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UNITED STATES MARINE CORPS PERSONAL DISCOUNT RATES: AS EVIDENCED FROM VOLUNTARY SEPARATION PAYMENT PROGRAMS

by

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March 2006

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Personal discount rates can be defined as the rate at which Marines trade current dollars for future dollars. This research attempts to fill in the gaps in previous discount rate studies where Marine Corps data were omitted, by determining the personal discount rates for each individual who separated from the Marine Corps under the SSB or VSI voluntary separation payment programs between 1992 and 1997. This study also determined those personal, professional, and economic traits that had a significant influence on Marines during their separation payment option decisions. The findings of this research are similar to previous studies, indicating that the methodology applied in this study is accurate. The implications of this research for the Marine Corps are that manpower planners can use the determined personal discount rates to create policies that can target Marines who possess certain personal or professional characteristics for reduction or retention, thereby assisting the efforts to create a balanced and capable Marine Corps in the future. Planners can also use this research to anticipate the effect of policy changes on Marines with specific professional or personal traits.

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UNITED STATES MARINE CORPS PERSONAL DISCOUNT RATES: AS EVIDENCED FROM VOLUNTARY SEPARATION PAYMENT PROGRAMS

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Personal discount rates can be defined as the rate at which Marines trade current dollars for future dollars. This research attempts to fill in the gaps in previous discount rate studies where Marine Corps data were omitted, by determining the personal discount rates for each individual who separated from the Marine Corps under the SSB or VSI voluntary separation payment programs between 1992 and 1997. This study also determined those personal, professional, and economic traits that had a significant influence on Marines during their separation payment option decisions. The findings of this research are similar to previous studies, indicating that the methodology applied in this study is accurate. The implications of this research for the Marine Corps are that manpower planners can use the determined personal discount rates to create policies that can target Marines who possess certain personal or professional characteristics for reduction or retention, thereby assisting the efforts to create a balanced and capable Marine Corps in the future. Planners can also use this research to anticipate the effect of policy changes on Marines with specific professional or personal traits.

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I. INTRODUCTION

A. BACKGROUND

The collapse of the Soviet Union in 1989 reduced the need for large U.S. military forces. Accordingly, in the 1991 Defense Authorization Act, Congress mandated a Department of Defense (DoD) wide reduction in active duty endstrength. The amount of personnel to be cut was 400,000 by fiscal year 1995 (FY95), a 25 percent decrease in total forces. Congress also stipulated that involuntary separations should be kept at a minimum. DoD developed two monetary incentive programs to be used to enable them to attain the required reduction in numbers, while limiting involuntary separations (Warner and Pleeter 2001, 34).

The first program to be implemented was the Voluntary Separations Incentive (VSI), which was an annuity equal to 2.5 percent of annual pay multiplied by the service member's years of service. VSI payments would be received for a period equal to two times the years of service, and would not increase over time to compensate for inflation. The second program to be introduced was the Selective Separation Benefit (SSB), which was a lump sum payment of 15 percent of annual base pay times years of service (Asch and Warner 2001, 5).

The offering of these two programs presented economists with the opportunity to evaluate the personal characteristics, and to determine the personal discount rates, of each service member who was making real separation decisions. It was an opportunity to see if economic theory would be supported for a group of people

that were representative of the country's population (Warner and Pleeter 2001, 33).

B. PURPOSE

This research evaluates the discount rate at which Marines exchanged present dollars for future dollars. The objective is to determine a personal discount rate for each Marine who separated from the Marine Corps under the VSI or SSB voluntary separation programs that were offered between 1992 and 1997, and then compare those rates with rates found in previous studies. This research includes detailed multivariate and economic analyses to determine and examine the economic and personal factors that influenced Marines in their personal discount rate decisions.

C. RESEARCH QUESTIONS

The study done by Warner and Pleeter incorporated Army, Navy and Air Force data. The Marine Corps was not included in their study due to improper eligibility reporting by this branch of service. This thesis follows closely the methodology used in the Warner and Pleeter study to determine the Marine Corps rates that were not determined in that study. The primary research goals of this thesis are to identify the personal discount rates used by Marines in their decision about which of the two separation programs, VSI or SSB, to take; and to identify personal characteristics that made an impact on their voluntary separation option choice.

Secondary research questions include:

- Could separation programs such as VSI and SSB provide the Marine Corps with an additional force-shaping tool to encourage voluntary separation?
- Is there applicability to the other services?

D. BENEFITS OF THE STUDY

Through use of the Marine Corps' Total Force Data Warehouse (TFDW), it is possible to collect the demographic and military characteristics of each Marine who separated under either of the VSI or SSB programs. From these data, it is possible to determine: 1) The discount rate that each individual used in his or her decision about which of the two separation payment options to take, and 2) Those personal characteristics that significantly influenced the Marine's decision to take either the VSI or SSB payments.

Knowing the discount rates and personal characteristics that influence a Marine's decision about the amount of current dollars he or she is willing to trade for future dollars is beneficial. If the Marine Corps is able to determine personal discount rates for each Marine, manpower planners should be able to craft appropriate force-shaping tools. Planners can create incentives that can be used to either encourage retention or separation, whichever is required at the time. Knowing the appropriate amount of money needed to entice Marines to stay or leave will also ensure that the Marine Corps avoids paying consumer surpluses as they choose to separate or retain Marines. Understanding the personal characteristics that influence a Marine's decision will prove useful in that those characteristics can be evaluated by manpower planners, who can then create incentives that encourage separation or retention.

E. SCOPE OF THE THESIS

The scope of this thesis includes a review of personal discount rate studies and a multiple regression analysis using TFDW data. The goal of this thesis is to determine

the individual discount rates and personal characteristics of those Marines who chose to separate under either of the voluntary separation incentive programs. This thesis concludes with a discussion of findings and recommendations for the usability of the model in explaining actual behavior and possible policy implications.

F. ORGANIZATION OF STUDY

The study includes six chapters. Chapter II reviews previous personal discount rate studies based on experimental and non-experimental data. Chapter III introduces the data set used in the study and gives results of preliminary analysis. Chapter IV describes the methodology and model specifications used in the multivariate analysis. Chapter V presents the results of the multivariate probit and logit models. Chapter VI includes a summary of the study, conclusions, limitations, and recommendations.

II. LITERATURE REVIEW

A. PERSONAL DISCOUNT RATE STUDIES

1. Study by Steven Cylke, Mathew Goldberg, Paul Hogan and Lee Mairs (1982)

In this paper, the authors evaluated the economic theory that suggests individuals discount annuity payments, making lump sum payments more likely to entice sailors to reenlist than annual installment payments. The opportunity to test this theory arose when DoD changed the manner in which it paid reenlistment bonuses. Before April 1, 1979 such bonuses were paid once a year at the beginning of each year of reenlistment, but, after that date, the entire bonus was paid as a lump sum on the date of reenlistment. This change in policy provided economists with a chance to evaluate personal discount rates based upon reenlistment choices made by sailors who were eligible to receive up to $20,000 for reenlisting. The authors studied the impact of bonuses on reenlistment rates before and after this change in policy to see what effect the lump sum payment method had on an individual's reenlistment decision. Then, once the lump sum payment effect was estimated, it was used to determine an implied discount rate (Cylke et al. 1982, 1).

The data set used in this study comes from U.S. Navy reenlistment records that cover FY78 through FY80. There were 87 Navy ratings with complete reenlistment records during this time period. The authors pooled the annual data. The data set includes one year under the original bonus payment policy, a year of transition to the new policy, and one year under the new bonus payment method (Cylke et al. 1982, 4).

The authors believed the reenlistment rate was a logistic function of the equation:

$$\log[R/(1-R)] = Xb + u$$

where R is a vector of reenlistment rates for each rating and *b* is the vector of coefficients of the independent variables. The authors chose to use two different model specifications in this study. In the first instance, dummy variables for the FY79 and FY80 observations were used to determine what influence time had on reenlistment decisions, not including the bonus multiple. The second specification replaced the FY79 and FY80 dummy variables with a variable for the unemployment rate for males aged 25-34. The authors tried to determine the effect of time on reenlistment decisions by confining the effect to suggest itself through the unemployment rate. Interaction variables linked the bonus multiple and fiscal year dummy variables, enabling the authors to see the effects of bonuses on reenlistment rates for the three different years being evaluated. They also enabled them to evaluate whether or not the policy change led to increased rates of effectiveness for the bonuses (Cylke et al. 1982, 4-5).

Table 1 highlights the resulting coefficients, t-values, and partial effects from the regression analysis. This table can be used to determine the partial effects in specification 1, showing that annuity reenlistment bonuses were only 71 percent as effective as the lump sum bonuses paid in FY80. The annuity reenlistment bonus effectiveness increased slightly under specification 2, but only to 74 percent.

Table 1. Results of Regression Analysis

	Specification 1			Specification 2		
	Coefficient	T-Value	Partial Effects	Coefficient	T-Value	Partial Effects
Intercept	-.7941	5.98	-	-.8569	3.23	-
Bonus	.1840	3.98	-	.1914	5.96	-
FY78	-	-	.044	-	-	.046
FY79	-.0410	.25	.054	-	-	.054
FY80	-.0166	.11	.062	-	-	.062
Unemployment	-	-	-	.0081	.16	-
Bonus * FY79	.0427	.69	-	.0329	.76	-
Bonus * FY80	.0747	1.23	-	.0664	1.38	-
R^2	.343			.342		
N	261			261		

(After Cylke et al. 1982)

The study then shifts its focus to determining the discount rate of the "marginal" reenlisting sailor, as implied by the difference in effectiveness on reenlistment rates between the lump sum and installment bonus payments. The authors address this problem by solving for the nominal discount rate, which they set equal to the real discount rate plus the expected rate of price inflation. They then determine the real discount rate by subtracting the observed rate of inflation from the nominal discount rate. The authors determine their nominal discount rate by setting the following expression equal to the 71 percent relative bonus effectiveness, as determined from the partial effects in Table 1, and then solving for *r*:

$$.25\frac{1+r}{r}\left(1-\frac{1}{(1+r)^4}\right)$$

Doing so resulted in a nominal discount rate, on average, of 29.1 percent. Deducting the Consumer Price Index, which averaged 10.6 percent during the three years of the sample, produces a real marginal discount rate of 18.5 percent (Cylke et al. 1982, 8).

The effects of progressive income taxation are evaluated next in the study. Progressive income taxation implies that the sailor's total tax costs are higher when the entire bonus is paid in one year. The question addressed here is whether or not an increase in annual taxes, for one year, negates or minimizes the effectiveness of a lump sum bonus payment. Even with increased taxes, a sailor may still prefer a one-time payout since deferred income must be discounted.

The authors use this expression to determine how much the annuity bonus increases the discounted present value of the sailor's after-tax income flow:

$$\sum_{i=1}^{4} \frac{B(1-t'[I_i+B])}{(1+r)^{i-1}}$$

B is the annual bonus installment, *t* is the taxes as a function of income, and *Ii* is taxable income not including the bonus. On the other hand, the lump sum bonus increases the sailor's present value by:

$$4B(1-t'[I_1+4B])$$

The authors now combine these two expressions, set the new equation equal to 71 percent, and determine the relative effectiveness of the annuity bonuses:

$$.25\sum_{i=1}^{4} \frac{1-t'[I_i+B]}{1-t'[I_1+4B]}\left(\frac{1}{(1+r)^{i-1}}\right)$$

The resulting discount rate exceeded the rate determined earlier, indicating that there are higher discount rates when progressive income taxation is taken into account. This is because discounting now must yield the empirical effectiveness of lump sum bonuses, but do so

in the face of the tax disadvantage of one-time payments (Cylke et al. 1982, 11).

The authors continue their evaluation of real discount rates by examining the effect of income averaging. They want to determine if reenlisting sailors may decide to receive their lump sum payment over time so they have lower total tax payments. The authors determine that the relative effectiveness of installment bonuses is determined by the formula:

$$\frac{B}{4B-(t_a-t[I_1])}\sum_{i=1}^{4}\frac{1-t'[I_i+B]}{(1+r)^{i-1}}$$

This expression suggests a nominal discount rate of 27.4 percent and correspondingly, a real discount rate of 16.8 percent (Cylke et al. 1982, 14). This rate is only 1.7 percent lower than the previous estimate of 18.5 percent, indicating that taxation has little impact on a sailor's decision as long as the income averaging option exists.

The authors conclude their study by addressing the implications of their estimated real personal discount rates on current bonus policy. The authors found that the net present cost to the Navy is greater than the net present value to the sailor receiving the bonus. They also determined that installments paid over time are not as efficient in enticing sailors to reenlist as lump sum bonuses. These conclusions are based on the difference between their estimated real discount rate of approximately 17 percent, and the Navy's discount rate of about 10 percent (Baumol 1968, Feldstein 1964, Marglin 1963).

Cylke et al. found that marginally, reenlisting sailors had a real discount rate of approximately 17 percent, when inflation and progressive income taxation are taken into consideration. They also determined that tax considerations had minimal effect on reenlistment rates providing sailors could “income average” their lump sum bonus payments (Cylke et al. 1982, 17). The study also concludes that lump sum bonuses are a more cost efficient method to entice sailors to reenlist, compared to annuity payments, so long as the Navy’s real discount rate is below 17 percent. The authors also advise against a return to a policy of installment bonuses or a mixture of installment and lump sum payments. These methods are more costly to the Navy and taxpayers than lump sum bonuses are, and do not achieve a higher reenlistment rate than lump sum bonuses.

This study evaluated the effects of bonuses on retention rates offered to sailors during the FY78 to FY80 time period. The authors took the opportunity offered by a change in Navy policy to see if a lump sum bonus payment had an effect on reenlistment rates when compared to annuity bonus payments. By determining the discount rate that set the present value of the lump sum payment equal to the present value of the annuity payment, Cylke et al. were able to estimate a personal discount rate for each sailor. They found that, marginally, enlisted sailors had a real discount rate of approximately 17 percent. This discount rate is higher than the rate used by the Navy, so it was

concluded that lump sum bonus payments were more likely to entice a sailor to reenlist than monetary payments over time.

