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Middle-Term Loss Prediction Models for the Air Force's Enlisted Force Management System

Specification and Estimation

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PREFACE

This report presents and discusses loss equations that were developed for the Air Force's Enlisted Force Management System (EFMS) to enable projection of the enlisted personnel inventory by occupational specialty, grade, and years of service. The conceptual design of the EFMS includes a variety of loss models distinguished by the time horizon of their predictions (short, middle, or long term) and whether or not predictions are disaggregated by occupational specialty. The two loss models discussed here—the middle-term aggregate model and the middle-term disaggregate model—aim for predictions that are most accurate between one and six years into the future. For an overview of the EFMS, see Grace M. Carter, Jan M. Chaiken, Michael P. Murray, and Warren E. Walker, *Conceptual Design of an Enlisted Force Management System for the Air Force*, N-2005-AF, The RAND Corporation, August 1983.

The models specified in this report are not the models that will be used in the operational EFMS. The operational models will differ in parameter values and may differ in structure, partly because of changes in specification that resulted from test and evaluation. Also, the models will be updated using more recent data before they are used in the EFMS.

The methodology and results should be of interest to policy analysts, economists, and statisticians in the manpower and personnel communities in all of the military services and in the Department of Defense. They should also be of interest to analysts outside of the government who are involved in manpower and personnel research. The primary users of the numbers in the report are likely to be those in the Air Force who are building the EFMS.

The work described here is part of the Enlisted Force Management Project (EFMP), a joint effort of the Air Force (through the Deputy Chief of Staff for Personnel) and The RAND Corporation. Six of the authors are RAND staff members; the seventh, Harvey Greenberg, is a Major in the Air Force. RAND's work falls within the Resource Management Program of Project AIR FORCE. The EFMP is part of a larger body of work in that program that is concerned with the effective utilization of human resources in the Air Force.

SUMMARY

This report specifies loss equations that were developed for the Air Force's Enlisted Force Management System (EFMS) to forecast enlisted losses during a period from one to seven years from the time of the forecast. These loss models provide an improved tool for personnel managers in the Air Force. They show how airmen would respond to changes in economic conditions, military pay raises, and bonuses. For each occupation in the Air Force, they provide forecasts that reflect the historical behavior of airmen in similar occupations. These forecasts will be used to predict the inventory in each Air Force occupation. They also allow forecasts of the behavior of various demographic groups, which will be used in an inventory projection model that aggregates over occupations.

Avoiding biases in the estimation of key policy parameters, such as bonus and pay effects, requires the estimation of a single set of statistical loss models that embrace the detail of both the aggregate and disaggregate models. Those statistical models are specified in this report.

METHODOLOGY

The models treat one year in the career of an individual airman as the unit of analysis. Each loss equation gives the probability that an airman will leave the Air Force on or before the end of the next year of his term. Equations describe the loss probabilities at different career points. We first subdivide the loss rates according to the type of airman:

- First-termers
- Second-termers
- Those who have completed at least two terms but are not yet eligible for retirement (called "career airmen" in the EFMS)
- Those who are eligible for retirement

We further subdivide the first three groups of loss rates into three subgroups based on the relationship between the year of the term under consideration and when the term was first scheduled to be completed (called the original expiration of term of service, or original ETS, in this report):

- The last year of the enlistment contract (i.e., the year that ends at the original ETS)
- The years preceding the year of the original ETS, for which the major cause of loss is attrition. (For example, this group would cover each of the first three years of a four-year term of enlistment.)
- Each year beyond the original ETS in which the airman remains in "extended" status and has not yet reenlisted.

This defines the ten decision groups whose loss behavior we model. For the years that end at original ETS, we also model the probability that an airman who stays past his original ETS does so by extending his current term rather than by reenlisting for a new term.

We created a file, called the Year-at-Risk (YAR) file, that contains longitudinal information on Air Force enlisted personnel, giving demographic characteristics, military histories of individual airmen, and economic conditions pertinent to loss decisions. The equations in this report were fitted with a 30 percent sample of data from the YAR file, representing airmen who were on regular active duty between June 30, 1973 and June 30, 1983.

Each equation models the outcome of the decision as a linear function. The independent variables for the models are either airmen's demographic traits (e.g., sex, race, education), Air Force circumstances (e.g., occupation, years of service, grade), or economic conditions (e.g., unemployment rate, an index of the ratio of military wages to civilian wages).

DEMOGRAPHIC CORRELATES OF LOSS BEHAVIOR

Table S.1 displays the demographic variables that appear in the middle-term loss equations. As the table makes clear, demographic influences lessen as an airman is in the force longer. The demographic effects in the equations conform closely to those that have been found by previous researchers; the only differences are the persistence of sex, race, and marital status effects through the second-term ETS decision, and a more refined treatment of the stay/leave decision process that allows us to distinguish, for example, three first-term attrition effects (for three periods) for each demographic variable.

Demographic effects are most varied in the first-term attrition equations. Attrition decreases with more education and better test scores. Those who join the Air Force before they are 18 leave at a higher rate than others throughout the first term. Those who join the Air Force after they are 18 leave at a slightly higher rate during their first year in the Air Force than those who join at exactly 18, but this effect reverses during the remainder of the term. Six-year enlistees who join the Air Force before age 18 leave at a slightly higher rate during their first year of service and at a slightly lower rate in later years of service (YOS) during the first term than would be predicted by the separate effects of term of enlistment, age, and other demographic effects.

Table S.1

DEMOGRAPHICS IN THE LOSS AND EXTENSION EQUATIONS

	Model							
	First-Term Attrition			First-Term ETS		Second-Term ETS		
Characteristic	Basic Training	Months 3–12	YOS ≥ 1	Loss	Extend Given Stay	Loss	Extend Given Stay	Retire
Older than 18	+	+	−					
Younger than 18	+	+	+					
Age × term length	x		x					
Black	−	−	x	−		−		
Female	+	+	x	−	x		+	
Single	−	+	+	+	+	+	+	
Dependents > 1		+	+					
Sex × marital status				x	x			
Female black		−	x					
Sex × occupation			x					
High school graduate	−	−	−		+			−
Some college						+	+	−
High intelligence	−	−	−		+			

NOTES: + = higher loss or extension rates for the group; − = lower loss or extension rates for the group; x = a statistically significant effect whose sign for the group may depend on other interactions in the equation.

Those who were married but without children when they entered the service had modestly lower attrition rates after Basic Military Training (BMT) than singles or persons with more than one dependent. Married recruits appear to have a slightly harder time getting through BMT.

Most previous studies of attrition in the Air Force found either no difference or only small differences due to race. We find that the first-term attrition rate is much higher for white women than for black women, but the difference in attrition rates between black men and white men is very small. The similarity in the rates for men and the preponderance of men in the Air Force means that the average rate does not differ much by race.

Demographic effects are simpler in the first-term ETS model than in the first-term attrition model. We find no effect of Armed Forces Qualification Test (AFQT) score on the stay/leave decision in the first term, but we do find that graduates and persons without low AFQT scores are more likely to extend than to immediately reenlist, thus decreasing their total reenlistment rate. The first-term reenlistment rate is lower for single persons than for married persons, but marital status is a much more important determinant of the first-term ETS decision for men than it is for women.

The total first-term reenlistment rate is higher for women than for men. Thus gender, in addition to education and AFQT score, has an effect on the first-term ETS decision that is opposite in sign from its effect on attrition. As other researchers have found previously, we find that blacks are less likely than whites to leave at ETS.

The demographic effects on second-term reenlistment decisions are even simpler than those at first-term ETS. The only important effects, as shown in Table S.1, are race, gender, marital status, and whether the airman has ever attended college.

After the second-term ETS, demographics play no discernible role in airmen's decision-making until they reach retirement eligibility. Airmen with some college training are significantly less likely to leave the Air Force during the retirement years than those with only a high school degree or those who never completed high school.

Air Force Circumstances

Table S.2 reports the variables pertaining to an airman's circumstances in the service that appear in the middle-term loss equations. The importance of these circumstances does not diminish with length of service as demographic effects do. Behavioral differences across occupations do become less for airmen beyond the second term, but the effects of grade, and particularly of years of service, become greater over an airman's career. The estimated effects of term of enlistment (TOE), grade, and years of service conform in general to those that previous researchers have found. The chief difference lies in the richer structure of stay/leave decisions incorporated in our models.

We find that from the beginning of the second term through 29 years of service, airmen in lower grades are more likely to leave the service than are airmen in higher grades. There is so little variation in grade at the first-term ETS decision that the effect of grade is indiscernible.

We asked if the causality between grade and loss behavior perhaps runs from the latter to the former, so that promoting additional airmen would have less effect on loss rates than the estimated equations suggest. Our analysis, conducted for second-term airmen, failed to reject the hypothesis that all the causality runs from grade to loss behavior. The small number of years of data in our sample makes this a weak test, so we urge future researchers to study the issue in greater detail.

Table S.2

AIRMAN'S CIRCUMSTANCES IN THE LOSS EQUATIONS

Characteristic	First-Term Attrition: Months 3–12	First-Term Attrition: YOS ≥ 1	First-Term ETS: Loss	First-Term ETS: Extend Given Stay	First-Term Extension: Nondecision-makers	First-Term Extension: Decision-makers	Second-Term Attrition: All Years	Second-Term ETS: Loss	Second-Term ETS: Extend Given Stay
Lower grade							+	+	+
More years of service		x					+	–	–
Six-year enlistees	+	+	x	–					
TOE × demographics	x	x							
TOE × grade								x	
TOE × pay			x						
Air Force Specialty Code			x	x				x	x
Career field		x					x		
Career field group					x	x			
Career field group × demographics		x							

Characteristic	Second-Term Extension: Nondecision-makers	Second-Term Extension: Decision-makers	Career Attrition: All Years	Career ETS: Loss	Career ETS: Extend Given Stay	Career Extension: Nondecision-makers	Career Extension: Decision-makers	Retirement: All Years
Lower grade			+	+				x
More years of service			–	–	x			x
Term of enlistment			+					
TOE × YOS			x					
Career field								x
Career field group	x	x	x	x		x	x	
Career field group × YOS				x				
Grade × YOS			x	x				
High year of tenure								x
Year in grade								x

NOTES: (1) + = higher loss rates for the group; – = lower loss rates for the group; x = a statistically significant effect whose sign for the group may depend on other interactions in the equation, or may vary across subgroups, or is not monotonic.

The strongest effects of grade are in the retirement years, where high year of tenure (HYT) rules force the separation of a large proportion of airmen.

Airmen in the first and second terms leave less frequently as their years of service (and years served within the term) increase. In the career years, attrition declines as years of service increase, but increases as the years served within the term increase. Non-attrition losses decrease as years of service increase in the first, second, and career terms.

The effect of year of service in the retirement years is dominated by the high year of tenure rules. Excluding cases for which HYT is effective, retirement losses are highest at 20 years of service, fall slightly from years 21–25, and generally rise thereafter.

An airman's term of enlistment is correlated with his loss behavior. In the first term, annual attrition losses for six-year enlistees are higher than those for four-year enlistees. Second-term attrition is not measurably influenced by term of enlistment. In the career terms, annual attrition losses are again found to be higher for six-year enlistees.

Of special importance to the EFMS is the ability of the middle-term loss models to forecast occupation-specific loss rates. In the first and second terms, occupations are distinguished to the AFSC (Air Force Specialty Code) level (for AFSCs with many personnel). In later terms, more aggregate depictions of occupation suffice.

Estimated first-term annual attrition rates for years beyond the first vary by as much as 23 percent across AFSCs, although variations of 3 percent are most common. By the second term, the magnitudes of the occupational effects on attrition are quite small, with only a few career fields differing much from the norm. The attrition effects are clustered so that the fields with higher attrition rates contain either administrative personnel or craftsmen. In the career years, occupational differences in attrition are even smaller.

The effect of occupation on ETS losses is quite different from its effect on attrition losses. When AFSC effects are averaged across AFSCs in each of four broad occupational categories (which we called Career Field Groups or CFGs), we found that skilled technicians had the highest loss rates and the greatest propensities to extend rather than reenlist at the end of both the first and second terms. These data are consistent with our a priori expectations that Skilled Technicians have better civilian career opportunities than other airmen and that civilian opportunities play a large part in end of term decisions.

Early in the career years, loss rates among CFGs differ in an absolutely small, but measurable degree. Airmen in the Skilled Technician CFG leave the service most often, while airmen in the Functional Support and Administration CFG and in the Craftsmen, Service, and Supply Handlers CFG leave least often. Beyond 12 years of service, however, the differences among the Career Field Groups become inconsequential.

In the retirement years, occupational effects become more varied than during the career years. Separate effects for each career field can be discerned and were estimated. The pattern of effects is not as strongly related to Career Field Groups as in the first-term and second-term models.

ECONOMIC CONDITIONS AND INCENTIVES

Economic variables appear in all but the attrition equations (see Table S.3). Unemployment appears in all non-attrition equations except the first-term and career extend-given-stay equations. The military/civilian pay ratio appears in all non-attrition equations except the extension and retirement loss models and the first-term and career extend-given-stay models. The absence of economic effects in the attrition equations does not surprise us, but we do expect pay effects to be uncovered in the first-term extend-given-stay model when more data become available.

In all cases, the signs of the coefficients are consistent with expectations based on economic theory. Losses increase and reenlistments decrease with decreases in unemployment, decreases in military wages relative to civilian wages, and decreases in the bonus amount.

Bonuses appear in the first- and second-term non-attrition equations, except the one for extension decisionmakers. We found that in the first term the first bonus multiple increases the fraction of airmen in a typical AFSC who stay past ETS by about 3.4 percentage points. However, it also increases the fraction of airmen who immediately reenlist out of those who stay past ETS by 3.8 percentage points. Each subsequent bonus multiple decreases the ETS loss rate by 1.3 percentage points and increases the immediate reenlistment rate by 3.8 percentage points. Thus, the bonus has a larger effect on immediate reenlistments than it has on immediate losses. Since many of those who extend leave during the next year or two, the full effect of a bonus on retention is not visible until the cohort is at least two years past ETS.

In the second term, as in the first, we find that the bonus has a larger effect on the immediate reenlistment rate than it does on the immediate loss rate. We also find that second-term loss rates are higher the greater the proportion of the second-termers who received bonuses at the end of their first term.

Table S.3

ECONOMIC CONDITIONS IN THE LOSS EQUATIONS

	Unemployment	Military/ Civilian Pay Ratio	Bonus Multiple	Cross Bonus Average	Received Bonus at First Reenlistment
First term					
ETS loss	–	–	–	–	
ETS extend | stay			–		
Extension decisionmakers	–				
Second term					
ETS loss	–	–	–		+
ETS extend | stay	–	–	–		
Extension decisionmakers	–				
Career					
ETS loss	–	–			
ETS extend | stay					
Extension decisionmakers	–				
Retirement	–				

NOTE: + = higher loss rates for the group; – = lower loss rates for the group.

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Most of the source data used for this study were furnished by the Defense Manpower Data Center. We would like to thank the Center's staff, particularly Mrs. Barbara Cunningham, Mr. Robert Brandewie, and Lieutenant Michael Schissel, for their efforts in creating the data files. We also thank Daniel Relles of RAND who helped this study on both of its ends: he contributed substantially to building the Year-at-Risk file, from which our analysis files were created; and provided a very helpful review of an earlier draft of the report. The critique of an earlier draft by Donald Waldman of the University of Colorado was also exceptionally useful.

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I. INTRODUCTION

This report specifies middle-term loss equations that were developed for the Air Force's Enlisted Force Management System (EFMS). The conceptual design of the EFMS[1] includes a variety of loss models distinguished by the time horizon of their predictions (short, medium, or long term). This document concerns only the middle-term loss models—those intended for forecasting losses one to seven years into the future.

The loss models developed here provide an improved tool for personnel managers in the Air Force. For example, in the past managers relied on ad hoc procedures for estimating the influence of unemployment, pay, or bonuses on loss rates. At best, elasticity estimates drawn from studies of ancillary problems were adapted to a manager's needs. The suitability of such estimates for use in extrapolated circumstances has not been tested, and because these ad hoc efforts ignore differences in specialities, they may yield biased findings. Those few studies that do estimate occupation-specific loss functions[2] frequently have coefficient estimates with large variances arising from limited sample sizes. Consequently, such models have not been used in ongoing management programs.

The models in this report use a very large sample of airmen to incorporate occupational effects into models of loss rates. Our approach to determining the effect of occupation on loss rates is to pool data across occupations *except* when the data show differences that are *both* large enough to be of policy importance *and* that are unlikely to be due to random errors. We show that such differences exist and can be adequately captured by reasonably simple models. Although the models require a substantial amount of data for estimation, they require only a modest amount of data for operational use.

Research has shown that the reenlistment decisions of first- and second-term airmen are affected by economic conditions. But little is known about the relationship between economic conditions and airman attrition, career reenlistments, or retirement. In building the models reported here, we tested for the effect of economic conditions at all stages of an airman's career; when the tests supported the existence of economic influences, economic variables were included in the models.

MODEL STRUCTURE

We have chosen simple structures for the middle-term loss equations. Most posit the probabilistic depiction of the outcome from any one decision to be a linear function of the airman's traits, circumstances, and economic opportunities. In particular, we eschew more sophisticated models that recognize the interdependence among an airman's choices at different times. The simple models we choose sacrifice that theoretical richness for less difficult estimation and, for our purposes, increased forecasting power.

A much more sophisticated approach for modeling airman losses would be to employ the Dynamic Retention Model of Gotz and McCall (1984). It offers a consistent framework for explaining how complicated changes in airman compensation, such as changes in the retirement system, would alter stay/leave decisions throughout an airman's career. However,

[1]See Carter et al. (1983).

[2]See, for example, Stone (1983).

difficulties in estimating that model's parameters precludes incorporating very many airman traits (such as race, sex, marital status, Air Force Specialty Code (AFSC), and Armed Forces Qualification Test (AFQT) scores) into an estimated model. Consequently, predictions of losses based on such a model would not capture the systematic variation in loss rates across demographic groups or across AFSCs. The simpler specifications we chose for the middle-term equations incorporate these covariates with ease.

Argüden (1986) compared a Gotz-McCall style loss model with simpler loss models. His analysis finds that simpler specifications can work effectively across a wide variety of changes in economic opportunities. He also clearly identifies the kinds of compensation changes whose effects simpler models will not forecast well. For example, the effects of military pay increases can be forecast adequately by simple models, but the effects of the new military retirement system cannot. Argüden also developed a simulation tool that will be part of the EFMS and will allow his analyses to be extended to cover these complex changes in compensation.

Models more complex than the middle-term loss equations but less complex than the Gotz-McCall model have been used in several services for analyzing military compensation policies. (They are the ACOL[3] and PVCOL[4] models.) These models are simpler to estimate than the Gotz-McCall model, but, as Argüden shows, they perform poorly in forecasting the effects of some complex changes in military compensation. Consequently, these models would need to be supplemented by analyses such as Argüden's just as the simple equations are.

Intermediate models would perform comparably to the simpler models for the most frequent changes in economic opportunities, but they would be computationally more demanding. Their only advantage would be that for certain complex compensation changes, their forecasts would reflect more subtle behavioral considerations. But since analysis is needed to check both the intermediate and simple models in the face of complex compensation changes, this advantage is of little importance for the EFMS. We, therefore, chose simpler probability models (primarily linear models) for the middle-term loss equations.

An integral activity of the EFMS will be the periodic updating of the middle-term loss equations as new data become available. If those data indicate that a change in regime has occurred, the model will be respecified to reflect the new structural circumstances. Thus, one might describe the middle-term loss equations as an adaptive approximation to a more complex underlying behavioral model. (The sections that follow contain numerous tables indicating the within-sample performance of the estimated models. The models have also been tested and their performance evaluated outside the sample period.)

Linear probability models have the undesirable characteristic that calculated probabilities can be greater than one or less than zero. This will rarely be a problem when the loss equations are used in the middle-term inventory projection models (IPMs) of the EFMS, because (1) the independent variables used for the forecast will be similar to those used to fit the models, and (2) the IPM will use the average prediction for all airmen in each cell. Thus, in the IPM it may be adequate to merely truncate rates that are out of the range from 0 to 1. An alternative would be to transform the estimated linear probability models into estimates of corresponding logistic probability functions—functions that preclude calculated probabilities greater than one or less than zero. The rationale for this transformation is an adaptation of the argument of Haggstrom (1983) that shows conditions under which linear regression estimates are consistent estimates of a transformation of a logistic function's parameters. Appendix C gives the necessary formulas for making this transformation.

[3]Annualized Cost of Leaving.

[4]Present Value of Cost of Leaving.

Two considerations constrain the structure of middle-term loss models. First are the practical needs of the personnel programmers and planners who will use the projections. Their applications require that losses be projected by AFSC, grade, years of service (YOS), and several demographic attributes.[5] The second constraint is to avoid statistical biases in policy variables that might arise if relevant variables were omitted from the model. For example, if bonuses are given more often in AFSCs that would otherwise have above average loss rates, failure to account for an airman's AFSC in the model would bias estimates of bonus effects.

The conceptual design of the EFMS refers to two sets of middle-term loss models: aggregate and disaggregate models. The aggregate models chiefly support planning and reporting activities. They do not distinguish airmen by occupational specialty, but do provide demographic detail as well as loss rates by year of service and grade. The disaggregate models chiefly serve personnel programming activities, such as bonus management. They require AFSC, grade, and year of service detail, but do not need demographic detail.

Avoiding biases in the estimation of key policy parameters, such as bonus and pay effects, requires the estimation of a single set of statistical loss models that embraces the detail of both the aggregate and disaggregate models. It is those statistical models that are specified in this report.

When these middle-term loss models are incorporated into the aggregate and disaggregate inventory projection models of the EFMS, the "superfluous" details of the statistical models (occupation in the case of the aggregate IPM, demographics in the case of the disaggregate IPM) will be swallowed into the constant terms of the models by fixing the superfluous variables at the levels holding at the time forecasting is done.

The models are built using one year in the career of an individual airman as the unit of analysis. Each loss equation gives the probability that the airman will leave the Air Force on or before the end of the next year of his term. Different equations are used to describe the loss probabilities at different career points. We first subdivide the loss rates according to the type of airman: (1) first termers; (2) second termers; (3) those who have completed at least two terms but are not yet eligible for retirement (called "career airmen" in this report); and (4) those who are eligible for retirement. We further subdivide the first three groups of loss rates into three subgroups based on the relationship between the year of the term under consideration and when the term was first scheduled to be completed (called the original expiration of term of service or original ETS in this report): (1) the last year of the enlistment contract (i.e., the year that ends at the original ETS); (2) the years preceding the year of the original ETS, for which the major cause of loss is attrition (for example, this group would cover each of the first three years of a four-year term of enlistment); and (3) each year beyond the original ETS in which the airman remains in extended status and has not yet reenlisted. We thus have the following ten decision groups for which we model loss behavior, as discussed in succeeding sections of the report):

1. First-term attrition (Sec. II)
2. Second-term attrition (Sec. III)
3. Career attrition (Sec. IV)
4. First-term ETS (Sec. V)
5. Second-term ETS (Sec. VI)

[5]Two typical applications involve evaluating the effect of alternative bonus plans on AFSC manning and evaluating the impact of a change in the education level of recruits.

6. Career ETS (Sec. VII)
7. First-term extension (Sec. VIII)
8. Second-term extension (Sec. VIII)
9. Career extension (Sec. VIII)
10. Retirement (Sec. IX)

To orient readers to the loss categories listed above, Fig. 1.1 shows the pattern of losses for a representative cohort of 60,000 four-year enlistees who enter the service together. The abscissa of the figure is the number of full years of service (YOS) an airman in the cohort has already completed in the Air Force. Thus, an airman's first year of service is YOS 0, his second year of service is YOS 1, etc. The loss rates used to build the figure are means from the sample data. No cohort actually has had precisely these loss rates, and indeed, our sample is not long enough to track the history of any entering cohort through the 30 years its members may serve. For simplicity, the figure assumes that all reenlistments are for four-year terms, which include as part of the four years any period of extended service in the previous term. The figure makes obvious the importance of the first-term models for forecasting the size of the force. Nearly three quarters of the airmen leave the service before the second term, and more than half of these losses occur right at the end of the first term. In relative terms, losses at the end of the second term and at the 20-year point are also especially large, with nearly a third of the airmen reaching each of these decision points choosing to leave the service.

In the first two months of service, when most enlistees are in basic military training (BMT), attrition losses cut the cohort to 56,820 airmen. (A short name for the model(s) that predict losses during the interval is listed below the years of service axis and decoded in the legend. For example, the model for BMT losses is denoted 1att2 in the figure.) During the remainder of the first year of service, when most enlistees engage in specialty training, attrition losses cut the cohort to 52,445 airmen. During the remaining years prior to the year in which the airman's original obligations end, attrition losses further cut the cohort to 42,711.

Only 22,210 airmen in the cohort remain beyond the originally scheduled end of their first term of service, of whom 12,326 extend their initial term of service beyond the initial ETS. During the following year, some airmen who extended their first term leave the service, either within one year of their new ETS or more than one year prior to their new ETS. In the second year beyond the original first-term ETS, the remaining airmen who extended their first terms leave or reenlist.

Attrition losses in the second term and the above losses cut the cohort to 14,807 who make a decision whether to stay or to leave at the end of their second term. Only 11,401 remain in the service beyond their original second-term ETS, of whom 4367 extend their second terms. Again, some airmen who extend leave the service more than one year prior to their new ETS, while others leave within one year of their new ETS.

The losses from second-term extension status occur at the same time as attrition losses among airmen who reenlisted for a third term of service. Together these losses cut the cohort to 9697 airmen who make a decision whether to stay or to leave at the end of their third term. A total of 9396 remain in the service beyond their original third-term ETS, of whom 2255 extend their third terms. Again, some airmen who extend leave the service more than one year prior to their new ETS, while others leave within one year of their new ETS.

