The Virtues of Patience:
Saving, Financial Well Being, and Awareness

John T. Warner*

Saul Pleeter

Curtis J. Simon

May 23, 2011

Abstract

This paper uses Warner and Pleeter's (2001) methodology to estimate the personal discount rate (PDR) for military personnel who were given the choice between receiving an immediate $30,000 bonus or increased retirement annuity. The estimated median PDR ranges from 2% for officers to 11% for enlistees, far less than the 7-31% rates estimated in the earlier study. We attribute the difference to the fact that individuals in the earlier study were involuntarily separating from the military while those in the current study are virtually guaranteed vesting in the pension of their choice. Unlike the earlier study, we are able to relate our estimated PDRs to a variety of other financial behaviors. We find that individuals with higher estimated PDRs tend to save less, prefer less risky investments, experience more financial problems, face higher borrowing interest rates, and are less financially aware.

*Warner: Department of Economics, 222 Sirrine Hall, Clemson University, Clemson, SC 29634-1309 (jtwarne@clemson.edu). Pleeter: (pleeters@gmail.com). Simon: Department of Economics, 222 Sirrine Hall, Clemson University, Clemson, SC 29634-1309 (cjsmn@clemson.edu). We are grateful to the many individuals in the Defense Manpower Data Center and elsewhere who participated in the assembly of the data used for this study. They include Peter Cerussi, Mark Gorsak, Brian Lippan, Fred Licari, Robert Tinney, Matt Torres, and Deborah West. Jon Pennington of SRA Corporation oversaw the survey described herein that was fielded to over 40,000 military personnel. Finally, we would like to thank participants of the 2010 meetings of the Western Economic Association for their comments, particularly our discussant, Mike Strobl.

1. Introduction

Because intertemporal preferences play a critical role in saving and wealth accumulation, a large literature has emerged that attempts to measure individuals' personal rates of discount. Despite the important theoretical link between impatience, saving, and wealth, there has been relatively little empirical study of the link between measured discount rates and other financial behaviors.

This void has begun to be filled. Laibson et. al. (2007) estimated the structure of time preference using data on life-long consumption, borrowing, and saving. Chabris et. al. (2008) examined whether individuals with higher laboratory-measured discount rates were more prone to engage in 15 field behaviors that reflect impulsivity and impatience, including financial behavior. Meier and Sprenger (2007) examined the link between credit constraints and long-run discount rates or present bias. Most recently, Hastings and Mitchell (2011) examined whether impatience or present bias helps explain sub-optimal financial decisions using data on Chilean participants.

This paper uses new field data deriving from a change in the U.S. military retirement system to estimate the relationship between the personal discount rate (PDR), saving behavior, and financial well being. The change in retirement system gave military personnel in their 15th year of service a choice between an immediate $30,000 cash bonus, called the Career Status Bonus (CSB) and an enhanced future retirement annuity. We use the information gleaned from individuals' choice of retirement system to estimate their rates of discount. We then relate the estimated discount rates to a variety of financial behaviors.

First, we have administrative data on individuals' participation in the federal government's Thrift Savings Program (TSP). We also have survey data for a subset of individuals on how TSP participants allocate their contributions into different types of investments. Of course, TSP participation is only one dimension of saving. Fortunately, the survey data include qualitative information on overall savings behavior. The survey also asked individuals whether they had experienced a variety of financial problems ranging from missing a credit card payment to personal bankruptcy, as well as information on credit card and car loan interest rates. Finally, the survey included questions about how well individuals were informed about specific features of the military retirement system.

The methodology used in this paper is the same as that developed by two of us (Warner and Pleeter 2001) to estimate the PDR using data from the early 1990s. During that time, the U.S. military downsized from 2.1 to 1.4 million active duty personnel. In order to encourage military personnel to separate voluntarily, DoD offered separatees a choice between an immediate cash bonus and a delayed annuity. The CSB choice faced by personnel in the 2000s is similar but not identical to the choice faced by separating personnel in the early 1990s. In contrast to the individuals studied by Warner and Pleeter (2001), who faced an unanticipated and largely involuntary career change, the individuals studied here are virtually guaranteed a 20-year career and vesting in a full military

pension. There were, in addition, a number of other "confounding factors" that could impact measures of the PDR in the earlier study.[1]

The paper is organized as follows.

Section 2 describes the policy environment. **Section 3** describes the Administrative and Survey data. **Section 4** presents the methodology and estimation of individuals' discount rates (PDR). The remainder of the paper examines the relationship between these estimated PDRs and a variety of financial behaviors. **Section 5** focuses on TSP participation and saving rates. **Section 6** examines a number of indicators of financial well being. **Section 7** focuses on individuals' awareness of key features of the military retirement system. **Section 8** concludes with a brief summary and suggestions for future research.

2. The Policy Environment

A. From High-3 to REDUX and Back

Prior to 1986, military retirees with 20 or more years of service received a monthly retirement annuity equal to 0.025 times years of service times the average monthly basic pay for the highest (typically final) 36 months of service.[2] This system, known as "High-3," was fully adjusted annually for changes in the Consumer Price Index. A retiree with 20 years of service would therefore typically receive an annuity equal to 50% of basic pay.

In order to reduce retirement costs, the Military Reform Act of 1986 replaced the High-3 system with a less generous military pension system known as REDUX. The REDUX system applied to personnel who entered service on August 1, 1986, and featured:

- a 2nd-career annuity between separation and age 61 equal to 40% of basic pay plus 3.5% of basic pay for every year of service beyond 20;
- a one-time adjustment upward to a pension based on the High-3 formula at age 62;
- an annual, incomplete inflation adjustment equal to CPI growth minus 1 percentage point.

REDUX reduced the second-career annuity from 50% to 40% of basic pay for 20-year retirees, and from 62.5% to 57.5% for 25-year retirees. A 30-year retiree would receive the same initial second-career annuity – 75% of basic pay -- under either system.

---

[1] Frederick et. al. (2002, p. 389) suggested that the "spectacular disagreement" among "dozens of studies that all purport to be estimating the discount rate" might arise due to the "tremendous variability" in methods used to measure them and the consequent presence of "confounding factors" that result in researchers measuring something other than pure time presence (p. 380).

[2] Appendix A describes the policy environment in more detail and provides additional references.

However, because of its incomplete inflation adjustment, the real value of REDUX would decline by 1 percent per year between separation and age 61, and after the age 62 reset.

Figure 1 illustrates the real lifetime annuity streams under the two systems for three ranks of enlisted personnel: E-7 with years of service (YOS) equal to 20, E-8 with YOS=25, and E-9 with YOS=30, assuming individuals entered service at age 20 and using the 2008 military basic pay table. For instance, the annual retirement benefit for an E-7 with 20 years of service is about $23,000 under High-3 and about $18,400 under REDUX. Between the age of separation age and age 61, the real value of the pension under REDUX declines to about $15,000 in constant 2008 dollars. The REDUX annuity resets at age 62 to what it would have been under High-3, after which it again declines in real value at the rate of 1 percent per year.

The National Defense Authorization Act of 2000 reversed the REDUX provision of the Military Reform Act of 1986. All personnel who entered the military after the year 2000 are enrolled in the High-3 retirement system. To address those already in the armed forces, the Act gave individuals who entered military service between 1986 and 2000 the option of either (1) returning to the High-3 pension system or (2) remaining in REDUX and receiving a $30,000 bonus, called the Career Status Bonus (CSB), in their 15th year of service. Because the relative values of the two retirement systems vary across individuals with different ages, rank, and expected retirement dates, the interest rate at which the two choices have equal present value – called the breakeven discount rate -- varies as well. Warner and Pleeter (2001) showed how to use information on the breakeven discount rate in combination with information on individual level demographic and economic characteristics to estimate individual's personal rates of discount.

B. Thrift Savings Plan

The repeal of REDUX was followed by Congressional approval of participation by military personnel in the federal government's Thrift Savings Plan (TSP) starting in FY 2002.[3] Prior to this authorization, military personnel were able to save on a pre-tax basis only through IRAs. The change in law gives us an opportunity to examine the link between the PDR and an important dimension of saving. Because data on Thrift Savings contributions are collected administratively (unlike, for example, IRAs), they are unusually accurate and not subject to subjects' estimation and recall errors.

3. Data

A. Administrative Data

Our data were provided by Defense Manpower Center (DMDC). They identified all active duty personnel potentially eligible to receive Career Status Bonus (CSB) as of December 31, 2007, that is, who had entered service on or after August 1, 1986 and had

[3] Unlike federal civilian employees, military personnel do not receive matching federal contributions.

completed 15 years (180 months) of service since October 1, 2000. DMDC attached each individual's information on gender, race and as of 30 September of each year information on age, rank, education level, marital status, the number of dependents, military service, and occupation. These personnel records were supplemented with data provided to DMDC by the Defense Financial Accounting Service (DFAS) on calendar-year total military pay, Career Status Bonus (CSB) receipt, and participation in the Thrift Savings Plan (TSP). After eliminating certain individuals ineligible to receive CSB and records with missing data, our dataset contained 139,680 individuals.

B. Survey Data

A key piece of information necessary to implement Warner and Pleeter's (2001) methodology is the expected number of completed years of service. Because this information is not available in administrative data, DMDC developed a survey, sent in October 2008 to a random sample of 46,566 personnel in the administrative data. DMDC purposely oversampled personnel who elected to receive the CSB at a rate of about 3 to 1 and constructed a survey weight to allow computation of population averages. They received 19,272 completed surveys, defined to be a survey with answers to more than 50 percent of the questions in the survey. After eliminating individuals who were not in fact eligible to receive CSB and individuals with other missing information, we had 14,666 usable survey observations.

The DMDC survey also included a range of questions regarding individuals' financial status. For example, individuals were asked how they allocated their TSP contributions across different classes of investments. The survey included questions about whether participants had missed a range of bill payments (credit card, mortgage, telephone, power, car, or other bill), whether they had ever declared bankruptcy, experienced foreclosure on a mortgage, or had an item repossessed. Participants were also asked to report their car loan and credit card interest rate. Finally, the survey asked participants whether they were aware of key features of the CSB/REDUX and High-3 retirement systems. We are therefore able to examine the relationship between our estimates of the PDR on the one hand and financial well being and awareness on the other.

C. Data Overview

Table 1 shows summary statistics on CSB take rates and TSP participation for survey participants and non-participants. Among survey participants, 56.85% took the High-3 option and 43.15% opted for the up-front CSB. The percentage taking High-3 was markedly higher (71%), and taking CSB lower (29%) among non-participants, a fact that might lead one to conclude that those who took the survey were less patient on average. However, as will be seen, such a conclusion is not warranted. Indeed, as can also be seen from **Table 1**, participation in TSP was slightly higher among survey participants than non-participants: 51.5% versus 47.1%. Similarly, average saving rates over the 2002-2008 period were slightly higher among survey participants: 2.65% versus 2.42%.[4]

[4]The saving rate is equal to total real TSP contributions divided by total real (2008 $) cash pay earned over the 2002-2008 period.

