DISSERTATION

Balancing Two Lives

The Relationship of Activation, Pay, and Retention Among U.S. Air Force Reserve Pilots

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This document was submitted as a dissertation in December 2006 in partial fulfillment of the requirements of the doctoral degree in public policy analysis at the Pardee RAND Graduate School. The faculty committee that supervised and approved the dissertation consisted of James R. Hosek (Chair), David S. Loughran, and Albert A. Robbert III.

The views expressed in this dissertation are those of the author and do not reflect the official policy or position of the United States Air Force, Department of Defense, or the U.S. Government.

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Abstract:

Following the events of September 11th, the average days served by the part-time pilots of the Air Force Reserve doubled and, at times, tripled compared to the pre-September 11th rates. These part-time military pilots often work for civilian airlines and earn some of the highest civilian incomes in the nation. Popular press reports and surveys of reservists suggest that becoming activated for active duty service results in income losses for the activated members. Both Congress and the Department of Defense have expressed concerns that if activation causes income losses, then these losses might lead some reservists to leave the reserves earlier than they otherwise would have, and the losses might also prevent some potential reservists from ever joining the reserves.

This dissertation analyzed whether the increased activations of reserve pilots negatively affected their earnings and retention rates. It began by exploring the information relevant to the dual-employment aspect of the part-time, reserve pilots. Using that information, a theoretical model was developed to hypothesize how an individual would behave as that individual chooses between reserve activation time and civilian employment opportunities. The insights from this model provided the basis for two empirical analyses of grouped administrative data from the Social Security Administration and the Department of Defense. In both cases, the results of the analyses suggested that positive income and retention impacts were associated with increased activation service.

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Abbreviations

AC	active-duty component
ACIP	aviation continuation incentive pay
ACP	aviation continuation pay
ADSC	active duty service commitment
AEF	air expeditionary force
AF	Air Force
AFRC	Air Force Reserve Command
ANG	Air National Guard
CAP	combat air patrol
CZTE	combat zone tax exclusion
DiD	difference-in-differences
DoD	Department of Defense
EIN	employer identification number
FTF	Future Total Force
HA	high activation
HFP	hostile fire pay
IDP	imminent danger pay
LPM	linear probability model
MEF	Master Earnings File
NAICS	North American Industry Classification System
NDAA	National Defense Authorization Act
OLS	ordinary least squares
OPSTEMPO	operational tempo
PSRC	Presidential Selected Reserve Call-up
RC	reserve component
SOFR	Status Of Forces survey - Reserve component
SSA	Social Security Administration

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I. Introduction

"The Air National Guard and Air Force Reserve will not be excluded from any mission set for any of the weapon systems for the Future Total Force."
-- Lieutenant General H Steven Blum, Chief of the National Guard Bureau,
2005 Speech on the Future Total Force.[1]

The Important, and Changing, RC Pilot Contribution

The number of pilots in the Air Force is a constant concern of the service's leadership. Policies have been created and evaluated to ensure that the Air Force maintains enough pilots to achieve its vision of global vigilance, reach, and power. For example, when the Air Force faced a potential pilot shortage in the latter 1990s, it steadily increased the number of pilots it trained from 650 per year in 1997 to a rate of 1,100 per year in 2000.[2] Another policy adjustment made in 2000 was the raising of the Active Duty Service Commitment (ADSC) that pilots incurred when they completed their pilot school training from eight years to ten years.[3]

After they fulfill their ADSCs, the pilots may leave the Air Force or serve additional tours of duty. Monetary policies such as the 1989 Congressional establishment of—and current continuation of—Aviation Continuation Pay (ACP) have been funded to motivate the officers to remain in the military after their ADSC.[4] As an additional pay of up to $25,000 a year, ACP was designed to increase the retention rates of Air Force pilots by making the compensation of full-time military pilots competitive with the pay of civilian airline pilots.

Even as policymakers have attempted to influence the retention rates and personnel strength of the pilot career field, broader military requirements have changed the Air Force and the operational tempo in which officers continue to serve in, or leave, at the end of their ADSC periods. 15 years ago, the Air Force's Active-duty Component (AC) was 660,000 service members--40% larger than today's AC force of 360,000.[5] Yet today the Air Force is deploying four times more often than it did back in 1990 (prior to DESERT SHEILD and DESERT STORM) to accomplish operations such as IRAQI FREEDOM and ENDURING FREEDOM.[6]

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[1] http://www.af.mil/news/story_print.asp?storyID=123011006: "Flexibility, working together key to Air Force FTF."
[2] http://senate.gov/armed_services/statement/2001/peterson.pdf.
[3] This commitment was previously 8 years during 1990-2000, 7 years during 1988-1989, and 6 years for 1980-1988.
[4] http://www.afa.org/magazine/June2002/0602pilot.htm, "Another look at pilot retention."
[5] http://www.af.mil/news/story.asp?storyID=123008033, "Murray talks deployments, force shaping."
[6] *Ibid.*

The Air Force has been creatively versatile in responding to this personnel-deployment challenge. Organizationally, the Air Force has transformed itself into an expeditionary air force in an attempt to increase the predictability and stability of deployment schedules. The air expeditionary force (AEF) deployment structure began in October of 1999 and consists of ten air and space expeditionary forces of equivalent capabilities (e.g., aircraft, personnel, etc.) designed to meet national security requirements. For every 20-month period, a pair of AEFs is scheduled for four consecutive months of deployment availability. According to an article by Herbert (2003), AEFs are designed to meet steady state taskings, such as Operations NOBLE EAGLE, ENDURING FREEDOM and IRAQI FREEDOM, as well as retain a crisis response capability for responding to emerging contingencies.

AEFs do not depend solely on AC pilots to meet operational flying needs. Instead, as noted by Herbert (2003), the Air Force's Air National Guard (ANG) and Air Force Reserve (AFR)—hereafter referred to collectively as the Reserve Component (RC)—provide 25 percent of the aviation assets in each AEF. This integration of the RC with the AC has paralleled another organizational initiative that Air Force has been implementing—its "Future Total Force" (FTF) structure. As an Office of the Secretary of Defense / Reserve Affairs (2004) report recently noted:

> "…the AF recognizes that organizational change is necessary to operationalize transformations in technology and concepts. With decreasing force structure and increasing OPSTEMPO, the AF relies more heavily on the Guard and Reserve. In order to further integrate Active, Guard and Reserve forces into one seamless force, the AF unveiled *Future Total Force*. The *Future Total Force* program is a transformational initiative aimed at more efficiently utilizing AF resources from the Active, Guard, and Reserve to maximize capability."

The RC plays a significant role in FTF operations. Since September 11, 2001, the RC pilots have flown over 500,000 hours of flight for the Air Force, with over 100,000 of those hours being flown in direct support of Operations NOBLE EAGLE, ENDURING FREEDOM, and IRAQI FREEDOM.[7] Herbert (2003) reports that, according to Lieutenant General James E. Sherrard III, commander of Air Force Reserve Command, during Operation IRAQI FREEDOM, RC forces flew approximately 45 percent of the C-17 airlift missions, 50 percent of the C-5, and 90 percent of the C-141. Additionally, the RC flew 43 percent of the Air Force fighter sorties and 86 percent of the refueling sorties.

The activation of RC pilots may lead to operational capability being provided at a lower cost than the AC equivalent. Since many of the RC pilots are pre-trained from their AC service,

[7] https://airguard.ang.af.mil/cf/ang101.asp, Air National Guard 101 Briefing, 25 March 2005.

they represent a continuing return on the initial investment in their flight training—costs that can range from over a hundred thousands dollars for an aerial refueling pilot to over two million dollars for each trained fighter pilot[8] Aside from initial training costs, there are also the annual costs of maintaining piloting capability. As part of the RC force, the Air National Guard offers an opportunity to achieve capabilities at a lower cost, for fiscal reasons that include not having to pay for federal health benefits or military housing when members are not activated.[9] Referring to the costs and personnel structure of the Army, the National Guard's top commander, Lieutenant General H. Steven Blum recently stated that "You have to have a lot of competent soldiers. It is not clear that you need to have a large, full-time active-duty force."[10] With regard to the Air Force, a framework developed by Robbert *et al.* (1999) revealed that the RC force can be more, or less, cost effective depending on whether the Air Force is being optimized for major theaters of war or for peacetime contingency operations.

Besides the training and sustainability savings, the RC pilots provide the additional benefit of bringing years of flying experience to any mission group in which they serve. Taken together, the RC pilots' contribution of operational flying, cost-effectiveness, and experience make them a significant portion of the Air Force's FTF design.

Figures 1-1 through 1-3 provide illustrations from the Air National Guard Resource Book (2004) of how the 6,500+ RC pilots and their crews contributed to FTF operations during fiscal year 2003, the year of Operation IRAQI FREEDOM.

[8] http://usmilitary.about.com/library/milinfo/blafaircrewcost.htm.
[9] http://ebird.afis.mil/ebfiles/e20060531437381.html "Guard Chief Says Having Fewer Active-Duty GIs Can Save Money for Pentagon," *San Antonio Express-News*, May 29, 2006.
[10] *Ibid.*

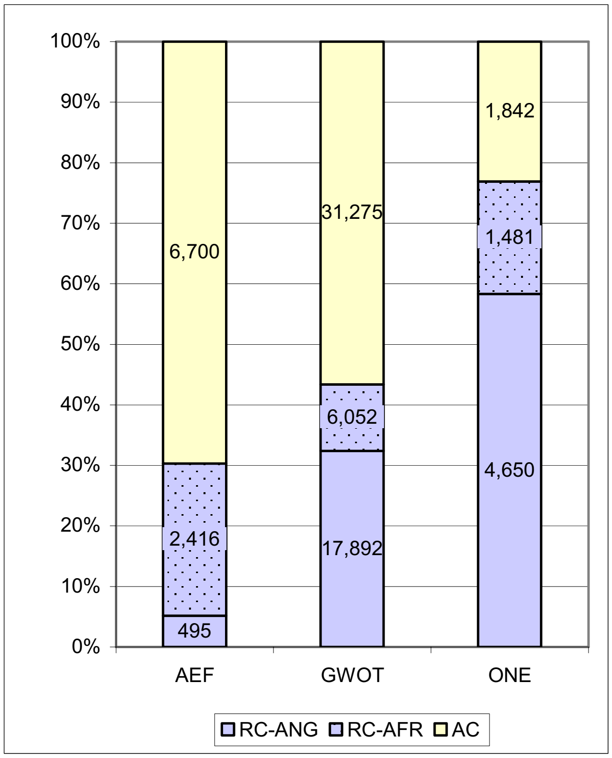

Figure 1-1: Total Force Aerial Refueling Flying Hours by Operation, FY03

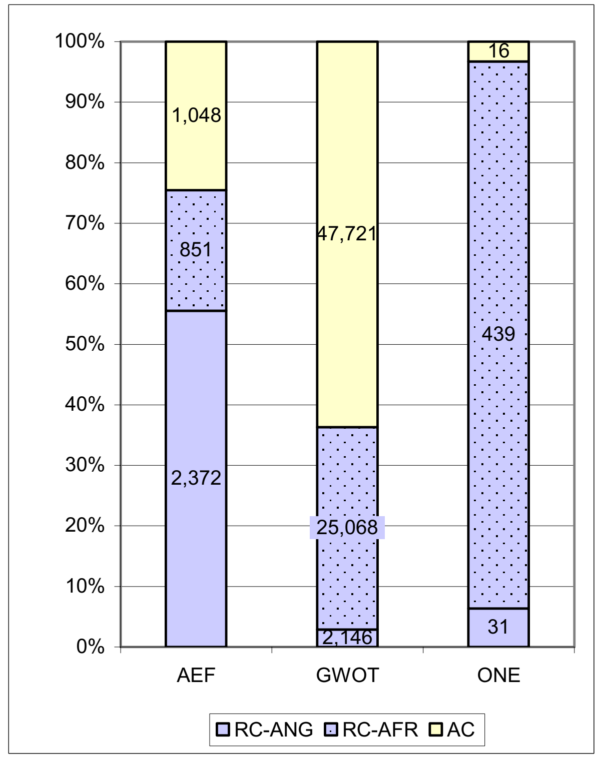

Figure 1-2: Total Force Airlift Flying Hours by Operation, FY03

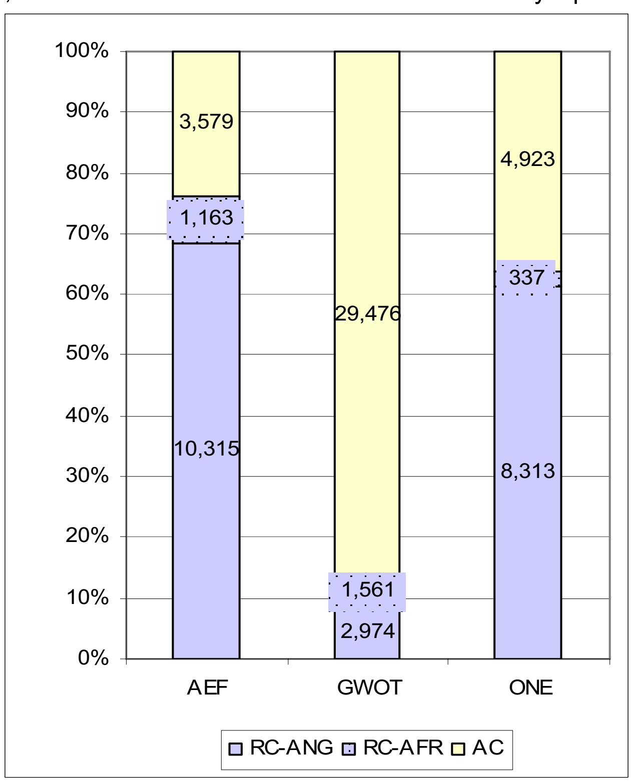

Figure 1-3: Total Force Fighter Flying Hours by Operation, FY03

Since September 11th, 2001, the RC pilot contribution has occurred during a period of longer average reserve activation for the RC as a whole. Between September 2001 and December 2004, an average reserve activation lasted more than eight months, and approximately 21 percent of activated reservists (some 73,000 reservists) had been activated more than once since September 11, 2001.[11] At present, the probability that any given reservist will be activated is much higher today than at any time during the Cold War, and those who are activated are likely to serve for a longer period of time.

Increased Activation Motivates Policy Analysis

The popular press has reported that reservists are being financially harmed as a result of their activations.[12] Both Congress and the Department of Defense (DoD) have been concerned that if activation causes income losses, then these losses might lead some reservists to leave the reserves earlier than they otherwise would have, and the losses might also prevent some potential reservists from ever joining the RC. To gain additional insight in these issues, in 2003, Congress directed the DoD to conduct a comprehensive review of compensation for reserve personnel.[13] The directive stated:

> The committee recognizes that the contributions of the reserve components have greatly increased in the past decade. In particular, there are certain mission-critical skills and units among reserve forces that have been recalled for contingency operations, placing stress upon the members and their families. The role of the reserves is so integral in the total force that military operations involving major, extended missions are required to include reserve participation.
>
> The committee is concerned that the pay and benefits of reserve personnel must appropriately compensate them for their service. Today's total force concept, which relies heavily on National Guard and Reserve forces for both day-to-day and contingency operations, differs from that envisioned by the designers of the reserve compensation and retirement system more than a half-century ago. Accordingly, the committee directs the Secretary of Defense to conduct a reserve

[11] Activation rates compiled from a December 2004 extract of DMDC's Global War on Terrorism Contingency File.
[12] For example, see "When Duty Calls, They Suffer," *USA Today,* April 17, 2003; "Reservists Under Economic Fire," *USA Today,* April 22, 2003; "Reservists Pay Steep Price for Service," *USA Today,* June 9, 2003.
[13] The request can be found in Senate Report 107–151 that accompanied the National Defense Authorization Act for Fiscal Year 2003. The original committee language can be found at http://thomas.loc.gov/cgi-bin/cpquery/?&db_id = cp107&r_n = sr151.107&sel = TOC_563910&. DoD's report is available as: "Reserve Personnel Compensation Program Review," OSD/P&R, March 15, 2004, http://www.defenselink.mil/ra/documents/rccompensation.pdf.

personnel compensation review aimed at determining the extent to which personnel and compensation policies and statutes, including the retirement system that defers eligibility for retired pay to age 60, appropriately address the demands placed on guard and reserve personnel.

Prior to this directive, there was little evidence about how activation demands, and the earnings changes associated with activation demands, affected the retention of RC pilots. Much of the research on activation, and its accompanying policy recommendations, had been directed at the AC force.

Some research suggested that periods of increased activation should be a concern for policy makers. For example, prior research by Taylor *et al.* (2000) on the exit polls of AC pilots showed that a pilot's desire to leave the Air Force was linked to the negative effects of deployments, frequent moves, and family turmoil. Although RC pilots do not typically have the requirement of rotating to a new base every 2-3 years like their AC counterparts do, many still deploy. However, deployments may not be the only source of "turmoil." For an RC pilot, raising the number of active days served—whether domestically or internationally—in a month by as little as two or three days represents the equivalent of one less weekend of time available to be home. If the RC member already works at a civilian job, such as an airline, that requires spending nights away from home, then the demands from increased activation might make RC service seem too burdensome and lead the individual to separate from the RC.

More recent research by Fricker (2002) studied deployments and showed that different types and amounts of deployments were associated with different rates of retention for the Air Force's AC officers. Analyzing lieutenants, captains, and majors, for the years 1990-1999, Fricker noted the tension between two deployment insights when analyzing Air Force officer retention across various career fields:

> For any time period for either junior or midgrade officers, more hostile deployment is associated with consistently increasing separation rates. However, any combination of deployment in terms of hostile and nonhostile is always associated with lower separation rates when compared with an equivalent group of nondeployers.

Fricker also found that, for the specific career field of Air Force AC pilots, a period of hostile deployment was associated with a higher separation rate when compared to non-hostile deployment, but again both of these separation rates were lower than the rate of AC pilots who did not deploy.

Other deployment research by Hosek and Totten (2002), which was conducted on enlisted AC members, has suggested that the higher retention rates among deployed service members might reflect that a military operations tempo with some amount of deployment increases the satisfaction that members obtain from serving. Deployment factors such as the opportunity to apply training to real world missions may have increased a member's personal and professional fulfillment and might have led the deployed members to have higher retention rates. Strategic compensation research, summarized by Martocchio (1998), notes that non-pecuniary rewards such as career advancement opportunities, interesting work and work location, a valued peer group, and training opportunities, may make a job more attractive.

However, that same Hosek and Totten report also suggested that total deployment amounts could be greater than the members desired—among the most-deployed members, retention rates were lower. Both the Fricker and Hosek and Totten studies occurred prior to September 11th, 2001. The relationships between deployment and retention could be different now, with more deployments going to AC members who would not have otherwise volunteered for duty.

The applicability of these AC findings to the current RC pilot force is not yet known. While deployments may, up to a point, have a positive relationship with AC pilot force retention, it is possible that deployments might have a negative relationship with the RC force. The nature of the community-based Reserves might reflect that RC members prefer less movement—otherwise, they would have stayed in the AC portion of the Air Force. For those who joined the RC prior to September 11th, the unexpected increases in activations and time away from their civilian homes and jobs could be greater than the members anticipated. If too great, the officers might choose to leave the RC force. Alternatively, RC pilots may seek out activation for reasons such as the opportunity to apply their training and gain experiences beneficial to their career progression.

Regardless of the desirability of deployments or activation, there are certain circumstances, documented in Title 10 of the United States Code, which could lead to a reservist being involuntarily called for activation. One such scenario begins with either the President or the Congress declaring a national emergency. If Congress declares the national emergency, then the entire RC population may be activated—a full mobilization—for service lasting the duration of the national emergency plus an additional six months. If the President declares a national emergency, up to one million members of the Ready Reserve may be activated—a partial mobilization—for up to 24 months of consecutive service.

A second possible way for a Reservist to be activated is through a Presidential Selected Reserve Call-up (PSRC). Under this provision, up to 200,000 RC members from the Selected Reserve may be activated for up to 270 days. The PSRC cannot be used for domestic emergencies.

Lastly, a third Title 10 provision allows for RC members to be called to active duty for up to 15 days each year. This clause facilitates RC members accomplishing their annual training requirements.

The data used for this dissertation's research does not provide a way to distinguish between voluntary and involuntary activation service. However, summary statistics, which will be further elaborated upon in the Chapter V, suggest that lengthy activation—whether voluntary or involuntary—is not a significant issue among RC pilots.

Surveys of RC retention decisions have examined how RC members value deployments vis-à-vis other considerations. A Defense Manpower Data Center Report (2005) on the results of the November 2004 SOFR showed that the top two (of seventeen) most widely selected factors affecting continuation decisions among all Reserve component members were "pay and allowances" and "the military retirement system." The deployment item of "predictability, frequency, and duration of deployments" was ranked fourth. Unfortunately, this listing did not include a "strength of preference" indication with each priority. The listing does not let a reader know if deployments are a distant concern when compared to pay, or part of a tight grouping of four, nearly equal priorities.

If, as the survey suggests, pay and compensation are the top factors of a retention decision, then a key question surrounding activations is whether that time devoted to military service generates as much income to RC pilots as their civilian jobs. When Reservists leave behind their full-time civilian jobs for an activation, that activation period may lead to the officers suffering a loss in income. Recent work by the Klerman *et al.* (2005) suggests that reservists, in aggregate, do not incur major financial hardship (i.e., losses of 10% of typical yearly income or losses of $10,000 or more). The study reported that over three-quarters of the individuals who experienced long activations experienced increases in earnings compared to when they were not activated for a long period, with a mean gain of $17,200 in earnings per individual—a mean increase of 44 percent.

A more recent study by Loughran *et al.* (2006) found that, for those RC members who were activated for less than 30 days in the year 2000, being activated for more than 30 days in 2002 or 2003 was associated with an average increase of 32 percent in earnings—a $13,500 increase—compared to the base year of 2000, as well as a 23 percent lower probability of experiencing an earnings loss.

However, these aggregate analyses have not yet explored, in detail, RC pilots. With their potentially higher paying civilian jobs, such as the job of an airline pilot, activations might cause RC pilots negative income impacts that differ from the average reservist's experience. The Bureau of Labor Statistics has reported that the annual income and career earnings of civilian pilots can be among the highest in the United States.[14] More specifically, Darby and Dean (2001) estimated that "the average career value for a 30-year old pilot with a 30 year career, living to age 74.5 at retirement was $7.8 million in 2000 dollars." Reports such as these support the possibility that activating an individual for RC pilot missions could result in that individual losing earnings during that time period.

