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RETIREMENT PAY AND OFFICER RETENTION

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ABSTRACT

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Abstract

We use data from a natural experiment in which retirement benefits were reduced by congressional legislation and later restored to estimate the effect of future retirement benefit eligibility upon the decision of whether to remain in the U.S. military. We find that the generosity of retirement benefits is significantly correlated with the decision to remain in service until members qualify for benefits. The estimated effect of a 20 percent reduction in the generosity of retirement benefits upon the probability of remaining on active duty is equivalent to the effect of a 0.27 percentage point reduction in the unemployment rate, or approximately a 2 percent increase in the GDP growth rate.

1 Introduction

It is somewhat surprising that members of the military, young people who stand ready to enter into combat on behalf of the nation, should place such a high value on retirement benefits. According to Blue Star Families, an advocacy group for military families which conducts an annual survey of military families, 31 percent of respondents (4,000 military families) list a change in retirement

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benefits as their number one concern. (Blue Star Families 2012)[1] Much of this concern may stem from a proposal put forward by the Defense Business Board[2] to replace the current generous defined benefit retirement plan with a defined contribution plan. (Defense Business Board 2011) This recommendation represents a radical departure from the current military pension system, but one that is more comparable with private sector pension systems and also addresses funding shortfalls, as well as some perceived inequities in the system.

The current military retirement system is costly to operate, and expected to become much more so. The annual expenditures required to maintain the current defined benefit program are forecast to increase from $52.2 billion in fiscal year 2011 to $116.9 billion in fiscal year 2035. (Office of the Actuary 2012) According to the Defense Business Board, "Whereas average private sector pension contributions range from 4 to 12 percent per year, military retirement benefits equate to an approximate contribution of 75 percent of annual pay per year." (Defense Business Board 2011) Concern about the sustainability of this system is not new. In 1983, House Armed Services Committee Chair, Representative Les Aspin, described the system as "a time bomb ... ready to go off." Notably, Representative Aspin later championed the one substantial change to the military retirement system (The Military Retirement Reform Act of 1986) which President Reagan signed into law July 1, 1986.[3] Commonly referred to as REDUX, this change reduced retirement benefits for all service members who enter active duty after July 31, 1986. The fiscal year 2000 National Defense Authorization Act repealed the mandatory provisions of REDUX, allowing members to choose between REDUX and the previous military retirement system.

To investigate the effect of the expected generosity of pensions on the decision to remain in the military, we use the passage and subsequent repeal of REDUX as a quasi-experiment. Persons who enter the officer corps just prior to the Congressional action that reduced the expected generosity of military pensions face the same macroeconomic environment and opportunity costs as those

[1]This is the third annual release of the Blue Star Families survey; however, in 2009 and 2010, the survey did not list retirement benefits/changes as an option. Given this is the first survey that includes retirement pay as a separate category, it is difficult to know how this concern has changed over time.

[2]The Defense Business Board (DBB) is established under the authority of the Secretary of Defense, under the provision of the Federal Advisory Committee Act (FACA) of 1972, with the charter to provide "... independent advice and recommendations on critical matters concerning the Department of Defense ... " http://dbb.defense.gov/charters.html The DBB is an independent group of 19 leading business persons with voting authority and four government observers

[3]Public Law 99-348

who enter the officer corps just after. We use this quasi-experiment to estimate the effect of expected future pension generosity on the decision of whether to remain in the military to qualify for retirement benefits.[4] Although REDUX was not in effect long enough to allow members of the military to retire under its provisions, we investigate the decisions of officers to remain in the military, a necessary condition for retirement.

We extend the military retirement literature by estimating the effect of expected retirement generosity on the decision to remain in the military for officers using a survival analysis framework. Most papers in this literature focus on retirement decisions of enlisted members of the military. (Asch and Warner 1994, Asch, Johnson, and Warner 1998, Asch, Hosek, Mattock, and Panis 2008) The major exception, Ausink and Wise (1996), examines military pilots, which are a subset of the larger officer corps. We choose to study all officers except pilots, lawyers, and medical doctors. We exclude these groups from our sample because of specialized rules affecting how these officers enter and leave military service, as well as the differing special bonuses that are available to individuals in these career fields. Our results show that the expected generosity of retirement benefits significantly affects the decision of whether to remain in the military or to separate before becoming eligible to receive retirement benefits.

Our paper proceeds as follows: We review the military retirement system, describe our data, present the theoretical framework of our model, present our results, and conclude.

2 The US Military Retirement System

The military retirement system has seen minimal changes since the passage of the Army and Air Force Vitalization Act of 1948, which standardized the retirement system across all services. For all members who entered the service before September 1980, their projected military retirement benefit was half of final pay[5] while on active duty if the member stayed until they reached 20 years

[4] Members of the military must complete 20 years of active duty service to qualify for a pension.

[5] Final pay is defined as taxable military compensation. Regular military compensation, which is most comparable to civilian salaries, includes allowances, which in some instances might be large, and tax benefits associated with these allowances (Office of the Actuary 2012). For instance, members receive allowances for housing and for subsistence; these do not, however, factor into retired pay calculations. From Office of the Actuary (2012), base pay represents about 69 percent of regular military compensation for all retirement eligible members and 67.3 percent for 20-year retirees; thus, a retiree at 20 years would receive about 33.7 percent of regular military compensation.

of service.[6] For each year of additional service past 20, an additional 2.5 percent is added to the benefit. Retirement payments are generally indexed for inflation, with the CPI index (now the CPI-W) the measure of an increase in the cost of living. For members who enter after September 1980 but before provisions of REDUX became effective on August 1, 1986, an average of the last three years of pay is used versus pay in their final year.