Saving rates were higher for High-3 takes than for CSB-takers: 3.14% versus 2.01% among survey participants and 2.70% versus 1.75% non-participants. A similar pattern holds for saving rates conditional on participation.

Summary statistics for other individual-level characteristics, seen in the first two columns of **Table 2**, reveal the two samples to have similar compositions along most dimensions. It is not surprising that the mean age in the two samples, 35.4 years for survey participants and 35.6 for non-participants are nearly identical because all individuals are in their 15th year of service. About 88.4% of survey participants were male compared with 87.65% of non-participants, 85.1% and 83.8% were married, 20.9% and 23.2% black, and 7.7% and 7.5% Hispanic. The education distributions are also similar. There are differences, however. The average AFQT score among (enlisted) survey participants is 60.08 compared with 57.6 for non-participants. Also, the sample of survey participants contains 14.9% officers compared with 20.4% among non-participants.

We do not have recourse to exclusion restrictions that would allow us to correct for selectivity. Instead, we take a practical approach to assessing the utility of our estimates: how well they predict out of sample. The next section shows that although implementing Warner and Pleeter's (2001) methodology requires information on anticipated career length that is available only for survey participants, the PDR can be estimated for non-participants as well. Because we have information on TSP saving behavior for both groups of individuals, we can compare the estimated TSP-PDR relationships. Finding that the estimated relationships are similar for survey participants and non-participants would give us greater confidence in our procedure.

4. Estimating the PDR

A. Methodology

Following Warner and Pleeter (2001), assume that individual *i*'s personal discount rate, D_i, is a function of observable characteristics, X_i, and an unobserved random error, u_i:

$$D_i = X_i\beta + u_i \quad (1)$$

Define the breakeven discount rate D_i* as the interest rate that equates the present value of the increased retirement income stream under High-3 and the present value of the REDUX retirement income stream plus immediate $30,000 CSB discounted to year of service 15. Assuming that individuals maximize the present discounted value of lifetime earnings, individual *i* chooses CSB if $D_i > D_i^*$, or if $X_i\beta - D_i^* > -u_i$. [5] If $u_i \sim N(0,\sigma)$, the

[5] Anderson et. al. (2011) observed that it may be important to distinguish between dollar amounts and the utility of those amounts. In particular, concavity of the utility function tends to yield lower estimates of the discount rate than will be inferred from assuming that utility is linear in the present value. We acknowledge the point, but continue to use the term PDR for the sake of exposition. It is worth noting, though, that because all of the individuals in our sample are virtually guaranteed a military pension, the degree of concavity in the relevant range may be smaller than typically observed in laboratory experiments, particularly those carried out on students.

probability of choosing CSB is equal to $\Pr(D_i > D_i^*) = \Pr\left(X_i\left(\frac{\beta}{\sigma}\right) - \frac{1}{\sigma} D_i^* > -\varepsilon_i \right)$ where $\varepsilon_i = u_i / \sigma$ is standard normal. Rearranging,

$$\begin{aligned} \Pr(choose\ CSB) &= \Phi\left(X_i\left(\frac{\beta}{\sigma}\right) - \frac{1}{\sigma} D_i^* \right) \\ &= \Phi\left(X_i\delta - \alpha D_i^* \right) \end{aligned} \tag{2}$$

where $\Phi(\bullet)$ denotes the standard normal CDF. Equation (2) defines a probit model with dependent variable equal to 1 if the individual chooses the up-front CSB and 0 otherwise, with regressors X_i and D_i^*. Identification is secured by the fact that the estimated probit coefficient α on D_i^* estimates 1/ σ, thus allowing us to compute $\hat{\beta} = \hat{\delta} / \hat{\alpha} = \hat{\delta}\hat{\sigma}$ and individuals' PDRs as $\hat{D}_i = X_i\hat{\beta}$. Theory requires the estimated value of α be positive, that is, individuals with higher breakeven discount rates should be less likely to take CSB. Variables that increase the likelihood of taking CSB, with positive estimated coefficients in the probit regression, result in higher estimated PDRs. Notice that Warner and Pleeter's (2001) methodology allows one to calculate the PDR even when information on D_i^* is available for only a subset of individuals.[6] The reason is that the PDR itself is not a function of D_i^*, but only the vector of attributes, X_i.

An undesirable side effect of assuming normality is that the estimated PDR can be negative. We can guarantee positive estimated PDRs if we replace the assumption of normality with that of log normality in which $\ln D_i = X_i\beta + u_i$ is normally distributed, in which the individual selects CSB if $\ln D_i > \ln D_i^*$. In the log normal case, $\ln D_i^*$ replaces D_i^* in equation (2) and α measures the inverse of the variance of the unobserved determinants of the log PDR. In addition to bounding the PDR below by 0, log-normality implies a right-skewed distribution of PDRs with a mean larger than the median. The median estimated PDR for a given individual *i* is equal to exp $(X_i\beta)$, and the mean estimated PDR is equal to exp $(X_i\beta + 0.5\sigma^2)$, or the median multiplied by exp $(.5\sigma^2)$. If exp $(.5\sigma^2)>1$, then the estimated mean is larger than the estimated median.

To reduce clutter, we focus on estimates from the log-linear model, but to facilitate comparison with Warner and Pleeter (2001), we also present estimates for a linear specification.

---

[6] Quester and Shuford (2005) attempted to estimate the PDR for Navy enlisted personnel, but lacked crucial information on anticipated career length necessary to fully implement Warner and Pleeter's (2001) methodology. Brown and Moskowitz (2007) reexamined Quester and Shuford's (2005) data to estimate the PDR for a subset of individuals (E-5s in their 15th year) whose career length could be surmised with a high degree of confidence by virtue of having exhausted their promotion opportunities and thereby facing mandatory separation at 20 years of service. By comparison, we are able to estimate the PDR for personnel from all four uniformed services, officers as well as enlisted.

B. Breakeven Discount rate

The breakeven discount rate D^*_i is a function of (1) the dollar value of retirement pay, (2) the duration of the military career, and (3) lifespan. About 40% of individuals expected to serve 20 years, 32% between 22 and 24 years, and 13.5% for 25 years or more. DoD and other actuarial data were used to assign to each individual an expected lifespan, discussed in **Appendix B**. A terminal rank was assigned using outside information on promotion patterns and a terminal salary was assigned using the 2008 pay table. The terminal salary determines the annuity amount and expected lifespan determines the duration of the annuity. We then calculated the breakeven discount rate, accounting for federal and state taxes on the CSB and retirement annuities as described in **Appendix C**.

Figures 2 and 3 show the effects of expected rank and career length on the breakeven discount rate for a white, male 35-year old enlistee and officer, respectively.[7] Notice that choosing the up front CSB bonus does not by itself mean that an individual is impatient. In particular, D^* is lower for those with longer (expected) military careers. For example, D^* for an E-5 is 3% at 30 years of service (YOS) and 9% at 20 YOS because the High-3/REDUX annuity differential is 0% at 30 YOS and 25% at 20 YOS. In addition, a shorter career translates into a larger number of years of incomplete (CPI-1%) REDUX inflation adjustment before the age-62 reset. The breakeven discount rate is also higher for those with higher rank because the REDUX penalty is larger at higher levels of pay. For example, D^* at 20 YOS is 14% for an E-9 compared with just 9% for an E-5. Similar relationships hold for officers.

In addition, D^* is positively related to lifespan because those with longer lives must endure the incomplete inflation adjustment of REDUX for more years. D^* also varies according to the military pay table in effect at the time of the decision. Because the CSB is fixed in nominal terms at $30,000 while military pay has tended to rise over time, the value of CSB has declined relative to the High-3 pension, raising D^*.

C. Model Estimates

We experimented with numerous specifications of the CSB choice model.[8] Because the various specifications led to similar conclusions, we focus on the most parsimonious one, estimated on enlisted and officer personnel combined.

The control variables in X_i include age, education, AFQT score (available for enlisted personnel only), gender, race and ethnicity, marital status, number of dependents, the number of months spent in a combat zone in the last year, branch of service, decision year, and indicators for whether the individual was enlisted, a warrant officer, or

---

[7] Incorporating taxes, neglected in constructing these figures, would not affect the patterns seen.

[8] We tried estimating the choice model separately for enlisted and officer personnel, and we tried including basic pay and years until separation in the list of control variables. We adopt the simple specification here because current pay effectively already enters through the breakeven discount rate (retirement pay is related to current pay) and because including years of separation makes it impossible to calculate the PDR for survey non-participants, for whom this information is not available.

commissioned officer. It is understood that the estimated coefficients are consistent with both causal and non-causal stories. For our purposes, it is sufficient that the variables included in the model help predict the PDR.

Table 2 reports estimates of the marginal effects of each variable on the probability of taking CSB evaluated at the sample mean of the normal density function. Because the estimated marginal effects are nearly identical in the linear and log-linear model, we focus on the latter. We also present the estimated effects on the estimated PDR in log points for the log-linear model – roughly speaking, the percent change -- and in percentage points for the linear model.[9]

Before turning to these estimates, recall that the negative inverse of the estimated coefficient on the breakeven discount rate – not shown in the Table to reduce clutter – is equal to $\hat{\sigma}$. Our estimates are uniformly positive as predicted by economic theory. The estimated value of σ in the linear model is 0.113 with a standard error of 0.009. In the log linear model, $\hat{\sigma}$ = 1.745 with a bootstrapped standard error of 0.168.

We now turn to the estimated effects of the explanatory variables. Each additional month deployed in a combat zone is associated with a 0.6 percent increase in the probability of taking CSB, with a bootstrapped standard error of 0.2. This corresponds to a 3 log point increase in the median PDR (s.e.=1.2), or 0.17 percentage points (s.e.=0.1). These estimated effects are consistent with the notion that individuals deployed in a combat zone, who face significantly higher risks of fatality or injury, place higher weights on current consumption.

Each year of age is associated with a 0.7% reduction in the probability of taking CSB (s.e.=0.2), which corresponds to an estimated reduction in the PDR of 3.8 log (s.e.=1.1) or 0.25 (s.e.=0.1) percentage points. The lower discount rates estimated for older individuals could reflect higher levels of wealth and collateral and hence a lower demand for liquidity.

The estimated effects of being male or married are economically small and imprecisely estimated. However, each additional dependent – holding constant marital status, this variable measures the number of children – is estimated to increase the probability of choosing CSB by 3.9% (s.e.=0.4). The estimated effects on the PDR are correspondingly large: 20.2 log points (s.e.=3) and 1.3 percentage points (s.e.=0.2). The estimated point effects of being divorced on the PDR are virtually identical to that of an additional dependent, but with standard errors 5 times as large, are imprecisely estimated.

