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Risk-adjusted valuation of the current military retirement and the CY2018 retirement system

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MONTEREY, CALIFORNIA

THESIS

RISK-ADJUSTED VALUATION OF THE CURRENT MILITARY RETIREMENT AND THE CY2018 RETIREMENT SYSTEM

by

Adam N. Heil

June 2016

Thesis Advisor:	Amilcar Menichini
Second Reader:	Robert Eger

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RISK-ADJUSTED VALUATION OF THE CURRENT MILITARY RETIREMENT AND THE CY2018 RETIREMENT SYSTEM

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Submitted in partial fulfillment of the
requirements for the degree of

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from the

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This paper analyzes the U.S. military's choice to transition to the blended retirement system in 2018. All service members will be grandfathered into the current system but those with less than 12 years of service will be able to change from the legacy cliff-vested annuity to a pension that includes a reduced annuity, a 401(k)-type matched investment, and a career continuation bonus. The method used to value the two systems leverages the assumptions made by the Military Compensation and Retirement Modernization Commission and RAND. However, it also incorporates risk into the calculation when valuing the annuity and continuation bonus portions of the retirement systems by using historical Department of Defense retention curves. All military members who do not intend to complete 20 years of service should switch to the blended system to derive at least some retirement value from their time in the military. Of the remaining population intending to complete at least 20 years of service, all service members—save for enlisted members with six or more years of service—benefit from the change to the new blended pension.

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LIST OF ACRONYMS AND ABBREVIATIONS

COLA	Cost-of-Living Adjustment
CP	Continuation Pay
CPI	Consumer Price Index
CSB/Redux	Career Service Bonus
DOD	Department of Defense
HI-3	High-3
MCRMC	Military Compensation and Retirement Modernization Commission
NPV	Net Present Value
TSP	Thrift Savings Plan
VA	Veterans Administration
YOS	Years of Service

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I.   INTRODUCTION

Following the research done by the Military Compensation and Retirement Modernization Commission (MCRMC), the Department of Defense (DOD) announced a change to the current retirement system that will take effect on January 1, 2018. All service members who enter after that date will be enrolled in the new program and all those already serving at the time the policy goes into effect will be grandfathered into the legacy system. Those members with less than 12 years of service will have the choice to "opt-in" to the new retirement system.

A.   PURPOSE

The purpose of this thesis is to address the retirement program alternatives of those service members who will have the option of transitioning to the new system. The MCRMC and RAND have focused primarily on the cost to the government and retention implications. The retirement commission has determined that the new system will at least match the legacy system in terms of net present value (NPV) for incoming military members, but the members who will have the choice to switch must make a complicated decision.

Very junior personnel with limited financial backgrounds will be forced to make an assessment that will impact their financial wellbeing for the remainder of their lives. To aid in this decision, service members will be provided compensation and fiscal education in the summer of 2016, including a NPV valuation of retirement options.

Utility theory stipulates that a rational decision maker faced with outcomes of different choices will prefer actions that maximize expected utility (Von Neumann & Morgenstern, 2007). This thesis attempts to capture the value of the two systems using the assumptions of the retirement commission when computing comparative NPVs and introducing the element of risk into the two pensions. Future inflation, market return, personal discount rates, life expectancy, continuation pay, and 401(k) contribution amounts have been the components of previous NPV calculations. This thesis examines the career retention curves, derives risk rates for each year group cohort between 0–11

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years of service, and then adjusts the NPV by the calculated rate. Choosing to transition to the new retirement system is a very personal decision; this paper provides information to help make it an informed decision.

B.   RESEARCH QUESTION

Given the opportunity, should a service member switch from the legacy retirement system to the new blended system effective January 1, 2018?

C.   SCOPE AND LIMITATIONS

This subject matter of this thesis is only applicable to the following personnel:

1.   Members who joined the military before January 1, 2018

2.   Members with less than 12 years of service

3.   Members who intend to stay in the military until at least 20 years of service

Service members who do not meet #1 or #2 do not have an option to exercise and service members who do not meet #3 should always choose to switch to the new system to derive some retirement benefit from their service.

D.   METHODOLOGY

A mathematical model is used to calculate the NPV for each retirement program based on the variables that influence the pensions. Chapter III discusses the details of the methodology.

E.   ORGANIZATION OF THE RESEARCH

Chapter II provides the history of the United States military retirement plan, details of the current system, and differences in the new program.

Chapter III discusses the methodology used to calculate the NPV of each retirement system and the variables that go into those calculations. In addition, the limitations incurred by the assumptions of the model are explored.

Chapter IV delivers the results of the models, compares the two retirement systems, and interprets the results.

Chapter V offers recommendations based on the analysis of the data.

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II. HISTORY AND CHANGES TO THE MILITARY RETIREMENT SYSTEM

This chapter explores the beginnings of the military pension plan and the transformation to the current system. In addition, the blended retirement system that will become the standard plan on January 1, 2018 is reviewed.

A. HISTORY OF THE UNITED STATES MILITARY RETIREMENT SYSTEM

English pension law was the basis for colonial pension legislation and provided for soldiers in the case of disability (DOD Office of the Actuary, 2015b). Those wounded in the Indian campaigns who could not earn a livelihood were provided aid in addition to families of soldiers who died in military service. The inaugural military pension law in the United States was passed on August 26, 1776, introducing the concept of half pay for life.

Disability pensions were the root of the current system, but the military transitioned to a non-disability model for four reasons listed by the Office of the Actuary:

1. To stay competitive as an employer with the civilian sector

2. To keep promotion opportunities open for junior personnel

3. To afford economic security for its members

4. To provide an experienced pool of personnel available for recall

Pension benefits for the military member ebbed and flowed throughout the Revolutionary, Civil, and World Wars based on force shaping needs and the overall economic health of the country. Disparate systems for officer and enlisted were eventually paralleled and differences between service-specific plans were eliminated (DOD Office of the Actuary, 2015b).