There have been some studies on military pilots. The factors related to AC pilot retention have been a consideration of research for over 20 years.[15] This AC research has typically assumed that an AC pilot would either serve full-time in the military or leave to become a full-time civilian airline pilot. The analyses did not explore the option of serving in the Air Force as an RC member while simultaneously working at a civilian airline job. Additionally, while the previous research analyzed Cold War and post-Cold War data, no research projects have examined RC pilot retention during the Global War on Terror and Operation IRAQI FREEDOM, as this research will.

Dissertation Overview

Have the increased activations of RC pilots negatively affected their earnings and retention rates?

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[14] http://www.bls.gov/oco/print/ocos107.htm.

[15] For example, see Roth, R.T. (1981) Bernhard, C.A. (1989), Fullerton, R. L. (2003), and Elliot *et al.*(2004).

A simplified answer is "apparently not." These two words summarize a more comprehensive answer that was developed for this dissertation. Research for this dissertation was begun by exploring the information relevant to the dual-employment aspect of the part-time RC pilots. Using that information, a theoretical model was developed to hypothesize how an individual would behave as that individual chooses between RC activation time and civilian employment opportunities. The insights from this model provided the basis for two empirical analyses designed to determine if the increased RC activation demands were negatively impacting the earnings and / or the retention of RC pilots. In both cases, the results pointed to positive impacts being associated with increased activation service.

These findings may be used to inform short-term and long-term RC pilot policy decisions. For example, if the empirical analysis of part-time RC pilots had shown that the pilots serving high activation amounts experienced losses in annual earnings, and that these losses were associated with higher separation rates from the RC, then policy makers might consider expanding the income replacement rules of the 2006 National Defense Authorization Act (NDAA) and provide RC pilots greater compensation in the near term.[16] However, the findings from this dissertation's research suggest that *income gains, not losses,* are typically associated with high activation service, and that additional compensation policies are unnecessary.

Additionally, this dissertation's exploration of civilian pay opportunities revealed that the specific earnings opportunity of a civilian airline pilot, with regard to both annual compensation and future pension benefits, has been decreasing. This suggests that the career-specific pilot incentive pays of Aviation Career Incentive Pay (ACIP) and ACP—pays which were based upon past estimates designed to make military pay more competitive with major airline pay—might be reexamined to see if their current levels of compensation are still appropriate.

This dissertation also found evidence that may be useful for future, force shaping policies. More specifically, the results of this analysis showed that RC pilots have a lower separation rate following periods of high activation. This suggests that it is unnecessary to design additional Air Force personnel policies to "improve" RC pilot retention by reducing the number of high activation episodes experienced by an RC pilot, such as by increasing the size of

[16] Miles, D., "Guard, Reserve benefit from 2006 defense authorization," *Air Force Print News*, Jan 9 2006.

the RC pilot force, increasing the number of AC pilots, or requesting a smaller RC OPSTEMPO tasking.

This dissertation, by observing the activation and separation patterns of RC pilots from 1999 through 2005, as well as their earnings from employment—within the privacy constraints specified by the Social Security Administration—builds upon previous RC and AC research efforts and provides more detailed insight into the relationship of activation, pay, and retention of RC pilots. It also incorporates a Fricker (2002) recommendation that future military retention studies should consider a more detailed analysis of specific career fields as well as consider the possibility of self-selection opportunities affecting retention behavior.

The remainder of this dissertation is organized in the following way:

Chapter II: Data. A description of how the grouped administrative data of RC service was linked with military and civilian earnings is provided as well as an explanation for how an Employer Identification Number (EIN) matching technique identifies the RC members that are receiving pay from a major or national level airline.

Chapter III: The Other Life: Civilian Employment Opportunities. Although much of the pilot retention research has emphasized the importance of the airline industry as the primary alternative for military members with a pilot's skill set,[17] no study has yet analyzed the depth and breadth of the RC force's airline employment and pay using individual level data across multiple years. Using the EIN matching technique described in Chapter II, the airline employment and earnings trends of RC members are uncovered. The results of decreased airline opportunities indicate that the assumption of guaranteed airline employment is no longer valid, especially following the events of September 11th.

Chapter IV: Predicting the Activation Behavior of an RC Pilot. Given the simultaneity of two major factors affecting an individual RC pilot's life—increased activation and deployment rates occurring at the same time as decreased civilian airline opportunities—this chapter presents a model to develop hypotheses about how an individual will behave as the individual chooses between RC activation time and civilian employment opportunities. The

[17] See for example, Levy, C. (1995) or Thie *et al.* (1995).

model demonstrates the importance of the relative wages associated with military and civilian opportunities. It also notes the possibility that individuals may substitute one form of employment for another in order to achieve a desired income level. Both issues are significant when interpreting the empirical analyses of Chapters VI and VII.

Chapter V: Activation Patterns of RC Pilots. Unlike the full-time AC force, service commitments in the RC force range from traditional, part-time service to full-time service. Chapter V is used to develop categories for these OPSTEMPO levels and describes the activation patterns of the RC force. Chapter V also describes RC OPSTEMPO by the three major missions of the RC pilot force—airlift, fighter, and refueler. The mission-specific focus provides a clearer view of various activation factors, such as which mission is more likely to serve in regions classified as areas of imminent danger. The chapter concludes by providing a working definition of what constitutes a high activation episode for a part-time RC pilot. In the spirit of the previously mentioned Congressional directive, this definition is a key variable of interest in Chapters VI and VII.

Chapter VI: The Effect of Activation on RC Pilot Earnings. The analysis within this chapter compares the change in earnings of RC pilots who did not ever experience a high activation episode to RC pilots who went from a year of no high activation to a year that included some amount of high activation. The results show that that high activation service was associated with an increase in the overall earnings of airlift pilots, and a positive, but not statistically significant, change in the earnings of fighter and refueler pilots. These earnings estimates most likely suffer from a downward bias because there was no available measurement for whether the individuals who anticipated a decline in their earnings were more likely to seek out high activation service as "substitute income"—a possibility previously noted in Chapter IV.

Chapter VII: The Effect of Activation on RC Pilot Retention. The analysis within this chapter shows how separation rates vary with RC activation, earnings, and other theory-based covariates. The findings reveal that a lower separation rate was associated with those RC pilots who had experienced high activation episodes in the prior year. These estimates likely suffer from a downward bias, due to the self-selection influence explained in Chapter VI.

Chapter VIII: Conclusions. Key findings and policy implications of this research, as well as directions for future study, are discussed.

In the post-9/11 environment, the stereotype of reservists being “weekend warriors” has given way to a Future Total Force concept that absolutely depends on the RC’s contribution. This dissertation advances the understanding of some of the key relationships within that contribution.

II. Data

To gain an understanding of the relationship between RC activation, annual earnings, and RC separation, a database had to be constructed that included three elements: activation time, military earnings, and civilian earnings. To build this database, information on activation time and military allowances from DoD administrative sources was merged with information on civilian earnings and military pay from the Social Security Administration (SSA). This chapter describes the data sources, how the data was processed, and the resulting sample of RC pilots that was analyzed.

Analyzing administrative data provides a more robust estimate of the earnings changes associated with activation than an estimate that is based upon survey data (e.g., the 2004 SOFR). For example, even though a considerable portion of the military earnings of activated reservists may enjoy tax-free treatment, surveys typically instruct reservists to report pretax earnings, which negates the benefit of tax-free earnings. In contrast, the estimates from the data collected for this dissertation explicitly include an estimate for the value of the tax-free treatment of earnings.

A second concern with survey responses is that they are self-reported and have the potential for significant error and bias. For example, survey questions often refer to the most recent activation. Sometimes, that activation occurred several years earlier, and the respondent's memory might not be as reliable as the person believes. Also, survey and item response rates in the most recent surveys of the SOFR are low, which raises the possibility that a particular group of reservists might be responding to these earnings questions—the group that lost earnings and hopes to benefit by completing a survey. In contrast to survey data, the administrative data used in this dissertation measure earnings with greater historical precision and without a bias towards a particular group of reservists.

Merging DoD and SSA Data

The RC pilot activation data came from the Defense Manpower Data Center's (DMDC) Work Experience File (WEX). The WEX is generated from DMDC's Active Reserve Component Common Personnel Data System File and contains records for each Reserve member serving on or after September 30, 1990.[18] From this file, an RC pilot's years of service, rank, and military occupation could be determined. For the time period of interest for this analysis (1999-2005), the WEX data were available as monthly records.

For this study, the RC pilots of interest are AFR and ANG pilots, serving at some time during the years 1999 – 2005, in the ranks of Captain, Major, and Lieutenant Colonel, with eight or more years of service. This population reflects the RC pilots who may leave the RC when they choose, versus not having the opportunity to leave as a result of an active duty service commitment. The RC pilots being studied served at least 50% of their recorded time in the data as airlift, fighter, or refueling mission pilots. These three mission areas represent approximately 70 percent of all RC flying mission activity. Smaller mission areas, such as special operations or initial flight instructors, were not analyzed. Another population restriction was that the RC pilots could *not* be full-time reservists (e.g., Active Guard Reserve). This created a sample population of approximately 5,500 RC pilots for each year.

The military pay information for the database came from the Reserve and Active-Duty Pay files. It was merged with the annual earnings data from the SSA's Master Earnings File (MEF).[19] To preserve confidentiality, SSA generates statistics on earnings (e.g., mean earnings) only for group "bins" that contain five or more individuals. To accommodate this limitation, I first examined the DMDC data that I possessed and determined the best set of variables that were theoretically relevant to my research as well as reasonable for their distribution across the resulting bins of group characteristics. I then requested that SSA supply earnings data to each group of RC members resulting from a combination of each of the following characteristics:

- *The Number of High Activation Periods that an RC member served in the Current and Previous Year*. Possible values: 0, 1, 2, 3, 4.

- *Whether or not Imminent Danger Pay was Received in the Previous Year*. Possible values: Zero for "no," one for "yes."

- *Mission ID*. Possible values: Airlift, Fighter, or Refueling mission.

- *Years of Service.* Possible values: low (8-14), medium (15-19), high (20+).

[18] The file contains transaction records back through 1975 for each service member present.

[19] The merging of the WEX and ADPF and RPF files occurred at RAND using pseudo-Social Security Numbers. My extract of the WEX did not contain SSN, name, or birthdate. DMDC added this identifying information and forwarded the resulting database directly to SSA, where the merging of SSA earnings data occurred using SSN, name, gender, and birth date.

- *Whether or not the RC member Joined after September 11th.* Possible values: Zero for "no," one for "yes."

The basic unit of analysis is an annual observation of the earnings of on each reservist between 2000 and 2004, and an annual observation of the service of each reservist between 2000 and 2005. The output received from SSA contained the mean earnings among all possible combinations of groups as listed above. To preserve the confidentiality of SSA earnings data, any group with too few members in it—five or less—was not reported.

Four Types of Earnings

The earnings concept of interest is the annual, after-tax equivalent, cash earnings of RC members from their military and civilian employment sources. This concept of interest had four components:

Civilian Earnings: Civilian earnings include all nonmilitary earnings subject to Medicare taxes. SSA uses earnings data recorded in the MEF to compute Social Security benefits and to compute Social Security and Medicare taxes.[20] Almost all U.S. employment and earnings are subject to Medicare taxes.[21] SSA earnings records have been used in many empirical studies, including several studies related to the military (for example, Angrist, 1990, 1998; and Angrist and Krueger, 1994). The specific measure of earnings from the MEF is its Medicare earnings measure.

Military Pay: Military pay includes all military pays (e.g., Basic Pay [BP], Imminent Danger Pay [IDP]) and bonuses. Only basic pay is reported to SSA and included in the earnings measure obtained from the MEF. The value of other pays was computed from DMDC's Reserve Pay File. Loughran *et al.* (2006) provides an overview of the military pays used in this analysis as well as any recent changes in those pays.

Military Allowances: Military allowances include all military allowances (e.g., Basic Allowance for Subsistence [BAS], Basic Allowance for Housing [BAH], Family Separation Allowance [FSA]). Allowances are computed from DMDC's Reserve Pay File.

[20] Social Security benefits include old-age, survivors, and disability insurance (OASDI) and supplemental security income (SSI).
[21] See http://www.ssa.gov/OP_Home/cfr20/404/404–0000.htm for a list of employment categories that are exempt from Medicare taxes. Unlike Social Security earnings, Medicare earnings are not capped at the Social Security taxable limit.

Tax Advantage: Military allowances and all military pays received while serving in a combat zone are not subject to federal income taxes. To allow for a consistent comparison of earnings when activated and not activated, tax tables were used to impute taxable-equivalent earnings.[22] The tax imputations assume that the reservist files as single with no dependents and account for all federal income taxes and Social Security taxes.[23] The tax advantage imputations did not account for state taxes. Military allowances and the value of pay subject to the Combat Zone Tax Exclusion (CZTE) were reported in the Reserve Pay File and in the Active-Duty Pay File.

Total earnings were computed by summing civilian earnings, military earnings, and the tax advantages associated with the applicable military compensation. All dollar values were converted to their value in the year 2004 using the Consumer Price Index (CPI-U).

Integrating Airline Employment

One other variable added to the database was a variable that indicated whether or not an RC member had worked for a major or national level airline during that year. The Social Security Administration has an Employer Identification Number (EIN) variable that made it possible to uncover an individual's employers. Therefore, to find out if an RC pilot worked for a business that would have a high likelihood of employing civilian pilots—such as United Parcel Service (UPS)--during one of the calendar years 2000-2004, I began by uncovering the EINs of various airlines.

By paying for a subscription to FreeErisa.com, I uncovered the EIN numbers of the major, national, and other airlines (please see Appendix A for a list of the major, national, and regional airline employers). For example, table 2-1 displays a partial list of the EINs that appeared in the output for "United Parcel Service":

[22] Technical details of the approach to imputing the tax advantage and taxable-equivalent earnings can be found in Klerman *et al.* (2005).

[23] The bias resulting from assuming that reservists file as single with no dependents is likely to be, on average, small. Assuming that reservists are unmarried means that spousal earnings do not affect the reservists' marginal tax bracket, which, all else equal, lowers the estimated taxes. At the same time, the assumption that reservists have no dependents reduces the number of exemptions that the reservist can declare, which would raise the estimated taxes.

EIN#		Company	Phone
13-1686691	**78.57%**	**UNITED PARCEL SERVICE COMPANY**	(502)329-6626
	14.29%	UNITED PARCEL SERVICE INC	
	7.14%	UNITED PARCEL SERVICEINC	
		1400 N HURSTBOURNE PKWY LOUISVILLE, KY 40223-4017	NAICS: 481000
58-2046334		**UNITED PARCEL SERVICE HEALTH & WELFARE PLAN TR**	
		55 GLENLAKE PKWY NE BARONE B D LADYEN J MODEROW TTEE ATLANTA, GA 30328-3498	
36-2407381		**UNITED PARCEL SERVICE INC**	
		55 GLENLAKE PKWY NE ATLANTA, GA 30328-3498	
95-1732075	**98.46%**	**UNITED PARCEL SERVICE OF AMERICA INC**	(706)828-7678
	1.54%	UNIED PARCEL SERVICE OF AMERICA INC	
		55 GLENLAKE PKWY NE ATLANTA, GA 30328-3498	NAICS: 484200

Figure 2-1: Partial Listing of EINs for United Parcel Service

UPS has numerous business units, each with their own unique EINs. This made determining the ones that would most likely employ pilots, versus truck drivers, a more difficult task. Although some of the unit names (e.g., "Health & Welfare Plan") allow for a prima facie elimination of the unit from being a likely airline business unit, some ambiguity remains with titles such as "United Parcel Service Inc."

Fortunately, there was one other piece of information that revealed which business units would be the most likely to employ airline pilots—the coding of the North American Industry Classification System (NAICS). NAICS was developed jointly by the U.S., Canada, and Mexico to provide new comparability in statistics about business activity across North America.[24]

Within the NAICS coding system, the first two digits of "48" are the designators for the broad categories "Transportation and Warehousing." More specific expansions of the two digit codes include:

[24] http://www.census.gov/epcd/www/naics.html.

(481 000)	**Air Transportation**
(482 110)	Rail Transportation
(483 000)	Water Transportation
(484 110)	General Freight Trucking, Local
(484 120)	General Freight Trucking, Long-distance
(484 200)	**Specialized Freight Trucking**

In the case of UPS, this resulted in me using the Louisville EIN with a NAICS of 481000, and not the Atlanta EIN with a NAICS of 484200.

Occasionally, there would be numerous 481000 codings for various business units. Consider the example of Omni Airlines, which is displayed in Figure 2-2:

EIN#	Company	Phone
73-1207159	**OMNI AIR INTERNATIONAL INC** 3303 N SHERIDAN RD TULSA, OK 74115-2219	(918)831-3068 NAICS: 481000
20-0605928	**OMNI AIR INTERNATIONAL INC** PO BOX 582527 TULSA, OK 74158-2527	(918)836-5393 NAICS: 481000
73-1207159	**OMNI AIR INTERNATIONAL INC** 3303 N SHERIDAN RD TULSA, OK 74115-2219	(918)831-3068 NAICS: 481000
22-3597802	**OMNI-SERV LLC** 614 FRELINGHUYSEN AVE NEWARK, NJ 07114-1356	(973)242-4431 NAICS: 481000
52-1270655	**OMNIFLIGHT INC** 4650 AIRPORT PKWY ADDISON, TX 75001-5306	(972)776-0130 NAICS: 481000

Figure 2-2: Listing of EINs for Omni Airlines

For cases such as Omni, I performed an internet search and used two sources to validate my determination of whether or not a business unit title was associated with an airline or not. The first three business units turned out to be potential pilot employers, but the fourth and fifth titles did not make it into my selection of EINs because an investigation of their titles revealed that they were a technology-based firm and a hospital helicopter med-evac unit.

Thus, my selection for EINs that would permit me to say “this RC pilot worked for a business that would have a high likelihood of employing civilian pilots” was based upon the following three criteria:

1) Having a NAICS of 481000

2) Being identified as a Major or National airline by the Bureau of Transportation Statistics

3) A subjective look at the title of the business, with verifications by an internet search if the title looked suspicious.

The final list of EINs is listed in Appendix B. Only major and national level carrier EINs were submitted to the Social Security Administration. Compared to the 2000 SOFR, which reported that 75 percent of Air Force RC pilots were "a pilot or navigator" in their civilian job,[25] my year 2000 EIN-matching technique observed that 70 percent of the Air Force's RC pilots were receiving pay from either a major or a national level airline. Given the possibility of RC members working for a charter plane service, or other non-top tier airlines, the similarity between the EIN-matching approach and the 2000 SOFR survey results adds further credibility to the EIN-matching technique.

Sample Selection

My initial sample for my first analysis contained 20,000+ observations, and my second analysis began with 30,000+ observations on reservists who, according to the WEX, were members of the Air Force's RC at any time during the period January 1999 to December 2005 (the last month of available WEX data). An average of 20 percent of the observations for any given year was dropped because there was no corresponding SSA earnings record during that year. The number of dropped records seemed large given that everyone in the reserves should get reserve pay and that pay should be reported to the SSA as earnings. It is possible that the dropped records resulted from a failure to pass validation with SSA. More specifically, if the name, gender, or date of birth information in SSA's records did not match the information provided, then SSA would not return earnings information for that individual.

Lastly, as the SSA only returns earnings averages for a grouping when that bin of characteristics contains 5 or more members, there was an additional loss of yearly observations, ranging from 4 to 10 percent of the original population.

[25] Author's computation using 2000 SOFR and unique, pilot identifier within the data.

Table 2-3 displays the matching rates of the RC members with SSA data. Overall, approximately 73 percent of the original population was usable for each empirical analysis employed.

Analysis 1: DiD Sample (Chapter VI)					
Year	DMDC Individuals	SSA Matched	Usable Pilots from Bins of 5+	SSA Match Rate	Bin Usable Rate
2000	5211	4274	4082	0.82	0.78
2001	5559	4616	4362	0.83	0.78
2002	4969	4104	3645	0.83	0.73
2003	3976	3171	2646	0.80	0.67
2004	2778	2090	1774	0.75	0.64
Total	22493	18255	16509	0.81	**0.73**

Analysis 2: Separation Sample (Chapter VII)					
Year	DMDC Individuals	SSA Matched	Usable Pilots from Bins of 5+	SSA Match Rate	Bin Usable Rate
2000	6034	4985	4734	0.83	0.78
2001	6020	5012	4721	0.83	0.78
2002	5827	4855	4529	0.83	0.78
2003	5554	4560	4007	0.82	0.72
2004	5041	4043	3470	0.80	0.69
2005	4719	3261	2805	0.69	0.59
Total	33195	26716	24266	0.80	**0.73**

Table 2-3: RC Pilot Sample Selected for Analysis as a result of SSA processing

III. The Other Life: Civilian Employment Opportunities

For most RC pilots, the pecuniary considerations of serving in the Air Force occur in conjunction with employment in the civilian workforce. It is commonly assumed that the Air Force's traditional, part-time RC pilots work as pilots in their civilian job. For example, Herbert (2003) reported that, while serving as Assistant Secretary of the Air Force for Manpower and Reserve Affairs, Michael Dominguez explained how an Air National Guard pilot flying a combat air patrol (CAP) over a city could take two days off from piloting duties at an airline, fly the CAP mission, and then "go back to the airline job." Darby and Dean (2001) note that, depending upon flight schedules and seniority, with total number days an airline pilot flies ranges from 10-20 days. Given that work schedule, an individual may contribute to the RC pilot force, but that contribution is balanced against civilian opportunities and enjoying personal leisure time.

This chapter explores the civilian employment opportunities of RC pilots. It describes the airline employment trends since September 11th, and uses Employer Identification Number (EIN) matching to uncover the pervasiveness of civilian airline employment.