2. Study by John Warner and Saul Pleeter (2001)

The Warner and Pleeter study used the congressionally mandated military drawdown during FY92 to FY95 to estimate personal discount rates based on observing which of the two separation incentive options (VSI or SSB) was chosen by 66,000 military personnel. The data used in their study came from the Defense Manpower Data Center (DMDC). DMDC's data set matched "(1) the service reports of eligibility, (2) DMDC's master file records containing information about, race, sex, education, rank, years of service, etc., and (3) Joint Uniform Military Pay System (JUMPS) records containing information about each service member's military compensation and the separation payment actually received" (Warner and Pleeter 2001, 41).

Warner and Pleeter began their evaluation by calculating a break-even discount rate (BEDR) for each individual in their sample. Break-even discount rates are defined as the rate which makes the Present Value of the Annuity Payment equal to the Present Value of the Lump Sum Payment. The authors used this formula to determine the break-even discount rates:

$$(1-t_1)SSB = \sum_{t=0}^{2YOS_{-1}} (1-t_2)*VSI*(1+BEDR)^{-t}$$

Their model posited the discount rate to be a linear function of the observed characteristics of the individual

(χ) and random error (ε), where β is a parameter estimate:

$$PDR = \chi\beta + \varepsilon$$

The probability of choosing the lump sum option could then be determined by the formula:

$$P(SSB) = P(\chi\beta - BEDR > -\varepsilon)$$

The SSB option was chosen if PDR > BEDR (Warner and Pleeter 2001, 38).

Table 2 below lists the regressors used in the model along with their anticipated effect on the likelihood of the SSB option being chosen.

Table 2. Expected Effect of Independent Variables

Independent Variables	**Expected Effect on Choosing SSB**
Wages	Negative
Education	Negative
Age	Negative
Mental Test Scores	Negative
Race	Positive
Gender	Unknown
Family Size	Positive
Military Occupational Specialty	Unknown
Geographic Region	Positive
End of Contract Term	Positive

The authors separated their data set into two groups: officers and enlisted, and ran a bivariate probit model to determine estimates for each of the independent variables. Overall, the effects of wages, education and age on the likelihood of selecting the SSB option were all found to be negative as had been anticipated. Those with more education had a significantly lower likelihood to take the lump sum and to have lower discount rates, as were older personnel. Blacks were estimated to be significantly more likely to take the lump sum payment than other races. Having more dependents had a positive effect on the probability of selecting the SSB option as had been anticipated, but the likelihood of selecting the lump sum decreased with age. Military Occupational Specialty (MOS) effects were mixed. Combat arms personnel had a higher separation probability than non-combat arms individuals. The study also found that enlisted personnel had a much higher average tendency to select the SSB, but the inclination to do so varied considerably with personal traits.

Specifically for the officers, it was found that the break-even discount rate had a negative and highly significant effect on an officer's decision to take the SSB payment. This implies that as the break-even discount rate increases, the less likely an officer will be to take the lump sum payment. Warner and Pleeter also found that black officers were more likely to take the SSB than nonwhites, and that as the officer's education level increases the likelihood of that person choosing the SSB decreases. As the number of dependents increases so does the likelihood

that the officer will take the SSB option, but this trend declines with age. The propensity to choose the SSB payment was found to be greater for officers in tactical operations, than for those officers who had different MOSs. Officers were less likely to choose the lump sum payment option as the size of the after-tax lump sum amount increased, revealing that individuals do discount larger amounts at lower discount rates than they do small values (Warner and Pleeter 2001, 45-46).

The enlisted personnel model produced similar results to those found for the officer ranks. The break-even discount rate coefficients were again negative and highly significant. Enlisted personnel were much more likely to choose the SSB payment, and black enlisted were, like their officer counterparts, more likely to take the lump sum payment than whites. Enlisted personnel with higher education levels were found to be less probable to take the SSB and they had lower discount rates just as officers did. The effect of having dependents on the enlisted payment option decision was not as important as it was for officers. Those enlisted personnel with the greater number of dependents were more likely to take the lump sum payment due to their higher discount rates. Male enlisted personnel were more likely than their female counterparts to take the SSB and they tended to have higher discount rates as well. Individuals in the two highest mental categories were found to be less likely to choose the SSB payment option than others, and they were found to have lower discount rates. As with officers, those enlisted personnel in combat arms MOS had a higher propensity to take the lump sum payment and to have higher discount

rates. The year in which the individual separated was also significant, with those separating in 1992 having a higher propensity to opt for the lump sum payment (Warner and Pleeter 2001, 47-48).

Warner and Pleeter inserted these estimated coefficients into the original model, $PDR = \chi\beta + \varepsilon$, to determine personal discount rates for each individual in the sample. Table 3 provides a summary of their results.

Table 3. Mean Nominal Discount Rates

	Officers		Enlisted Personnel	
	Linear Model	Loglinear Model[1]	Linear Model	Loglinear Model
All	0.104	0.187	0.354	0.536
Stayers	0.099	0.182	0.350	0.525
Leavers	0.129	0.210	0.369	0.572
All in YOS:				
7	0.205	0.291	0.410	0.714
9	0.159	0.232	0.381	0.607
11	0.111	0.180	0.353	0.527
13	0.046	0.132	0.327	0.459
15	0	0.099	0.294	0.389

(Warner and Pleeter 2001, 48)

They found that the average nominal discount rate for the officers was 0.104 while enlisted personnel had a rate of 0.354. Table 3 also shows that discount rates decline as an individual's YOS increase.

[1] Loglinear models restrict the estimated discount rates to positive values (Warner and Pleeter 2001, 48).

Warner and Pleeter had a unique opportunity to study personal discount rates during the DoD-wide force reduction that took place between 1992 and 1995. They evaluated the individual discount rates of 11,000 officers and 55,000 enlisted who chose to leave the military through either the VSI or SSB voluntary separations programs. This study of personal discount rates was quite different from previous evaluations due to the fact that they were able to use a real-life situation in which people made real choices over large amounts of real money. The individual's choice between the two programs made it possible for the authors to determine the break-even discount rate that equalized the present values of the annuity and lump sum payments, which they used in their models to determine coefficients that were then used to calculate personal discount rates for each person in their data set.

Warner and Pleeter found that officer personal discount rates averaged between 10 and 19 percent, while enlisted rates were higher, ranging between 35 to 54 percent (Warner and Pleeter 2001, 48). As break-even discount rates increased, fewer service personnel opted for the SSB payment. Race was found to have a significant positive effect on the option decision, with blacks having a higher propensity to take the lump sum payment than other nonwhites. Education levels had a negative influence on taking the SSB payment, as the likelihood of choosing the one time payment decreased with the more education an individual had. Officer and enlisted members who were in combat arms MOS were positively influenced to select the lump sum payment as did the year in which the separation option was chosen.

The authors believe that the SSB separation option was welfare enhancing for the government. This is because the services were able to save $1.7 billion through paying lump sum payments and not through the more costly annuity payments. The personnel separating also thought they were better off with the lump sum payments as well, or they would have chosen the VSI option. Knowing this, it will be possible in the future for military planners to create monetary policies that are capable of earning the greatest return on their investments.

3. Study by Pat Mackin (1995)

This study uses the DoD-wide drawdown that occurred during the early to mid 1990s to evaluate personal discount rates. Following the Warner and Pleeter techniques, the author uses the difference in payment methods of the VSI and SSB payments to estimate personal discount rates for Air Force personnel. Mackin evaluated the records of 6,220 officers and 33,804 enlisted personnel who separated from the service, taking either the VSI or SSB, under any of the six loss-programs offered by the Air Force.

The methodology applied to this study follows the procedures in the Warner and Pleeter study. Mackin evaluated the economic theory that a person's discount rate is affected by personal characteristics such as age, race, sex and education level. First, a break-even discount rate was determined for each individual by solving for D*, which makes the two separation payment methods equal in their present values. The author accomplished this using the formula:

$$\Pr(SSB) = \Pr[x_i\beta + \varepsilon > D^*]$$

The resulting individual break-even discount rates were then added to the data set, and then a probit regression was run to predict the probability of an airman choosing the SSB over the VSI.

$$\Pr(SSB) = \Phi[x_i \frac{\beta}{\sigma} - D^* \frac{1}{\sigma}]$$

The following table highlights the results obtained from the probit regression analysis:

Table 4. Results of Probit Analysis

	Enlisted Results			Officer Results		
	Probit Estimate	Standard Error	T-Statistic	Probit Estimate	Standard Error	T-Statistic
Constant	6.2179	.2506	24.81***	2.5276	.1931	13.09***
Wage	-.00005	.0000	-9.20***	.00001	.0000	1.57
Nonwhite	.2512	.0233	10.78***	.3237	.0522	6.20***
Female	-.1716	.0244	-7.04***	-.0884	.0451	-1.96**
Marital	.1055	.0271	3.90***	.0055	.0465	.12
NumDep	.0285	.0069	4.14***	.0021	.0120	.18
Prog92	.1886	.0208	9.08***	.1132	.0435	2.60***
D*	-25.7858	2.0420	-12.63***	-21.8899	1.8438	-11.87***
Log-Likelihood	24,199.3955			8,233.7488		

*** Significant at the .01 level (After Mackin 1995, 7)
** Significant at the .05 level
* Significant at the .10 level

The results from the analysis show that the variable, wages, had a minimal effect on the choice between taking the SSB or VSI programs. The effect on enlisted was significantly negative, but for officers the effect was not significant. The race and gender variables revealed that non-whites and males have higher predicted discount rates than otherwise similar whites or females. Discount rates were also higher for enlisted personnel who were married and for those with dependents. The year in which the

selection decision was made influenced the likelihood of both officer and enlisted choosing the SSB, with selection rates being significantly higher during 1992, a year in which some non-monetary differences existed (Mackin 1995, 6).

The results from the model estimating the probability of selecting the SSB separation payment enabled the calculation of an individual discount rate, for each Air Force service member as a function of that individual's personal characteristics. The predicted personal discount rate for each individual was based on the formula used by Warner and Pleeter:

$$PDR = \chi\beta + \varepsilon$$

Table 5 lists the estimated personal discount rates by for officers and enlisted personnel based on YOS:

Table 5. USAF Personal Discount Rates

	Enlisted Results	Officer Results
YOS 9	.209	.147
YOS 12	.209	.149
YOS 15	.205	.155
YOS 18	.202	.155
All YOS	.209	.146

(After Mackin 1995, 11)

The estimated personal discount rate for enlisted personnel averaged approximately 21 percent, while the officer average was lower, around 14 percent. Personal discount rates for enlisted members fell as YOS increased, but for officers, the rates increased with YOS. Personal discount rates were found to vary by gender and race.

The author indicates some potential policy implications from the findings. Males and non-whites appear to be more attracted to current dollars than females or whites. This preference of males and non-whites is indicated by the higher discount rates determined for these two groups. This inclination towards current dollars may extend into other monetary programs as well, such as reenlistment bonuses, retirement, and veteran's benefits. There is also the potential that the Air Force can maximize the effect of its special pays through maintaining their discount rate at a lower percentage than the rates being used by individual airmen. The author also indicates that the findings can potentially provide policy makers with indications of how a policy will affect specific demographic groups (Mackin 1995, 6).

The study conducted by Steve Mackin determined the individual discount rates of 40,024 Air Force personnel who left that service under the VSI or SSB voluntary separations programs during 1992 through 1995. He found that officer personal discount rates averaged 14 percent, while enlisted rates were higher, averaging 21 percent. Wages were found to have little effect on the option decision, but gender and race did impact the individual's choice of separation payment option. The results of this study of personal discount rates were consistent with the Warner and Pleeter study, although the rates were slightly lower and Mackin found an upward rate trend as tenure increased, while the opposite was true in the Warner and Pleeter study. Mackin's evaluation of personal characteristics and their effect on individual discount rates reveals a potential for DoD planners to create pay

policies that are able to maximize the retention effect of special pays. These characteristics can also potentially suggest what effects certain types of pay policies will have on specific demographic groups of service personnel.

B. CHAPTER SUMMARY

The three studies under review took advantage of changes in DoD policy that enabled them to measure and evaluate the rate at which service personnel exchanged current dollars for future dollars, or the personal discount rate. The Cylke et al. study evaluated the effect of a lump sum bonus payment on reenlistment rates to see if receiving current dollars would effect a sailor's decision to reenlist. The Warner and Pleeter study evaluated the choices made by service personnel in choosing the VSI or SSB separation payment, again an investigation into the exchange of current dollars for future dollars. The Mackin study closely resembled Warner and Pleeter's, but focused only on Air Force personnel and their VSI and SSB choices.

In all three cases, the methodology was similar. A break-even discount rate was determined for each individual by equating the present value of the lump sum bonus or SSB payment to the present value of the annuity or VSI payment. These individual break-even discount rates were then added to each data set, a regression analysis conducted, and the estimated coefficients evaluated.

The resulting coefficients revealed some interesting facts. Race was found to have a significant effect on the lump sum or annuity separation option decision. Blacks were found with a higher likelihood to choose the SSB payment than other nonwhite personnel. Gender too, prove a significant factor revealing that men were more likely to

take the lump sum payment than women were, and their personal discount rates were, on average, higher than for females. An individual's education level was found to have a negative influence on choosing the lump sum payment, meaning that as a person's education level increases, his or her likelihood to opt for the SSB payment decreases. The MOS of the individual impacted the personal discount rate as well. Personnel in combat arms MOS had a higher propensity to take the SSB payment. Wages were found to have little impact on an individual's discount rate decision.

Once the estimated coefficients were evaluated, each study determined an individual personal discount rate for each service member. The results of each study proved interesting. Cylke et al. estimated that enlisted sailors had, on the margin, a real discount rate of approximately 17 percent (Cylke et al. 1982, 17). Warner and Pleeter determined a higher personal discount rate for enlisted personnel ranging from 35 to 54 percent and a lower rate for officers, averaging between 10 to 19 percent (Warner and Pleeter 2001, 48). The Mackin study results were quite similar to those of Warner and Pleeter. Mackin found that officer personal discount rates were approximately 14 percent with enlisted rates of approximately 21 percent.

Fiscal policy implications were also discussed. Cylke et al. found that their estimated personal discount rate of 17 percent is higher than the rate used by the Navy, and therefore concluded that the lump sum bonus payments were more likely to entice a sailor to reenlist than annuity-type payments would be, and therefore recommended that the Navy use lump sum bonus payments for reenlistment purposes.

