-0.116	.4016	-0.024	.8425
SCIPROF	0.412	.6021	1.576	.1418
HEALTH	-0.040	.9144	0.796	.0002
SUPPLY	-0.079	.6843	-0.167	.3277
chi squared	182		235	
concordance ratio	65.0		66.3	
N	2,794		3,022	

Source: Derived from data provided by the Defense Manpower Data Center.

Table 30. Change in Percent Probability of Promotion to 0-4 for Army Officers, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Change in Probability (Percent)	1980 Cohort Change in Probability (Percent)
FEMALE	7.9	*
POSTGRAD	15.8	18.8
ACADEMY	9.4	8.7
MARRIED	18.6	19.2
ENTRYAGE	-1.0	-2.9
ADMIN	*	7.9
HEALTH	*	18.1

Source: Derived from data provided by the Defense Manpower Data Center.
*Coefficients not statistically significant in Table 29.

Navy results are displayed in Table 31, followed by Table 32 showing the percent change in the probability of promotion. Results indicate that women have a higher probability of promotion than men in each cohort, even during the drawdown period. These probabilities range from an 8.0 percent difference between men and women for the 1977 entrants to an 18.1 percent difference in favor of women who entered in 1983. Officers with graduate education, those who were married, and those with children had a higher probability of promotion in each cohort. The difference in the promotion probability was the greatest for married officers. Minorities had a 10.7 percent lower probability of promotion than whites before the downsizing began. The trend continued early in the drawdown, as the coefficients suggest a 7.8 percent lower probability of promotion for the 1980 cohort. In the 1983 cohort, the race/ethnic variable was not significant, indicating that it no longer had an effect on promotion in the later years of the drawdown.

Table 31. Logit Models for Promotion to 0-4 for Navy Officers, 1977, 1980, and 1983 Cohorts

	1977 Cohort		1980 Cohort		1983 Cohort	
VARIABLE	Coeff.	Pr>chi-squared	Coeff.	Pr>chi-squared	Coeff.	Pr>chi-squared
FEMALE	0.540	.0303	0.497	.0114	0.863	.0001
ETHNIC	-0.722	.0018	-0.440	.0301	-0.169	.3303
POSTGRAD	0.752	.0001	1.034	.0001	0.753	.0001
ACADEMY	0.244	.2449	0.228	.2071	0.107	.5007
ROTC	-0.474	.0140	-0.266	.1261	-0.176	.2983
MARRIED	1.456	.0001	1.268	.0001	1.195	.0001
CHILDREN	0.562	.0008	0.292	.0412	0.351	.0055
PRIORSVC	-0.245	.2036	-0.416	.0046	-0.125	.3362
ENTRYAGE	-0.009	.7707	-0.094	.0001	-0.009	.6500
ADMIN	-0.785	.0003	-0.346	.1039	-0.607	.0011
INTEL	-0.396	.2526	0.792	.0113	0.173	.5526
ENGMAINT	-0.175	.3046	-0.175	.2650	0.064	.6928
SCIPROF	-0.652	.0693	-0.730	.0246	-0.566	.0938
HEALTH	-0.748	.0018	-0.259	.3398	-0.011	.9566
SUPPLY	-0.202	.5795	-0.234	.4326	-0.023	.9400
chi squared	330		277		262	
concordance ratio	75.1		71.9		68.9	
N	2,176		2,246		2,257	

Source: Derived from data provided by the Defense Manpower Data Center.

Table 32. Percent Change in Probability of Promotion to 0-4 for Navy Officers, 1977, 1980, and 1983 Cohorts

VARIABLE	1977 Cohort Change in Probability (Percent)	1980 Cohort Change in Probability (Percent)	1983 Cohort Change in Probability (Percent)
FEMALE	8.0	8.8	18.1
ETHNIC	-10.7	-7.8	*
POSTGRAD	11.1	18.3	15.8
ROTC	-7.0		
MARRIED	21.5	22.5	25.1
CHILDREN	8.3	5.2	7.4
PRIORSVC	*	-7.4	*
ENTRYAGE	*	-1.7	*
ADMIN	-11.6	*	-12.8
INTEL	*	14.0	*
SCIPROF	*	-12.9	*
HEALTH	-11.4	*	*

Source: Derived from data provided by the Defense Manpower Data Center.
*Coefficients not statistically significant in Table 31.