These losses from third-term extension status occur at the same time as attrition losses among airmen who reenlisted for a fourth term of service. Together these losses cut the cohort to 8998 who make a decision whether to stay or to leave at the end of their fourth term. A

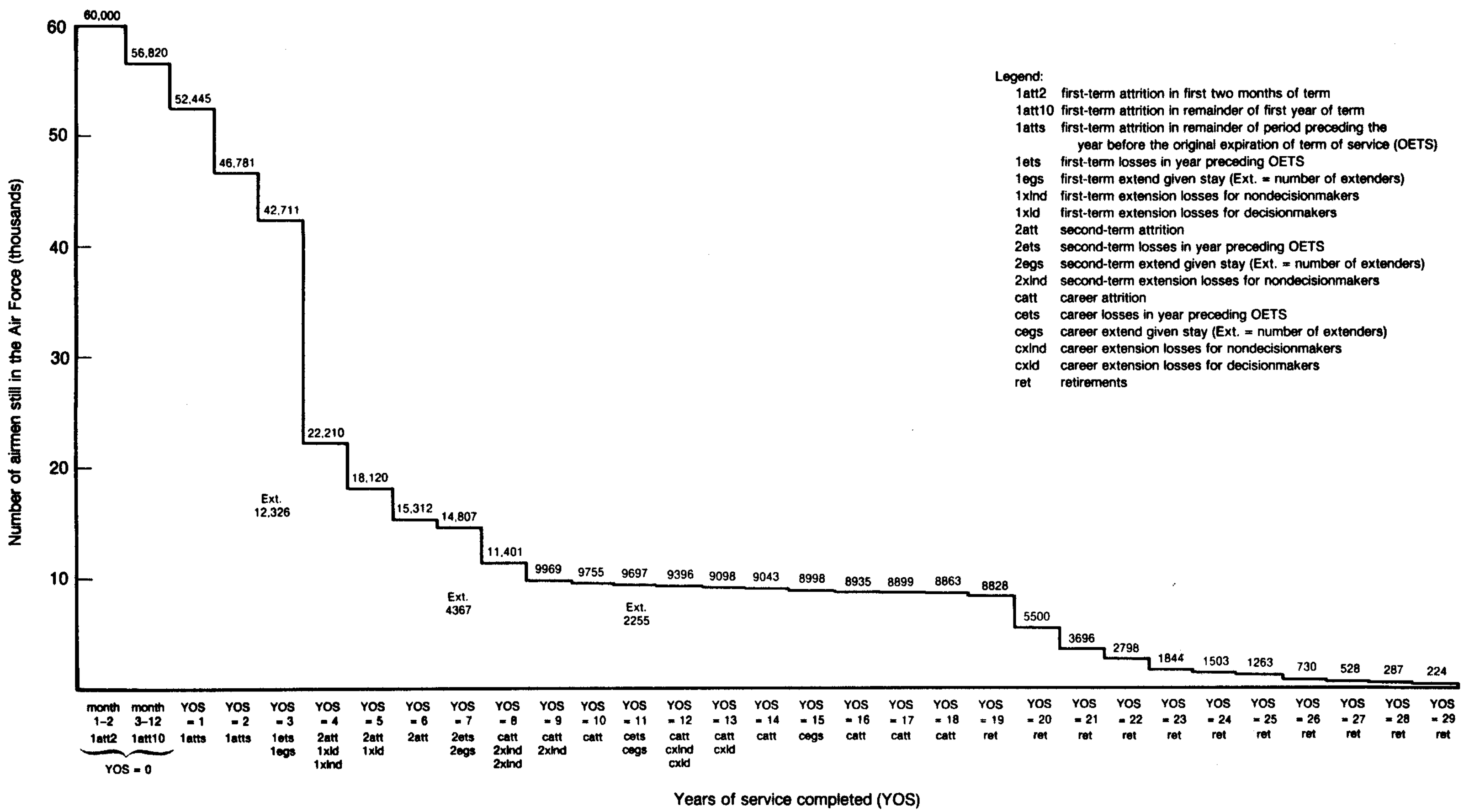

Fig. 1.1—Progression of a representative cohort of 60,000 four-year enlistees

airmen cuts the cohort to 8828 airmen who make a retirement decision at the end of 20 years of service.

Only 5500 airmen stay in the service beyond their twentieth year; by the twenty-ninth year only 224 of these airmen have not yet retired.

DATA SOURCES

Fitting these loss models required using data files that contained three types of information:

- Demographic profiles of cohorts of airmen
- Military histories of individual airmen
- Economic conditions pertinent to loss decisions

No single file contained all three types of information. We therefore created a file, called the Year-at-Risk (YAR) file, which contains longitudinal information on Air Force enlisted personnel. The models in this report were fit with a 30 percent sample of data from a YAR file consisting of airmen who were on regular active duty between June 30, 1973 and June 30, 1983. Preliminary analyses were performed using a 30 percent sample from an early version of the file (called the ETS file) that contained information on enlisted persons who were on regular active duty between June 30, 1973 and June 30, 1980. When we refer to preliminary results in the remainder of this report we mean the results obtained using these data.

Each airman's record in the YAR includes:

- Traits at time of enlistment (e.g., education and marital status)
- An annual snapshot of the airman (e.g., grade and occupation)
- Data on up to three transactions per year (e.g., reenlistments, extensions, and losses)
- Economic variables for each year (e.g., unemployment rate)

The YAR files have two important advantages over the files used in the preliminary analyses. First, the additional three years of data offered a substantial increase in the variability of unemployment and pay. Second, the YAR files contain much improved measures of several key variables, such as term of service (improvements developed as products of the preliminary analyses).

EXPLANATORY VARIABLES

Three classes of variables appear in the middle-term loss equations. There are variables for:

- An airman's demographic traits
- An airman's circumstances in the service
- An airman's economic opportunities

Not all classes appear in every model. In this subsection, we briefly discuss how we derived variables to capture occupational differences among airmen and economic effects.

We categorize occupation at three different levels of detail depending on the particular model. At the most detailed level we distinguish individual occupations. By tracking the Air Force's conversions of AFSCs over time, AFSC designations at each date were mapped into a corresponding AFSC as of October 31, 1980 (for the preliminary analyses) or April 29, 1983 (for the revised models). These "ultimate" AFSCs are contained in each airman's YAR records (see App. A).

The use of AFSCs in the models introduces a methodological problem. Only 20 percent of the AFSCs contained as many as 100 airmen in the samples used and many AFSCs contained only a handful of airmen. Such small AFSCs do not allow precise estimation of AFSC-specific effects. Consequently, some clustering of small AFSCs into larger groups is sure to achieve smaller mean square errors of forecasts. However, clustering of AFSCs that do not have identical AFSC-specific effects on losses risks biasing the estimates of the bonus coefficients in the model—a risk we were unwilling to tolerate. To balance these two conflicting pressures we estimated the models that contain AFSC-specific effects in two stages. First, we estimated the models by ordinary least squares, including a dummy variable for each AFSC. Second, we clustered small AFSCs into what we thought were relatively homogeneous groups and estimated the group-specific effect as the mean AFSC-specific effect (measured by the estimated coefficient of the AFSC's dummy variable) among airmen in the cluster. In effect, for the non-AFSC coefficients we sacrifice the efficiency gained from clustering to avoid introducing biases into the bonus coefficient estimates, while we preserve the efficiency from clustering for estimation of the AFSC effects themselves.

In several of our models[6] we found that the effects of occupation on losses were indistinguishable among AFSCs in the same career field (first two digits of the AFSC). In those cases we include career fields in the models and not AFSCs.

In other models we found yet larger aggregations of occupations to be appropriate. We based these groupings on the four-part categorization of occupations used by Buddin (1981) to describe first-term attrition in the Army and Air Force. We assigned each career field to one of the four Career Field Groups (or to a residual category, "unknown"), guided by Buddin's original assignment of AFSCs and by empirical patterns of losses. The assignments used for the middle-term models are a refinement of Buddin's and are contained in Table A.1 of Appendix A.

Economic variables appear in all but the attrition equations. Unemployment appears in all non-attrition equations except the first-term and career extend-given-stay equations. In all cases, we used the log of the monthly unemployment rate for 20–24 year olds averaged over the 12 months of the year at risk. The military civilian pay ratio appears in all non-attrition equations except the extension and retirement loss equations and first-term and career extend-given-stay equations. (Pay effects may be uncovered in some of these models when more data are available.)

In our preliminary analyses, we investigated whether the size of the response to change in the amount of the bonus differs by occupation. To test for differences in the first-term ETS bonus response, we fit a separate slope for each AFSC in our sample. We could not reject the null hypothesis that all the slopes were the same. Our models, therefore, have no AFSC-specific bonus effect.

OVERVIEW

The middle-term loss equations presented in Secs. II through IX result from a detailed empirical analysis of airman loss behavior—perhaps the most detailed ever undertaken. The simple models these analyses produced lack the behavioral richness of, say, Argüden's (1986)

[6]None of these were for decisions that were affected by bonuses.

model of loss behavior that the Enlisted Force Management Project (EFMP) developed for analyzing complex policy changes, such as revisions in the retirement system. But the middle-term loss equations complement such theoretically rich models with a degree of empirical detail that adds markedly to our understanding of who stays and who leaves the Air Force at different career points. In particular, the inclusion of occupation-specific effects in the equations should increase their forecasting power relative to theoretically rich but empirically parsimonious specifications. At the same time, the inclusion of simple economic variables in the models should markedly improve their forecasting power relative to the models that have been available to the Air Force in the past.

II. FIRST-TERM ATTRITION

SPECIFICATION OF THE MODEL

There are several equations within the first-term attrition model. In all equations, the dependent variables are 0/1 variables that indicate whether an airman left the service (= 1) or remained in the service (= 0) during a specific portion of his first term. The independent variables all enter the equation linearly.

Previous research on the Enlisted Force Management Project showed that, following Basic Military Training, losses occur at approximately a constant rate throughout the first year.[1] Consequently, we have two equations for attrition during the first year of service: (1) losses during the month of accession and the following two months to represent basic training losses, and (2) losses during the remainder of the first year of service. Each equation gives the probability that an enlisted person will leave the Air Force during the relevant time period. These equations describe the loss probability of an individual based on his characteristics at accession.

In preliminary analyses, we first fit one equation to give the probability of attrition during each year of service beyond the first. However, the several equations were indistinguishable except for the constant term. Consequently, the specification contains just a single equation for attrition beyond the first year of service, with a dummy variable to distinguish the year of service being predicted. Other explanatory variables include the AFSC and demographic characteristics at accession.

For attrition losses before completion of training, we did not distinguish training losses by the occupational specialty for which the attritee was being trained. Data that indicate the occupation are not available in a substantial fraction of cases. In some cases—e.g., basic training losses of personnel who have not yet been assigned to a specialty—the occupational designation is logically impossible. Information on the trainees' specialty is not necessary for management of end strength, accessions, or trained personnel requirements.[2]

Our information about occupational specialty comes from two sources: (1) snapshots that describe the primary AFSC[3] of each currently enlisted person as of the end of June of each year, and (2) the control AFSC[4] that is in effect when a person leaves the service, extends, or reenlists. The control AFSC tells us the occupation of attritees who have completed training. However, since we do not have historical data concerning the dates at which training was completed, we cannot be sure how many persons trained in each specialty were at risk for attrition at any one point in time. Our solution to this problem was to examine attrition losses by specialty among only those who have completed at least 12 months of service, almost all of whom have an occupational specialty code recorded on the YAR file. When the model is used, occupational effects can be extrapolated backwards in order to estimate losses of trained personnel during YOS 0.

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[1]Based on unpublished work by Joseph Adams and Jan Chaiken: "Short-Term Loss Prediction Model for Air Force Enlisted Members: First-Term Attrition," The RAND Corporation.

[2]The EFMS also needs to estimate training costs. But this requires data about persons who are "recycled" through the same training course and about others who are entered into a different specialty after dropping out of training in addition to the loss data on trainees. All of these are beyond the scope of this model.

[3]The primary AFSC is the one in which the person has been certified at the highest skill level.

[4]The control AFSC is the one in which assignments are to be made.

VARIATIONS AMONG SPECIALTIES

The middle-term disaggregate loss model is designed to predict loss rates by AFSC. An important question is whether we can reliably predict loss rates by AFSC or whether we should merely estimate a single attrition rate and apply it to each AFSC.

The question has two parts—are differences among AFSCs statistically significant and, if so, are they meaningfully different? In tests we found statistically significant differences. Table 2.1 gives attrition rates for 23 of the largest AFSCs and shows that there are meaningful differences. Air Force policymakers care about AFSC-specific loss rates. The magnitudes of loss rate differences across AFSCs and the sample sizes for AFSCs depicted in the table suggest that we should and can predict separate attrition rates for the larger AFSCs. However, there is also a lot of variation in attrition rates among small AFSCs that we will not be able to predict reliably; attrition rates in those AFSCs should be estimated jointly.

Table 2.1

SAMPLE ANNUAL ATTRITION RATES BY YOS AND AFSC

	During YOS 1		During YOS 2	
AFSC Group	Sample Size	Loss Rate	Sample Size	Loss Rate
306X0	111	.027	99	.010
304Y4	134	.015	122	.033
321X2Q	433	.060	388	.049
645X0	645	.075	571	.051
511X0	230	.078	208	.038
672Y2	247	.061	227	.066
462Y0	399	.085	354	.071
361X0	183	.082	161	.075
431X1F	159	.101	137	.051
427X5	141	.085	125	.072
251X0	123	.089	103	.068
545X0	122	.074	104	.087
542X2	227	.088	205	.088
902X0	461	.100	401	.082
981X0	153	.105	134	.082
906X0	115	.139	95	.053
431X1E	445	.101	386	.096
603X0	113	.115	100	.140
811X2	801	.111	692	.105
571X0	435	.117	345	.119
631X0	244	.184	197	.086
276X0	196	.184	159	.119
811X0	1278	.144	1092	.105
Total (all AFSCs)	17,108	.095	15,363	.076

SOURCE: From preliminary analysis based on 30 percent sample from the ETS file; includes only accessions between July 1975 and June 1976 with a four-year term of enlistment. Omits persons released through an early-out program. The AFSCs were chosen to cover the range in the attrition rates experienced by AFSCs in which at least 100 of the cohort were trained.

RESULTS

The model for attrition during the first year of service is shown in Table 2.2 and for attrition during the rest of the first term in Table 2.3. We discuss these findings and the analyses that led to them below according to the following major categories of variables: (1) demographics, (2) service-related variables (term of enlistment and year of service), (3) occupation, and (4) cohort and temporal effects.

Demographics

The effects on attrition in each year of service related to education, Air Force Qualification Test score, and age are precisely what we expected to find, based on the literature. (See, for example, Buddin (1981), Blandin (1980), and Lockman (1976).) Attrition decreases with more education and better test scores. Those who join the Air Force when they are young leave at a higher rate than others throughout the first term. In addition, those who are older than 18 leave at a slightly higher rate during their first year in the Air Force than those who join at exactly 18, but this effect reverses during the remainder of the term.

The accessions in our sample took different qualifying examinations depending on the year they entered the service. In preliminary analyses, however, we could find no differences among cohorts in the relationships between the AFQT category and attrition.[5]

Table 2.2

MODEL FOR FIRST-TERM ATTRITION DURING FIRST YEAR OF SERVICE (YOS 0)

	First Two Months		Rest of First Year	
Predictor Variable	Coefficient	t-Statistic	Coefficient	t-Statistic
Not a HS graduate	.061	21.99	.105	30.06
At least some college	–.020	–8.98	–.021	–7.65
AFQT Group I or II	–.015	–11.94	–.022	–13.93
AFQT Group IV or higher	.003	2.20	.003	1.82
Age 17 or younger	.017	8.62	.041	16.18
Age 19 or older	.005	4.14	.008	5.00
Single	–.026	–16.62	.007	3.23
More than 1 dependent	—	—	.018	5.19
Male	–.011	–7.37	–.028	–14.14
Black	–.029	–17.94	—	—
Black female	—	—	–.036	–7.52
Six–year enlistee	—	—	.009	3.61
Six–year term × age < 17	—	—	.029	3.86
Constant term	.089	38.34	.09	29.03
Mean loss rate	.053		.077	
Sample Size[a]	(168,483)		(159,627)	

NOTES: All variables are based on characteristics at accession. Results are based on a 30 percent sample from the YAR file of persons who joined the Air Force after June 1973 and before July 1982 and were present at the start of the period and either left or were observed for the entire period.

[a]Number of person-years observed.

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[5]We tried two different specifications. In the first, we tested all possible interactions between cohort and score category. In the second, we grouped the cohorts as follows: Group 1 was FY74 and FY75 accessions which were years when a separate Air Force test was given rather than the later armed-services-wide test; Group 2 was FY76 and FY77;

Table 2.3

MODEL FOR FIRST-TERM ATTRITION AFTER FIRST YEAR OF SERVICE

Predictor Variable	Coefficient	t-Statistic
Not a HS graduate	.083	26.72
At least some college	-.017	-6.97
AFQT Group I or II	-.010	-7.26
AFQT Group IV or higher	.003	2.08
Age 17 or younger	.045	19.86
Age 19 or older	-.005	-3.64
Single	.013	6.88
More than 1 dependent	.008	2.63
Female and white	.040	18.55
Female in FSADM[a]	-.031	-8.07
Female in UNK[b]	-.019	-3.74
Black and male	.012	5.73
Black male in FSADM	-.020	-4.45
4-year enlistee in YOS 2	-.013	-9.35
6-year enlistee in YOS 1	.016	5.54
6-year enlistee in YOS 2	.005	1.56
6-year enlistee in YOS 3	-.004	-1.19
6-year enlistee in YOS 4	-.022	-5.77
Age 17 and 6-year enlistee	-.019	-3.43
AFSC dummies	Table B.1	
Mean rate	.092	
Sample size[c]	(251,449)	

NOTES: All variables are based on characteristics at accession. Characteristics at the decision point are available only for airmen who left. To avoid selection biases we measure all traits at the nearest point available for everyone. Results are based on a 30 percent sample from the YAR file of persons who joined the Air Force after June 1973 and before July 1982 and were present at the start of the period and either left or were observed for the entire period.

[a]Functional Support and Administration Career Field Group.

[b]Unknown AFSC.

[c]Number of person-years observed.

Our findings with regard to marital status and dependents are also in agreement with previous studies (e.g., Buddin (1981)) if we consider the bulk of attrition that takes place after Basic Military Training is completed. We find that those who were married but without children when they entered the service have modestly lower attrition rates than singles or persons with more than one dependent. The data suggest that married accessions do have a slightly harder time getting through BMT.

and Group 3 was the last two fiscal years of the data used for preliminary analysis. The last two groups were an attempt to separate the groups subject to a norming error from others. We could detect no statistically significant interaction between AFQT category and cohort or cohort group.

Most previous studies of attrition in the Air Force found either no difference or only small differences due to race.[6] However, we find that the attrition rate is much higher for white women than for black women, but that the difference in attrition rates between black men and white men is very small. The similarity in the rates for men and the preponderance of men in the Air Force means that the average rate does not differ much by race (see Table 2.4 for the raw data).

In the preliminary analysis we explored various hypotheses about how gender might interact with other characteristics. We found no large or consistent differences between men and women in the effect of education, AFQT category, marital status, or age on attrition rates. However, in common with other researchers (see Thomas (1980)), we did find that differences in attrition rates between men and women depend on occupation. Women in the Functional Support and Administration Career Field Group (which covers most clerical duties) attrit at a rate 0.032 per year lower than otherwise similar women in other Career Field Groups. (This is true for both racial groups.) Black men differ from white men in having higher loss rates in all Career Field Groups except Functional Support and Administration, in which they have a lower loss rate.

Term of Enlistment

Enlistees who sign up for a four-year term have attrition rates that are only slightly lower than the attrition rates of similar six-year enlistees. We could find no statistically significant difference in the loss rates from Basic Military Training of these two groups. After completion of BMT, most of the six-year enlistees leave at a slightly higher rate than otherwise similar four-year enlistees. (The difference is .009 in the first year and approximately .017 in the second year.)

Table 2.4

ANNUAL LOSS RATES IN EACH OF FIRST THREE YEARS OF SERVICE BY RACE AND GENDER

	YOS 0		YOS 1		YOS 2	
Group	Sample Size	Loss Rate (%)	Sample Size	Loss Rate (%)	Sample Size	Loss Rate (%)
Black men	14,235	12.4	10,393	12.9	7,288	9.5
Black women	2,592	11.5	1,745	8.4	1,184	6.8
White men	92,804	14.2	67,316	10.4	47,820	8.2
White women	15,792	17.2	10,357	11.7	6,758	11.5
Men subtotal	107,039	13.9	77,709	10.7	55,108	8.4
Women subtotal	18,384	16.4	12,102	11.2	7,942	10.8
Black subtotal	16,827	12.3	12,138	12.3	8,472	9.1
White subtotal	108,596	14.6	77,673	10.6	57,578	8.6
Total	125,423	14.3	89,811	10.8	63,050	8.7

SOURCE: Persons enlisting in the Air Force between June 1973 and June 1980 in a 30 percent sample from the ETS file.

NOTE: Persons who left the Air Force via an early release or a special release program are omitted from the sample in the year they left the service.

[6]Many studies of the reenlistment decision show that there are differences by race.

We explored the interaction of demographic characteristics with term of enlistment to see if any interactions were present.[7] The only statistically significant effect we found was related to age. Six-year enlistees who join the Air Force before age 18 leave at a slightly higher rate during their first YOS and at a slightly lower rate subsequently than would be predicted by the separate effects of term of enlistment, age, and other demographic effects. This apparent shift in the timing of attrition is not related to the presence of controls for occupational specialty in the second- and third-year attrition equation.

Years of Service

The default group for measuring the YOS effect in Table 2.3 is four-year enlistees with YOS = 1. Four-year enlistees in YOS 2 leave at a rate 1.3 percentage points lower than similar enlistees in YOS 1. The attrition rate for six-year enlistees steadily declines with years of service. No interactions between this YOS variable and any of the demographic variables or term of enlistment could be found in the data.

Occupational Effects

In addition to the differences across demographic groups (particularly education, AFQT score, and age), there are definite occupational effects that are due to the circumstances of the job. (For example, in the preliminary analysis the hypothesis that all of the career field effects are zero was tested with an F-test, which yielded an F = 9.99 with 46 and 152,870 degrees of freedom. This is significant with $p < .0001$.)

Table B.1 reports AFSC-specific coefficients for the attrition model for first-term airmen after their first year of service. The coefficients were estimated individually for AFSCs with 50 or more observations; smaller AFSCs were given the mean effect for their career field if that field contained 50 or more observations, or were given the mean effect for the full sample otherwise.

The career fields with the highest attrition rate (after controlling for demographics) are 23 (Audiovisual), 44 (Missile Maintenance), 47 (Vehicle Mechanics), 60 (Transportation), 63 (Fuels), and 81 (Security Police). The fields with the lowest attrition rates (after controlling for demographics) are Communications and Electronics Systems (30), Avionic Systems (32), Training Devices (34), and Instructors (75). In some cases, the actual attrition rates vary substantially from the marginal effects that control for demographics. For example, the attrition rate for Air Crew in our sample is actually only slightly above average, but those assigned to the Air Crew career field scored exceptionally well on their AFQT tests and were all men.

Temporal and Economic Effects

Since attrition losses generally occur when airmen are found unfit for the service or when unpredictable calamities strike an airman or his family, there is little reason to expect economic variables to be of importance in these equations.

The military-civilian wage ratio was small and statistically insignificant in all the equations, and was therefore deleted. Beyond the first two months of service, unemployment rates were found to have a small positive correlation with attrition; in the first two months the correlation was small and negative. The correlations were small enough to be of little practical importance in forecasting.

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[7]This exploratory analysis was performed with aggregated data.

III. SECOND-TERM ATTRITION

Our model of attrition during the second term is the simplest of all the models and contains only three effects: (1) the attrition rate is smallest during the first year of the term and then rises slowly during the remainder of the term; (2) E-4s have a higher attrition rate than those in higher grades (almost all of whom are E-5s); and (3) the attrition rate varies by occupational specialty.

Table 3.1 gives the specification for the second-term attrition model. The effect of year of term is monotonic, with the largest effect found in the first year. This is quite similar to the pattern found in career attrition (see Table 4.2). The reasons that people do not complete their terms include death, disabling illness, unusually attractive civilian opportunities, and family problems.

If people do not complete their original ETS for such reasons as accidental death, we would expect to have a constant attrition rate that is not correlated with YOS or with number of years served in a term. If, on the other hand, an airman has information that indicates that he will not be able to finish another term, like symptoms of an illness that would make military service too hard for him, then he may choose to leave before reenlisting for a new term. Under this condition, we would expect attrition rates to be lower in the first year of a term and increase as the term proceeds, because those who would leave the Air Force in their first year of a term due to such an illness would not have started the term, and some of those who will become sick later would not have observed the symptoms far enough in advance. This argument assumes that the availability of such information (like awareness of symptoms) increases as the event (sickness) comes closer.

Table 3.1

MODEL FOR SECOND-TERM ATTRITION

	Probability of Attriting During One Year	
Predictor Variable	Coefficient	t-Statistic
Grade E-4	.017	16.92
Four-year enlistees[a]		
Second year of term	.014	12.05
Third year of term	.019	15.02
Six-year enlistees[a]		
First year of term	−.000	−.10
Second year of term	.017	8.42
Third year of term	.025	10.86
Fourth year of term	.022	8.94
Fifth year of term	.025	9.00
Career field dummies	Table B.2	
Mean loss rate	.024	
Sample size	(123,677)	

[a] Base case is four-year enlistee of grade E-5 or E-6 in first year of term.

We find no independent effect of year of service on attrition rates. This may be because of the strong correlation of year of service and year of term (71 percent of our data points came from persons who began their second term during their fourth year of service). In any case, we found in preliminary analysis that the model succeeds quite well in tracking the small variation in attrition rates across YOS. (See Table 3.2.) We also find no effect of the length of the second term on annual attrition rates.

We use career field to control for occupational effects and the collection of such effects is statistically significant.[1] However, the magnitudes of the occupational effects is quite small, with only a few career fields having strong attrition effects. The attrition effects are clustered so that administrative personnel and craftsmen tend to have slightly higher attrition rates than others. The career field effects are presented in Table B.2.