Warner and Pleeter understand the SSB separation payment to be cost effective. The government would be able to save considerable amounts of money by using lump sum reenlistment or separation payments and by avoiding the more costly annuity-type payments. The authors also suggest that it is possible for manpower planners to create force-shaping policies that more accurately take into account personal discount rates, thereby increasing the efficiency of the payment while limiting consumer surplus.

The Mackin study found that by observing personal characteristics and their effects on personal discount rate decisions, fiscal planners will be able to get the most out of special pay incentives and will be able to determine, ahead of time, an incentive’s effect on particular demographic groups.

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III. DATA SET, VARIABLES, AND PRELIMINARY ANALYSIS

A. DATA SET

The Marine Corps' Total Force Data Warehouse (TFDW) provided the data set used for this study. TFDW is the Marine Corps' authorized system of record for current, historical, demographic and service-related records. The data contained in TFDW come in quarterly and monthly snapshots dating from 1988 to the present (Thomas and Beebe 2004, 4). TFDW is used in this study to collect data for historical analysis and trend analysis. It provided the specific demographic and service-related information on the 3,241 Marines who chose to separate using either the VSI or SSB voluntary separation payment programs. The data that were extracted from TFDW were pooled. Groupings were based on the year in which the Marine took the separation payment option, which included the years 1992 to 1997.

The data retrieved from TFDW were very complete and had very few instances of missing values. Of the 158,809 (49 Variables * 3,241 Marines) values obtained, there were only 32 missing values. Thirty-one of these values were in the "number of dependents" category, and belonged to Marines who were single. Since these Marines were single, the assumption was made that they had no dependents, and were therefore assigned a zero under the "number of dependents" variable. The other missing value was a Staff Sergeant's level of education. Based on the fact that this Marine had demonstrated "determination" through getting promoted to that rank, it is assumed that he had

demonstrated the same level of determination in attaining a high school diploma, and was therefore assigned that level of education.

The accuracy of the records found for the category "educational level" are questionable. TFDW records show that only 85 officers had a degree higher than a high school diploma. Marine Corps policy is for officers to have a minimum educational level of a bachelor's degree (Powers 2006, 1).[1] Since this policy is in effect, all officers were assumed to have the minimum educational level of a bachelor's degree, unless a higher level was recorded in TFDW.

B. VARIABLE DESCRIPTIONS

TFDW provided information on each Marine for 49 different characteristics. Table 6 lists these initial variables and their definitions.

Table 6. Initial Variables from TFDW

Variable Name	Variable Definition
Action Date	Year separated from service
Option Chosen	1 = SSB, 2 = VSI
Gender	1 = Male, 2 = Female
Race	1 = White
	2 = Asian
	3 = African American
	4 = Native Hawaiian/Pacific Islander
	5 = American Indian/Alaska Native
	6 = No response
Marital Status	1 = Married

[1] Some officers, particularly prior-enlisted officers, do not have a bachelor's degree at time of commissioning. However, these officers are required to earn a bachelor's degree to remain an officer.

	2 = Divorced
	3 = Legally Separated
	4 = Annulled
	5 = Single
	6 = Widowed
Number of Dependents	Number of non-spouse dependents
Present Grade	1 = E4
	2 = E5
	3 = E6
	4 = E7
	5 = O3
	6 = O3E
	7 = O4
	8 = O5
Military Occupational Specialty (MOS)	1 = Combat Arms
	2 = Combat Service Support
	3 = Aviation
Civilian Education	1 = Less than HS Diploma
	2 = Adult Diploma
	3 = Occupational Cert
	4 = Associated Degree
	5 = GED
	6 = Certification Att
	7 = Correspondence Diploma
	8 = 1 Semester College
	9 = Bachelor’s Degree
	10 = HS Diploma
	11 = Master’s Degree
	12 = Post Masters
	13 = Doctorate
	14 = First Professional
Date of Birth	Date of Birth
Active Duty Base Date	Date Marine came on active duty

Additional variables were also created to better explain the discount rate decisions being made. These variables are listed below with their definitions.

Table 7. Created Variables

Variable Name	Variable Definition
Other Minority	Marine has Race = 2, 4, or 5
Single	Marine has Marital Status = 2, 3, 4, 5 or 6
Single with Dependents	Single Marines who have dependents
Field Grade	Marine is an O4 or O5
Less than HS Diploma	Marine has a civilian education level = 1
Equivalent to a HS Diploma	Marine has a civilian education level = 2, 5, 10
Greater than HS Diploma	Marine has a civilian education level = 3, 4, 6, 7, 8, 9, 11, 12, 13, 14
Unemployment Rate	The national unemployment rate that corresponds to the month in which the Marine separated
Age at Separation	Action Date – Date of Birth
Years of Service (YOS)	Action Date – Active Duty Base Date
Annual Base Pay	Annual Base Pay at separation
Break-Even Discount Rate	The rate at which the PV(SSB)=PV(VSI)

Three critical variables that had to be created were YOS, annual base pay and the break-even discount rate. YOS was determined by subtracting each individual’s active duty base date from the date on which he or she took the separation payment option. This produced the total active duty time for each Marine who was separating. The annual pay variable was created by taking the rank, YOS and

monthly pay for each Marine, as determined from the annual pay charts for the years 1992 through 1997, and multiplying that by 12. The break-even discount rate variable was formed by determining the rate that equates the present value of an annuity formula, where the PV(SSB) = PV(VSI), or stated another way, where the PV(lump sum payment) = PV(annuity payment).

C. PRELIMINARY ANALYSIS

1. Descriptive Statistics

There are 3,241 Marine officers and enlisted men and women who separated under either of the two voluntary separation payment options that were offered during 1992 to 1997. Table 8 shows the demographic and military service statistics for the 494 Marine officers who separated during this time period.

Table 8. Descriptive Statistics for Marine Officers

Variable	Frequency	Percent	Mean	SSB Frequency	SSB Percentage
Separation Year					
1992	13	2.63	-	2	15.38
1993	268	54.25	-	119	44.40
1994	207	41.90	-	66	31.88
1995	5	1.01	-	1	20.00
1996	1	.002	-	1	100
Option Chosen					
SSB	189	38.26	-	189	38.26
VSI	305	61.74	-	305	61.74
Gender					

Male	470	95.14	-	181	38.51
Female	24	4.86	-	8	33.33
Race					
White	460	93.12	-	172	37.39
Black	23	4.66	-	10	43.48
Am Indian/ Alaska	1	.002	-	0	0
Marital Status					
Married	399	80.77	-	152	38.10
Single	95	19.23	-	37	38.95
Number of Dependents					
0 – 3	385	77.94	1.76	146	37.92
> 3	109	22.06	4.72	43	39.45
Rank					
O3	397	80.37	-	161	40.55
O3E	43	8.70	-	16	37.21
Field Grade	54	10.93	-	12	22.22
MOS					
Combat Arms	173	35.02	-	73	42.20
Combat Service Support	167	33.81	-	60	35.93
Aviation	154	31.17	-	56	36.36
Education Level					
Bachelors Degree	411	83.20	-	173	42.09

> Bachelors	83	16.80	-	16	19.28
Age					
27 – 30	48	9.72	29.65	25	52.08
31 – 35	332	67.21	33.06	127	38.25
36 - 40	105	21.26	37.29	37	35.24
41 - 44	9	1.81	41.89	0	0
YOS					
4 – 10	224	45.34	8.98	114	50.89
11 - 15	234	47.37	11.89	65	27.78
16 – 22	36	7.29	17.19	10	27.78
Unemployment Rate					
5.5 – 6.4	209	42.31	5.96	67	32.06
6.5 – 7.1	231	46.76	6.86	101	43.72
7.2 – 7.8	54	10.93	7.36	21	38.89
Break-Even Discount Rates					
6 – 13.99	1	.20	6.88	0	0
14 - 14.99	68	13.77	14.70	36	52.94
15 – 15.99	155	31.38	15.60	78	50.32
16 – 16.99	270	54.66	16.22	75	27.78

Table 9 shows a breakdown of the demographic and military service statistics for the 2,747 enlisted Marines who separated.

Table 9. Descriptive Statistics for Marine Enlisted

Variable	Frequency	Percent	Mean	SSB Frequency	SSB Percentage
Separation Year					
1992	1231	44.81	-	999	81.15
1993	1340	48.78	-	1012	75.52
1994	175	6.37	-	85	48.57
1997	1	.04	-	1	100
Option Chosen					
SSB	2097	76.34	-	2097	76.34
VSI	650	23.66	-	650	23.66
Gender					
Male	2599	94.61	-	1993	76.68
Female	148	5.39	-	104	70.27
Race					
White	2012	73.24	-	1510	75.05
Black	594	21.62	-	474	79.80
Other Minority	9	.33	-	8	88.89
Marital Status					
Married	2240	81.54	-	1713	76.47
Single	507	18.64	-	384	75.74
Number of Dependents					
0 – 3	2115	76.99	1.85	1629	77.02
> 3	632	23.01	4.51	468	74.05

Rank					
E4	115	4.19	-	103	89.57
E5	1268	46.16	-	1057	83.36
E6	1175	42.77	-	810	68.94
E7	189	6.88	-	127	67.20
MOS					
Combat Arms	405	14.74	-	318	78.52
Combat Service Support	1303	47.43	-	974	74.75
Aviation	1039	37.82	-	805	77.48
Education Level					
Less than HS Diploma	14	.51	-	10	71.43
HS Diploma Equivalent	274	9.97	-	200	72.99
Greater than HS Diploma	2459	89.52	-	1887	76.74
Age					
22 – 30	989	36.02	28.51	855	86.45
31 – 35	1303	47.43	32.91	958	73.52
36 - 40	394	14.34	37.28	245	62.18
41 - 46	61	2.21	42.39	39	63.93
YOS					
4 – 10	599	21.81	8.58	541	90.32

11 - 15	1671	60.83	12.66	1264	75.64
16 – 21	477	17.36	16.80	292	61.22
Unemployment Rate					
5.2 – 6.5	204	7.43	6.47	132	64.71
6.6 – 7.3	1600	58.25	7.10	1179	73.69
7.4 – 7.8	943	34.32	7.58	786	83.35
Break-Even Discount Rates					
6 – 10.99	2	.07	8.72	1	50.00
11 – 14.99	270	9.83	14.22	252	93.33
15 – 15.99	327	11.90	15.65	288	88.07
16 – 16.99	2148	78.20	16.33	1556	72.44

2. Preliminary Findings

A preliminary evaluation reveals interesting facts about the Marines in the data set and the rate at which they chose the SSB voluntary separation payment option. Marine officers chose the lump sum payment 38 percent of the time while enlisted Marines were twice as likely to take the SSB option, selecting it at a rate of 76 percent. For both officers and enlisted, men had a higher percentage of individuals choosing the SSB payment than women did, although the differences in selection rates were relatively small, the differences between genders being 5.18 percent for officers and 6.41 percent for enlisted Marines. African-American officers and enlisted Marines, had a higher percentage of individuals who selected the lump sum

payment than whites did, but a rate not as high as seen in Marines of other minority groups.

Marital status information highlighted some differences between those Marines who are married and those who are not. Single officers chose the lump sum payment .85 percent more frequently than did married officers, but this trend was reversed for the enlisted Marines where those who were married had a .73 percent higher percent rate for choosing the SSB payment option. Overall, enlisted Marines, both married and single, were approximately twice as likely to choose the lump sum option when compared to married and single officers. The number of dependents had a positive effect on officers, meaning that as the number of dependents increased, a higher percentage of officers took the SSB payment. The opposite effect was seen in the enlisted data. Here, as the number of dependents increased, the less frequently an enlisted Marine opted to take the lump sum payment option.

Differences in the percentages of SSB takers can also be seen in the rank and MOS data. The data from these categories show that, as Marines increased in rank, the percentage of those who took the lump sum payment decreased. This was true for both officers and enlisted Marines. Marines who have combat arms MOS had the highest percentage of SSB choosers - 42.20 for officers, and 78.52 for enlisted. Aviation MOS Marines were next with percentages of takers at 36.36 for officers and 77.48 for enlisted. Marines in combat service support MOS had the lowest percentage of men and women who took the SSB payment, 35.93 among officers, and 74.75 percent among enlisted.

Education data reveal different behavior for officers and enlisted Marines. For officers, as their educational levels increased beyond that of a bachelor's degree, fewer officers chose the lump sum payment option. Officers with just a bachelor's degree had a 42.09 percent SSB selection rate, while officers with more education had a 19.28 percent SSB take rate. Education had the opposite effect on the enlisted Marines. As educational levels increased, a higher percentage of Marines selected the SSB payment. Enlisted Marines with a high school diploma took the SSB payment 1.56 percent more frequently than those without a high school diploma. Marines who had educational levels above that of a high school diploma were 3.75 percent more likely to take the SSB than those individuals with just a high school diploma.

The data on age show that, for officers, the percentage of those who took the SSB payment decreases as age increases. Over half of the officers in the 27 to 30 year- old category chose the lump sum payment. The percentage of takers drops to 38.25 for the 31 to 35 year-old officers and falls further to 35.24 for those officers between 36 and 40. There were no officers in the 41 to 44 year-old range that selected the SSB payment over the VSI payment option. This age effect was generally found among enlisted Marines as well. The youngest group of enlisted Marines, 22 to 30 years of age, had a high rate of SSB takers, 86.45 percent. The next age range of enlisted Marines, 31 to 35, took the SSB payment 73.52 percent of the time. Those Marines in the 36 to 40 year-old group had the lowest percentage of takers, at 62.18 percent. This

was 1.75 percent less than the percentage of SSB takers for the oldest group of enlisted Marines who ranged in age from 41 to 46 years old.

As YOS increased for officers and enlisted alike, there was a decreasing percentage of those who were willing to take the lump sum payment. Those officers with 4 to 10 YOS selected the SSB 50.89 percent of the time, while enlisted Marines in the same YOS group had a very high lump sum selection rate, 90.32 percent. The SSB selection rate dropped to 27.78 percent for officers in the 11 to 15 and 16 to 22 YOS groups, while enlisted Marines in these two YOS ranges had higher SSB selection rates of 75.64 and 61.22 respectively.