From inception to current policy, over 60 legal changes to the military compensation and pension policy have occurred. These reforms can be categorized in terms of recruitment/retention, administrative, and economic agendas, which have reflected the nation's needs, public opinion, and economic standing. While some of the

restructurings applied to multiple categories, usually only one appeared to be the driving factor in the passing of the particular piece of legislature. All changes and reforms listed in the following sections have been paraphrased from DOD Office of the Actuary (2015b).

1. Recruitment/Retention

- **1636**—Pilgrims at Plymouth decree that soldiers returning maimed should be maintained for life.

- **1776**—The first national pension law is passed, promising disability payments of half-pay for life.

- **1780**—Pensions based on service by itself (non-disability) of half-pay for life is offered to officers who served to the end of the war.

- **1790**—The Act of 1790 establishes a defined pay structure for the military.

- **1805**—Disability pensions are granted to those who became disabled due to wounds received in prior military service.

- **1855**—Involuntary separation due to performance with partial pay of Navy officers is authorized.

- **1861**—The first major voluntary retirement act, not based on disability, is passed for all officers after 40 years of service and involuntary retirements for age are authorized.

- **1862**—Involuntary retirements for years of service is authorized.

- **1870**—Voluntary retirement is offered to officers after 30 years of service at a rate of 75 percent pay.

- **1916**—Navy selection boards are established for promotion to rear admiral, captain, and commander. In addition, the Fleet Naval Reserve is created to provide a pool of people able to be recalled in the case of a national emergency (P.L. 64-241).

- **1925**—Retainer pay for Navy and Marine Corps enlistees is provided at 20 years of service when transitioning to the Fleet Naval Reserve.

- **1926**—Service in grade replaces age in grade for Navy selection boards (P.L. 69-413).

- **1938**—Navy selection boards instituted for all officer grades above the rank of lieutenant, limits set on years of service for lieutenant commanders through captains, and voluntary retirement at 20 years of service provided (P.L. 75-706).

- **1958**—The Uniformed Services Pay Act is the beginning of regular basic pay increased aimed at making personnel pay competitive (P.L. 85-422).

- **1967**—The Act of 1967 introduces new basic pay adjustment procedures that are still used today (P.L. 90-207).

- **1981**—The Department of Defense Authorization Act increases basic pay further in order to close the gap with civilian wages (P.L. 96-342).

- **1993**—The National Defense Authorization Act enables Selected Reserve members to apply for a transfer to the retired reserve in an effort to downsize the force (P.L. 102-484).

- **2008**—The retirement age for a reserve retirement below age 60 is reduced by three months for every 90-day aggregate of service performed with a 10-year limit (P.L. 110-181).

2. Administrative

- **1790**—The Secretary of War becomes the principle administrator of the military pension, taking over from the States.

- **1849**—The Department of the Interior assumes control of the military pension from the Bureau of Pensions.

- **1867**—Disability retirement is provided for Navy and Marine Corps enlisted personnel.

- **1873**—Navy officers are offered the same 75 percent pension given to the Army and Marine Corps in 1870.

- **1885**—Non-disability pension extended to Army and Marine Corps Enlistees for voluntary retirement after 30 years of service with 75 percent pay.

- **1899**—Navy enlisted are offered the same non-disability pension granted for the Army and Marine Corps in 1885.

- **1930**—The Veterans Administration (VA) assumes control of the military pension from the Department of the Interior.

- **1947**—The Officer Personnel Act aligns the Army and Air Force with the Navy officer selection process and offers severance pay for those officers who fail to promote and are not eligible for retirement (P.L. 80–381).

- **1948**—The Army and Air Force Vitalization and Retirement Equalization Act standardizes non disability retirement laws for all the services and establishes a non-disability retirement program for reserve personnel (P.L. 80-810).

- **1949**—The Career Compensation Act standardizes disability ratings and schedules by the VA (P.L. 81-351).

- **1969**—An additional one percent is added to cost-of-living adjustment (COLA) to compensate for a five month lag in benefits increase (P.L. 91-179).

- **1977**—COLA adjustments are made every 6 months and the additional one percent from 1969 is eliminated (P.L. 94-440).

- **1981**—Once-a-year COLA increases are implemented (P.L. 97-35).

- **1984**—Entitlements are paid at the beginning of the subsequent month rather than at the end of the month (P.L. 98-369). In addition, retired and retainer pay are paid on the first day of each month (P.L. 111-383).

- **1986**—Full COLA is restored for those members who decline the CSB/Redux option (P.L. 106-65).

- **2003**—The required reserve service eligibility for retired pay is reduced from eight to six years and a 10 percent retired pay bonus is established for enlisted members determined to have demonstrated extraordinary heroism in the line of duty (P.L. 107-314).

- **2003**—The Concurrent Receipt Law is passed, addressing the offset to military retired pay due to receipt of VA disability compensation (P.L. 108-136).

- **2006**—The 75 percent cap on non-disability retirements for over 30 years of service is lifted (P.L. 109-364).

- **2008**—An independent three-member DOD Retirement Board of Actuaries is established (P.L. 110-181).

- **2011**—The 100 percent cap on disability retirements for over 40 years of service is lifted (P.L. 111-383).

- **2014**—Full COLA is restored for the disabled and survivors of members who die on active duty (P.L. 113-76). In addition, the president

grandfathers all military members who entered service prior to January 1, 2014 from the reduced COLA program (Senate Bill 25).

3.   **Economic**

- **1818**—Revolutionary War veterans are provided relief from previously discounted claims due to an increasing treasury and political controversy.

- **1832**—Revolutionary War veterans are provided full-pay for life, regardless of need.