For members who entered between August 1986 and the subsequent repeal of REDUX in 2000, members initially were entitled to 40 percent of their highest three years of military pay at 20 years of service. For each year that a member stays past 20, they would earn an additional 3.5 percent versus the 2.5 percent under the previous plan. Thus, a member who stays 30 years under REDUX would almost have the same retirement benefit as one who retired before REDUX. [7] The National Defense Authorization Act for Fiscal Year 2000 repealed the mandatory provision of REDUX. After its repeal, members could opt to take REDUX upon reaching 15 years of service; to make this option more attractive, members receive a one-time taxable payment of $\$30,000$.

The American system of vesting after 20 years of service stands in contrast to that of some major military allies. Both Canada and the United Kingdom offer the possibility of partial retirement benefits. The United Kingdom offers benefits after just two years of "reckonable service", while Canada offers the possibility of a deferred annuity at age 60 for members who have just two years of pensionable service.

U.S. military members who involuntarily separate typically receive involuntary separation pay; however, a member who chooses to leave on their own prior to reaching the requisite number of years of service does not receive any pension benefit. One caveat, though, is that military members are currently allowed to contribute pre-tax, non-DOD matched dollars to a 401-K plan, known as the Thrift Savings Plan (TSP), which heretofore was only open to Federal civilian employees. This option was established with the passage of the defense bill in FY2001.

There is evidence that military members are concerned about the lack of pension benefits

[6]The military retirement system includes individuals who served for at least 20 years on active duty and chose to retire, individuals who retired early due to disability, and individuals who served in the reserves and satisfied the reserve criteria for retirement, of which the biggest difference is that reservists must wait until they reach 60 years of age to begin drawing retirement.

[7]Under REDUX, members also received a 1 percent reduction in their cost of living increase until age 62. At age 62, there is a one-time catch-up in the retirement pay amount; for each year after age 62, a member covered under REDUX would continue to receive a cost of living increase as measured by the CPI less one percent.

before reaching 20 years of service. A 2008 TSP survey found that the average plan participant contributed 11.8 percent of their base pay, or an average annual contribution of $8,824 (Watson Wyatt Worldwide 2008). A separate study conducted by the Defense Manpower Data Center (DMDC) reported an average contribution rate of 6.1% (DMDC Report # 2009-002, 2009). Ninety five percent of the respondents stated the reason for participating was to save more money. While this may seem obvious, 10 percent responded they participated because they were advised to by their career counselor, and 10 percent responded they participated because they were advised to participate by their commander. A more recent survey of approximately 19,000 active duty members revealed that 46 percent of DOD respondents were currently participating in the TSP program; however, this number is skewed upward as the Navy's participation rate on this survey is 65 percent, with no other branch of service exceeding 44 percent (Defense Manpower Data Center 2011).

This same survey revealed that military members generally understand the apparent generosity of their retirement benefits, even as many of them fail to serve long enough to earn this benefit (Defense Manpower Data Center 2011). Fifty two percent of overall respondents were either satisfied or extremely satisfied with the military retirement system[8]. Less than half (45 percent) of respondents for the Army and Marine Corps responded that they were either satisfied or extremely satisfied, while at the high end, 63 percent of Air Force respondents were either satisfied or extremely satisfied. Only one demographic, male enlisted members, fell below 50 percent when answering this question, with the answers from Army and Marine Corps enlisted members pulling this average below 50 percent. When asked how they felt their retirement benefits compared to those of their high school classmates, 76 percent responded either "better" or "much better" than their high school peers[9]. When asked if saving for retirement was a goal, 48 percent indicated they were currently saving for retirement, with only 42 percent of enlisted respondents currently saving, as compared to 77 percent of officer respondents who are currently saving.

There are two remaining concerns regarding the U.S. military retirement system: the equity of a system that requires 20 years before it vests, and its cost. The Defense Manpower Commission

[8]By comparison, 76 percent of respondents were either satisfied or extremely satisfied with medical benefits.
[9]For this question, health care scored 82 percent.

in 1976 first looked at the cost of the military retirement system. At that time, several recommendations were made to slow the growth in costs, one of which was to allow members who occupied combat jobs to retire with 20 years of service, while those occupying non-combat jobs could retire after reaching 30 years of service (Hudson 2007). While this recommendation was not implemented, there were no less than nine subsequent attempts to review the military retirement system, a few which implemented changes (such as REDUX) (Hudson 2007). Some were stand-alone reviews, while others were conducted under the auspices of reviewing total military compensation; nonetheless, cost and equity were primary considerations in most, if not all of these initiatives.