Unemployment rate figures show an increase in the percentage of SSB choosers as the unemployment rate increased. When unemployment rates were low in the 5.2 to 6.5 percent range, 32.06 percent of officers and 64.71 percent of enlisted Marines chose the SSB payment. The selection rates increased to 43.72 for officers and 73.69 for enlisted as unemployment rates increased from 6.5 to 7.3 percent. In the highest unemployment rate level, 7.4 to 7.8 percent, more enlisted Marines took the SSB payment, 83.35 percent; however fewer officers who separated during a period with these higher rates took the lump sum payment option, only 38.89 percent.

The percentage of enlisted Marines who take the SSB payment decreases as their break-even discount rates increase. Marines with BEDR rates ranging from 12 to 14.99 percent have a high 93.33 percent SSB selection rate, while those with BEDR between 15 and 15.99 percent select the lump sum payment 88.07 percent of the time. Enlisted

personnel with BEDR ranging from 16 to 16.99 percent have the lowest lump sum payment selection rate of 72.44 percent. Marine officer data do not reveal quite the same pattern, although it is similar. Officers in the 14 to 14.99 BEDR group have a 52.94 percent SSB selection rate. Those officers in the next higher range of BEDR have a lump sum selection rate of 50.32. The last group of officers has BEDR in the 16 to 16.99 percent range, and these Marines have a 27.78 percent SSB selection rate.

D. CHAPTER SUMMARY

The Total Force Data Warehouse provided the demographic and service-related information on the 3,241 Marines who chose to separate from the service through the VSI and SSB voluntary separation payment programs during the years 1992 to 1997. The TFDW data set was very complete, having only 32 values of information missing. The values for these absent data were logically estimated. While the data set was complete, the accuracy of the variable describing each Marine's level of education appeared to be inaccurate. This problem was overcome by making the assumption that all officers have a bachelor's degree as their minimum level of education, based on Marine Corps policy for officer education requirements.

TFDW provided 49 different categories of information on each Marine that were converted into the variables that are used in the study. YOS, annual base pay and the break-even discount rate were three variables that had to be created and added to the data set before analysis could be done. YOS and annual base pay calculations were used to determine the break-even discount rate, which is the key variable that was not in the TFDW data. The break-even

discount rate variable represents the rate that makes the present value of an annuity equal to the present value of the lump sum payment.

The descriptive statistics addressing the personal aspects of the 494 officers and 2,747 enlisted Marines who separated under either the VSI or SSB voluntary separation payment options during 1992 to 1997 reveal SSB selection patterns that are worthy of notice. First, male Marines were more frequent takers of the lump sum payment than were women Marines. Second, when looking at race, Marines who are members of a minority group other than blacks, had the highest SSB selection rate. African-American Marines had the second highest selection rate, while white Marines had the lowest percentage of SSB option takers. Marital status data show that single officers chose the lump sum option more often than did married officers, but for enlisted Marines those who were married had the higher SSB participation rates than those enlisted who were single. Both married and single enlisted Marines chose the SSB payment almost twice as often as their officer counterparts. When the number of dependents was considered, the data reveal that fewer officers took the lump sum payment as the number of dependents increased. The opposite was true for enlisted Marines. Age too, affects the number of SSB takers in that as officers age, they less frequently select the lump sum separation payment. Enlisted Marines generally follow this age pattern as well, with a minor variation in the 31 to 35 age bracket where their selection frequency was 1.75 percent lower than the oldest group of enlisted Marines.

The statistics that describe the professional characteristics of the separating Marines also show lump sum selection patterns that are interesting. First, enlisted Marines took the SSB payment twice as often as the officers did. Rank and MOS statistics point to the fact that officers and enlisted Marines chose the SSB option less frequently as they rise in rank, and that those Marines with combat arms MOS take the lump sum payment more frequently than those in combat service support or aviation MOS. Officers and enlisted Marines took the SSB payment at a decreasing rate as their years of service increased. Educational data point to a difference between officers and enlisted. As an officer's education level increases beyond a bachelor's degree, he or she less frequently selects the lump sum payment option. Enlisted Marines show the opposite tendency. As their education levels increase above a high school diploma, their SSB selection percentages increase. Evaluation of the Marines' break-even discount rates shows that the percentage of enlisted Marines who choose the lump sum payment decreases as the break-even discount rates increase. Marine officers have a similar tendency, but officers in the middle range of BEDR have the lowest SSB selection rate, .24 percent lower than the group of officers who have the highest BEDR range.

External factors also seemed to influence the Marines' payment option decisions. The descriptive statistics show that as the unemployment rate that separating Marines faced increased, the percentage of SSB choosers increased. When unemployment rates were low, fewer officers and enlisted Marines chose the SSB payment, but correspondingly, as

those rates went up so did the number of Marines who opted for the lump sum money.

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IV. METHODOLOGY AND MODEL SPECIFICATION

A. OBJECTIVE

The objective of this study is two-fold. The first goal is to determine the personal discount rate for each Marine who left the Marine Corps under either the VSI or the SSB voluntary separation payment programs between 1992 and 1997. These data will reveal the discount rate at which present dollars were exchanged for future dollars. This research also determines and evaluates the personal, professional, and economic factors that had a significant effect on the Marines in their personal discount rate decisions.

B. METHODOLOGY

The break-even discount rate for each Marine was calculated using the following method outlined by Warner and Pleeter (2001, 45):

- Obtain data from TFDW on those Marines who separated from active duty service under the VSI and SSB programs.
- Calculate the monetary value of the SSB and VSI options for each individual based on their base pay and YOS.
  - Determine the present value of the SSB payment through the formula: $(15\% * BasePay) * YOS$.
  - Determine the present value of the VSI payment through the formula: $(2.5\% * BasePay) * YOS * (2 * YOS)$.
- Calculate the break-even discount rate for each Marine that equates the SSB and VSI payments, where: .

- Include these break-even discount rates as an explanatory variable in a regression to estimate the probability of each individual selecting the SSB payment option.
- Run a regression to determine the parameter estimates for the independent variables in the model.
- Calculate sigma for the model using this formula:

- Calculate beta for each independent variable using this formula:

- Predict each individual's personal discount rate using the formula:

C. THEORETICAL MODELS

1. Population Model

The probability of choosing the SSB option is expected to be a function of gender, race, marital status, number of dependents, present grade, MOS, civilian education level, year in which separated, YOS, age at separation, base pay, and personal discount rate. The population model is represented by:

$$\Pr(SSB) = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \beta_3\chi_3 ... \beta_k\chi_k + \varepsilon$$

2. Empirical Model

Given the specific variables in the data set, the empirical model to be estimated is:

$$\Pr(SSB) = \beta_0 + \beta_1(SEP\_1992) + \beta_2(SEP\_1993) + \beta_3(SEP\_1994) + \beta_4(SEP\_1995) + \beta_5(SEP\_1996) + \beta_6(SEP\_1997) + \beta_7(MALE) + \beta_8(FEMALE) + \beta_9(WHT) + \beta_{10}(ASIAN) + \beta_{11}(BLK) + \beta_{12}(HA\_PI) + \beta_{13}(AMIN\_AL) + \beta_{14}(OTHER\_MINORITY) + \beta_{15}(SINGLE) + \beta_{16}(MARRIED) + \beta_{17}(NUMBER\_OF\_DEPENDENTS) + \beta_{18}(E4) + \beta_{19}(E5) + \beta_{20}(E6) + \beta_{21}(E7) + \beta_{22}(O3) + \beta_{23}(O3E) + \beta_{24}(FIELD\_GRADE) + \beta_{25}(COMBAT\_ARMS) + \beta_{26}(COMBAT\_SERVICE\_SUPPORT) + \beta_{27}(AVIATION) + \beta_{35}(LT\_HS\_DIPLOMA) + \beta_{36}(EQUIV\_HS\_DIPLOMA) + \beta_{37}(GT\_HS\_DIPLOMA) + \beta_{38}(BACHELORS\_DEGREE) + \beta_{39}(GRADUATE\_EDUC) + \beta_{40}(UNEMPLOYMENT\_RATE) + \beta_{41}(AGE) + \beta_{42}(YOS) + \beta_{43}(BEDR) + \beta_{44}(SINGWITHDEP)$$

3. Hypothesized Relationships

Over the past 20 years, economists have attempted to determine personal discount rates and identify the personal and professional characteristics that influence those rates. The following table lists the variables that are thought to have an effect on an individual's likelihood to select the lump sum voluntary separation option, and the direction of the effect that is anticipated.

Table 10. Variables and Hypothesized Effects

Variable	Type of Effect on Pr(SSB)
Separation Year	Negative
Gender	Positive for Males Negative for Females
Race	Positive for minorities Negative for non-minorities
Marital Status	Unknown
Number of Dependents	Positive

Rank	Negative
MOS	Positive for Combat Arms Negative for Combat Service Support and Aviation MOS
Education Level	Negative
Age	Negative
YOS	Negative
Unemployment Rate	Positive
Break-Even Discount Rate	Negative

The year in which a Marine made the separation payment decision is expected to have a significant effect on an individual's option decision and ultimately their personal discount rate. It is estimated that as the time increases from the original start date of these programs, there will be a decrease in a Marine's propensity to choose the SSB program. The first year in which these two programs were offered, 1992, the VSI option required a longer reserve commitment and had none of the transitional benefits that were included with the SSB option, such as commissary and exchange privileges, medical coverage and shipment of household goods. These features acted as deterrents to Marines selecting the VSI program and highly encouraged them to opt for the SSB separation payment, which entitled them to much greater intrinsic and psychological benefits. This encouragement to select the lump sum payment motivated Marines to use high discount rates because they would want larger amounts of money in the future in order to give up the benefits offered now by the SSB option. The negative effect on the separation option decision that resulted from

the way in which this policy was written was recognized, and the unequal aspects of the two programs were corrected in the FY 1993 Defense Authorization Act. From 1993 onward, the SSB and VSI choices were both based only on the financial characteristics of the two options (Warner and Pleeter 2001, 36).

Previous studies have produced varied results on the effect of gender on an individual's separation option decision and accordingly, his or her personal discount rate. Warner and Pleeter found that men have higher probabilities of taking the lump sum payment, while Gilman found that women had higher discount rates (Gilman 1976, B-3). This study anticipates that male Marines are more likely to have the higher discount rates. It is believed that men can discount future income at a higher rate because their earnings in the civilian job market will be higher than that of women (Ehrenberg and Smith 2003, 380). Male Marines leaving the service could expect to earn more in their civilian employment, so they could better afford to take the lower amount of money offered by the lump sum payment option.

Economic theory suggests that younger individuals should discount income at a higher rate than older people do because they have a longer anticipated time in which to earn money (Mankiw 2004, 435). The average age for the male Marines in the data set is lower than it is for the female Marines. The average age for male officers is 32 years old, while female officers are, on average three years older. The same pattern is seen in the enlisted Marines, but there is not as large an age gap between the

two genders. Marine enlisted males average 32 years old, while female enlisted Marines are on average 33 years old.

Race is expected to have a significant effect on a Marine's personal discount rate and his or her separation program decision. It is anticipated that minority Marines would be more positively influenced to select the SSB payment than non-minority Marines, indicating a higher personal discount rate. Warner and Pleeter (2001, 37) suggest that these effects are to be expected because those Marines who are better educated and at higher income levels may be able to borrow money at lower rates than minority personnel who are not as educated or as financially well-off. They go on to suggest that discrimination could also be an influencing factor on a minority member's personal discount rate. The influence would be in proportion to the amount of discrimination faced in the credit markets. Marines who are members of a minority will face higher borrowing rates and therefore would have higher personal discount rates to compensate for that discrimination.

The impact of marital status on a Marine's personal discount rate is unknown. At first thought, it could be anticipated that a married individual would value larger payments over time because of his or her need to take care of a spouse and the other responsibilities that are associated with being married. Economic theory would seem to support this view as an individual would want to maximize his or her utility; so therefore, married Marines should be less likely to select the SSB option because it would give them less money. In other words, the opportunity cost would be too great for them to accept the lower amount of money (Mankiw 2004, 6). Their increased

responsibilities for family members would encourage them to focus on long range choices and benefits instead of short range benefits. A married person may however prefer a lump sum payment because that would give him or her a sizeable amount money in the present, which would enable him or her to better provide a spouse's needs now.

The number of dependents in a Marine's family is anticipated to have a positive effect on personal discount rates. It is also expected that as the number of dependents increases, the more likely a Marine will be to select the lump sum payment option. These effects are anticipated because those Marines with larger families have more financial obligations during the transition to civilian life, and this should encourage them to select the SSB option. This program would provide monetary benefits in the present, which these Marines could use as they seek new employment, support their families, and look to establish themselves in a new lifestyle.

It is anticipated that as a Marine's rank increases, it will have a negative influence on his or her decision to select the SSB payment option, and hence it would have a negative effect on that individual's personal discount rate. Junior enlisted Marines would be expected to have the highest SSB selection rate due to their lower level of education and experience. They would not be expected to fully understand the monetary differences between the two options, and therefore not be able to make as good a decision as to which option was the best (Mankiw 2004, 5). The more senior enlisted Marines and officers, it is believed, would be less likely to take the SSB payment because these individuals are better educated, more mature

and would be more inclined to wait for larger returns. They would also be better educated on the benefits of patience and therefore be more willing to wait for future benefits.

It is expected that Marines serving in combat arms MOS would have a higher propensity to select the lump sum payment than those Marines serving in combat service support and aviation MOS, and to have a higher personal discount rate. This result is anticipated because these Marines face a higher probability of suffering bodily harm due to the nature of their MOS. This should encourage them to enjoy their rewards now, rather than postpone their benefits to a future time, which might not come. Marine officers in combat arms MOS are also, on average, younger than those serving in combat service support and aviation MOS, again leading to a higher likelihood of selecting the SSB payment due to their younger age and lower levels of education. Since combat service support and aviation Marines do not experience the same level of imminent danger, and are generally better educated, it is expected that they would more fully comprehend the benefits that come from selecting the annuity option, which should decrease their likelihood of selecting the SSB.