The Changing Domestic Airline Pilot Opportunities

There is a considerable range of pay within the piloting profession. For example, according to an Occupational Employment Statistics report (OES 2000) by the Bureau of Labor Statistics, the median income of a pilot who worked as an airline pilot in 2000 was $111,000. Working at a major airline—an airline that earns $1 billion in revenues annually—such as Northwest Airlines could be even more lucrative. Even prior to the 2000 BLS survey earnings, an article by Mills (1998) stated that estimates by Northwest's management place the average salary of a pilot at $133,000. Northwest's pilots stated that it was closer to $120,000. By any of the previous estimates, the civilian airline pilot career offers attractive pay. In contrast, the OES report noted that civilian commercial pilots, whose duties might include dusting crops, tracking criminals, or evacuating injured personnel, had a median income of $43,000 for the year 2000.

Although there is a range of potential opportunities within the piloting profession, military pilots are very competitive for employment with major airlines such as American Airlines or United Parcel Service. As Dean and Darby (2001) reported, a military pilot with thousands of hours of flying experience, as well as high quality, standardized training with some of the world's most technologically advanced flying equipment makes for a desirable airline job candidate. In fact, it is possible to have a strong overlap between military flying skill sets and civilian airline pilot skill sets. For example, pilots who chose to fly the Air Force's KC-135 refueler are flying the Boeing airframe model 367-80, whose basic design has been used for the commercial aircraft Boeing 707.[26]

Of course, using major airline earnings estimates as a standard for RC employment opportunities assumes that there is available employment. Just as the RC's deployment pace and operational tempo changed with the events of September 11th, so too did the airline industry change. Even before September 11th, ever since deregulation in 1978 the major airlines (e.g., United, Northwest) have operated in an increasingly competitive environment. The older airlines now have higher operating costs because they have to pay higher salaries to their veteran employees. Also, as Chadwick (2005) noted, the older airlines also have more retirees—who receive pension payments—compared to the younger competitors such as Southwest or JetBlue.

However, following the events of September 11th, the whole airline industry that lost its lift. As the Bureau of Transportation Statistics (2001) noted, in 2001, for the first time in a decade, fewer airline passengers traveled on US airlines than they did the year previously. Also, as the Bureau of Labor Statistics (2005) noted, "After September 11, 2001, air travel was severely depressed. A number of the major airlines were forced to reduce schedules, lay off pilots, and even declare bankruptcy."

In an industry where eight major airlines had filed for bankruptcy since 1980—of which, according to Walsh (2005), Pan Am, TWA, Braniff, and Eastern airlines were either sold or liquidated and no longer exist—the decrease in airline passengers further choked the industry. Said US Airways spokesman Rick Weintraub when announcing the layoff of 1,100 pilots at the end of September of 2001, "This is part of the sequence of events forced on us by the attacks in New York, and the response of the traveling public to those events."[27] US Airways has laid off approximately 1,800 of the 6,000 pilots it had before the September 11th terrorist attacks. "They are cutting pilots to the point where it reaches people who have been here 15 years," said Roy Freundlich, a spokesman for the Air Line Pilots Association.[28]

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[26] http://www.af.mil/factsheets/factsheet.asp?id=110.
[27] AP, "Airline-Union announce pilot layoffs," September 21 2001.
[28] AP, "US Airways plans to lay off 471 more pilots to return bankrupt airline to profitability," Oct 26 05.

As the airlines staggered, so too did the previous security of their pilots' incomes, both in present earnings and future retirement plans. Northwest and Delta airlines provide recent examples of the major airlines' troubles. Both Delta and Northwest filed for Section 11 bankruptcy status on September 14, 2005. Schlangenstien (2005) and Jacobius (2005) both noted that, along with United and US Air, Delta and Northwest—all of which were in bankruptcy status in 2005--represented 50 percent of US airline capacity. In 2005, Northwest pilots made between $60,000 and $160,000 per year, according to their union. According to Freed (2005), all of Northwest's pilots who had joined within the last year were eventually laid off.

In addition to the layoff from work for recent hires, pilot salaries for those still employed have also been reduced. Delta's pilots earn an average of $169,393, according to the company's bankruptcy court filing. Weber (2005) reported that, just one year prior, Delta's pilots had accepted a five-year deal that included a 32.5 percent pay cut. In 2005, those same pilots, whose salaries still ranked among the highest in the nation, accepted an additional 14 percent pay cut. Ultimately, according to CNN (2005), Delta's 3,001 pilots voted to cut their average salary from approximately $170,000 to $146,000.

Not only has yearly income become less secure than before, so too have the substantial pensions that airline pilots could once assume were secure. The Pension Benefit Guaranty Corporation (PBGC) is a federal government agency that insures pensions. When a company becomes bankrupt, and the PBGC takes over the pension plan, PBGC guarantees only a minimum pension amount. The PBGC handles the pensions of bankrupt airlines United (United alone is a $7 billion plan),[29] Delta, Northwest, and US Air. PBGC caps pensions at $45,613 for pensions plans cancelled in 2005. According to Karnowski (2005), for a major airline pilot, such as a Northwest pilot, this pension cap could lead to a loss of half or more of an expected pension.

Another indicator of the business health of the airlines is the industry's hiring rates and furlough levels. These rates are significant because of the strict seniority system that accompanies airlines. As Darby and Dean (2001) reported, one hundred percent of the 14 major airlines' 63,000 pilots are unionized, and the unions strongly enforce a seniority system—regardless of previous experience, if a pilot joins a new airline, then that pilot starts at the bottom of the seniority list and pay scales. Quitting one airline to join another is not a very likely option,

[29] United has since emerged from bankruptcy in February 2006.

but may occur under certain circumstances, such as leaving behind a regional airline in pursuit of the higher paying major airlines. Seniority also affects how a pilot advances through an airline's piloting ranks. Job performance alone is not enough to achieve promotion. The first consideration for any promotion will be the seniority associated with the pilot's initial date of hire.

Seniority's influence also extends to the laying off of employees. According to Darby and Dean's 2001 AIR Inc. report:

> The average furlough period is from 1-3 years ranging from as short as one month to as long as 10 years or more. When a furlough occurs, pilots are laid off in reverse seniority order, beginning at the bottom of the pilot seniority list. When recalls begin, pilots usually return to work in seniority order. Furloughed pilots at unionized carriers (which the major airlines are) have recall rights—the company must recall any pilots off furlough before hiring new pilots. Most pilot contracts stipulate "recall rights"—the maximum number of years a pilot can be on furlough before the company can remove him from the seniority list. Retention ranges from five years to an unlimited number of years, depending upon the airline….during the furlough period, few if any benefits remain in effect.

Figure 3-1 displays what full-time RC pilots,[30] or traditional RC pilots, would surmise if they were looking to join a new airline. Prior to September 11th, the major airlines, where salaries could reach $100,000 per year by the fifth year of service, were hiring hundreds of new pilots each month.[31] After September 11th, the average number of new hires per month, for the years 2002 and 2003, was under 45.[32] The next tier of piloting opportunities is the national airline level. These carriers generate between $100 million and $1 billion in annual revenues. While it may take more than 10 years before achieving a $100,000 annual salary at a national level carrier, they have offered employment opportunities to hundreds of pilots every month. However, after September 11th, they too were affected and their hiring rates dropped by an average of 200 new hires per month.

Figure 3-2 provides a complement to the airline hiring rates by illustrating the number of pilots on furlough status before and after September 11th. Within months after September 11th, thousands of pilots were furloughed.

[30] Full-time RC pilots could either be Active Guard Reserve (AGR) positions for Air National Guard, Air Reserve Technicians (ART) for the Air Force Reserve Command, or Individual Mobilization Augmentees (IMAs) in either.
[31] Author's compilation of AIR, Inc. data, www.jet-jobs.com.
[32] *Ibid.*

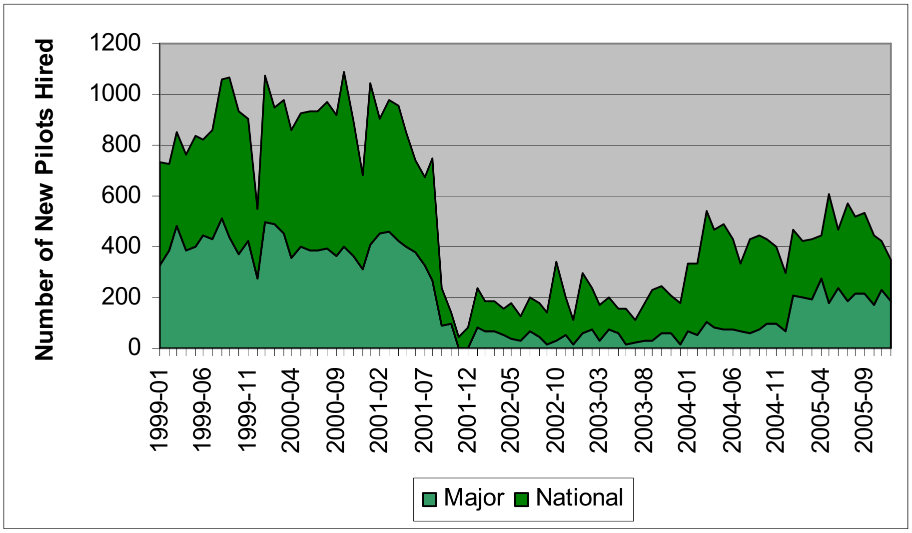

Figure 3-1: Monthly Airline Hiring Rates by Major and National Airlines, 1999-2005

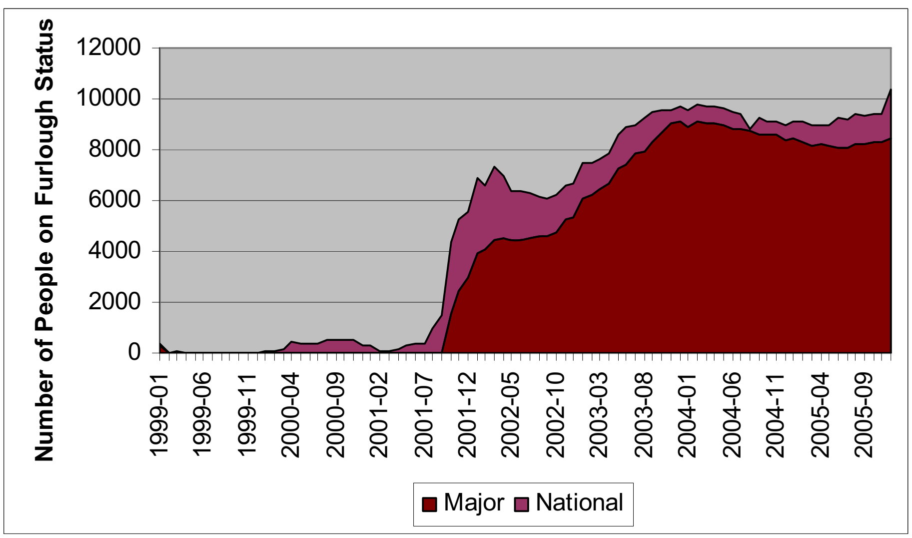

Figure 3-2: Monthly Airline Furlough Levels by Major and National Airlines, 1999-2005

Insights from EIN-Matching

The general trends of decreased airline opportunities were also applicable to RC pilots. Using the EIN-matching procedure (described in Chapter II), I uncovered the annual percent of the RC pilot population that was employed by a major or a national level airline. Figure 3-3 displays the results:

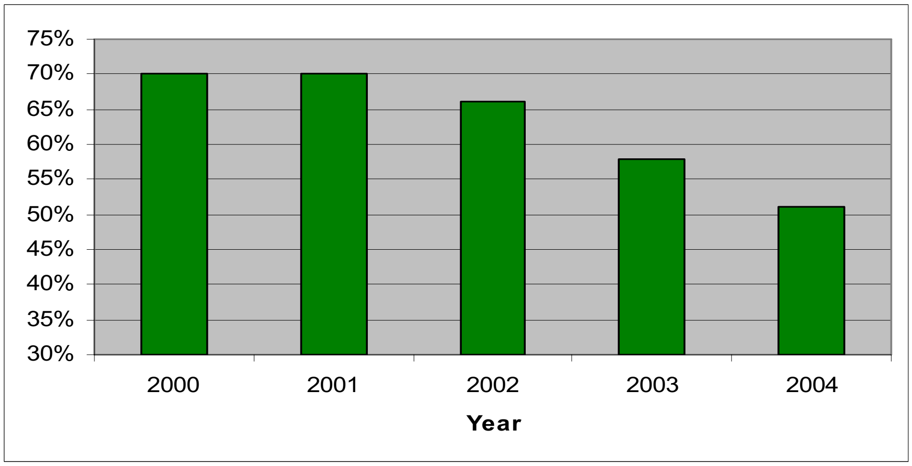

Figure 3-3: Yearly Employment Percent of RC Pilots by Major and National level Airlines

Figure 3-3 shows that in the year 2000, 70 percent of RC pilots were receiving paychecks from either a major or national level airline. This 70 percent from the EIN-matching closely resembles the employment estimates I calculated from the 2000 SOFR. By analyzing the subset of respondents who were Air Force RC pilots (a unique pilot identifier was available), I discovered that 75 percent of RC pilots were pilots or navigators in their civilian jobs. Additional summary statistics from my DoD/SSA database showed that the percentage of RC pilots who worked for major airlines in their civilian job was is very similar across the three major mission areas—airlift, fighter, refueling—within two to five percent of one another for any given year. Figure 3-3 also shows that the percent of RC pilots employed by civilian airlines gradually dropped to 50 percent by the year 2004, coinciding with the general trend of decreased opportunities within the top two airline tiers.

Although the EIN-matching allows us to know if an individual worked for a major airline, we still do not know if the RC pilot was working as an airline pilot or in some other capacity for the airline, such as an air traffic controller. However, given the high pay available to someone with a pilot's skill set, it seems rather unlikely that an RC member would work as a flight attendant or some other non-pilot job.

RC members that work for a major or national airline earn more than non-airline employed RC peers. As a crude attempt to control for some of the earnings issues associated with seniority issues, Figure 3-4 reports the RC averages of airline employees and non-airline employees based upon the three different "years of service" groups:

- those with less than 14 years of military service (approximately age 36 and younger)

- those with 14-19 years of military service (approximately 37 - 42 years old)

- those with 20 or more years of military service (approximately 43 years old or older)

Figure 3-4 also shows the Bureau of Labor Statistics reported averages for airline pilots according to its Occupational Employment Statistics Survey, occupational code 53-2011, "Airline Pilots, Copilots, and Flight Engineers."

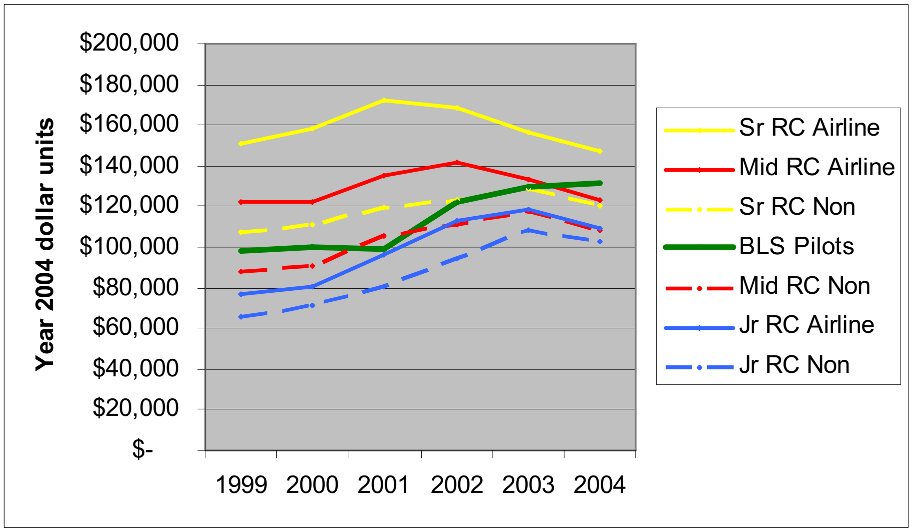

Figure 3-4: Annual Earnings of RC Pilots, by Airline Employment and Years of Service

Figure 3-4 shows that the top two annual average earnings were made by RC pilots, who had 14 or more years of service, and were employed by airlines. Both show a trend of downward earnings in 2003 and 2004. The older RC members who did not have a job working for an airline made the third largest annual earnings. Junior RC members receiving pay from an airline caught up to the mid-level RC members who were not pilots by 2004. Junior RC members who were not receiving pay from an airline received the lowest pay.

These earnings based upon EIN-matching paint a distinctly different picture of airline trends than the BLS average. The BLS average shows a continuous, albeit gradual, rise in pay. The rise of the BLS average is probably due to a "survivor bias"—as the airlines laid off their junior workers, the average salary would be composed of the remaining pilots, who would be earning more. As the EIN-matching has revealed, assuming that earnings always increase, or that airline employment is always assured, is no longer an accurate assumption for RC pilots.

Figure 3-4 also displays that RC pilots who receive pay from a major or national airline have been earning over $100,000 a year since 2001. It is possible that a deployment, or a high activation period, would take RC members away from their high paying civilian jobs and cause the RC pilot an overall earnings loss for the year. Hints of the possibility of deployments resulting in lower income for pilots were found in the May 2004 SOFR. It reported that all Air Force RC officers—which included the RC pilots—averaged losses of $1300 in "total monthly income during activation."

Taken together, the evidence in this chapter shows that a large fraction of RC pilots were civilian pilots during this period and they experienced a decrease in civilian employment and pay opportunities following September 11th. The significance of this trend plays an important role in understanding the results of the forthcoming empirical analyses.

IV. Predicting the Activation Behavior of an RC Pilot

Given the simultaneity of two major factors affecting an individual RC pilot's life—increased activation and deployment rates occurring at the same time as decreased civilian airline opportunities—this chapter presents a model to develop hypotheses about how an individual will behave as the individual chooses between RC activation time and civilian employment opportunities.

For simplicity, assume that an individual gains satisfaction in life from consuming goods and services. These goods and services are paid for by the wages earned by working as a civilian employee or as an RC pilot, or both. Assume further that working in either firm offers some satisfaction from job factors such as pay, patriotism, or the flexibility of work schedules and leisure time.

Assume also that individuals are constrained to purchase goods and services based only on the wages that they earn during that same period. Finally, assume that an individual's time is divided between being a military member, a civilian, or some mix of both.

A formal model that captures these criteria would have the following variables:

U: Utility—the satisfaction that an individual gains from a mix of choices

G: Goods and services consumed—combined together into one representative good, G

p_G: The price of good G

A: Time as an Air Force RC pilot

w_A: Wage associated with time serving as an Air Force RC pilot

C: Time as a Civilian

w_C: Wage associated with time as a Civilian employee

T: Total time available

Formal equations of the variables to represent the behavior of an individual are as follows:

$$\text{Max } U(G, A, C) \tag{1}$$

$$\text{s.t.} \quad A + C = T \tag{2}$$

$$w_A A + w_C C = p_G G \tag{3}$$

Equation (1) states that a rational individual's utility is maximized based upon the individual's choice of goods and services purchased, time served as an activated Air Force RC pilot, and time devoted as a civilian employee.

Equations (2) and (3) state the constraints that bind the maximum value of this utility. Equation (2) notes that an individual's time is completely encompassed by living the lifestyle of an RC pilot or a civilian employee, or some mix of both. Equation (3) shows that the total amount of earnings from Air Force and civilian employment will equal the total cost associated with purchasing goods.

Equation (2) can be rearranged to show the relationship of time spent as a civilian employee, C, to the total time available, T, and time served as an Air Force RC pilot, A:

$$C = T - A \tag{4}$$

Equation (4)'s expression for C may then be substituted into equation 3, resulting in a single constraint:

$$w_A A + w_C(T-A) = p_G G \tag{5}$$

A rational individual will seek to maximize personal utility by choosing some combination of factors that the individual controls—in this case, goods purchased and time in the Air Force RC. To maximize an individual's utility, the utility may first be expressed as a single equation with a Lagrangian multiplier, in this case lambda (λ), used to incorporate the constraint of equation (5):

$$Max\ L = U(G, A) + \lambda(w_A A + w_C(T - A) - p_G G) \tag{6}$$

$$= U(G, A) + \lambda(w_A A + w_C T - w_C A - p_G G) \tag{7}$$

To uncover the optimal values of G and A, solve for the derivative of equation (7), with respect to both choices G and A, when the value of equation (7) equals zero:

$$\frac{\partial L}{\partial G} = \frac{\partial (U(G,A) + \lambda (w_A A + w_C T - w_C A - p_G G))}{\partial G} = U_G - \lambda p_G = 0 \qquad (8)$$

$$\frac{\partial L}{\partial A} = \frac{\partial (U(G,A) + \lambda (w_A A + w_C T - w_C A - p_G G))}{\partial A} = U_A + \lambda w_A - \lambda w_C = 0 \qquad (9)$$

The relationship between choices of G and A can be obtained by solving for the common lambda in each expression:

$$\lambda = \frac{U_G}{p_G} = \frac{U_A}{w_C - w_A} \qquad (10)$$

Rearranging the two expressions of equation (10):

$$\frac{w_C - w_A}{p_G} = \frac{U_A}{U_G} \qquad (11)$$

Equation (11) shows how, in making choices, the pilot should choose levels of A and G so that the individual's internal rate of exchange between choices, as measured by the ratio of marginal utilities U_A and U_G, is equal to the ratio of prices associated with these choices. Simplifying equation (11) further by normalizing all prices in terms of p_G and thereby setting the value of the price of the composite good to one yields:

$$w_C - w_A = \frac{U_A}{U_G} \qquad (12)$$

The right hand side of equation (12) is the ratio of marginal utility from Air Force RC pilot service to the marginal utility of goods purchased. Marginal utility can be thought of as the change in utility given an additional unit of a choice variable. In the case of the marginal utility of goods, U_G, additional goods are generally assumed to be positive. Therefore, the denominator U_G is assumed to have a positive value. Figure 4-1 visually presents a possible valuation of the marginal utility of Air Force RC pilot service, U_A, to an individual.