Since the Defense Manpower Commission of 1976, the number of military members receiving retirement pay has grown by 76 percent, from 1.1M to 1.93M in 2011 (Office of the Actuary 2012). As of Fiscal Year 2010, there were approximately 440,000 more retirees than active duty members and full-time reservists.[10] Retirees are also living longer. Figure 1 shows the growth in retirees in each age group. While this growth rate may not seem alarming, the size of the annual pension obligation has grown orders of magnitude more than the growth in retirees, equaling 596 percent growth (from $7.3B to $50.7B) over this same period. (Office of the Actuary 2012) The Congressional Budget Office (CBO) projects this number will increase by 50 percent over the next ten years, (Congressional Budget Office 2012) while it is expected to grow five-fold by the year 2060. Due to this explosive growth in retirees and obligations, the pension fund is currently only 26 percent funded. (Office of the Actuary 2012)

Of the 1.4M current active duty retirees who chose to retire (non-disability retirees excluding retired reservists), more than half retire at 20 years of service (51.9 percent), 63 percent retire within the first two years of eligibility, and almost 73 percent retire within their first three years of eligibility.(Office of the Actuary 2012) This suggests there may be pent up demand to retire and that some people may extend their time of service in the military simply to avoid the loss of retirement benefits[11]. From 1993 to 2002, though, DoD temporarily offered members the opportunity to retire with as little as 15 years of service, accepting a 1 percent reduction for each year of service less

[10] A full-time reservist is someone who is serving in an active duty status but belongs to the active reserves.

[11] Members selected for separation involuntarily may receive a lump sum payment that is based on their rank and years of service. For example, an E-6 with 15 years of service would receive approximately $62,000. A captain (O-3) with 8 years of service would receive approximately $52,000. There are many stipulations, though, to earn full involuntary separation pay.

than 20 years, up to a maximum of a 5 percent reduction in their immediate annuity; to encourage participation, any member accepting early retirement was treated as a regular military retiree concerning any cost of living protection. During this time, only 2.5 percent of all eligible officers and 3.4 percent of all eligible enlisted members accepted this offer, for a blended take rate of 3 percent.[12]

The number of enlisted and officers at each rank (military end-strengths) are determined by law annually, giving rise to the moniker "up-or-out". Enlisted members are subject to high-year tenure rules, while officers are governed by the Defense Officer Personnel Management Act (DOPMA) of 1980. The small proportion of those who enter active duty and then stay to retirement is quite stark: a military compensation study conducted in 2006 calculated the probabilities of reaching 20 years of service for enlisted members and officers is less than 10 percent and 40 percent, respectively. (Defense Advisory Committee on Military Compensation 2006) Warner (2008) shows similar survival rates for enlisted, but much lower rates (approximately 20 percent) for officers. The 2006 DACMC study also shows the proportion of loss over time for a given cohort, based on steady-state loss rates. The highest proportion of loss for both officers and enlisted members occurs at the four-year point (see Figure 2). The lowest observed proportion of loss for enlisted members at the four-year point is 18 percent, with the Marine Corps experiencing a proportion of loss in excess of 40 percent. The trend quickly drops below 5 percent and then reaches steady-state around the 11-year mark. For officers, it is not nearly so well defined. The peak occurs at the four-year point, as well, with an average proportion of loss across all four services of about 13 percent, but the decline to steady state is much more gradual, with three services seeing a proportion of loss for officers above 5 percent, even as late as year 10, reaching the steady-state around the 14-year mark. For both enlisted members and officers, the next largest spike is at the 20-year point. Warner (2008) generally has lower survival rates at each year of service, but the overall conclusion is that, while the system is costly, a surprisingly small number of members actually collect retirement benefits. Given this small number, we now turn our attention to whether the expected generosity of future retirement benefits affects the decision to remain in the military on active duty.

[12]On the basis of these choices Warner and Pleeter (2001) estimated discount rates ranging from 10% to 19% for officers, and 35% to 54% for enlisted.

3 Data

Our work draws on data that are maintained at the Defense Manpower Data Center (DMDC). Our interest focuses on the retirement system's effects on active duty military members; as such, DMDC provided us with every active duty military member from 1981 through 2011. For this quasi-experiment, though, we only use those officers who initially enter military service within 12 months of the start of REDUX. The data consist of an observation that indicates when a transaction took place, with transaction defined as either a gain or loss to active duty. The data also include an annual update, describing the pay and demographic characteristics at each year of military service.

We gather military pay data from the Defense Finance Accounting Service, which maintains historical pay tables across the relevant time span. Over the 30 years of our larger data set, military wages, adjusted for inflation using the Consumer Price Index, grew at an average annual rate of 0.8%. During the same time period, civilian wages as calculated from the Employment Cost Index and adjusted for inflation by the CPI, grew at an average annual rate of 0.2%. We use these growth rates to project expected wage and retirement benefit growth. [13] We use broad occupational categories collected from the Current Employment Statistics series maintained by the Bureau of Labor Statistics as an estimate of alternative civilian wages. We use weekly average wages across broad civilian categories, which are necessary to have observations that span the entire timeframe of our military data, and converted these into annual, real earnings using the CPI. We use probabilistic life expectancies in the expected utility calculations taken from life tables as prepared for actuarial study 120, which is a report produced every three years by the Social Security Administration. (Bell and Miller 2005) The probability of survival beyond age 115 is effectively zero.

From the summary statistics of our data in Table 2, the treatment and control groups are broadly similar, despite a disparity in the size of each group. Officers in both groups commit to the military when they are 20 years old. Eighty five percent of the control group is male, compared to eighty three percent males in the treatment group. Native Americans make up less than 1 percent of each group; Asians make up 3 percent of each group; African-Americans make up 9.5 percent of the control group but only 8.5 percent of the treatment group; finally, Hispanics make up about 5

[13] Military retirement is fully indexed for inflation, starting the year after the individual retires, except for those who accepted the REDUX retirement.

percent of each group. The biggest disparity between the treatment and the control group occurs in the composition of the services, with Army officers making up 38 percent of the control group, but only 25 percent of the treatment group. Additionally, only 24 percent of the control group are Air Force officers, as compared to 32 percent of the treatment group. Finally, there are 4,223 officers in the control group and approximately 3,549 officers in the treatment group. Ideally these numbers would be equal, but the relative similarity of the demographics between the two groups is reassuring. .