CSB choices and the estimated PDRs of Hispanics and Asians are economically similar to – and given the large standard errors, not statistically different than -- those of whites. However, blacks are estimated to be 13% more likely to choose CSB (s.e.=1.5%), corresponding to 67 log point (s.e.=11) and 4.3 percentage point (s.e.=0.7) higher PDRs. The higher estimated PRDs among blacks compared with other racial and ethnic groups are consistent with many explanations, including lower wealth and hence less access to

[9] It is of course possible to calculate the percent effect in the linear model and the absolute effect in the log-linear model, not shown to reduce clutter.

capital markets, lower levels of unmeasured human capital, and the presence of racial discrimination.

Although higher levels of (enlisted) AFQT and education are both associated with lower PDRs, the estimated effects of AFQT are tiny while those of education are substantial. For example, associate degree graduates are 11% (s.e.=3.1) less likely to choose CSB relative to high school dropouts, with estimated PDRs 57 log points (s.e.=17.3) and 3.65 percentage points (s.e.=1.1) lower. BA degree holders are estimated to be 15% (s.e.=3.2) less likely to choose CSB, with estimated PDRs 77.4 log points (s.e.=18.2) and 4.9 linear points (s.e.=1.2) lower than otherwise comparable dropouts.

Because the magnitude of the estimated relationship between impatience is so large, it is important to know the mechanism responsible. One interpretation is that better-educated individuals make better-informed choices because they are cognitively better able to carry out the calculations. For example, Dohmen et. al. (2010) found higher cognitive ability to be negatively associated with laboratory-derived measures of impatience. However, explanations based on computational facility are better geared to explaining differences in the variance of outcomes than to explaining why the outcomes tend to fall on the side of impatience. A second interpretation is that the same high levels of impatience that lead to a preference for current over future consumption lead to a preference for lower levels of education. A third possible explanation is that individuals with higher levels of cognitive ability have higher levels of wealth and hence better access to credit markets. Finally, the results are consistent with Becker and Mulligan's (1997) theory of endogenous time preference. In particular, they suggested, "educated people should be more productive at reducing the remoteness of future pleasures" (p. 736). They focused their analysis on the act of becoming better informed about one's future self, but their argument should also apply to acquiring information about the financial implications of future annuity streams.

D. Estimated PDRs

Table 3 reports estimates of the PDR using both the log-linear and linear models. Using the linear model, we estimate a mean expected PDR of 5.9%. Using the log-linear model, we estimate an expected PDR of 37.6% and a mean median of 8.2%. Although the range of estimates of the "typical" PDR appears to be extremely wide, the differences are not as large as may first appear.

To put these various estimates in perspective, recall that the expected value of an individual's PDR in the log-linear model is equal to exp $(X_i\hat{\beta} + 0.5\hat{\sigma}^2)$, which in turn is equal to the median, exp$\left(X_i\hat{\beta}\right)$, multiplied by exp $(.5\hat{\sigma}^2)$. By construction, the log-linear mean and median are perfectly rank correlated but the former will exceed the latter by a factor of exp$(.5 \times 1.745^2) = 2.4$. Log-linear estimates of the PDR for an individual at the 50th percentile of the error distribution are higher than in the linear case by "only" a factor of 40%: 8.2% versus 5.9%. Estimates of the log linear expected value are driven by

high estimated values of σ, which suggest the existence of high PDRs of a relatively "small" number of individuals in the right-hand tail of the distribution.[10]

E. Comparison with Warner and Pleeter (2001)

At fist glance, our estimates of the PDR seem to be in the same ballpark as those estimated by Warner and Pleeter (2001). In particular, using the log-linear model, they estimated a mean PDR of 9.9% for officers and 38.9% for enlisted personnel in their 15th year of service (their Table 6, p. 48). The corresponding estimates in our case are 6.25% for officers and 45.2% for enlisted personnel. However, the two studies obtain very different estimates of the *median* PDR: Warner and Pleeter (2001) estimated a median PDR for enlisted personnel of 31.2% and for officers of 6.9%.[11] Our estimates of the median PDR are only a third as large: 10.9% for enlistees and 2.0% for officers.

The reason why the estimated mean PDRs of the two studies are similar while the estimated medians are so different is straightforward. Our estimate of σ of 1.745 is more than twice as high as the values estimated by Warner and Pleeter (2001) of 0.850 for officers and 0.663 for enlistees, which for any given estimated median will translate into substantially higher estimated means in the present study. [12] By construction, estimates of the *median* PDR are inherently less sensitive to the estimate of σ than are estimates of the *mean*. Estimates of the PDR based on the linear model are also inherently less sensitive to the estimated value of σ. Warner and Pleeter's (2001) linear estimates of the mean were equal to 29.4% for enlisted personnel and 0% for officers. By comparison, we estimate means of 8.0% and *negative* 2.6%, respectively.

The key to understanding why we estimate the representative individual to be more patient than Warner and Pleeter (2001) may lie in the circumstances under which individuals' choices were made. Warner and Pleeter (2001) used data on the choices of military personnel between an upfront cash bonus and future annuity that derived from the downsizing of the U.S. active military force in the early 1990s from 2.1 to 1.4 million members. Because downsizing required the largely involuntary and unanticipated separation of large numbers of personnel, DoD attempted to reduce the impact by inducing them to separate voluntarily in return for either an up-front lump sum payment or a future retirement benefit. Those who opted not to accept the offer faced the prospect of involuntary termination prior to vesting and of receiving of a much smaller separation payment. Moreover, the military drawdown occurred in the midst of a recession in which

---

[10] The reader may wonder, given the different estimates from the linear and log-linear model, which specification fit the CSB choice model better? In fact, the chi-square statistic from the linear model was 1331.45 and from the log-linear model 1304.11.

[11] These estimates are obtained by dividing their estimated mean PDRs by exp $(0.5\hat{\sigma}^2)$, where $\hat{\sigma} = 0.663$.

[12] When the model was estimated separately for officers and enlistees (suppressed to save space), the estimated values of σ were 1.507 and 1.827.

unemployment rates exceeded 8 percent. The prospect of a spell of unemployment may have generated a higher demand for liquidity among separatees.[13]

By contrast, the repeal of REDUX does not involve an unanticipated career change. The individuals examined by Warner and Pleeter (2001) were in the process of separating from the military during the drawdown. By contrast, virtually all of the individuals in our study who make a CSB choice are in their 15th year of service and are all but guaranteed vesting in a military pension at 20 years. Because the individuals in the current study are at the other end of the spectrum of risk and uncertainty compared with those in the earlier study, the PDRs estimated should probably be regarded as a lower bound. [14]

The differences in circumstances faced by the two groups of individuals can also help explain why our estimate of σ is higher than estimated by Warner and Pleeter (2001). The involuntary termination involved in the military drawdown could have caused even patient individuals to become risk averse, thereby raising their effective discount rates relative to those of less patient individuals, and reducing the role of underlying variation in the unobservable component of the discount rate across individuals.

F. Differences Across Demographic Groups

Table 3 reports estimated median PDRs from the log-linear model – we drop the qualifier "median" for the remainder of the paper for the sake of exposition -- for a number of demographic groups of interest.[15] Many of the patterns are similar to those found by Warner and Pleeter (2001). For example, like Warner and Pleeter (2001), the estimated PDR is negatively related to education, averaging 13.8% among high school dropouts, 10.9% among high school graduates, 4.1% among four-year college graduates and 1.8% among advanced degree holders. Like the earlier study, the estimated PDR for whites is lower than for other groups. In particular, the estimated PDR for whites averages 5.6%, compared with 6.8% for Hispanics and 15.6% for blacks. Finally, like the earlier study, we find that the PDR rises the number of dependents, rising from 4.2% for those with no dependents to 9.9% for those with 4 dependents.

There are other patterns of interest. For example, we estimate a mean PDR of 12.4% for enlistees in the bottom half of the AFQT distribution, compared with 8.5% for

---

[13] Card et. al. (2007) studied the Austrian unemployment insurance system, which provides a lump-sum payment at the start of a spell that is independent of the ultimate duration of the spell. They estimated that the lump-sum benefit positively affects the duration of unemployment and consumption during unemployment, neither of which would occur in the absence of a liquidity constraint.

[14] The earlier study was affected by a number of additional confounding factors. First, annuity recipients were required to affiliate with a reserve component for the life of the payment whereas bonus recipients required only a three-year commitment to the Ready Reserve. Second, bonus recipients were given extended commissary and exchange privileges, extended medical coverage for up to 120 days, shipment of household goods, and possibly extended housing benefits while annuity recipients were not. Third, bonus recipients who found jobs in civil service were permitted to include military time towards federal civil service retirement; annuity recipients were not.

[15] Because **Table 2** reports partial effects, we report simple means here.

those in the top half. We also estimate higher PDRs for divorced than for married individuals, 10.0% versus 8.4%.

5. Saving Behavior

A. Thrift Savings Plan Participation

We now relate the estimated PDRs to individuals' saving behavior. We have information for all CSB-eligible individuals on TSP contributions and cash pay for each year between 2002 and 2008. Although we experimented with models estimated using annual data, we found little to be gained by exploiting the year-to-year variation in the data. We therefore constructed an average saving rate equal to the sum of real TSP contributions and dividing by the sum of real total cash pay over the 2002-2008 period (the CPI base year is 2008).

Fewer than half of military personnel participate in TSP. To account for the large number of zeroes in the data, we assume that saving can be characterized as a zero-inflated negative binomial process. Because this model is typically applied to count data in which the dependent variable is an integer, we define saving rates in integer units of basis points. For example, an individual with a saving rate S_i of 2.564% (0.02564) will have S_i=256.[16]

The probability of TSP non-participation is specified to be a probit model:

$$\Pr(S_i = 0) = \Phi(\phi_0 + \phi_1 lnD_i) \qquad (3)$$

and the expected rate of saving is assumed to be equal to

$$E(S_i|lnD_i) = (1 - \Pr(S_i = 0))\lambda_i \qquad (4)$$

where $\lambda_i = \exp(\theta_0 + \theta_1 lnD_i)$ is the expected saving rate conditional on positive saving. We expect that more patient individuals are more likely to save ($\phi_1 > 0$) and, conditional on saving, will tend to save more ($\theta_1 < 0$). By specifying equation (4) as a negative binomial (rather than a Poisson) process, the variance is permitted to exceed the mean. The parameters ($\phi_0, \phi_1, \theta_0, \theta_1$) are estimated via maximum likelihood and the standard errors are bootstrapped using 1000 replications to account for the fact that lnD_i is estimated. The PDR is entered as a natural log because it fits the data better than when entered linearly.

