It is difficult to take raw trends in deployment and retention, such as those shown in the previous chapter, and draw meaningful conclusions from them for a number of reasons. The most important reason is that there are many factors that affect retention besides deployment and, prior to drawing any conclusion about the relationship between deployment and retention, it is vitally important to account for those other factors. For example, there are known differences in retention by occupation, gender, and whether a service-member has dependents. The methods we employ allow such factors to be accounted for prior to evaluating how deployment is related to retention.

Our data were drawn from the Perstempo database provided by DMDC. The initial database consisted of all officers on active duty between December 1987 and March 1998. This was subsequently updated with data through September 1999. The resulting combined database gives quarterly “snapshots” for the first five years (December 1987–December 1992) and monthly thereafter. For junior officers, we subset the data to those officers commissioned after December 1986, whose initial service obligation ended before September 1998, and whom we could identify as not having been involuntarily separated from military service. For midgrade officers,

1To determine personnel who were not involuntarily separated, we obtained the Inter-Service Separation Code (ISC) from DMDC for each individual and removed from our database those with an ISC greater than 05. These are personnel who were separated for the following reasons: medical disqualifications, dependency or hardship, retirement, failure to meet minimum behavioral or performance criteria, etc.
we included those officers whose initial obligation expired between November 1992 and September 1998.

To account for differences in the services’ policies, practices, and organizational cultures, we model each service individually, and we further model junior and midgrade officers separately. In particular, we first evaluate junior officer retention at the end of the initial service obligation period. Officers at this stage are primarily O-2s and junior O-3s after about four or five years of service. We then evaluate midcareer officers, O-3s and O-4s, who remained in the service after their initial service obligation.

We model the junior officers separately from the midgrade officers for a number of reasons. First, the initial service obligation provides a definitive point at which to evaluate junior officer retention. This is convenient for modeling and substantively important, as the initial service obligation is incurred before the junior officers have actually been able to experience the military. As a result, they are not fully informed about the consequences of their decision to incur a service obligation, and many will choose to leave the military after this initial obligation. Thus, those officers who remain on active duty after their initial obligation constitute a significantly different group who have made a more informed choice to remain on active duty.

Second, officers who have chosen to remain on active duty after their initial service obligation are then continuously at risk to leave the service at any time. While new service obligations can be incurred, these subsequent service obligations are incurred after the officer has experienced the realities of his or her chosen career, so that these service obligation decisions can be interpreted as confirmation of a career choice. From a modeling standpoint, we assume that an officer who has incurred such an additional obligation has simply made an early decision to remain on active duty for the duration of the obligation.

Note that the ISC was not available for all personnel who had left the service and the percentage varied by service. The assumption we are forced to make is within service, for those personnel who separated in our time period of interest, the ISC is missing randomly.
JUNIOR OFFICER MODELS

We model the effect of deployment on junior officers by looking one year after the expiration of each officer’s initial service obligation and evaluating those who remained on active duty versus those who did not. As we discuss in the next subsection, we employed standard statistical modeling techniques (logistic regression) to construct our models. Details about the statistical methodology can be found in Appendix A. For each junior officer, we calculate the number of episodes of long deployment and the number of episodes of hostile deployment for the 36 months prior to the expiration of each officer’s initial service obligation. We assigned officers to occupational groupings to capture the effects of occupation (see Appendix D for occupational category definitions). We also incorporate demographic covariates in our models, including gender, race, whether the officer has dependents or not, and accession source (academy graduate or not), to capture the effects of these characteristics on the decision to remain in the military, prior to evaluating the effect of deployment.²

Figure 3.1 shows how the deployment measures and the determination of whether an officer has been retained are tied to the date when

Figure 3.1—Definition of the Periods for Allowable Data and When the Measures Were Constructed for Junior Officer Models

²Covariates that could vary over time, such as whether an officer has dependents or not, were set based on the officer’s status during the quarter of his or her minimum service obligation date.
an officer’s minimum service obligation ends. All the characteristics in the model are measured at or before the minimum service obligation date. For example, the deployment measures are calculated for the three years preceding the minimum service obligation date; occupation is determined from the latest occupational data in the third year after commissioning.