4 Model

We choose to model the effect of reducing the expected value of retirement benefits upon the decision of whether to remain in the military as a regression discontinuity within a survival analysis framework. A growing number of studies use the regression discontinuity design (RDD) framework to study the effect of a discontinuous change in an explanatory variable upon the treatment group in a quasi-experimental setting. (Angrist and Lavy 1999, Black 1999, Carrell, Hoekstra, and West 2011) Here, we use a RDD to investigate the effect of reducing retirement pay from 50 percent of average final pay to 40 percent.[14] A necessary assumption of the RDD approach is that determinants of the outcome variable other than the one containing the discontinuity (here the passing and implementation of REDUX) be continuous through this same time period. Military officers can come from three major sources: military service academies, the Reserve Officers Training Corps (ROTC), and the Officer Training School (OTS). To attend a military service academy, one must obtain an appointment from their Congressional Representative, Senator, or the President or Vice-President of the United States. Given the lengthy lead-time in securing an appointment, we consider it very unlikely that a forward-looking person could accelerate their acceptance into a service academy to qualify for a more generous retirement pension. Likewise, a potential entrant into ROTC or OTS would be unable to accelerate their commitment time to avoid provisions of REDUX, as ROTC commitment times are a function of fall class schedules and OTS start times are centrally controlled by the military personnel center for the service they are planning to join. We acknowledge

[14]Hahn, Todd, and Van der Klaauw (2001) show that RDD is appropriate for this type of study. "It would be of interest, for example, if the policy change being considered is a small change in the program rules ... ".

the theoretical possibility that a person considering joining the officer corps around July 1986 could be advised to accelerate their commitment time to qualify for more generous pension benefits, but believe it to be very unlikely and do not see significant evidence of this occurring in Table 2.

The decision of whether to remain in the military must compare the value of the stream of payments received in the military including military retirement with the stream of payments that would alternatively be received in the civilian labor market. In the retirement literature, previous studies have used a dynamic programming approach, (Duala and Moffitt 1995) an option value approach, (Stock and Wise 1990, Samwick 1998, Asch, Haider, and Zissimopoulos 2005) and peak value. (Coile and Gruber 2001). While stochastic dynamic programming models are computationally more complex, Lumsdaine, Stock, and Wise (1992) set out to test the performance of dynamic stochastic programming models as compared to option value models as developed by Stock and Wise (1990), recognizing that "...more complex specifications may presume computational facility that is beyond the grasp of most real people." (pg 22) They conclude that both models perform better than other alternatives, based on in- and out-of-sample predictions, but that neither is preferred to the other.

In the standard application of the option value approach, individuals compute the expected gain of retirement in each future year relative to the present, and choose to retire if the expected gain is negative for all future retirement dates. (Stock and Wise 1990, Ausink and Wise 1996) Expected future income and pension benefits are discounted to the present, weighted by the probability of survival, and exponentiated by a risk aversion parameter, γ. Pension benefits are further weighted by a parameter to reflect the additional utility of pension benefits over equivalent wage income given leisure time does not need to be given up to earn pension benefits. For a member of the military with $t < 20$ years of service, the option value of retirement can be computed as

$$\begin{aligned} G_t(20) &= \sum_{s=t}^{19} \delta^{s-t}\pi(s|t)\mathbb{E}_t Y_s^{\gamma} + \sum_{s=20}^{R} \delta^{s-t}\pi(s|t)\mathbb{E}_t C_s(20)^{\gamma} \\ &+ \sum_{s=20}^{T} \delta^{s-t}\pi(s|t)k\mathbb{E}_t B_s(20)^{\gamma} - \sum_{s=t}^{R} \delta^{s-t}\pi(s|t)\mathbb{E}_t C_s(t)^{\gamma} \end{aligned} \quad (1)$$

for discount rate δ, military salary in year s, Y_s, civilian salary in year s contingent upon starting

in year t, $C_s(t)$, and retirement benefits in year s contingent upon retiring in year 20, $B_s(20)$, the probability of survival to year s given survival to year t, $pi(s|t)$, risk aversion parameter γ, retirement from civilian employment at year R, and maximum possible length of life T. k is the additional utility of retirement income relative to wage income.

According to Samwick (2001), "Peak value is defined as the maximum increment to the actuarial present value of future retirement benefits for any possible year of retirement." (pp 348) If military pay exceeds the next best alternative civilian wages, as it does in aggregate for wages we compute from Current Employment Statistics, and given the vesting of retirement benefits at 20 years of service, the peak value must occur for retirement at 20 years of service. Our data show that there is an extraordinarily large exodus of military members when they reach 20 years of service, [15] when they first become eligible to receive retirement benefits. For their analyses, Samwick (1998) and Asch, Haider, and Zissimopoulos (2005) set $\gamma = 0.75$ and $k = 1.5$. For values of $\gamma < 1$, members prefer a more even distribution of income over time.