Table 3.2

COMPARISON OF SECOND-TERM ANNUAL ATTRITION RATE PREDICTION WITH ACTUAL BY YEARS OF SERVICE

Years of Service Completed at Beginning of Term Year	Sample Size	Attrition Rate (%)	
		Actual	Predicted
3	14,827	1.77	1.75
4	22,812	3.45	3.34
5	24,978	3.73	3.74
6	9930	3.30	3.51
7	3642	3.87	3.83
8	776	2.45	3.08
9	331	3.02	2.93
10	174	1.72	2.96

SOURCE: Based on 77,470 term years that began in the period from July 1973 through June 1979. Includes all second termers on the 30 percent sample from the ETS file who were in grade E-4 or higher at the beginning of the year and who had clean data.

[1] $F = 2.37$ with 48 and 2881 degrees of freedom ($p < .0001$).

IV. CAREER ATTRITION

THE CAREER FORCE

The career force has not received nearly as much attention as first and second termers in loss modeling. High (above 95 percent) and stable[1] retention rates are responsible for this inattention. High and stable retention rates are the result of two factors. First, at the end of their first and second term, those who are not happy with the Air Force (and with whom the Air Force is not happy) leave. Therefore, the remaining population is more homogeneous in their attitudes toward the Air Force than the starting cohort. Second, the military retirement system keeps the retention rate high during career years. In the current system, airmen are not vested before the 20-year point. But as soon as they reach 20 years of service, they can retire[2] and receive a substantial percentage of their income[3] as retirement pay for the rest of their lives. This partly explains why about 60 percent of all airmen who start their tenth year of service complete 20 years of service,[4] and nearly 35 percent of those who reach retirement eligibility leave immediately.

The low and stable loss rates of career airmen imply that we can accurately predict career losses. This is a boon for the EFMS because career people constitute approximately 25 percent of the enlisted force.[5] For modeling purposes, we define the career force to consist of persons who have reenlisted at least twice, who have completed less than 19 years of service at the beginning of the current term year, and who will have completed at least nine years of service by the end of their current term.

Career attrition refers to losses of career airmen who are more than one year away from their original ETS. *Career ETS losses* refer to losses of career airmen who have 12 months or less to go to their original ETS. As Table 4.1 indicates, loss rates are strongly related to whether a term is due to expire, even for career people. Only about 1 percent of the airmen who reach nine years of service leave in any non-ETS year.

SPECIFICATION OF THE MODEL

The career force attrition and ETS models are structurally different from the models for first and second terms. The primary reason for this is that career decisions are made over a longer span of time. That is, decisions in the ninth year of service and the eighteenth year of service are both "career decisions," and it is reasonable to expect that the effects of independent variables are different at different YOS. Therefore, interactions of YOS with other variables were used; we opted for a variable that declines exponentially with YOS as the interaction term.

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[1]Grissmer (1985) shows that using a simple continuation assumption to forecast a year's retention rate with the previous year's retention rate results in a mean absolute percentage error of less than 2 percent for the career years. (For example, see Table 4.9 for career attrition errors.)

[2]Barring other commitments.

[3]For example, 40 percent of the average of their basic pay over the last three years for those who enlisted after July 31, 1986.

[4]Equivalent to a yearly continuation rate higher than 95 percent.

[5]Our definition of the career force is different from the definition used by the Air Force's TOPCAP system. In particular, we do not include airmen who are serving their second term or those who would come to the last year of their contract before completing nine years of service in the career force. See *USAF Personnel Plan*, Vol. 3, Appendix D, p. 85. Numbers are for 1977.

Table 4.1

COMPARISON OF LOSS RATES FOR ORIGINAL ETS YEARS AND EARLIER YEARS IN THE TERM BY YOS

YOS Completed at Beginning of Term Year	Original ETS Year		Earlier Years	
	Loss Rate	Number of Observations	Loss Rate	Number of Observations
9	.141	2838	.015	19,731
10	.085	6701	.010	13,897
11	.052	6711	.007	10,742
12	.062	925	.009	19,596
13	.033	634	.007	19,283
14	.020	4426	.005	14,350
15	.016	9736	.004	7999
16	.028	725	.004	18,224
17	.011	467	.004	16,346
18	.017	4020	.004	9736

As Table 4.2 indicates, attrition in the career years declines with YOS for two primary reasons. First, airmen tend to delay events that would lead them to leave the Air Force before reaching retirement eligibility. Losses due to "hardship" decline as the 20-year point comes closer. Second, the gradual elimination of the unsuitable leaves fewer people to be forced out by the Air Force as the YOS increases (quality losses decline with YOS). The losses due to acts of God, like death or disability due to a catastrophic accident, do not follow the same pattern.

Table 4.2

CAREER ATTRITION RATE BY CATEGORY OF LOSS AND YEARS OF SERVICE

YOS Completed at the Beginning of a Term Year	Number of Airmen[a]	Category of Loss			
		Hardship	Quality	Disability/ Early Retirement	Death
9	19,731	.00253	.00542	.00198	.00086
10	13,897	.00151	.00439	.00144	.00043
11	10,742	.00093	.00363	.00102	.00037
12	19,596	.00097	.00443	.00142	.00071
13	19,283	.00057	.00311	.00135	.00062
14	14,350	.00028	.00202	.00084	.00139
15	7999	.00012	.00113	.00187	.00050
16	18,224	.00005	.00104	.00148	.00137
17	16,346	.00024	.00055	.00220	.00122
18	9736	.00000	.00031	.00216	.00154

[a]The number of airmen observed with each completed YOS in a 30 percent sample from the ETS file between 1974 and 1979.

As in the second-term model, we found that attrition rates increase during the term, probably for the same reasons as discussed for second-term attrition (Sec. III). However, we find that attrition rates for career airmen decline as persons approach 20 YOS. We were unable to detect any effect of economic variables such as unemployment rate and military/civilian wage rates on attrition rates.

We found that the effects of both number of years from start of term and number of years to original ETS are statistically significant, but the effects are very small. We chose to include only the number of years to original ETS in the final specification, a decision that facilitates implementation of the models in the Middle-Term Disaggregate IPM.

The specification for the middle-term model for career attrition is as follows:[6]

$$
\begin{aligned}
P(\text{loss}) = {} & (\alpha_0 + \alpha_1 \bullet e^{-YOS/b}) \\
& + (\alpha_2 + \alpha_3 \bullet e^{-YOS/b}) \bullet \text{(Number of years to original ETS)} \\
& + (\alpha_4 + \alpha_5 \bullet e^{-YOS/b}) \bullet \text{(Term of enlistment)} \\
& + (\alpha_6 + \alpha_7 \bullet e^{-YOS/b}) \bullet \text{(Being E-4)} \\
& + (\alpha_8 + \alpha_9 \bullet e^{-YOS/b}) \bullet \text{(Being E-6 or above)} \\
& + (\alpha_{10}) \bullet \text{(Skilled Technician)} \\
& + (\alpha_{11}) \bullet \text{(Craftsman Service and Supply Handler)} \\
& + (\alpha_{12}) \bullet \text{(Functional Support and Administration)} \\
& + (\alpha_{13}) \bullet \text{(Unknown)}
\end{aligned}
$$

RESULTS

Our estimates of the model coefficients are given in Table 4.3. The model was fit using data for all airmen with an original ETS after June 1974 who were in a non-ETS year that began before July 1982. Attrition rates decrease as the YOS increases and increase at a steadily decreasing rate as the original ETS comes closer (see Table 4.4). Attrition is also higher for six-year enlistees than for four-year enlistees. This effect declines in magnitude exponentially with YOS (see Table 4.5). Occupational groups and grade also have an effect on attrition rates. Occupations are grouped by Career Field Groups (see App. A). Once we had controlled for these occupational groups, using career fields in the regression model did not increase our explanatory power. The effects of Career Field Groups do not decrease with YOS. Table 4.6 indicates that the attrition rate for the Mechanical and Electrical Equipment Repairmen group is lower than that for all other groups.

The data also indicate that E-4s and E-5s have higher attrition rates than E-6s and E-7s. Furthermore, we have observed that grades E-6 and all above behave the same in non-ETS years. The difference in attrition rates of E-5s as compared with E-6s and above declines with YOS. This may be due to the fact that, as YOS increases, those who have not been promoted to E-5 have smaller chances of being promoted, and the thought of (or the reality of) high-

[6]Our estimate for b is 2 and it is not directly estimated by nonlinear estimation methods; rather, we search over the integers 1 through 5 for the value of b that yields the lowest residual variance.

Table 4.3

PARAMETER ESTIMATES FOR THE CAREER ATTRITION MODEL

Parameter	Estimate	t-Statistic
α_0	.0038	1.85
α_1	.5589	4.99
α_2	−.0012	−3.50
α_3	−.2369	−9.05
α_4	.0015	3.01
α_5	.1201	4.29
α_6	.0319	12.14
α_7	−.4357	−5.31
α_8	−.0046	−6.45
α_9	.0691	.55
α_{10}	.0009	1.57
α_{11}	.0029	3.52
α_{12}	.0018	2.83
α_{13}	.0051	2.39

Table 4.4

MARGINAL EFFECT OF YEARS UNTIL ORIGINAL ETS ON CAREER ATTRITION RATE FOR SELECTED YOS
(Term length = 6 years)[a]

Years to Original ETS	YOS Completed at the Beginning of a Term Year		
	9	12	8
6	.0041	.0050	.0053
5	.0079	.0068	.0065
4	.0117	.0086	.0077
3	.0155	.0104	.0090
2	.0193	.0122	.0102

NOTE: Based on regression of Table 4.3.
[a]The loss rates are for an E-5 whose AFSC belongs to the Electrical/Mechanical Equipment Repairmen Career Field Group.

Table 4.5

MARGINAL EFFECT OF YEARS UNTIL ORIGINAL ETS ON CAREER ATTRITION RATE FOR SELECTED YOS (Term length = 4 years)[a]

Years to Original ETS	YOS Completed at the Beginning of a Term Year			
	6	9	12	18
4	.0100	.0060	.0052	.0049
3	.0229	.0098	.0069	.0061
2	.0358	.0137	.0087	.0074

NOTE: Based on regression of Table 4.3.
[a]The loss rates are for an E-5 whose AFSC is in the Electrical/Mechanical Equipment Repairmen Career Field Group.

Table 4.6

MARGINAL EFFECT OF OCCUPATIONAL GROUP ON CAREER ATTRITION RATE (Relative to Electrical/Mechanical Equipment Repairmen)

Occupational Group	Coefficient
Skilled Technicians	+.0012
Craftsmen, Service, and Supply Handlers	+.0026
Functional Support and Administration	+.0013
Others and Unknown	+.0087

NOTE: Based on regression of Table 4.3.

year-of-tenure enforcement leads them to leave the Air Force before their term expires. The decline in the difference of attrition rates of E-5s and E-6s and above with YOS is consistent with what we observed for the ETS years. It is a reflection of the growing importance of retirement benefits in the present value of future income stream and the gradual elimination of the unsuitable. Table 4.7 shows the effects of grade on attrition rates at selected YOS.

PERFORMANCE

Loss rates are low and stable in the career years (see Table 3.18 in Grissmer (1985)). As Grissmer shows, even a very simple model that uses the previous year's loss rates to predict losses in the current year does a good job (see Table 4.11 in Grissmer (1985)). But as Table 4.8 shows, the structural model estimated here does markedly better than that very simple model. Table 4.8 shows prediction errors by YOS. Table 4.9 shows prediction errors according to the year during which the airman was at risk of attrition. These tables indicate that the model fits the data it was estimated from quite well.

Table 4.7

MARGINAL EFFECT OF GRADE ON CAREER ATTRITION RATE BY YOS
(Relative to E-5)

	YOS Completed at the Beginning of a Term Year			
Grade	6	9	12	18
E-4	.0083	.0318	.0370[a]	.0384[a]
E-6 and above	−.0041	−.0043	−.0044	−.0044

NOTE: Based on regression of Table 4.3.
[a]By YOS = 12, the number of E-4s in the force is negligible.

Table 4.8

THE FORECASTING ACCURACY OF TWO CAREER ATTRITION MODELS BY YOS

	Model in Table 4.3			
Years of Service	Number of Observations	Actual Loss Rate	Error in Prediction[a]	Simple Continuation Rate[b] (1971–1980): Error in Prediction
6	7539	0.0158	.00004	.0110
7	18,843	0.0150	−.00077	.0220
8	25,671	0.0161	.00087	.0070
9	23,480	0.0135	.00001	.0040
10	15,746	0.0115	−.00089	.0040
11	14,641	0.0053	−.00156	.0040
12	21,350	0.0055	.00020	.0030
13	21,634	0.0071	.00126	.0020
14	15,562	0.0048	−.00094	.0020
15	10,393	0.0033	−.00045	.0020
16	20,123	0.0028	.00045	.0020
17	21,527	0.0045	.00056	.0010
18	14,737	0.0041	.00042	.0010

[a]Error = actual − predicted.
[b]Grissmer (1985), p. 51.

Table 4.9

FIT OF CAREER ATTRITION MODEL
BY YEAR AT RISK

Year at Risk	Number of Observations	Actual Loss Rate	Error in Prediction[a]
74/75	24,294	.0098	.00219
75/76	25,374	.0076	−.00057
76/77	25,366	.0102	.00140
77/78	26,874	.0084	−.00093
78/79	27,127	.0091	.00007
79/80	25,269	.0089	.00015
80/81	24,599	.0072	−.00128
81/82	26,377	.0067	−.00138
82/83	25,956	.0091	.00050
Total	23,1236	.0086	.00000

[a]Error = actual − predicted.

V. FIRST-TERM ETS DECISION

This section describes our model of the decision made by airmen at the end of the first term. We define the model to apply to all first-term airmen who are in the Air Force 12 months before the expiration of their original term of service (ETS). The decision the airman makes is to (1) leave the Air Force, (2) reenlist, or (3) postpone a final decision by extending his term of enlistment. For simplicity we model the decision as if it were two sequential decisions:

1. Whether or not to leave the Air Force by original ETS, and
2. Whether to extend or reenlist, given that he has decided to remain in the Air Force past original ETS.

This model abstracts from the actual decisionmaking process in several respects. In particular, all extensions that are followed by a reenlistment or loss prior to ETS are not modeled—only the final outcome is modeled. Also, the model makes no distinction among an ETS loss at the end of the term, an ETS loss prior to the end of the term (sometimes called a "PETS" loss), and an attrition loss during the last year of the term.

DATA SELECTION

One of the major objectives of our middle-term models is an accurate account of the way airmen respond to changes in bonus levels, and this objective largely determined our data selection criteria. In the preliminary analysis, we found that the effects of the determinants of the first-term ETS decision were quite different for those who enlisted in the All Volunteer Force (AVF) era than they were for earlier enlistees. For example, bonuses appear to be a more effective retention incentive for members of the AVF than they were in the draft era when many persons chose the Air Force as the place where they wished to serve their obligatory term of duty. Consequently, we chose to restrict our data solely to persons enlisting in FY73 or later.[1] The data were further restricted to persons who were in the Air Force 12 months before their first ETS.

The Air Force increases bonuses in AFSCs where it wishes to increase the number of reenlistments and decreases bonuses in the AFSCs where it is willing to accept fewer reenlistments. A priori, it seemed likely that bonuses would be awarded more frequently to AFSCs with lower than average retention rates than to AFSCs with higher than average retention rates. (Such was indeed the case—see Table 5.1.) Further, the Air Force may increase bonuses in years when the retention rate is poor and vice versa. The inclusion of variables to estimate AFSC-specific effects and variables to control for economic conditions that might influence Air Force bonus policy should mean that the coefficient on bonus amount is estimated from the changes in behavior that arise from changes in the bonus amount.[2]

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[1]The draft actually continued into January 1973, but at a greatly reduced level and reduced rate. We expect that the number of persons in our sample who volunteered for the Air Force under pressure from the draft is so small that they will have no noticeable effect on the results.

[2]It remains possible that the Air Force might change policies within a particular AFSC in a way that would affect retention and simultaneously offer a compensating bonus change. We expect such occurrences, if any, to be very rare. Another threat to validity, which we believe does not seriously affect the data used here but which will affect future

Table 5.1

OUTCOME OF THE FIRST-TERM ETS DECISION BY WHETHER OR NOT A BONUS WAS OFFERED
(4-year enlistees with first ETS between July 1979 and June 1980)

		Percent of Cohort			
Bonus	Sample Size	Left On or Before ETS	Extended Past ETS	Reenlisted On or Before ETS	Total
None	11,585	57.55	24.51	17.94	100.0
Some	1956	61.15	17.79	21.06	100.0
Total	13,541	58.07	23.54	18.39	100.0

RESULTS

Table 5.2 shows the specification and coefficients for the two equations that constitute our model of the first-term ETS decision. Since only some portion of those who extend will ever reenlist, total losses increase with an increase in the value of either equation and correspondingly total reenlistments decrease with an increase in either equation. We shall use the phrase *total reenlistment rate* to denote the fraction of persons who ever reenlist out of those who make an ETS decision to distinguish it from the *immediate reenlistment rate* whose numerator is limited to those who reenlist on or before their original ETS.

In this section we discuss the findings of Table 5.2 and the preliminary analysis that resulted in choosing this form for the equation. Most of that preliminary analysis was aimed at choosing the proper specification for the bonus variables. But first we discuss demographic, temporal, and cohort variables.

Demographics

Demographic effects are simpler in the first-term ETS model than in the first-term attrition model. This probably reflects the elimination of those who are least suitable for an Air Force career through attrition. Those who make the ETS decision are a more homogeneous group than the entering cohort. As with the other models, the specification of demographic effects was first explored in a separate, smaller sample of airmen. The specification arrived at in that exploration was confirmed in the larger sample for which results are reported here.

As other researchers have found previously, we find that blacks are less likely to leave at ETS. We find no effect of AFQT score on the stay/leave decision;[3] but we do find that high school graduates and persons with higher AFQT scores are more likely to extend than to immediately reenlist, thus decreasing their total reenlistment rate.

The reenlistment rate is lower for single persons than for married persons, but marital status is a much more important determinant of the ETS decision for men than it is for women. Although, to our knowledge, this interaction has not previously been reported in the literature, it is so statistically significant that it is unlikely to be erroneous. The total reenlistment rate is higher for women than for men. Thus gender, in addition to education and AFQT

estimates of these equations, arises from the Career Job Reservation (CJR) system. If reenlistments are significantly constrained in some specialties, the model must account for this limitation of demand.

[3] $F = .22$ with 2 and infinity degrees of freedom; $p > 0.5$.

Table 5.2

FIRST-TERM ETS LOSS AND EXTEND-GIVEN-STAY MODELS

Predictor Variable	Probability of Leaving At or Before ETS		Probability of Extending If Stay	
	Coeffi-cient	t-Statistic	Coeffi-cient	t-Statistic
Constant	—	—	−.554	
High school graduate	—	—	.048	3.881
AFQT Group III or lower	—	—	−.053	−10.319
Male	.137	19.91	.018	2.129
Married	−.025	−2.85	−.073	−6.913
Male and married	−.089	−9.50	−.041	−3.562
Black	−.172	−37.48	—	—
Log(mil. wages/civ. wages)	−.437	−4.68	—	—
Log(moving avg. of unemployment rate) if four-year enlistee	−.361	−28.94	—	—
Six-year enlistee	.685	24.62	−.202	−26.455
Half bonus	.001	.06	—	—
Bonus level = 1	−.034	−5.60	—	—
Bonus level > 1	−.013	−1.89	—	—
Bonus level	—	—	−.038	−13.997
Cross-bonus average	−.022	−1.55	—	—
Period of Regular Reenlistment bonus[a]	.078	15.79	—	—
Period of operational manning[a]	−.030	−6.75	—	—
FY77 dummy			−.134	−8.772
FY78 dummy			−.071	−4.522
FY79 dummy			.088	5.703
FY80 dummy			.032	2.087
FY81 dummy			.142	9.291
FY82 dummy			.117	7.706
FY83 dummy			−.029	−1.877
AFSC dummies	Table B.3a		Table B.3b	
Mean rate	.480		.555	
Sample size	(95,069)		(51,417)	

NOTES: Education and marital status measured at the June preceding one year prior to ETS. The table is based on a 30 percent sample from the YAR file of four-year enlistees whose first ETS was between July 1976 and June 1983 and who were in the Air Force 12 months prior to that ETS.

[a]See Temporal and Economic Effects, below.

score, has an effect on the ETS decision that is opposite in sign from its effect on attrition. In preliminary analysis we could find no statistically significant interaction between either gender and race or gender and occupational group.

Bonus Effect

We found that the first bonus multiple increases the fraction of airmen in a typical AFSC who stay past ETS by about 3.4 percentage points. However, it also increases the fraction of airmen who immediately reenlist out of those who stay past ETS by 3.8 percentage points. Each subsequent bonus multiple decreases the ETS loss rate by 1.3 percentage points and increases the immediate reenlistment rate by 3.8 percentage points. The bonus thus has a larger effect on immediate reenlistments than it has on immediate losses. Since many of those who extend leave during the next year or two, the full effect of a bonus on retention is not visible until the cohort is at least two years past ETS.[4] For those few airmen who receive bonus multiples of .5 we could not find a statistically significant effect. We recommend that in using the model in the IPM, the coefficient for bonus multiples of .5 be set to half that for bonus multiples of 1.0.

At any one time, the Air Force offers a specified bonus multiple (including 0) to all persons in each specialty who choose to reenlist. But the Air Force changes the specifics of the bonus program at least twice a year. Bonuses were changed 19 times during our seven years of data, although of course each change did not involve each AFSC. A person is eligible to reenlist any time on or after one year prior to his ETS. Thus, the bonus amount given to some of those in our sample depended on when they chose to reenlist.

Because of the ambiguity in the bonus offer available to each person in our sample, in the preliminary analysis we estimated the stay/leave equation using alternative forms for the bonus variable. Although we found that the average bonus multiple available over the 12 months prior to ETS performed slightly better than the maximum bonus multiple available in the same 12-month period and slightly better than the bonus multiple available at ETS, we chose to use the bonus multiple available in the ETS month on the grounds of simplicity.[5] We also tried to determine whether the effect of an increasing multiple differs from the effect of a decreasing multiple with the same average multiple, but did not obtain a statistically significant coefficient.

Several research reports have asserted that the size of the response to a change in the amount of the bonus differs by occupation, although we are not aware of any rigorous test of this hypothesis. In our preliminary analysis, we tested whether there were occupational differences in bonus response by fitting a separate slope for each AFSC in our sample. We could not reject the null hypothesis that the slopes were the same for each AFSC based upon the F-test for this interaction ($F = 1.09$ with 71 and 28,480 degrees of freedom; $p = 0.27$).[6]

Another bonus variable in the model is a measure of an airman's opportunities for a bonus in AFSCs other than the one he is in during his first term (his "own AFSC"). This cross-bonus variable is a weighted average of bonuses in other AFSCs, where the weights Π are the historical probabilities of an airman moving from one specific first-term AFSC to other specific AFSCs. Thus, for the i^{th} AFSC, the cross-bonus variable (CB_i) is

$$CB_i = \sum_{\substack{j \epsilon N \\ j \neq i}} \Pi_{ij} \, B_j$$

where N is the class of all AFSCs and B_j is the bonus level available in $AFSC_j$. The estimated magnitude of this effect is somewhat smaller than that found for a level one bonus. On average, the cross-bonus variable (CB_i) is about one-fourth the value of the bonus available to an airman in his own AFSC (B_i).

Attempts to differentiate bonus effects for bonuses given in lump sums from other bonuses were unsuccessful. The magnitudes of estimated differences were small, statistically insignificant, and of mixed signs.

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[4]The effect may continue to be felt even further in the future. Reenlistees who receive a bonus are more likely to choose a six-year term of enlistment (TOE) than those without a bonus. However, they are also more likely to leave at the end of the second term than those with similar YOS (see Sec. VI).

[5]The Regular Reenlistment Bonus that was available to those whose ETS was before June 1, 1978 was treated as a multiple of one.

[6]In our preliminary analysis, we found an interaction of bonus effect and marital status. This interaction did not persist in the larger sample. We tested but did not find interactions with bonus and gender, education, AFQT score, and race.

Temporal and Economic Effects

The temporal and economic effects differ between the loss and extend-given-stay equations. We first discuss the loss equation.

As expected, higher military pay (relative to civilian pay) and higher civilian unemployment both lower the immediate loss rate, but unemployment does not affect six-year enlistees.

For airmen who first enlisted before July 1974, the Air Force offered a Regular Reenlistment Bonus to all first-term airmen who reenlisted. A dummy variable for this period is included in the loss model. Another dummy variable in the model (labeled "Period of operational manning") represents the period August 1979 to January 1983 when more lenient extension policies were in place.[7] As expected, losses were lower during this period than they would otherwise have been.

Table 5.3 presents the equations of the first-term loss model based on three alternative sample periods and for the full sample. Dropping the first two years of data from the sample has only modest effects on the parameters of the model. However, restricting attention only to recent years yields sharper responses to wages, unemployment, and bonus levels in excess of one than are seen in the full sample.

This variability in the parameter estimates is a reflection in part of the relatively small sample of pay and unemployment regimes in our data set. The cross-bonus effect is significant only in the full sample; its inclusion in the model has almost no effect on the coefficients of the other variables.

Table 5.3

FIRST-TERM ETS LOSS MODEL WITH FITS FOR FULL SAMPLE PERIOD AND FOR THREE SUBPERIODS

Predictor Variable	7807–8306 Coefficient	7907–8306 Coefficient	8010–8306 Coefficient	7607–8306 Coefficient
Male	.115	.112	.103	.137
Married	–.036	–.033	–.032	–.025
Male and married	–.073	–.079	–.095	–.089
Black	–.167	–.161	–.157	–.172
Log(mil. wages/civ. wages)	–.415	–.717	–.908	–.437
Log(moving avg. of unemployment rate) if four-year enlistee	–.392	–.368	–.483	–.361
Six-year enlistee	.764	.716	.950	.685
Half bonus	.005	–.002	.017	.001
Bonus level = 1	–.034	–.037	–.028	–.034
Bonus level > 1	–.019	–.027	–.043	–.013
Cross-bonus average	.012	–.015	–.000	–.022
Period of Regular Reenlist Bonus	.068	.044	.000	.078
Period of operational manning	–.027	–.014	–.030	–.030
Sample size	(70,881)	(56,828)	(36,845)	(95,069)

[7]In August 1979, the Air Force added "operational manning" as a legitimate reason for extending. This allowed an airman a one-time opportunity to stay at his or her current base for an additional 3–12 months because of an operational manning need. This policy was eliminated in February 1983.