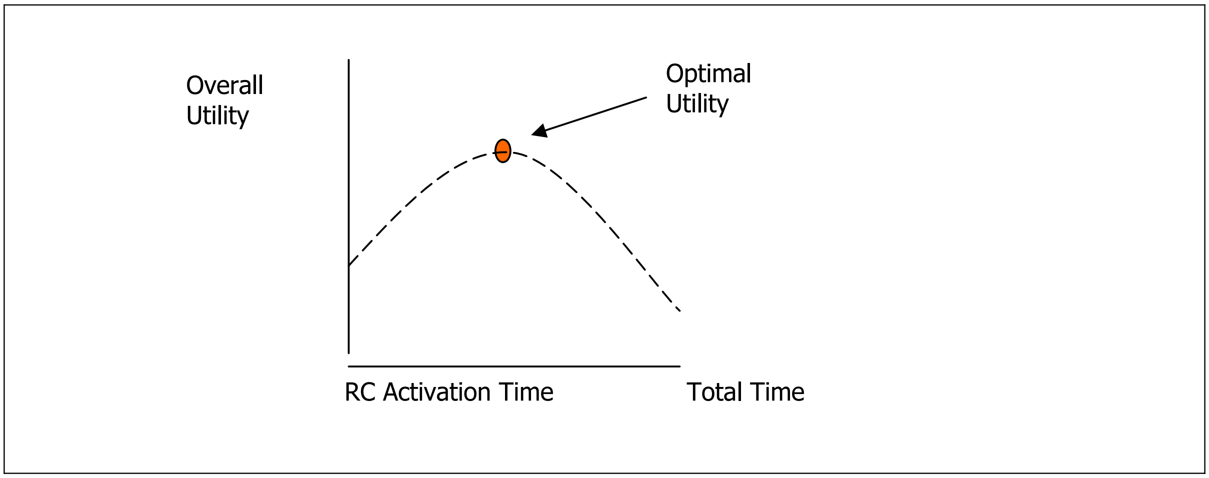

Figure 4-1: Marginal Utility Associated with Additional RC Activation

In this valuation, marginal utility from serving in the Air Force RC at first increases, and then decreases. Given that the RC force is voluntary, it is reasonable to assume that some amount of RC service produces positive marginal utility, and increases a members overall life utility. A member might receive positive utility from the pride of serving the people of the United States, as the November 2004 SOFR suggested. In that case, the right hand side of equation (12) would be positive. This would imply that the left hand side of equation (12) should also be positive. This is significant from a policymaker's perspective because it means that the wage associated with a civilian lifestyle could be greater than the wage of RC Air Force service and that individuals would still want to keep some amount of RC service in their optimal mix of choices.

However, there could also be a point where additional RC pilot service creates dissatisfaction and lowers a person's utility. Hosek and Totten's research (2002) that found that active duty component (AC) members who had three or more deployments were associated with higher exit rates from the military than AC members who had two deployments. These results suggest that too much additional activation time in the RC could lead to a lower overall utility. If the decrease in overall utility from negative U_A leads to a lower overall utility than if a member had no RC service time, then a rational individual would leave the RC and enjoy a life of higher utility without RC time.

Thus, a negative numerator on the right hand side of equation (12), and therefore an overall negative right hand side of the equation, is possible. The left hand side of the equation reveals how to compensate an RC member when they have a negative marginal utility, $U_A<0$, from additional activation—raise the wage associated with RC time to be greater than the wage associated with civilian time. When w_A is greater than w_C, a negative left hand side of equation (12) results. Although the actual magnitude of wage differentials cannot be determined from this model, the main outcome of this possibility is to note that if too much activation occurs for an RC member, the negative marginal utility from activation ($U_A<0$) can be sustained in equilibrium provided that the reserve wage is greater than the civilian wage. Policy makers can lever this earnings factor.

The final possible value of U_A would be zero. At such a value, the marginal utility associated with RC service is neither positive nor negative, and the individual has attained the highest possible overall utility. This possibility occurs when the individual perceives that the overall wages associated with Air Force RC service equals the available civilian wage. Although optimal amount of RC time and the heights of overall utility will vary by individual, if the RC allowed each member to serve exactly the amount of RC time that was desired, individuals would choose an amount of RC service that was associated with the highest possible utility. This opportunity to "self-select" an optimal amount of RC service time may have a considerable impact on empirical analyses, as will be discussed in Chapters 6 and 7.

To further develop an intuition about how the wages associated with civilian work and RC service affect an individual's desire for RC service, two different effects from microeconomic theory—an income effect and a substitution effect—should be referenced.[33] For example, an increase in civilian wages may lower an individual's desire to serve in the Air Force RC. Individuals "substitute" more civilian work in place of some Air Force work in order to increase their earnings within a certain period of time. As a result, the desire for more RC service would decrease.

It is also possible that increases in the civilian wage would lead to an increase in an individual's desire for time served in the Air Force. This scenario is possible because the extra earnings from civilian work leads to an "income effect" that allows an individual to work less as a civilian and still achieve the individual's same level of earnings. With a lesser need to work as

[33] Numerous elaborations of these effects may be found in economics texts. See, for example, Nicholson (1998).

a civilian, an individual may then choose to spend more time in the military. One example of this scenario would be an RC fighter pilot who earns a raise in his civilian job, and can therefore afford to work less as a civilian and spend more time flying fighter missions for the RC—an activity that can only be performed in the RC, and an activity that the pilot would like to spend more time doing.

One heroic example of a high-income individual choosing to serve in the military at great monetary cost is Pat Tillman. Following the attacks of September 11th, Tillman turned down the chance to continue to play for the National Football League's Arizona Cardinals—a three-year, $3.6 million contract—to enlist as an Army Ranger in May 2002.

As Tillman told NBC News, "My great grandfather was at Pearl Harbor, and a lot of my family has ... gone and fought in wars, and I really haven't done a damn thing as far as laying myself on the line like that." [34]

Tillman died in Afghanistan in 2004 during a night-time firefight with opposition forces.

Although this dissertation will not investigate all of the elements—such as patriotism—that go into an RC pilot's utility function, it will be able to empirically investigate the relationship between pay, high activation, and separation rates.

[34] http://www.msnbc.msn.com/id/4815441, "Ex-NFL star Tillman makes 'ultimate sacrifice.'"

V. Activation Patterns of RC Pilots

Unlike the full-time AC force, service commitments in the RC force range from traditional, part-time service to full-time service. This chapter begins by reviewing the average activation trends of the Air Force's RC pilots. It then develops categories for the various OPSTEMPO levels of the force and describes the activation patterns of the three major flying missions of RC force—airlift, fighter, and refueling—within these levels. The mission-specific focus provides a clearer view of various activation factors. For example, airlift pilots have a higher likelihood of serving in regions classified as imminent danger areas. These areas involve more hazardous duties, but also include grater military compensation. The insights gained from these descriptive findings were beneficial when interpreting the results of the empirical analyses of the next two chapters.

Lastly, this chapter shows how a working definition of what constitutes "high activation" was developed. This research definition of the high activation concept would be a prominent factor in the upcoming empirical analyses.

The Average Activation of RC Pilots

In making their contribution to the FTF and AEF structures, the RC pilots have seen a significant change in the number of days served and days deployed since September 11th, 2001. According to a GAO report (2005), by performing missions such as airlift, aerial refueling, and an unanticipated homeland mission of increased combat air patrols (CAPs) over U.S. cities, the RC pilots have seen an increase in the number of duty days activated in a year. Figure 5-1 displays the average number of days activated per month for traditional RC pilots from January, 1999, through December, 2005.

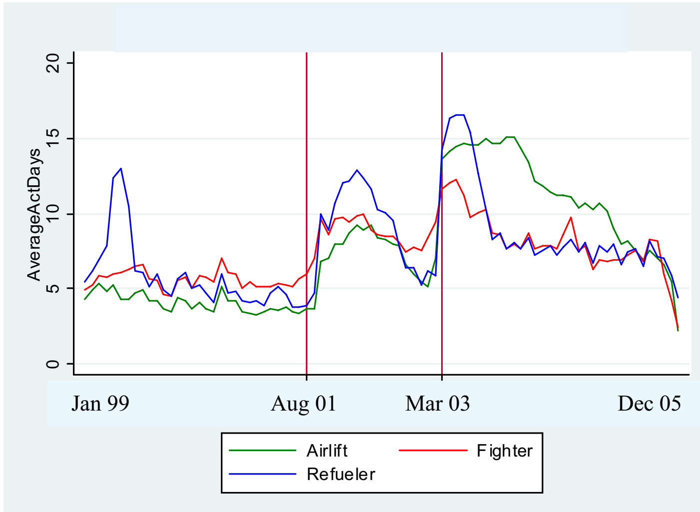

Figure 5-1: Average Days Activated Per Part-time RC Pilot

The three broad operations analyzed in Figure 5-1 are airlift, refueling, and fighter missions. They represent approximately 70 percent of the mission activity during the 1999-2005 time periods. Figure 5-1 uses the calendar time of months as its x-axis, with January 1999 as its first month. The y-axis displays the average number of days that an RC pilot was activated. The number of days activated in a month was imputed from the DMDC pay files.

With the exception of a brief period of higher activation for refuelers coinciding with the dates of Operation ALLIED FORCE, the average number of activated days per month prior to September 2001 was approximately five days. From September 2001 until the end of 2003, the average number of days activated increased, doubling following the events of September 11th and nearly tripling for airlifters and refuelers in support of Operation IRAQI FREEDOM, which began in March 2003. By December, 2005, the average activation levels for part-time RC pilots had returned to pre-September 11th levels.

Of course, an average activation pattern from aggregated data does not necessarily reflect an individual RC pilot's activation experience. An increase in the average number of days can result from every RC pilot having a few more days of deployment, relatively few RC pilots serving longer activations, or some mix of the two extremes.

Additionally, all activation is not equal in its level of risk. As an approximate measure for the number of RC pilots deploying to hostile regions, Figure 5-2 shows the number of imminent danger pay (IDP, previously hostile fire pay (HFP)) payments made to the RC pilot force during the months January 1999 through December 2005.[35] Figure 5-3 displays the percent of each of the three major flying mission groups of RC pilots receiving IDP.

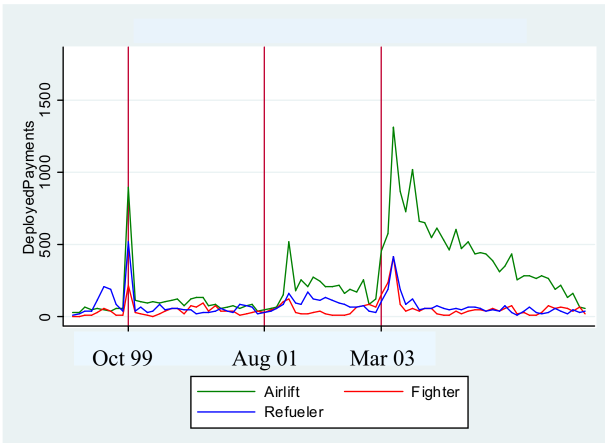

Figure 5-2: Number of IDP Received by RC Pilots

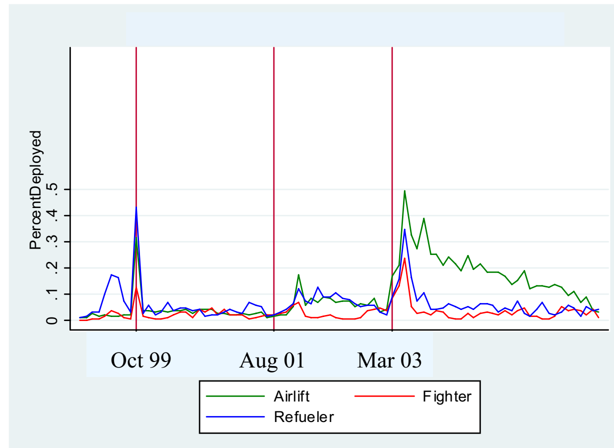

Figure 5-3: Percent of RC Pilots Receiving IDP

There are some administrative lags in payments. For example, prior to October 2002, when IDP was $150, some service members received payments of $300 and $450, most likely due to late payments being made for earlier service in a hostile fire area. Still, the general trend is that there was a spike in payments made in:

- October, 1999, perhaps delayed payments for Operation ALLIED FORCE
- December, 2001, coinciding with Operation ENDURING FREEDOM
- May, 2003, corresponding to support for Operation IRAQI FREEDOM

So, due to late payments that include double or triple payments, operational deployment reality is not quite as spiked as the data on the graphs appear, but the increase in deployments to hostile areas is notable**.**

Operational Tempo by Activation Categories and Mission Types

To achieve a deeper look into RC pilot activation trends, some categories of RC activation OPSTEMPO needed to be defined. Unlike the full-time AC force, service

[35] Hostile Fire Pay is paid to a member if a member is serving in an area designated as an Imminent Danger Pay (IDP) area or a Hostile Fire Pay (HFP) area where a member is in danger of being exposed to the same dangers actually experienced by other service members subjected to hostile fire or the explosion of hostile mines. These areas include Iraq, Afghanistan, and Bosnia-Herzegovina. A complete list can be found in the DoD Financial Management Regulation, Volume 7A, Section 10.

commitments in the RC force range from the traditional, part-time service to full-time service. Full-time service for a month is achieved if a member serves 30 days in a month. Full-time, continuous members work as civil service employees during the week in the same jobs that they hold as RC members during training drill weekends. These full-time members provide day-to-day support for unit training, administrative matters, and operational continuity. In order to better understand the OPSTEMPO that the RC pilot force uses, graphical representations of three types of activation levels were developed as follows:

1) Full-time, continuous service
2) Full-time, temporary service
3) Part-time service

The data for this research lacks indicators for the full-time members of the AFR and ANG. Therefore, a distinction was made about those who served full-time. If a member worked full-time continuously, for at least seven months, and was still working full-time as of December 2005, then that pilot was designated as a continuous, full-time pilot. Otherwise, any other type of 30-day monthly service, whether for one month or one year, was designated as temporary, full-time service. Part-time service was designated for members who served within the range of four to twenty-nine days in a month.

Table 5-4 displays each of the three types of OPSTEMPO in the three mission areas, based upon whether or not the pilots serving joined before or after September 11th. The x-axis represents time, and the y-axis represents the number of RC members associated with each of the OPSTEMPO levels.

Table 5-4: OPSTEMPO Overview

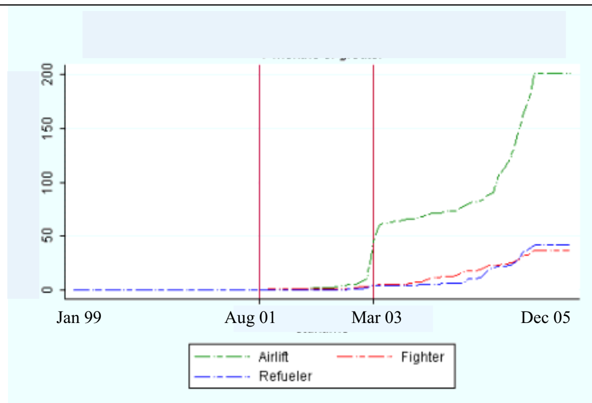

Figure 5-4a: Continuous 30 Pilots, Pre-9/11 Cohort

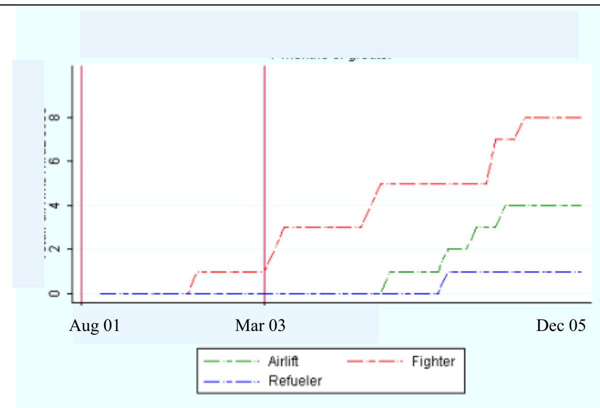

Figure 5-4b: Continuous 30 Pilots, Post-9/11 Cohort

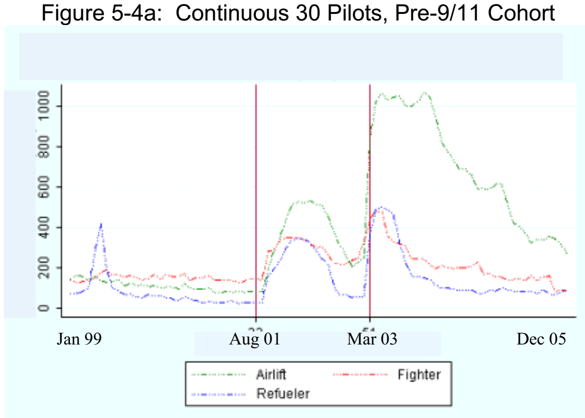

Figure 5-4c: Temporary 30 Pilots, Pre-9/11 Cohort

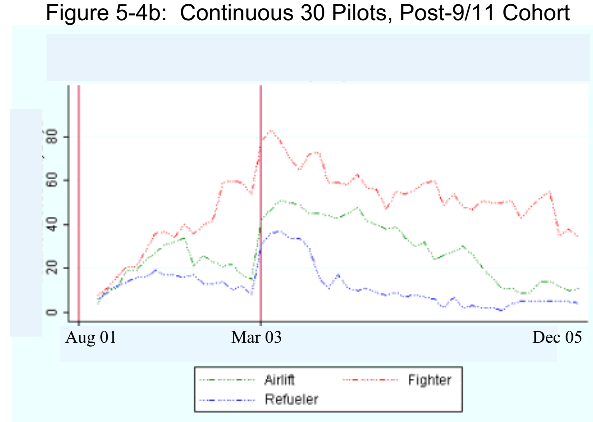

Figure 5-4d: Temporary 30 Pilots, Post-9/11 Cohort

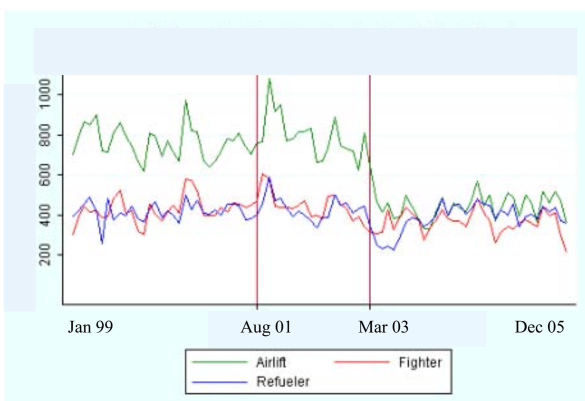

Figure 5-4e: Part-Time Pilots, Pre-9/11 Cohort

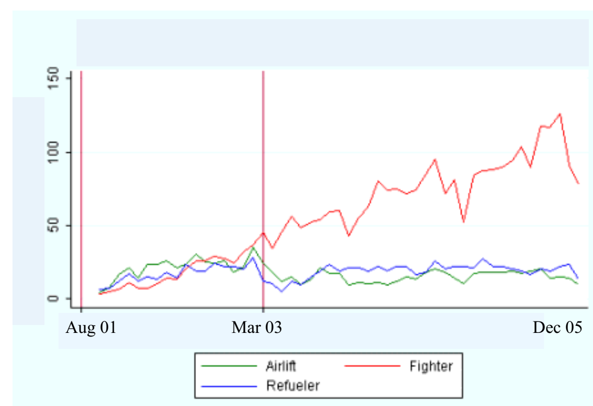

Figure 5-4f: Part-Time Pilots, Post 9/11 Cohort

Figures 5-4a and 5-4b display the number of RC pilots acquiring positions of continuous, full-time service of at least seven months, and still working full-time as of December 2005. The largest portion of continuous full-time positions was filled by the pre-September 11th cohort. Within that cohort, it was the airlift mission pilots who were most likely to join for full-time service, with their numbers increasing from roughly zero to 50 in March 2003 and rising to 200 by December 2005.

Figures 5-4c and 5-4d display the RC's use of temporary, 30-day activation pilots. The number of 30-day months that were not part of continuous full-time service increased after September 11th and increased again for Operation IRAQI FREEDOM. It increased the most for the pre-September 11th cohort of airlift pilots. For those who joined the RC after September 11th, the largest increase in 30-day months occurred within the fighter mission.

A final categorization of RC service is presented in Figures 5-4e and 5-4f. These figures display the use of part-time RC member service—pilots who served between four and twenty-nine days in a month. The most prominent feature for those who joined before September 11th is the decrease in the use of part-time airlift pilots. For those who joined after September 11th, part-time fighter pilot mission use increased the most.

An additional way of looking at the OPSTEMPO categories is to view them from the perspective of each mission category. The next table, Table 5-5, displays the figures of the different mission areas. Overall, the table shows that throughout the period of January 1999 through December 2005, much of the demand for each mission category—airlift, fighter, and refueler—was met through the part-time use of pilots. This was accompanied by increases in temporary 30-day service, particularly in mid-2002 and again just after March 2003.