- **1836**—Revolutionary War widows are extended the pension benefits.

- **1935**—The Military Retirement system is moved to an unfunded or "pay-as-you-go" basis.

- **1958**—Retired pay is increased six percent in order to catch up from the last time retired pay was increased in 1955 (P.L. 85-422).

- **1963**—A permanent system of increasing retired pay is established based on an economic formula (P.L. 88-132).

- **1965**—Adjustments are made to the COLA formula, linking it to the Consumer Price Index (P.L. 89-132).

- **1980**—High-3 (HI-3) is introduced, where the 2.5 percent per year is multiplied by the average of the highest 36 months of pay rather than final pay when computing the annuity payment (P.L. 96-513).

- **1982**—COLA is temporarily decreased (P.L. 97-253).

- **1983**—The Military Retirement Fund is established (P.L. 98-94).

- **1984**—COLA is set to the percentage increase in the average CPIs for July, August, and September over the averaged indexes of the prior year (P.L. 98-270).

- **1986**—Redux is enacted, reducing the 2.5 percent multiplier to 2 percent but then readjusting at age 62 to a level had the 2.5 percent been used for each year of service (P.L. 99-348). In addition, COLA increases for members entering the service after July 31, 1986 are reduced by one percent. At age 62, a catch-up mechanism is used to increase the amount payable had full adjustments been made (P.L. 99–348). Furthermore, separate normal cost percentages are mandated for the active duty and reserve retirements (P.L. 99-661).

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- **1999**—In a reversing move, DOD converts those members under the Redux system back to HI-3. At the 15-year point, service members have the choice to stay with HI-3, or opt into the Redux program. A $30,000 bonus is provided when transitioning to Career Status Bonus (CSB)/Redux that includes a 5-year service obligation (P.L. 106-65).

- **2000**—Basic pay increases are linked to the Employment Cost Index and the President is authorized to adjust the amount (P.L. 106-65).

- **2013**—The Bipartisan Budget Act makes changes to COLA, reducing the rate to COLA less one percent until age 62 when the rate would be restored to an amount had there been no reduction (P.L. 113-67).

- **2018**—The Blended Retirement System is launched, providing a matched 401(k)-type investment and reducing the annuity multiplier from 2.5 percent to 2 percent.

The timeline in Figure 1 shows where these changes have fallen over time, punctuated by relevant wars.

Figure 1.   Military Retirement Timeline
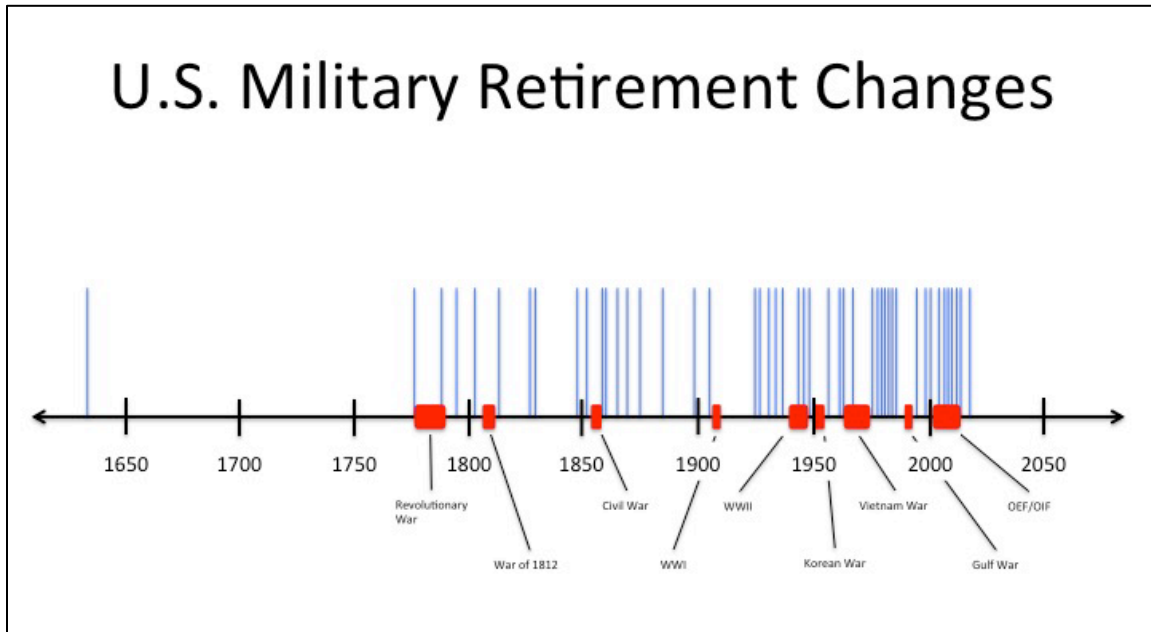
B.   LEGACY RETIREMENT SYSTEM

The current system is a 20-year cliff-vested defined benefit annuity (DOD Office of the Actuary, 2015b). The multiplier is 2.5 percent per year of service and the average of the highest 36 months of basic pay (HI-3) is used for the calculation. Service members who entered before 2014 receive full COLA and members who entered in 2014 or later receive a reduced COLA of the Consumer Price Index (CPI) less one percent until the catch-up mechanism at age 62. The CSB/Redux option at the 15 years of service mark is available, reducing the multiplier to two percent for each year of service and reducing to COLA until the first day of the month after the retiree's 62nd birthday.

Basic pay increases while on active duty attempt to mirror the private sector and are influenced by the health of the American economy. After FY2006, increases were tied to the Employment Cost Index but the President has the authority embedded in the law to adjust the pay scale increases to meet recruitment and retention needs (DOD Office of the Actuary, 2015b).