The extend-given-stay equation is not parsimoniously specified. Shifts in Air Force policy from year to year markedly affected extension rates. These policy changes made it impossible to estimate effects for unemployment and pay—the risk of spurious correlations between these variables and the policy periods is too great in such a small sample of time periods. (A simple regression of extension rates in each fiscal year against unemployment and pay results in small and insignificant coefficients for each—a result not in accord with our intuitions about extension behavior.)

Two particular policies dominated the sample period: the operational manning program was in effect between August 1979 and January 1983 and prior to April 1982 airmen were permitted to extend for personal reasons. But even within the periods of these policies, there were year-to-year variations in the Air Force's willingness to allow extensions. Consequently, in the first-term extend-given-stay equation we include dummy variables for each fiscal year in the sample period. These dummies avoid any spurious effects to which changing policies might give rise, but they also preclude estimation of pay or unemployment effects, and they make difficult the generation of forecasts from the model. Users of the model must always decide which sample fiscal year best represents policy conditions over the period for which forecasts are to be made, so that a base level of extensions can be forecast. This done, the model enables the user to forecast differences in extension rates across AFSCs and the effects on extensions of alternative bonus policies.

If, as additional years of data become available, it becomes possible to identify pay and unemployment effects within periods of similar extension policies, a better forecasting model would incorporate those effects. Explorations of such specifications with the current sample were unsuccessful.

Occupational Effects

Each model was fit with a separate effect for each AFSC. To estimate AFSC effects (which are reported in Table B.3), the AFSC coefficients from the fitted model were used if the AFSC contained at least 50 observations. If there were fewer than 50 observations in an AFSC, its estimated coefficient is the mean effect for that AFSC's career field if the career field contains 50 or more observations and the Air Force average effect otherwise.

Performance

Table 5.4 reports the performance of the first-term ETS loss model over the sample years and for four- and six-year enlistees.

The fit of the extend-given-stay model over the sample period is not informative because the fiscal year dummies ensure a perfect fit.

Table 5.4

PERFORMANCE OF FIRST-TERM ETS LOSS MODEL BY ETS YEAR AND LENGTH OF TERM

Term Length	Year of ETS	No. of Observations	Predicted Loss Rate	Error in Prediction[a]
4	.	91,343	.485	.0002
6	.	7141	.391	.0001
.	76/77	14,705	.541	.0223
.	77/78	10,118	.571	−.0304
.	78/79	14,188	.516	.0207
.	79/80	15,945	.541	−.0078
.	80/81	16,010	.448	−.0007
.	81/82	14,703	.383	−.0090
.	82/83	12,815	.351	−.0020
Total		98,484	.478	.0002

NOTE: A "." indicates that the results in that row are averages over all values of the column variable.

[a]Error = actual − predicted.

VI. SECOND-TERM ETS DECISION

Our specification for the second-term ETS decision consists of two equations similar to those used for the first term. They give (1) the probability of leaving the Air Force on or before the original ETS for the term, and (2) the probability that an airman will extend his term of enlistment rather than reenlist, given that he has decided to stay past the original ETS. The model was fit on all second termers whose original ETS was scheduled between January 1975 and June 1983 and who would have completed more than six but no more than ten YOS at the original ETS. The specification of the loss model is given in Table 6.1 and the specification of the extend-given-stay model is given in Table 6.2.

Table 6.1

SECOND-TERM ETS LOSS MODEL

			Instrumental Variables Estimate[a]	
Predictor Variable	Coefficient	t-Statistic	Coefficient	t-Statistic
Married	−.026	−4.54		
Black	−.095	−15.86		
Some college	.024	3.46		
YOS = 6	.082	5.41		
YOS = 7	.063	4.05		
YOS = 8	.023	1.47		
Grade = E-5	−.077	−14.27	−.045	−1.65
Grade ≥ E-6	−.151	−5.32	.502	1.68
Six-year enlistee and grade = E-4	.052	1.85	.016	.19
Log(moving average of unemployment rate)	−.234	−13.87		
Log(mil. wages/civ. wages)	−.128	−1.12		
Average bonus multiple	−.042	−6.35		
Received zone A bonus	.037	5.55		
AFSC dummies	Table B.4			
Mean loss rate	.230			
Sample size	(33,033)			

NOTES: Education and marital status are measured at the June preceding one year prior to ETS; grade is measured 12 months prior to ETS. The table is based on a 30 percent sample from the YAR file of second termers whose ETS was between January 1975 and June 1983 who were in the Air Force 12 months prior to ETS.

Instrumental variables (IV) estimates of variables besides grade are not reported since the grade coefficient estimates do not evidence bias in the ordinary least squares (OLS) estimators. The IV estimates of all the coefficients would differ from their OLS estimates.

[a]Using −.045 for grade = E-5 and 0.0 for both grade = E-6 and 6-year enlistee with grade = E-4 would be the appropriate specification to best estimate the effect of changes in grade on total losses, but would not be used correctly for grade-specific forecasts.

Table 6.2

SECOND-TERM EXTEND-GIVEN-STAY MODEL

Predictor Variable	Coefficient	t-Statistic
Married	−.048	−6.38
Male	−.069	−5.45
Some college	.054	5.98
YOS = 6	.131	6.89
YOS = 7	.111	5.73
YOS = 8	.058	2.95
Grade = E-5	−.037	−5.29
Grade ≥ E-6	−.081	−2.34
Log(moving average unemployment rate)	−.376	−2.26
Log(mil. wages/civ. wages)	−.633	−2.92
Added effect of log(mov. avg. unemp.) in personal extension period	.643	3.57
Added effect of log(mil. wages/civ. wages) in personal extension period	.299	3.85
Average bonus multiple	−.142	−10.57
Added bonus effect in personal extension period	.067	4.60
Before July 1978	−.194	−15.40
Period of operational manning	.073	6.62
AFSC dummies	Table B.5	
Mean extension rate	.383	
Sample size	(25,432)	

NOTES: Education and marital status measured at the June preceding one year prior to ETS; grade measured 12 months prior to ETS. The table is based on a 30 percent sample from the YAR file of second termers whose ETS was between January 1975 and June 1983 who were in the Air Force 12 months prior to ETS.

RESULTS

Demographics

The demographic effects in these models are fairly simple. Married persons are more likely to stay in the Air Force beyond their second term and to do so by reenlisting. We also find that those who have started or completed college leave more frequently and extend more frequently if they stay. (Perhaps many of these embarked on higher education while in the Air Force as part of their preparation for a civilian career.) Blacks are more likely to stay past ETS, but those who stay reenlist at the same rate as whites. There are no differences in the loss rate by gender, but males are less likely to extend.

Years of Service

The effects of years of service in the loss equation show a large monotonic decrease in the loss rate as the years of completed service increase from six to nine. Similarly large effects are seen in the extend-given-stay model.

Grade

There are large effects of grade: E-5s leave 7.7 percentage points less frequently than E-4s, and E-6s leave 15.1 percentage points less frequently than E-4s. We expected to find an interaction of YOS and grade, but the differences are not strong enough to identify separate YOS effects for each grade or even grade groups. The grade effects in the extend-given-stay equation are smaller than those in the loss equation, but are still important.

Because of "high year of promotion,"[1] we expected that those who are still E-4s 12 months before ETS would be more likely to leave if their ETS is in their tenth year of service than if it is earlier. Although this expectation was not fulfilled, there is mild evidence that six-year enlistees who are E-4s leave the service more often than other E-4s. Since many fewer six-year enlistees than four-year enlistees are still E-4s one year before ETS, the higher loss rate may reflect the discouragement felt by these particularly unsuccessful individuals.

We tried to separate two aspects of the differential loss rates across grades. First, a higher grade is itself an incentive to stay in the force, since it affords an airman higher pay and higher status. But second, achieving promotion requires effort on the part of the airman, and airmen less inclined to stay in the force may be less willing to make the investment needed to get promoted. Hence, policy changes that increase the proportion of E-5s relative to E-4s may not alter retention rates as much as the coefficients in Table 6.1 suggest.

In econometric terms, the dummy variables for E-5 and E-6 are correlated with an omitted variable, "intention to stay in the service," which is captured by the stochastic disturbance in the loss equation. An airman chosen at random and promoted to E-5 will, on average, have a higher value of the disturbance term (a lower intention to remain in the service) than do the airmen who, knowing their intentions, strive especially—and successfully—to get themselves promoted to E-5 in the actual promotion system.

To estimate the effect of promoting an airman at random to E-5—and hence to estimate the effect of changing promotion policies—one must "purge" the E-5 variable of its endogenous component (endogenous in the sense that airmen do or do not choose to improve their chances for promotion). One way to do this would be to pool together all airmen in a particular ETS cohort and use the proportion who are E-5 as an explanatory variable in predicting loss rates for the pooled groups. If the pooled groups are large, say 50 or more airmen, this approach would yield nearly unbiased estimates of the exogenous effect of grade on losses. Unfortunately, to avoid biasing the bonus coefficient, the pooling must be done within AFSCs. Hence, such an analysis could be conducted only for relatively large AFSCs.

Alternatively, the proportion of E-5s in one's ETS cohort can be used as an instrumental variable for estimating the effect of grade on losses. This approach permits one to use all airmen and all AFSCs in the analyses.

Table 6.1 reports in the last two columns the instrumental variables (IV) estimates for the grade variables in the updated loss model. As expected, the coefficients are not so negative as in the ordinary least squares (OLS) specification (the first two columns). However, the standard errors are disappointingly large and one cannot reject the hypothesis of no endogeneity. (Since the new grade coefficients do not evidence bias in the OLS estimates, IV estimates for the other coefficients in the model are not reported.)

Nonetheless, it seems likely that there is some endogeneity. Relying on the wage coefficient to predict the effect of grade differences would yield an estimate of –.016. Since

[1]During the years covered by our data, an individual not promoted to grade E-5 by his tenth year of service was not allowed to reenlist. This policy was rescinded in January 1985.

promotion brings status as well as higher pay, the total effect of promotion would reasonably be higher than the pay effect alone, but surely not nearly five times higher, as suggested by the ordinary least squares coefficient.

For practical purposes, what should the analyst do? Across the entire range of grade structures found in our sample data, the OLS fits of mean loss rates for all second-term ETS decisionmakers vary by less than .01 from what one would get using −.045 (the E-5 instrumental variable estimate) as the incremental effect of both E-5 and E-6. Hence, if grade structures remain stable over the next few years, the OLS estimates are likely to introduce little bias, and they will give better loss rates by grade than would the instrumental variables estimators. (If each grade group is considered distinctly, mean square error would be lower for the OLS estimator.) Consequently, we recommend using the OLS estimates for the IPM. However, an analyst wishing to examine explicitly the effect of promotions on overall loss rates would do better to use −.038 as the incremental effect of grade, which requires an additional intercept term of −.027 to be used as a counterbalancing adjustment to the mean loss rate.

Temporal and Economic Effects

There are very strong temporal effects in the data, as shown in Table 6.3. The percentage of persons who leave by ETS shows a U-shape pattern that strongly parallels the unemployment rate and leads to the large coefficient and high t-statistic shown in Table 6.1. A 10 percent increase in the unemployment rate (say from 8.0 percent to 8.8 percent) will lead to a 2.2 percentage point decline in the loss rate—an elasticity of about 0.8.

Military pay also appears to have a large effect on the stay/leave decisions of second termers.[2] The positive correlation between the unemployment rate and the military civilian wage ratio means that it is difficult to disentangle the effects of unemployment and wages, but we were still able to get a statistically significant coefficient on wages. If military pay is increased by 10 percent, then we would estimate a decrease in the loss rate of roughly 1.2 percentage points—about 4 percent.

The temporal variation in the extend-given-stay decision is much greater than can rationally be attributed to changes in economic conditions. We believe it reflects, at least in

Table 6.3

OUTCOME OF SECOND-TERM ETS DECISION BY COHORT

		Percent of Cohort Who			
ETS in Period	Sample Size	Leave by ETS	Extend	Reenlist by ETS	Total
July 1974–June 1975	4070	33.8	5.0	61.2	100.0
July 1975–June 1976	6259	28.0	15.1	56.9	100.0
July 1976–June 1977	4010	23.0	16.0	61.0	100.0
July 1977–June 1978	4950	26.8	20.0	53.3	100.0
July 1978–June 1979	2901	30.6	24.5	44.9	100.0
July 1979–June 1980	4176	31.2	27.8	41.9	100.0

[2]The variable used is the log of the ratio of typical military pay to typical civilian wage. We also tried using the ratio of actual regular military compensation (which depends on grade, YOS, and FY) to estimated civilian wages (which depend on AFSC, YOS, and FY) but this variable performed much worse—probably because of errors in measuring civilian opportunity.

part, changes in Air Force policy concerning extensions (see the discussion of extension policies in Sec. V).

We therefore include dummy variables in the model to reflect the periods of the operational manning policy and the period that permitted extension for personal reasons. As was the case for first-term extension, we find extensions higher and economic incentives less influential during the period in which extensions for personal reasons were permitted. In the second-term model, however, a main effect for the operational manning subperiod performs better than that for the personal extensions period.

Bonus Effects

As in the first-term ETS decision, we find that at the second-term ETS decision point, the bonus has a larger effect on the reenlistment rate than it does on the loss rate.

The other bonus variable in the loss equation shows that persons who received a zone A bonus for reenlisting after the first term are more likely to leave at the end of the second term than those who did not.

Occupational Effects

Table B.4 presents the occupational effects for the loss model and Table B.5 gives the occupational effects for the extend-given-stay model. The set of effects is statistically significant at the .0001 level. One effect is estimated for each AFSC, again using career field averages for small AFSCs.

PERFORMANCE

Table 6.4 reports the within-sample performance of the loss model by ETS year and by length of term. Table 6.5 provides similar information for the extend-given-stay model.

As with the first-term extend-given-stay model, performance within sample, by ETS year and by length of term, is not very good.

Table 6.4

PERFORMANCE OF SECOND-TERM ETS LOSS MODEL
BY ETS YEAR AND LENGTH OF TERM

Term Length	ETS Year	No. of Observations	Predicted Loss Rate	Error in Prediction[a]
4	.	29,863	.231	−.001
6	.	3058	.199	.004
.	74/75	1652	.260	−.004
.	75/76	3844	.215	.022
.	76/77	3772	.232	.014
.	77/78	4869	.261	−.003
.	78/79	3063	.286	−.001
.	79/80	4198	.284	.004
.	80/81	4942	.218	.004
.	81/82	3343	.170	−.015
.	82/83	3350	.128	−.013

NOTE: A "." indicates that the results in that row are averages over all values of the column variable.

[a]Error = actual − predicted.

Table 6.5

PERFORMANCE OF SECOND-TERM ETS EXTEND-GIVEN-STAY MODEL BY ETS YEAR AND LENGTH OF TERM

Term Length	ETS Year	No. of Observations	Predicted Extend Rate	Error in Prediction[a]
4	.	22,995	.378	.0020
6	.	2437	.437	−.0164
.	74/75	1231	.227	−.0278
.	75/76	2931	.294	−.0407
.	76/77	2847	.284	−.0128
.	77/78	3617	.256	.0553
.	78/79	2190	.410	−.0089
.	79/80	2982	.487	−.0448
.	80/81	3842	.524	.0234
.	81/82	2829	.487	.0320
.	82/83	2963	.384	−.0104

NOTE: A "." indicates that the results in that row are averages over all values of the column variable.

[a]Error = actual − predicted.

VII. CAREER FORCE ETS DECISION

In this model, we concentrate our efforts on predicting the proportion of career airmen who will stay with the Air Force past their original ETS, assuming they are serving 12 months prior to that ETS.[1] We estimate the fraction of persons who extend their term beyond its original ETS as a function of only year of service.

About 80 percent of the people who stay reenlist if they have completed less than 17 years of service. But over 50 percent of those who stay past their ETS and have completed 18 or more YOS extend instead of reenlisting (see Table 7.1). The primary reason for the increase in extensions after 17 YOS is planning for retirement.

The extend-given-stay model is simply the historical mean value for each YOS as shown in Table 7.1. The average extension length is 12 months and seems to be stable over YOS and years (see Tables 7.2 and 7.3).

For the loss analysis, we used information on the terms of all airmen who had completed two or more terms and had served more than nine years and less than 19 years by 12 months prior to their original ETS. We excluded terms that were scheduled to end before July 1974 because we did not observe all the early reenlistments that were associated with them. We also excluded E-4s because, in some years, high year of promotion was enforced more rigorously, and because they constituted less than .5 percent of our sample. We used terms with contractual end dates through June of 1983.

The model was estimated from grouped data. Individuals who faced a career ETS decision in the same year,[2] who completed the same number of years of service, and who shared the same career field and grade were grouped together. For each group, means of the loss rate, civilian pay, military pay, unemployment rate, sex, race, and previous bonus variables were

Table 7.1

PROBABILITY EXTEND GIVEN STAY BY YOS AMONG CAREER AIRMEN

YOS at ETS	Proportion Extending of Those Who Stayed
9	.263
10	.266
11	.185
12	.243
13	.200
14	.210
15	.103
16	.206
17	.389
18	.588
Average	.243

[1]About 3.5 percent of airmen reenlist before 12 months prior to their ETS. For this model, we assumed that they reenlisted exactly 12 months prior to their ETS and lumped them into the reenlistment category. Failure to do so would have inflated our loss rates marginally (by approximately .15 percent: $[4.1/(100 - 3.5)] - .041 = .0015$).

[2]Years are from July 1 to June 30.

Table 7.2

AVERAGE LENGTH OF EXTENSION BY YEAR OF ETS

ETS in Period	Number of Airmen	Average Length of Extension (Months)[a]
July 71–June 72	2450	13
July 72–June 73	3590	13
July 73–June 74	4420	13
July 74–June 75	5209	12
July 75–June 76	5119	11
July 76–June 77	4146	11
July 77–June 78	2955	11
July 78–June 79	1754	11

[a]One reason for the decline of length of extension in the later years is that long extensions are truncated because these data end in 1980.

calculated. These variables would not be expected to vary much within each group. (Grouping variables such as grade, YOS, and AFSC are the determinants of pay variables.) Therefore, using means of these variables was not expected to influence our results.[3] Using grouped data for our analysis reduces the sample size and, therefore, the cost of the exploratory regressions. Each group constitutes one observation in a weighted least-squares analysis. (The weights are the number of individuals in the group.)

PRELIMINARY ANALYSIS

Our preliminary analysis of the career ETS decision indicated that current economic variables such as civilian/military pay ratio[4] and unemployment rate have significant effects on ETS losses in the career force, and that the loss rate decreases with YOS. This led us to test whether the effects of economic variables were different at different YOS. As a first cut, we fit a model to YOS 9–12 separately from YOS 13–18. Table 7.4, which shows the results of this analysis, clearly indicates that the effects of current economic variables on loss rates are

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[3]We tested for intragroup correlation in the preliminary analysis and it did not change our results significantly.

$$\text{Let } Y_{ij} = \alpha_i + \beta_{ij} ,$$

where Y_{ij} is the effect for the *jth* individual in the *ith* group, α_i is the group effect, and β_{ij} is the effect for the individual. If Var $(\alpha) = 0$, then using the number of individuals in each group as the weights in a weighted least-squares analysis will be appropriate. Otherwise, the weight should be equal to:

$$\frac{MSE}{MS_{grp} + MSE/n_i},$$

where MSE is the mean square error within group, and MS_{grp} is an estimate of the mean square error for the group, Var (α). Note that, when MS_{grp} approaches zero, the weight approaches n_i, the number of individuals in group i.

[4]The ratio of average civilian wages to Air Force-wide military pay performed better than the ratio of civilian wage (assigned to each airman by his experience level (YOS) and AFSC) to the airman's military wage. If the airmen leaving the Air Force find jobs that are unrelated to their AFSCs, then the civilian wage assigned to an airman according to his YOS and AFSC will introduce errors in the measurement. Furthermore, once we included the average civilian/military pay index in our equation, the individually based civilian and military pay variables did not have significant explanatory powers.

Table 7.3

AVERAGE LENGTH OF EXTENSION BY YOS

Completed Years of Service	Number of Airmen[a]	Length of Extension (Months)
6	332	9
7	1157	10
8	1215	11
9	1892	11
10	2042	11
11	2243	11
12	2283	12
13	1676	15
14	2826	14
15	3194	12
16	4467	12
17	3823	12
18	3648	12

[a]From sample for preliminary analysis. Total number of airmen is slightly larger than that of Table 7.2 (by 655) because 1980 numbers are not shown in Table 7.2.

significantly different from zero in the YOS 9–12 group, whereas the effects for the YOS 13–18 group are not.

SPECIFICATION OF THE MODEL

Our preliminary analysis had indicated that the career ETS loss rate decreases approximately exponentially with YOS. Furthermore, the value of retirement benefits increases exponentially as an airman comes closer to the 20-year vesting point. Therefore, we expected the effect of current economic variables on loss rates to decline approximately as an exponential function. In fact, we restricted the coefficients of the economic variables to decay to exactly zero at 20 YOS. Our justification is that serving the day before retirement eligibility will give an airman such a large payoff that no matter what happens in the civilian economy, he will serve that day.

Therefore, our model is:

$$
\begin{aligned}
P(\text{loss}) = \alpha_0 &+ \alpha_1 e^{-YOS/b} \\
&+ (\alpha_2 + \alpha_3 \bullet e^{-YOS/b}) \bullet \text{(Skilled Technicians)} \\
&+ (\alpha_4 + \alpha_5\, e^{-YOS/b}) \bullet \text{(Functional Support and Administration)} \\
&+ (\alpha_6 + \alpha_7\, e^{-YOS/b}) \bullet \text{(Craftsman, Service, and Supply Handlers)}
\end{aligned}
$$

$$+ (\alpha_8 + \alpha_9 e^{-YOS/b}) \bullet \text{(Unknown AFSCs)}$$

$$+ (\alpha_{10} + \alpha_{11} e^{-YOS/b}) \bullet \text{(Being E-6)}$$

$$+ (\alpha_{12} + \alpha_{13} e^{-YOS/b}) \bullet \text{(Being E-7 or above)}$$

$$+ (\alpha_{14} + \alpha_{15} e^{-YOS/b}) \bullet \log\text{(Unemployment rate)}$$

$$+ (\alpha_{16} + \alpha_{17} e^{-YOS/b}) \bullet \log\text{(Military/civilian pay ratio)}$$

with the restrictions that:

$\alpha_2 + \alpha_3 e^{-20/b} = 0$ (t−statistic = .441)

$\alpha_4 + \alpha_5 e^{-20/b} = 0$ (t−statistic = .599)

$\alpha_6 + \alpha_7 e^{-20/b} = 0$ (t−statistic = −.874)

$\alpha_8 + \alpha_9 e^{-20/b} = 0$ (t−statistic = .815)

$\alpha_{14} + \alpha_{15} e^{-20/b} = 0$ (t−statistic = −.440)

$\alpha_{16} + \alpha_{17} e^{-20/b} = 0$ (t−statistic = 1.675)

We did not use nonlinear estimation methods to estimate b. Instead, we tried several values (the integers 1 to 5) for this variable, and chose the value ($b = 2$) that gave the highest R^2 in linear least-squares estimation.

Table 7.4

PRELIMINARY MODEL OF CAREER ETS LOSS RATES FOR TWO YOS GROUPS

Predictor Variable	YOS 9–12	YOS 13–18
Constant term	.0356	.0219
	(58.19)	(58.19)
Skilled Technicians	+.0206	+.0007
	(+3.72)	(+.18)
Functional Support and Administration	−.0002	−.0019
	(−.03)	(−.47)
Craftsmen, Service, and Supply Handlers	+.0001	+.0032
	(+.02)	(+.06)
Unknown AFSC	+.0148	−.0054
	(+1.51)	(−.83)
Grade ≥ E−7	−.0544	−.0107
	(−2.74)	(−2.00)
Grade = E−6	−.0283	−.0079
	(−5.03)	(−2.05)
Unemployment rate	−.0111	+.0003
	(−5.82)	(+.21)
Civilian/military pay ratio[a]	+.0898	+.0013
	(+4.84)	(+.10)

[a]This is an individually based ratio, not the general ratio employed in all other models described in this report.
$R^2 = .1979$.

RESULTS

Table 7.5 contains the fitted coefficients for the model. Because of the nonlinear interactions of the coefficients, subsequent tables provide marginal effects found at various years of service. For example, Table 7.6 shows the effect of a 10 percent change in the military/civilian pay ratio and a 1 percent change in the unemployment rate on loss rates by YOS that were obtained using the model.

Career Field Variables

In our exploratory analyses, we used career fields to identify differences in loss rates by occupational specialties. This aggregation was used because, in most career fields, the airmen in different AFSCs perform similar jobs, and the number of airmen in some AFSCs is so small that, unless we use some kind of aggregation, those AFSCs cannot be analyzed reliably. However, the effects of career field were not statistically significant after we controlled for the aggregations of career fields called Career Field Groups (see Table A.1). Consequently, only Career Field Groups are used in the model.

With reasoning similar to that applied to the economic variables and support from data, the occupational effects were modeled as an exponential decay function. Here, again, the effects were restricted to be zero at exactly 20 YOS.[5] The effects of occupational groups on loss rates by YOS as compared with Electrical/Mechanical Equipment Repairmen are given in Table 7.7.

Table 7.5

PARAMETER ESTIMATES FOR THE CAREER ETS LOSS MODEL

Parameter	Estimate	t-Statistic
α_0	.0094	4.17
α_1	163.1210	4.95
α_2	$-1.3131*10^{-4}$	−7.66
α_3	2.8924	7.66
α_4	$5.9477*10^{-5}$	3.23
α_5	−1.3101	−3.23
α_6	$5.4137*10^{-5}$	2.25
α_7	−1.1924	−2.25
α_8	$-2.3596*10^{-4}$	−3.82
α_9	5.1970	3.82
α_{10}	−.0126	−5.47
α_{11}	−2.1246	−3.78
α_{12}	−.0133	−4.33
α_{13}	−4.9089	−1.88
α_{14}	$5.6833*10^{-4}$	11.12
α_{15}	−12.5183	−11.12
α_{16}	.0018	5.78
α_{17}	−40.0881	−5.78

[5]These restrictions are consistent with the data (t-statistics between −.5 and .8).