As the level of a Marine’s education increases, the probability of selecting the SSB payment should fall. As a Marine becomes more educated, he or she would be better able to understand the monetary benefits associated with the annuity option when compared to the lump sum payment. Marines with higher education would be able to understand that there is a higher payoff from taking the VSI option, despite their having to wait longer to receive that

benefit. Additional evidence to support this theory comes from the studies done by Gilman and Black who found that personal discount rates decrease with education (Warner and Pleeter 2001, 37)

As a Marine's age increases, the likelihood of that individual taking the SSB payment is expected to decrease, which in turn lowers his or her personal discount rate. It is believed that older Marines would be more educated and better able to understand the benefits of the two different payment plans, and then use that knowledge to make the most personally-beneficial choice, which would be to accept the VSI option. Older Marines are also expected to place more value on future benefits than present benefits. According to the Gilman study, the life cycle consumption theory suggests that younger people would be more likely to select current income over future money than older people (Gilman 1976, 29). The implication is also that younger individuals would have higher personal discount rates.

The number of years a Marine has served on active duty is expected to significantly affect his or her separation payment option decision. It is believed that the Marines with higher YOS would be more likely to select the VSI payment option because they would receive higher monetary values through that program. Being older and more educated should help them to see that the VSI program would give them more money than the SSB program would. They are also expected to be more future oriented and therefore value long-term investments more than short-term ones. Marines with lower YOS would be expected to prefer the lump sum payment because they are younger (Gilman 1976, 28), less well educated and not as able to fully understand the two

programs, and are therefore more likely to make a poor decision about which option to take (Mankiw 2004, 6).

The higher the unemployment rate that a Marine will face upon separation from the military, the more positive is the influence that is anticipated on that Marine's decision to select the SSB payment option. This is believed because, as unemployment rates increase, it is harder for the individual to find a job, thereby encouraging that person to select the payment option that will provide him or her with current money. They can then use these funds to support themselves during the time in which they are searching for civilian employment.

Economic theory suggests that Marines will make their voluntary separation payment option decision by comparing the present value of the VSI option with that of the SSB option (Goldberg 2001, 67). The break-even discount rate is that rate which equates the present value of the lump sum payment with the present value of the annuity payment:

$$PV(LumpSum) = \mathrm{P}V(Annuity)$$

or

$$PV(LumpSum) = \left\{ \mathrm{P}V(Annuity) = C * \left[\frac{1}{r} - \frac{1}{r}(1+r)^{t} \right] \right\}$$

As a Marine's break-even discount rate increases, it is expected to have a negative effect on that individual's personal discount rate. This would also imply that, as the break-even discount rate goes up, the likelihood of choosing the SSB option goes down. In Goldberg's evaluation of the Warner and Pleeter study, the author concludes that individuals will choose the SSB payment

option only if their personal discount rate is larger than their break-even discount rate (Goldberg 2001, 75).

D. MODEL SPECIFICATION

1. Types of Models

The preliminary findings and descriptive statistics indicated that for this data set, it might be prudent to segregate the Marines into officers and enlisted. A restricted model test confirmed that the coefficients for these two groups were in fact significantly different from each other (.01 significance level), and should therefore be evaluated in separate models[1].

2. Model Forms

For this study, logit and probit models were chosen instead of linear probability models for several reasons. The purpose of this study is to evaluate the probability of a Marine selecting the SSB payment option. There are only two options, the Marine selects the SSB or does not select the SSB. The results of these decisions are best expressed in terms of a binary response. A negative predicted probability can be obtained through a linear probability model, and is not appropriate here. Probit and logit models also solve the problem of heteroskedasticity by using the maximum likelihood estimation (Wooldridge 2003, 557).

A probit model was used for the officer data because the officer data appears to conform better to a probit distribution than it does to a logit model's distribution. Conversely, the enlisted data had a distribution that better fit a logit model's distribution.

[1] -2 Log L of the unrestricted model was 3523.919, and the -2 Log L of the restricted officer model was.616.061, and the restricted enlisted model was 2790.776

3. Potential Problems

Selection bias is a potential problem in the models. This is because the only Marines included in the data set are those who made the decision to separate from the Marine Corps. The data does not include those Marines who were eligible for the VSI and SSB programs, but chose to remain on active duty. There is not a comparison between those who were eligible and chose to leave, and those who were eligible and chose to stay. This bias could inflate, or overstate, the personal discount rates because only those Marines with high personal discount rates would be observed in the data set. Individuals who have lower discount rates are not observed in the data set because they remained in the Marines.

A second potential problem in the models is that of omitted variable bias. Omitted variables can lead to under specifying the models. Omitted variables can bias the other variables in the models because, not only do they affect the dependent variable, but they can also affect the other independent variables. Omitted variables can cause the coefficients of the independent variables to be biased and thereby making the models less accurate. If the omitted variables could be included, it would diminish the variable bias, but it would increase the variance; however the accuracy of the parameter estimates would be improved. Specifically for these models, there is no variable in the models that accounts for the potential civilian earnings of the Marines who separated. It is not known what an individual is expected to make in a civilian job, and therefore his or her “cost of leaving” cannot be accurately estimated and taken into account. The resulting bias can

produce values that are higher than they should be since the negative cost of leaving the military has not been properly accounted for in the models. A solution would be finding a suitable proxy variable for the anticipated civilian earnings variable, but the TFDW data did not offer a suitable alternative variable (Wooldridge 2003, 485).

The potential for downward bias also exists because the models only use the money received from taking the VSI or SSB payment option. They do not consider the total compensation received from taking one option over the other. Psychic and implicit benefits are difficult to measure as well, which can increase bias due to the fact that the total benefits cannot be determined and then monetized for comparison purposes (Boardman, et al. 2001, 40).

E. CHAPTER SUMMARY

The aims of this study are to determine the rates at which Marines who separated from the Marine Corps under the VSI or the SSB voluntary separation payment programs exchanged present dollars for future dollars and to establish and assess the personal, professional, and economic factors that significantly affected the personal discount rate decisions.

Using Warner and Pleeter as a guide, this study determined the break-even discount rate for each separating Marine by finding the rate that set the present value of the lump sum payment equal to present value of the annuity payment. These break-even discount rates were then used as an independent variable in a regression to predict the probability of each Marine selecting the SSB payment plan. The resulting model coefficients were each multiplied by

the value of one divided by the BEDR coefficient, with the results being used to estimate each Marine's personal discount rate.

The likelihood to select the SSB option is a function of a Marine's personal and professional traits, as well as external economic factors. Male Marines, black Marines and Marines with dependents are expected to have a higher probability of taking the lump sum payment than female Marines, non-minority Marines and those individuals without dependents. These personal traits are anticipated to produce positive and significant effects on the decision about which separation option to choose. Marines with these traits are expected to need current dollars to support his or her transition to civilian life, and would therefore be more likely to take the SSB payment plan. Education, age, and personal discount rate are characteristics that are expected to negatively influence the Marine's payment option decision. As the first two variables increase in number, there is a corresponding increase in a Marine's ability to understand the monetary benefits that come from selecting the VSI plan, and this should enable them to make a better decision, which in this instance is to select the annuity payment because it proves a larger amount of money. The break-even discount rate should negatively affect the likelihood of choosing the SSB option because individuals will choose the SSB payment option only if their personal discount rate is larger than their break-even discount rate. The effect that marital status will have on the separation payment option decision is unknown, because while a married Marine may value the larger payments associated with the VSI plan, he or she may

opt for the SSB payment since it provides current income that can be used to provide for the needs of a spouse during the time of transition between professions.

MOS is the only professional trait that is anticipated to have a positive effect on a Marine selecting the lump sum payment plan. Marines who are in combat arms MOS should have a higher propensity to select the lump sum payment and to have a higher personal discount rate, than non-combat arms Marines. This is expected because combat arms Marines are, on average, less educated and younger than Marines in other MOS, which makes comprehending the benefits resulting from the VSI payment more difficult. Not fully understanding the payment options would increase the probability of combat arms Marines making poorer choices, which would be choosing the SSB plan.

Separation year, rank and YOS are all anticipated to have negative effects on the SSB payment option being selected. The policy differences that existed in 1992 encouraged Marines to select the lump sum payment, but when the programs were changed in 1993, monetary characteristics became the most important factor in the option decision. Therefore, as time increased there is a lesser propensity to choose the SSB payment since it provides fewer benefits when compared to those provided by the VSI plan. Rank and YOS are anticipated to have negative effects because as Marines become more senior, their ability to more fully understand the monetary differences between the two programs increases, which gives he or she a better understanding of finances and a higher probability of selecting the VSI payment since that plan produces more return on the investment.

The unemployment rate is an external characteristic that will likely have a positive influence on a Marine's decision to select the SSB payment plan. As unemployment rates increase, the more difficult it will be for the Marine to find a job. This knowledge should then encourage that individual to take the current money that the SSB program offers, so that these funds can be used as financial support during the time of transition to civilian employment.

The Marines in the data set were separated into officer and enlisted categories because the parameter estimates for these two groups were significantly different to warrant such segregation. Logit and probit models were chosen because the results of the separation payment option decisions are best expressed as binary responses. Marine officer data had a distribution that better fit a probit distribution, while the enlisted data appears to conform better to a logit distribution.

There are three areas of potential bias in this study. Selection bias could exist because there is a lack of comparison between those who were eligible and chose to leave, and those who were eligible and chose to stay. Personal discount rates could be overstated because only those Marines with high personal discount rates would be observed in the data. Individuals with lower discount rates are not seen because they remained in the Marines. Omitted variable bias could lead to lower personal discount rate values because an accurate "cost of leaving" cannot be determined since the civilian earnings that the Marine expected to be paid after separation cannot be estimated precisely. Upward bias may raise the predicted personal

discount rates because the models use only the monetary values received from taking the VSI or SSB payment option. Total compensation received from choosing one plan over the other is not considered, nor are the psychic and implicit benefits addressed since they are difficult to measure and properly quantify for comparison purposes.

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V. RESULTS OF MULTIVARIATE MODELS

A. OFFICER ESTIMATION RESULTS

Table 11 displays the estimation results for Marine officers:

Table 11. Marine Officer Estimation Results

Variable	Parameter Estimate	Standard Error	Pr > ChiSq	Partial Effects
Intercept	-3.3960	2.8221	0.2288	-0.0000
SEP_1992	-0.8386	0.5201	0.1069[3]	-0.2424
SEP_1994	0.3361	0.2898	0.2461	0.1613
SEP_1995	0.1507	0.7602	0.8428	0.1008
FEMALE	-0.0665	0.3044	0.8272	-0.0179
BLK	0.1627	0.2844	0.5672	0.0684
SINGLE	0.1270	0.2053	0.5364	-0.0684
NUMBER_DEPENDENTS	0.0544	0.0475	0.2515	0.0221
O3E	0.1809	0.2586	0.4841	0.0667
FIELD_GRADE	0.000386	0.2877	0.9989	0.0116
COMBAT_SERVICE_SUPPORT	-0.0785	0.1507	0.6024	-0.0319
AVIATION	-0.1065	0.1481	0.4721	-0.0371
GRADUATE_EDUCATION	-0.5751	0.1812	0.0015[1]	-0.1895
UNEMPLOYMENT_RATE	0.6165	0.2840	0.0299[2]	0.2721
AGE	-0.00170	0.0362	0.9625	-0.0004
YOS	-0.0707	0.0584	0.2257	-0.0296
BEDR	-1.5549	14.1831	0.9127	0.0029
SINGLE_WITH_DEPENDENTS	-0.1283	0.0906	0.1566[3]	-0.2439
R-Squared	0.0859			
Max-rescaled R-Squared	0.1168			
Number of Observations	494			

1 Coefficient is significant at the 0.01 level.

2 Coefficient is significant at the 0.05 level.

3 Coefficient is significant at the 0.10 level, one-tail test.

The partial effects[1] results reveal that those officers who separated from the Marine Corps during the year 1992 had a .2424 lower likelihood of selecting the SSB payment option when compared to those officers who left in 1993, the base year. Officers who made the separation payment decision during 1992 were also .4037 and .3432 less likely to choose the SSB payment than those officers separating in 1994 and 1995, respectively[2]. While the effect of separating in 1992 on the officer's decision to select the lump sum payment option was negative, it was only slightly significant at the 0.10 level for a one-tail test (0.0534), *ceteris paribus*. These results were not anticipated. It was thought that since the intrinsic and psychological advantages to selecting the SSB plan were neutralized after 1992, there would be a higher propensity to choose the VSI payment in later years because the annuity option offered a greater amount of money to the separating officer. The results indicate that as time progressed, Marine officers continued to discount future money at a high discount rate, indicating their preference for current dollars over future dollars. For those separating officers, their need for current dollars appears to outweigh the value they place on future benefits. The decisions being made here do not support economic theory in terms of maximizing utility; but it may be that, to those officers who were separating, maximum utility was defined as having current money to facilitate their transition from the military to a civilian profession. Their opportunity cost of not having current dollars was too great for them to trade for future money.

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1 Partial effects were calculated by determining the effect of a change in a single variable of the base case officer on the Pr(SSB).

2 .4037 = 0.1613-(-.2424) and .3432 = 0.1008-(-.2424), respectively.

Graduate education had a highly significant negative effect on a Marine officer's probability of selecting the lump sum payment option. The partial effects of a graduate education show that officers with a level of education greater than a bachelor's degree were .1895 less likely to choose the SSB payment plan. This graduate education coefficient was highly significant at all usual levels (0.0015), *ceteris paribus*. These results were anticipated, because as officers become more educated, they are better able to understand fiscal programs and to recognize that an annuity-type payment offers them greater monetary value than a lump sum payment would. Out of 83 officers who had educational levels higher than a bachelor's degree, 67 of them, or 80.7 percent, decided to take the VSI payment. This high percentage of officers selecting the VSI payment option indicates that those officers with a greater educational level applied the added wisdom, gained from a higher level of education, to their present value decision making process, which led them to choose the VSI option since it gives them the greatest utility.

The unemployment rate faced by Marine officers at their time of separation had a significantly positive effect on their decision to choose the lump sum payment option. The partial effects of the unemployment rate reveal that, as the rate of unemployment increased by 0.1 percent, the officers were .2721 more likely to take the SSB payment than officers who faced the average unemployment rate of 6.5 percent. The unemployment rate estimate was significant at the 0.05 level (0.0299), *ceteris paribus*. These results were expected. The data show that 81 out of the 152 officers, who faced a higher

than average unemployment rate upon separation from the Marine Corps, selected the lump sum payment option. This indicates that 53.3 percent of the officers who would have a more difficult time locating civilian employment chose the separation payment option that provided them with current dollars, which could them be used during the time they were temporarily unemployed.