Table 5-5: Mission Area Overview

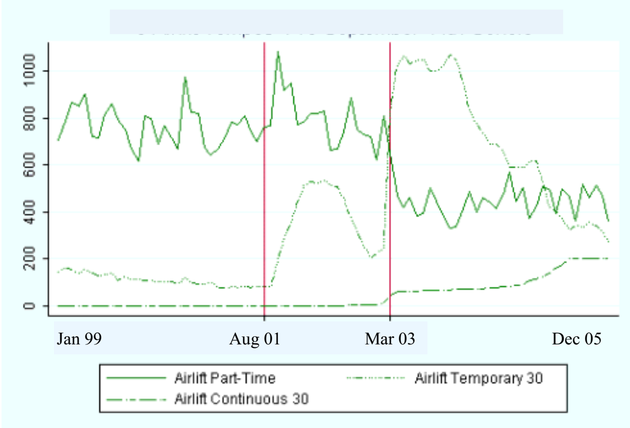

Figure 5-5a: Airlift Pilots, Pre-9/11 Cohort

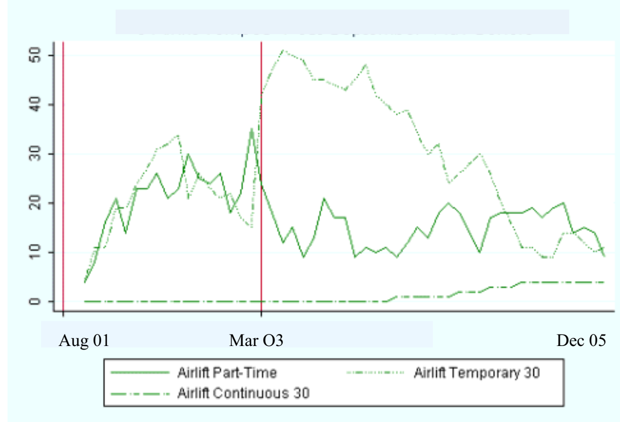

Figure 5-5b: Airlift Pilots, Post-9/11 Cohort

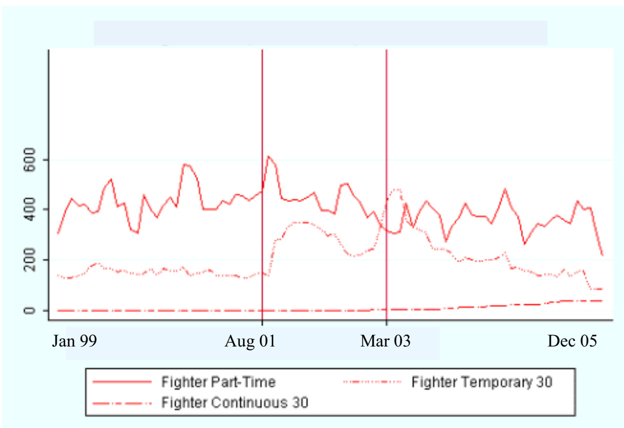

Figure 5-5c: Fighter Pilots, Pre-9/11 Cohort

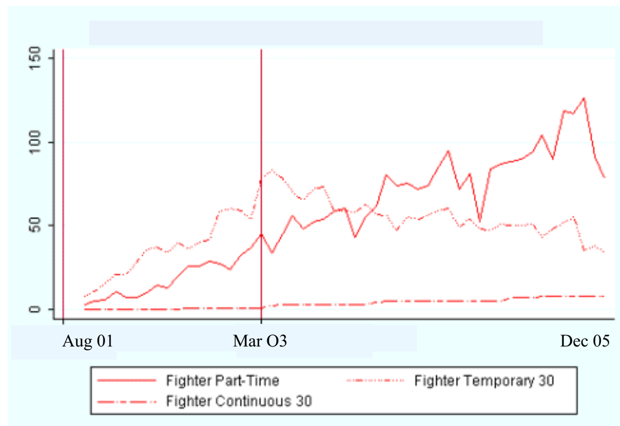

Figure 5-5d: Fighter Pilots, Post-9/11 Cohort

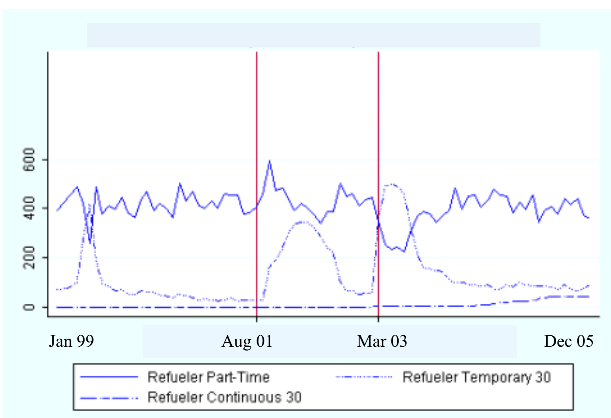

Figure 5-5e: Refueler Pilots, Pre 9-11 Cohort

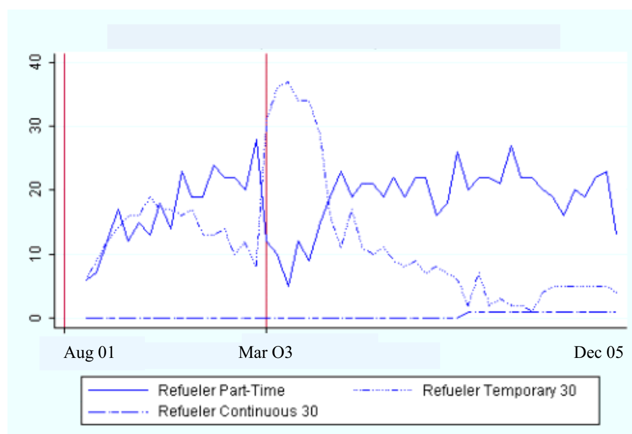

Figure 5-5f: Refueler Pilots, Post-9/11 Cohort

In Figures 5-5a and 5-5b, the most notable feature of the airlift mission number is how the number of part-time RC members (i.e., solid line) generally declined with the commencement of Operation IRAQI FREEDOM while the use of temporary and continuous full-time positions increased. This movement coincides with the need to continuously move troops, tanks, and other weapon systems during the major operations, and the ensuing insurgent battles, associated with Operation IRAQI FREEDOM.

The fighter pilot mission offers a different OPSTEMPO. As Figures 5-5c and 5-5d show, the pre-September 11th fighters also temporarily substituted full-time service for part-time service during the period following Operation ENDURING FREEDOM and Operation IRAQI FREEDOM. Also, while the pre-September 11th cohort exhibited a general trend of using 400 part-time pilots per month, with occasional spikes and dips in usage, the post-September 11th cohort steadily climbed to periods where over 125 part-time pilots were used in a month.

Lastly, Figures 5-5e and 5-5f show the refueling mission. Both cohorts surged to fill Operation IRAQI FREEDOM requirements by shifting from part-time to full-time service tempos.

With the exception of the RC fighter pilots who joined after September 11th, all of the figures in Table 5-5 display periods of time where part-time service became lower than the full-time months of temporary service. In aggregate, this suggests that higher rates of activation were occurring during these periods.

How that aggregated OPSTEMPO affected an individual RC member's experience will be the focus of my empirical analysis. However, before an evaluation of higher OPSTEMPO experiences at the individual level can occur, a definition of what constitutes a high activation experience needs to be constructed. Although various possibilities of high activation were explored, one OPSTEMPO was the most appropriate.

Defining High Activation

Summary statistics of the data from DMDC revealed that, following September 11th, the biggest change in how RC pilots were activated was through an increase in months where members served for 30 days. Although it initially accounted for six percent of the way members were activated each month from January 1999 through August 2001, being activated for 30 days in a month rose to 20 percent of the way members were activated each month from September 2001 through December 2005, as Figure 5-6 displays.

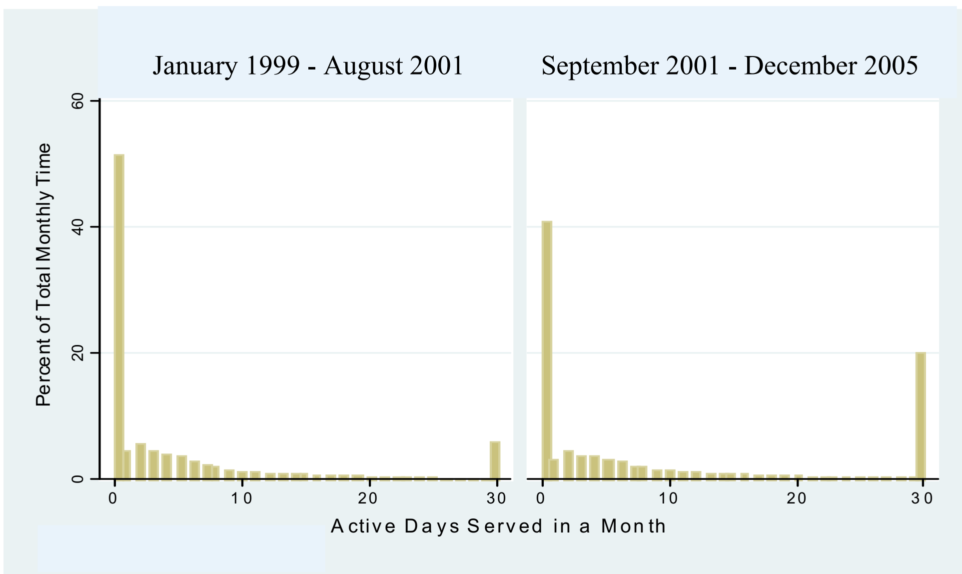

Figure 5-6: Percent of Activation Distributed among Zero to Thirty Days Service in a Month, by Pre- and Post-September 11 Time Frames

In addition to the prominence of months where zero or 30 days of service activity occurred, Figure 5-6 also displays a lack of members serving 11 - 29 days in a month. While a 30-day month of service is intrusive on an RC member's civilian life, it qualifies the pilot for additional pays such as an allowance for housing. Such additional pay could be worth over $2,000 a month, and it raises the wages associated with RC service. In contrast, 11-29 days of service may be intrusive, but not as financially rewarding. The data appear to suggest that RC pilots are rational actors who behave with a premise that, as long as intrusion is going to occur, it is optimal to try to earn a larger pay by serving 30 days. If not surging in a tempo of full-time service, or taking a month off from duty, a member is most likely to work less than 10 days in a month.

Although the RC force saw an aggregate rise in the use of the 30-day activation tempo for its pilots, it was unusual for a member to serve two or more 30-day months of service in a year—either consecutively or in aggregate. The boxplot of Figure 5-7 displays that, with the exception of 2003, at least 50 percent of the RC pilots in any given year did not even have a month of 30-day service. The rectangles represent the 25th - 75th percentile of activation in a year, with the solid line within the each rectangle representing the median amount of activation. The whiskers are one and a half times the size of the rectangle in each direction, truncated back to the last observed point. The remaining dots represent the outlier observations, which naturally range up to the 12 months of the year.

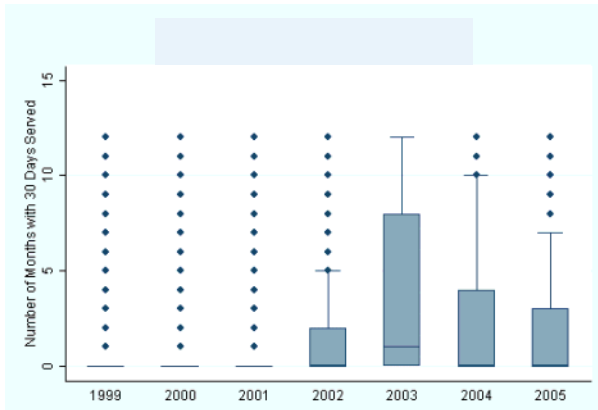

Figure 5-7: Number of 30 Day Months Served By Pilots

One other distinction of RC pilot activation from other, more publicized versions of RC activation is that RC pilot activations involve foreign deployments only a minority of the time. As Figure 5-2 previously displayed, it was rare for either the fighter or the refueler missions to have above 10 percent of its forces deployed to areas of imminent danger during any one month. The boxplot of Figure 5-8 shows the low foreign deployment rate by revealing that, with the exception of 2003, at least 75 percent of the pilots never served a 30-day month where IDP was received.

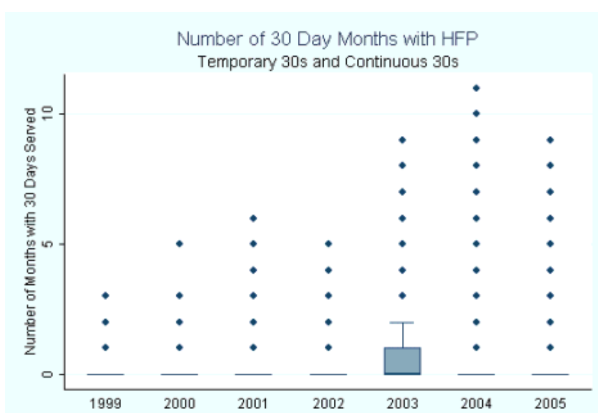

Figure 5-8: Number of 30 Day Months Served with IDP Receipt

One other distinction about an RC pilot receiving IDP is that this does not necessarily imply that the pilot was in an area of imminent danger for the entire month. By definition, an RC pilot need only fly over the area of imminent danger to earn IDP—the pilot does not have to land in the IDP area.

Developing a standard of "high activation" for individual RC pilots required integrating all of the previous activation facts. By combining these facts with interviews of RC pilots in the field, a definition of high activation was chosen as "serving 60 or more days during 3 consecutive months." Other possible definitions of high activation (HA) were examined.[36] These other definitions rarely applied to more than 15 to 20 percent of the RC force for any given year. In contrast, the HA of "60+ during 3" impacted 30 to 50 percent of the pilots during each of the post-September 11th years.

The HA of "60+ during 3" reflects the OPSTEMPO reality described in this chapter. Over 95 percent of the high activations of "60+ during 3" periods included 30-day months of service, and over 33 percent of these high activation periods included receipt of IDP. One other HA definition that was similar to the "60+ during 3" standard in its pervasiveness was an HA definition of "40+ during 2." Given that the emphasis of my research is on the demands of high activation, and that the "40+ during 2" concept appears to be a subset of the larger "60+ during 3" phenomenon, the HA standard of "60+ during 3" was selected.

This standard reflects a significant RC commitment. A data definition of "serving 60 to 90 days in a year" would not permit an analyst to know whether the RC service was performed in a single period or spread across the year at the RC member's convenience. The "60+ during 3" definition reflects a period of intense RC service that would be disruptive to an RC member's civilian employment and home life.

This high activation definition also reflects the RC practice of "rainbowing." Rainbowing occurs when multiple units are used to cover an AEF deployment. Rather than one RC pilot covering an entire 120-day tour of duty overseas, three different pilots each cover a 40-day portion of the AEF. This more than likely requires pilots to use one month of 30-day activation, as well as "spin up" and "draw down" days associated with getting to and from the AEF theatres.

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[36] Traditional AEF tempos, such as 90+ days during 4 consecutive months were examined, as well as 90+ and 120+ days over 5 consecutive months. Shorter "high activation" tempos, such as 20+, 30+, 40+, and 50+ days during 2 consecutive months, and 40+, 50+, 60+, 70+, 80+ during 3 consecutive months, were also examined.

High activation service is a key variable of interest. Just as Hosek and Totten's research suggested that there might a burdensome level of too much AC deployment, there might also be an RC equivalent of too much activation. My assumption *ex ante* is that the majority of the traditional RC—those who joined before September 11th—would not want more than some expected amount of activation. If the post-September 11th activation increases were distributed uniformly, then to the extent that the increases in RC activations exceeded the original levels of expected activation, the increases will seem more burdensome for RC pilots who joined prior to September 11th. The pre-September 11th cohort of pilots would be more inclined to leave the RC. Those RC pilots who joined after September 11th would already have an expectation of greater activation and be less surprised and less affected by an increase in high activation rates.

Having constructed a definition of high activation service, empirical analysis of the relationship between high activation, pay, and retention could now be performed.

VI. The Effect of Activation on Earnings

Both Congress and the DoD have demonstrated concern that activation might cause income losses, and that these losses would then lead some reservists to leave the reserves earlier than they otherwise would have, as well as discourage some potential reservists from joining the RC. This chapter reports the development and results of an empirical analysis of how serving high activation episodes affected the annual earnings of RC pilots. The possibility of a bias in the measurement of the high activation effect is also explored.

Ideally, to analyze the causal effect of a variable of interest, an experiment would be performed with pre-test and post-test measures, using randomly assigned control and treatment groups. Of course, both ethical and practical concerns prohibit learning about the effect of activation on the earnings of part-time RC pilots by assigning an RC pilot to either the control group that serves a "typical" OPSTEMPO or the treatment group that serves episodes of "high activation." However, under certain assumptions, the econometric procedure known as difference-in-differences (DiD) can yield causal estimates of the effect of activation on earnings. The DiD approach was applied to the database previously described in Chapter II.

Developing a DiD Design

To better understand how a DiD design calculates high activation's relationship with annual earnings, consider a simple analysis based upon one year's worth of data on two groups of RC pilots—those without high activation experiences for the year and those with a high activation experience for the year. The simplest ordinary least squares (OLS) regression that could be used to analyze the earnings and activation relationship for that single year would be:

$$Y_{Earnings\ i} = \alpha + \beta_1\ High\ Activation_i + \varepsilon_i \qquad (1)$$

Equation (1) states that the earnings of an individual for a particular year will vary by some constant value, experiencing a period of high activation, and some potential error from not including all of the factors—observable and unobservable—in the regression to predict an individual's annual earnings. Estimating equation (1) by an OLS regression will yield an estimate of β_1 (beta one) that is interpreted as "holding all else equal, serving a period of high activation is associated with a \$$\beta_1$ change in earnings." If there is no covariance between high activation and the unmeasured error, then the estimate of β_1 may be interpreted as the causal effect of high activation on earnings. If β_1 and ε (epsilon) covary, then the estimate of the relationship of high activation with earnings is being biased by some factor omitted from observation in the OLS regression.

Even if the estimates for high activation's relationship with earnings were unbiased, the results of an OLS estimation that used only a single year of data may be misleading. For example, consider the population of RC pilots from the year 2003 who did not serve any periods of high activation (HA) in the year 2002. Those members who served a single period of high activation earned in 2003 an average of \$130,000 for the year, while RC pilots who did not serve any high activation periods earned an average of \$132,000.

If data were only available from the year 2003, then as Table 6-1 shows, the earnings impact associated with serving a high activation episode would be -\$2,000.

Group	Year: 2003
Experienced High Activation	\$130,000
No High Activation	\$132,000
Difference across Groups:	**-\$2,000**

Table 6-1: Single Year, 2003, Earnings Effect Associated with High Activation

While Table 6-1 shows that RC pilots who experience a high activation episode earn \$2,000 less than RC pilots who do not experience high activation, expanding the analysis of RC pilot earnings to include the year 2002 leads to a different result. Table 6-2 displays the DiD result from comparing the difference in earnings between the two groups across the two years (all dollars normalized to 2004 dollars values).

Group	2002	2003	Difference over Time 2003 - 2002
Typical, then High Activation	$134,000	$130,000	-$4,000
Typical, then Typical again	$138,000	$132,000	-$6,000
Difference across Groups	-$4,000	-$2,000	**DiD: $2,000**

Table 6-2: Difference-in-Differences, Years 2002 and 2003, Earnings Effect Associated with High Activation

Table 6-2 shows that the members who experienced one episode of high activation in 2003 had lower average earnings than the members who did not experience high activation in both 2002 and 2003. At the same time, both groups of pilots experienced earnings decreases in 2003. However, the RC pilots who did experience a high activation episode in 2003 had a lower decrease in earnings from the prior year. The lower right corner of Table 6-2 shows that, by differencing the earnings between the two groups over time, an average *increase* in earnings of $2,000 is now associated with members who experienced a period of high activation, compared to those who did not serve a high activation episode. Using multiple years of data has led to a more informative result. Therefore, following RC pilots across two years is now added to the model for analysis, as symbolized by the ***t*** subscripts. Also, the model will focus on an individual's change in earnings, which is symbolized by the delta-Y expression. Finally, the DiD model is written with a delta-HA expression to account for the possibility of individual changing from zero HA experiences in one year to one HA experience in the following year:

$$\Delta Y_{Earnings\,it} = \alpha + \beta_1 \, \Delta High\ Activation_{it} + \varepsilon_{it} \tag{2}$$

Table 6-2 compared the control group of RC pilots that served no high activation with the treatment group of RC pilots who served one high activation episode in 2003. The larger OPSTEMPO reality of RC pilots is that they may serve up to four HA periods in one year. Table 6-3 displays the DiD earnings comparisons for each consecutive two year period between the years 2000 and 2004. The earlier year in each grid displays the earnings of the RC pilots when they did not serve any HA periods. In the later year, the high activation group of RC pilots served between one and four episodes of HA, while the "control group" of RC pilots did not participate in any episodes of HA.

The DiD result for each pair of years is displayed in bold type in the lower right corner of each table. Additionally, the difference between the average total earnings of the two groups for each year is reported along the bottom row.

Lastly, the differences between the total earnings over time, as well as for the three component parts of total earnings, appear along the right-most column. While the civilian pay portion of total earnings is an intuitive element of an RC individual's total earnings, the separation of military pay and its potential tax advantages deserves a brief review of its Chapter II explanation. The tax advantage amount represents the additional amount of taxable civilian earnings that an individual would have to earn in order to equal the portions of military earnings that are tax exempt. For example, an RC member who served 30 days in a month received a Basic Allowance for Housing (BAH). BAH is exempt from taxes, and therefore worth more than its raw dollar value. Another example of military compensation that is worth more than its civilian equivalent is the earnings that an RC pilot receives when that member performs a mission in an area with an imminent danger designation. Such areas are most likely combat zones. Serving any one day of a month in a combat zone exempts an RC member from having to pay taxes on their military pay for that entire month. This is known as the combat zone tax exclusion (CZTE) benefit.

Therefore, to further distinguish the value of earnings of actual military pay from the tax advantages associated with various forms of military compensation, Table 6-3 reports the military pay in its gross amount form, and then reports the additional value of that pay due to exemptions from taxes.

Table 6-3: DiD Results for Years 2000 - 2004

		2000	2001	Time Difference
HA in 2001	Total Earnings	83,732	108,213	24,481
(N = 591)	Civilian Pay	65,740	64,202	-1,538
	Military Pay	16,943	39,702	22,759
	Military Tax Advantage	1,049	4,309	3,260
No HA	Total Earnings	108,430	126,417	17,987
(N = 4,025)	Civilian Pay	89,476	105,695	16,219
	Military Pay	17,875	19,459	1,584
	Military Tax Advantage	1,078	1,262	184
Group Difference, Total Earnings		-24,698	-18,204	**DiD: 6,494**

		2001	2002	Difference
HA in 2002	Total Earnings	108,545	125,153	16,608
(N = 884)	Civilian Pay	81,022	54,149	-26,873
	Military Pay	25,618	60,550	34,932
	Military Tax Advantage	1,904	10,454	8,550
No HA	Total Earnings	128,531	135,980	7,449
(N = 3,220)	Civilian Pay	108,157	113,200	5,043
	Military Pay	19,190	21,267	2,077
	Military Tax Advantage	1,184	1,513	329
Group Difference, Total Earnings		-19,986	-10,827	**DiD: 9,159**

		2002	2003	Difference
HA in 2003	Total Earnings	134,052	140,889	6,837
(N = 1,179)	Civilian Pay	104,231	44,864	-59,367
	Military Pay	27,749	78,650	50,901
	Military Tax Advantage	2,072	17,374	15,302
No HA	Total Earnings	138,346	131,509	-6,837
(N = 1,992)	Civilian Pay	119,110	113,451	-5,659
	Military Pay	18,193	17,120	-1,073
	Military Tax Advantage	1,043	938	-105
Group Difference, Total Earnings		-4,294	9,380	**DiD: 13,674**

		2003	2004	Difference
HA in 2004	Total Earnings	134,024	131,584	-2,440
(N = 341)	Civilian Pay	100,824	45,363	-55,461
	Military Pay	31,166	71,650	40,484
	Military Tax Advantage	2,034	14,571	12,537
No HA	Total Earnings	132,757	124,521	-8,236
(N = 1,749)	Civilian Pay	113,117	105,365	-7,752
	Military Pay	18,716	18,294	-422
	Military Tax Advantage	923	862	-61
Group Difference, Total Earnings		1,267	7,063	**DiD: 5,796**

Table 6-3 shows that, for each consecutive pair of years, RC pilots who went from serving no high activation periods in the earlier year to serving one or more high activation episodes in the later year had either an increase in earnings associated with their HA service, or a lower decrease in total earnings when compared to those RC pilots who did not serve an HA episodes.