Table 7.6

MARGINAL EFFECTS OF ECONOMIC VARIABLES
ON CAREER ETS LOSS RATES

	Completed YOS by 12 Months Prior to ETS			
Effect	9	12	15	18
10 percent increase in military/civilian pay ratio[a]	–.0423	–.0093	–.0019	–.0003
1 percentage point change in unemployment rate[b]	–.0253	–.0056	–.0012	–.0002

NOTE: Estimated from regression equation of Table 7.5.
[a]From 1.0 to 1.1.
[b]From 5 percent to 6 percent.

Grade Effects

E-6s and E-7s[6] have significantly lower loss rates than do E-5s all through the career years.[7] Table 7.4 shows that the grade variables are the only effects significantly different from zero in YOS 13 to 18. The grade effects, like other effects, decline in magnitude as the 20-year point comes closer. Therefore, we continued to use an exponential decay function to describe the grade effects. However, we chose not to require them to decay to exactly zero at the 20-year point because that restriction reduced the grade effects of later years by an order of magnitude. As it currently stands, the grade effects are very close but not equal to zero at the 20-year point (see Table 7.8).

Table 7.7

MARGINAL EFFECT OF CAREER FIELD GROUP ON CAREER
ETS LOSS RATES
(Relative to Electrical/Mechanical Equipment Repairmen)

	Completed YOS by 12 Months Prior to ETS			
Career Field Group	9	12	15	18
Skilled Technicians	+.0320	+.0070	+.0015	+.0002
Craftsman, Service, and Supply Handlers	–.0140	–.0029	–.0006	–.0001
Functional Support and Administration	–.0145	–.0032	–.0007	–.0001
Others and Unknown	+.0575	+.0126	+.0026	+.0004

NOTE: Estimated from regression equation of Table 7.5.

[6]Or above.

[7]Note that because we use the general rather than the individual military/civilian pay ratio in our equation, part of the grade effect may be due to higher military pay at higher grades.

Table 7.8

MARGINAL EFFECT OF GRADE ON CAREER ETS LOSS RATES (Relative to E-5)

	Completed YOS by 12 Months Prior to ETS				
Grade	9	12	15	18	20
E-6	−.0362	−.0179	−.0138	−.0129	−.0127
E-7 and above	−.0678	−.0255	−.0160	−.0139	−.0135

NOTE: Based on regression of Table 7.5.

PERFORMANCE

Tables 7.9 and 7.10 show that the career ETS loss model performs well within sample across ETS years and across years of service.

Table 7.9

FIT OF CAREER ETS LOSS MODEL BY YEAR OF ETS

Year of ETS[a]	Number of Observations	Actual Loss Rate	Error in Prediction[b]
74/75	4752	.0294	−.00193
75/76	5880	.0229	.00015
76/77	6885	.0310	−.00048
77/78	6160	.0305	−.00560
78/79	6228	.0499	−.00270
79/80	6894	.0581	.00343
80/81	6996	.0358	.00361
81/82	5893	.0285	.00318
82/83	5503	.0194	−.00086
Total	55,191	.0347	.00000

[a]Years run from July 1 of first year through June 30 of the following year.
[b]Error = actual − predicted.

Table 7.10

FIT OF CAREER ETS LOSS MODEL
BY YEARS OF SERVICE

Years of Service[a]	Number of Observations	Actual Loss Rate	Error in Prediction
9	4471	.1084	−.00538
10	10,460	.0685	.00314
11	9109	.0431	.00089
12	1883	.0313	.00508
13	2068	.0183	.00255
14	7128	.0124	.00001
15	12,042	.0068	−.00281
16	1254	.0047	−.00221
17	727	.0041	−.00252
18	6049	.0069	.00108

[a]YOS completed by 12 months prior to ETS.

[b]Error = actual − predicted.

VIII. LOSSES FROM EXTENSIONS

INTRODUCTION

Airmen approaching the expiration of their terms of service can extend for a variety of reasons. Most extensions are made to increase retainability if the airman wishes to retrain, accept a PCS (Permanent Change of Station) move, or assume a grade of E-7 or higher. Airmen also extend for personal reasons, such as to provide extra time to make a career decision or look for a civilian job. Through the years, the Air Force has changed the allowable reasons for extensions and has generally tightened or loosened the policy to adjust to changing retention rates. Of interest to the EFMS is that airmen on extension status differ from normal ETS decisionmakers in their mean loss rates. In particular, airmen in extension status generally leave the service at a lower rate than the typical airmen reaching ETS.

The remainder of this section documents the specifications of the models for predicting losses from extensions. For each category of enlistment (first term, second term, and career), two models appear to be appropriate. One model applies to people whose Date of Separation (DOS) falls sometime within the year for which losses are being predicted. (We call these airmen *decisionmakers*, since they have to make a decision to stay or leave at some time during the year.) The other applies to people whose DOS is beyond the current year (nondecisionmakers). The loss models for decisionmakers are called DOS models; the models for nondecisionmakers are called attrition models.

ANALYTIC FRAMEWORK

We next discuss the framework for the analysis and, by way of illustration, the first-term loss models. The first-term problem is relatively clean, since airmen who extend can only do so for up to 23 months. Therefore, roughly 97 percent of the airmen are either decisionmakers in the first year of a one-year extension, decisionmakers in the second year of a two-year extension, or nondecisionmakers in the first year of a two-year extension. Although there are many multiple extensions, by the end of 24 months past original ETS, the airman has been lost or has reenlisted into the second term.

One of the first things we did in the analysis was to confirm the hypothesis that decisionmakers and nondecisionmakers do, in fact, behave differently. Figure 8.1 shows plots of the loss rate by calendar year for decisionmakers and non-decisionmakers. It clearly shows that the two populations exhibit different loss behavior.

Many airmen in extension status extend again. An issue we explored was whether a separate model was needed to forecast extensions for extenders. This led to the question of whether people who were reextenders were lost differently from people who were not. An F-test for equivalent regressions indicated that they were not. Since the IPM is trying to forecast losses and is not unduly concerned with forecasting DOS status, we decided that it was not necessary to include a separate reextension model.

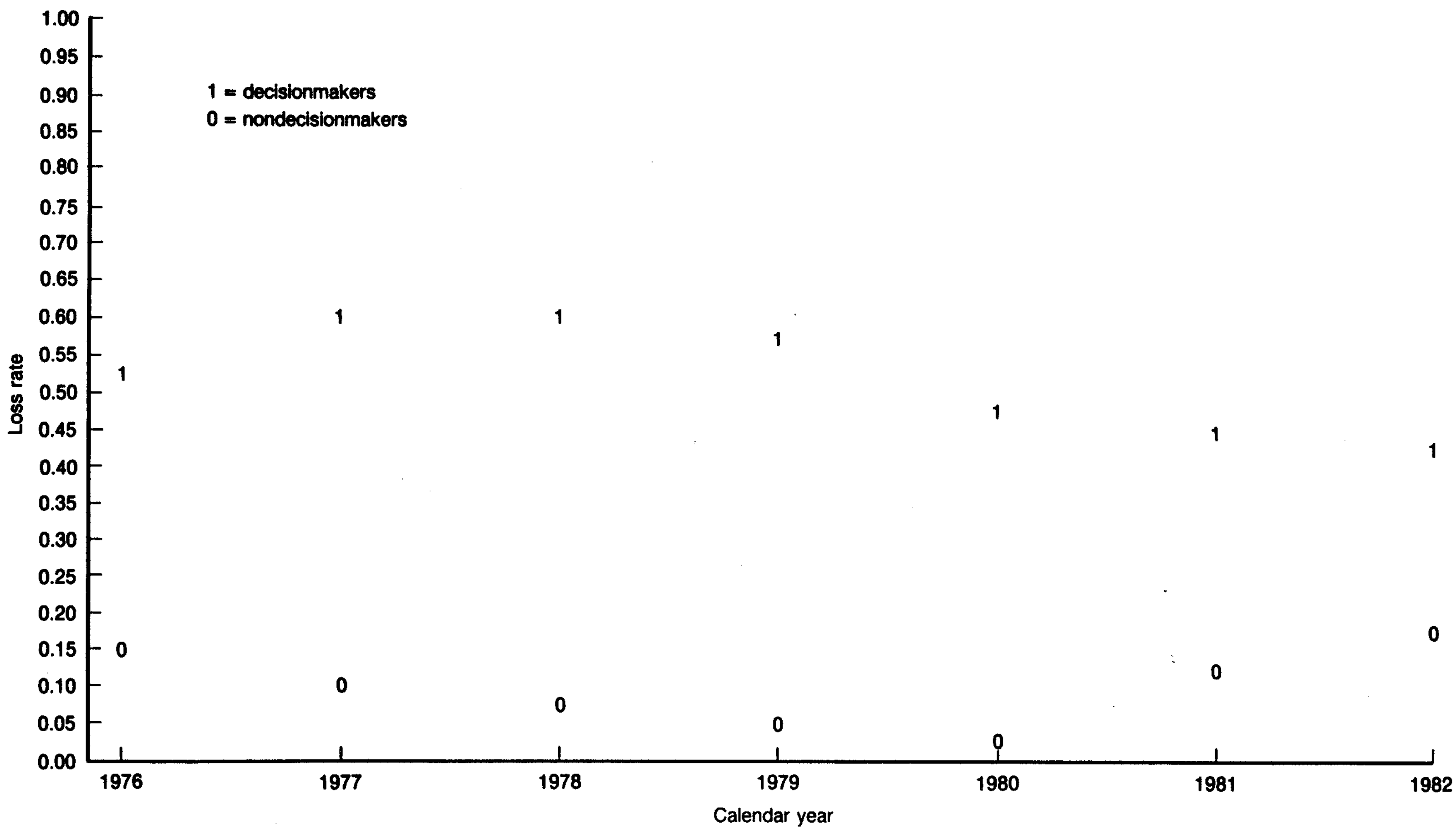

Fig. 8.1—Loss rate by calendar year for first-term extenders (decisionmakers and nondecisionmakers)

Nondecisionmakers

The nondecisionmaker loss equations are simple, including only four variables, one for each Career Field Group. The models for the three non-retirement-eligible categories of enlistment (first term, second term, and career) are given in Table 8.1. More complex specifications did not perform appreciably better than the simple ones. The models were fit with a 40 percent YAR sample, using data for the seven years from 1977 through 1983.[1]

Decisionmakers

The decisionmaker loss equations are only slightly more complex. They add pay and unemployment variables to the Career Field Groups and also contain an indicator variable (Last YETS) that differentiates airmen whose new ETS is more than one year after the original ETS for the term from those for whom the new ETS is less than one year after their original ETS. Bonus opportunities were found to not affect loss rates among extenders, indicating that airmen who take especial account of their bonus opportunities do so by reenlisting rather than by extending. Airmen stationed overseas (CONUS = 0) were not found to have different loss rates from airmen stationed in the continental U.S. (CONUS = 1) when other effects are controlled for. Table 8.2 contains the parameters of the decisionmaker loss equations for the three non-retirement-eligible categories of enlistment.

Table 8.1

PARAMETER ESTIMATES FOR NONDECISIONMAKER EXTENSION LOSS MODELS

	First Term		Second Term		Career	
Predictor Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Constant term	.143	8.59	.000	.00	.000	.00
Craftsmen, Service, and Supply Handlers	–.079	7.56	.031	3.07	.022	3.22
Functional Support and Administration	–.090	7.76	.035	5.02	.017	4.35
Skilled Technicians	–.099	6.80	.043	7.10	.012	3.29
Electrical/Mechanical Equipment Repairmen	–.100	6.47	.025	3.44	.008	2.11
Sample size	3923		2584		2996	

[1]A year is July 1 through June 30.

Table 8.2

PARAMETER ESTIMATES FOR DECISIONMAKER EXTENSION LOSS MODELS

	First Term		Second Term		Career	
Predictor Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Constant term	−.771	8.23	4.077	6.23	.463	3.23
Craftsmen, Service, and Supply Handlers	−.152	2.06	−.077	.53	.076	1.07
Functional Support and Administration	−.175	2.38	−.091	.66	.019	.29
Skilled Technicians	−.081	1.12	−.031	.13	.043	.63
Electrical/Mechanical Equipment Repairmen	−.141	1.92	−.075	.54	.019	.29
Log(mil. wages/civ. wages)	.125	1.86	−.957	2.73	−.134	1.60
Moving average of unemployment rate	−.404	13.27	−.349	7.78	−.102	3.02
Last YETS	−.066	6.16	−.147	7.71	−.025	1.97
Sample size	9053		2642		2208	

IX. RETIREMENT

In this section we describe the retention behavior of enlisted personnel once they are eligible to retire. We have specified a model that estimates airman loss rates for a period of 10 years following the first opportunity to retire at 20 years of service. We begin this section by discussing the variables considered in the development of the model and the results of our exploratory analysis. We then present the final model specification and an interpretation of its parameters.

DEPENDENT VARIABLE

The middle-term equations for first-term, second-term, and career airmen are based on the probability that an airman will leave the Air Force on or before the end of the next year of his term. These are the equations used to describe the loss rates of enlistees before they are eligible to retire. During the retirement years, however, we based the loss-rate estimates on year of service, rather than on an airman's year in term. Air Force policy allows retirement-eligible employees to retire with seven days notice under certain conditions. Thus the date of original ETS is not as closely correlated with retirement as it is with preretirement losses. Year of service is closely correlated with retirement, however, partly because of the Air Force's high year of tenure policy discussed in the next subsection.

The dependent variable for the model is a zero-one variable which indicates that an airman who has completed n years of service will retire (value of variable equals one) on or before completing $n + 1$ YOS, where n is an integer between 19 and 28. The definition of losses within a year of service is computed to correspond to the rule that a retirement always becomes effective on the first day of a month. We assume that a person who wishes to retire at the 20-year point (his first opportunity) serves throughout the month in which he attains 20 YOS but no longer. The date of the separation found in our files is the following month, and the computed Total Active Federal Military Service (TAFMS) at loss would be 241 months. Similarly, a person who decides to retire at the completion of 21 YOS would appear to have served 253 months. Consequently, we count all losses as if they occurred one month earlier than the date recorded in our files (as, in fact, they did).

INDEPENDENT VARIABLES

The demographic variables that might have some effect on retirement behavior include education, sex, and race. The effect of education on retirement was tested by considering an airman's educational background as one of three categories: (1) training below high school, (2) completion of a high school degree, and (3) some college training. Unfortunately, data on sex and race were missing for personnel eligible to retire before 1976. It is highly unlikely, however, that these variables would have significantly influenced the results of the analysis, since the number of women and blacks enlisting before 1960 was very low. (For instance, the fraction of persons reaching 20 years of service in 1978 who were women was less than 1 percent, whereas the fraction who were blacks was 12 percent.)

Two important variables that influence retirement behavior are years of service and grade. These variables are measured at the beginning of the risk interval covered by the observation. Thus, YOS takes on integer values from 19 to 28. Likewise, grade is also defined at the beginning of a year. (Any promotions during a given year are taken into account only at the beginning of the following year.) Both of these variables are categorical rather than continuous variables.

Much of the effect of YOS and grade is due to Air Force retirement policies. Three of these policies are particularly relevant to our model. First, the amount of pension received after retirement increases with the number of years served before retirement. (Retirees who enlisted before July 31, 1986 receive 50 percent of their final salary[1] plus 2.5 percent for each year of service beyond 20 years.) The effect of this policy can be captured by the YOS variables.

A second important retirement policy specifies a maximum allowable number of years of service for each Air Force rank, called the high year of tenure (HYT). The high year of tenure for grades E-5, E-6, E-7, E-8, and E-9 are 20, 23, 26, 28, and 30 years of service, respectively. The model includes a variable that indicates a HYT point could be reached at the end of the year at risk. Since we measure grade 12 months before the HYT point is reached, some people who enter a HYT-risk year do not actually reach their HYT because they are first promoted. The model variable consists of five levels allowing separate high year of tenure effects for each grade (5, 6, 7, and 8) contrasted with non-HYT years. The HYT year for E-9s (which begins with YOS = 29) is not included in the model since this year must end in a loss unless the person is granted a waiver.

The third set of retirement policies captured by our model consists of year-in-grade policies. Those promoted into grades E-7 and higher must fulfill an additional two-year commitment in that new grade before they are eligible to retire. (Airmen promoted into grades below E-7 are able to leave any time following promotion.) The variable we use to capture the effect of this policy on losses takes on one of three levels for persons in grade E-7, E-8, or E-9: (1) less than one year in grade at the beginning of the year at risk, (2) at least one year but less than two years in grade, and, (3) more than two years in grade. All persons who are in grades of E-6 or lower are assigned to the third group, which is the comparison group for calculating the coefficients. The loss behavior of persons in grades E-5 and E-6 has no effect on any coefficient of the year-in-grade variable because of the separate grade variable in the model.

We examined the influence of occupation on losses at two different levels of detail. The most detailed level consisted of career fields, which are specified by the first two digits of the AFSC. The least detailed level was the aggregation of career fields into the four Career Field Groups presented in Table A.1.

The average enlisted retiree separates from service at age 42. Thus, an airman's decision to retire is likely to depend both on his perception of his ability to return to the civilian workforce in a desired occupation and on his financial status in the Air Force compared with prospects in the civilian sector. Therefore, we examined the effects of two economic indicators on retirement losses: (1) the ratio of military to civilian wages and (2) unemployment rates in the civilian sector. The military/civilian wage ratio was not statistically significant. The model does, however, include other variables that are correlated with wages. The variables describing occupation probably pick up much of the effect of differing civilian opportunities among airmen; and the grade variables are correlated with military wages.

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[1]Persons who enlisted after September 8, 1980 have their pension calculated based on the average of their highest three years of salary. This group will first be eligible to retire in 2000. A new retirement policy is now in effect for those enlisting after July 31, 1986. Under the new policy, the amount of pension still depends on years of service.

The unemployment variable was significantly related to losses in our final model. There is an interaction between the HYT variable and the unemployment variable. We postulated that economic variables have no effect on cohorts reaching their HYT since Air Force rules require them to leave the service. Computationally, we multiplied the log of the unemployment variable by zero during the high years of tenure. This method allowed us to separate the airmen who had completed the maximum allowable number of years of service and were required to leave from those who could still choose to leave.

We also analyzed the effect of the number of years to an airman's scheduled ETS on the probability that an airman will retire. This "YETS" variable was made up of four levels based on whether the airman was in extension status at the beginning of the year of risk, or if not, whether the year at risk began: (1) within 12 months of original ETS, (2) within 13–24 months of original ETS, or (3) more than 25 months before original ETS.

DATA SELECTION

We used all records of retirement years at risk that began after July 1, 1973 and before the end of May 1982. (We could not use June 1982 because retirements during June 1983 were not recorded until July 1983 and consequently did not appear in our data base.) We eliminated years at risk that began on or after a HYT point. These are found in our data when the Air Force grants a waiver of its HYT policy.

EXPLORATORY ANALYSIS

Our first exploratory analysis was devoted to determining whether the model should be based on YOS and grade or on years to original ETS as are the other middle-term models. We found that the effect of years of service accounts for a major portion of the variation observed in retirement losses (Table 9.1). The plurality of losses in our sample occurs at 20 years of service—the first opportunity to retire. (The 20-YOS point occurs during the year that begins with the airman having completed 19 YOS.) The effect of high year of tenure is also apparent at years 23, 26, and 28, when the percentages of airmen that leave are higher than those during

Table 9.1

RETIREMENT RATE BY YEARS OF SERVICE

Years of Service Completed at Beginning of Risk Interval	Sample Size	Retirement Rate (% lost)	Notes
19	35,059	37.7	First opportunity
20	22,693	32.8	
21	15,902	24.3	
22	13,037	34.1	HYT for E-6
23	9063	19.5	
24	7475	16.0	
25	6561	42.2	HYT for E-7
26	3553	27.7	
27	2620	45.5	HYT for E-8
28	1170	22.1	

the other years of service. This distribution of loss rates confirms the importance of the effects of Air Force retirement policies on retirement behavior. Table 9.2 compares the loss rates for each grade that occur at the high years of tenure. The highest loss rate within each grade occurs at the high year of tenure associated with that grade. (The rate is not 1.0 because of promotions.)

To control for possible interactions between year of service and other variables, we tested the effects of the demographic, economic, and policy variables in separate equations for each year of service. This analysis revealed that the effects of mandatory retirement at each high year of tenure are so great that economic variables have little or no impact on the retirement behavior of those required to leave. Conversely, in years other than HYT, economic variables strongly affect retirement losses. In the equations developed for the high years of tenure, unemployment rate was not statistically significant ($p > .7$) when high year of tenure was greater than 20 years of service. After accounting for the interaction of high year of tenure with the explanatory variables, the coefficients of most of the variables were relatively stable over YOS. Consequently, we pooled the data to estimate a single equation for all the YOS. F-tests were used to determine whether there was a statistically significant interaction between YOS and either unemployment or grade (after controlling for HYT).

We found that the ratio of military to civilian pay was not statistically significant in our model at all. It is not clear if this is due to the correlation in the data between this pay ratio and unemployment. Another possibility is that military wages are not a large factor in current retirement decisions, since an increase in military wages will increase retirement income as well.

Preliminary tests showed that there are significant differences among career fields. Career fields accounted for a significant portion of the variation in loss rates in the model ($p < .001$, $F_{47} = 8.36$) even after controlling for the Career Field Groups. Thus, the more detailed occupational grouping, the two-digit career field, was used in the final model specification.

SPECIFICATION OF THE MODEL

The specification of the middle-term model for the retirement-eligible enlisted force is shown in Table 9.3. The estimated coefficients for the parameters and the associated t-statistics are presented along with the parameters to be included in the model.

Table 9.2

RETIREMENT RATE AT HIGH YEAR OF TENURE BY GRADE AT BEGINNING OF RISK INTERVAL

	Grade				
YOS	E-5	E-6	E-7	E-8	E-9
19	73.7 (3689)[a]	40.4 (15,609)	28.2 (13,475)	17.6 (2082)	18.1 (204)
22		71.3 (2701)	26.6 (6770)	20.1 (2787)	19.5 (779)
25			75.8 (2701)	18.4 (2201)	19.2 (1659)
27				71.5 (1151)	25.2 (1469)

[a]Numbers in parentheses are sample sizes.

Table 9.3

SPECIFICATION OF RETIREMENT MODEL

Predictor Variable	Coefficient	t-Statistic
Intercept	.5255	18.83
Education:		
Less than high school education	.0531	10.19
High school degree	.0207	6.76
Some college education	.0	(cg)[a]
Grade:		
E-5	.0242	1.10
E-6	.0914	12.32
E-7	.0330	5.24
E-8	−.0086	−1.43
E-9	.0	(cg)
Natural log (unemployment rate) (In other than high years of tenure)	−.1352	−16.40
High year of tenure variable:		
Year of Service not a HYT	−.0813	−3.02
E-6 HYT	−.0714	−3.47
E-7 HYT	.0538	2.56
E-8 HYT	.0	(cg)
Time in grade:		
Less than 1 year in grade E-7 or higher	−.1757	−42.10
More than 1 year in grade E-7 or higher	.0728	19.16
More than 2 years in grade or E-5 or E-6	.0	(cg)
Years to ETS variable:		
Extension year	.1422	33.16
Year of ETS	.1113	29.47
One to two years to ETS	.0683	18.51
Two to three or more years to ETS	.0	(cg)
Number of years of service completed:		
19	.0499	3.47
20	.0617	4.26
21	.0079	.55
22	.0191	1.32
23	−.0324	−2.25
24	−.0584	−4.05
25	−.0019	−.13
26	.0621	4.17
27	.0450	2.66
28	.0	(cg)
Career Field	Table B.6	

[a]cg = comparison group.

Our analysis indicated that the current unemployment rate strongly affects retirement losses during years other than high years of tenure. As unemployment rates increase in the civilian sector, the probability that enlisted personnel will retire is significantly lower than during periods of low unemployment. Thus, current economic conditions affect the timing of retirement losses: airmen will delay retirement during periods of economic decline.

Educational background is inversely related to the probability of retirement. Airmen with some college training are significantly less likely to leave the Air Force during the retirement years than those with only a high school degree or those who never completed high school. This finding is perhaps related to the probability that highly educated enlistees who have served at least 20 years tend to be more successful in the Air Force and, therefore, less likely to switch to a career in the civilian sector.

The coefficients of the grade variable given in Table 9.3 give marginal effects assuming the risk interval does not cover a high year of tenure and controlling for the time in grade of E-7s, E-8s, and E-9s. The E-6 coefficient shows that for risk intervals beginning with YOS 19, 20, or 21, E-6s retire at a rate .0914 higher than the retirement rate for E-9s with more than two years in grade. The similar E-7 coefficient shows that for each YOS from 19 through 24 and each time-in-grade category, E-7s retire at a rate .0330 higher than E-9s in the same time-in-grade category. Determining the prediction of the effect of grade at high year of tenure is more complicated because it is necessary to account for the effects of the HYT class variable and economic variables in addition to the grade variable. This is done in Table 9.4 (using E-9s with more than two years in grade as the comparison group). Table 9.4 shows, for example, that the retirement rate for E-6s with 22 YOS is approximately .43 higher than the retirement rate for E-9s with the same YOS and more than two years in grade. These calculations depend on the unemployment rate; in Table 9.4 we used the average value (11.44) for years 1973 through 1983.[2]

E-8s and E-9s have similar retirement rates aside from the high year of tenure. In all other cases, the probability that persons in lower grades will retire is much higher than the probability for a similar person in a higher grade for all years of service (Table 9.3). In most cases, the person's grade at the date of retirement determines the amount of the retirement pension. Airmen who are expecting promotion may delay retirement until they advance to the higher grade. But at a high year of tenure, the loss probability greatly increases for the relevant grade.

Airmen in grade E-7 or higher with less than one year in grade leave at a much lower rate than those with one or more years in grade (Table 9.3). However, the loss rate increases at the completion of the two years of obligated service, substantially exceeding the rate in subsequent years in grade.