The interaction term that evaluates the effect of the number of dependents on a single officer's decision to select the SSB payment option shows that the effect of another dependent on a single Marine is different from the effect of another dependent on a married Marine. Those single officers who added one more dependent were 0.2439 less likely to choose the lump sum payment than were married officers who added one more dependent. While the effect of one more dependent on single officers was negative, it was minimally so at the 0.10 level for a one-tail test (0.0783), *ceteris paribus*. These results were not anticipated. The preliminary data led to the belief that those Marines with more dependents would be more likely to take the current dollars to aid them in their transition out of the service and this was true for married Marines. The results of the model show however that single Marines became less likely to take the lump sum payment as their number of dependents increased by one. It appears that as the responsibility for additional dependents increased for single Marines, they valued the larger amounts of money offered by the VSI program, even though they would be required to wait longer for the benefits.

The opportunity cost brought about by a larger family was too great for single Marines to accept the SSB payment with its lesser amount of money.

The effect of a one year increase in age on the probability of taking the lump sum payment was a negative .0017. This effect, although insignificant, was anticipated because, as officers age, their education and experience levels increase, making them better equipped to understand the financial difference between the two programs, which would encourage them to choose the annuity payment option since that plan provides the greatest monetary returns.

YOS had a similar effect on the probability of an officer choosing the SSB separation option. The effect of one more year of service was a negative .0707, and again this effect was insignificant. While the significance of this variable was not anticipated, the negative influence was. As an officer's time in service increases, that individual would be better able to comprehend the monetary value of the annuity payment option over that of the lump sum payment. This knowledge would help that officer make the most financially rewarding decision, which would be to select the VSI plan. Also, as YOS increase, so does the amount of benefits that would be given up should the Marine take the lump sum payment.

The effects of having a combat service support or aviation MOS were anticipated. Compared to the base case, combat arms MOS, both combat service support and aviation MOS effects were negative, .0785 and .1065 respectively. While the effects were insignificant, the results do reveal that those officers in non-combat arms MOS do have a lesser

inclination to opt for current dollars, which would be expected since those officers are generally better educated and on average, older than Marines in combat arms MOSs.

B. ENLISTED ESTIMATION RESULTS

Table 12 displays the estimation results for Marine enlisted:

Table 12. Marine Enlisted Estimation Results

Variable	Parameter Estimate	Standard Error	Pr > ChiSq	Partial Effects
Intercept	5.0954	3.2671	0.1189	-0.0000
SEP_1993	-0.1286	0.1392	0.3556	-0.0184
SEP_1994	-1.0816	0.2551	<.0001[1]	-0.2027
FEMALE	-0.3751	0.2013	0.0624[3]	-0.0581
BLK	0.3259	0.1210	0.0071[1]	0.0400
OTHER_MINORITY	0.5610	1.0802	0.6035	0.0634
SINGLE	-0.0334	0.1393	0.8104	-0.0046
NUMBER_DEPENDENTS	0.0686	0.0357	0.0546[3]	0.0009
E4	-0.4608	0.4220	0.2749	-0.0733
E6	-0.1469	0.1432	0.3048	-0.0212
E7	-0.0488	0.2403	0.8392	-0.0068
COMBAT_SERVICE_SUPPORT	-0.1387	0.1442	0.3363	-0.0200
AVIATION	-0.1971	0.1514	0.1930[4]	-0.0289
LT_HS_DIPLOMA	-0.4550	0.6242	0.4661	-0.0722
GT_HS_DIPLOMA	-0.0257	0.1527	0.8662	-0.0036
UNEMPLOYMENT_RATE	0.2099	0.2013	0.2970	0.0268
AGE	-0.0361	0.0210	0.0852[3]	-0.0050
YOS	-0.1136	0.0458	0.0132[2]	-0.0162
BEDR	-16.0714	19.5024	0.4099	-0.3308
R-Squared	0.0764			
Max-rescaled R-Squared	0.1148			
Number of Observations	2747			

1 Coefficient is significant at the 0.01 level.

2 Coefficient is significant at the 0.05 level.

3 Coefficient is significant at the 0.10 level.

4 Coefficient is significant at the 0.10 level, one-tail test.

The partial effects data reveal that those enlisted Marines who separated from active duty during 1994 were .2027 less likely to select the SSB payment than those enlisted personnel who separated in 1992, the base year. The negative effect of separating in 1994 was highly significant at all the usual levels (<.0001), *ceteris paribus*. These results were anticipated because, as the advantages of taking the SSB over the VSI payment were eliminated by the Defense Authorization Act of 1993, the choice between the two options became solely based on the financial aspects of the different plans (Warner and Pleeter 2001, 36). The enlisted Marines realized the transitional, intrinsic, and psychological benefits that had encouraged them to use high discount rates in 1992 did not exist in the following years and were therefore more likely to select the annuity payment plan. The enlisted Marines chose the VSI program after 1992 since it was more financially beneficial to them to do so.

The effects of gender determined by this study reveal that enlisted women do have a lower propensity to select a lump sum payment option than do enlisted men. A female enlisted Marine was .0581 less likely to choose the SSB payment plan upon separation, and the variable for female proved to be significant at the 0.10 level (0.0624), *ceteris paribus*. This study found that female enlisted Marines are less likely to choose the lump sum payment and to have lower personal discount rates. There are two reasons why these results have been found. The first reason that enlisted women have a lower propensity to take the SSB payment is due to the nature of the enlisted women in the data set. The enlisted women in the data set are

older, 33 years of age on average, than the enlisted men in the data set, who average 32 years of age. Economic theory notes that older individuals should discount income at a lower rate than younger people, since they place more value on future dollars (Mankiw 2004, 435). Older Marines also discount at lower rates because they do not have as long a period of time in which to earn money, so they choose the most monetarily-beneficial payment option. The second reason why enlisted women are likely to have a lower likelihood to take the lump sum payment is because their wages in a civilian job are likely to be lower than those of men (Ehrenberg and Smith 2003, 380). Women Marines leaving the service could expect to earn less in their civilian employment, so they could not afford to take the lower amount of money offered by the lump sum payment option.

Race proved to have a significant effect on an enlisted Marine's separation payment option decision. Black enlisted Marines were 0.0400 more likely to choose the lump sum payment than white enlisted Marines. The variable for black was highly significant at all levels (0.0071), *ceteris paribus*. This finding was expected based on the results of previous studies, specifically Warner and Pleeter (2001), who found blacks to have a higher propensity to take lump sum payment and to correspondingly have higher personal discount rates. In that same study, Warner and Pleeter propose that blacks may not be able to borrow money at low interest rates because they could be less educated or less financially well off. They suggest that discrimination may be an influence on a minority member's personal discount rate, because they will have to

increase their personal discount rates to compensate for only being able to borrow at higher rates (Warner and Pleeter 2001, 37).

To evaluate the potential value of these hypotheses as explanations for the results found in this study, black and white enlisted Marines in the data set were compared and two interesting facts appeared. First, the educational levels of the two races were very similar. Blacks had a higher percentage of enlisted personnel with less than a high school diploma, 0.7 percent compared to 0.5 percent for whites. Whites had the highest percentage of enlisted Marines with a high school equivalent degree, 11 percent; while blacks had 7 percent. About 92 percent of black Marines had education beyond a high school diploma while 88 percent of white enlisted Marines had more than a high school education. These data imply that, at least in this sample, black enlisted Marines had on average, a higher educational level. The higher education level implies that blacks would be more able to understand the benefits of an annuity payment, and therefore select that option; however, they still chose the lump sum payment more frequently. Education level then must not have been the overriding factor in the black enlisted payment option decision.

Financial status may help explain the propensity of black enlisted Marines to select the lump sum payment option. The financial status of each enlisted Marine was inferred from his or her rank. Those Marines with higher rank are estimated to be better off financially than those of lower rank. The data show that blacks have a higher percentage, 53.5 percent, of individuals in the two lowest ranks. Whites have 49 percent of their number in the ranks

of corporal and sergeant. The high percentage of blacks in the two lowest ranks implies that blacks are paid less, when compared to whites who are in the data set. Black enlisted Marines might compensate for their lower pay by having higher personal discount rates. The data confirm this because the average black enlisted predicted personal discount rate was 0.2541, which was 0.0178 higher than the average white enlisted rate of 0.2363.

The number of dependents in a Marine's family had a positive effect on that individual selecting the SSB payment. For every increase by one in the number of dependents a Marine had, the likelihood of the SSB option being chosen increased by 0.0009. This was a small effect, but it is significant at the 0.10 percent level (0.0546), *ceteris paribus*. This result was anticipated. The data show that at each level of number of dependents, which in the data set ranges from zero to twelve, the percentage of enlisted Marines who took the lump sum payment is consistently higher than those who opted for the annuity payment. The only exception is at the eight-child level, where 50 percent of the Marines took the SSB payment and the other half took the VSI payment. The higher percentage of enlisted personnel taking the lump sum payment indicates that Marines will more often take the SSB payment, no matter how many dependents they have. This is believed to be true because Marines with larger families will have increased financial obligations during their transition out of the military. These obligations will in turn encourage them to select the lump sum payment because it would provide current dollars to assist them during their move to the civilian sector.

A Marine's MOS was found to affect his or her separation payment option decision. Being in an aviation MOS had a negative effect of 0.0289 on the probability of that Marine taking the SSB payment. The significance of this effect was minimal however, being significant at the 0.10 level for a one tail test (0.0965), *ceteris paribus*. It is not surprising that a Marine's MOS affected the separation payment option decision, nor is it surprising that being in an aviation MOS had a significant negative effect on choosing the SSB plan. It was anticipated that Marines in aviation MOSs would have a lower propensity to choose the lump sum payment than Marines in combat arms MOS because of their higher level of education. The percentage of aviation MOS Marines who had a level of education greater than that of a high school diploma was 91.7 percent, which was 3.6 percent higher than combat arms MOS Marines and 2.8 percent greater than combat service support MOS enlisted. The higher education level enabled the aviation Marines to better understand the benefits that would be provided by the VSI plan, resulting in more of them selecting the annuity payment since it offered more dollars in the long run. The higher level of education was likely a key factor in the aviation Marine's decision. It may have overshadowed the fact that aviation Marines were, on average, two years younger than Marines in the other MOS; and the fact that they had one year less of service time on average than the other MOS Marines. Both of these traits would influence a Marine to take the lump sum payment, so the effect of a higher education level had to be more significant than the other factors combined, because the aviation MOS Marines chose the annuity payment more often than they chose the SSB option.

As a Marine's age increases by one year, the probability of that person selecting the SSB payment decreased by 0.0050, which proved to be significant at the 0.10 percent level, *ceteris paribus*. The data support the belief that older Marines would be more likely to select the annuity payment. The data show that from age 30 through 46, there is a decline in the percentage of SSB takers with every one-year increase in age. Marines in this age bracket constitute 75.8 percent of the enlisted sample, which helps explain why there is the negative effect of age on taking the SSB option. Another reason why older Marines would be less likely to select the lump sum payment is because they would be more educated and more capable of understanding the differences between the two different payment plans, and then use that knowledge to make the most beneficial decision, which would be to accept the VSI option. The life cycle consumption theory proposes that older Marines can be expected to place more value on future benefits than present benefits, and to select future income over current dollars (Gilman 1976, 29).

The number of years in the Marine Corps had a significant effect on an individual's separation option decision. YOS were found to have a negative effect on the probability of selecting the SSB option with each increase of one year of time in service. The partial effect for the YOS variable was a negative 0.0162, which proved to be significant at the 0.05 level (0.0132), *ceteris paribus*. This effect was anticipated because as a Marine's YOS increase, he or she would be forfeiting a larger amount of dollars by taking the lump sum payment option; so that individual should be persuaded to take the VSI payment

because of the higher monetary values that would come through that program. The data show a second reason why an increase in YOS produces this negative effect on SSB selection. This is because Marines with more time in service have, on average, higher levels of education. As Marines spend time on active duty, they are able to attain higher levels of education which in turn makes them more capable of understanding the financial aspects of the SSB and VSI programs. Their better education should also enable them to make a better decision about which option would result in the most benefits, and then make the decision in favor of the VSI program (Mankiw 2004, 6).

C. PERSONAL DISCOUNT RATE ESTIMATES FOR OFFICERS

The estimation results from Table 11 were used to predict a personal discount rate for each Marine officer in the sample. The mean implied personal discount rates were estimated by using the model to predict each officer's discount rate and then averaging them, based on the variables. The initial officer model produced negative predicted personal discount rates. The first approach to addressing this issue involved setting all negative personal discount rates to zero and leaving the officers in the data set. The resulting average discount rates were low, indicating that this corrective method produced a negative bias, and was therefore not appropriate. The mean implied personal discount rates listed in Table 13 below were determined by removing all officers with negative discount rates from the data set. This methodology produced discount rates that are more consistent with the results found in previous studies.

Table 13. Mean Implied PDR for Marine Officers

Variable	Mean PDR	Standard Deviation	Number in Category
SEPARATION YEAR			
1993	0.1533	0.1024	152
1994	0.1127	0.0849	32
GENDER			
MALE	0.1461	0.1017	177
FEMALE	0.1497	0.0716	7
RACE			
WHITE	0.1397	0.0988	167
BLACK	0.2121	0.1108	11
AMERICAN INDIAN	0.2417	0.0000	1
MARITAL STATUS			
MARRIED	0.1392	0.0979	129
SINGLE	0.1628	0.1056	55
SINGLE W/DEPENDENTS	0.1817	0.1392	13
NUMBER OF DEPENDENTS			
0 - 3	0.1382	0.0890	147
> 3	0.1785	0.1339	37
RANK			
O3	0.1441	0.0991	165
O3E	0.1669	0.1164	18
FIELD GRADE	0.1268	0.0000	1
MOS			
COMBAT ARMS	0.1696	0.1095	82
COMBAT SERVICE SPT	0.1328	0.0981	55
AVIATION	0.1213	0.0776	47
EDUCATION LEVEL			
BACHELOR’S DEGREE	0.1463	0.1006	184
GRADUATE EDUCATION	0.0000	0.0000	0

UNEMPLOYMENT RATE			
5.5 – 6.4	0.1103	0.0851	31
6.5 – 7.1	0.1346	0.0973	121
7.2– 7.8	0.2251	0.0885	32
AGE			
27 - 30	0.1725	0.1105	40
31 - 35	0.1415	0.0937	124
36 - 40	0.1203	0.1179	19
41 - 44	0.1814	0.0000	1
YOS			
4 - 10	0.1549	0.1029	148
11 - 15	0.1118	0.0831	34
16 - 22	0.0949	0.0970	2
BEDR			
6 – 13.99	0.2417	0.0000	1
14 – 14.99	0.1797	0.1011	54
15 – 15.99	0.1395	0.1017	93
16 – 16.99	0.1109	0.0824	36

There are several interesting features in the results displayed in Table 13. There is a decrease in the average personal discount rate as the number of years increased since the start of the programs, with the average personal discount rate dropping 0.0406 percent between 1993 and 1994. The dropping in average personal discount rates does not mean however, that more officers were choosing the VSI program. Even though the average personal discount rate decreased over time, the larger percentage of Marine officers continued to prefer current dollars over future dollars, but they were doing so at lower discount rates. That is the cause for the lower personal discount rates seen over time, not the fact that the VSI program was being

chosen more often. The separating officers needed current dollars to fund their transition from the Marine Corps, and they were willing to discount those current funds at lower discount rates.