Officers in the Intelligence field had a higher likelihood of promotion in the early stages of the drawdown (1980 cohort), while Scientists and Professionals and those with prior service and higher entry ages had lower promotion probabilities. Health and Administration officers were less likely to be promoted before the drawdown. This effect disappeared for both occupations in the 1980 cohort, but reappeared for Administrators who entered in 1983.

Coefficient estimates and levels of significance for Marine Corps models are displayed in Table 33. Sample sizes for these models were much smaller than those for other services, and the "fit" of the models indicated the explanatory variables were not very good at predicting changes in promotion probability. Table 34 shows these changes

for the few statistically significant coefficients. Minorities had a much lower probability of promotion before the drawdown (21.8 percent), while there were no significant differences in the later cohort. Married officers had a higher likelihood of promotion both before and during the drawdown, while having children had a negative effect only in the second cohort.

Table 33. Logit Models for Promotion to 0-4 for Marine Corps Officers, 1977 and 1980 Cohorts

	1977 Cohort		1980 Cohort	
VARIABLE	Coeff.	Pr>chi-squared	Coeff.	Pr>chi-squared
FEMALE	-0.296	.5996	-0.395	.5501
ETHNIC	-0.970	.0085	0.157	.7429
POSTGRAD	0.352	.1592	0.461	.1229
ACADEMY	-0.195	.6122	0.327	.3079
ROTC	0.085	.6759	0.106	.6512
MARRIED	0.637	.0190	0.913	.0059
CHILDREN	0.144	.4997	-0.981	.0007
PRIORSVC	0.191	.3674	0.004	.9843
ENTRYAGE	0.041	.4039	0.012	.8435
ADMIN	0.048	.9052	0.357	.5355
INTEL	0.526	.4144	-0.704	.3504
ENGMAINT	0.748	.0805	0.404	.3871
SUPPLY	0.542	.1359	-0.486	.1544
chi squared	29		21	
concordance ratio	61.9		59.5	
N	591		504	

Source: Derived from data provided by the Defense Manpower Data Center.

Table 34. Change in Percent Probability of Promotion to 0-4 for Marine Corps Officers, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Change in Probability (Percent)	1980 Cohort Change in Probability (Percent)
ETHNIC	-21.8	*
MARRIED	14.3	20.2
CHILDREN	*	-21.7

Source: Derived from data provided by the Defense Manpower Data Center.
*Coefficients not statistically significant in Table 33.

Air Force results can be found in Table 35, with the resulting changes in probabilities found in Table 36. Many of the variables that were found to be significant in models for the other services held true for the Air Force model as well. Officers with a graduate degree, graduates of the academy and ROTC, married officers, and those with children all had a higher probability of promotion, both before and during the drawdown. Furthermore, the percent change actually *increased* during the drawdown for all of these officers except those who were married, for whom the percent change dropped slightly. Women had a greater chance of promotion than men only in the 1980 cohort. Minorities had lower chances of promotion in the first cohort, before the downsizing began. The same applies to those with prior service in the second cohort during the drawdown. Several occupation variables had no effect before the drawdown but became significant during the downsizing promotion boards. Officers in Administration, Intelligence, Engineering and Maintenance, and Scientists and Professionals all had lower chances of promotion in the 1980 cohort. Health Care officers, on the other hand, had a higher likelihood of promotion both before and into the drawdown period.