**Determining Whether a Junior Officer Was Retained**

We look one year after expiration of the minimum service obligation. If an officer is still recorded in the Perstempo data file as being on active duty, we make the determination that the officer chose to remain on active duty. If not, we conclude that he or she chose to leave.

Depending on timing and service considerations, an officer may not leave exactly at the expiration of his or her minimum obligated service. The one-year period allows for delays in actually leaving the service. Unlike enlisted personnel, officers do not serve for a fixed period of time and they are formally required to resign their commission to leave the military. This must normally be done with some prior notice, perhaps up to a year in advance. The assumption we make by using the year window is that an officer who leaves within that time period intended to leave the service at the expiration of his or her initial service obligation but may not have been able to actually leave until some time after. Shortening the window could affect the results by classifying some officers as having been retained when, in fact, circumstances required them to stay on active duty for slightly longer than their obligation.

Lengthening the window would likely have less of an effect because those who left within the one-year window would still be classified the same way. However, it could result in classifying a few more individuals as leaving immediately after their obligation date, when instead they had chosen to leave at a later date. The primary effects on the model would be:

- For some individuals, the time between the three years when we measure deployment and when they actually leave would be larger. This might serve to decrease the effect we are trying to measure.
• It would decrease the number of records available for us to build models given that each individual in the data would need to have more than four years of data between December 1986 and September 1999. We thus settled on a one-year window as a reasonable compromise between these two competing requirements.³

Definition of Occupational Categories

Service obligations, as well as retention decisions, on average, vary by occupation. For example, pilots and other occupations that are given special training often incur greater initial service obligation periods. Similarly, various occupational skills are in greater or lesser demand in the civilian sector, and some occupations are given incentive pays to increase retention. These factors and others serve to influence retention by occupational category.

In order to account for such effects in our models, we assigned officers to occupational specialty groupings. As shown in Figure 3.1, a junior officer’s occupational specialty was determined three years after commissioning, based on the occupational specialty code recorded in the Perstempo database. We allowed the three-year delay so that officers given training and student occupational codes early in their careers had time to have their true occupational codes assigned. For midgrade officers, we used the latest occupational code listed in the data.

We then used the occupational codes⁴ to assign officers to one of fifteen categories that we attempted to standardize as much as possible across the services. The occupational categories (see Appendix D for a mapping of occupational codes to occupational categories) are

• acquisition,

³As part of a sensitivity analysis, we constructed and evaluated models with two-year windows. The results, as expected, were consistent with the one-year window models and were what we expected. The two-year window was to mitigate the observed effect of the deployment effects.

⁴For the Army we used Area of Concentration codes; for the Navy, a combination of Designator codes and Navy Officer Billet Classification codes; for the Marine Corps, Military Occupational Specialty codes; and for the Air Force, Air Force Specialty codes.
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- pilot,
- intelligence,
- information technology/management information sciences (IT/MIS),
- legal,
- line,
- medical,
- nuclear power,
- other aviation,
- other/unknown,
- personnel/administration,
- religious,
- scientific/engineering,
- student, and
- supply.

Of these, nuclear power is an occupation unique to the Navy; the Marine Corps does not have codes for medical or religious occupations; the Navy does not have occupational codes for students; and the Air Force has pilots rather than line officers.

**Calculation of Initial Service Obligation**

Service obligation was available for some officers on the DMDC Master/Loss file. We were interested in modeling whether deployment affected an officer’s decision to remain in the service after his or her initial service obligation expired. We assumed that if an officer incurred an additional service obligation, then he or she was making the decision to remain in the military—at least beyond his or her initial obligation.

We imputed an initial service obligation for those officers who did not have one in the Master/Loss file. To do this, we first extracted the records from the Master/Loss file that had a service obligation
and used the most recent observation between the second and third year after commissioning. We next computed the median service obligation by occupational category and rounded it to the nearest half year. Then, for those records missing service obligation, we assigned them the value for their occupational category; for those with a service obligation, we used the minimum of the actual value or the occupational group median plus two years. That is, we truncated unusually long service obligations to correct for errors and other data anomalies.5

**Model Covariates**

In addition to occupation, we incorporated data on each officer’s gender, race, accession source (academy or not), and family status (single or has dependents at the time of expiration of minimum service obligation). These covariates all may have some effect on an individual’s decision to remain in the military. We also included indicator covariates for the year each junior officer was eligible to separate from the service (i.e., the year the initial service obligation expired). These “fixed effect” covariates account for year-to-year variation, such as changes in the civilian unemployment rate and temporal changes in each service.