The female officer average personal discount rate, .1497, was higher than the average for male officers, .1461. This result was surprising because it had been anticipated that women would have the lower rate. It is likely that a woman would earn less than a man while employed in the civilian sector, and would therefore be more likely to take the VSI options since it would provide her with more money (Ehrenberg and Smith 2003, 380).

Officers who are members of a minority group revealed a higher personal discount rate than did white officers. Black officers had an average discount rate of .2121, which is a full 7.24 percent higher than the average white officer's personal discount rate. This suggests that black officers have a very high inclination towards current dollars.

The data show that those officers with more dependents have higher personal discount rates, on average, than those Marines with fewer dependents. Officers with more than three dependents had an average discount rate of 17.85 percent, which was 4.03 percent higher than officers with zero to two dependents. This result was anticipated because those officers with more children would need more immediate financial support during his or her transition to civilian employment. This fact then, should encourage them to select the lump sum payment, which has a higher associated personal discount rate than the annuity payment.

Single officers with dependents had the highest average personal discount rate of all family status categories. The average for this group of officers was 0.1817 percent, and was 0.0425 percent higher than married officers and 0.0189 percent higher than single officers without dependents. This indicates that those officers who were not married, but responsible for dependents used higher personal discount rates in their payment option decisions than married and single officers without dependents did. The higher personal discount rates used by single officers with dependents are believed to show that these officers compensated for the lack of financial support that a spouse can provide, by using higher discount rates.

Prior enlisted Marine captains had the highest average personal discount rates, .1669, when compared to those officers without enlisted service. Field grade officers had the lowest average rate of .1268, with captains falling between at .1441. This result was not anticipated because the prior enlisted captains were on average, older and had more time in service than Marines in the other two ranks. These traits should have encouraged prior service captains to choose the VSI payment option because they would be better educated and more able to understand the financial alternatives, plus they would be giving up more money by choosing the SSB plan. It appears that the number of dependents was the key factor in the prior service captain’s decision. This group of officers had, on average, three dependents compared to the other ranks that averaged two. It seems plausible that the higher number of dependents encouraged the prior service captains to take

the lump sum payment because it gave them money in the present with which he or she could support their family during the transition out of the Marine Corps.

Marines in combat arms MOSs have the highest average personal discount rate at .1696. This rate is .0368 and .0483 higher than the rates for Marines in combat service support and aviation MOSs, respectively. This was anticipated because the average officer in a combat arms MOS was 32 years old, and younger individuals are expected to have higher personal discount rates since they generally have a longer period of time to earn money, than those Marines who are older. The following table highlights the ages and educational levels of Marine officers broken down by MOS:

Table 14. Age and Education Levels by MOS for Marine Officers

MOS	AGE			EDUCATION LEVEL		
	Mean	Standard Deviation	Number of Observations	Mean	Standard Deviation	Number of Observations
Combat Arms	32.4	2.4391	82	10[1]	0.0000	82
Combat Service Support	32.8	2.2311	55	10	0.0000	55
Aviation	32.1	1.9430	47	10	0.0000	47

The results for graduate education show that those officers with only a bachelor's degree had an average personal discount rate of 0.1463. The absence of any officers with higher educational levels with positive discount rates indicates that officers with graduate

[1] The number 10 represents a bachelor's degree level of education.

education were highly disinclined towards selecting the SSB payment, and therefore highly probable to have low personal discount rates. Even those 16 officers with graduate degrees who did take the SSB payment used negative discount rates in their payment option decision.

Evaluating the unemployment rates faced by separating Marines reveals that as the unemployment rates increased, officers used increasingly higher personal discount rates to compensate for their anticipated higher level of difficulty in finding civilian employment. Those Marines facing higher unemployment rates were more likely to choose the SSB payment option because they desired current dollars for use immediately after separation. Their higher likelihood to take the lump sum payment reveals that they were using higher discount rates in their separation decisions, so naturally the data would show higher personal discount rates as the unemployment rates increased.

The age of a Marine officer has a negative effect on personal discount rates. The youngest group of officers, 27 to 30 years of age, has an average discount rate of .1725. This rate is .0310 and .0522 higher than the following two age brackets. It was expected that younger officers would have higher personal discount rates because they took the lump sum payment more frequently than older officers, indicating a preference for current dollars to fund the costs during the time of separation.

Marine officers who had the most time in service had the lowest average personal discount rate, .0949, compared to officers with four to ten YOS, .1549, and to officers with 11 – 15 YOS, .1115. This was expected because the more senior Marines would give up a large amount of money

by selecting the SSB payment, so he or she would be likely to choose the annuity payment plan in order to retain as much of the benefits as possible. The following table highlights the ages and educational levels of Marine officers broken down by YOS:

Table 15. Age and Education Levels by YOS for Marine Officers

YOS	AGE			EDUCATION LEVEL		
	Mean	Standard Deviation	Number of Observations	Mean	Standard Deviation	Number of Observations
4 to 10	32.0	1.9772	148	10[1]	0.0000	148
11 to 15	34.4	2.3109	34	10	0.0000	34
16 to 22	35.5	0.7071	2	10	0.0000	2

As an officer's BEDR increases, there is a decrease in the average personal discount rate. This negative effect is anticipated because as an individual's discount rate increases to equate the present value of the lump sum payment to the present value of the annuity payment, they become less likely to select the SSB plan. The preference for the annuity payment results in low personal discount rates because annuity payments are generally discounted at lower rates.

[1] The number 10 represents a bachelor's degree level of education.

D. PERSONAL DISCOUNT RATE ESTIMATES FOR ENLISTED

The estimation results from Table 12 were used to predict a personal discount rate for each enlisted Marine in the sample. The models were used to predict each Marine's discount rate, and then these rates were averaged to determine the mean implied personal discount rates, based on the variables listed below in Table 16.

Table 16. Mean Implied PDR for Marine Enlisted

Variable	Mean PDR	Standard Deviation	Number in Category
SEPARATION YEAR			
1992	0.2559	0.0299	1231
1993	0.2365	0.0308	1340
1994	0.1600	0.0288	175
1997	0.2115	0.0000	1
GENDER			
MALE	0.2416	0.0379	2599
FEMALE	0.2181	0.0319	148
RACE			
WHITE	0.2363	0.0372	2012
ASIAN	0.2972	0.0108	4
BLACK	0.2541	0.0376	594
HAWAIIAN PACIFIC	0.2874	0.0052	2
AMERICAN INDIAN	0.2750	0.0357	3
OTHER MINORITY	0.2876	0.0217	9
MARITAL STATUS			
MARRIED	0.2411	0.0382	2240
SINGLE	0.2368	0.0367	507
NUMBER OF DEPENDENTS			
0 – 3	0.2405	0.0381	2115
> 3	0.2400	0.0376	632

RANK			
E4	0.2753	0.0139	115
E5	0.2632	0.0268	1268
E6	0.2168	0.0335	1175
E7	0.2116	0.0240	189
MOS			
COMBAT ARMS	0.2486	0.0350	405
COMBAT SERVICE SPT	0.2354	0.0388	1303
AVIATION	0.2433	0.0373	1039
EDUCATION LEVEL			
LT HS DIPLOMA	0.2221	0.0293	14
EQUIV HS DIPLOMA	0.2299	0.0367	274
GT HS DIPLOMA	0.2416	0.0380	2459
UNEMPLOYMENT RATE			
5.2 – 6.5	0.2158	0.0352	204
6.6 – 7.3	0.2321	0.0378	1600
7.4 – 7.8	0.2596	0.0301	943
AGE			
22 – 30	0.2705	0.0225	989
31 – 35	0.2318	0.0312	1303
36 – 40	0.2017	0.0300	394
41 - 46	0.1833	0.0306	61
YOS			
4 – 10	0.2779	0.0202	599
11 – 15	0.2390	0.0315	1671
16 - 21	0.1979	0.0271	477
BEDR			
6 – 10.99	0.3122	0.0107	2
11 – 14.99	0.2863	0.0173	270
15 – 15.99	0.2708	0.0195	327
16 - 16.99	0.2299	0.0350	2148

The average personal discount rate for enlisted Marines decreased over the period of 1992 to 1994. The high personal discount rate average of 0.2559 in 1992 can be attributed to the difference in benefit packages offered by the two programs. Since the SSB plan provided more intrinsic and psychological benefits than the VSI program did, it encouraged Marines to select the lump sum payment option over the VSI plan, creating essentially a bias towards the lump sum payment. Since lump sum payments are associated with higher discount rates, it is no surprise that for 1992 there is a high average personal discount rate for those Marines who separated during that year. The 1993 and 1994 separation year average personal discount rates decrease due to the fact that the benefits that biased the choice towards the SSB program were eliminated. With the greater non-monetary benefits removed, the choice of option was then based on fiscal benefits, which are clearly greater from the annuity option.

The female average personal discount rate proved to be lower than the average for men by 0.0235 percent. The lower rate for females can be attributed to the fact that the women in the data set are on average, older, and that women have been found to value larger amounts of money associated with annuity separation payments because they are likely to earn less in a civilian job, and therefore need more money to make up for that anticipated difference in pay (Ehrenberg and Smith 2003, 380).

Minority groups produced the highest personal discount rate averages than non-minorities. Marines who were Asian, American Indian, and Hawaiian/Pacific Islanders had the highest personal discount rate average of 0.2876, but the

number of Marines in this category was small. Black enlisted Marines had a lower personal discount rate average, 0.2541, indicating that there is a clear preference towards current dollars among black enlisted Marines. Black Marines were more likely to take the SSB payment than white Marines, and that produced the higher personal discount rates for blacks, 0.2541 percent compared to 0.2363, respectively.

As an enlisted Marine's number of dependents increased, the average personal discount rate decreased slightly. Those Marines with zero to three dependents had an average discount rate of .2405, which is only marginally higher than the average rate of Marines with more than three dependents, .2400. The closeness of the two averages indicates that enlisted personnel discount current dollars at approximately the same rate

The hierarchy of average personal discount rates determined for the enlisted ranks was anticipated. The lowest ranking Marines, corporals, had the highest average discount rate of .2753, while the most senior enlisted Marines, gunnery sergeants, had the lowest average rates of .2116. Sergeants and staff sergeants placed in between with average discount rates of .2632 and .2168, respectively. These results were expected because those Marines with a lower rank would generally have less education that could help them understand the financial comparison being made between the two separation payment plans. Junior Marines would also be younger, which is a trait that encourages taking current dollars because he or she would potentially have more time to earn money than an older Marine. The more senior Marines would be expected to

have lower personal discount rates because the amount of future dollars that he or she would be opting out of is much greater the higher in rank one becomes. Another factor that influenced these results involves race. Black Marines made up a larger percentage of the lowest ranks than whites did. Blacks have been found to have higher personal discount rates on average than white enlisted Marines. It is no surprise then, that the two ranks containing the higher proportion of blacks would have the highest average rates. The opposite is true for the two highest ranks, where there is a larger white population. The average personal discount rates in these ranks are lower because there are more white enlisted Marines in these categories, with lower rates, which lessen the overall average discount rate.

Enlisted Marines with an aviation MOS were found to have lower average personal discount rates than Marines in combat arms MOS, by an average of 0.0053 percent. Aviation Marines used lower discount rates in their separation option decisions because of their higher educational levels, relative to the base case of combat arms MOS, which enabled them to better understand the choice being made between the SSB and VSI programs. They understood that the VSI option provides more value over time, and were therefore more likely to take the annuity payment which resulted in lower personal discount rates. The table below outlines the average age and educational level by MOS:

Table 17. Age and Education Levels by MOS for Enlisted Marines

MOS	AGE			EDUCATION LEVEL		
	Mean	Standard Deviation	Number of Observations	Mean	Standard Deviation	Number of Observations
Combat Arms	32.6	3.3714	405	3[1]	1.2762	405
Combat Service Support	32.7	3.5796	1303	3	1.7870	1303
Aviation	31.4	3.6748	1039	3	1.4972	1039

Enlisted Marine education levels produced the opposite results of what was expected. Those enlisted personnel with levels of education greater than a high school diploma had higher personal discount rates on average, .2416, than those with high school diplomas, .2299, and those who had no high school diploma, .2221. Individuals with higher education should be better able to understand the benefits of the annuity payment and then choose that option since it provides more monetary benefits to the Marine. This is not what is seen happening, indicating that those Marines in the top educational level have a greater preference for current dollars than those personnel with lower levels of education. A possible explanation for these results could be the fact that the Marines in the highest education bracket faced the highest average unemployment rate upon separation from the service. It appears that these enlisted personnel placed a higher value on current money, to facilitate their transition to a new occupation, than they did on future benefits. The average rank for Marines in this educational level was between a corporal and

[1] The number 3 represents that a Marine has earned an occupational certification, the level of education above a high school diploma.

sergeant, indicating that these individuals were in the lowest ranks, which tend to have higher personal discount rates on average than more senior ranks.