Table 35. Logit Models for Promotion to 0-4 for Air Force Officers, 1977 and 1980 Cohorts

	1977 Cohort		1980 Cohort	
VARIABLE	Coeff.	Pr>chi-squared	Coeff.	Pr>chi-squared
FEMALE	0.136	.4519	0.704	.0001
ETHNIC	-0.620	.0001	0.042	.6934
POSTGRAD	1.632	.0001	1.591	.0001
ACADEMY	0.541	.0082	0.813	.0001
ROTC	0.493	.0036	0.540	.0001
MARRIED	1.314	.0001	1.020	.0001
CHILDREN	0.326	.0070	0.297	.0017
PRIORSVC	-0.106	.4895	-0.351	.0001
ENTRYAGE	-0.002	.9464	0.024	.0830
ADMIN	-0.067	.6821	-0.327	.0026
INTEL	0.013	.9628	-0.294	.0492
ENGMAINT	0.057	.6892	-0.279	.0028
SCIPROF	-0.117	.6896	-0.486	.0096
HEALTH	1.065	.0004	0.459	.0202
SUPPLY	-0.414	.0875	-0.143	.4056
chi squared	662		1041	
concordance ratio	77.2		76.5	
N	3133		4827	

Source: Derived from data provided by the Defense Manpower Data Center.

Table 36. Change in Percent Probability of Promotion to 0-4 for Air Force Officers, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Change in Probability (Percent)	1980 Cohort Change in Probability (Percent)
FEMALE	*	15.6
ETHNIC	-11.0	*
POSTGRAD	28.9	35.2
ACADEMY	9.6	18.0
ROTC	8.7	11.9
MARRIED	23.3	22.6
CHILDREN	5.8	6.6
PRIORSVC	*	-7.8
ADMIN	*	-7.2
INTEL	*	-6.5
ENGMAINT	*	-6.2
SCIPROF	*	-10.8
HEALTH	18.9	10.2

Source: Derived from data provided by the Defense Manpower Data Center.
*Coefficients not statistically significant in Table 35.

2. Summary of Logit Models

One of the most interesting results obtained from the logit models is the higher probabilities of promotion for women across all cohorts in the Navy. These probabilities rise throughout the drawdown from 8.0 percent to 8.8 percent to 18.1 percent in the 1977, 1980, and 1983 cohorts, respectively. Recall that in Table 27, the Navy promotion rates for men exceeded those for women in the 1977 cohort, evened out in the 1980 cohort, and reversed in the 1983 cohort with the female promotion rate exceeding the male rate. The promotion rates in Table 27, although derived strictly from cross-tabulations without controlling for other influences, show similarities with the logit results in that the most favorable promotion outcomes for Navy women are experienced in the 1983 cohort.

Finally, the Army and Air Force have higher probabilities of promotion for women in only one of the cohorts, while the Marine Corps models showed no effects of gender on promotion.

Occupation variables were not very strong in predicting promotion. These data suggest that there were few significant differences in promotion across occupation both before and during the drawdown. The only exception is in the Air Force, where many career fields that were not statistically significant before the drawdown became so after the downsizing began.

C. RESTRICTED LOGIT MODELS

Restricted logit models were estimated for DoD men and women. These models are helpful in isolating the effects of different variables in the separate gender groups. Due to the small sample sizes of women being promoted to 0-4 when examining each service, the restricted models were run for all services combined.

1. Logit Promotion Models for Women

Results of the models restricted to women only are found in Table 37. The calculated percent changes in probabilities are presented in Table 38. Female officers with graduate degrees and those that are married experienced higher chances of promotion in both cohorts. Female minorities had a lower likelihood of promotion before the drawdown; but that effect was eliminated in the 1980 cohort. Female officers with children and those in the Supply field had lower probabilities of promotion in the 1980 cohort.