All of the estimated coefficients, reported in **Table 4**, are of the correct sign. In order to gauge the magnitude of the estimated coefficients, we simulated the effect of adding a standard deviation in the PDR to each individual's PDR – about 0.9 log points. The estimated "effect" for the 14,666 survey participants, seen in the two left-hand columns, is to reduce the probability of contributing to TSP by 7.5% (s.e.=0.7%), from

[16]We experimented with tobit, which is known to be sensitive to the assumption of normality, as well as OLS. The qualitative results are robust to such variation in econometric specification.

48.6% to 56.1%, and to reduce the TSP saving rate among contributors by 0.72 percentage points (s.e.=0.045).

We have already noted that concern could arise that survey participants may not be purely randomly selected. Warner and Pleeter's (2001) allows one to calculate the PDR even when information on D_i^* is available for only a subset of individuals.[17] Such concern can be at least partially alleviated by examining the relationship between the estimated PDRs and TSP saving for survey non-participants, seen in the middle two columns. Although the estimated intercept in the probit equation for zero saving differs for participants and non-participants, the predictions for saving are similar. In particular, adding 1 standard deviation to each individual's PDR is associated with a reduction in the probability of contributing to TSP of 8.0% (s.e.=0.3) and a reduction in TSP saving among contributors of 0.72 percentage points (s.e.=0.014).

Because the PDR is a linear combination of individual characteristics, X_i, the question naturally arises how well this particular linear combination fits relative to an unrestricted model. We therefore estimate the savings regressions as an unrestricted function of X_i (not shown to save space) and graph the fitted values as a function of the log median PDR in **Figure 4**, limited to survey participants in order to reduce visual clutter. The negative relationship appears to be a good fit, the near linearity suggesting that entering the PDR in log form is appropriate. Nevertheless, statistically speaking there is no contest between the restricted and unrestricted models: a log likelihood statistic for the 50 restrictions implied by the system of equations (3) and (4) is equal to (2 x -63,685 – (-64,051)=) 732, indicating that they can be easily rejected. That being said, the correlation between the two sets of fitted values is 0.61, and almost 40% of the variation in the unrestricted fitted values is predicted by the restricted ones. We find it striking how much of the variation in the unrestricted TSP model is predictable from a one-time choice between $30,000 today and a higher annuity in the future.

To summarize, we find that TSP saving is negatively related to the PDR. The fact that the estimated relationships are similar for survey participants and non-participants gives us at least some confidence that the estimated PDRs are not unduly affected by selectivity problems associated with deciding to respond or not respond to the survey.

B. Overall Saving Habits

TSP participation is but one dimension of saving. Concern could therefore arise that the negative relationship between measured PDRs and TSP saving is offset by other forms of saving. Fortunately, the DMDC survey included a question about individuals' overall saving habits. The responses, broken down by CSB status, are displayed in **part**

[17] Quester and Shuford (2005) attempted to estimate the PDR for Navy enlisted personnel, but lacked crucial information on anticipated career length necessary to fully implement Warner and Pleeter's (2001) methodology. Brown and Moskowitz (2007) reexamined Quester and Shuford's (2005) data to estimate the PDR for a subset of individuals (E-5s in their 15th year) whose career length could be surmised with a high degree of confidence by virtue of having exhausted their promotion opportunities and thereby facing mandatory separation at 20 years of service. By comparison, we are able to estimate the PDR for personnel from all four uniformed services, officers as well as enlisted.

A of **Table 5**. About 1.8% of individuals report that they usually spend more than their income, 3.0% of CSB takers and 0.9% of High-3 takers, and another 9.6% of survey participants reported spending about as much as they earned, 14.3% of CSB takers and 6.1% of High-3 takers. At the other end of the spectrum, 57.4% reported putting aside money each month: 44.5% of CSB takers and 67.2% of High-3 takers.

Although not all individuals who take CSB are necessarily impatient, the average (median) PDR, seen in the right-most column, declines from an estimated 10.1% for negative savers to 7.0% for regular savers, and suggest that there is a negative relationship between PDR and overall rates of saving. To get a better idea of the magnitude of this relationship, we estimated an ordered probit model of saving behavior as a function of the PDR, suppressed to save space. We then simulate the "effect" of adding a standard deviation in the PDR for each individual in the sample. The results are shown in **Part A** of **Table 6**. The probability of negative saving is estimated to increase by an imprecisely estimated 1 percentage point (s.e.=0.7), but the probability of zero saving is estimated to rise by 3.6 percentage points (s.e.=0.8) and the probability of saving whatever is left over at the end of the month is estimated to rise by 4.7 percentage points (s.e.=1.1). The probability of saving regularly is estimated to decline by 9.7 percentage points (s.e.=0.8).

To summarize, the negative estimated relationship between the PDR and TSP saving found in the previous section appears to reflect an overall lower propensity to save and is not offset by higher saving in other forms.

C. Percentage of TSP Allocated to Stocks

Using Swedish data, Calvett, Campbell, and Sodini (2009) found that more sophisticated investors tended to invest more aggressively. Our data are not sufficiently detailed to construct similar measures of sophistication and relate them to the PDR. However, the DMDC questionnaire included questions about the allocation of TSP contributions across funds invested in short-term US Treasury securities, the bond market, the S&P 500, the Wilshire 4500, international stocks, and lifecycle fund blends. Because stocks fluctuate in value over short periods of time, the possibility arises that more patient individuals are better able to ride out short term declines in order to enjoy the historically higher average rates of return in the stock market. We estimate whether the percentage of funds allocated to the three stock funds combined is related to the PDR.

Like TSP saving, allocation of TSP to the stock market is characterized by a high fraction – about 45% -- of zeroes. We therefore estimate the relationship between stock market participation and PDR in the same way, using negative binomial regression for the 5,501 TSP participants. The results, reported in the right-most columns of **Table 4**, indicate that individuals with higher measured PDRs are less likely to allocate TSP contributions to the stock market and allocate less to stocks conditional on doing so. Increasing each individual's log PDR by one standard deviation is associated with a reduction in the probability of investing in stocks of 6.1 percentage points (s.e.=1%), from 55% to 49%, and with a reduction in the proportion of TSP allocated to stocks of 6.5 percentage points (s.e.=0.7), from 36% to 29%. The analog of **Figure 4** for the allocation of TSP to stocks, seen in **Figure 5**, shows a strong negative relationship

between the predicted percentages allocated to stocks estimated using the restricted and unrestricted models.

In summary, the results are consistent with the notion that patient individuals tend to invest more aggressively.

6. Financial Well Being

A. Overall Financial Stability

Because high levels of borrowing are associated with lower levels of financial stability, many researchers have examined the relationship between impatience and individuals' borrowing behavior. Harrison, Lau, and Williams (2002) found no evidence that individual long-run discount rates were correlated with borrowing behavior. However, Meier and Sprenger (2010) found that present bias was associated with higher debt levels (p. 17), and Meier and Sprenger (2007) found that present bias was associated with higher incidence of credit market delinquencies (pp.19-20), defaulted balances (p.20), and lower Fair Isaac Corporation (FICO) scores (p. 21).

Although the DMDC questionnaire did not include questions about borrowing per se, it did ask individuals about their overall financial stability. Responses to this question, broken down by CSB status, are contained in **part B** of **Table 5**. Generally speaking, CSB takers are less likely to be financially well off. About 22.9% of participants reported being very comfortable, 27.7% of High-3 takers and 16.6% of CSB takers. At the other end of the financial spectrum, 5.5% reported being over their head or having trouble making ends meet, 8.5% of CSB takers and 5.0% of High-3 takers.

Again, taking CSB does not by itself indicate that an individual is impatient. However, the estimated PDRs in the rightmost column rise uniformly with financial instability from 6.6% to 9.4%. We estimated the relationship between financial stability and the PDR using ordered probit (suppressed to save space) and used it to calculate the " effect" of adding 1 standard deviation to each individual's PDR. The results are reported in **Part B** of **Table 6**. The probability of being in the most financially secure group is estimated to decline by 5.7 percentage points (s.e.=0.9). At the other end of the financial spectrum, the probability of having difficulty making ends meet is estimated to rise by 1.8 percentage points (s.e.=0.5) and the probability of being over one's head by an imprecisely estimated 0.5 percentage points (s.e.=0.3).

To summarize, individuals with higher estimated PDRs are more likely to describe themselves as being financially less stable in general.

B. Evidence on Specific Financial Difficulties

DMDC surveyed individuals about whether they exhibited a variety of financial difficulties, seen in **Table 7**. Four percent of individuals reported bouncing 2 or more checks in a month and about 14% report having had to pay overdraft fees on at least 2 occasions in the past year. Three-and-one-half percent fell behind paying the rent or mortgage and 2.7% failed to make a car payment. About 7.8% report being pressured to pay bills by collectors, 3.0% had their telephone, cable, or internet access shut off, and

1.1 percent had their water, heat, or electricity shut off. In all, 16.1% reported having at least one financial problem.

Table 7 reports mean estimated PDRs for those who do and do not exhibit each problem along with the difference. As can be seen, those with financial problems tend to have higher PDRs. For example, the mean estimated PDR among those who bounced 2 or more checks was 10.0% compared with 8.0% for those who did not. The 2.0% percent difference is statistically highly significant (s.e.=0.6). Indeed, the mean of the estimated PDRs is higher for those with financial problems in each of the 11 cases. The mean estimated PDR among individuals with at least one financial problem of 10.9% is 3.6 percentage points higher (s.e.=0.7) than the 7.3% for those reporting no such problems.

The estimated PDRs have thus far been based solely on what might broadly be characterized as demographic factors. However, individuals with demographic factors that are associated with a higher propensity to have financial problems may not get into difficulty and individuals with demographic factors that are associated with a low propensity to have financial problems may nonetheless get into difficulty. To see whether financial problems are associated with higher discount rates "independently" of demographic factors, we re-estimated the CSB choice equation augmented to include indicators for the presence of 1, 2, 3, and 4 or more of financial problems.[18] We also included measures of credit market access in the form of the interest rate paid on individuals' largest credit card and automobile loan balances, along with dummy variables to indicate that information on the interest rates was missing.

Table 8 reports the findings. Generally speaking, individuals with more financial problems are estimated to be more likely to take CSB and have higher estimated PDRs. Individuals with a single financial problem – 9.8% of the sample – are estimated to be 9.4% more likely to take CSB (s.e.=1.9) and are estimated to have a 0.489 log point higher PDR than otherwise comparable individuals with no such problems. Those with 4 or more problems are estimated to be 20.3% more likely to take CSB and to have 1.05 log point higher (that is, about twice as high) PDRs. In addition, individuals with higher credit card and car loan rates are more likely to take CSB and are estimated to have higher PDRs.