C. BLENDED RETIREMENT SYSTEM

In response to rising personnel costs and a changing work force that has different career values, the MCRMC was tasked with changing the retirement system to remain competitive in compensation. The majority of the private sector has transitioned from cliff-vested annuity retirement packages to a 401(k)-type program that is mobile between employers. At least 83 percent of the military does not make it to 20 years of service and a matching-type 401(k) program provides at least some retirement compensation for careers that do not span 20 years (Maldon, 2015). Under the new system there are three components, which are described in the following sections.

1. Defined Contribution

According to the Office of Management and Budget (OMB), service members will automatically be enrolled in the Thrift Saving Plan (TSP) with three percent of their basic pay going into the Roth type account (2015). Only after the completion of financial literacy training can the member change the contribution amount or change the TSP account to a traditional type. OMB further explains that DOD will contribute one percent of basic pay every month, vesting upon completion of two years of service; after four years of service, DOD will match up to five percent of basic pay in the TSP account.

2. Defined Benefit

The cliff-vested annuity is available for service members who make it to 20 years of service with the difference being a two percent multiplier for all and a reduction to COLA less one percent for those who entered the service before January 1, 2014 (OMB, 2015).

3. Continuation Pay

In response to potential retention impacts, the service member may be offered a one-time retention pay determined by the individual services up to 22 times basic pay at 12 years of service (OMB, 2015).

All members serving on January 1, 2018 will be grandfathered into the legacy system and those with less than 12 years of service will have two years to "opt-in" to the new system. This period of time will allow for financial literacy training because a decision to opt-in is not reversible. Service members joining on or after January 1, 2018 will be enrolled in the new retirement system (OMB, 2015). Tables 1 and 2 display the differences in the retirement systems.

Table 1.   Retirement System Properties

Benefit System	HI-3	CSB/Redux	CY2018
Multiplier	2.5% per YOS	2% per YOS**	2% per YOS
COLA Adjustment	Full CPI*	CPI less 1%**	CPI less 1%
Bonus	-	$30,000	5x base pay***
TSP Matching	-	-	Up to 5% per year

*If service member entered prior to January 1, 2014. Otherwise CPI less 1% until age 62.
**Multiplier and COLA is adjusted to catch-up at age 62.
***Service dependent and only proposed at this time.
Adapted from OMB (2015).

Table 2.   Retirement System Multipliers

Years of Service	HI-3 Multiplier	CSB/Redux Multiplier		CY2018 Multiplier
		Before 62	After 62	
20	50.0%	40.0%	50.0%	40%
21	52.5%	43.5%	52.5%	42%
22	55.0%	47.0%	55.0%	44%
23	57.5%	50.5%	57.5%	46%
24	60.0%	54.0%	60.0%	48%
25	62.5%	57.5%	62.5%	50%
26	65.0%	61.0%	65.0%	52%
27	67.5%	64.5%	67.5%	54%
28	70.0%	68.0%	70.0%	56%
29	72.5%	71.5%	72.5%	58%
30	75.0%	75.0%	75.0%	60%

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III. METHODOLOGY

A. INTRODUCTION

In order to compare the two retirement systems in a way that captures the transformation of money over time and personal values, a multi-step process ending with a risk-adjusted NPV determination is used. The baseline for all calculations is the year of retirement and each of the segments of the blended system are calculated separately and then aggregated to compare to the legacy system.

1. Defined Benefit

Each retirement system features an annuity based on the HI-3 base pay multiplied by either 2.5 percent or 2 percent. The present value of the annuity from retirement age to life expectancy is computed using the personal discount rate. Then, a risk multiplier is incorporated to compensate for the likelihood of the service member making it to 20 years of service.

Step 1) HI-3 is calculated using the assumed pay schedule

HI-3= [(year 18 pay)+(year 19 pay)+(year 20 pay)]/3

Step 2) PV of the annuity is calculated using the HI-3 as the "C," life expectancy minus retirement age as the "n" periods, and the personal discount rate as the "r."

PV= C*{[1-(1+r)^-n]/r}

Step 3) The risk factor for the year group cohort is calculated by dividing the survival percentage of the service at year 20 by the survival percentage of the cohort

RF= (20 year %)/(cohort %)

Step 4) The balance from step 2 is risk adjusted by multiplying it to the risk factor from step 3

RAPV= (step 3)*(step 4)

2.   Defined Contribution

The unique portion of the blended system is the matched 401(k) style retirement benefit. For the first time in U.S. military pension history, service members who do not serve for at least 20 years will leave with some amount of retirement benefit. For this reason, any service member not intending to stay until 20 years of service should always switch to the blended system.

In order to calculate this portion of the retirement benefit in a comparable way to the legacy retirement system, only the funds contributed by the government are considered in the evaluation. The retirement commission and RAND have included the funds contributed by the service member in recent studies, but this money is not considered relevant in this thesis. The money a service member chooses to save out of a paycheck is not germane when comparing these two retirement systems.

Another assumption that needs to be made is the amount contributed by the service member in the defined contribution portion of the pension system. As little as one percent or as much as five percent will be matched by the government based on the member's contribution. For the scope of this thesis (in parallel to the retirement commission and the RAND study), a three percent member contribution is assumed, yielding a four percent contribution by the government and invested in the TSP 2050 Life cycle Fund (Asch, Mattock, & Hosek, 2015).

The government contributions are added and compounded until the age of retirement and then compounded until age 59.5. Then, the amount is discounted to the year of retirement. The risk factor is not incorporated because there is not cliff vesting in this portion of the benefit.

Step 1) Contributions are added as the yearly "C," compounded using the assumed market rate of return "x," and discounted by the assumed inflation "i" up to retirement where "t" equals 20 minus the cohort year.