The unemployment rates faced by enlisted Marines leaving the service affected personal discount rates. The results here were consistent with what was found for the officers; as unemployment rates increased, enlisted personnel used higher personal discount rates to compensate for their expected increased level of difficulty in locating employment in the civilian sector. Marines in the highest unemployment rate bracket, 7.4 to 7.8, had on average, a discount rate of .2596, which was 4.28 and 2.75 percent larger than the rates used by individuals in the 5.2 to 6.5 and 6.6 to 7.3 brackets, respectively. Other factors that could be influencing the discount rates used by Marines in the unemployment ranges are age, YOS and rank. The average age for Marines in the highest unemployment rate group was 31, two years younger than the Marines in the other two groups. Younger individuals generally use higher personal discount rates, and this may contribute to the high discount rate average seen among the 7.4 to 7.8 percent unemployment rate group. Marines who faced the highest unemployment rates also had on average, the least amount of active duty time and the lowest ranks. Again, those individuals with less time in service and lower ranks are generally younger and less educated, which makes the propensity of using higher personal discount rates in their financial decisions more likely.

There is a decrease in average personal discount rates as enlisted Marines get older. Younger Marines have a preference for current dollars that produces high personal

discount rate averages, but as a Marine ages, that preference for current money diminishes so there is a corresponding drop in personal discount rates. There is a consistent decrease in discount rates starting at age 25, 0.2917 percent, that continues until age 39, 0.1905 percent. Beyond age 40, the personal discount rates vary somewhat, but even then there is still a downward pattern. These results are in keeping with the anticipated effect of age and education on a Marine's separation option decision.

Years of service have similar effects on personal discount rates. As the number of years in service increase, there is a general decrease in personal discount rates. Five years in service had the highest discount rate with 0.3197, while year 21 had the lowest rate at .01280. This general decrease in personal discount rates was expected because as a Marine stays in the service longer, he or she would forfeit larger amounts of money by choosing the SSB payment, and would therefore be more likely to opt for the VSI program since it offers the most financial benefit. Marines with more time on active duty would also have higher education levels than less senior individuals. Higher education enables the Marines with more time in service to make more competent financial decisions that are based on their better understanding of the monetary aspects of the SSB and VSI programs. The table below highlights the average age and education level by YOS:

Table 18. Age and Education Levels by YOS for Enlisted Marines

YOS	AGE			EDUCATION LEVEL		
	Mean	Standard Deviation	Number of Observations	Mean	Standard Deviation	Number of Observations
4 to 10	28.4	2.5678	599	3[1]	1.5909	599
11 to 15	32.3	2.6386	1671	3	1.5977	1671
16 to 22	36.5	2.5227	477	3	1.7124	477

There is a decrease in average personal discount rates as BEDR increase for enlisted Marines, similar to the results seen in the officer data. The preference of the lump sum payment decreases as individuals increase his or her personal discount rates to solve the present value of an annuity equation. The increased preference for the VSI separation option decreases the average personal discount rate since lower discount rates are associated with annuity-type payment.

E. COMPARISON TO PREVIOUS STUDIES

The results of this study are consistent with the findings reported by Warner and Pleeter (2001) and Mackin (1995), who constructed similar models for the other branches of service. Table 15 is a comparison of this study's results with those of Warner and Pleeter, and Mackin.

[1] The number 3 represents that a Marine has earned an occupational certification, the level of education above a high school diploma.

Table 19. USMC Results Compared to Previous Studies

Sample	Decision Point	Warner and Pleeter (1994)	Mackin (1995)	USMC Estimates (2006)	USMC Standard Deviations	USMC Number of Observations
Officer	All YOS	0.190	0.146	0.146	0.1006	184
	YOS 9	0.191	0.147	0.154	0.1122	51
	YOS 12	0.188	0.149	0.143	0.0827	4
	YOS 15	0.183	0.155	0.019	0.0000	1
	YOS 18	0.182	0.155	0.026	0.0000	1
Enlisted	All YOS	0.233	0.209	0.240	0.0380	2747
	YOS 9	0.234	0.209	0.276	0.0204	112
	YOS 12	0.232	0.209	0.250	0.0243	349
	YOS 15	0.229	0.205	0.208	0.0292	315
	YOS 18	0.225	0.202	0.187	0.0270	81

(After Mackin 1995, 11)

The Marine results show that, on average, the personal discount rates determined in this study are consistent with past estimates. The average officer personal discount rate estimated here was 0.1463, and the range of rates for officers was from 0.0002 to 0.4925. Enlisted personnel had rates that ranged from 0.0993 to 0.3384, with their average personal discount rate being 0.2403. The noticeable differences between the Marine data and the previous results are in YOS 15 and 18 for the officers. In the Marine data, there was only one individual in each of those year groups with a positive discount rate. This fact makes the personal discount rates shown suspect, because that individual is not representative of all Marines who have

the same amount of time in service. The personal discount rate at 16 YOS for the Marines was 0.1635, which is in line with the other results. This study's estimate of enlisted personal discount rates are more consistent with Warner and Pleeter's rates per years of service in that both studies have rates that decrease over time, whereas Mackin's averages slightly increase with tenure.

This study has not resulted in any findings that would surprise those who are familiar with personal discount rates. Based on the estimates, it appears that the Marines who separated from the service during the DOD drawdown used approximately the same personal discount rates, in their separation payment option decisions, as did those men and women in the other branches of service. The findings in this study do provide a foundation for future personal discount rate evaluations that are Marine Corps specific; and it compliments the evaluations done by Warner and Pleeter (2001) and Mackin (1995) because it provides the Marine Corps data that those studies lacked.

The closeness of the results in all three evaluations shows that the methodology is appropriate and that the personal discount rates used by servicemen and women are generally the same across the four services. This implies then, that manpower planners can develop separation and retention policies based on the estimated personal discount rates found here, and can transfer similar policies to other services.

F. CHAPTER SUMMARY

The officer and enlisted models used in this study produced findings that were both expected and others that were not anticipated. In terms of personal

characteristics, both models found the year in which an officer or enlisted Marine separated to be a significant factor in the separation program decision. For officers, 1992 had a significant negative influence on the SSB option being chosen, while 1994 had a strong positive effect on an enlisted Marine's discount rate choice. Gender and race did not have a significant effect on an officer's payment option choice, but for enlisted Marines both of these characteristics were very significant factors in the decision making process. Likewise, the number of dependents was a significant part of an enlisted Marine's decision, but officers did not seem to be influenced in their payment choice by the number of dependents they have.

Surprisingly, rank did not weigh significantly on the separation payment decision for either officers or enlisted Marines. Educational levels were expected to be significant factors in a Marine's payment choice. This hypothesis proved true for officers, because those with a graduate level education or higher were significantly less likely to choose the SSB payment. Enlisted Marines however were not significantly influenced in their payment option decision by their level of education.

Unemployment rates faced at the time of separation were expected to be influential on the decision about which option a Marine would select. Officers were more likely to take the SSB payment as unemployment rates rose, presumably to receive current dollars with which they can fund their transition to civilian employment. Enlisted Marines were not significantly influenced in their payment option decision by the unemployment rate they would face. This may indicate that the groups would be seeking different

types of jobs. Since unemployment rates were not influencing enlisted Marines, this could also mean that the employment pursued by enlisted Marines was easier to obtain than those jobs sought after by separating officers. Military occupational specialties were expected to be an influence on which separation payment a Marine would choose. This was not true at all for officers, and only marginally true for enlisted Marines who had aviation MOS.

Age and YOS were significant factors influencing an enlisted Marine's separation option decision, but these characteristics were not influential for officers making the same decision. Single officers who had dependents were positively influenced to select the SSB payment, but enlisted Marines were not.

The personal discount rates estimated here are consistent with those produced by previous studies. The estimated personal discount rates vary widely for officers, but their average of 0.1463 falls in between those of Warner and Pleeter, and Mackin. The enlisted average personal discount rate here is higher than that of previous studies, but the difference relative to the other studies is less than one percent, indicating that the individuals who separated from Marine Corps during the drawdown used approximately the same personal discount rates as their counterparts in the other branches of service. The closeness of estimated personal discount rates across the services implies that manpower planners can transfer estimated rates across the services as they write policies affecting retention and separation.

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VI. SUMMARY AND CONCLUSIONS

A. SUMMARY

This research determined the discount rate that each individual Marine used to exchange present dollars for future dollars during severance from the Marine Corps under either the VSI or SSB voluntary separation payment programs between 1992 and 1997. This study also determined those professional, personal and economic factors that significantly influenced Marines in their separation payment option decisions. Once estimated, the personal discount rates were compared to rates found in earlier studies to determine the accuracy of the estimates and to see if there is any potential applicability to the other branches of service. This study compliments the study done by Warner and Pleeter (2001) because it estimates the personal discount rates of Marines who were omitted from that study due to improper reporting.

The probability of selecting the lump sum payment option is estimated as a function of these personal, professional, and economic traits defined by the model:

- Separation in 1992,
- Separation in 1993,
- Separation in 1994,
- Separation in 1995,
- Separation in 1996,
- Separation in 1997,
- Male,
- Female,

- White,
- Asian,
- Black,
- Hawaiian/Pacific Islands,
- American Indian/Alaskan Native,
- Other Minority,
- Single,
- Single with Dependents,
- Married,
- Number of Dependents,
- E4,
- E5,
- E6,
- E7,
- O3,
- O3E,
- Field Grade,
- Combat Arms,
- Combat Service Support,
- Aviation,
- Less than High School Diploma,
- Equivalent of High School Diploma,
- Greater than High School Diploma,
- Bachelor’s Degree,
- Graduate Education,
- Unemployment Rate,
- Age,
- YOS, and
- BEDR

The methodology used to determine the personal discount rates for the Marines closely followed that used by Warner and Pleeter(2001) and Mackin(1995), but focused only on Marine Corps officer and enlisted personnel who separated under the two voluntary separation payment plans. Using data provided by the Marine Corps' Total Force Data Warehouse, personal and professional traits of the 494 officers and 2,747 enlisted Marines who separated were collected and used to determine a break-even discount rate that equated the present value of the SSB payment with the present value of the VSI payment. This information was added to the data set and then a probit model and a logit model were run to estimate, separately, the coefficients for officers and enlisted personnel. These coefficients were then used to calculate individual personal discount rates for every Marine. The officer data best conformed to a probit model's distribution, while a logit model best described the enlisted Marine data.

The estimated personal discount rates determined by this study averaged 14.63 percent for officers and 24.03 percent for enlisted Marines. These results coincide closely with those of Cylke et al. who found discount rates of approximately 17 percent (Cylke et al. 1982, 17), and also Warner and Pleeter who estimated enlisted personal discount rates to be between 35 to 54 percent and officer rates to range between 10 to 19 percent (Warner and Pleeter 2001, 48). The Mackin study results were also similar as they estimated officer personal discount rates of approximately 14 percent and enlisted rates of approximately 21 percent.

B. CONCLUSIONS

This study has several strengths. The separation option decisions made by the Marines in the data set are based on real choices and large amounts of money, taking advantage of the natural experiment that resulted from having to choose between the annuity and lump sum voluntary separation options. The Marines involved in making the choices are also a good representation of American society as a whole, with respect to earnings, education levels, and other personal attributes. The personal discount rates estimated in this study are similar to those found in earlier studies, revealing that the methodology used to determine the rates in this study is appropriate and can be used again for future personal discount rate evaluations.

The similar rates found for Marines and the other branches of service imply that the rates estimated here can be transferred to the other services and used in establishing manpower policies that deal with separation and retention payment issues. Based on the personal discount rate estimates and the influential variables found in this study, the Marine Corps can predict the discount rates for each Marine and from that create appropriate force-shaping tools. Manpower planners can create incentives that either encourages separation or retention, depending on the needs of the Marine Corps at the time. Being able to determine the approximate amount of money that would be required to encourage Marines to leave or stay can prevent the Marine Corps from paying excessive consumer surpluses to separating or reenlisting Marines, and will enable the Marine Corps to determine in advance, an incentive’s effect on a particular demographic group

(Mackin 1995, 6). Knowing the personal traits that influence a Marine's decision will prove useful in recruiting profiles, and these influential factors can also be targeted for improvement, which in turn will positively influence Marines to remain in the service.

Selection bias is an issue in this study because TFDW could only provide the data on those Marines who chose to leave the service. Marines who were eligible for either program, but decided to remain on active duty are not included in the regression models. The inability to compare these two groups of Marines could result in overestimating the personal discount rates being used since only Marines who used high personal discount rates in their separation option decision would be evaluated in the data. Those Marines who used lower discount rates are not seen because they remained in the service.

Omitted variable bias could also be an issue in this study. It was not possible to determine an accurate "cost of leaving" value since the Marine Corps did not track the earnings that the Marine expected to receive in their future civilian employment. A "cost of leaving" variable is probably positively correlated with selection of the SSB separation option. As the cost of separating from the service increases, an individual would be more likely to take the lump sum payment so he or she would have current funds available to use in the transition to civilian employment. The BEDR variable in the model captures the monetary effect on the probability of selecting the SSB plan, and this variable has been found to be negatively correlated with the probability of choosing the lump sum payment. Therefore, it is likely that omitting the "cost

of leaving" variable has created a negative or downward, bias effect on at least one of the coefficient estimates (Wooldridge 2003, 92).

The models in this study evaluate only the money received from taking the lump sum or annuity payment options. The total compensation a Marine would receive by taking one plan over the other is not a variable in the models. The probable effect of compensation on the dependent variable is likely to be negatively correlated. The greater the total compensation, the less likely it would be for a Marine to select the SSB payment. The BEDR variable, which measures the monetary aspects of the models, is also negatively correlated with the probability of selecting the lump sum payment. Based on these two relationships, it is likely that the lack of a total compensation variable in the models has produced a positive or upward bias in at least one coefficient in the models (Wooldridge 2003, 92).

C. RECOMMENDATIONS

It is recommended that further studies on personal discount rates be conducted. There are two reasons for this. First, manpower planners need to have the current discount rates being used by Marines. The rates determined in this study were based on data that are 14 years old, and which may not now accurately reflect the rates currently being used by Marines today. Having the contemporary discount rates will enable manpower planners to create policies that will most effectively shape the desired force of tomorrow. Another reason why further research should be done in this area is to determine whether or not those traits that influence a Marine's financial decisions change

over time. The demographic characteristics that influenced the Marines in this study may not have the same impact on those individuals serving today. The characteristics that affect a Marine's decision about differing sums of money may change, and it is important for planners to know and understand these changes to create manpower policies that most positively influence separation and retention.

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