Summarizing, the results indicate that impatience and the tendency to get into financial difficulty are positively related. However, we have no way of knowing the direction of causality. For example, the data could indicate that individuals who find themselves in financial difficulty have higher demands for liquidity, perhaps in an attempt to reduce their burden by paying off outstanding obligations.[19]

---

[18] We also experimented with specifications that included a dummy variable for each problem in Table 7 and with various subsets and aggregations of those indicators. In absence of strong priors on how the various problems should map into the PDR, we chose a specification to allow for the possibility that individuals with more financial problems tend to be less (or more) patient.

[19] Indeed, 82% of those who took the CSB reported using it to pay down debt. We do not emphasize this in the text because we have no way of knowing how individuals' overall asset positions evolved over time.

7. Awareness of Program Features

Financial illiteracy has been implicated in the suboptimality of financial decisions and low levels of accumulated wealth (Behrman et. al. 2010; Lusardi and Tufano 2008). This raises the possibility that what looks like impatience to the researcher is in fact a result of ignorance of individual choice makers. The individuals in our sample probably are better able than the typical member of the population to analyze and understand their retirement and CSB choices. Nevertheless, and in spite of vigorous efforts on the part of the Department of Defense to publicize and explain the program, the individuals in our sample are not perfectly informed. [20]

The DMDC survey quizzed individuals about their knowledge of 4 key program features at the time they made their CSB decision. **Table 9** summarizes the responses. More than 9 in 10 survey participants knew that retirement pay was equal to 40% of basic pay under REDUX and equal to 50% of basic pay under High-3. About three-fourths knew that staying to 30 years yielded retirement pay equal to 75% of basic pay under both systems, and nearly as many knew that the REDUX annuity reset at age 62. The least understood feature of the program was the incomplete inflation adjustment under REDUX; even so, nearly 70% of participants were aware of this feature. Nearly 6 in 10 survey participants reported being aware of all 4 features and only 5.2% reported being aware of none.

Table 9 reports mean estimated PDRs for informed and uninformed individuals, along with the difference.[21] In each case, the mean of the estimated PDRs is lower for informed individuals. We used probit to estimate the relationship between the PDR and the probability of awareness of each feature (not reported to save space) and simulated the "effect" of adding 1 standard deviation increase to each individual's PDR. The results are seen in the right-most column of **Table 9**. The probability of being aware of the 40% provision, the best-known feature, is estimated to fall by just 1.3 percentage points (s.d.=0.36). The estimated effects are larger for the other, less-known features, the largest being 6.75 percentage points (s.e.=0.6) for the incomplete inflation adjustment under REDUX.

---

[20] The Department of Defense publicized the features of the systems to individuals in a variety of outlets and in easy-to-understand ways. For example, a web page of the Office of the Secretary of Defense included a table showing annuity multipliers under REDUX and High-3 year-by-year from 20 to 30 years of service. (http://militarypay.defense.gov/retirement/ad/06_rc_thechoice.html, last accessed on March 22, 2011, Google date of February 1, 2001). The official website of the U.S. Navy ran a story entitled, "Do a Reality Check Before Taking Career Status Bonus/REDUX," complete with links to an April 2001 study by Center for Naval Analyses (Quester et. al. 2004) and a DoD-sponsored retirement pay calculator (http://www.navy.mil/search/display.asp?story_id=1614, last accessed on March 22, 2011, Google date of July 8, 2002). A similar story ran in the Air Force publication, *Airman,* in July 2003 (Roberts 2003). A Powerpoint presentation authored by the Army's Retirement Service office, dated February 2001, included a discussion of how the money from the CSB might be used, including being designated for individuals' Thrift Savings Plan accounts and how it might be allocated among the various asset classes.

[21] These estimated PDRs are based solely on demographics; a similar pattern is observed for PDRs estimated using the financial problem variables.

It is tempting to conclude that being less informed causes individuals to be less patient. However, Becker and Mulligan (1997) suggested that causality ran in the opposite direction. In their theory of endogenous time preference, they argued that the incentive to collect information about the future is lower for less patient individuals. (p. 746).[22] Our results are consistent with the notion that less patient individuals had less incentive to acquaint themselves with the details of annuity flows that disproportionately affected their future utilities. We return to the issue of causality shortly.

8. CONCLUSION

This paper has provided new estimates of the personal discount rate (PDR) using the methodology of Warner and Pleeter (2001). Like that study, the current paper exploits information on individuals' willingness to trade an upfront cash bonus for a higher future annuity. Despite the similarity of the methodology, our estimates of the median PDR are only about a third as high as those obtained in the earlier study. The most likely explanation for the lower estimates obtained here lies in the fact that the individuals in the earlier study were faced with an unexpected change in career. By contrast, the individuals in the current paper are all virtually guaranteed vesting in a full pension within 5 years. Neither circumstance can be characterized as normal. Indeed, the individuals in the two studies are probably best characterized as lying at opposite ends of the risk and uncertainty spectrums. The PDR estimates in the two studies should probably be regarded as lower and upper bounds relative to those that would be estimated for individuals in more normal circumstances.

We related individuals' estimated PDRs to a wide variety of financial behaviors. We found that individuals with higher measured PDRs were less likely to participate in the tax-favored Thrift Savings Plan (TSP), and that TSP contributions were negatively related to the PDR among those who did participate. Higher PDRs were also associated with less aggressive investment decisions as measured by the allocation of TSP contributions to stock funds. Higher PDRs were associated with a greater tendency to be in financial difficulty.

One of the most interesting findings is that higher PDRs are associated with lower rates of financial awareness. The fact that less informed individuals tend to have higher PDRs is important in light of Becker and Mulligan's (1997) prediction that the incentive to acquire information about the future is lower for less patient individuals, and raises the question of whether they might have made different choices had they been better informed and been made better off. The DMDC survey included a question asking whether individuals were satisfied with their CSB/REDUX decision. Althoug difficult to interpret, it is worth observing that despite high overall reported satisfaction of 90%, a full 40% of those who took the upfront cash bonus reported being dissatisfied compared

[22] For given assets, more patient consumers have higher future utilities and a higher marginal utility of wealth. These two channels have opposite effects on the incentive to acquire information about the future. In the multiplicative case – personal discount rates differ by factors of proportion, as, say, in the log formulation of the discount rate used in this paper – more patient individuals will invest more.

with less than 5% of those who chose the High-3 annuity. In addition, individuals who were better informed were less likely to report being dissatisfied.

One way to distinguish the direction of causality between patience and information would have been to randomly assign a certain fraction of individuals to take a short quiz right after they made their CSB choice. Some proportion of individuals could have been given the correct answers and asked whether they would like to alter their choice. One could then compare the choices and satisfaction of individuals who did and did not receive the treatments. If even such a concerted effort to correct individuals' misperceptions failed to change behavior, the case in favor of causality running from impatience to information would be strengthened.

REFERENCES

Agarwal, Sumit, Chunlin Liu, and Nicholas Souleles (2007). The Reaction of Consumer Spending and Debt to Tax Rebates – Evidence from Consumer Credit Data. *Journal of Political Economy* Vol. 115, No. 6 (December): 986-1019.

Ameriks, John, Andrew Caplin, John Leahy, and Tom Tyler (2007). Measuring Self-Control Problems. *American Economic Review* 97 (June): 966-972.

Arias, Elizabeth (2007). United States Life Tables, 2004. *National Vital Statistics Reports (Volume 56, Number 9)*. Washington, DC: National Center for Health Statistics.

Army Retirement Services (2001). Career Status Bonus: Weighing Your Options. Powerpoint presentation (February): Washington, D.C.: Office of the Deputy Chief of Staff, Personnel.

Asch, Beth J. and John T. Warner (1994). *A Policy Analysis of Alternative Military Retirement Systems*. MR-465-OSD. Santa Monica, CA: RAND.

Asch, Beth J. and John T. Warner (1996). Should the Military Retirement System Be Reformed?, in *Professionals on the Front Line: Two Decades of the All-Volunteer Force*, edited by J. Eric Fredland, Curtis Gilroy, Roger D. Little, and W. S. Sellman, Washington, DC: Brasseys's, 175-206.

Becker, Gary and Casey Mulligan (1997). The Endogenous Determination of Time Preference. *Quarterly Journal of Economics* 112(3) (August): 729-58.

Behrman, Jere, Olivia S. Mitchell, Cindy Soo, and David Bravo (2010). Financial Literacy and Household Wealth Accumulation. NBER Working Paper 16452.

Brown, Keith, and Michael Moskowitz (2007). *Friendly Advice and Time Discounting: The Case of Retirement Choice in the Military*. Arlington, VA: CNA Corporation.

Calvet, Laurent E, John Y. Campbell, and Paolo Sodini (2009). Measuring the Financial Sophistication of Households. *American Economic Review* 99 (May): 393-398.

Card, David, Raj Chetty, and Andrea Weber (2007). Cash-on-Hand and Competing Models of Intertemporal Behavior: New Evidence from the Labor Market, *Quarterly Journal of Economics* 122(4), 1511-1560.

Chabris, Christopher, David Laibson, Carrie L. Morris, Jonathan P. Schuldt, and Dmitry Taubinsky (2008). Individual Laboratory-Measured Discount Rates Predict Field Behavior." *Journal of Risk and Uncertainty*. Vol. 37, nos. 2-3, 237-269.

Defense Manpower Data Center. *2008 Quick Compass on Career Status Bonus: Administration, Datasets, and Codebook*. DMDC Report No. 2009-003. Arlington, Va: Defense Manpower Data Center (December 2008).

Defense Manpower Data Center. *2008 Quick Compass on Career Status Bonus: Tabulations of Responses*. DMDC Report No. 2009-002. Arlington, Va: Defense Manpower Data Center (April 2009).

Dohmen, Thomas, Armin Falk, David Huffman, and Uwe Sunde (2010). Are Risk Aversion and Impatience Related to Cognitive Ability? *American Economic Review* 100 (June): 1238-1260.

Frederick, Shane, George Loewenstein, and Ted O'Donoghue (2002). Time Discounting and Time Preference: A Critical Review, *Journal of Economic Literature* 40(2), 351-401.

Harrison, Glenn W., Morten I. Lau, and Melonie B. Williams (2002). Estimating Individual Discount Rates in Denmark. *American Economic Review* 92 (December): 1606-17.

Hasting, Justine S. and Olivia S. Mitchell (2011). How Financial Literacy and Impatience Shape Retirement Wealth and Investment Behaviors. NBER Working Paper 16740 (Cambridge, MA).

Leth-Petersen, Søren (2010). Intertemporal Consumption and Credit Constraints: Does Total Expenditure Respond to an Exogenous Shock to Credit? *American Economic Review* 100 (June): 1080-1103.

Lusardi, Annamaria and Peter Tufano (2008). Debt Literacy, Financial Experiences, and Overindebtedness. NBER Working Paper No. 14808.