Contribution= Sum of $[C0*(1+(x-i))^{\wedge}t] + [C1*(1+(x-i))^{\wedge}(t-1)] + \ldots + Ct$

Step 2) FV of an investment is calculated using the balance from step 1 as the "C," assumed market rate of return "x," assumed inflation "i," and 59.5 minus the year of retirement as the "n" periods

$$FV = (\text{step 1})*(1+(x-i))^n$$

Step 3) The FV is discounted to the year of retirement using the balance from step 2 as the "C," the personal discount rate as the "r," and 59.5 minus the year of retirement as the "n" periods

$$PV = (\text{step 2})/(1+r)^n$$

3.   Continuation Pay

The mid-career bonus in the blended system has not been defined by each service and will likely change over time to compensate for force shaping needs. However, the initial targets set by RAND are used in this model as seen in Table 3 (3.37 months' pay for enlisted members and 14 months' pay for officers). As in the RAND study, it is assumed that the service member places the bonus in the TSP 2050 Life cycle Fund (Asch et al., 2015). The amount is compounded to age 59.5 and then discounted to the year of retirement. Then, as in the cliff-based annuity, it is risk adjusted based on the likelihood the service member will make it to 12 years of service.

Table 3.   Continuation Pay Multipliers by Service

	Enlisted		Officer	
	AC	RC	AC	RC
Army	2.8	0.9	13.0	6.2
Marine Corps	4.2	1.1	11.7	5.8
Navy	4.8	1.2	15.2	6.7
Air Force	2.4	0.8	15.9	6.4

Source: Asch et al. (2015).

The most current law passed stipulates a multiplier of 2.5 for all service members, but is under petition to be changed to the MCRMC recommended method where each service can adjust as needed for force shaping. For the purposes of this thesis, the suggested rates used by the retirement commission and RAND are used in the model with the expectation that the law will change to reflect those recommendations.

Step 1) The bonus is calculated by multiplying the 12th year monthly pay by the assumed CP multiplier

Bonus= (12th year pay)*(bonus multiplier)

Step 2) FV of an investment is calculated using the balance from step 1 as the "C," assumed market rate of return "x," assumed inflation "i," and 59.5 minus the year of 12 years of service as the "n" periods

$FV= (step\ 1)*(1+(x-i))^{\wedge}n$

Step 3) The FV is discounted to the year of retirement using the balance from step 2 as the "C," the personal discount rate as the "r," and 59.5 minus the year of retirement as the "n" periods

$PV= (step\ 2)/(1+r)^{\wedge}n$

Step 4) The risk factor for the year group cohort is calculated by dividing the survival percentage of the service at year 12 by the survival percentage of the cohort

RF= (12 year %)/(cohort %)

Step 5) The balance from step 3 is risk adjusted by multiplying it to the risk factor from step 4

RAPV= (step 3)*(step 4)

B.   YEARS OF SERVICE AND PROMOTION

For the scope of this thesis, a few assumptions about the age and promotion schedule of a typical service member are made in order to simplify the model. These assumptions are consistent with the ones made by the retirement commission and the studies done by RAND.

1.   Enlisted members enter at age 18

2.   Officers enter at age 22

3.   Service members retire at 20 years of service

4.   Terminal rank for enlisted members is E-7

5.   Terminal rank of officers is O-5

While career progression is unique for service members, there is an advancement sequence that approximates most careers. The minor differences from the baseline progression do not have a significant impact on the end valuation (Asch et al, 2015). In addition, both systems are evaluated using the same career progression.

C.   LIFE EXPECTANCY

Using the assumption that the majority of enlisted members enter the military at age 18 and officers enter at age 22, the retirement age at the 20-year mark is 38 and 42 years old, respectively. The Office of the Actuary publishes life expectancy charts for enlisted and officer members that use retirement age as an independent variable. It also separates calculations based on gender (Office of the Actuary, 2015a).

Following the life expectancy chart for the assumed retirement ages and using a weighted average of the gender demographics of the enlisted and officer population within DOD yields the following (OSD, 2104):

- Enlisted

    (85.2% x 79.7yo) + (14.8% x 82.5yo) = 80.1 years old

- Officer

    (83.3% x 84.3yo) + (17.7% x 85.9yo) = 84.6 years old

D.   INFLATION

For the purposes of this thesis, the interest rate of 2.35 percent per year used by the retirement commission is assumed.

E.   MARKET RETURN

One of the key variables in the blended retirement program is the projected rate of return on the invested portion. In order to provide a reasonable return rate that approximates the historical S&P 500 return, the retirement commission used the TSP Life cycle 2050 Fund with a 7.3 percent average return. This fund is spread across the G, F, C, S, and I Funds to provide diversification and is adjusted over time to meet changing risk profiles. When combined with the assumed 2.35 percent interest rate, the real rate of return is 4.95 percent. In agreement with the retirement commission, the L2050 Fund is used for the Defined Contribution and Continuation Pay portions of this thesis (Asch et al., 2015).

F.   PRESENT AND FUTURE VALUE

Using the assumed interest rate, market rate of return, and the yearly periods, present and future values are calculated for each of the segments in the legacy and blended retirement systems as seen in Figures 2 and 3. The theory of compounding is used to evaluate monetary growth over time and discounting is used to adjust for the time value of money (Brealey, Meyers, & Allen, 2011).

Figure 2.   Present Value Equation

$$PV = \frac{C}{(1 + i)^n}$$

Figure 3.   Future Value Equation

$$FV = PV(1 + i)^t$$

G.   PERSONAL DISCOUNT RATE

Experimental and non-experimental studies have measured the personal discount rate, which is the rate at which an individual will trade a current dollar for a future dollar (Cunha & Menichini, 2014). Included in these studies is an examination of the early 1990s military drawdown and the introduction of the Voluntary Separation Incentive and the Selective Separation Benefit. The behavior of service members was evaluated when given a choice to have money in hand at the expense of their annuity. The results of the program were not what was expected; the "take rate" was far above the projected rate, illuminating this promising concept (Warner & Pleeter, 2001).