Table 9.4

THE NET EFFECT OF GRADE ON RETIREMENT RATES AT HIGH YEARS OF TENURE[a]

	Grade at Beginning of Risk Interval			
YOS	E-5	E-6	E-7	E-8
19	.4349	.0914	.0330	-.0086
22	—	.4307	.0330	-.0086
25	—	—	.4975	-.0086
27	—	—	—	.4021

[a]Effects are relative to an E-9 with more than two years in grade, and are calculated using the average unemployment rates in years 1973–1983.

[2]Although most airmen are likely to be in their late 30s or early 40s, we used unemployment rates for ages 20 to 24 to remain consistent with the rates used in the other loss models.

The number of years until an airman's scheduled ETS at the 20-year point is significantly related to the probability that an airman will leave the Air Force. Airmen are most likely to leave at ETS or in an extension year; they are increasingly more likely to leave as they approach ETS (Table 9.3).

The number of years of service an airman has completed also contributes to the probability of retirement. After a peak at 20 YOS, there is a slight decline in retirement rates between 21 and 25 YOS. This relationship is U-shaped (see end of Table 9.3). Thus, enlistees are more likely to retire at the beginning and end of the retirement years than they are during the middle of this period.

Table 9.5 reports the within-sample performance of the middle-term retirement specification by year. Our predictions agree well with the actual retirement rates. In addition, there are no clear trends in the magnitude of our predictions over time.

Table 9.5

PERFORMANCE OF RETIREMENT LOSS MODEL BY END OF RETIREMENT-YEAR-AT-RISK

	Retirement Rate			
Year-at-Risk End	Number of Observations	Actual	Predicted	Error
July 74–June 75	18,906	.3702	.3710	-.0008
July 75–June 76	16,418	.3237	.3046	.0191
July 76–June 77	15,060	.2974	.3114	-.0140
July 77–June 78	13,424	.3236	.3249	-.0013
July 78–June 79	11,799	.3188	.3241	-.0053
July 79–June 80	11,177	.3406	.3284	.0122
July 80–June 81	10,900	.3114	.3048	.0065
July 81–June 82	10,569	.2594	.2739	-.0145
July 82–June 83	8880	.2578	.2648	-.0070

X. CONCLUSIONS

The middle-term loss equations presented in Secs. II through IX result from a detailed empirical analysis of airman loss behavior—perhaps the most detailed ever undertaken. The equations do not track all the interactions among airmen decisions, and, therefore, are not appropriate for analyzing complex policy changes, such as revisions in the retirement system. But the middle-term loss equations complement theoretically richer models with a degree of empirical detail that adds markedly to our understanding of who stays and who leaves the Air Force at different career points. In particular, the inclusion of occupation-specific effects in the equations should increase their forecasting power over theoretically rich but empirically parsimonious specifications. At the same time, the inclusion of economic variables in the models should markedly improve their forecasting power over other models that have been available to the Air Force in the past.

There are 10 groups of middle-term loss equations that describe the behavior of 10 mutually exclusive and exhaustive groups of airmen:

1. First-term attrition
2. Second-term attrition
3. Career attrition
4. First-term ETS
5. Second-term ETS
6. Career ETS
7. First-term extension
8. Second-term extension
9. Career extension
10. Retirement

These equations were estimated from a single set of data, and in all the specifications the same basic variables were examined for inclusion. The variables spanned an airman's:

- demographic traits,
- circumstances in the service, and
- economic opportunities.

Not all variables appear in every equation, but most equations include numerous variables. In this section, we summarize the empirical findings from the models.

DEMOGRAPHIC TRAITS

Demographic influences lessen as airmen are in the service longer. Airmen at later stages of their Air Force careers seem more alike in their attachment to the service than airmen early in their careers. At first, this is doubtless because airmen who are disenchanted with the service or unfit for it leave; later, the homogeneity of attachment is strengthened by the increasing attractiveness of retirement benefits as airmen increase in years of service.

The demographic effects uncovered in our analysis conform closely to those that have been found by previous researchers; the only notable differences are the persistence of sex, race, and marital status effects through the second-term ETS decision and our finding of some interactions that previous researchers have not explored.

During the first term, and at the second-term ETS decision point, demographic differences account for considerable variation among airmen's decisions. But demographics do not appear in the second-term attrition equations, the career equations, or the loss from extension equations, and only a single demographic variable—having begun college—appears in the retirement equations.

Demographic effects are most varied in the first-term attrition equations. The effects on first-term attrition in each year of service of education, Air Force Qualification Test score (AFQT), and age are precisely what we expected to find based on the literature.

Attrition decreases with more education and better test scores. Those who join the Air Force before they are 18 leave at a higher rate than others throughout the first term. Those who join the Air Force after they are 18 leave at a slightly higher rate during their first year in the Air Force than those who join at exactly 18, but this effect reverses during the remainder of the term. Six-year enlistees who join the Air Force before age 18 leave at a slightly higher rate during their first YOS and at a slightly lower rate subsequently during the first term than would be predicted by the separate effects of term of enlistment, age, and other demographic effects.

Our findings with regard to marital status and dependents are also in agreement with previous studies, if we consider first-term attrition which takes place after Basic Military Training (BMT) is completed (which is the bulk of attrition). We find that those who were married but without children when they entered the service have modestly lower attrition rates after BMT than singles or persons with more than one dependent. But other researchers have not broken first-term attrition into so many components, so they have not observed, as we do, that married accessions have a slightly harder time getting through BMT.

Most previous studies of attrition in the Air Force found either no difference or only small differences due to race. We find that the first-term attrition rate is much higher for white women than for black women, but that the difference in attrition rates between black men and white men is very small. The similarity in the rates for men and the preponderance of men in the Air Force means that the average rate does not differ much by race.

Demographic effects are quite a bit simpler in the first-term ETS model than in the first-term attrition model. Past research has analyzed the cumulative effect of AFQT scores on reenlistments in the first term; our results confirm theirs. We find no effect of AFQT score on the stay/leave decision in the first term, but we do find that graduates and persons without low AFQT scores are more likely to extend than to immediately reenlist, thus decreasing their total reenlistment rate.

The first-term reenlistment rate is lower for single persons than for married persons, but marital status is a much more important determinant of the first-term ETS decision for men than it is for women. To our knowledge, this interaction has not previously been reported in the literature.

The total first-term reenlistment rate is higher for women than for men. Thus gender, in addition to education and AFQT score, has an effect on the first-term ETS decision that is opposite in sign from its effect on attrition. As other researchers have found previously, we find that blacks are less likely than whites to leave at ETS.

The demographic effects on second-term reenlistment decisions are even simpler than those at first-term ETS. Those who have started or completed college leave more frequently at the end of their second terms, and extend more frequently if they stay. Perhaps many of these more educated airmen embarked on higher education while in the Air Force in preparation for a civilian career.

Married persons are more likely to stay in the Air Force beyond their second term, and to do so by reenlisting. There are no differences in the immediate second-term loss rate by gender, but males are less likely to extend. Blacks are more likely to stay past their second original ETS, but those who stay reenlist at the same rate as whites.

After the second-term ETS, demographics play no discernible role in airmen's decision-making until they reach retirement eligibility. Educational background is inversely related to the probability of retirement in any year of retirement eligibility. Airmen with some college training are significantly less likely to leave the Air Force during the retirement years than those with only a high school degree or those who never completed high school. This finding is perhaps related to the probability that highly educated enlistees who have served at least 20 years tend to be more successful in the Air Force and, therefore, less likely to switch to a career in the civilian sector.

CIRCUMSTANCES IN THE SERVICE

The importance of an airman's circumstances does not diminish with length of service as demographic effects do. Behavioral differences across occupations do become less for airmen beyond the second term, but the effects of grade, and particularly of years of service, become greater over an airman's career. The estimated effects of term of enlistment, grade, and years of service conform in general to those that previous researchers have found. The chief difference lies in the more detailed array of decisions allowed for in our models.

Occupational Effects

Of special importance to the EFMS is the ability of the middle-term loss models to forecast occupation-specific loss rates. In the first and second terms, occupations are broken down to the AFSC level (for AFSCs with many personnel). In later terms, simpler depictions of occupation suffice.

Estimated first-term annual attrition rates for years beyond the first vary by as much as 23 percent across AFSCs, although variations of three percent are most common. The high attrition career fields (after controlling for demographics) are Audiovisual, Missile Maintenance, Vehicle Mechanics, Transportation, Fuels, and Security Police; the low attrition career fields are Communications and Electronics Systems, Avionic Systems, Training Devices, and Instructors. High-technology and education-linked fields may be especially attractive to airmen, but it may also be that the training requirements of these career fields lead to higher attrition during the first year, leaving fewer misfits for attrition in subsequent years. Our data do not permit us to identify losses by career field in the first year of service.

By the second term, the magnitudes of the occupational effects on attrition are quite small, with only a few career fields having strong attrition effects. The attrition effects are clustered so that the fields with higher attrition rates contain either administrative personnel or craftsmen.

In the career years, occupational differences in attrition are again small, with the Mechanical and Electrical Equipment Repairmen CFG having lower attrition rates than all other groups.

Occupational effects on losses at ETS are quite different from their effects on attrition. For both the first- and second-term ETS decisions, we fit both the loss and extension models with an effect for each AFSC. This was done to avoid bias in measuring bonus effects. When these AFSC effects are averaged across AFSCs in each of four broad occupational categories, we found that Skilled Technicians had the highest loss rate and the greatest propensities to extend rather than reenlist at the end of both the first and second terms. These data are consistent with our a priori expectations that Skilled Technicians have better civilian career opportunities than other airmen and that civilian opportunities play a large part in end-of-term decisions.

Although the AFSC effects in these four equations are positively correlated with each other, there are some differences among the models.[1] AFSCs with exceptionally high loss rate effects at ETS in both terms include 511X1 (Computer Programming), 316X0 (Missile Systems Analyst), and 272X0 (Air Traffic Controller). AFSCs with high effects in the first-term loss equation also include 321X2 (Weapons Control Systems) and 445X0G (Missile Facilities Technician). AFSCs with high effects in the second-term loss rate equation include the entire 31 career field (Missile Maintenance) and the entire 79 career field, which includes 791X0 (Public Affairs), 791X1 (Radio and TV Broadcasting), and 791X2 (Historian). AFSCs with exceptionally low first-term loss rates include those in career fields 73 (Personnel) and 75 (Education and Training).

Early in the career years, Career Field Group loss rates differ in an absolutely small, but still measurable degree. Airmen in the Skilled Technician group leave the service most often, while airmen in the Functional Support and Administration group, and in the Craftsmen, Service, and Supply Handlers group leave least often. Beyond 12 years of service, however, the differences among the Career Field Groups become inconsequential.

In the retirement years, occupational effects become more varied than during the career years. Separate effects for each career field can be discerned and were estimated. The pattern of effects is not as strongly related to Career Field Groups as in the earlier models. The career fields with the highest effects are 51 (computer systems), which is classified as a Skilled Technician field, 39 (Flight Simulators and Training Devices), and 65 (Contracting), which are both classified in the Functional Support and Administration CFG, and most fields in the Electrical and Mechanical Repairmen CFG.

Grade Effects

We find that from the beginning of the second term through 29 years of service, airmen in lower grades are more likely to leave the service than are airmen in higher grades. There is so little variation in grade at the first-term ETS decision that the data do not permit analysis of the grade effect for the model.

We asked if the causality between grade and loss behavior perhaps runs from the latter to the former, so that promoting additional airmen would have less effect on loss rates than the estimated equations suggest. Our analysis, conducted for second-term airmen, failed to reject the hypothesis that all the causality runs from grade to loss behavior. The small number of years of data in our sample make this a weak test, so we urge future researchers to study this issue in greater detail.

The strongest effects of grade are in the retirement years. High year of tenure rules constrain a much larger proportion of airmen in those years than at other times in an airman's career.

[1]The six Pearson correlation coefficients are between .22 and .54.

Years of Service Effects

In the first and second terms, years of service and year of term are highly correlated, so their effects on attrition behavior are indistinguishable. Airmen in the first and second terms leave less frequently as their years of service (and years served within the term) increase. In the career years, years of service and years served in a given term are distinguishable. Attrition declines as years of service increase, but increases as the years served within the term increases. Non-attrition losses decrease as years of service increase in the first, second, and career terms.

The effect of years of service in the retirement years is dominated by the high year of tenure rules. Excluding cases for which HYT is effective, retirement losses are highest at 20 years of service, fall slightly from years 21–25, and generally rise thereafter.

Term of Enlistment Effects

An airman's term of enlistment is correlated with his loss behavior. In the first term, annual attrition losses for six-year enlistees are higher than those for four-year enlistees. Second-term attrition is not measurably influenced by term of enlistment. In the career terms, annual attrition losses are again found to be higher for six-year enlistees.

In the first-term ETS loss model, we find no effect of unemployment on the loss rate of six-year enlistees. One interpretation of this finding is that six-year enlistees often receive especially good training and may be better insulated from general employment fluctuations than are four-year enlistees.

In the second-term ETS decision, six-year enlistees who are still in grade E-4 are more likely to leave the service than are other airmen. In the career terms and retirement years, there are no effects of term of enlistment on ETS losses.

ECONOMIC OPPORTUNITIES

Economic variables appear in all but the attrition equations. Unemployment appears in all non-attrition equations except the first-term extend-given-stay equation. The military/civilian pay ratio appears in all non-attrition equations except the retirement and first-term extend-given-stay equations. The absence of economic effects in the attrition equations does not surprise us, but we do expect pay effects to be uncovered in the first-term extend-given-stay models when more data become available.

Bonuses appear in the first- and second-term non-attrition equations. We found that in the first term the first bonus multiple increases the fraction of airmen in a typical AFSC who stay past ETS by about 3.4 percentage points. However, it also increases the fraction of airmen who immediately reenlist out of those who stay past ETS by 3.8 percentage points. Each subsequent bonus multiple decreases the ETS loss rate by 1.3 percentage points and increases the immediate reenlistment rate by 3.8 percentage points. Thus, the bonus has a larger effect on immediate reenlistments than it has on immediate losses. Since many of those who extend leave during the next year or two, the full effect of a bonus on retention is not visible until the cohort is at least two years past ETS. The effect may continue to be felt even further in the future. Reenlistees who receive a bonus are more likely to choose a six-year term of enlistment than those without a bonus. However, they are also more likely to leave at the end of the second term than those with similar YOS.

Several research reports have asserted that the size of the response to a change in the amount of the bonus differs by occupation, although we are not aware of any rigorous test of this hypothesis. In our preliminary analyses, we tested whether there were occupational differences in the bonus response in the first term by fitting a separate slope for each AFSC in our sample. We could not reject the null hypothesis that the slopes were the same for each AFSC.

In the second term, as in the first, we find that the bonus has a larger effect on the immediate reenlistment rate than it does on the immediate loss rate. We also find that second-term loss rates are higher the greater the proportion of the second termers who received bonuses at the end of their first term.

Appendix A

AFSCs IN THE MIDDLE-TERM MODELS

ULTIMATE AFSCs

The Air Force modifies the set of Air Force Specialty Codes (AFSCs) twice a year (normally on April 30 and October 31). Some of the changes affect only the specialty descriptions or names and do not affect the codes or the persons who are assigned to those codes. However, other changes set up new AFSCs, eliminate existing AFSCs, split single AFSCs into two or more AFSCs, and combine two or more AFSCs into a single AFSC.

As a result, the developer of a model such as the middle-term disaggregate loss model that predicts loss rates by AFSC is faced with a number of problems:

- Historical data on a new AFSC may not be available to enable a coefficient to be fit for that AFSC.
- The same types of persons (doing the same work) were associated with different AFSCs at different times.
- The model will need to predict loss rates for AFSCs not currently in existence.

We handled these problems by attempting to map all historical AFSC designations onto the set of AFSCs in existence at one point in time. We called the result of this mapping the "ultimate AFSCs." The AFSCs referred to in this report in the tables containing AFSC coefficients for the models are those that were in existence on April 29, 1983.

In order to assign an ultimate AFSC (ULTAFSC) designation to an AFSC in existence at some prior time (an OLDAFSC), the changes in AFSC designations were tracked from July 1, 1971 through April 29, 1983 using the information in Air Force Regulation 39-1.

When the chain of designations for an AFSC included only two or more AFSCs being combined to produce a new AFSC, or a change in AFSC designation, the tracking was easy and the ULTAFSC unambiguous. However, if somewhere in the chain an AFSC was split into two or more AFSCs, the ULTAFSC may not be known with certainty.

In this case, we tried to include as much information about the ULTAFSC as possible. If the first three digits of the ULTAFSC are known with certainty, the ULTAFSC is these first three digits followed by ZZ (i.e., nnnZZ). If only the first two digits are known (i.e., the new and old AFSCs are in the same career field), the ULTAFSC is these two digits followed by ZZZ (i.e., nnZZZ). If one of the split AFSCs was in a different career field from the others, the ULTAFSC was assigned the value AMBIG.

If the OLDAFSC or its successor was deleted before April 29, 1983 (without being converted), the ULTAFSC was assigned the value DELETD.

Thus, the values that appear in the tables containing AFSC coefficients for the models are either AFSCs in existence on April 29, 1983 or nnZZZ, nnnZZ, AMBIG, or DELETD.

Changes are made in AFSCs twice a year, whereas the middle-term disaggregate model may be updated only once per year or every other year. In the intervening periods, the coefficients from the previous revision of the model can be used with little loss in precision. The changes will make little or no difference in the non-AFSC coefficients. There will, however, be some differences in the names of the AFSCs. To get effects for a newly created AFSC, one should average the effects found in the model for the AFSCs that supplied the personnel to the new AFSC.

CAREER FIELD GROUPS

In several of our models we found that the effects of occupation on losses were indistinguishable among AFSCs in the same career field (first two digits of the AFSC). In those cases we provide a coefficient for the career field, which applies to all AFSCs in the career field.

In other models we found yet larger aggregations of occupations to be appropriate. We based these groupings on the four-part categorization of occupations used by Buddin (1981) to describe first-term attrition in the Army and Air Force. We assigned each career field to one of his four Career Field Groups (or to a residual category, labeled "unknown"), guided by Buddin's original assignment of AFSCs and by empirical patterns of losses. The assignments used in the middle-term models are contained in Table A.1.

Table A.1

CAREER FIELD GROUPS USED IN MIDDLE-TERM MODELS

Group	Career Fields
Skilled Technicians	10, 12, 20, 22, 23, 25, 27, 29 30, 31, 32, 41 49, 51, 57, 90 91, 92, 98
Electrical/Mechanical Equipment Repairmen	11, 36, 39, 40 42, 43, 44, 46 47, 54, 59
Functional Support and Administration	34, 60, 64, 65 66, 67, 69, 70 73, 74, 75, 79 82
Craftsmen, Service, and Supply Handlers	24, 55, 56, 61 62, 63, 81, 87
Other and Unknown	99, unknown, ambiguous, and deleted

Appendix B

OCCUPATIONAL EFFECTS FOR MODELS

Table B.1

AFSC EFFECTS FOR FIRST-TERM ATTRITION
AFTER FIRST YEAR OF SERVICE[a]
(For Table 2.3)

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
100X0	.0814706	208X5D	.0562272	302X1	.050456	321X0L	.056152
11ZZZ	.0803876	208ZZ	.070692	30299	.050456	321X1E	.117195
111X0	.0570424	20800	.056227	303X1	.031390	321X1G	.078621
112X0	.0978991	20899	.056227	303X2	.069112	321X2	.054847
113X0B	.0803876	209X0	.063366	303X3	.065417	321X2A	.066678
113X0C	.0803876	22ZZZ	.081471	30399	.050456	321X2C	.056152
11300	.0803876	222X0	.081471	304X0	.063476	321X2P	.058875
11399	.0803876	23ZZZ	.187598	304X1	.049449	321X2Q	.055462
114X0	.0815849	231X0	.069007	304X4	.042232	321ZU	.056152
115X0	.0870633	231X1	.061768	304X5	.061893	32199	.056152
116X0	.0803876	231X2	.075212	304X6	.054484	322X2A	.058764
121X0	.0855239	23100	.080566	304X6A	.050456	322X2B	.040946
122X0	.0870022	23199	.080566	304X6B	.050456	322X2C	.043057
20ZZZ	.0718325	232X0	.080566	30499	.050456	32299	.056152
201X0	.0546490	232X0B	.080566	305X4	.050922	323X1	.056152
201X1	.0636009	233X0	.068152	305X4E	.062889	323X2	.056152
20199	.0562272	233X1	.080566	305X4F	.050456	323X3	.056152
202X0	.0443944	233ZZ	.080566	305X4G	.098985	32399	.056152
202ZU	.0562272	23399	.080566	305X4H	.050456	324X0	.054991
203X0	.0562272	241X0	.081471	305X4J	.050456	325X0	.061468
205X0	.0556742	242X0	.081471	305X4K	.050456	325X1	.053760
206X0	.0615715	25ZZZ	.051383	305X4P	.050456	32599	.056152
20600	.0562272	251X0	.059231	305X4Q	.050456	326X0C	.026502
207X1	.0511009	251ZU	.058468	305X4R	.050456	326X0D	.056152
207X2	.0481661	27ZZZ	.100352	306X0	.032463	326X3A	.075909
20700	.0562272	271X1	.086368	306X1	.045301	326X3B	.041313
20799	.0562272	271X2	.072441	306X2	.040431	326X4A	.035825
208X0	.0641122	271ZZ	.061320	30699	.050456	326X4B	.048456
208X1	.0562272	27100	.074522	307X0	.041106	326X4C	.056152
208X1A	.0562272	272X0	.060162	309X0	.050456	326X5A	.031794
208X2	.0562272	273X0	.074522	31ZZZ	.068402	326X5B	.078672
208X2A	.0562272	274X0	.078902	316X0	.052972	326X6	.056152
208X2C	.0562272	275X0	.059018	316X0C	.052972	326X6A	.021218
208X2E	.0562272	276X0	.090294	316X0F	.052972	326X6B	.049928
208X3	.0562272	276X0A	.074522	316X0G	.052972	326X6C	.056152
208X3A	.0217075	276X0B	.070154	316X0T	.052972	326X7	.056152
208X3B	.0562272	276X0C	.060284	316X1	.052972	326X7A	.031838
208X3C	.0562272	27600	.074522	316X1L	.052972	326X7B	.045778
208X3D	.0562272	277X0	.074522	316X1P	.052972	326X7C	.056152
208X3F	.0562272	29ZZZ	.063490	316X2	.052972	326X8	.056152
208X3J	.0562272	291X0	.061093	316X2F	.052972	326X8A	.092940
208X4	.0562272	29100	.061093	316X2G	.052972	326X8B	.111175
208X4A	.0562272	293X3	.055647	316X2T	.052972	326X8C	.056152
208X4B	.0562272	295X0	.061093	316X3	.034803	326ZZ	.075467
208X4C	.0562272	296X0	.061093	31600	.052972	32673	.056152
208X4G	.0562272	297X0	.061093	31699	.052972	32674	.056152
208X5	.0562272	30ZZZ	.056996	32ZZZ	.065409	32675	.056152
208X5A	.0562272	30100	.05045	321X0	.092545	32676	.056152
208X5C	.0562272	302X0	.051367	321X0K	.056152	32677	.056152

Table B.1—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
32678	.056152	411X2E	.074447	431X2A	.079682	472X2	.108584
32699	.056152	411X3	.077968	431X2E	.084984	472X3	.112676
328X0	.048494	411X4	.088138	431X3	.081458	472X4	.102765
328X1	.039903	42ZZZ	.129170	431X3A	.063881	47200	.102765
328X2	.055502	423X0	.064786	431X3B	.036349	47271	.102765
328X3	.050335	423X1	.061220	431X3C	.072741	47275	.102765
328X4	.047086	423X2	.078622	431X3D	.073000	47299	.102765
328X5	.056152	423X3	.089853	431X4	.063435	491X1	.069303
32899	.056152	423X4	.090387	43199	.081458	491X2	.063888
32900	.056152	423X5	.085193	43200	.081458	51ZZZ	.090572
34ZZZ	.051983	42399	.081138	44ZZZ	.152317	511X0	.090572
341X1	.044779	426X1	.097778	443X0	.152317	511X1	.090572
341X2	.052367	426X2	.081138	443X0C	.152317	51100	.090572
341X4	.028668	426X3	.067523	443X0E	.152317	51199	.090572
341X6	.070337	426ZZ	.069923	443X0G	.152317	53ZZZ	.132111
341X7	.022104	426X4	.081138	443X0P	.152317	54ZZZ	.121977
341ZZ	.044779	42699	.081138	443X1	.152317	542X0	.053281
34100	.044779	427X0	.122729	44300	.152317	542X1	.069536
34199	.044779	427X1	.106313	44399	.152317	542X2	.068020
36ZZZ	.046188	427X2	.057898	445X0E	.152317	54200	.074185
361X0	.080141	427X3	.079394	445X0F	.152317	54299	.074185
361X1	.092254	427X4	.089816	445X0G	.152317	545X0	.058983
36199	.060638	427X5	.089819	445X1	.152317	545X1	.091150
362X1	.025538	42700	.081138	44500	.152317	545X2	.093379
362X3	.072348	42799	.081138	44599	.152317	545X3	.074185
362X4	.056144	43ZZZ	.109617	46ZZZ	.091618	54500	.074185
36200	.060638	431XZZ	.072465	461X0	.078825	54599	.074185
36299	.060638	431X0	.081458	462X0	.065581	55ZZZ	.152212
39ZZZ	.057269	431X0C	.088389	462X0A	.065621	551X0	.123815
391X0	.048183	431X0D	.081458	462X0B	.068796	551X1	.100008
392X0	.057269	431X1	.062391	462X0C	.014714	55100	.106141
40ZZZ	.148043	431X1A	.100700	462X0D	.057160	55199	.106141
404X0	.064856	431X1B	.003158	462X0E	.044721	552X0	.106323
404X1	.045908	431X1C	.079507	462X0F	.069504	552X1	.101374
40400	.069389	431X1D	.037233	462X0G	.064506	552X2	.087306
40499	.069389	431X1E	.103023	462X0H	.067179	552X4	.114095
411X0	.074061	431X1F	.094137	462X0J	.118254	552X5	.089693
411X0A	.073933	431X1G	.081458	462X0K	.050121	55200	.106141
411X0B	.059969	431X1H	.107056	462X0Z	.089577	55273	.106141
411X0C	.077968	431X1J	.112214	463X0	.066769	55299	.106141
411X0D	.100199	431X1K	.081458	464X0	.042240	553X0	.073307
411X0E	.062018	431X1L	.081458	47ZZZ	.152429	554X0	.098917
411X0F	.053645	431X1M	.126515	472X0	.088621	555X0	.106141
411X1	.064768	431X1N	.053974	472X1	.102765	56ZZZ	.092740
411X1A	.105384	431X1P	.081458	472X1A	.086498	566X0	.081302
411X1D	.094338	431X1Q	.081458	472X1B	.131124	566X1	.092840
411X2A	.072187	431X1Z	.055005	472X1C	.082666	56600	.092740
411X2D	.085458	431X2	.081458	472X1D	.069505	56699	.092740