Table 37. Restricted Logit Models for Promotion to 0-4, DoD Women Only, 1977 and 1980 Cohorts

	1977 Cohort		1980 Cohort	
VARIABLE	Coeff.	Pr>chi-squared	Coeff.	Pr>chi-squared
ETHNIC	-.4621	.0506	-0.258	.1226
POSTGRAD	1.158	.0001	1.600	.0001
ROTC	-0.128	.5728	-0.263	.0983
MARRIED	0.747	.0001	0.741	.0001
CHILDREN	-.0166	.5311	-0.701	.0001
PRIORSVC	0.276	.3800	-0.156	.3093
ENTRYAGE	0.047	.3136	0.002	.9543
ADMIN	-0.555	.0887	-0.149	.4874
INTEL	-0.378	.3331	-0.128	.6218
ENGMAINT	-0.580	.0774	-0.284	.2002
SCIPROF	-0.519	.2565	-0.247	.4381
HEALTH	-0.247	.4742	0.122	.6305
SUPPLY	-0.294	.4851	-0.537	.0454
chi squared	70		194	
concordance ratio	69.6		72.9	
N	726		1323	

Source: Derived from data provided by the Defense Manpower Data Center.

Table 38. Percent Change in Probability of Promotion to 0-4, DoD Women Only, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Change in Probability (Percent)	1980 Cohort Change in Probability (Percent)
ETHNIC	-9.1	*
POSTGRAD	22.8	33.6
MARRIED	14.7	15.6
CHILDREN	*	-14.7
SUPPLY	*	-11.3

Source: Derived from data provided by the Defense Manpower Data Center.
*Coefficients not statistically significant in Table 37.

2. Logit Promotion Models for Men

Estimates of coefficients in the restricted models for men are found in Table 39. The interpretation of these results is found in Table 40. As expected, officers with graduate education and married personnel had a higher likelihood of promotion in both cohorts. Academy graduates experienced this only in the 1980 cohort. Having children had a positive effect only in the earlier yeargroup. Minority males and those commissioned through ROTC were less likely to be promoted before the drawdown. This effect was eliminated for minorities and was reversed for persons with ROTC commissions after the drawdown began. Prior service and higher entry ages contributed to lower chances of promotion for both yeargroups.

Table 39. Restricted Logit Models for Promotion to 0-4, DoD Men Only, 1977 and 1980 Cohorts

	1977 Cohort		1980 Cohort	
VARIABLE	Coeff.	Pr>chi-squared	Coeff.	Pr>chi-squared
ETHNIC	-0.509	.0001	-0.056	.4757
POSTGRAD	1.023	.0001	1.050	.0001
ACADEMY	0.162	.1106	0.517	.0001
ROTC	-0.205	.0057	0.164	.0066
MARRIED	1.246	.0001	1.171	.0001
CHILDREN	0.202	.0049	0.076	.2394
PRIORSVC	-0.300	.0001	-0.337	.0001
ENTRYAGE	-0.061	.0001	-0.058	.0001
ADMIN	-0.223	.0205	-0.320	.0001
INTEL	0.085	.5863	-0.082	.4679
ENGMAINT	0.020	.8111	-0.193	.0034
SCIPROF	-0.004	.9862	-0.430	.0134
HEALTH	0.319	.1071	0.387	.0116
SUPPLY	-0.146	.2866	-0.272	.0184
chi squared	917		1150	
concordance ratio	71.0		69.7	
N	7,968		9,276	

Source: Derived from data provided by the Defense Manpower Data Center.

Table 40. Percent Change in Probability of Promotion to 0-4, DoD Men only, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Change in Probability (Percent)	1980 Cohort Change in Probability (Percent)
ETHNIC	-9.3	*
POSTGRAD	18.7	22.8
ACADEMY	*	11.3
ROTC	-3.7	3.6
MARRIED	22.7	25.5
CHILDREN	3.7	*
PRIORSVC	-5.5	-7.3
ENTRYAGE	-1.1	-1.3
ADMIN	-4.1	-7.0
ENGMAINT	*	-4.2
SCIPROF	*	-9.4
HEALTH	*	8.4
SUPPLY	*	-5.9

Source: Derived from data provided by the Defense Manpower Data Center.
*Coefficients not statistically significant in Table 39.

These results suggest that occupation became more important for men after the downsizing began. While male Administrators had a lower likelihood of promotion in both cohorts, those in Engineering and Maintenance, Scientists and Professionals, and Supply experienced the same effect only in the drawdown cohort. The Health category was the only occupation showing improved probabilities of promotion for men during the drawdown.