The behavioral economic community has determined there are three actualities to the personal discount rate (D):

    1.   Individuals do not discount all future values at the same rate

    2.   D varies with the time delay of the reward or penalty

    3.   D varies with personal characteristics

The retirement commission and RAND use a personal discount rate of 12.7 percent for enlisted members and 6.4 percent for officers. These assumptions are accepted for the purpose of this thesis (Asch et al, 2015).

H.   NET PRESENT VALUE

The time value of money stipulates that a dollar in hand today is worth more than a dollar in the future because it could be used to make money in an investment vehicle and inflation diminishes its buying power over time. NPV is a tool that allows for a return-on-investment evaluation of a project or the comparison of multiple projects (Gallo, 2014).

The equation for NPV is shown in Figure 4 and the output of this model does not represent a dollar amount the service member will likely see in a bank account. Rather, the NPVs are only useful in comparing options. The direction of difference between the pension systems and the magnitude of the difference provide guidance on the best fiscal course of action based on the assumed variables.

Figure 4.   Net Present Value Equation

$$\text{NPV}(i, N) = \sum_{t=0}^{N} \frac{R_t}{(1+i)^t}$$

I.   CAREER SURVIVAL RATES

One of the differentiating features of this thesis is the introduction of risk into the valuation of the two pension systems (Luce & Krantz, 1971). Emphasis is placed on the Defined Benefit portion of the retirement plans, but the reality is that the majority of service members will never be eligible for the annuity. In addition to administrative reasons for leaving before 20 years of service, like failing to promote, and being discharged punitively, many service members choose to transition to the civilian sector for personal reasons, like quality of life and pay. In the end, only 17 percent of service members make it to the 20-year mark and are eligible for the defined annuity pension as seen in Figure 5 (Maldon, 2015).

Figure 5.   Active Duty Retirement Curves
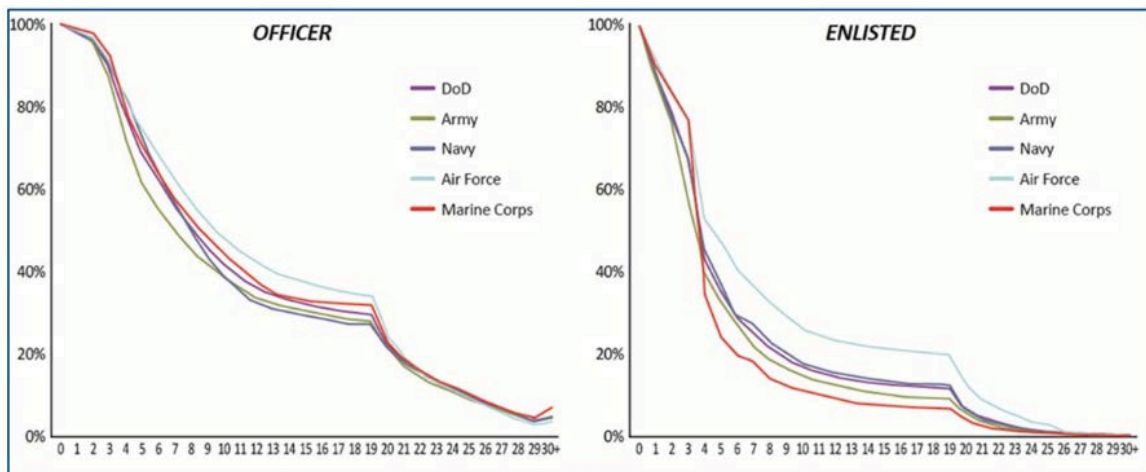
Source: Asch et al. (2015).

The retention curves are different for the enlisted and officer population and even differ slightly between services. However, they all share a common shape, illustrating a steep loss rate in the first six years and then flattening as the member approaches 20 years of service. The odds that a service member with two years of service making it to 20 years are significantly less than a service member with 10 years, regardless of demographic. For the purposes of this thesis, the Navy Active Component Enlisted and Officer retention curves are used to determine risk, displayed in Table 4.

Table 4.   Navy Retention

YOS	Enlisted	Officer
1	87.0%	96.6%
2	78.1%	94.5%
3	59.6%	92.8%
4	45.7%	91.9%
5	34.8%	76.1%
6	27.6%	63.8%
7	22.4%	54.2%
8	18.7%	46.1%
9	15.8%	40.1%
10	13.8%	35.8%
11	12.4%	32.3%
12	11.6%	30.3%
13	11.0%	28.8%
14	10.6%	27.8%
15	10.3%	27.0%
16	10.1%	26.6%
17	10.1%	26.1%
18	10.0%	25.9%
19	9.9%	25.7%
20	7.7%	20.3%

*Active Component based on DRM simulations of the retention profile under the baseline by RAND (2015).

J. MODELS, INPUTS, AND OUTPUTS

Two models, one for enlisted and one for officers, were built in Excel. The inputs to the models are the following:

- 2016 military pay schedule

- 2015 retention rates

- Age at entry

- Life expectancy

- Interest rate

- Personal discount rate

- Market return

The outputs of the models are NPV's for each year group cohort, comparing the legacy to the new retirement system. The actual number is not as important as the direction and magnitude of the difference between the two values. Based on the years of service, an enlisted member or officer can compare the risk-adjusted values of each system and use that to make a decision on whether to switch to the blended retirement program.

K. SUMMARY

The results of the model present a valuation useful in the decision-making process military members with less than 12 years of service will complete in 2018. This is a generalized model with assumptions made for the enlisted and officer community. The numbers output by the model are not suitable for financial expenditure planning, only for comparison purposes. However, the models do provide a base-line comparison of the retirement systems that goes beyond bank account balances and attempts to capture the holistic benefit or value of the systems.