Table 6-3 also displays that those who served HA episodes, on average, earned less civilian earnings than the non-HA group in each year. Additionally, the HA pilots, on average, earned less total earnings than the non-HA in the earlier year, with the exception of the relatively small RC HA population of the 2003/4 year pairing.

Better DiD estimates of the earnings effect associated with high activation may be obtained by expanding the list of "X factors" that are controlled for during the calculation of the high activation coefficient. Such a DiD model looks like:

$$\Delta Y_{Earnings\, i,t} = \alpha + \beta_1 \Delta\, High\ Activation_{i,t} + \delta_N X_{N\, i,t} + \varepsilon_{i,t} \qquad (3)$$

Equation (3) now adds X, a vector of N observable characteristics that are associated with the earnings of RC pilots. For this dissertation's research, these additional covariates are years of service, whether the individual was previously working for a major or national airline, whether the individual joined the RC after September 11th, and the RC mission category of working as an airlift, fighter, or refueler pilot.

Thus far, it has been assumed that the change in earnings has been accurately measured by controlling for observable factors, and that any measurement errors are not correlated with the high activation variable. Separating the error term into three components permits a closer examination of how accurate those assumptions have been.

Consider the possibility that measurement error is composed of three elements:

- Fixed effects associated with a particular year, such as average economic conditions
- Fixed effects associated with a particular individual, such as individual ability
- Time-varying effects, such as an individual's employment status

Such a separation of the potential error is more visible when the error term of equation (3) is disentangled into the three parts:

$$\Delta Y_{Earnings\,i,t} = \alpha + \beta_1 \, \Delta High\ Activation_{i,t} + \delta_N X_{N\,i,t} + \tau_t \Delta Year_t + \mu_i Individual_i + \eta_{i,t} \qquad (4)$$

Equation (4) includes a variable for the fixed effects of the year when the data was recorded, symbolized by τ (tau), and a variable to account for the fixed effects of an individual, symbolized by μ (mu), and a variable to account for time-varying effects, symbolized by η (eta).

By following a population of RC pilots across two consecutive years, who have no HA experiences in the first year and zero to four episodes of HA in the following year, the fixed effects of each individual will be differenced out in the calculation of the earnings change. Also, by including a dummy variable for each year, except for a comparison base year, the time invariant effects will have been measured.

Although the possibility of error has been reduced, a potential measurement bias of the high activation variable remains. The unobserved effects that change from one period to the next have not been differenced away. If these time-varying effects are not correlated with high activation, then they will not bias that coefficient's estimate. However, it is possible that a time-varying factor within the error term eta is associated with high activation—employment opportunity.

Recall that "pay and allowances" and "the military retirement system" were the two most widely selected factors affecting RC continuation decisions in the 2004 SOFR. Given that pay is valued by RC pilots, it is possible that they may be choosing the amount of high activation that they experience based upon their projected earnings from their employment opportunities. More specifically, members who anticipate lower earnings from their civilian work might be seeking the earnings from high activation service in the RC. For example, RC pilots who were furloughed by their airline employers following the events of September 11th might substitute RC activation, and its associated earnings, to make up for lost civilian earnings. This "substitution" possibility was previously discussed in Chapter IV. Prior empirical research suggests that workers seek to achieve a target level of income, and will work more when their accumulated earnings are lower than that level, and work less when their earnings have increased enough.[37]

[37] For examples of the target earnings, see Dunn (1978): 533-540, and Kagel *et al.* (1977)

Interviews with RC pilots revealed that there were opportunities for RC pilots to influence the amount of activation that they served. These opportunities varied by flying unit. For example, some units, such as the 163rd Air Refueling Wing of the California Air National Guard, used "volunteers first" when selecting who would perform various AEF and call-up mission requirements (e.g., supplying 50 percent of a unit's pilots for an eight month tour in support of Operation IRAQI FREEDOM). Also, if officers wished to acquire more activation time, then there were opportunities to add up to 48 days of training into an individual's annual schedule. It is possible that some RC members may, to some degree, influence the amount of RC service that they contribute during a year.

Potential Earnings Estimation Bias

Given that some level of self-selection for RC service is endogenous to the RC pilot population, the coefficient estimates of high activation will suffer from a bias. To better understand that bias, consider the situation of RC pilots who were working for civilian airlines in the year 2000. Following September 11th, it is possible that, due to the strict seniority system of the airline pilot's union, individual pilots would be able to project how close they were to being the next person laid off from work, or "unemployed soon" for short. Those pilots might have sought high activation opportunities as a substitution for their previous pay with their civilian airline. If activated as a deployed member, versus a local CAP mission, a pilot could look forward to additional compensation, such as IDP and CZTE benefits.

In this scenario, the estimate for the beta in front of high activation is no longer based only on high activation—there is also some influence from high activation's relationship with "unemployed soon." It is conceivable that "unemployed soon" is negatively correlated with an individual's annual earnings—individuals who will be unemployed soon will be more likely to have lower earnings. At the same time, "unemployed soon" could be positively associated with high activation, as the desire for an individual to perform RC service to make up for the lost civilian airline earnings increases in response to being "unemployed soon."

This negative correlation between "unemployed soon" and annual earnings, in conjunction with the positive correlation between "unemployed soon" and belonging to the high activation group, would lead to the β_1 parameter being biased downward. This downward bias would mean that if serving high activation periods actually increased an individual's annual earnings, then that increase would be understated in the final estimates. Similarly, the downward bias would mean that if serving high activation periods actually led to a decrease in an individual's annual earnings, then that decrease is now overstated in the output. In either hypothetical outcome, serving high activation periods appears in the output as being associated with less income to pilots than the circumstances actually produced.

Thus, the earnings coefficient associated with high activation will most likely be biased downward. Table 6-3 showed that those who served high activation periods in one year were, on average, more likely to be individuals who were earning less than the non-HA pilots in the prior year. If the HA group of pilots were seeking out high activation episodes because of the higher pay associated with such service, then in the absence of such high activation opportunities, these individuals would probably not have earned as much as they did by serving HA episodes. Most likely, they would have earned less, and their earnings loss would have been steeper that the non-HA group of pilots. This suggests that the bias on the HA coefficient will be downward, and the earnings impact associated with high activation will be conservatively reported.

One other impact of unobserved effects being associated high activation is that the interpretation of high activation coefficient *cannot be causal*. Lacking an observable measure for HA-related factors that are not in the OLS regression, such as "unemployed soon" and "voluntary versus involuntary" service, the interpretation of the HA coefficient will be that "each episode of high activation *is associated with* a \$β1 change in earnings."

DiD Results

Using the combined DMDC/SSA data, the population of RC pilots that was selected for analysis included only those individuals who had zero activation episodes in one year, and then any number of HA experiences—zero through four—in the following year. *Ex ante*, after controlling for other theory-based, observable variables, I expected that each episode of HA would be associated with an earnings increase. The DiD model used for the earning estimation was:

$$\Delta Y_{Earnings_{g,t}} = \alpha + \beta_1 \, \Delta High\ Activation_{g,t} + \delta_N X_{N\,g,t} + \tau_t Year_t + \varepsilon_{g,t} \qquad (5)$$

Table 6-4 displays the results of the DiD modeling of the missions separately, as well as with "all missions encompassed," for the years 2000 through 2004. Statistically insignificant coefficients, based upon an $\alpha = 0.05$, are not reported with the exception of the key variable of interest, the high activation variable (please see Appendix D for a table with standard errors). The coefficients are standardized to pre-tax dollar values of the year 2004, and include the tax benefits associated with various military earnings. A discussion of each of the variables follows the table.

Variable	Airlift	Fighter	Refueler	ALL
For each HA of "60+ during 3 months" in Year "t+1"	2,566***	714	1,046	2,360**
Years of Service, 15 - 19, versus 14 or less	33,289***	17,098***	28,204***	28,137***
Years of Service, 20+, versus 14 or less	52,736***	32,929***	47,800***	46,702***
Joined After Sept 11th	-28,800***	-19,573***	-25,328**	-20,460***
2001, vs 2000	7,404**	10,909**	10,272**	8,697***
2002, vs 2000	10,976***	15,695***	18,363***	13,398***
2003, vs 2000	7,987**	+	+	7,607***
2004, vs 2000	-7,783**	+	-	-
Received pay from an Airline in Previous Year, versus not	33,805***	41,009***	28,840***	34,848***
Serves in the Airlift mission, versus as a Fighter Pilot				-5,138***
Serves in the Refueler mission, versus as a Fighter Pilot				-6,505***

Table 6-4: DiD Results for HA Service, with Covariates, Years 2000-2004

- *High Activation.* The top row of Table 6-4 shows that, depending on how the data is organized, HA experiences either are, or are not, statistically significant in their relationship with an RC pilot's annual earnings. If all of the data were modeled together (the right most column), then, *ceteris paribus*, each HA experience would be associated with an increase in earnings of approximately $2,300. However, when separated into the various mission areas, the HA experiences only result in a statistically significant effect for the airlift pilots.

It is possible that the various mission areas are reflecting one variable missing from this analysis—IDP receipt. Due to a bin size limitation while acquiring the data from the Social Security Administration, this variable was not included. Summary statistics of the DMDC data noted that IDP was a part of an HA experience in 33 percent of the cases. As Figure 5-3 previously displayed, the airlift mission had a much higher propensity to perform mission work that included IDP receipt, as well as CZTE of income earned for the month of IDP receipt. These facts offer an explanation as to why airlift HAs are associated with higher income, while fighter pilots who may be flying domestic CAP missions, and refuelers who support the CAPs, do not have HA service associated with higher earnings.

In addition to the DiD model that analyzed the years 2000-2004, DiD analysis with OLS was also performed for each pair of years within that time period. Table 6-5 displays the year pairing results for the key variable of interest—HA service—within the "all missions encompassed" model.

DiD Year Pairs	All Missions
2000 - 2001	-3,869
2001 - 2002	-3,124***
2002 - 2003	5,417***
2003 - 2004	3,770**

Table 6-5: DiD Analysis of HA by Year Pairings

The estimates of HA associated effect with earnings in Table 6-5--estimates which controlled for factors such as years of service and airline employment—present a different set of DiD results than Table 6-3, which did not control for additional variables. Table 6-5 shows that there were not statistically significant earnings differences associated with the HA service of RC pilots in 2001.

For those who went from no HA service in 2001 to serving one or more HA episodes in 2002, each episode of HA service was associated with an average loss in earnings of $3,124. One possible explanation for this result is that in the year 2002, the members who were performing HA service were members who had been furloughed by their airline, and did they not acquire enough substitute income from their RC service to make up for the difference in lost civilian earnings. This $3,100 "loss" should be interpreted with the possibility that the estimate suffers from a downward bias.

Lastly, each episode of HA service in 2003 and 2004 was associated with an increase in earnings. One possible reason for this result is that, by 2003 and 2004, the non-HA group of pilots experienced pay cuts in their civilian jobs. In 2003, the pilots serving HA episodes increased their earnings relative to their earnings in the previous year, while the earnings on non-HA serving pilots decreased. In 2004, the RC members who served HA episodes experienced smaller earnings decreases than the non-HA group. Thus, for each pair of years, the HA-serving pilots tended to have in a more positive difference in their income relative to pilots without HA service.

The year pairings results of the individual mission models for high activation, as well as the other covariates, were similar to the results of Table 6-4. The estimates associated with HA service for each pair of years were statistically insignificant at the $\alpha = 0.05$ level, with the exception of the last three years of airlift pilots, and the 2002/3 year pairing for fighter pilots.

The remaining factors that were controlled for in each pair of years were consistent in direction and magnitude with Table 6-4, which are elaborated upon next.

- *Years of Service.* The next category of variables in Table 6-4, years of service, confirms the expected. The years of service categories are represented by dummy variables. The coefficients represent the average difference in pay between those with 15-19 years of service and 20 or more years of service, versus those with 14 or less years of service. For pilots who stayed in the same experience category from one year to the next, there was no change in their years of experience dummy variable. The change occurred for pilots who moved from one category to the next.

The more years of service that a member possessed, and therefore the older and more experienced an RC member was, the higher the annual earnings estimate. This reaffirms the standard intuition displayed in Figure 3-4 that older individuals, with more years of working and acquiring seniority, earn a larger income than junior individuals. This result occurred in the individual mission models as well as the "all missions encompassed" model.

- *Joined after September 11th.* Table 6-4 also shows that being a member who joined the RC after September 11th was associated with a decrease in earnings. Once again, a possible explanation for this effect is that the members who joined after September 11th were members who were furloughed by their airline, and did not acquire enough substitute income from their RC service to make up for the difference in lost civilian earnings. Summary statistics from the DMDC and SSA data showed that an average of only 27 percent of the members who joined the RC after September 11th received a paycheck from either a major or a national airline. This contrasts sharply with the yearly average of 65 percent of pre-September 11th RC members who received pay from an airline. Since the airline pay is relatively high (for those who were still employed by an airline), this probably accounts for the majority of the income differences associated with the September 11th cohort. This result occurred in the individual mission models as well as the "all missions encompassed" model.

- *Year Indicators*. The next set of variables is the year indicators. They may be interpreted as, "compared to the year 2000, holding all else equal, the earnings of this year are associated with $\$\beta$ change in earnings." The general trend is that total earnings followed an inverted U shape, rising to a peak in 2003, and then declining, but still staying above the year 2000 earnings until 2004. This inverted U pattern aligns with the annual amount of HA and IDP-related missions, in conjunction with the overall decreases in the civilian job pay. Summary statistics of the data showed that military earnings rose over this period of time, but not as much as civilian earnings decreased. This result occurred in the individual mission models as well as the "all missions encompassed" model.

- *Airline Pay Receipt.* A variable indicating whether or not an RC member was receiving pay from an airline in the previous year confirms another expected result—receiving pay from a major or national airline was associated with higher earnings. This result occurred in both the individual mission models as well as the "all missions encompassed" model. Ideally, an indicator of "received airline pay in the current year" would have been used, but constraints during the data acquisition from SSA prevented acquiring such a variable.

However, the "airline employee in the previous year" indicator appears to serve as a reasonable proxy for airline employment in the current year. As Figure 3-4 showed, the population of RC members who receive pay from a major or national airline only drops by approximately 10 percent each year between the years 2001 and 2004. Given the low hiring rates following September 11th, and the strict seniority system of the pilots, on a year-to-year basis, a crude estimate can be formed that an RC pilot who is employed by an airline in one year would have an approximately 90 percent likelihood of being employed by an airline again in the following year. Thus, even though it is a "previous year" variable, I expected this covariate to be a good proxy for current airline employment status. Its association with an earnings increase is probably due to the more senior, higher paid pilots having been less likely to be furloughed and more likely to make higher overall earnings.

- *Pilot Types of "All Missions" Model*. Lastly, in the "all missions encompassed" model, there are statistically significant effects of lower annual incomes associated with members who were airlift or refueling pilots, when compared to fighter pilots. These were dummy variables for mission types that did not change from year to year. Summary tabulations of the data showed that, across years of service and time, the fighter pilots consistently had higher-paying civilian earnings for any year and by each grouping of years of service, so much so that the higher military earnings of the airlift and refueling mission pilots did not offset this difference. One possible explanation for this is that fighter pilots had the lowest likelihood of performing IDP-related missions, and therefore had the opportunity to work and advance more in their domestic, civilian jobs.

Taken together, these findings suggest that high activation service increased the earnings of airlift RC pilots, but not fighters and refuelers. These estimates must be interpreted in lieu of the fact that there was no available measurement for whether the pilots who anticipated a decline in earnings were more likely to seek out high activation service. Lacking a measure for this factor, the estimate of earnings associated with high activation service most likely suffer from a downward bias.

VII. How Separation Rates Change with Activation

One of the major policy concerns surrounding high activation service is whether it leads to RC pilots leaving the RC at a rate that is too high to keep the RC force sustainable. Using the historical data described in Chapter II, an analysis was conducted to determine, after controlling for a number of theory-based covariates, how the separation rates of RC pilots varied with the number of high activation episodes that they served in the prior year. This chapter reports the selection process that was used to choose a unique form of an OLS regression—the Linear Probability Model (LPM)—for analyzing the high activation effect. A prediction of high activation's effect, based upon proper specification, is given, as well as the results of the LPM. A potential downward bias in the HA estimate is also noted.

Validating the LPM Approach

One approach to analyzing the retention and separation rates military members is to use the Cox nonproportional hazard model, as Fricker (2002) did. The Cox model begins by assuming that T is a non-negative random variable denoting the time until a separation. Mathematically, the cumulative distribution function of $F(t)$ would represent the amount of time that passes until the separation, such that $F(\text{t}) = \Pr(T \leq t)$.

The hazard function $h(t)$ is an instantaneous rate of failure. For this dissertation's analysis, it was the probability that an RC pilot separated within a given time period, conditional upon that pilot serving in the RC at the beginning of that time period. A generalized form of the hazard function would be:

$$h(t) = \frac{f(t)}{1 - F(t)} \quad (1)$$

Note that $h(t)$ is, like the LPM outcome, an instantaneous measure that is unaffected by the past.

The Cox nonproportional hazard model multiplies the baseline hazard, $h_0(t)$, by a set of covariates, in an exponential form to keep the $h_i(t)$ from having a negative value. Such a parameterization looks like:

$$h_i(t) = h_0(t)\exp(\beta_0 + \beta_n X_i) \quad (2)$$

With regard to this dissertation's data, the Cox model performed an analysis for each month where a separation was recorded. Each analysis returned the probability of separation for those RC pilots who separated in that month. Maximum likelihood methods were used to calculate the value of the betas that maximized the L(β|data).

A major advantage of this type of model was that it required no distributional assumptions about the data, such as normality. It was possible that a bimodal distribution might have occurred following a period of high activation, due to the RC pilots being heterogeneous in their desire for HA experiences. For example, those who incurred dissatisfaction from the activation might have been more inclined to separate from the RC as soon as possible, while those who found the activation acceptable, or derived positive satisfaction from the activation period, might have been more likely to separate at a lower rate. Since the baseline hazard, $h_0(t)$, gets cancelled out during the calculation of the parameter coefficients, the Cox model did not require having a specified distribution—normal, bimodal, or otherwise.

One of the drawbacks of the Cox nonproportional hazard model is that the coefficients in front of the parameters—in either hazard ratio or unexponentiated form—are less intuitive to interpret compared to the OLS coefficients. However, a far more pragmatic concern with the Cox model was that algorithms for applying the Cox model to SSA data had not yet been reliably tested. In contrast, using weighted OLS regressions on binned data—such as the data described in Chapter II—had proven dependable. Therefore, if possible, the preferred method of analysis was to use an OLS model, such as the LPM.

When used for analyzing the separation of RC pilots, the LPM displays an instantaneous rate of separation. The outcome of interest—whether or not an RC pilot separates from the Air Force—had a value of either a one for a "yes" or a zero for a "no" for each given year ***t***. A separation score of one was assigned to an individual who had a final record of service that was before December of 2005. Otherwise, the separation score was zero.[38] The LPM used an OLS regression, with a binary outcome of separation, modeled as:

$$Separate_{i,t} = \alpha + \beta_1 HighActivation_{t-1} + \delta_n X_{n_{i,t}} + \gamma_n Z_{n,t-1} + \varepsilon_{i,t} \qquad (3)$$

[38] The possibility of whether members frequently entered and exited the RC was examined. Instances of RC records "ending" more than once before December of 2005 occurred in less than two percent of the individuals, and it could not be determined whether a blank in a pay cell represented a temporary separation from the RC or merely a missing month of data.

Equation (3) states that the separation decision of a pilot varied based upon some constant value, an effect associated with each episode of high activation from the prior year, a series of covariates from the same and prior year of the separation decision, and some possible error that not all of the variance in separation was accounted for by the observed variables.

The LPM model offered the benefit of simple interpretation. A coefficient may be interpreted as the change in the probability that an RC pilot separated in a given year when the covariate changed by one unit. Given the concerns that high activation episodes were burdensome to an RC pilot's civilian life, it was expected that the beta coefficient of high activation should have a positive value, implying that high activation causes higher rates of separation.

The LPM also offered the benefit of practicality for analyzing the data bins formed with the SSA earnings data. Although the DMDC data was longitudinal in nature, integrating the earnings data into the database required transforming the final database into a series of cross-section panels of data, with a variable assigned for each year of measurement. This resulting database could then be analyzed using weighted OLS techniques (see Appendix C).

Although it offered the benefits of simple interpretation, the LPM analysis had some drawbacks. One such drawback was its linear, constant rate assumption. However, numerous model specifications of this dissertation's data—performed prior to the selection of the final model—consistently revealed that the relationship of the HA variable with separation was approximately linear. Since the remaining covariates were dummy variables, the constant linearity assumption was not a concern.

Also, another assumption implicit with using OLS regression was that the error terms would be normally distributed, which would be necessary for deriving the standard errors, t-tests, and confidence intervals of the beta estimates. In a binary outcome model such as the LPM (i.e., separated = 1, retained = 0), the error term cannot be normally distributed. However, given the 24,000+ observations of this research, it can be shown, via the Law of Large Numbers and the Central Limit Theorem, that the OLS estimators satisfied asymptotic normality, and that the LPM model estimates obtained were valid. Also, to account for the possibility that the error variances of those who separate and those who remain might differ, robust standard errors were used to account for potential heteroskedasticity.