Meier, Stephan and Charles Sprenger (2007). Impatience and Credit Behavior: Evidence from a Field Experiment. Federal Reserve Bank of Boston Working Paper 07-3.

Meier, Stephan and Charles Sprenger (2007). Present Biased Preferences and Credit Card Borrowing. *American Economic Journal: Applied Economics* 1 (January): 193-210.

Mitchell, Olivia S., James Poterba, Mark Warshawsky, and Jeffrey Brown (1999). New Evidence on the Money's Worth of Individual Annuities. *American Economic Review* 89 (December): 1299-1318.

Quester, Aline and Lewis Lee with Ian McLeod (2004). *The Retirement Choice*. CRM D0003713.A4/2REV (April), originally published as CNA Research Memorandum 3713.A1 in April 2001. Alexandria, VA: Center for Naval Analyses.

Quester, Aline and Robert Shuford (2005). *Get Paid Now or Get Paid Later: What are Sailors Deciding?* Alexandria, VA: CNA Corporation. (November 2005).

Roberts, Chuck (2003). The $30,000 Question—Airman Consumer. Airman (July), accessed at http://findarticles.com/p/articles/mi_m0IBP/is_7_47/ai_105477553/pg_2/?tag=content;col1 on March 22, 2011.

Shapiro, Matthew D. and Joel Slemrod (2009). Did the 2008 Tax Rebates Stimulate Spending? *American Economic Review* Vol. 99 No. 2 (May): 374-379.

Warner, John T. and Saul Pleeter (2001). The Personal discount rate: Evidence from Military Downsizing Programs, *American Economic Review* 91(1), 33-53.

Warner, John T. (2006). *Thinking About Military Retirement*. CRM D0013583.A1/Final. Alexandria, VA: CNA Corporation.

Appendix A: Military Retirement Incentives

The annual actuarial charge for military retirement ranges between ¼ and 1/3 of outlays for basic pay. The rising cost of the High-3 system reflected the rise in basic pay, which grew by more than 25% between 1980 and 1982. The repeal of REDUX was a part of a larger effort to overcome recruiting and retention difficulties that bean in the late 2000s. The repeal of REDUX was opposed by many policy makers, including the Office of the Secretary of Defense, because of its high cost and the fact that such challenges could be overcome in more efficient ways. However, Joint Chiefs of Staff Chairman General Hugh Shelton and a number of other high-ranking officers supported repeal and carried the day.

Because U.S. taxpayers are able to borrow at relatively low rates of interest in comparison to individual rates of discount, the Department of Defense has found it mutually beneficial to give employees a choice between current and deferred compensation. The first such experiment occurred during the downsizing of the U.S. military from 2.1 to 1.4 million during the early 1990s. The success of that policy led to the offering of a similar choice during the repeal of REDUX.

Interestingly, the incentive to remain in military service beyond 20 years was stronger under REDUX than High-3 because each additional year of service increased retirement pay by 3.5%, compared with just 2.5% under High-3. The retention effects of the retirement system are offset to some extent by up-or-out rules that vary by uniformed service. In addition, military annuities were capped at 75 percent of basic pay prior to FY 2007, at which time the cap rose to 100%. Asch and Warner (1994) analyzed the effect of REDUX on force structure and cost, and Asch and Warner (1996) and Warner (2006) contain additional information on the evolution of the military retirement system.

Appendix B: Expected Lifespan

The Office of the DOD Actuary supplied us with its most recent calculations of survival rates and expected lifespan of officer and enlisted retirees, by current age.[23] The DOD Actuary data indicate that the average officer retiree lifespan is 82.9 years and ranges from 82.6 (based on current age of 30) to 83.7 years (based on current age of 60). The average enlisted retiree lifespan is 78.8 years and ranges from 78.3 to 80.1 years.

Unfortunately, the DOD Actuary's lifespan data do not vary by race and gender in addition to officer/enlisted status. To account for such variation, we collected data on lifespan by current age, race (white, non-white), and gender from the National Center for Health Statistics (Arias, 2007).[24] Expected lifespans for military personnel were estimated by race and gender by imposing the Census lifespan differentials by race and gender on military lifespans such that the weighted averages by race and gender

[23] We are indebted to Peter Zouras of the Actuary's office for supplying the data and explaining how they were constructed.

[24] Specifically, the data used came from tables 5, 6, 8, and 9 of Arias (2007).

reproduce the overall observed military lifespans. The weights in the calculations were obtained from the race-gender distribution of the personnel in the administrative dataset.

Military retirees live longer than all civilians. Our calculations indicate that the average white male officer will live 83.1 years, slightly longer than the overall officer average of 82.9 years. The average white female officer will live much longer, to almost 87. The average non-white male officer is estimated to live to age 79, almost four years less than officers overall. Enlisted white males are estimated to live to age 79.9, just over a year longer than enlisted males overall. Non-white enlisted males are predicted to live to only age 75.8, about 3 years less than enlisted males on average. White enlisted females are estimated to live to age 83.9 while their non-white counterparts are estimated to live to age 80.9.

Appendix C: Accounting for Taxes

We accounted for federal and state taxes on the CSB and retirement annuities as follows. Personnel were classified as married filing jointly, single with dependents, or single with no dependents. We assumed individuals used the standard deduction and accounted for personal deductions for each household member. In absence of information on home state, we used data from the 2001-2009 IPUMS Current Population Surveys (CPS) to assign a state tax rate on the CSB equal to the sample mean for US resident military personnel of 4%. We used data on military retirees in the CPS to assign federal and state tax liability on pensions using linear regression as a function of the annuity amount, education level, marital status, and (separation) age. In accordance with federal statute, individuals who made their CSB decision while in a combat zone were assigned a federal and state tax liability of zero.

Figure 1: Lifetime Retirement Streams Under High-3 and REDUX

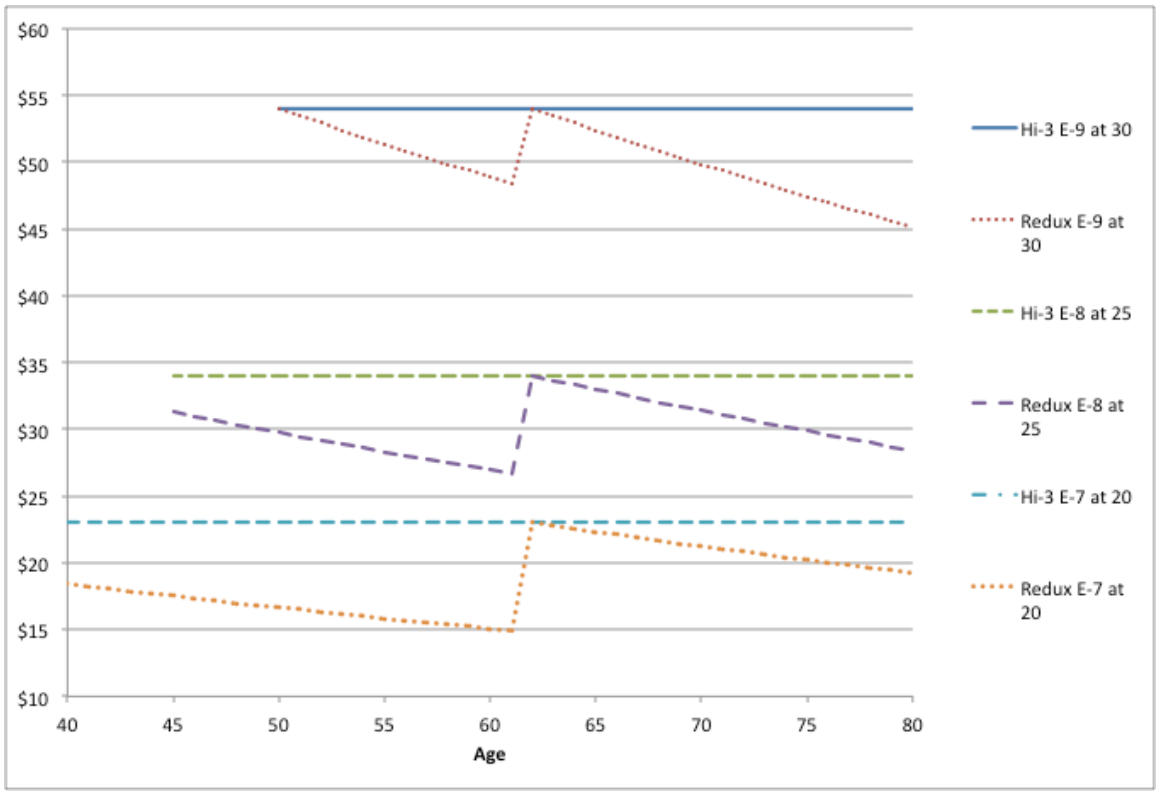


Figure 2: Breakeven Discount Rates for 2008 by Enlisted Rank and Separation YOS
(White Males Age 35 at Time of Choice)