**MIDGRADE OFFICER MODELS**

Because midgrade officers may leave the service at any time, we model the effect of deployment on midgrade officers differently from

5The percentage of truncation varied by service. This variation is a function of both service anomalies, such as data quality and recordkeeping practices, and the fraction of service obligations actually recorded in the data. For example, Marine Corps service obligations were entirely imputed because none were available in the data. The result is that none of these imputed service obligations had to be truncated. For the other services, almost 7 percent of the Army, slightly more than 4 percent of the Navy, and almost 19 percent of the Air Force service obligations were truncated.

There are a number of possible explanations for the higher truncation percentage in the Air Force, including differences or errors in recordkeeping and the possibility of a very bimodal distribution for Air Force service obligation times. If, in fact, the truncated service obligation times were correct, then truncation would tend to attenuate the relationship between deployment and retention, as those who were truncated would be counted as choosing to remain on active duty when, in fact, they simply were not able to leave because of their service commitment.
the way we model it on junior officers. We employed another standard statistical modeling technique—survival analysis—to construct our models. Survival analysis models the time to an event where, in this case, we model the time until separation from the service. See Appendix A for details.

An advantage of survival analysis is that it can handle “censored” observations, such as with Officer #1 in Figure 3.2. In this particular case, the Perstempo data ends in September 1999 but Officer #1 is still on active duty. Hence, we know when Officer #1 was commissioned, and all information about this servicemember through September 1999, but we do not know if or when he or she left the service. Survival analysis also handles completely observed cases, such as Officer #2 in Figure 3.2.

As shown in Figure 3.2, for each midgrade officer who remained on active duty after his or her initial service obligation,6 we calculate the

![Figure 3.2—Definition of the Periods for Allowable Data and When the Measures Were Constructed for Midgrade Officer Models](image)

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6Remaining on active duty after the initial service obligation was defined for the midgrade officers exactly as it was for the junior officers. If a midgrade officer was still on active duty one year after his or her initial service obligation period expired, that individual was included in the midgrade officer analysis.
number of long deployments and the number of hostile deployments for the 36 months preceding either the servicemember’s exit date or September 1999 if the officer is still on active duty at that point. We use this information, along with covariates similar to those used in the junior officer models (e.g., occupational category, gender, race, whether the officer has dependents or not), to capture the effect of these characteristics on the decision to remain in the military. The models use this quarterly information, along with the information about how long each officer remained on active duty, to determine the effects of deployment on retention.\footnote{Survival models can easily incorporate “time-varying” covariates, such as dependent status. This allows the model to explicitly account for demographic characteristics that can change with time. For our models, the time-varying covariates are rank, whether an officer had dependents, educational status, whether the officer was promoted in the last year, and whether the officer obtained an advanced degree in the last two years.}

**Definition of Occupational Categories**

As with the junior officer models, we assigned midgrade officers to occupational specialty groupings. However, unlike the junior officers, we used the latest occupational code listed in the data. This corresponded either to the occupational code the officer held upon separation from the service or the one held on September 1999, the end of our data. We used the same 15 categories listed above, which were standardized as much as possible across the services.

**Model Covariates**

In addition to the covariates from the junior officer models (gender, race, accession source, family status), we incorporated time-varying covariates for rank, educational level, whether the officer had been promoted in the last year, whether the officer had received an advanced degree in the past two years, and indicators for each year. The year indicators have the same role in these models as they do in the junior officer models: to account for year-to-year variation that affects the decision to separate from the service.
The promotion and advanced degree receipt indicators were included since these affect the individual’s inclination or ability to separate. In the case of degree receipt (from an educational program funded by the Department of Defense [DoD]), officers in all services incur a service obligation, so an individual has a much lower likelihood of separation after receiving a degree. For the promotion indicators, some services require the promoted officer to attend a service school, after which the officer incurs an additional service obligation. For those who do not, it is also reasonable to assume that promotion is likely to positively influence, and reflect, the decision to remain on active duty.