One additional challenge with analysis by LPM was that, given the right combination of beta estimates, it is possible that the outcome prediction of separation might exceed the range of zero to one. While Wooldridge (2003) notes that this type of outcome—a negative probability or a probability greater than one—can be "a little embarrassing" for a model of probabilities, he also notes that LPM is often applied in economics because the analysis is usually concerned about the *ceteris paribus* relationship of a certain variable with an outcome, and not the aggregated prediction per se.

Given the potential limitation of the LPM approach, the question of whether the LPM would produce results similar to the Cox model needed to be answered. Therefore, before sending the DMDC data to SSA, the data was analyzed using the LPM and Cox methods of analysis. In a blunt attempt to control for military earnings, a variable for the total number of days activated was added to model.

Tables 7-1, the Cox model, and 7-2, the LPM, provide strong evidence that, for this research, the LPM was an acceptable analysis tool. Variables that were associated with a higher separation rate are highlighted red. Variables that were associated with a lower separation rate are highlighted blue. Non-statistically significant outcomes do not have a coefficient number associated with them, but the direction of their likelihood is reported (please see Appendix D for a table with standard errors reported).[39]

Variable	Airlift	Fighter	Refueler
Active Days above 40, previous year, by 80 day increments	0.53***	0.60***	0.48***
HA of "60+ days during 3 months" during Previous Year	2.06***	1.71***	1.99***
Received HFP / IDP during Previous Year	0.57***	0.58***	0.67***
Years of Service, 15 - 19, versus 14 or less	0.42***	0.79**	0.46***
Years of Service, 20+, versus 14 or less	1.53***	1.78***	1.73**
Joined After Sept 11th	-	+	.37***
2001, vs. 2000	-	+	-
2002, vs. 2000	-	-	+
2003, vs. 2000	+	-	6.78***
2004, vs. 2000	+	-	6.1**
2005, vs. 2000	+	-	+

Table 7-1: Cox Nonproportional Hazard Model of Separation

Airlift	Fighter	Refueler
-.04***	-.04***	-.04***
.04***	.04***	.04***
-.04***	-.04***	-.03***
-.05***	-.01***	-.04***
.05***	.06***	.05***
+	-	-
-.03***	-	-
-.03***	-.02***	-
.02***	+	.04***
+	+	-
+	+	+

Table 7-2: LPM

[39] ** = p <0.05, *** = p <0.01

Looking down the "Airlift" column of Table 7-1 shows that, *ceteris paribus*, for each high activation period an RC pilot experienced (a number N ranging from zero to four), that pilot was 2.06^N times more likely to separate compared to RC pilots who do not undergo any periods of high activation.

Of course, if RC pilots served a period of high activation of 60 or more days in a three month period, then they must have served more than 40 days over the course of the year. The first line of Table 7-1 reports the hazard ratio of a pilot leaving the RC, based upon their previous year's service above 40 days, binned by 80-day increments.[40] Continuing with the HA example, if an RC member had served 100 days in the previous year as well as one high activation period, then the RC pilot would be in one bin higher than 40--the bin of "41 through 120 days"—and the separation hazard ratio would be $0.53^1 * 2.06^1 = 1.09$. This implies that the member is nine percent more likely to separate than the baseline hazard of a member who did not serve more than 40 days and did not undergo a period of high activation. If that high activation member also received IDP during the previous year, then that pilot's proportional hazard is now $0.53^1 * 2.06^1 * 0.57^1 = 0.62$, and the member is now 38 percent less likely to separate than the under-40-day RC pilot. When applied to the baseline hazard separation rate, which is an annualized separation rate of approximately 6.8 percent in this case, the result is a 2.6 percent lower separation rate.[41] The multiplicative nature of hazard ratios, combined with comparing them, requires layers of interpretive effort.

In contrast, the LPM model offers a more straightforward interpretation. The associated effects of different covariates are additive. Thus, an RC member who served 100 days in the previous year with one high activation period, as well as received IDP during the previous year, would be four percent less likely to separate.[42]

Overall, there was agreement between the Cox and LPM models in all of the corresponding likelihoods of the first five rows of variables. There were no instances of statistically significant disagreement between the two models, although there were some cases where a statistically significant relationship was present in one model, but not in the other.

[40] There were 5 possible bins of service days: 0-40, 41-120, 121-200, 201-280, 281-360.
[41] 0.38 * 0.068 = 0.026.
[42] (-0.04) + 0.04 + (-0.04) = (-0.04).

Albert Einstein once said that everything should be made as simple as possible, but not simpler. Since the key variables of the LPM revealed information similar to the Cox model, provided an easier interpretation, and were more conducive for analysis with Social Security Data, the LPM was chosen for this dissertation's analysis.

The results of the full analysis of the DMDC and SSA database appear in Table 7-3 below. A discussion of each variable follows.

Variable	Airlift	Fighter	Refueler		ALL
For each HA of "60+ during 3 months" during Previous Year	.024***	.027***	.020***		.023***
Log (Military Earnings Previous Year)	-.037***	-.048***	-.037***		-.039***
Log (Total Earnings Previous Year)	+	.105***	-		.031*
Received HFP / IDP during Previous Year, versus not	-.024**	-.033***	-		-.025***
Received Pay from an Airline in Previous Year, versus not	.028***	-	+		.012*
Years of Service, 15 - 19, versus 14 or less	-.049***	-.036***	-		-.040***
Years of Service, 20+, versus 14 or less	.041**	+	.079***		.042***
Joined After Sept 11th	-	+	-		-
2001, vs 2000	-	-	-		-
2002, vs 2000	-	-.044**	+		-.023*
2003, vs 2000	+	-	.040**		+
2004, vs 2000	-	-	+		-
2005, vs 2000	+	-	+		+
Serves in the Airlift mission, versus as a Fighter Pilot					-.016**
Serves in the Refueler mission, versus as a Fighter Pilot					-.012*

Table 7-3: LPM Analysis of Separation, Years 2000-2005

- *Activation in the Previous Year (High Activation and Military Earnings).* The key variable of interest, high activation periods, is located in the first row. Within the LPM context of the "all missions encompassed" model, the HA coefficient is interpreted as, "for each high activation period an RC airlift pilot experiences in the prior year, *ceteris paribus*, there was a 2.3 percent increase in separation likelihood in the following year." This positive correlation between high activation and separation was expected, due to the HA period being a more intrusive period of service on an RC pilot, compared to serving the same number of days over a longer period of time (e.g., a whole year). This result of increased separation occurred in both the individual mission models, as well as the "all missions encompassed" model.

However, the HA variable cannot be interpreted in isolation. Serving an HA period required serving 60 or more days in 3 month period, which also led to an increase in military pay. This military pay variable was modeled in a log format to allow for a percentage interpretation. Using the "all missions encompassed" model, the second row variable may be interpreted as "for every one percent increase in an RC pilot's military earnings in the previous year, there was a 3.9 percent reduction in the likelihood of separation in the following year."

Given that the median amount of RC pilot service in a given year was approximately 40 days, an HA experience represented a significant percentage increase in military pay. Therefore, taken together, the first two variables show that increases in military service in the prior year, including when served with high activation periods, were associated with lower likelihoods of separation in the following year. This suggested that those RC members who wanted more mission time in the RC were able to serve it, and were more satisfied with their RC service as a result. This outcome reflects the possible selection bias for activation discussed in Chapter VI--an increase in pay might be representative of a self-selected increase in RC commitment, for reasons ranging from patriotism to lower civilian alternatives. This result of decreased separation likelihood occurred in the individual mission models as well as the "all missions encompassed" model.

- *Total Earnings in the Previous Year*: The total earnings variable, which represents civilian pay under the "after controlling for military pay" assumption, was added as a control variable. As discussed in Chapter IV, in equilibrium, the difference between the civilian wage and the reserve wage should equal the ratio of the marginal utilities of reserve time to goods consumed. As civilian wages increase, if the marginal utility of reserve service does not increase as fast as the wage difference between the civilian and reserve opportunities, then an individual would be more likely to leave the reserves.

The variable of total earnings was only statistically significant at the $\alpha = 0.05$ level for the fighter pilots, where it was the strongest of all of the variables in predicting separation. After controlling for all of the other variables in the model, a one percent higher earnings in an RC fighter pilot's total annual earnings was associated with a 10.5 percent increase in separation likelihood in the following year.

This result of increased separation did not occur in a statistically significant way for either of the other missions. Summary tabulations of the data showed that, across time and years of service categories, fighter pilots consistently had higher civilian earnings than either the airlift or the refueler pilots, who were both similar in their earnings levels. It is possible that the highest earning fighter pilots perceived that the marginal utility from additional RC service did not keep pace with their increasingly larger wages differentials between civilian employment and RC service. The positive coefficient suggests that as the total earnings of fighter pilots increased, RC service became more expensive for them in terms of lost civilian wages, leading them to separate at a higher rate.

Combined together in the "all missions encompassed" model, the total earnings variable had a coefficient that was significant at the $\alpha = 0.10$ level, again suggesting that as RC service became more expensive in terms of lost civilian wages, separate rates increased. This variable provided another example of the more specific insight that is gained by deeper analysis of career field data, such as through mission level analysis, as Fricker (2002) had recommended.

- *IDP Receipt in the Previous Year.* The coefficients in front of the IDP variable confirmed expectations. Although not statistically significant in the refueler mission, the sign of the coefficient aligned with the other statistically significant coefficients for IDP. Performing duties that earned the receipt of IDP was associated with a lower separation likelihood in the following year. Much like the Hosek and Totten and Fricker studies had found, this finding supports the notion that military members who served in mission areas of imminent danger found their service time more satisfying.

There are many possible reasons for this outcome. RC members may gain greater satisfaction from the opportunity to apply training to real world missions and may gain an increase in personal and professional fulfillment. Especially following the events of September 11th, the duties associated with IDP-receipt missions to areas such as Afghanistan and Iraq reinforce the notion that these RC missions are making an impact on high profile, real world events. In addition to the career fulfillment and patriotism, IDP missions also offer higher financial incentives in the form of special pays and CZTE benefits.

- *Airline Pay Receipt in Previous Year*. The airline employment variable came next. Within the specific mission models, after controlling for all other variables in the model, receiving payment from a major or national airline was only significantly associated with separation for the airlift pilots. The traditional reading of this indicator variable would be that receiving pay from an airline in one year was associated with a 2.8 percent increase in separation in the following year, compared to non-airline employees. Given the reduced airline opportunity that followed September 11th, the coefficient might be read more appropriately as "not receiving a paycheck from an airline in one year was associated with a 2.8 percent decrease in separation in the following year, compared to those who did receive pay from an airline." Summary statistics of the data showed that over 700 RC pilots within the airlift mission stopped receiving pay from the airlines during this period of analysis. It seems plausible that some of these stops were the result of the airline furloughs, and that these members had an additional incentive to stay in the RC and earn as much substitute income as possible.

- *Years of Service*. The years of service indicators met expectations. Although not all of the indicators were statistically significant, all of the coefficients aligned in the appropriate directions. There are two simultaneous explanations for this result.

First, as RC service is a voluntary endeavor, belonging to a higher years of service category reflects that someone has found RC service satisfying enough to remain for more years of service. Thus, the higher years of service categories reflect a self-selection of members who are less likely to separate from the RC.

In addition to the self-selection aspect of years of service, the variable also reflects one of the financial incentives of RC service—a retirement pension. Due to the cliff-vesting nature of the military retirement benefit system—after 20 years of satisfactory service, RC members are fully vested for a pension, but prior to reaching that years of service level, there are no pension benefits—as an RC pilot moves closer to achieving 20 "creditable" years of service, there is a higher financial loss associated with separation. Therefore, as a member approaches 20 years of service—whether 20 "full" years (allowing for immediate pension receipt) or 20 "creditable" years of service that included some amount of part-time service (leading to a pension that begins at age 60)--separation rates should be lower. Table 7-3 shows that those who were within six years of vesting into a pension—the 15-to-19 years of service group—had a lower separation rate than those with 14 years of service or less.

Separation rates should have increased when 20 years of service were reached, and the rates did. A study by Warner and Pleeter (2001) on military discount rates for time and money makes it plausible to believe that the "wait until 60" payoff from a traditional reservist's pension—which might only be viewed as a marginal "extra" to an already secured pension from a civilian job—might not be a significant enough incentive to make traditional RC pilots want to stay beyond the initial vesting point of 20 years. Table 7-3 shows that those with 20 or more years of service had a higher separation rate than those with less than 20 years of service. These results occurred in the individual mission models as well as the “all missions encompassed” model.

The increasing inverse relationship of years of service with separation—through the first 19 years of service—was probably mitigated by the simultaneous effect of the airline furloughs. When considering airline employment, the younger, more junior, airline pilots would be the most likely to be furloughed first and the most likely to want to substitute airline income with RC income. Thus, separation differences between the various categories of years of service will be less statistically significant than they would be during a period of airline industry health because both the junior and the senior RC pilots had incentives to remain in the RC during the airline industry’s downturn.

- *Joined after September 11th.* The indicator for joining after September 11th did not have a statistically significant coefficient. The lack of a statistically significant difference in separation rates between the two cohorts is understandable given the potential opportunity for individual members to self-select the amount of RC service that they would like to contribute. As Figures 7-4 and 7-5 display below, a higher percentage of the post-September 11th cohort served high activation episodes than the pre-September 11th cohort.

Figures 7-4 and 7-5 display the percent of the RC force that recorded at least one episode of high activation within a given year. As Figure 7-4 shows, the percent of the pre-September 11th cohort members who experienced one or more episodes of high activation in 1999 was under 20 percent for the fighter and airlift missions. Probably due to Operation ALLIED FORCE, 35 percent of the refueler pilots had a period of high activation in 1999. By 2000, all of the mission areas were under 20 percent. Between then and 2003, the percent of the various mission pilots that experienced a period of high activation more than doubled. In contrast, the post-September 11th cohort was even greater in its HA service. These members experienced high activation at rates of 35 to 70 percent of the cohort during the years 2002 through 2004.

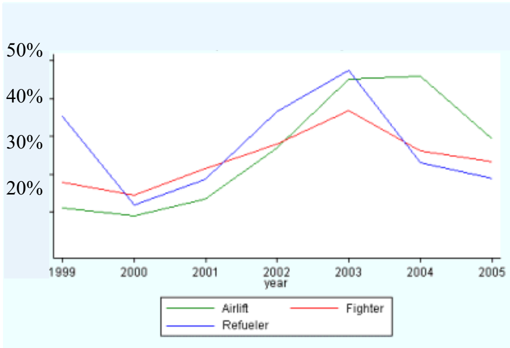

Figure 7-4: Percent Experiencing One or More HA in a Year, Pre-9/11 Cohort

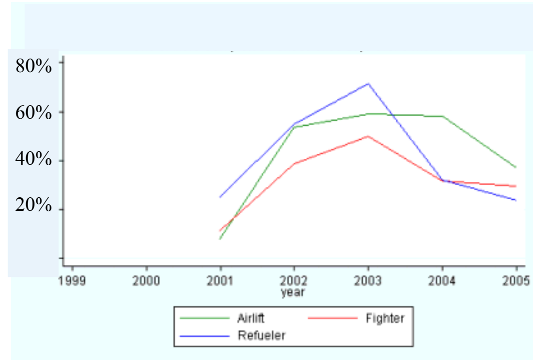

Figure 7-5: Percent Experiencing One or More HA in a Year, Post-9/11 Cohort

This difference in HA service reinforces with the previously mentioned possibility that those RC members who wanted more mission time in the RC were able to serve it, and were more satisfied with their RC service as a result. Also, because these pilots volunteered for more activation, it was not necessary to require the RC pilots who did not want more activation to serve an HA episode. Thus, those RC members who wanted less mission time in the RC were also satisfied with their RC service commitment. Taken together, both were satisfied and did not separate from the RC at a statistically significant, different rate.

- *Year Indicators.* The indicators for the years did not reveal any statistically significant trends across any of the four models. This lack of any year having an associated effect was itself interesting. *Ex ante*, it would be expected that the later years, and their associated furlough environment, would have been associated with lower separation rates. However, as Figure 7-6 and 7-7 show, monthly separation rates did not increase substantially either after September 11th or Operation IRAQI FREEDOM. Monthly separation rates were below one percent and two percent for the majority of the time for the pre-September 11th and post-September 11th cohorts, respectively. [43]

[43] It is worth noting the population difference between the 6,700 RC pilots in the pre-9/11 cohort and the 570 pilots in the post-9/11 cohort, whose fighter separation rate in month 38 of nearly six percent is only 4 fighter pilots.

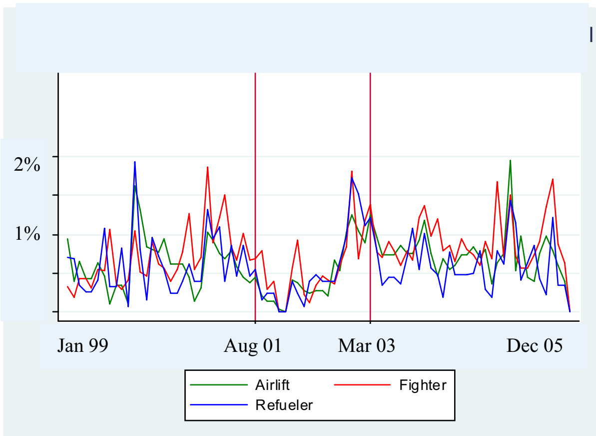

Figure 7-6: Monthly Separation Rate, Pre-9/11 Cohort

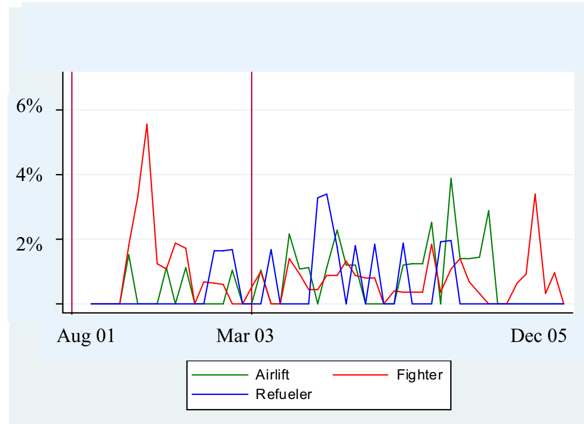

Figure 7-7: Monthly Separation Rate, Post-9/11 Cohort

Given the possibility of self-selection for activation, and the consistently low rate of separation across time, the lack of difference among the years is understandable. These factors combined allow for the possible explanation that the increased RC OPSTEMPO was simultaneously filled by the RC members who saw a decrease in civilian opportunities during that same time period.

- *Pilot Types of "All Missions" Model.* The final sets of covariates concerns how the three mission separation rates compared to one another after controlling for all other variables in the model. In the "all missions encompassed" model, belonging to the airlift mission was associated with a 1.6 percent lower likelihood of separation, while belonging to the refueler mission was weakly associated ($\alpha = 0.10$) with a 1.2 percent lower likelihood of separation. A review of Figures 7-6 and 7-7 shows that the fighter pilot separation rate was slightly higher during much of the period of analysis.

One possible reason for the higher fighter mission separation rate was that fighters did not, as a percent of their force, perform as many IDP-oriented duties as the other mission areas. Their lower foreign duty requirements allowed the fighter RC pilots to contribute more effort and energy into their civilian jobs. Analysis of SSA earnings revealed that, across years and "year of service" groups, fighter pilots consistently had higher civilian earnings. For them, the opportunity costs associated with RC service were higher. This effect might have been enough to account for much of the one and a half percentage point difference between the mission areas.

Taken together, these findings show that activation was correlated with lower separation rates for all three pilot categories. Since the factor of self-selection was missing from the analysis, it cannot be known whether the inverse relationship between activation and separation is causal. There are at least two possible reasons for this self-selection phenomenon. First, those that served greater amounts of activation chose to do so out of a patriotic spirit, and would have had a low separation likelihood even without the HA opportunities. A second possibility is that those pilots that served more activation were individuals who had poorer civilian opportunities, and sought out the HA opportunities partly to substitute for their lower civilian earnings.

VIII. Conclusions

This dissertation has produced a set of findings on the relationships between RC pilot activation, earnings, and separation—relationships that previously received little published review. This chapter reviews the highlights of those findings, their implications for policy, and potential future research that would benefit from those findings.

Findings

First, this research revealed that RC pilots have high annual earnings, with many of them earning over $100,000 per year.

At the same time, RC pilots saw their civilian airline opportunities reduced. EIN-matching showed that only 50 percent of the RC pilot population received earnings from a major or national level airline in 2004, compared to the 70 percent rate of the 2001 force. This decrease in airline employment occurred within a broader airline trend of reduced hiring opportunities and an extensive pilot furlough.

Further, RC pilots who worked for a major airline as a pilot during this period faced substantial salary reductions, cuts in pension benefits, and uncertainty about job security. Many airlines were in bankruptcy status, although some have since begun to recover their fiscal strength and employment stability.[44] Given these circumstances, the steady employment, pay, and pension system of the RC might have made RC service more attractive than it was prior to September 11th.

Two empirical analyses provided more insight into the RC relationships. First, a DiD model of analysis showed that serving "high activation" episodes was associated with an increase in overall pay for airlift pilots, and a positive, but not statistically significant, change in earnings for fighter and refueler pilots. Stated more broadly, the analysis supported the idea that activated RC pilots typically gained in earnings relative to their unactivated peers. The analysis did not support the widely-held belief that activation tended to result in lower pay. This analysis did not control for the possibility of higher expenses incurred by RC pilots during high activation service, such as increased child support costs, self-employed business expenses / losses, and other non-trivial costs. At the same time, the analysis did not account for all of the benefits of

[44] United emerged from bankruptcy status in February, 2006.

increased activation, such as an increase in RC retirement points and the increased access to commissary and BX shopping.

One other limitation of the DiD analysis was that it could not control for a possible estimate bias resulting from self-selection. It is possible that pilots who were most likely to face a pay cut or a furlough at their civilian job might be more likely to volunteer for high activation episodes. This self-selection effect would have led to a downward bias in the estimate of the pay gains associated with high activation.

The second empirical analysis—an LPM model of separation—revealed that a lower separation likelihood was associated with those who had experienced high activation episodes in the prior year. This result was consistent across all three mission areas. Although this result supported the notion that HA service causes lower separation rates, this result also supported the possibility that of a simultaneous influence on separation rates—self-selection. More specifically, it is possible that pilots with a stronger preference for reserve activation, for reasons ranging from patriotism to earnings accumulation, might have been able to influence the likelihood that they were activated. In the LPM regression, this would lead to a downward bias of the true effect of HA service on separation. The causal effect of self-selection for HA service was not measured in the LPM, leaving the precise, causal effect of HA service unknown.