Samwick (2001) explains that in a peak value framework, future earnings, the first term in equation (1), are omitted, $k = 1$ and $\gamma = 1$. As a result of these changes, peak value "evaluates the financial gains to delaying retirement to the most advantageous year." (Samwick 2001) (pp 348) Because wage income is omitted, peak value estimates now compare income allocations within retirement. As such, a scaling of the utility of retirement income is without effect. With $\gamma = 1$, the previous preference of a more smooth distribution of income over time is removed. Since defined benefit pensions are annuities, the distribution of retirement income is by definition equal over time. γ can be restricted to 1 without a loss of generality.

For our calculations of the present value of military wages, civilian wages, and military retirement, we set $\gamma = 1$, as in the peak value framework. We believe this is appropriate due to the proscribed nature of military pay. Military rank and years of service alone determine pay. Although far more personal discretion exists in the civilian labor market, we use the CES wage series as an estimate of wages. Due to the lack of variation across individual observations within each year, γ can be set to 1 without loss of generality.

[15] Defense Manpower Data Center research shows that 52 percent of officers retire at 20 years of service, with fully 73 percent of members leaving by 23 years of service.

We next consider the discount rate. Samwick (1998) and Asch, Haider, and Zissimopoulos (2005) both use a discount rate of 5% in their studies of duration to retirement in the broader civilian workforce and federal civilian workers respectively. We acknowledge the personal discount rates of 10% to 19% estimated by Warner and Pleeter (2001) for officers of the U.S. military, but find such rates to be inconsistent with the broad participation observed in elective savings for retirement by officers under the Thrift Savings Plan. We choose for our main specifications present values calculated with a discount rate of 3%, or $\delta = 1/(1 - .03)$. Results estimated with discount rates up to 10% yielded qualitatively similar results.

To examine whether changes in the expected generosity of retirement benefits affect individual officers' decision to remain in the military, we choose a survival analysis framework. This model has been used in the economics literature to model the duration to retirement, (Hausman and Wise 1985) the duration of spells of unemployment, (Lancaster 1979) and the effects of tax cuts on entrepreneurial longevity. (Gurley-Calvez and Bruce 2008) Likewise, we use a duration model to estimate the effect of the change in the generosity of retirement benefits caused by the passage of REDUX upon the "survival" (or non-separation) of a military member into the following time period controlling for demographic and financial characteristics. Thus, we "follow" the two groups of officers: the control group of officers which consists of those who became officers in the 12 months preceding REDUX implementation, and the treatment group which consists of those who became officers within 12 months after REDUX. This experiment concludes at the end of 1999 with the repeal of REDUX. [16].

Duration models are broadly classified as either a proportional hazard, where each member's individual hazard function (probability of experiencing an event through time) is a vertical shift of a common non-parametric hazard function, or an accelerated failure time specification in which the hazard function is parametrically determined. Our data rejected the proportional hazards hypothesis for all but two variables and for the overall model, leading us to choose an accelerated failure time specification.[17]

In an accelerated failure time model, the time to failure is accelerated by a linear function of

[16]We use the date of initial entry to military service (DIEMS) relative to August 1, 1986 to place officers in the treatment or control groups.

[17]Results of proportional hazard specification tests are available from the authors upon request.

the explanatory variables.

$$\ln(t) = X\beta + \epsilon \tag{2}$$

where ϵ is assumed to follow a statistical distribution, the most popular of which are exponential, Gompertz, Weibull, generalized gamma, lognormal, and loglogistic. The irregular shape of Figure 2, Years of Service Completed at Separation, does not neatly conform to any of the shapes generated by the previously mentioned distributions, complicating our choice of which distribution to use. Of the distributions mentioned above, the generalized gamma alone is able to model regions of decreasing hazard, then increasing hazard. This "bathtub shape" accounts for the popularity of this functional form in mortality-based studies. The other functional forms above specify hazard functions that are either monotonically decreasing, monotonically increasing, but never with regions that are both decreasing, then increasing. In addition to allowing more flexible shapes, the Weibull, exponential, and lognormal distributions are all special cases of the generalized gamma distribution and can be tested within a nested structure. Thus we begin with a generalized gamma distribution. When allowing the categorical variable redux to affect the shape of the survival function, we failed to find a statistical difference between the generalized gamma and lognormal specifications. Therefore, we assume a lognormal distribution. We note that Warner and Pleeter (2001) use both a linear and lognormal model in their analysis of personal military discount rates.

5 Results

Table 3 presents present values of military wages, civilian wages, and expected future retirement benefits by military years of service contingent upon serving 20 years and qualifying for military retirement benefits. All figures reported are in thousands of 1982-84 dollars. The present value of military wages for both the control and treatment group are broadly similar across all years of service, with the largest difference equal to $3,000 in the eleventh year of service, and all years of service for the treatment group are slightly larger than the control group. This is not unexpected, as real military wages grow at an annual rate of 0.8% in our 30-year sample. The story is the same for the present value of civilian wages, with no difference exceeding $2,000. Unlike the present value of military wages, the present value of civilian wages is higher for the control group for 5 of

the 8 different years of service. As expected, there is a significant difference in the present value of retirement benefits. Members who entered after REDUX received 40 percent of average final base pay versus 50 percent for those who entered before. Consistent with this change, the present value of military retirement benefits are approximately 20 percent less in the treatment column relative to control. We now turn our attention to whether this difference affects the probability of continuing on active duty.