D. OLS PROMOTION MODELS

OLS models are used to predict the effects of variables on the time to promotion to 0-4. Again, two separate cohorts are tracked into their 0-4 promotion zones, which occur right before the drawdown for the 1977 cohort and during the drawdown for the 1980 cohort. (Analysis for the Navy also includes the 1983 cohort.) Comparable to the log-likelihood ratio test for the logit models, a Chow test is run on the OLS models to test for differences among the cohorts. The calculated F-value of 104.13 exceeded the critical value of 1.67 at the .05 level of significance. As expected, the results indicate that the cohorts behave differently and should not be pooled and studied as a single sample. Hence, separate OLS models are run for each service and for each cohort.

1. Models of Time to 0-4 by Service

Results of the Army model are displayed in Table 41. Coefficients of ETHNIC, POSTGRAD, and ACADEMY variables are all statistically significant in one or both cohorts; however, the predicted effect on time to promotion is rather trivial. Hence, there is no practical significance seen in the effect of these variables on the dependent variable. The occupational category of Scientists and Professionals and that of Health are seen to have a more substantial effect on the time it takes to get promoted to 0-4. Both variables are statistically significant before and during the drawdown, and have the effect of decreasing time-to-promotion from six months to over one year.

Table 41. OLS Models for Time to Promotion to 0-4 for Army Officers, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Coeff.	Pr>t	1980 Cohort Coeff.	Pr>t
FEMALE	0.397	.4785	-0.630	.2281
ETHNIC	0.363	.3350	1.510	.0007
POSTGRAD	-0.708	.0142	-0.925	.0061
ACADEMY	-2.188	.0001	-2.797	.0001
ROTC	0.646	.0948	-0.001	.9989
MARRIED	-0.097	.8325	-0.749	.1303
CHILDREN	0.048	.8844	-0.125	.7394
PRIORSVC	-0.254	.5047	-0.836	.1445
ENTRYAGE	-0.052	.4973	-0.148	.0558
ADMIN	0.041	.9237	-0.276	.6025
INTEL	0.209	.7209	-0.436	.4886
ENGMAINT	-0.406	.3435	-0.669	.1503
SCIPROF	-10.059	.0001	-13.828	.0001
HEALTH	-7.408	.0001	-6.117	.0001
SUPPLY	0.357	.5629	-0.611	.3811
N	2026		1959	
R-squared	.0753		.1031	

Source: Derived from data provided by the Defense Manpower Data Center.

Navy results are displayed in Table 42. Once again, several coefficient estimates are statistically significant, but offer no practical value in predicting differences in time to promotion. Administrative and Supply occupations both increase time to promotion in each cohort, the largest increase being 7 months and 9 months, respectively, for these occupations in the 1980 cohort.

Table 42. OLS Models for Time to Promotion to 0-4 for Navy Officers, 1977, 1980 and 1983 Cohorts

	1977 Cohort		1980 Cohort		1983 Cohort	
VARIABLE	Coeff.	Pr>t	Coeff.	Pr>t	Coeff.	Pr>t
FEMALE	3.687	.0003	0.577	.4758	1.852	.0436
ETHNIC	0.206	.8442	0.115	.9023	1.103	.2492
POSTGRAD	-0.394	.4644	1.532	.0020	-1.072	.0528
ACADEMY	-0.021	.9772	0.388	.5740	1.222	.1296
ROTC	1.970	.0089	0.140	.8465	0.262	.7731
MARRIED	1.309	.0715	1.849	.0097	2.107	.0108
CHILDREN	0.210	.7212	-0.541	.3380	0.440	.4889
PRIORSVC	-3.160	.0001	0.384	.5359	-0.103	.8775
ENTRYAGE	0.264	.0352	0.279	.0108	0.100	.3224
ADMIN	3.275	.0005	7.100	.0001	5.560	.0001
INTEL	-4.958	.0003	-3.647	.0006	-2.181	.1284
ENGMAINT	-3.053	.0001	0.154	.8156	3.021	.0002
SCIPROF	3.137	.0388	1.188	.3906	3.611	.0637
HEALTH	2.023	.0376	-2.150	.0501	-5.067	.0001
SUPPLY	3.627	.0107	9.239	.0001	6.988	.0001
N	1,786		1,725		1,583	
R-squared	.1130		.0808		.0789	

Source: Derived from data provided by the Defense Manpower Data Center.