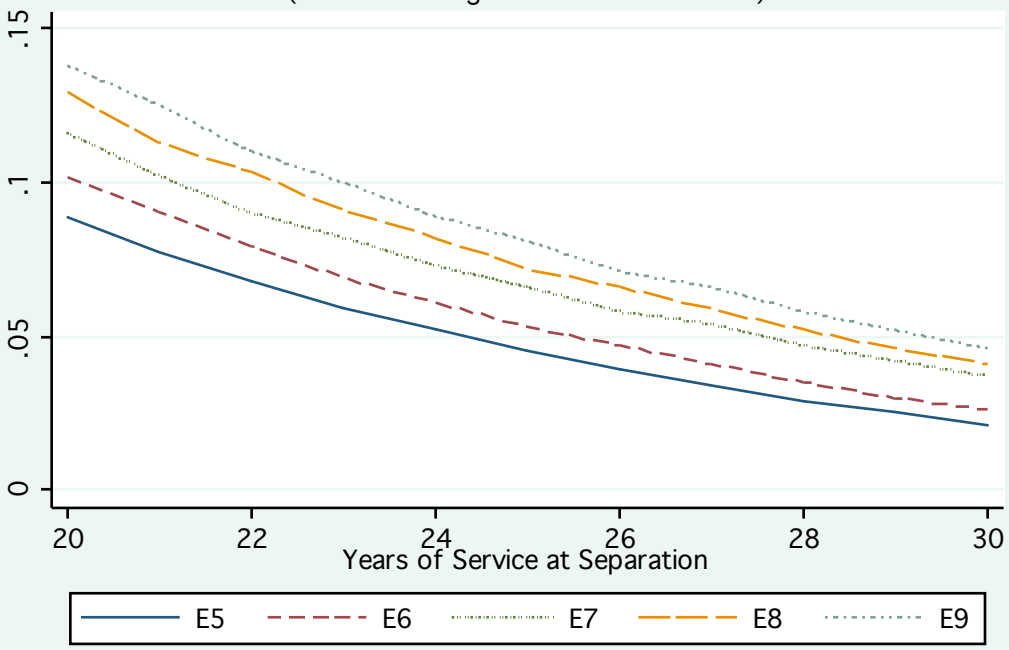
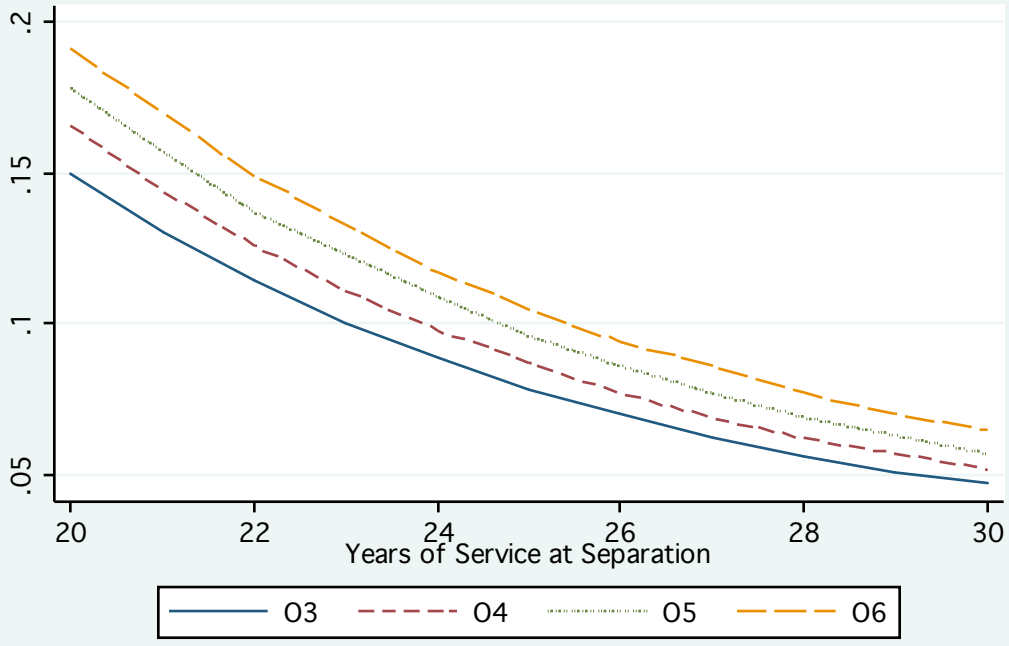


Figure 3: Breakeven Discount Rate by Officer Rank and Separation YOS
(White Males age 38 at Time of Decision)



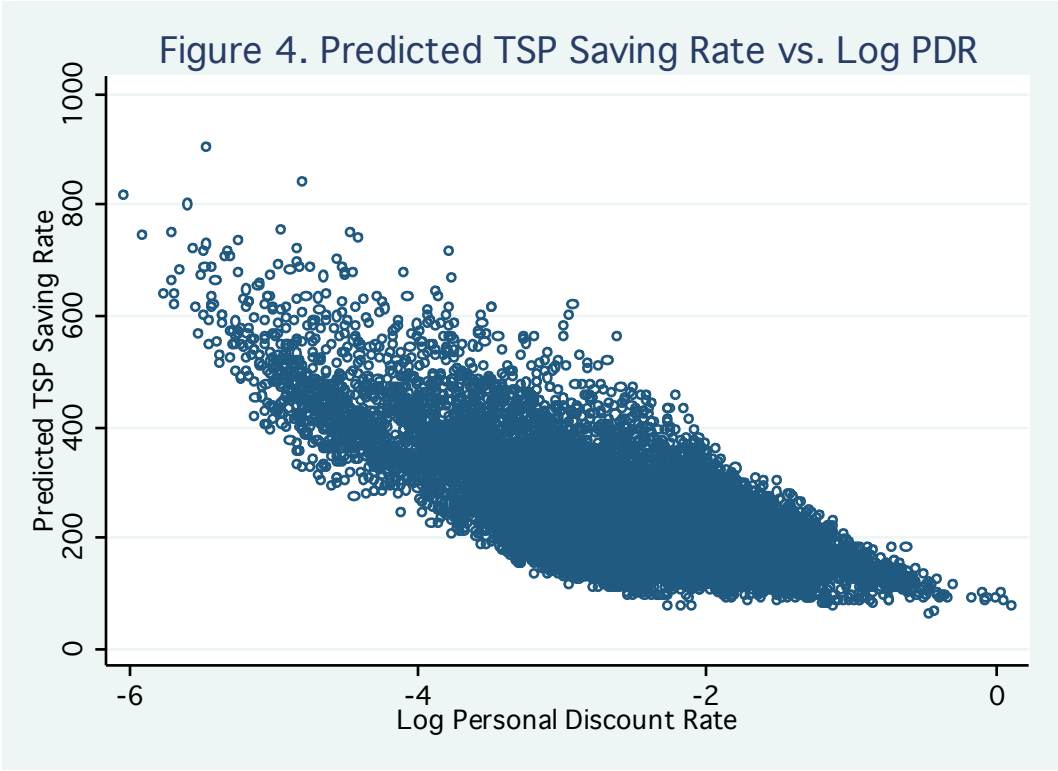


Figure 4. Predicted TSP Saving Rate vs. Log PDR
Predicted TSP Saving Rate
0
200
400
600
800
1000
-6
-4
-2
0
Log Personal Discount Rate

Figure 5. Predicted TSP Allocated to Stocks vs. Log PDR

Table 1. CSB and Thrift Savings Participation

	High 3	CSB	All
Percent Taking			
Survey Participants	56.85%	43.15%	100%
Non-Participants	70.77%	29.23%	100%
TSP Participation			
Survey Participants	54.0	48.3	51.5
Non-Participants	48.6	43.7	47.1
TSP Saving Rate			
Survey Participants	3.14%	2.01%	2.65%
	(4.05%)	(3.14%)	(3.73%)
Non-Participants	2.70%	1.75%	2.42%
	(3.79%)	(2.89%)	(3.58%)
TSP Saving Rate Conditional on Participation			
Survey Participants	5.84%	4.18%	5.17%
	(3.83%)	(3.38%)	(3.75%)
Non-Participants	5.56%	4.00%	5.14%
	(3.69%)	(3.19%)	(3.63%)

Sample standard deviations in parentheses

Table 2. Summary Table and CSB Choice Estimated Effects

	Means and Standard Deviations		CSB Choice: Log Linear		CSB Choice: Linear	
	Survey Participants	Non-Participants	Marginal Effect	Log PDR Points	Marginal Effect	Linear PDR Points
Combat Zone Months	1.4959	1.4888	0.0059	0.0307	0.0053	0.0017
	(2.849)	(2.862)	(0.002)	(0.012)	(0.002)	(0.001)
Age	35.3461	35.5468	-0.0073	-0.0379	-0.0076	-0.0025
	(2.953)	(3.082)	(0.002)	(0.011)	(0.002)	(0.001)
AFQT (enlisted only)	60.0750	57.6502	-0.0006	-0.0030	-0.0006	-0.0002
	(21.172)	(21.215)	(0.)	(0.0016)	(0.0003)	(0.)
Male	0.8835	0.8758	-0.0047	-0.0241	-0.0022	-0.0007
	(0.321)	(0.33)	(0.017)	(0.091)	(0.018)	(0.006)
Married	0.8511	0.8380	0.0058	0.0301	0.0057	0.0018
	(0.356)	(0.368)	(0.023)	(0.119)	(0.024)	(0.008)
Divorced	0.0725	0.0731	0.0389	0.2017	0.0388	0.0125
	(0.259)	(0.26)	(0.029)	(0.154)	(0.03)	(0.01)
Dependents	2.8192	2.7419	0.0389	0.2017	0.0403	0.0130
	(1.487)	(1.508)	(0.004)	(0.03)	(0.004)	(0.002)
Hispanic	0.0768	0.0749	-0.0148	-0.0767	-0.0165	-0.0053
	(0.266)	(0.263)	(0.022)	(0.117)	(0.023)	(0.007)
Black	0.2091	0.2324	0.1299	0.6731	0.1344	0.0433
	(0.407)	(0.422)	(0.015)	(0.106)	(0.016)	(0.007)
Asian	0.0332	0.0371	0.0077	0.0399	0.0134	0.0043
	(0.179)	(0.189)	(0.03)	(0.159)	(0.031)	(0.01)
Other race	0.0808	0.0823	0.1001	0.5183	0.1034	0.0333
	(0.272)	(0.275)	(0.046)	(0.245)	(0.049)	(0.016)
HS Grad	0.5120	0.5027	-0.0412	-0.2133	-0.0423	-0.0136
	(0.5)	(0.5)	(0.029)	(0.156)	(0.031)	(0.01)
Associate Degree	0.1942	0.1632	-0.1101	-0.5701	-0.1132	-0.0365
	(0.396)	(0.37)	(0.031)	(0.173)	(0.033)	(0.011)
BA degree	0.1490	0.1559	-0.1493	-0.7737	-0.1520	-0.0490
	(0.356)	(0.363)	(0.032)	(0.182)	(0.033)	(0.012)
Advanced Degree	0.1031	0.1330	-0.2076	-1.0756	-0.2071	-0.0667
	(0.304)	(0.34)	(0.034)	(0.211)	(0.036)	(0.013)
Officer	0.1488	0.2039	-0.2234	-1.1573	-0.2140	-0.0690
	(0.356)	(0.403)	(0.029)	(0.201)	(0.03)	(0.012)
Warrant officer	0.0292	0.0302	-0.1200	-0.6214	-0.1192	-0.0384
	(0.168)	(0.171)	(0.035)	(0.195)	(0.037)	(0.012)

Estimates are based on a probit model for CSB choice in which the dependent variable equals 1if the individual chose the upfront bonus and 0 if they chose the High-3 annuity. In addition to the variables shown, models included dummy variables for unknown race, branch of service, and decision year, not reported to reduce clutter. Marginal effects are evaluated at the sample average of the normal density function. The estimated effects of each variable on the PDR in points or log points is equal to the estimated probit coefficient divided by the negative inverse of the estimated coefficient on the break-even discount rate (see equation 2). Bootstrapped standard errors in parentheses are based on 1,000 replications

Table 3. Estimated Personal Discount Rates by Selected Demographic

	Log-linear Model		
	Expected Value	Median	Linear Model
All	0.376	0.082	0.059
	(0.188)	(0.006)	(0.003)
AFQT (enlisted only)			
50+	0.390	0.085	0.072
	(0.318)	(0.005)	(0.002)
0-49	0.567	0.124	0.094
	(0.19)	(0.013)	(0.003)
Education			
HS dropout	0.635	0.138	0.098
	(0.418)	(0.028)	(0.009)
HS graduate	0.498	0.109	0.087
	(0.259)	(0.009)	(0.003)
2-year degree	0.333	0.073	0.064
	(0.153)	(0.005)	(0.004)
4-year degree	0.186	0.041	0.017
	(0.075)	(0.003)	(0.007)
Graduate degree	0.082	0.018	-0.023
	(0.021)	(0.003)	(0.011)
Race			
White	0.257	0.056	0.040
	(0.106)	(0.002)	(0.004)
Black	0.715	0.156	0.110
	(0.429)	(0.021)	(0.005)
Hispanic	0.311	0.068	0.054
	(0.15)	(0.008)	(0.007)
Family Structure			
Married	0.385	0.084	0.061
	(0.193)	(0.006)	(0.003)
Divorced	0.457	0.100	0.075
	(0.253)	(0.013)	(0.007)
Dependents			
None	0.192	0.042	0.019
	(0.073)	(0.003)	(0.007)
One	0.258	0.056	0.039
	(0.108)	(0.003)	(0.005)
Two	0.319	0.070	0.054
	(0.144)	(0.004)	(0.003)
Three	0.346	0.075	0.058
	(0.162)	(0.004)	(0.003)
Four	0.455	0.099	0.075
	(0.237)	(0.008)	(0.003)

Note: Estimates are for the full sample of 139,685 CSB-eligibles.