In all years, the percentage of officers who separate from a particular years-of-service category is larger in the treatment group than the control group, except for the eleven years-of-service category. When grouping by years-of-service, from five years through seven years, more than twice as many officers (by percentages) in the treatment group exit as compared to the control group. For those with five years of service, 4 percent of the cohort in the treatment group separated, while only 1 percent in the control group separated. This again, suggests that members of the treatment group are more likely to separate as compared to the control group. We estimate various RDD specifications to parametrically estimate the effects associated with the reduction in retirement benefits. Table 4 presents the results of a series of estimations, starting from a simple model that only includes a variable representing the discontinuity, to the full specification with controls for age at commitment to the military, wage variables, and demographic variables.

Within the duration framework, the accelerated failure time models estimate the effect of a variable on the probability of survival. Thus, positive coefficients represent an increased probability of survival, which in our context is remaining on active duty. For model 1, our simplest specification, the estimated coefficient associated with the regression discontinuity is negative and significant at the 0.01 level. This indicates that officers affected by REDUX are more likely to exit the military. This is consistent with evidence from Table 3. Specification 2 adds controls for officers who are in the different branches of service. Redux remains both economically and statistically significant, although the coefficient is marginally smaller. Notwithstanding this difference, after controlling for branch of service, officers who entered with reduced retirement benefits are more likely to exit active duty. Model three adds additional control variables that account for gender, marital status, and a service member's age at the time of commitment. The coefficient on REDUX becomes larger, but none of the other controls appear to be statistically significant. We first added a control

variable for ethnicity, which was broadly defined to include any minority group. This variable was statistically insignificant. When we further disaggregated this variable into the four major racial or ethnic groups, African-American and Hispanic members are both statistically significant but with different outcomes. Members who are African-American are more likely to remain on active duty, while Hispanic members are more likely to exit relative to the omitted category of Caucasians. When aggregated, the individual effect of belonging to a specific racial or ethnic minority group is muted to the point of statistical insignificance. This heterogeneity warrants further study, but is beyond the scope of this paper.

Model four is our most robust specification. Model four includes all control variables as previously estimated in model three, as well as the present value of military wages and the present value of civilian wages. We also add the contemporaneous unemployment rate and the growth rate for real GDP to proxy for the strength of the economy when a member is faced with making the decision of whether to separate. The fully specified results are dramatic. REDUX remains significant at the 0.01 level and becomes slightly larger in magnitude. Exponentiating the REDUX coefficient in model four suggests that members who enter under the reduced retirement benefit are 39 percent more likely to separate in any given year. This is a 4.5 percentage point increase in the likelihood of separating when compared against the estimated effect from model one, and almost an 8 percentage point increase when compared against model 3. Curiously, neither the present value of military or civilian wages were significantly different from zero. The variables representing membership in a racial or ethinic minority group retain the same pattern as they did in the previous specification. Both African-American and Hispanic grow in magnitude, but Hispanic is now only marginally significant. Being African-American or Hispanic still has the same economic effect, although both grow in magnitude. Under this specification, members who are married are now significantly more likely to stay until the next year. Being married was not statistically significant in model 3. Concerning the macroeconomic control variables, unemployment is positively and real GDP growth negatively correlated with duration with both significant at the 0.01 level. Although average wages as an indicator of macroeconomic strength do not appear to have a significant effect upon duration, the unemployment rate and real gdp growth does.

We are encouraged that the coefficient on REDUX, which we label as Reduced Retirement

in Table 4, remains significant at the 0.01 level and of roughly the same magnitude as we add additional explanatory variables from specifications 1 through 4. The estimated effect of less generous retirement benefits upon the probability of remaining on active duty is equivalent to the effect of a 0.27 percentage point reduction in the unemployment rate, or approximately a 2 percent increase in the GDP growth rate. We find that reducing the generosity of retirement benefits, as did REDUX, does lead to a significant decrease in the probability of remaining in the military. But due to a lack of statistical significance in the estimated effect of military wages, we are not able to estimate the increase in military wages that would be necessary to counteract this effect.

6 Conclusion

The US military retirement system, little changed since 1948, offers a pension of 50 percent of basic pay from the final 3 years of service for the life of the beneficiary after 20 years of service. These benefits appear quite generous when compared to those of allied nations and the American private sector, and are becoming increasingly costly to the Department of Defense (DoD). Surveys of military members indicate that many do understand the generosity these retirement benefits and are concerned about the possibility of changes to the system.

The Military Retirement Reform Act of 1986 reduced the retirement benefit to 40 percent of basic pay. The provisions of this act were later repealed by the Fiscal Year 2000 Defense Authorization Act. This quasi-experiment provides an opportunity to examine the effect of generosity of retirement benefits on the probability of remaining in the military. Using a regression discontinuity design within a survival model, we find that the reduction in benefits does significantly reduce the probability of remaining in the military. We estimate comparable effects upon officer retainment from a 0.27 percentage point reduction in the unemployment rate, or a 2 percent increase in the GDP growth rate.