Table B.1—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
57ZZZ	.146049	691X0	.097461	871X0B	.068429	92ZZZ	.072140
571X0	.085753	70ZZZ	.187011	871X0C	.068429	924X0	.060016
58ZZZ	.081471	701X0	.109087	871X0D	.068429	924X1	.072140
591X0	.081471	702X0	.086510	871X0E	.068429	92400	.072140
591X1	.081471	702X0A	.093390	871X0F	.068429	92499	.072140
59100	.081471	702X0B	.093390	871X0G	.045455	925X0	.072140
59199	.081471	702X0C	.093390	871X0H	.068429	926X0	.120492
60ZZZ	.184535	70200	.093390	871X0J	.015108	98ZZZ	.098339
602X0	.068297	70270	.093390	871X0K	.068429	981X0	.069477
602X1	.098350	703X0	.104908	871X0L	.068429	982X0	.043133
602X2	.119121	705X0	.037696	871X0M	.068429	99ZZZ	.236947
60200	.109113	71ZZZ	.081471	871X0N	.068429	99000	.080386
60273	.109113	73ZZZ	.107473	871X0P	.068429	99001	.082694
60299	.109113	732X0	.073725	871X0R	.068429	99005	.082694
603X0	.118632	732X1	.082145	871X0S	.068429	99006	.168568
605X0	.089137	732X4	.075429	871X0Z	.068429	99008	.082694
605X1	.090863	73200	.075429	87100	.068429	991X2	.082694
60500	.109113	73299	.075429	87199	.068429	991X4	.082694
60572	.109113	733X1	.075429	872X0	.036324	991X5	.082694
60599	.109113	734X0A	.075429	90ZZZ	.141306	991X6	.082694
61ZZZ	.103020	734X0B	.075429	902X0	.075622	991X7	.082694
611X0	.095114	73400	.075429	902X0A	.084856	99104	.082694
612X0	.103020	73499	.075429	902X0C	.066156	99105	.005027
612X1	.103020	74ZZZ	.139236	902X1	.084856	99106	.082694
61200	.103020	741X1	.139728	902X2	.086704	995X0	.082694
61299	.103020	742X0	.129138	902X2B	.084856	995X1	.082694
62ZZZ	.176988	75ZZZ	.062517	902X2C	.084856	995X2	.082694
622X0	.126810	751X0	.062517	90200	.084856	995X3	.082694
63ZZZ	.181770	751X2	.062517	90299	.084856	995X4	.082694
631X0	.106923	751X3	.062517	903X0	.061151	995X5	.082694
64ZZZ	.151437	75199	.062517	903X1	.084856	995X6	.082694
645X0	.068719	753X0	.064663	90300	.084856	99500	.082694
645X0A	.080814	753X1	.062517	90399	.084856	99501	.072611
645X1	.087573	75300	.062517	905X0	.128196	99502	.082694
645X2	.077220	75399	.062517	906X0	.087200	99503	.082694
64500	.077552	79ZZZ	.121462	907X0	.057835	996X0	.082694
64599	.077552	791X0	.147409	908X0	.074807	996X1	.0826938
65ZZZ	.094324	791X1	.087689	911X0	.127424	996X2	.0826938
651X0	.089289	791X2	.121462	912X5	.067225	996X3	.0826938
661X0	.081471	79100	.121462	912X5A	.097698	996X4	.0826938
67ZZZ	.084416	79199	.121462	913X0	.057465	996X5	.0826938
672X1	.074669	81ZZZ	.169347	913X1	.097698	996X7	.0826938
672X2	.066967	811X0	.113952	91300	.097698	996X8	.0826938
672X2A	.082017	811X2	.083982	91399	.097698	99604	.0826938
672X2B	.073298	811X2A	.077978	914X0	.111574	997X0	.0826938
672ZU	.071435	811ZU	.109349	914X1	.112433	997X1	.0826938
67200	.071435	81100	.109349	91400	.097698	997X2	.0826938
67273	.071435	81199	.109349	91499	.097698	99701	.0826932
67299	.071435	821X0	.081471	915X0	.096290	99999	.0788702
673X0	.071435	87ZZZ	.068429	918X0	.065472		
69ZZZ	.109528	871X0A	.080215	919X0	.097698		

[a]The AFSCs appearing in the tables providing coefficients for the models are "ultimate AFSCs"; they convert AFSCs at different dates into a consistent set of AFSCs. See App. A for a detailed discussion.

Table B.2

CAREER FIELD EFFECTS FOR SECOND-TERM ATTRITION MODEL
(For Table 3.1)

Career Field	Coeffi-cient	Career Field	Coeffi-cient
10	.001	55	.008
11	−.005	56	.015
12	−.005	57	−.004
20	−.007	59	.001
22	.001	60	.002
23	.006	61	−.004
24	.022	62	.012
25	−.010	63	−.002
27	−.002	64	.005
29	−.003	65	−.003
30	−.004	66	.001
31	−.006	67	.001
32	−.003	69	.005
34	−.003	70	.004
36	−.003	71	.001
39	−.007	73	.013
40	−.016	74	.002
41	.004	75	.005
42	−.002	79	.004
43	−.000	81	.001
44	.001	82	.023
46	−.004	87	−.001
47	−.003	90	.009
49	−.002	91	.004
51	.001	92	.009
53	.001	98	.005
54	.001	99	.018

Table B.3a

AFSC EFFECTS FOR FIRST-TERM ETS LOSS MODEL
(For Table 5.2)

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
100X0	1.64678	23399	1.62975	316X0	1.80576	326X8A	
111X0	1.78438	241X0	1.64678	316X0C	1.72497	326X8B	1.70518
112X0	1.66936	241XO	1.64678	316X0F	1.75792	326X8C	1.70518
113X0B	1.65065	25ZZZ	1.63817	316X0G	1.77424	326ZZ	1.76590
113X0C	1.65065	251X0	1.63817	316X0T	1.75516	32673	1.70518
11300	1.65065	251ZU	1.63817	316X1	1.72497	32674	1.70518
11399	1.65065	27ZZZ	1.69626	316X1L	1.65730	32675	1.70518
114X0	1.63216	271X1	1.59323	316X1P	1.72497	32676	1.70518
115X0	1.46337	271X2	1.53360	316X2	1.72497	32677	1.70518
116X0	1.65065	271ZZ	1.57449	316X2F		32678	1.70518
121X0	1.65931	27100	1.69626	316X2G	1.72497	32699	1.70518
122X0	1.66517	272X0	1.78396	316X2T	1.72497	328X0	1.69433
20ZZZ	1.63916	273X0	1.69626	316X3	1.67996	328X1	1.67555
201X0	1.60252	274X0	1.67040	31600	1.72497	328X2	1.70518
20199	1.63916	275X0		31699	1.72497	328X3	1.68582
202X0	1.63457	276X0B	1.69626	32ZZZ	1.70518	328X4	
203X0	1.63916	276X0C	1.69626	321X0K	1.77121	328X5	1.70518
205X0	1.73047	276X2	1.69626	321X0L	1.70518	328ZU	1.70518
206X0	1.61201	27600	1.69626	321X1E	1.70518	32899	1.70518
20600	1.63916	277X0	1.69626	321X1G	1.76591	32900	1.70518
207X1	1.66138	29ZZZ	1.60460	321X2	1.82476	341X1	1.60409
207X2		291XO	1.60868	321X2A	1.67129	341X2	1.65960
20700	1.63916	29100	1.60859	321X2C	1.70518	341X3	1.66100
20799	1.63916	293X3	1.60859	321X2P	1.65543	341X4	1.70834
208X0	1.70375	295X0	1.60859	321X2Q	1.70066	341X5	1.65960
208X1	1.63916	296X0	1.60859	32199	1.70518	341X6	1.71055
208X1A	1.63916	297X0	1.60859	322X2A	1.60045	341X7	1.65960
208X2	1.63916	30ZZZ	1.70452	322X2B	1.67973	341ZZ	1.65960
208X2A	1.63916	30100	1.70452	322X2C	1.70518	34100	1.65960
208X3	1.63916	302X0	1.69394	32299	1.70518	34199	1.65960
208X3A	1.63916	302X1	1.70452	323X1	1.70518	36ZZZ	1.68362
208X3B	1.63916	30299	1.70452	323X2	1.70518	361X0	1.71464
208X3C	1.63916	303X1	1.79840	323X3	1.70518	361X1	1.64797
208X4	1.63916	303X2	1.68364	32399	1.70518	36199	1.68362
208X4A	1.63916	303X3	1.71265	324X0	1.73880	362X1	1.69658
208X4B	1.63916	30399	1.70452	325X0	1.65901	362X3	1.68362
208X4G	1.63916	304X0	1.70215	325X1	1.73763	362X4	1.66875
208X5	1.63916	304X1	1.71899	32599	1.70518	36200	1.68362
208X5A	1.63916	304X4	1.63441	326X0C	1.65466	36299	1.68362
208X5C	1.63916	304X5	1.66750	326XOD	1.70518	391X0	1.58764
208X5E	1.63916	304X6	1.64935	326X3B	1.70518	392X0	1.58479
208ZZ	1.59705	304X6A	1.70452	326X4	1.70518	404X0	1.60025
20800	1.63916	30499	1.70452	326X4A		404X1	1.58163
20899	1.63916	305X4	1.82172	326X4B		40400	1.59194
209X0	1.63916	305X4E	1.70452	326X4C	1.70518	40499	1.59194
23ZZZ	1.62975	305X4G	1.70452	326X5	1.70518	42ZZZ	1.64119
231X0	1.59447	305X4J	1.70452	326X5A	1.70518	423X0	1.66530
231X1	1.63434	306X0	1.72813	326X5B	1.70518	423X1	1.67953
231X2	1.58730	306X1	1.74610	326X6A		423X2	1.64488
23100	1.62975	306X2	1.63858	326X6B	1.70518	423X3	1.63523
23199	1.62975	30699	1.70452	326X6C	1.70518	423X4	1.64807
232X0	1.62975	307X0	1.64146	326X7A		423X5	1.61665
233X0	1.65580	309X0	1.70452	326X7B	1.70518	42399	1.64066
233X1	1.62975	309ZU	1.70452	326X7C	1.70518	426X1	1.64066

Table B.3a—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
426X2	1.63279	462X0A	1.62592	554X0	1.66523	701X0	1.55627
426X3		462X0C	1.62592	555X0	1.68059	702X0	1.56460
426X4	1.64066	462X0D	1.62592	56ZZZ	1.67486	702X0B	1.56545
42699	1.64066	462XOE	1.62592	566X0	1.69464	702ZU	1.56545
427X0	1.60630	462X0G	1.62592	566X1	1.66861	70200	1.56545
427X1	1.62080	462X0K	1.62592	56600	1.67486	70270	1.56545
427X2	1.61479	463X0	1.71263	56699	1.67486	703X0	1.52322
427X3	1.61912	464X0	1.51540	571X0	1.72022	705X0	1.63173
427X4	1.72388	47ZZZ	1.63107	591X0	1.64678	73ZZZ	1.50882
427X5	1.67353	472X0	1.62998	591X1	1.64678	732X0	1.50017
42700	1.64066	472X1	1.63107	59100	1.64678	732X1	1.67144
42799	1.64066	472X1A	1.59134	59199	1.64678	732X4	1.50882
43ZZZ	1.62219	472X1B	1.59022	60ZZZ	1.61570	73200	1.50882
431X0C	1.64939	472X1C	1.57767	602X0	1.59897	73299	1.50882
431X0D	1.64939	472X1D	1.69190	602X1	1.55841	733X1	1.50882
431X1	1.65527	472X2	1.63321	602X2	1.57896	734X0A	1.50882
431X1A	1.62394	472X3	1.65547	60200	1.61570	734X0B	1.50882
431X1C	1.62330	472X4	1.63107	60273	1.61570	73400	1.50882
431X1D	1.64939	47200	1.63107	60299	1.61570	73499	1.50882
431X1E	1.62711	47271	1.63107	603X0	1.63609	741X1	1.57778
431X1F	1.59328	47275	1.63107	605X0	1.57358	742X0	1.58354
431X1H	1.64939	47299	1.63107	605X1	1.61753	75ZZZ	1.50800
431X1J	1.64939	511X0	1.69481	60500	1.61570	751X0	1.50800
431X1M	1.64939	511X1	1.82622	60572	1.61570	751X2	1.50800
431X1Q	1.64939	51100	1.72534	60599	1.61570	751X3	1.50800
431X1Z	1.64939	51199	1.72534	611X0	1.61740	75199	1.50800
431X2	1.69288	53ZZZ	1.64678	61130	1.61740	753X0	1.47638
431X2A		54ZZZ	1.68409	612X0	1.61740	753X1	1.50800
431X2C		542X0	1.69972	612X1	1.61740	75300	1.50800
431X2D	1.64939	542XOF	1.68409	61200	1.61740	75399	1.50800
431X2E		542X1	1.72717	61299	1.61740	791X0	1.66414
431X2G		542X2	1.66255	62ZZZ	1.61908	791X1	1.66414
431X2Z	1.64939	54200	1.68409	622X0	1.61865	791X2	1.66414
431X3	1.64939	54299	1.68409	622X1	1.62290	79100	1.66414
431X4	1.64939	545X0	1.66273	631X0	1.62073	79199	1.66414
43199	1.64939	545X1	1.65694	64ZZZ	1.56247	81ZZZ	1.66765
43200	1.64939	545X2	1.70405	645XO	1.55251	811X0	1.69280
443X0	1.70496	545X3	1.68409			811X2	1.60087
443X0C	1.70496	54500	1.68409	645X0A	1.51232	811X2A	1.61588
443X0E	1.57138	54599	1.68409	645X1	1.58040	81100	1.66765
443XOG	1.69069	55ZZZ	1.68059	645X2	1.56247	81199	1.66765
443XOP	1.70496	551X0	1.68302	64500	1.56247	821X0	1.64678
443X1	1.70496	551X1	1.70066	64599	1.56247	87ZZZ	1.56626
44300	1.70496	55100	1.68059	651X0	1.59901	871X0A	1.56626
44399	1.70496	55199	1.68059	661X0	1.64678	871X0B	1.56626
445XOE		552X0	1.66516	672X1	1.65290	871XOC	1.56626
445XOF	1.66426	552X1	1.58680	672X2	1.60481	871X0E	1.56626
445XOG	1.79282	552X2	1.67203	672X2A	1.62170	871X0F	1.56626
445X1	1.70496	552X4	1.64561	67200	1.62170	871X0G	1.56626
44500	1.70496	552X5	1.73233	67273	1.62170	871X0H	1.56626
44599	1.70496	55200	1.68059	67299	1.62170	871X0J	1.56626
46ZZZ	1.62592	55273	1.68059	673X0	1.62170	871X0K	1.56626
461X0	1.58702	55299	1.68059	691X0	1.64678	871X0L	1.56626
462X0	1.63711	553X0	1.70780	70ZZZ	1.56545	871X0M	1.56626

Table B.3a—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
871X0N	1.56626	90399	1.66095	926X0	1.66700	995X3	1.73651
871X0P	1.56626	905X0	1.69641	98ZZZ	1.69724	995X4	1.73651
871X0R	1.56626	906X0	1.61373	981X0	1.70608	995X5	1.73651
871X0S	1.56626	907X0	1.65060	982X0	1.65662	995X6	1.73651
871X0T	1.56626	908X0	1.63236	99ZZZ	1.71635	99501	1.73651
871X0Z	1.56626	911X0	1.69137	99000	1.73651	99502	1.73651
87100	1.56626	912X5	1.67934	99001	1.73651	99503	1.73651
87199	1.56626	913X0	1.67934	99005	1.73651	996X0	1.73651
872X0	1.56626	913X1	1.67934	99006		996X1	1.73651
90ZZZ	1.66095	91300	1.67934	99008	1.73651	996X2	1.73651
902X0	1.66199	91399	1.67934	991X2	1.73651	996X3	1.73651
902X0A	1.66095	914X0	1.75001	991X4	1.73651	996X4	1.73651
902X0B	1.66095	914X1	1.72774	991X5	1.73651	996X5	1.73651
902X0C	1.60146	91400	1.67934	991X6	1.73651	996X7	1.73651
902X1	1.66095	91499	1.67934	991X7	1.73651	996X8	1.73651
902X2	1.73584	915X0	1.61311	99101	1.73651	99604	1.73651
902X2B	1.66095	918X0	1.67934	99102	1.73651	997X0	1.73651
902X2C	1.66095	919X0	1.67934	99104	1.73651	997X1	1.73651
90200	1.66095	924X0	1.66851	99105	1.73651	997X2	1.73651
90299	1.66095	924X1	1.66700	99106	1.73651	99701	1.73651
903X0	1.74400	92400	1.66700	995X0	1.73651	AMBIG	
903X1	1.66095	92499	1.66700	995X1	1.73651	DELETD	1.64678
90300	1.66095	925X0	1.66700	995X2	1.73651		

Table B.3b

AFSC EFFECTS FOR FIRST-TERM EXTEND-GIVEN-STAY MODEL
(For Table 5.2)

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
		233X1	.5329	316X0F	.3647	326X8B	.6233
		23399	.5329	316X0G	.3647	326X8C	.6233
100X0	.5535	241X0	.5535	316X0T	.3647	326ZZ	.6427
111X0	.3776	242X0	.5535	316X1	.3647	32673	.6233
112X0	.3776	251X0	.4897	316X1L	.3647	32674	.6233
113X0B	.3776	251ZU	.4879	316X1P	.3647	32675	.6233
113X0C	.3776	27ZZZ	.5067	316X2	.3647	32676	.6233
11300	.3776	271X1	.6131	316X2F	.3647	32677	.6233
11399	.3776	271X2	.5417	316X2G	.3647	32678	.6233
114X0	.3507	271ZZ	.5067	316X2T	.3647	32699	.6233
115X0	.3776	27100	.5067	316X3	.3719	328X0	.5700
116X0	.3776	272X0	.4574	31600	.3647	328X1	.5970
121X0	.5181	273X0	.5067	31699	.3647	328X2	.6233
122X0	.5461	274X0	.4186	321X0	.6177	328X3	.6384
201X0	.5063	275X0	.5067	321X0K	.6233	328X4	.6394
201X1	.5134	276X0	.5098	321X0L	.6233	328X5	.6233
20199	.5134	276X0B	.5067	321X1E	.6233	32899	.6233
202X0	.5478	27600	.5067	321X1G	.6233	32900	.6233
203X0	.5134	277X0	.5067	321X2	.6233	34ZZZ	.5067
205X0	.5134	29ZZZ	.5422	321X2A	.6268	341X1	.5067
206X0	.4810	291X0	.5836	321X2C	.6233	341X2	.5067
20600	.5134	29100	.5836	321X2P	.6926	341X4	.4941
207X1	.5122	293X3	.6255	321X2Q	.7139	341X6	.5324
207X2	.5654	295X0	.5836	32199	.6233	341X7	.5067
20700	.5134	296X0	.5836	322X2A	.6233	341ZZ	.5067
20799	.5134	297X0	.5836	322X2B	.6662	34100	.5067
208X0	.5134	30100	.5947	322X2C	.6233	34199	.5067
208X1	.5134	302X0	.6120	32299	.6233	36ZZZ	.5306
208X1A	.5134	302X1	.5947	323X1	.6233	361X0	.6437
208X2	.5134	30299	.5947	323X2	.6233	361X1	.4194
208X2A	.5134	303X1	.5772	323X3	.6233	36199	.5306
208X3	.5134	303X2	.7675	32399	.6233	362X1	.5447
208X3A	.5134	303X3	.5747	324X0	.6401	362X3	.5306
208X3C	.5134	30399	.5947	325X0	.5954	362X4	.5027
208X4	.5134	304X0	.5877	325X1	.6526	36200	.5306
208X4A	.5134	304X1	.5405	32599	.6233	36299	.5306
208X4B	.5134	304X4	.6164	326X0C	.6233	391X0	.4193
208X4G	.5134	304X5	.4359	326X0D	.6233	392X0	.3568
208X5	.5134	304X6	.6442	326X3A	.6233	404X0	.6301
208X5A	.5134	304X6A	.5947	326X3B	.6233	404X1	.6070
208X5C	.5134	30499	.5947	326X4	.6233	40400	.6070
208X5E	.5134	305X4	.5458	326X4A	.6233	40499	.6070
208ZZ	.4553	305X4E	.5947	326X4B	.6233	411X0	.5298
20800	.5134	305X4G	.5947	326X4C	.6233	411X0A	.4579
20899	.5134	305X4J	.5947	326X5	.6233	411X0B	.3751
209X0	.5134	306X0	.4573	326X5A	.6233	411X0D	.5298
222X0	.5535	306X1	.5697	326X5B	.6233	411X0E	.5298
231X0	.5329	306X2	.6143	326X6A	.6233	411X0F	.7441
231X1	.4888	30699	.5947	326X6B	.6233	411X1	.5298
231X2	.4588	307X0	.7007	326X6C	.6233	411X1A	.4834
23100	.5329	309X0	.5947	326X7A	.6233	411X1D	.5298
23199	.5329	309ZU	.5947	326X7B	.6233	411X2A	.5191
232X0	.5329	316X0	.3647	326X7C	.6233	411X2D	.5298
233X0	.5788	316X0C	.3647	326X8A	.6233	411X2E	.5298

Table B.3b—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
411X3	.5298	44300	.5161	55199	.5205	67200	.5116
411X4	.5298	44399	.5161	552X0	.5198	67273	.5116
42ZZZ	.5220	445X0E	.5161	552X1	.5010	67299	.5116
423X0	.5747	445X0F	.5161	552X2	.4492	673X0	.5116
423X1	.5154	445X0G	.5161	552X4	.5537	691X0	.5535
423X2	.5031	445X1	.5161	552X5	.5661	70ZZZ	.5399
423X3	.5613	44500	.5161	55200	.5205	701X0	.4997
423X4	.5512	44599	.5161	55273	.5205	702X0	.5424
423X5	.5284	461X0	.4659	55299	.5205	702X0A	.5399
42399	.5220	462X0	.6022	553X0	.3428	702X0B	.5399
426X1	.5220	462X0A	.5564	554X0	.5205	702X0C	.5399
426X2	.5220	462X0B	.5564	555X0	.5205	702ZU	.5399
426X3	.4718	462X0C	.5564	56ZZZ	.5022	70200	.5399
426X4	.5220	462X0D	.5564	566X0	.5022	70270	.5399
426ZZ	.5022	462X0G	.5564	566X1	.5051	703X0	.4620
42699	.5220	462X0K	.5564	56600	.5022	705X0	.5399
427X0	.5913	463X0	.5363	56699	.5022	71ZZZ	.5535
427X1	.4649	464X0	.4776	571X0	.6127	732X0	.4807
427X2	.5162	47ZZZ	.5036	591X0	.5535	732X1	.4782
427X3	.5181	472X0	.4641	591X1	.5535	732X4	.4782
427X4	.5533	472X1A	.5036	59100	.5535	73200	.4782
427X5	.4950	472X1B	.5036	59199	.5535	73299	.4782
42700	.5220	472X1C	.5036	60ZZZ	.6345	733X1	.4782
42799	.5220	472X1D	.4377	602X0	.5693	734X0A	.4782
43ZZZ	.4271	472X2	.5467	602X1	.6457	734X0B	.4782
431XZZ	.5307	472X3	.5036	602X2	.6503	73400	.4782
431X0C	.5161	472X4	.5036	60200	.6345	73499	.4782
431X0D	.5161	47200	.5036	60273	.6345	741X1	.5203
431X1	.5538	47271	.5036	60299	.6345	742X0	.5124
431X1A	.5161	47275	.5036	603X0	.6625	751X0	.4463
431X1B	.5161	47299	.5036	605X0	.6679	751X2	.4463
431X1C	.4877	491X1	.5520	605X1	.5890	751X3	.4463
431X1D	.5161	491X2	.4992	60500	.6345	75199	.4463
431X1E	.4615	511X0	.5494	60572	.6345	753X0	.3990
431X1F	.4798	511X1	.5494	60599	.6345	753X1	.4463
431X1J	.5161	51100	.5494	611X0	.5994	75300	.4463
431X1M	.5161	51199	.5494	612X0	.6095	75399	.4463
431X1Q	.5161	53ZZZ	.5535	612X1	.6095	791X0	.4713
431X1Z	.5161	54ZZZ	.5991	61200	.6095	791X1	.4713
431X2	.5161	542X0	.5599	61299	.6095	791X2	.4713
431X2A	.5161	542X1	.5711	622X0	.5839	79100	.4713
431X2E	.5750	542X2	.6550	631X0	.6034	79199	.4713
431X3	.5161	54200	.5991	645X0	.4986	811X0	.6471
431X3A	.5544	54299	.5991	645X0A	.5402	811X2	.5965
431X3D	.4550	545X0	.5461	645X1	.6191	811X2A	.6536
431X4	.5161	545X1	.5542	645X2	.5402	81100	.6338
43199	.5161	545X2	.6119	64500	.5402	81199	.6338
43200	.5161	545X3	.5991	64599	.5402	821X0	.5535
443X0	.5161	54500	.5991	651X0	.3425	87ZZZ	.5271
443X0C	.5161	54599	.5991	661X0	.3425	871X0A	.5271
443X0E	.5161	55ZZZ	.5205	672X1	.5463	871X0B	.5271
443X0G	.5161	551X0	.5801	672X2	.4904	871X0C	.5271
443X0P	.5161	551X1	.5614	672X2A	.5116	871X0D	.5271
443X1	.5161	55100	.5205	672X2B	.5116	871X0E	.5271