IV. ANALYSIS OF RESULTS

Using the produced models for valuation, the following results are provided for enlisted members and officers. In addition, a sensitivity analysis is afforded for relevant input variables assuming all other variables are held constant. Since service members must proactively change to the blended system, the assumption for the valuations in this chapter is that the member remains grandfathered under the legacy system.

A. VALUATION

1. Enlisted

Members from 0–5 years of service increase the value of their pension when switching to the blended system, with the most relative value changing for cohorts with 0–2 years of service. Cohorts with 6–11 years of service realize an advantage by remaining under the legacy system, as shown in Table 5 and Figure 6. However, the magnitude of the advantage is less than the corresponding advantage junior service members see when switching to the blended system.

Table 5.   Enlisted Retirement Value

Cohort	Legacy	Blend	Delta	% Difference
0 YOS	$18,124.95	$26,302.21	-$8,177.26	-45.12%
1 YOS	$20,200.22	$27,903.68	-$7,703.46	-38.14%
2 YOS	$26,450.33	$32,980.72	-$6,530.39	-24.69%
3 YOS	$34,490.12	$39,542.38	-$5,052.26	-14.65%
4 YOS	$45,296.76	$48,398.42	-$3,101.66	-6.85%
5 YOS	$57,249.84	$57,720.17	-$470.33	-0.82%
6 YOS	$70,506.63	$68,100.14	$2,406.48	3.41%
7 YOS	$84,208.93	$78,838.34	$5,370.59	6.38%
8 YOS	$100,141.79	$91,471.14	$8,670.65	8.66%
9 YOS	$114,209.50	$102,535.12	$11,674.39	10.22%
10 YOS	$127,093.73	$112,643.28	$14,450.45	11.37%
11 YOS	$136,320.94	$119,643.67	$16,677.27	12.23%

Figure 6.   Enlisted Retirement Value
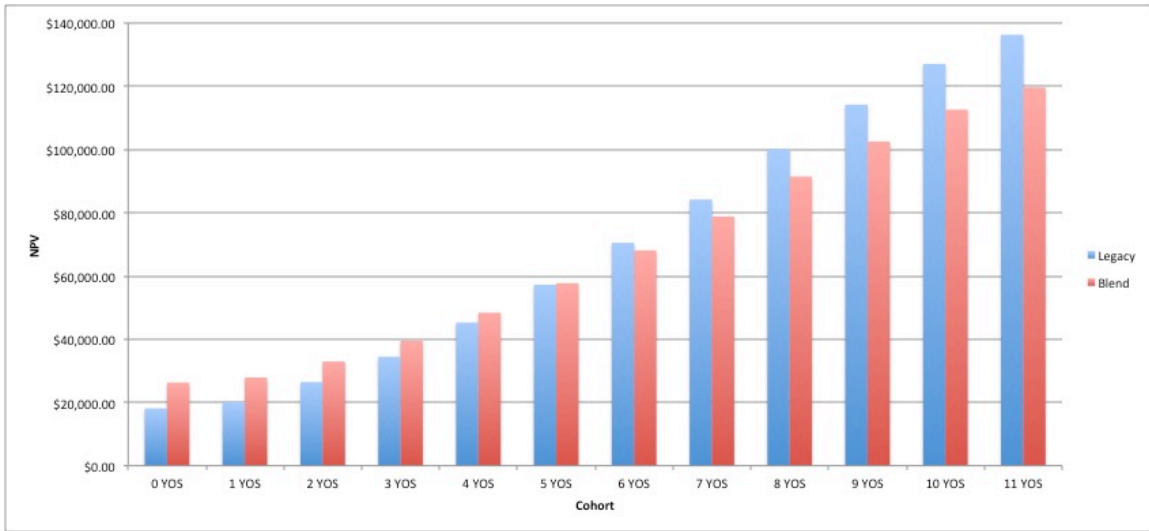
2. Officer

All members from 0–11 years of service realize an advantage under the blended system as shown by Table 6 and Figure 7. The valuation indicates that switching to the blended system provides the most benefit to the junior service member with the most relative value change.

Table 6.   Officer Retirement Value

Cohort	Legacy	Blend	Delta	% Difference
0 YOS	$152,108.99	$216,634.14	-$64,525.15	-42.42%
1 YOS	$155,424.11	$219,328.05	-$63,903.94	-41.12%
2 YOS	$158,270.70	$221,575.54	-$63,304.84	-40.00%
3 YOS	$159,872.53	$222,383.14	-$62,510.61	-39.10%
4 YOS	$193,019.14	$255,381.79	-$62,362.65	-32.31%
5 YOS	$230,153.32	$289,280.24	-$59,126.92	-25.69%
6 YOS	$270,945.90	$327,114.43	-$56,168.53	-20.73%
7 YOS	$318,393.72	$371,763.42	-$53,369.70	-16.76%
8 YOS	$366,351.28	$417,117.50	-$50,766.22	-13.86%
9 YOS	$410,583.75	$458,658.20	-$48,074.45	-11.71%
10 YOS	$454,257.47	$499,802.33	-$45,544.86	-10.03%
11 YOS	$485,642.53	$528,004.37	-$42,361.85	-8.72%