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Figure 1: Change in Retirees

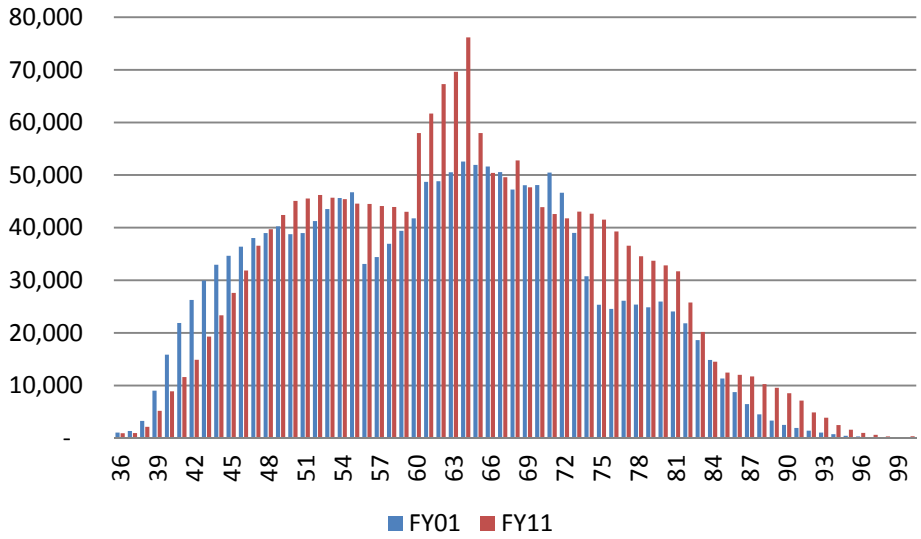

Figure 2: Years of Service Completed at Separation: Officers, Enlisted

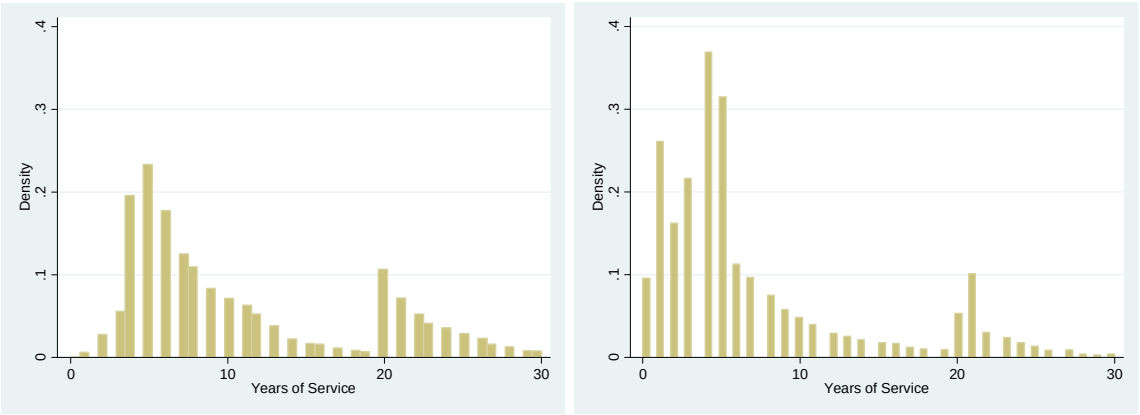

Figure 3: Smoothed Hazard Estimates for Treatment and Control Groups

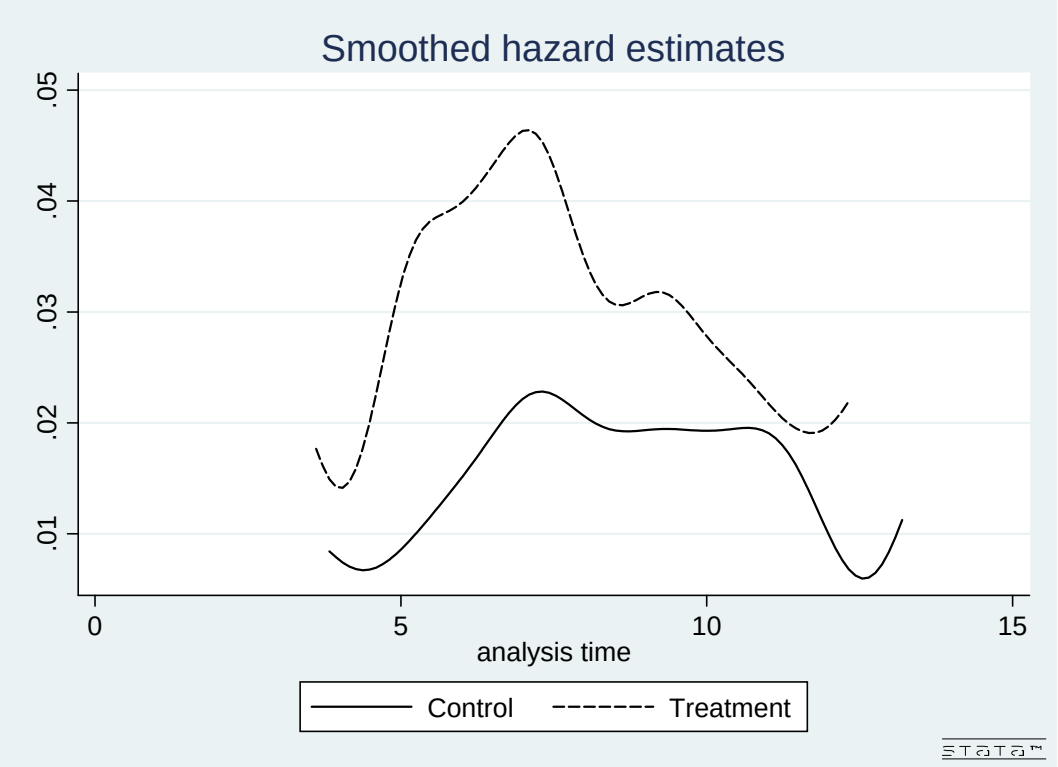

Table 1: Comparison of Two Most Prevalent Retirement Plans

	High Three	**REDUX**
Base Pay Amount	Average base pay in highest 36 months excluding bonuses	Average base in highest 36 months excluding bonuses
Percent of Base Pay Received in Retirement	$0.5 + 0.025 \times (S - 20)$	Age < 62: $0.4 + 0.035 \times (S - 20)$ Age > 62: $0.5 + 0.025 \times (S - 20)$
Cost-of-living Adjustment	Base Pay Amount Increases with CPI	Age < 62: Base Pay Increases by $CPI - 1$ Age $= 62$: Base Pay Amount set to High Three Age > 62: Adj. Base Pay Increases by $CPI - 1$