Table B.3b—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
871X0F	.5271	902X2C	.5306	919X0	.4468	995X1	.5881
871X0G	.5271	90200	.5306	924X0	.4638	995X2	.5881
871X0H	.5271	90299	.5306	924X1	.4732	995X3	.5881
871X0J	.5271	903X0	.4927	92400	.4732	995X4	.5881
871X0K	.5271	903X1	.5306	92499	.4732	995X5	.5881
871X0L	.5271	90300	.5306	925X0	.4732	995X6	.5881
871X0M	.5271	90399	.5306	926X0	.5245	99501	.5881
871X0N	.5271	905X0	.4831	98ZZZ	.5792	99503	.5881
871X0P	.5271	906X0	.5207	981X0	.6025	996X0	.5881
871X0R	.5271	907X0	.4602	982X0	.4437	996X1	.5881
871X0S	.5271	908X0	.4649	99ZZZ	.5881	996X2	.5881
871X0T	.5271	911X0	.3672	99005	.5881	996X3	.5881
871X0Z	.5271	912X5	.4468	99006	.5881	996X4	.5881
87100	.5271	913X0	.4468	991X2	.5881	996X5	.5881
87199	.5271	913X1	.4468	991X4	.5881	996X7	.5881
872X0	.5271	91300	.4468	991X5	.5881	996X8	.5881
90ZZZ	.5306	91399	.4468	991X6	.5881	99603	.5881
902X0	.5643	914X0	.4468	991X7	.5881	99604	.5881
902X0A	.5306	914X1	.4468	99104	.5881	997X0	.5881
902X0C	.5283	91400	.4468	99105	.5881	997X1	.5881
902X1	.5306	91499	.4468	99106	.5881	997X2	.5881
902X2	.4866	915X0	.4551	995X0	.5881	99701	.5881
902X2B	.5306	918X0	.4468				

Table B.4

AFSC EFFECTS FOR SECOND-TERM ETS LOSS MODEL
(For Table 6.1)

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
100X0	.327241	27ZZZ	.418878	316X3	.489996	32699	.379938
111X0	.325426	271X1	.276342	31600	.427911	328X0	.373086
112X0	.382287	271X2	.285262	31699	.427911	328X1	.337120
113X0B	.325426	271ZZ	.319292	321X0K	.379938	328X2	.379938
113X0C	.374131	27100	.418878	321X0L	.379938	328X3	.386352
11300	.325426	272X0	.531272	321X1E	.379938	328X4	.350680
11399	.325426	273X0	.418878	321X1G	.379938	328X5	.379938
111X0	.325426	274X0	.284399	321X2	.379938	32899	.379938
114X0	.282308	274ZU	.418878	321X2A	.379938	32900	.379938
115X0	.325426	275X0	.418878	321X2C	.379938	341X1	.428265
116X0	.325426	276X0	.375939	321X2P	.274570	341X2	.428265
121X0	.255167	276X0B	.418878	321X2Q	.313224	341X3	.428265
122X0	.251687	276X2	.418878	32199	.379938	341X4	.428265
201X0	.305202	27600	.418878	322X2A	.379938	341X5	.428265
201X1	.313206	277X0	.418878	322X2B	.379938	341X6	.428265
20199	.313206	29ZZZ	.299955	322X2C	.379938	341X7	.428265
202X0	.338662	291X0	.288815	32299	.379938	341ZZ	.428265
203X0	.313206	29100	.304073	323X1	.379938	34100	.428265
205X0	.313206	293X3	.304073	323X2	.379938	34199	.428265
206X0	.299284	295X0	.495871	323X3	.379938	36ZZZ	.362314
20600	.313206	296X0	.304073	32399	.379938	361X0	.409992
207X1	.352713	297X0	.304073	324X0	.420661	361X1	.285891
207X2	.313206	30100	.376280	325X0	.314878	36199	.362314
20700	.313206	302X0	.276323	325X1	.372328	362X1	.346749
20799	.313206	302X1	.376280	32599	.379938	362X3	.362314
208X0	.314906	30299	.376280	326X0C	.379938	362X4	.372657
208X1	.313206	303X1	.419174	326X0D	.379938	36200	.362314
208X2	.313206	303X2	.314972	326X3	.379938	36299	.362314
208X3	.313206	303X3	.323157	326X3A	.379938	391X0	.339477
208X3A	.313206	30399	.376280	326X3B	.379938	392X0	.319275
208X4	.313206	304X0	.353589	326X4	.379938	404X0	.354807
208X4A	.313206	304X1	.389438	326X4A	.379938	404X1	.354807
208X5	.313206	304X4	.368602	326X4B	.379938	40400	.354807
208X5A	.313206	304X5	.376280	326X4C	.379938	40499	.354807
208ZZ	.240266	304X6	.376280	326X5	.379938	42ZZZ	.326393
20800	.313206	30499	.376280	326X5A	.379938	423X0	.302457
20899	.313206	305X4	.466720	326X5B	.379938	423X1	.302191
209X0	.313206	306X0	.359528	326X6	.379938	423X2	.321252
22ZZZ	.327241	306X1	.425931	326X6A	.379938	423X3	.340399
222X0	.327241	306X2	.288029	326X6B	.379938	423X4	.301321
23ZZZ	.305286	30699	.376280	326X6C	.379938	423X5	.304784
231X0	.305286	307X0	.424921	326X7	.379938	42399	.321481
231X1	.404978	309X0	.376280	326X7A	.379938	426X1	.321481
231X2	.326116	309ZU	.376280	326X7B	.379938	426X2	.330708
23100	.305286	316X0	.427911	326X7C	.379938	426X3	.321481
23199	.305286	316X0C	.427911	326X8	.379938	426X4	.321481
232X0	.305286	316X0F	.427911	326X8A	.379938	42699	.321481
233X0	.232739	316X0G	.535203	326X8B	.379938	427X0	.444355
233X1	.305286	316X0T	.440032	326X8C	.379938	427X1	.249816
233ZZ	.305286	316X1	.427911	326ZZ	.447507	427X2	.399980
23399	.305286	316X1L	.258104	32673	.379938	427X3	.229964
241X0	.374284	316X1P	.427911	32674	.379938	427X4	.434279
241ZU	.374284	316X2	.427911	32675	.379938	427X5	.334439
242X0	.374284	316X2F	.427911	32676	.379938	42700	.321481
251X0	.353733	316X2G	.427911	32677	.379938	42799	.321481
251ZU	.365803	316X2T	.427911	32678	.379938	43ZZZ	.308802

Table B.4—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
431X0C	.334567	542X2	.276732	645X0	.283530	811X2A	.258716
431X0D	.334567	54200	.301771	645X0A	.350247	81100	.318488
431X1	.334423	54299	.301771	645X1	.261689	81199	.318488
431X1A	.273475	545X0	.269786	645X2	.328406	821X0	.327241
431X1C	.310871	545X1	.301771	64500	.280249	87ZZZ	.309083
431X1E	.354694	545X2	.306649	64599	.280249	871X0A	.309083
431X1F	.331597	545X3	.301771	65ZZZ	.387978	871X0B	.309083
431X2	.354042	54500	.301771	651X0	.384875	871X0C	.309083
431X2A	.334567	54599	.301771	661X0	.327241	871X0D	.309083
431X2C	.334567	55ZZZ	.318559	672X1	.279374	871X0E	.309083
431X2E	.334567	551X0	.353114	672X2	.272619	871X0F	.309083
431X2G	.334567	551X1	.297343	672ZZ	.300358	871X0G	.309083
431X2Z	.334567	55100	.318559	67200	.300358	871X0H	.309083
431X3	.334567	55199	.318559	67273	.320421	871X0J	.309083
431X4	.334567	552X0	.267875	67299	.300358	871X0K	.309083
43199	.334567	552X1	.318559	673X0	.300358	871X0L	.309083
43200	.334567	552X2	.398156	691X0	.327241	871X0M	.309083
443X0	.378195	552X4	.318559	70ZZZ	.269004	871X0N	.309083
443X0C	.378195	552X5	.298266	701X0	.336164	871X0P	.309083
443X0E	.378195	55200	.318559	702X0	.264614	871X0R	.309083
443X0G	.400012	55273	.318559	702X0A	.269004	871X0S	.309083
443X0P	.378195	55299	.318559	702X0B	.269004	871X0T	.309083
443X1	.378195	553X0	.273541	702X0C	.269004	871X0Z	.309083
44300	.378195	554X0	.372534	70200	.269004	87100	.309083
44399	.378195	555X0	.326777	70270	.269004	87199	.309083
445X0E	.378195	566X0	.315810	703X0	.271906	872X0	.309083
445X0F	.378195	566X1	.276646	705X0	.350650	90ZZZ	.324950
445X0G	.378195	56600	.315810	71ZZZ	.327241	902X0	.323203
445X1	.378195	56699	.315810	732X0	.293580	902X0A	.324950
44500	.378195	571X0	.338550	732X1	.300515	902X0B	.324950
44599	.378195	591X0	.327241	732X4	.300515	902X0C	.283004
461X0	.268309	591X1	.327241	73200	.300515	902X1	.324950
462X0	.323677	59100	.327241	73299	.300515	902X2	.305690
463X0	.441718	59199	.327241	733X1	.300515	902X2A	.324950
464X0	.312089	602X0	.265234	734X0A	.300515	902X2B	.324950
472X0	.271950	602X1	.298781	734X0B	.300515	902X2C	.324950
472X1	.401918	602X2	.298781	73400	.300515	902X2D	.324950
472X1A	.317106	60200	.298781	73499	.300515	90200	.324950
472X1B	.317106	60273	.383306	741X1	.287858	90299	.324950
472X1C	.317106	60299	.298781	742X0	.309856	903X0	.301784
472X1D	.317106	603X0	.285953	75ZZZ	.361797	903X1	.324950
472X2	.267678	605X0	.242193	751X0	.361797	90300	.324950
472X3	.317106	605X1	.296468	751X2	.367202	90399	.324950
472X4	.317106	60500	.298781	751X3	.361797	905X0	.324950
47200	.317106	60572	.366105	75199	.361797	906X0	.311485
47271	.317106	60572A	.298781	753X0	.361797	907X0	.289417
47275	.354862	60599	.298781	753X1	.361797	908X0	.316424
47299	.317106	611X0	.286137	75300	.361797	911X0	.289156
511X0	.398989	612X0	.279902	75399	.361797	912X5	.289156
511X1	.676578	612X1	.279902	791X0	.457994	913X0	.289156
51100	.468692	61200	.279902	791X1	.443379	913X1	.289156
51199	.468692	61299	.279902	791X2	.443379	91300	.289156
54ZZZ	.301771	622X0	.307304	79100	.443379	91399	.289156
542X0	.310419	622X1	.310182	79199	.443379	914X0	.289156
542X0F	.301771	63ZZZ	.313351	811X0	.341465	914X1	.289156
542X1	.406939	631X0	.313833	811X2	.285877	91400	.289156

Table B.4—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
91499	.289156	982X0	.374398	995X1	.280373	996X4	.280373
915X0	.250775	99ZZZ	.280373	995X2	.280373	996X5	.280373
917X0	.289156	99005	.280373	995X3	.280373	996X7	.280373
918X0	.289156	99006	.280373	995X4	.280373	996X8	.280373
919X0	.289156	991X2	.280373	995X5	.280373	99600	.280373
924X0	.298380	991X4	.280373	995X6	.280373	99604	.280373
924X1	.305899	991X5	.280373	99500	.280373	997X0	.280373
92400	.305899	991X6	.280373	99502	.280373	997X1	.280373
92499	.305899	991X7	.280373	99503	.280373	997X2	.280373
925X0	.305899	99104	.280373	996X0	.280373	99701	.280373
926X0	.305899	99105	.280373	996X1	.280373	99999	.280373
98ZZZ	.387965	99106	.280373	996X2	.280373	AMBIG	.338436
981X0	.392613	995X0	.280373	996X3	.280373	DELETD	.460302

Table B.5

AFSC EFFECTS FOR SECOND-TERM ETS EXTEND-GIVEN-STAY MODEL
(For Table 6.2)

AFSC	Coefficent	AFSC	Coefficient	AFSC	Coefficent	AFSC	Coefficient
100X0	2.58072	27100	2.64810	321X0L	2.69501	328X3	2.76773
111X0	2.47367	272X0	2.72188	321X1E	2.69501	328X4	2.69341
112X0	2.47367	273X0	2.64810	321X1G	2.69501	328X5	2.69501
113X0B	2.47367	274X0	2.73257	321X2	2.69501	32899	2.69501
113X0C	2.50645	274ZU	2.64810	321X2A	2.69501	32900	2.69501
11300	2.47367	275X0	2.64810	321X2C	2.69501	341X1	2.65455
11399	2.47367	276X0	2.57305	321X2P	2.72448	341X2	2.65455
114X0	2.35818	276X0B	2.64810	321X2Q	2.69501	341X3	2.65455
115X0	2.47367	276X2	2.64810	32199	2.69501	341X4	2.65455
116X0	2.47367	27600	2.64810	322X2A	2.69501	341X5	2.65455
121X0	2.45277	277X0	2.64810	322X2B	2.69501	341X6	2.65455
122X0	2.46878	29ZZZ	2.66092	322X2C	2.69501	341X7	2.65455
201X0	2.63317	291X0	2.62619	32299	2.69501	341ZZ	2.65455
201X1	2.67048	29100	2.62755	323X1	2.69501	34100	2.65455
20199	2.67048	293X3	2.62755	323X2	2.69501	34199	2.65455
202X0	2.65991	295X0	2.62755	323X3	2.69501	36ZZZ	2.64232
203X0	2.67048	296X0	2.62755	32399	2.69501	361X0	2.64232
205X0	2.67048	297X0	2.62755	324X0	2.86962	361X1	2.71343
206X0	2.63683	30100	2.75955	325X0	2.71226	36199	2.64232
20600	2.67048	302X0	2.75955	325X1	2.65728	362X1	2.62470
207X1	2.68647	302X1	2.75955	32599	2.69501	362X3	2.64232
207X2	2.67048	30299	2.75955	326X0C	2.69501	362X4	2.73455
20700	2.67048	303X1	2.68504	326X0D	2.69501	36200	2.64232
20799	2.67048	303X2	2.66673	326X3	2.69501	36299	2.64232
208X0	2.67048	303X3	2.71832	326X3A	2.69501	391X0	2.74329
208X1	2.67048	30399	2.75955	326X3B	2.69501	392X0	2.54648
208X2	2.67048	304X0	2.78482	326X4	2.69501	404X0	2.58072
208X3	2.67048	304X1	2.86651	326X4A	2.69501	404X1	2.58072
208X3A	2.67048	304X4	2.75829	326X4B	2.69501	40400	2.58072
208X4	2.67048	304X5	2.75955	326X4C	2.69501	40499	2.58072
208X4A	2.67048	304X6	2.75955	326X5	2.69501	42ZZZ	2.53804
208X5	2.67048	30499	2.75955	326X5A	2.69501	423X0	2.57198
208X5A	2.67048	305X4	2.83003	326X5B	2.69501	423X1	2.58867
208ZZ	2.63487	306X0	2.75437	326X6	2.69501	423X2	2.58305
20800	2.67048	306X1	2.75955	326X6A	2.69501	423X3	2.55326
20899	2.67048	306X2	2.70838	326X6B	2.69501	423X4	2.56238
209X0	2.67048	30699	2.75955	326X6C	2.69501	423X5	2.51597
222X0	2.58072	307X0	2.85095	326X7	2.69501	42399	2.53804
23ZZZ	2.56579	309X0	2.75955	326X7A	2.69501	426X1	2.53804
231X0	2.56579	309ZU	2.75955	326X7B	2.69501	426X2	2.51625
231X1	2.57422	316X0	2.57543	326X7C	2.69501	426X3	2.53804
231X2	2.55994	316X0C	2.57543	326X8	2.69501	426X4	2.53804
23100	2.56579	316X0F	2.57543	326X8A	2.69501	42699	2.53804
23199	2.56579	316X0G	2.53585	326X8B	2.69501	427X0	2.57363
232X0	2.56579	316X0T	2.57543	326X8C	2.69501	427X1	2.48823
233X0	2.60655	316X1	2.57543	326ZZ	2.69501	427X2	2.57183
233X1	2.56579	316X1L	2.65183	32673	2.69501	427X3	2.50471
233ZZ	2.56579	316X1P	2.57543	32674	2.69501	427X4	2.58110
23399	2.56579	316X2	2.57543	32675	2.69501	427X5	2.57006
241X0	2.58072	316X2F	2.57543	32676	2.69501	42700	2.53804
242X0	2.58072	316X2G	2.57543	32677	2.69501	42799	2.53804
251X0	2.65119	316X2T	2.57543	32678	2.69501	43ZZZ	2.54604
251ZU	2.66098	316X3	2.57543	32699	2.69501	431X0C	2.55812
271X1	2.64810	31600	2.57543	328X0	2.66551	431X0D	2.55812
271X2	2.47879	31699	2.57543	328X1	2.76126	431X1	2.59204
271ZZ	2.52351	321X0K	2.69501	328X2	2.69501	431X1A	2.51667

Table B.5—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
431X1C	2.55011	545X3	2.61492	661X0	2.58072	871X0G	2.54013
431X1E	2.51401	54500	2.61492	672X1	2.53427	871X0H	2.54013
431X1F	2.61330	54599	2.61492	672X2	2.52651	871X0J	2.54013
431X2	2.57489	55ZZZ	2.56506	672ZZ	2.54865	871X0K	2.54013
431X2A	2.55812	551X0	2.55508	67200	2.54865	871X0L	2.54013
431X2C	2.55812	551X1	2.55477	67273	2.55949	871X0M	2.54013
431X2E	2.55812	55100	2.56506	67299	2.54865	871X0N	2.54013
431X2G	2.55812	55199	2.56506	673X0	2.54865	871X0P	2.54013
431X2Z	2.55812	552X0	2.57859	691X0	2.58072	871X0R	2.54013
431X3	2.55812	552X1	2.56506	70ZZZ	2.51220	871X0S	2.54013
431X4	2.55812	552X2	2.56506	701X0	2.67710	871X0T	2.54013
43199	2.55812	552X4	2.56506	702X0	2.50202	871X0Z	2.54013
43200	2.55812	552X5	2.57123	702X0A	2.51220	87100	2.54013
443X0	2.40991	55200	2.56506	702X0B	2.51220	87199	2.54013
443X0C	2.40991	55273	2.56506	702X0C	2.51220	872X0	2.54013
443X0E	2.40991	55299	2.56506	70200	2.51220	90ZZZ	2.57834
443X0G	2.42852	553X0	2.50759	70270	2.51220	902X0	2.59050
443X0P	2.40991	554X0	2.56506	703X0	2.60846	902X0A	2.57834
443X1	2.40991	555X0	2.59609	705X0	2.51220	902X0B	2.57834
44300	2.40991	566X0	2.50354	732X0	2.60836	902X0C	2.59088
44399	2.40991	566X1	2.53634	732X1	2.61336	902X1	2.57834
445X0E	2.40991	56600	2.50354	732X4	2.61336	902X2	2.54295
445X0F	2.40991	56699	2.50354	73200	2.61336	902X2A	2.57834
445X0G	2.40991	571X0	2.62745	73299	2.61336	902X2B	2.57834
445X1	2.40991	591X0	2.58072	733X1	2.61336	902X2C	2.57834
44500	2.40991	591X1	2.58072	734X0A	2.61336	902X2D	2.57834
44599	2.40991	59100	2.58072	734X0B	2.61336	90200	2.57834
461X0	2.57439	59199	2.58072	73400	2.61336	90299	2.57834
462X0	2.60864	602X0	2.59555	73499	2.61336	903X0	2.56422
463X0	2.74287	602X1	2.57047	741X1	2.54206	903X1	2.57834
464X0	2.60669	602X2	2.57047	742X0	2.55636	90300	2.57834
472X0	2.57705	60200	2.57047	75ZZZ	2.61355	90399	2.57834
472X1	2.51994	60273	2.58557	751X0	2.61355	905X0	2.57834
472X1A	2.56400	60299	2.57047	751X2	2.65477	906X0	2.56137
472X1B	2.56400	603X0	2.57625	751X3	2.61355	907X0	2.72734
472X1C	2.56400	605X0	2.64286	75199	2.61355	908X0	2.48631
472X1D	2.56400	605X1	2.53015	753X0	2.61355	911X0	2.55803
472X2	2.56630	60500	2.57047	753X1	2.61355	912X5	2.55803
472X3	2.56400	60572	2.55548	75300	2.61355	913X0	2.55803
472X4	2.56400	60572A	2.57047	75399	2.61355	913X1	2.55803
47200	2.56400	60599	2.57047	791X0	2.61567	91300	2.55803
47271	2.56400	611X0	2.55906	791X1	2.61567	91399	2.55803
47275	2.56400	612X0	2.54586	791X2	2.61567	914X0	2.55803
47299	2.56400	612X1	2.54586	79100	2.61567	914X1	2.55803
511X0	2.57438	61200	2.54586	79199	2.61567	91400	2.55803
511X1	2.64411	61299	2.54586	811X0	2.53843	91499	2.55803
51100	2.58678	622X0	2.52935	811X2	2.59090	915X0	2.47531
51199	2.58678	622X1	2.52822	811X2A	2.56054	917X0	2.55803
54ZZZ	2.61492	63ZZZ	2.51049	81100	2.56054	918X0	2.55803
542X0	2.57754	631X0	2.50873	81199	2.56054	919X0	2.55803
542X0F	2.61492	645X0	2.52355	821X0	2.58072	924X0	2.54713
542X1	2.61492	645X0A	2.51448	87ZZZ	2.54013	924X1	2.53244
542X2	2.67015	645X1	2.48251	871X0A	2.54013	92400	2.53244
54200	2.61492	645X2	2.64310	871X0B	2.54013	92499	2.53244
54299	2.61492	64500	2.51448	871X0C	2.54013	925X0	2.53244
545X0	2.57637	64599	2.51448	871X0D	2.54013	926X0	2.53244
545X1	2.61492	65ZZZ	2.52649	871X0E	2.54013	98ZZZ	2.62753
545X2	2.59360	651X0	2.52815	871X0F	2.54013	981X0	2.63336

TableB.5—continued

AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient	AFSC	Coefficient
982X0	2.62753	99106	2.61941	99503	2.61941	99600	2.61941
99ZZZ	2.61941	995X0	2.61941	996X0	2.61941	99604	2.61941
99006	2.61941	995X1	2.61941	996X1	2.61941	997X0	2.61941
991X2	2.61941	995X2	2.61941	996X2	2.61941	997X1	2.61941
991X4	2.61941	995X3	2.61941	996X3	2.61941	997X2	2.61941
991X5	2.61941	995X4	2.61941	996X4	2.61941	99701	2.61941
991X6	2.61941	995X5	2.61941	996X5	2.61941	99999	2.61941
991X7	2.61941	995X6	2.61941	996X7	2.61941	AMBIG	2.73201
99104	2.61941	99500	2.61941	996X8	2.61941	DELETD	2.58072
99105	2.61941	99502	2.61941				

Table B.6

CAREER FIELD EFFECTS FOR RETIREMENT MODEL
(For Table 9.3)

Career Field	Coefficient	t-Statistic
10	.0011	.06
11	−.0119	−.67
12	.0126	.51
20	−.0126	−.68
22	−.0030	−.06
23	.0189	.91
24	.0372	1.45
25	.0191	.83
27	.0110	.63
29	−.0103	−.57
30	.0450	2.58
31	.0425	2.17
32	.0533	3.04
34	.0768	3.33
36	.0187	.88
39	.0633	3.23
40	.0163	.43
42	.0451	2.58
43	.0437	2.53
44	.0818	3.59
46	.0252	1.38
47	.0776	3.65
51	.0916	4.77
54	.0726	3.67
55	.0377	2.01
56	−.0323	−1.01
57	.0367	1.64
59	−.0685	−1.22
60	.0043	.23
61	.0071	.27
62	.0406	1.87
63	.0157	.72
64	−.0022	−.13
65	.0954	3.56
66	−.0581	−1.88
67	.0015	−.07
69	.0203	.67
70	−.0195	−1.12
73	.0048	.27
74	.0383	1.71
75	.0320	1.66
79	.0277	1.03
81	.0276	1.51
82	.0349	1.37
87	−.0312	−1.08
90	.0174	.95
91	.0033	.15
92	.0293	.95
98	.0000	(cg)
Other	.0281	1.41

NOTE: The model was fitted with data from a 30 percent sample from the YAR file for years at risk ending between July 1974 and May 1983. The sample set contained 117,133 observations and consisted of airmen whose Social Security Number ended in 3, 4, or 9.

Appendix C

LOGIT TRANSFORMATION OF LINEAR EQUATIONS

The middle-term loss models are linear models. The general form of each of the equations is:

$$P_j = \alpha_o + \sum \alpha_i X_{ij} + \epsilon \qquad \text{(C.1)}$$

where P_j is the probability of a specific outcome (either a loss or an extend-given-stay decision) in the equation for airman j, α_i is the linear coefficient for the ith independent variable, X_{ij} is the value of the ith independent variable for airman j, and ϵ is the error term.

This linear specification works well for forecasting purposes, because actual changes in the independent variables are quite modest. However, large changes in the range of an independent variable are outside the competence of a purely linear specification. Consequently, when necessary, we transform the model into a logit form specified by the equation:

$$\log (P_j/(1 - P_j)) = \beta_o + \sum \beta_i X_{ij} + \epsilon' \qquad \text{(C.2)}$$

According to Haggstrom (1983), β_i can be estimated using the following formula:

$$\beta_i = (n/SS_E)\alpha_i \qquad \text{(C.3)}$$

where SS_E is the sum of the squared errors of the regression equation (C.1), and n is the sample size.

The value of β_o is given by:

$$\beta_o = \log(n_1/n_2) + n*\log(\alpha_0 - .5)/SS_E + .5*n*(1/n_1 - 1/n_2)$$

where $n_1 =$ n*(mean loss rate), and $n_2 =$ n*(1 − mean loss rate).

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