Table 4. TSP Saving Rate and Percent TSP Allocated to Stocks: Zero-Inflated Negative Binomial Estimates

	TSP Saving Rate in Basis Points				Percent TSP Allocated to Stocks	
	Survey Participants		CSB-Eligible, Non-Participants		Survey Participants	
	Zero Saving	Conditional Saving	Zero Saving	Conditional Saving	Zero Stocks	Conditional Stocks
Constant	0.563	5.69	0.709	5.67	0.375	8.51
	(0.077)	(0.066)	(0.061)	(0.053)	(0.096)	(0.046)
log PDR	0.206	-0.18	0.215	-0.18	0.168	-0.09
	(0.029)	(0.024)	(0.023)	(0.02)	(0.033)	(0.015)
Overdispersion	0.639		0.615		0.278	
	(0.017)		(0.004)		(0.013)	
Observations	14,666		124,909		5,501	
Predicted Values						
Baseline	0.486	265.144	0.531	239.144	0.456	3550.098
	(0.007)	(5.145)	(0.001)	(1.006)	(0.01)	(80.051)
High log PDR	0.561	192.745	0.611	167.483	0.517	2900.698
	(0.008)	(4.503)	(0.003)	(1.535)	(0.014)	(95.327)
Difference	0.075	72.399	0.080	71.661	0.061	649.400
	(0.007)	(4.47)	(0.003)	(1.378)	(0.01)	(67.862)

The dependent variable in TSP regressions saving rate over the 2002-2008 period in basis points, equal to the sum of total real TSP contributions divided by the sum of total real cash pay multiplied by 10,000 (to the nearest integer). The dependent variable in the stocks regression is also defined in basis points. Predicted values of the saving rate and stock allocation with "High log PDR" are obtained as the fitted values evaluated at each individual's PDR plus 1 standard deviation (about 0.9 log points). Bootstrapped standard errors in parentheses are based on 1,000 replications.

Table 5. Saving Habits and Financial Condition

A. Which of the following statements comes closest to descibing your saving habits?	Percent in each category			Median PDR
	Overall	High 3	CSB	Overall
Don't save, usually spend more than income	1.8	0.9	3.0	0.101
Don't save, usuall spend about as much as income	9.6	6.1	14.3	0.090
Save whateve is left over at the end of the month, no regular plar	26.0	20.7	33.0	0.089
Spend regular income, save other income	5.2	5.1	5.3	0.077
Save regularly by putting money aside each month	57.4	67.2	44.5	0.070
Total	100.0	100.0	100.0	0.082
B. Which of the following best describes your financial condition?				
Very comfortable and secure	22.9	27.7	16.6	0.066
Able to make ends meet without much difficulty	50.4	50.8	49.8	0.078
Occasionally have some difficulty making ends meet	20.2	16.5	25.1	0.087
Tough to make ends meet but keeping head above water	5.4	4.0	7.3	0.093
Over your head	1.1	1.0	1.2	0.094

Table 6. Estimated Effect of 1 Standard Deviation Increase in log PDR on Saving Habits and Financial Stability

	Probability		
	Baseline	High PDR	Difference
A. Saving Habits			
Don't save, usually spend more than income	0.011	0.021	0.010
	(0.012)	(0.018)	(0.007)
Don't save, usuall spend about as much as income	0.075	0.111	0.036
	(0.036)	(0.042)	(0.008)
Save whateve is left over at the end of the month, no regular plan	0.237	0.285	0.047
	(0.043)	(0.035)	(0.011)
Spend regular income, save other income	0.051	0.055	0.003
	(0.005)	(0.004)	(0.003)
Save regularly by putting money aside each month	0.625	0.528	-0.097
	(0.091)	(0.092)	(0.008)
B. Financial Stability			
Over your head	0.007	0.012	0.005
	(0.006)	(0.009)	(0.003)
Tough to make ends meet	0.044	0.062	0.018
	(0.019)	(0.023)	(0.005)
Occasionally have some difficulty making ends meet	0.182	0.221	0.039
	(0.037)	(0.036)	(0.004)
Able to make ends meet without difficulty	0.512	0.507	-0.005
	(0.014)	(0.023)	(0.014)
Very comfortable and secure	0.255	0.198	-0.057
	(0.055)	(0.047)	(0.009)

Estimated probabilities are based on an ordered probit regressions of individuals' saving habits or financial stability on the individual log personal discount rate. Bootstrapped standard errors in parentheses are based on 1,000 replications. Probabilities in column labeled "High PDR" are calculated by adding 0.9 log points to each individual's log individual discount factor.

Table 7. Financial Problems and Personal Discount Rate

In the past 12 months, did any of the following happened to you?		Median Estimated PDR		
	Frequency	w/o problem	w/problem	difference
Bounced 2 or more checks	0.040	0.100	0.080	0.020
		(0.01)	(0.005)	(0.006)
Had to pay overdraft fees to your bank or credit union 2 or more times	0.142	0.112	0.076	0.036
		(0.011)	(0.004)	(0.007)
Failed to make a monthly/minimum payment on your credit card or [other] account	0.077	0.123	0.077	0.046
		(0.013)	(0.004)	(0.009)
Fell behind in paying the rent or mortgage	0.035	0.113	0.080	0.034
		(0.012)	(0.005)	(0.009)
Was pressured to pay bills by stores, creditors, or collectors	0.078	0.117	0.078	0.039
		(0.012)	(0.004)	(0.008)
Had your telephone, cable, or internet shut off	0.030	0.126	0.079	0.047
		(0.015)	(0.005)	(0.011)
Had your water, heat, or electricity shut off	0.011	0.128	0.080	0.048
		(0.019)	(0.005)	(0.015)
Had a car, household appliance, or furniture repossessed	0.006	0.134	0.081	0.054
		(0.021)	(0.005)	(0.018)
Failed to make a car payment	0.027	0.132	0.079	0.053
		(0.016)	(0.005)	(0.012)
Filed for personal bankruptcy	0.006	0.125	0.081	0.044
		(0.016)	(0.005)	(0.013)
Received notice that foreclosure proceedings had been initated or competed on your home	0.011	0.119	0.080	0.038
		(0.019)	(0.005)	(0.016)
Had at least one of the above	0.161	0.109	0.073	0.036
		(0.01)	(0.004)	(0.007)

Bootstrapped standard errors, in parentheses, are based on 1,000 replications.

Table 8. Effects of Financial Problems on CSB Choice and Median PDR

	Means and Standard Deviations	CSB Choice Marginal Effect	Log Median PDR Points
Number of Financial Problems			
One	0.0980	0.0945	0.4886
	(0.297)	(0.019)	(0.113)
Two	0.0567	0.0878	0.4541
	(0.231)	(0.025)	(0.143)
Three	0.0258	0.1537	0.7950
	(0.159)	(0.04)	(0.225)
Four or more	0.0344	0.2026	1.0477
	(0.182)	(0.04)	(0.232)
Credit card interest rate	7.5446	0.0067	0.0345
	(6.406)	(0.001)	(0.007)
Car loan interest rate	4.6219	0.0079	0.0410
	(5.487)	(0.002)	(0.014)
No credit card rate reported	0.2429	0.0629	0.3254
	(0.429)	(0.018)	(0.098)
No car loan rate reported	0.1613	0.0290	0.1500
	(0.368)	(0.02)	(0.106)

Note: Dependent variable is equal to unity if individual chose CSB and zero otherwise. All regressions include the same variables as used in baseline model -- see Table 2. Bootstrapped standard errors in parentheses are based on 1000 replications

Table 9. Awareness and Impatience

When you made your decision whether to accept the $30,000 Career Status Bonus, were you aware of the following characteristics of REDUX?

		Estimated Median PDRs			ΔP due to 1 sd increse in log PDR
	Frequency	Not aware	Aware	Difference	abs. value
Staying 20 years in the military provides 40% of my basic pay in retired pay under REDUX, as compared to 50% under High-3	0.929	0.091	0.080	0.011	0.013
		(0.008)	(0.005)	(0.004)	(0.0036)
Staying 30 years under REDUX provides the same retired pay as High-3	0.747	0.09	0.077	0.013	0.036
		(0.007)	(0.005)	(0.0013)	(0.0064)
Under REDUX, retired pay is increased annually, but less than the increased cost of living. Under High-3, retirement pay is increased annually by the full increase in the cost of living.	0.691	0.098	0.074	0.024	0.0675
		(0.009)	(0.004)	(0.005)	(0.0059)
Under REDUX, retirement pay is reset at age 62 to the same amount as under High-3	0.744	0.09	0.077	0.013	0.0415
		(0.007)	(0.004)	(0.004)	(0.0064)
Aware of all of the above	0.580	0.091	0.073	0.017	0.0608
		(0.007)	(0.004)	(0.001)	(0.0068)
Aware of none of the above	0.052	0.100	0.080	0.02	0.013
		(0.01)	(0.005)	(0.006)	(0.0028)

The PDR columns report means of the demographic-based estimates of the PDR for aware and non-aware individuals along with the difference. The rightmost column reports the reduction in the estimated probability of being aware of each program feature associated with a 1 standard deviation increase in the log PDR, about .9 points. The estimates are based on simple probit estimates for being aware on the estimated PDR or the estimated PDR plus 1 standard devation. A positive estimated coefficient indicates that more patient individuals, with lower estimated median PDRs, are more likely to be aware. All computations are weighted by survey weight. Bootstrapped standard errors, in parentheses, are based on 1,000 replications.