Table adapted from Jennings and Riechenstein (2001) with permission

Table 2: Selected Summary Statistics

	Control		Treatment	
	Mean	(sd)	Mean	(sd)
Age of Commitment	20.57	(3.00)	20.19	(2.88)
Female	0.15	(0.35)	0.17	(0.37)
Max Years of Service	9.10	(1.79)	8.02	(1.96)
Asian	0.03	(0.17)	0.03	(0.16)
Black	0.09	(0.29)	0.08	(0.27)
Hispanic	0.05	(0.22)	0.06	(0.23)
Native American	0.005	(0.07)	0.005	(0.07)
Army	0.38	(0.49)	0.25	(0.46)
Air Force	0.24	(0.42)	0.32	(0.47)
Marines	0.03	(0.16)	0.06	(0.23)
Navy	0.35	(0.48)	0.34	(0.47)
Divorced	0.02	(0.12)	0.02	(0.14)
Married	0.69	(0.46)	0.65	(0.48)
Never Married	0.29	(0.46)	0.33	(0.47)
Observations	29,488		21,339	
Number of Officers	4,223		3,549	

Table 3: Present Value of Wages and Retirement Benefits by Years of Service

Years of Service	Control				Treatment			
	PV Mil Wages (sd)	PV Civ Wages (sd)	PV Mil Pension (sd)	Exits (obs)	PV Mil Wages (sd)	PV Civ Wages (sd)	PV Mil Pension (sd)	Exits (obs)
4	369.91	318.95	268.69	21	370.05	317.45	216.47	59
	(5.32)	(2.72)	(18.50)	(4,225)	(5.36)	(2.07)	(15.26)	(3,557)
5	356.55	301.75	276.01	45	357.98	300.92	222.49	150
	(4.68)	(1.99)	(18.67)	(4,093)	(3.35)	(2.65)	(15.31)	(3,404)
6	343.21	285.30	283.65	68	344.67	284.41	228.40	138
	(3.53)	(2.60)	(18.80)	(3,925)	(3.14)	(1.99)	(15.74)	(3,180)
7	328.31	268.09	292.02	103	329.49	268.69	235.00	150
	(3.42)	(2.06)	(19.40)	(3,774)	(4.05)	(2.62)	(16.41)	(2,861)
8	312.77	251.22	300.10	70	312.46	250.90	239.91	59
	(4.01)	(2.14)	(20.18)	(3,391)	(4.30)	(2.35)	(17.31)	(1,879)
9	294.70	233.53	307.93	61	295.33	233.45	246.35	63
	(3.81)	(2.11)	(21.50)	(2,586)	(4.52)	(2.68)	(17.99)	(1,468)
10	275.23	214.78	314.62	47	276.34	215.41	252.21	36
	(3.43)	(2.17)	(22.79)	(2,003)	(4.09)	(2.40)	(18.99)	(928)
11	254.90	196.23	322.65	34	257.60	198.90	259.52	10
	(4.28)	(1.85)	(24.37)	(1,390)	(3.69)	(1.15)	(20.95)	(568)

Notes: All values reported are deflated by the Consumer Price Index to 1982-84 dollars. Present values are calculated using a 3% discount rate and the expected probability of survival from Social Security Life Tables.(Bell and Miller 2005)

Table 4: Survival Model Specifications

VARIABLES	(1) ln(t)	(2) ln(t)	(3) ln(t)	(4) ln(t)
Reduced Retirement	-0.428**	-0.329**	-0.384**	-0.500**
	(0.037)	(0.033)	(0.041)	(0.108)
Married			0.013	0.255*
			(0.041)	(0.112)
Divorced			0.080	0.300
			(0.170)	(0.530)
Female			0.019	-0.065
			(0.052)	(0.140)
African American			0.208**	0.538**
			(0.077)	(0.195)
Asian			-0.031	0.258
			(0.110)	(0.268)
Hispanic			-0.240**	-0.330+
			(0.072)	(0.182)
Native American			0.259	0.580
			(0.293)	(0.683)
PV Military Wages				0.012
				(0.011)
PV Civilian Wages				-0.014
				(0.009)
Unemployment Rate				1.870**
				(0.182)
Real GDP Growth Rate				-0.273**
				(0.091)
Branch of Service	No	Yes	Yes	Yes
Age Cohort	No	No	Yes	Yes
Observations	50,827	50,827	50,827	50,827
Number of Clusters	8077	8077	8077	8077
σ	0.918	0.831	0.933	1.666
Log Likelihood	-3093	-2876	-2818	-2333
χ^2	130.9	338.9	296.5	254.5

Notes: Robust standard errors in parentheses are clustered by officer. ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$.