The models for the Marine Corps, as seen in Table 43, had only two statistically significant variables with negligible effects on time-to-promotion. The only coefficient estimates in the Air Force models (Table 44) of practical significance were those of the HEALTH variable. In both cohorts, Health Care officers were expected to reach 0-4 over one year sooner than the base case, Tactical.

Table 43. OLS Models for Time to Promotion to 0-4 for Marine Corps Officers, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Coeff.	Pr>t	1980 Cohort Coeff.	Pr>t
FEMALE	0.440	.8378	0.436	.7238
ETHNIC	-3.406	.0386	0.621	.4833
POSTGRAD	-1.486	.0622	0.289	.5737
ACADEMY	-1.958	.1948	1.186	.0401
ROTC	0.240	.7301	0.488	.2727
MARRIED	-0.433	.6958	-0.703	.2342
CHILDREN	0.733	.3434	0.775	.0882
PRIORSVC	0.077	.9193	0.513	.2256
ENTRYAGE	-0.112	.4888	0.013	.9144
ADMIN	-0.200	.8868	0.207	.8264
INTEL	-1.300	.5414	2.418	.1709
ENGMAINT	-0.231	.8479	0.555	.4776
SCIPROF	-4.814	.2907	-0.323	.9254
SUPPLY	0.863	.4433	0.205	.7785
N	391		337	
R-squared	.0393		.0374	

Source: Derived from data provided by the Defense Manpower Data Center.

Table 44. OLS Models for Time to Promotion to 0-4 for Air Force Officers, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Coeff.	Pr>t	1980 Cohort Coeff.	Pr>t
FEMALE	0.502	.3307	-0.495	.2223
ETHNIC	0.261	.5287	0.966	.0110
POSTGRAD	-1.120	.0001	-0.427	.1293
ACADEMY	-1.498	.0041	-0.720	.1074
ROTC	0.451	.3143	-1.878	.0001
MARRIED	0.035	.9368	-0.228	.5814
CHILDREN	0.094	.7628	-0.332	.3053
PRIORSVC	0.552	.1690	-1.954	.0001
ENTRYAGE	-0.340	.0001	-0.089	.0908
ADMIN	1.814	.0001	0.991	.0137
INTEL	0.569	.4396	1.083	.0503
ENGMAINT	0.741	.0428	1.740	.0001
SCIPROF	0.852	.2557	0.694	.3004
HEALTH	-12.737	.0001	-13.029	.0001
SUPPLY	2.386	.0006	0.557	.3619
N	2414		3230	
R-squared	.1952		.1454	

Source: Derived from data provided by the Defense Manpower Data Center.

2. OLS Promotion Models for Women

Results of the OLS female restricted models (Table 45) indicate that Administration and Supply occupations increased the mean time to 0-4 by five months or more in each cohort. Health, on the other hand, reduced the promotion time for women up to six months both before and during the drawdown.

Table 45. Restricted OLS Models for Time to Promotion to 0-4, DoD Women Only, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Coeff.	Pr>t	1980 Cohort Coeff.	Pr>t
ETHNIC	1.929	.1982	3.094	.0014
POSTGRAD	-3.059	.0046	2.779	.0001
ROTC	0.558	.6686	3.704	.0001
MARRIED	0.098	.9284	-0.700	.3635
CHILDREN	0.502	.7272	0.891	.3397
PRIORSVC	-0.933	.5605	-1.045	.2056
ENTRYAGE	-0.277	.2749	0.120	.3758
ADMIN	7.315	.0001	5.671	.0001
INTEL	7.082	.0007	1.853	.1813
ENGMAINT	4.583	.0101	3.552	.0025
SCIPROF	-6.642	.0084	-2.401	.1495
HEALTH	-6.278	.0011	-6.175	.0001
SUPPLY	8.659	.0004	7.055	.0001
N	531		924	
R-squared	.2017		.1837	

Source: Derived from data provided by the Defense Manpower Data Center.