Separation rates were also lower for RC pilots who performed duties that involved receiving IDP. Even after controlling for military and civilian earnings, as well as other covariates, those who served in a mission area of imminent danger displayed a lower separation rate in the following year. This suggested that there were non-monetary influences, such as patriotism, fulfillment from performing important missions, and career development, which brought satisfaction to an RC pilot's experience. This also suggested that my prior assumption that the community-based RC force would not desire foreign deployments was incorrect.

A final finding from the LPM model was that there was not a statistically significant difference in the retention rates between the cohorts of RC pilots who joined before and after September 11th. This suggested that there have not been too many "undesired" high activations for the pre-September 11th cohort.

More generally, this dissertation has demonstrated the value of being able to perform a career field analysis, as Fricker had suggested. The empirical models revealed examples where an individual mission category, within the broader career field of RC pilots, would be the significant driver of a coefficient's significance in an "all missions encompassed" model. For example, Table 6-4 showed that in the DiD "all missions encompassed" model, serving HA episodes was associated with higher annual earnings. However, when the mission areas were analyzed separately, the fighter pilots and refueler pilots did not have an increase in pay associated with HA episodes. Only the airlift mission, with its higher propensity for IDP duties, had an increase in earnings associated with HA service.

Policy Implications

The results of these analyses point toward two policy recommendations. First, the findings of this research suggest that creating additional policies to compensate RC pilots for serving high activation episodes—such as income replacement provisions or bonuses for serving HA episodes—is unnecessary. Pilots who went from serving zero HA episodes per year to some amount of HA service, and who were compensated according to current military policies, tended to have better earnings outcomes than pilots who did not serve any HA episodes.

Second, with regard to personnel force shaping policies, this dissertation showed that the RC's traditional, part-time pilots responded to the post-September 11th OPSTEMPO with a monthly separation rate that fluctuated little, including after periods of high activation OPSTEMPO. The annual RC pilot separation rate hovered around seven percent for its traditional, part-time force. At face value, these findings suggest that it is unnecessary to rebalance the OPSTEMPO responsibility of the RC, by increasing the Air Force's portion of AC pilots, or increasing the number of RC pilots in order to disperse the number of HA episodes experienced by RC pilots, or by requesting reduced OPSTEMPO taskings.

However, the RC's ability to fulfill OPSTEMPO taskings was achieved in part by a portion of the RC pilots volunteering for high activation service, and the RC being able to provide some opportunity for those pilots to volunteer. It is possible that, as the DiD evidence suggested, the RC members who were volunteering for HA service were members with lower total earnings.

If civilian earnings opportunities, such as those within the airline industry, were to increase, then it is possible that the pool of RC pilots that volunteered for HA service might decrease. It is also possible that RC pilot OPSTEMPO could increase to a level where HA service was imposed upon large numbers of RC pilots who would not voluntarily choose such service. In either scenario, HA service might then lead to higher separation rates. Under such circumstances, rebalancing the AC/RC force mix, or increasing the size of the RC so that HA service is dispersed to individuals at a relatively low rate, or requesting a smaller RC OPSTEMPO tasking, would be alternatives worth investigating.

Future Research

In lieu of the decreasing civilian airline opportunities, an evaluation of pilot-specific incentives, such as ACIP and ACP, which were based upon military pay competing with the major airline pay, might be reexamined to see if the same levels of compensation are necessary. My earnings analysis included data only through the year 2004. If the downward earnings trend of individuals continued into 2005 and 2006, then the annual, multi-million dollar pilot incentive pays may now be unnecessarily large, or unnecessary altogether. Alternatively, since my LPM model demonstrated that separation was negatively correlated with military earnings, the pilot-specific incentives might still be necessary.

Of course, any analysis of the incentives must be broader than their costs because retaining experienced pilots is worth more than just the pilots' training and pay costs. As Fullerton (2000) stated in his earlier study, the Air Force must ensure operational effectiveness first, with budgetary efficiency as a close second priority. The pilot force needs an adequate mix of experienced pilots in addition to its junior pilots in order to safely perform its mission. Thus, the cost of the incentive pays should only be viewed as a secondary consideration for judging their effectiveness.

One other area of research to which this research offers a contribution is in the area of force structure studies. In conjunction with other RC force mix studies, such as the previously cited study on force mix by Robbert *et al.*, this research may be used in the formation of parameter values surrounding the attrition rates of RC pilots. Such parameters would be useful in studies that compare the recruiting, training and operational pay costs associated with various RC force sizes that require different levels of activation from its members, and have different separation rates as a result.

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Appendix A: Potential Airline Employers, 1999 – 2004.

Compiled from Bureau of Transportation Statistics, Office of Airline Information

1999	2000	2001	2002	2003	2004
Majors	***Majors***	***Majors***	***Majors***	***Majors***	***Majors***
Alaska	Alaska	Alaska	Alaska	Alaska	Alaska
America West	America West	America West	America West	America West	America West
American	American	American	American	American	American
	American Eagle	American Eagle	American Eagle	American Eagle	American Eagle
	American Trans Air	American Trans Air	American Trans Air	American Trans Air (ATA)	American Trans Air
Continental	Continental	Continental	Continental	Continental	Continental
Delta	Delta	Delta	Delta	Delta	Delta
DHL		DHL			
				Express Jet	Express Jet
Federal Express	Federal Express	Federal Express	Federal Express	Federal Express	Federal Express
Northwest	Northwest	Northwest	Northwest	Northwest	Northwest
Southwest	Southwest	Southwest	Southwest	Southwest	Southwest
Trans World	Trans World	Trans World			
United	United	United	United	United	United
United Parcel	United Parcel	United Parcel	United Parcel	United Parcel	United Parcel
USAIR	USAIR	USAIR	USAIR	US Airways	USAIR
Nationals	***Nationals***	***Nationals***	***Nationals***	***Nationals***	***Nationals***
Air Transport	Air Transport	Air Transport	Air Transport	Air Transport	Air Transport
Air Wisconsin	Air Wisconsin	Air Wisconsin	Air Wisconsin	Air Wisconsin	Air Wisconsin
AirTran	Airtran	Airtran	Airtran	Airtran	Airtran
Aloha	Aloha	Aloha	Aloha	Aloha	Aloha
American Eagle					
American Trans					
Arrow	Arrow	Arrow	Arrow		
				Astar (DHL)	Astar
				Atlantic Coast	
Atlantic Southeast	Atlantic Southeast	Atlantic Southeast	Atlantic Southeast	Atlantic Southeast	Atlantic Southeast
	Atlas Air				
Challenge Air Cargo	Challenge Air Cargo	Challenge Air Cargo	Centurion (Challenge Air)		
		Champion Air	Champion Air	Champion Air	Champion Air
			Comair	Comair	Comair
Continental Express	Continental Express				
Continental Micrones	Continental Micronesia	Continental Micronesia	Continental Micronesia	Continental Micronesia	Continental Micronesia
			DHL Airways		
Emery	Emery				
Evergreen	Evergreen				Evergreen
Executive	Executive	Executive	Executive	Executive	Executive
Express One	Express One				
Frontier	Frontier	Frontier	Frontier	Frontier	Frontier
	Gemini	Gemini	Gemini	Gemini	Gemini
Hawaiian	Hawaiian	Hawaiian	Hawaiian	Hawaiian	Hawaiian
Horizon	Horizon	Horizon	Horizon	Horizon	Horizon
					Independence Air
	Jet Blue	Jet Blue	Jet Blue	Jet Blue	Jet Blue
				Kalitta Air	Kalitta Air
Kitty Hawk Int''l	Kitty Hawk Air Cargo	Kitty Hawk Air Cargo	Kitty Hawk Air Cargo		
	Legend				
					Mesa
Mesaba	Mesaba	Mesaba	Mesaba	Mesaba	Mesaba

Midway	Midway		Midway (US Air Express)		
Midwest Express	Midwest Express	Midwest Express	Midwest Express	Midwest Express	Midwest Express
National	National	National	National		
				North American	
				Omni	Omni Air
					Pinnacle
Polar	Polar Air	Polar Air	Polar Air		
Ryan	Ryan	Ryan	Ryan	Ryan	Ryan
				Sky West	Skywest
Spirit	Spirit	Spirit	Spirit	Spirit	Spirit
Sun Country	Sun Country	Sun Country	Sun Country		
Tower					
Trans States	Trans States	Trans States	Trans States	Trans States	Trans States
USAIR Shuttle	USA Jet	USA Jet	USA Jet		
	Vanguard	Vanguard	Vanguard		
	World Airways	World Airways	World Airways	World Airways	World Airways
Large Regionals	***Large Regionals***	***Large Regionals***	***Large Regionals***	***Large Regionals***	***Large Regionals***
				Aerodynamics	Aerodynamics
				Allegiant	Allegiant
Amerijet	Amerijet	Amerijet	Amerijet	Amerijet	Amerijet
	Capital Cargo	Capital Cargo	Capital Cargo	Capital Cargo	Capital Cargo
			Casino Express	Casino Express	Casino Express
Champion Air	Champion Air				
	Expressnet		Expressnet		Expressnet
		Falcon	Falcon	Falcon	Falcon
Fine Airlines					
Florida West	Florida West	Florida West	Florida West	Florida West	Florida West
				Freedom	Freedom Airlines
Gemini					
					Kitty Hawk Air Cargo
Lynden	Lynden	Lynden	Lynden		Lynden
Miami Air	Miami Air	Miami Air	Miami Air		Miami Air
North American	North American	North American	North American		
Northern Air Cargo	Northern Air Cargo	Northern Air Cargo	Northern Air Cargo	Northern Air Cargo	Northern Air Cargo
Omni		Omni	Omni		
				Pace	Pace
			Pan Am		
					Primaris
					PSA Airlines
Reeve	Reeve				
		Reliant			
				Southeast	
				Sun Country	
Sun Pacific	Sun Pacific				
Tatonduk	Tatonduk	Tatonduk	Tatonduk	Tatonduk	Tatonduk
	Tradewinds	Tradewinds	Tradewinds	Tradewinds	Tradewinds
Trans Continental					
Transmeridian				Transmeridian	Transmeridian
UFS					
			USA 3000	USA 3000	USA 3000
Usa Jet					
Vanguard					
		Zantop	Zantop		
Total Medium Regionals	***Medium Regionals***	***Medium Regionals***	***Medium Regionals***	***Medium Regionals***	***Medium Regional***

Accessair					
Allegiant	Allegiant	Allegiant	Allegiant		
	Ameristar	Ameristar	Ameristar	Ameristar	
Asia Pacific	Asia Pacific	Asia Pacific	Asia Pacific	Asia Pacific	Asia Pacific
				BNJ Charter	BNJ Charter Company
Capital Cargo					
Casino Express	Casino Express				
				Centurion	
					Centurion Air Cargo
Custom Air	Custom Air	Custom Air	Custom Air	Custom Air	
		Expressnet			
Falcon	Falcon				
		Kalitta Air	Kalitta Air		
Lorair					
Pace	Pace	Pace	Pace		
Pan Am	Pan Am	Pan Am			
	Planet	Planet	Planet		
Pro Air					
Reliant	Reliant				
Renown					
Sierra Pacific	Sierra Pacific	Sierra Pacific	Sierra Pacific	Sierra Pacific	Sierra Pacific
			Sky King	Sky King	Sky King
Sky Trek					
Southeast	Southeast	Southeast	Southeast		
	Southern Air	Southern Air	Southern Air		
Sunworld	Sun World	Sun World	Sun World	Sun World	Sun World
Tradewinds					
Trans Air Link	Trans Air Link	Trans Air Link	Trans Air Link		
Zantop	Zantop			Zantop	Zantop

Appendix B: Major and National Airline EINs

Major (M) / National (N)	Name	EIN
M	Alaska Air Group Inc	911292054
M	Alaska Airlines Inc	920009235
M	America West Holdings	860418245
M	America West Holdings	860847214
M	American Airlines Inc	131302798
M	American Airlines Inc	131502798
M	American Airlines Inc	330081882
M	American Trans Air Inc	351305077
M	Continental Airlines Inc	742099724
M	Delta Air Lines Inc	580218548
M	Airborne Express ("DHL")	910837469
M	Federal Express Corporation	710427007
M	Northwest Airlines Corporation	954205287
M	Northwest Airlines Inc World HQ	410449230
M	Southwest Airlines	741563240
M	Trans World Airlines Inc	431145889
M	United Air Lines Inc	362675206
M	United Parcel Service Company	131686691
M	US Airways Shuttle	133487400
M	US Airways Inc	530218143
M	ExpressJet Airlines Inc	753033091
N	Air Transport International LLC	621698134
N	Air Wisconsin UAL	391042730
N	Air Wisconsin Airlines Corp	391767281
N	Aloha Airlines	990064888
N	Arrow Air Inc	592929045
N	Airtran Airways Inc	650440712
N	Airtrain Holdings Inc	582189551
N	Atlantic Southeast Airlines Inc	581354495
N	Challenge Air Cargo Inc	592738544
N	Continental Express Inc	760396099
N	Continental Micronesia	760378377
N	Executive Air Inc	550537295
N	Executive Air Transport	381616681
N	Frontier Airlines Inc	841256945
N	Hawaiian Airlines Inc	990042880
N	Hawaiian Airlines Inc II	990004288
N	Horizon Air Freight Inc	112257658
N	Horizon Air Industries Inc	911201373
N	Kitty Hawk Inc	752564006
N	Kitty Hawk via American Intl Air	382025173
N	Mesaba Airlines	411399425
N	Midway Airlines & US Air Express	363915637
N	Atlantic Coast Airlines / Indpdce Air	770291749
N	Atlantic Coast Airlines Inc	133621051

N	Champion Air	880329499
N	Comair Holdings	311243613
N	JetBlue Airways	870617894
N	Kalitta Air LLC	383512795
N	Mesa Air Group	850302351
N	Midwest Express Airlines Inc	391440079
N	National Air Cargo	161386678
N	National Airlines Inc	860793702
N	Polar Air Cargo	330420245
N	Ryan International Airlines	480801437
N	Spirit Airlines	381747023
N	Sun Country Airlines Inc	411431256
N	Trans States Airlines Inc	431274565
N	USA Jet Airlines Inc	311409276
N	Vanguard Airlines	481149290
N	North American Airlines Inc	330358792
N	Omni Air International Inc	731207159
N	Omni Air International Inc II	200605928
N	Pinnacle Airlines Inc	581605378
N	SkyWest Inc	870292166

Appendix C: Weighted OLS Methodology for SSA Analysis

To illustrate how earnings data are acquired and analyzed from the Social Security Administration, consider a simplified, analogous research example. Suppose a researcher wanted to examine the relationship of high activation periods with separation from the Air Force's RC. Suppose further that there was only one year of data on 4,892 part-time reservists, and that data contained only two variables:

1) Separation from the Air Force, a binary variable where "did not separate" equals zero and "separated" equals one.

2) High Activation (HA) in the previous year, a binary variable where an individual either served zero HA periods, or some amount—up to four "exposures"—of 60 or more days of service in 3 consecutive months.

If a researcher possessed all of the data at the individual level, a typical OLS regression would reveal the relationship between undergoing some amount of HA in the previous year and separating ("sep") from the RC in the following year would be…

```
. regress sep HA60over3MonthsInYearB41plus

      Source |       SS       df       MS              Number of obs =    4892
-------------+------------------------------           F(  1,  4890) =   17.67
       Model |  1.37376231     1  1.37376231           Prob > F      =  0.0000
    Residual |  380.080653  4890  .077726105           R-squared     =  0.0036
-------------+------------------------------           Adj R-squared =  0.0034
       Total |  381.454415  4891  .077991089           Root MSE      =  .27879

------------------------------------------------------------------------------
         sep |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
HA60over3M~s |  -.0336819   .0080117    -4.20   0.000    -.0493884   -.0179754
       _cons |   .1004091   .0053764    18.68   0.000      .089869    .1109491
------------------------------------------------------------------------------
```

In this case, as a "linear probability model," the interpretation of the HA coefficient is that having one or more periods of HA, in the prior year, is associated with a 3.3% decrease in the likelihood of separation during the current year. Note that the number of observations is 4,892.

Suppose that a researcher did not possess individual level data on the separation of members. Instead a data request must be made to a "Separation Administration" (SA). When the researcher sends the 4,892 observations on individuals with one or no amount of HA are sent forward to the SA, the SA would match the individuals to their separation records, and the results, in aggregate, the cross tabulation would look like:

HA60over3MonthsInYearB41plus	sep 0	sep 1	Total
0	2,419	270	2,689
1	2,056	147	2,203
Total	4,475	417	4,892

To protect privacy interests, the Separation Administration will not return separation rates at an individual level. Instead, it will return data for any "bin" that has at least five people in it. In this example, there are four bins, each with hundreds or thousands of members in each bin. Privacy is protected., and all of the separation results will be reported in the bins.

The SA would then compute the separation rates of the eligible bins:

HA60over3MonthsInYearB41plus	sep 0	sep 1	Total
0	2,419 89.96	270 10.04	2,689 100.00
1	2,056 93.33	147 6.67	2,203 100.00
Total	4,475 91.48	417 8.52	4,892 100.00

The two bins of data returned to the researcher would now look like:

HA60over3MonthsInYearB41plus	sep_rate	Number
1	6.67	2203
0	10.04	2689

A weighted regression is used to analyze the two bins, leading to the following results:

```
regress sep_rate HA60over3MonthsInYearB41plus [aweight=Number]
(sum of wgt is   4.8920e+03)

      Source |       SS       df       MS              Number of obs =       2
-------------+------------------------------           F(  1,     0) =       .
       Model |  5.62240558     1  5.62240558           Prob > F      =       .
    Residual |           0     0           .           R-squared     =  1.0000
-------------+------------------------------           Adj R-squared =       .
       Total |  5.62240558     1  5.62240558           Root MSE      =       0

------------------------------------------------------------------------------
    sep_rate |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
HA60over3M~s |      -3.37          .        .       .            .           .
       _cons |      10.04          .        .       .            .           .
------------------------------------------------------------------------------
```

Once again, HA is associated with a 3.3 percent lower likelihood of separation.

Similarly, requests for data from the Social Security Administration may be made, and average earnings are only returned if each bin contains five or more members. Therefore, the fewer the number of bins used to create the data, the less "thin" the data bins will become and the less likely it is that a bin of four or less people will be created, and no data will be returned. For this dissertation's research, the following bins were submitted, which resulted in a data set of usable SSA bins that total 73 percent of the size of the original DMDC data. This "usable rate" was higher than other RC compensation previously published. The bins were:

```
Number of HA periods the Previous Year:     0, 1, 2, 3, 4
Number of HA periods in the Current Year:   0, 1, 2, 3, 4
HFP in the Previous Year:                   0 No, 1 Yes
Mission ID:                                 1 Airlift, 2 Fighter, 3 Refueler
Years of Service:                           0-14, 15-19, 20+
Joined after September 11th:                0 No, 1 Yes
Year of Measurement:                        2000, 2001, 2002, 2003, 2004, 2005
```

Appendix D: DiD and LPM Results with Standard Errors Reported

Table 6-4 with Standard Errors reported in the second row of each variable:

Variable	Airlift	Fighter	Refueler	ALL
For each HA of "60+ during 3 months"" in Year "t+1"	2566	714	1046	2360
	998	2993	2603	944
Years of Service, 15 - 19, versus 14 or less	33289	17098	28204	28137
	1848	3112	3203	1494
Years of Service, 20+, versus 14 or less	52736	32929	47800	46702
	2064	3467	3568	1665
Joined After Sept 11th	-28800	-19573	-25328	- 20460
	9271	6173	12565	4512
2001, vs 2000	7404	10909	10272	8697
	2155	3499	3765	1728
2002, vs 2000	10976	15695	18363	13398
	2280	3715	4107	1841
2003, vs 2000	7987	7840	7592	7607
	2728	4121	4747	2136
2004, vs 2000	-7783	1241	-2160	-4011
	3047	4349	5040	2320
Received pay from an Airline in Previous Year, versus not	33805	41009	28840	34848
	1689	2672	2921	1341
Serves in the Airlift mission, versus as a Fighter Pilot				5138
				1432
Serves in the Refueler mission, versus as a Fighter Pilot				-1367
				1684

Table 7-3 with Standard Errors reported in the second row of each variable:

Variable	Airlift	Fighter	Refueler	ALL
For each HA of "60+ during 3 months" during Previous Year	0.024	0.027	0.02	0.023
	0.005	0.007	0.007	0.003
Log (Military Earnings Previous Year)	-0.037	-0.048	-0.037	-0.039
	0.007	0.009	0.008	0.004
Log (Total Earnings Previous Year)	0.019	0.105	-0.036	0.036
	0.027	0.032	0.033	0.016
Received HFP / IDP during Previous Year	-0.024	-0.033	-0.016	-0.027
	0.008	0.011	0.01	0.005
Received Pay from an Airline in Previous Year, versus not	0.028	-0.017	0.008	0.011
	0.009	0.012	0.01	0.006
Years of Service, 15 - 19, versus 14 or less	-0.049	-0.036	-0.018	-0.041
	0.012	0.013	0.013	0.007
Years of Service, 20+, versus 14 or less	0.041	0.029	0.079	0.041
	0.017	0.016	0.019	0.01
Joined After Sept 11th	-0.035	0.029	-0.052	0.004
	0.032	0.02	0.04	0.014
2001, vs 2000	-0.03	-0.012	-0.004	-0.02
	0.01	0.014	0.013	0.007
2002, vs 2000	-0.024	-0.044	0.012	-0.025
	0.011	0.015	0.015	0.008
2003, vs 2000	0.022	-0.025	0.04	0.011
	0.012	0.016	0.016	0.008
2004, vs 2000	-0.008	-0.018	0.001	-0.009
	0.013	0.017	0.017	0.009
2005, vs 2000	0.007	-0.008	0.026	0.007
	0.013	0.017	0.016	0.009
Serves in the Airlift mission, versus as a Fighter Pilot				-0.016
				0.005
Serves in the Refueler mission, versus as a Fighter Pilot				-0.012
				0.006