3. OLS Promotion Models for Men

The OLS models restricted to men (Table 46) did not predict very large changes in time to 0-4 except for ROTC graduates and those working in Health occupations. The 1977 entrants commissioned through ROTC could expect an eleven-month delay in promotion to 0-4. The models estimated quicker promotion times for men in Health Care. These officers could expect promotion to 0-4 approximately ten months more quickly for the 1977 cohort, and seven months more quickly for the 1980 cohort.

Table 46. Restricted OLS Models for Time to Promotion to 0-4, DoD Men Only, 1977 and 1980 Cohorts

VARIABLE	1977 Cohort Coeff.	Pr>t	1980 Cohort Coeff.	Pr>t
ETHNIC	2.901	.0001	3.220	.0001
POSTGRAD	0.215	.5117	3.251	.0001
ACADEMY	4.866	.0001	0.349	.4672
ROTC	10.741	.0001	3.228	.0001
MARRIED	1.530	.0071	0.552	.3147
CHILDREN	0.693	.0802	0.436	.2589
PRIORSVC	2.507	.0001	-1.989	.0001
ENTRYAGE	1.105	.0001	0.479	.0001
ADMIN	2.028	.0003	4.851	.0001
INTEL	-0.269	.7604	1.502	.0335
ENGMAINT	-2.823	.0001	2.005	.0001
SCIPROF	-1.692	.1757	1.149	.3039
HEALTH	-10.269	.0001	-7.055	.0001
SUPPLY	3.035	.0002	3.793	.0001
N	6086		6327	
R-squared	.1829		.0871	

Source: Derived from data provided by the Defense Manpower Data Center.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The results of this study suggest that there has been no adverse impact of the defense drawdown on the promotion opportunities of female officers in DoD. Analysis of the data reveals no detrimental trends in promotion or career opportunities occurring from 1987, before the downsizing began, through 1994, a period well into the military's force reductions.

Overall, representation of women increased the most in the more technical fields and increased the least in the so-called "traditional" fields. These findings are consistent with previous studies and analyses (such as Eitelberg, 1988) of occupational trends for women in the military.

The distribution of women throughout the various occupational categories changed significantly during the drawdown. The predominant trend was an apparent shift of women away from the Administration category toward Health occupations. These patterns are clearly evident when each service is examined separately. Recall that, in this portion of the study, no restrictions were placed on Health Care officers under consideration. Hence, included in this occupational category are doctors, dentists, and other health professionals in careers that are still considered somewhat nontraditional for women. In fact, closer examination of the Health field reveals that the representation and distribution of female officers are decreasing in nursing and increasing in the Health areas that have historically had the lowest representation of women. Again, this shift out of the non-technical area (Administration) toward more nontraditional fields corresponds with the literature and expectations.

The movement of women toward the Health fields appears to be a positive trend, as evidenced in the review of promotion rates by occupation. Women in Health fields were the only group to experience an increase in promotion rates during the drawdown. Both men and women in all other occupations saw their promotion rates *drop* during the drawdown. Furthermore, the 1980 cohort of women in Health experienced the highest

promotion rate compared with women in all other occupations in that cohort. Men in Health also had relatively high promotion rates, and the highest of all the categories in both cohorts. Finally, Tactical fields offered greater promotion opportunities for women, second only to women in Health Care in the 1980 cohort.

The lowest promotion rates for both men and women were found in Supply and Administration occupations. The proportion of women serving in each of these categories grew very little or actually decreased during the drawdown period. These particular career fields are considered to be two of the more non-technical or traditional areas for women.

The higher promotion rates for men before the drawdown (1977 cohort) in the Navy, Marine Corps, and Air Force were balanced with those of women in the Navy and Marine Corps during the drawdown (1980 cohort). Female rates exceeded male rates both in the Air Force in the 1980 yeargroup, and in the Navy in the 1983 yeargroup. Rates for Army men and women remained similar for both cohorts. Thus, it appears that the drawdown had a favorable impact on women with respect to promotion opportunities, either holding the rates similar to those of men, leveling off, or exceeding male rates in the later cohorts.

Analysis of the multivariate models reconfirmed many results found in other studies. Namely, officers with graduate education, those getting commissions through service academies, officers who are married, and those with children have an increased probability of promotion.

One of the most significant findings was associated with the effect of gender on promotion. The models revealed that women in the Navy had a higher probability of promotion than men in all of the cohorts, all else equal. Although this finding may be viewed as a positive result for Navy women, it is a trend that should be closely monitored in the years ahead.

The occupation variables, as defined by DoD, showed no clear patterns of statistical significance in the promotion models in most cases. The only interesting trend

occurred in the Air Force models, where several of these occupation variables became significant after the drawdown began.

Although a person's occupation is apparently not significant in predicting promotion, it should be remembered that this conclusion is based on specific occupational groupings created by DoD for cross-service comparisons. A similar study employing disaggregated categories or occupation groupings used by the services might lead to different results.

The results of this thesis suggest that the defense downsizing has not adversely affected the promotion and career opportunities of female officers. Indeed, the promotion rates, times-to-promotion, and promotion models studied here indicate that only positive changes have occurred for women over the present course of the military's force reduction. At the same time, it should be emphasized that this conclusion is formed on the basis of a single study, limited in its scope and application of available data.

B. RECOMMENDATIONS

This thesis adopted a rather broad approach in attempting to study the effects of the defense drawdown on female officers in DoD. Any continuation of this study might try to focus more on service-specific models using, for example, variables for occupational communities as they apply to each individual service rather than to DoD as a whole. Alternatively, the models could be estimated separately by military occupational specialty, or community. The DoD aggregate occupation variables may mask important promotion differences across the service specific communities (Navy) or branches (Army). For example, it would be instructive to investigate promotion differences across the major unrestricted line communities of the Navy -- aviation, surface warfare, and submarine.

Since only two cohorts (three for the Navy) were used, a basic assumption is made that the first cohort represents the pre-drawdown period and the latter cohort is typical of the drawdown years. A much more thorough trend analysis could be accomplished if more cohorts were used, allowing a study of promotion for each year of the drawdown.

Furthermore, the study should be continued through the final years of the drawdown to capture any changes that result as personnel inventories stabilize.

Occupations may become more significant predictors of promotion in the next few years as changes in combat exclusion policies for women begin to take effect. Any future study of female promotion and career opportunities needs to account for these on-going changes, their interaction with other policies, and their impact on women's careers.

The differences in male and female promotion probabilities, particularly in the Navy, warrant further examination. Instead of showing decreasing chances of promotion, (an a priori hypothesis based on the literature review), the models point to an increased likelihood of promotion for women in all three Navy cohorts. This can be interpreted as a positive result, suggesting that the drawdown has thus far had no adverse effect on female promotion opportunities. However, the positive coefficients indicate that Navy women have an advantage over their male peers in terms of increased probability of promotion. Improved model specification might identify the source of these differences.

Due to data limitations, promotion models did not include measures of performance and information on college background. These are key predictors of promotion and would greatly improve model specification if they were available. Future studies of this type should strive to incorporate a data base that includes these important variables.

Finally, the structural relationship between retention and promotion must be fully investigated. This thesis only examined the promotion experiences of men and women who stayed in the military until the 0-4 promotion point, between ten and twelve years of service. Thus, promotion is conditional on staying in the military until this point. There could be significant gender differences in retention behavior that affect the estimated promotion probabilities. These possible connections should be explored and estimated.

APPENDIX: OCCUPATIONAL CONVERSION INDEX

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