Figure 7.   Officer Retirement Value
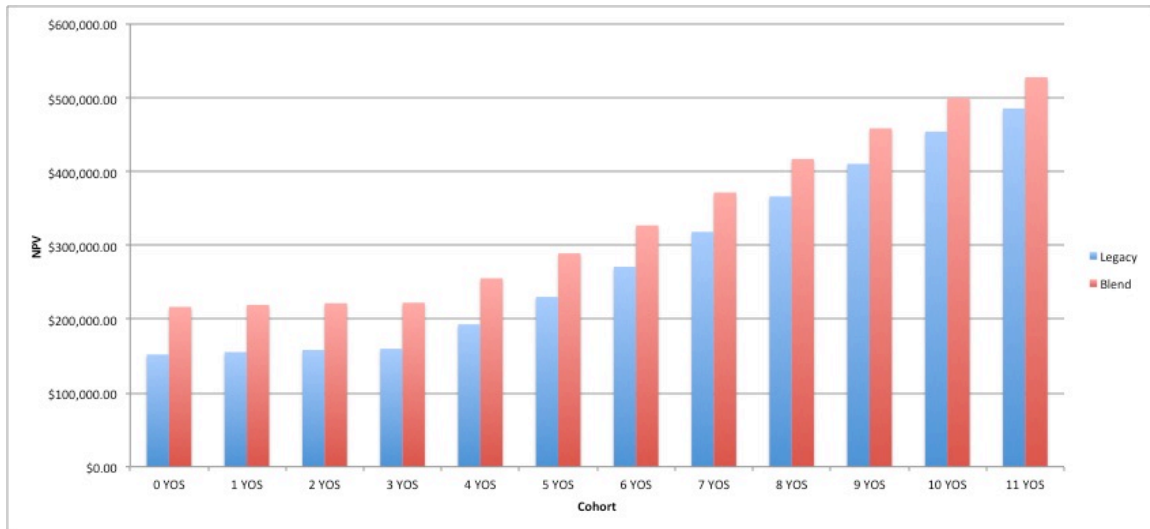
B.   SENSITIVITY

Each of the variables in the model has different effects on the valuation of the retirement systems. In order to capture the significance of each variable, a sensitivity analysis is conducted to determine the critical level that changes the NPV determination with all other variables held constant.

1.   Market Return

A 4.95 percent is the base real rate of return (L2050 Fund return-interest) and as the rate goes up, the blended system increases in value. An increase or decrease to the critical level indicated in the table changes the NPV determination to stay with the legacy pension or switch to the blended system. The critical return rate drives both models to an equal valuation as displayed in Figures 8 and 9.

Enlisted members with 0–5 years of service should prefer the legacy retirement system if the real rate of return falls below the values in Table 7. Similarly, those with 6–11 years of service should switch to the blended pension is the rate rises above the values in Table 7.

For example, an enlisted member with two years of service should value the blended retirement system over the legacy pension assuming the 4.95 percent real rate of return. This valuation hold true until the real rate of return drops to below 1.6 percent, at which point the member should value the legacy retirement higher than the blended system.

Officers in all cohorts should choose the legacy system if return rates drop below the values in Table 8.

Table 7. Enlisted Market Return Sensitivity

Cohort	Critical %
0 YOS	0.2%
1 YOS	0.6%
2 YOS	1.6%
3 YOS	2.7%
4 YOS	3.7%
5 YOS	4.7%
6 YOS	**5.8%**
7 YOS	**6.6%**
8 YOS	**7.5%**
9 YOS	**8.1%**
10 YOS	**8.7%**
11 YOS	**9.2%**

Figure 8. Enlisted Market Return Sensitivity
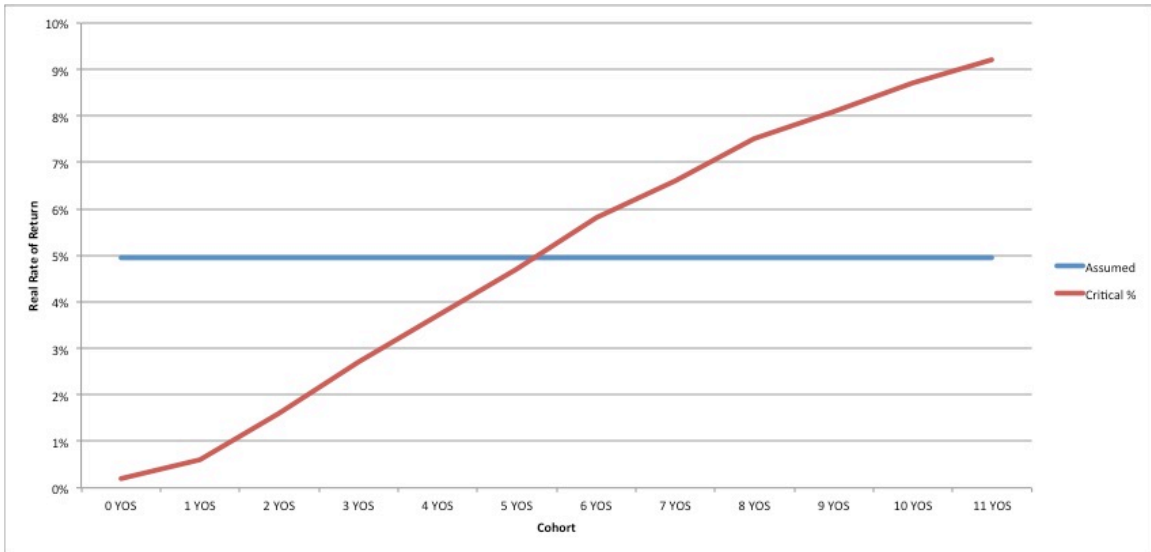
Table 8.   Officer Market Return Sensitivity

Cohort	Critical %
0 YOS	0.5%
1 YOS	0.5%
2 YOS	0.6%
3 YOS	0.7%
4 YOS	1.0%
5 YOS	1.5%
6 YOS	2.1%
7 YOS	2.4%
8 YOS	2.7%
9 YOS	3.0%
10 YOS	3.1%
11 YOS	3.4%

Figure 9.   Officer Market Return Sensitivity
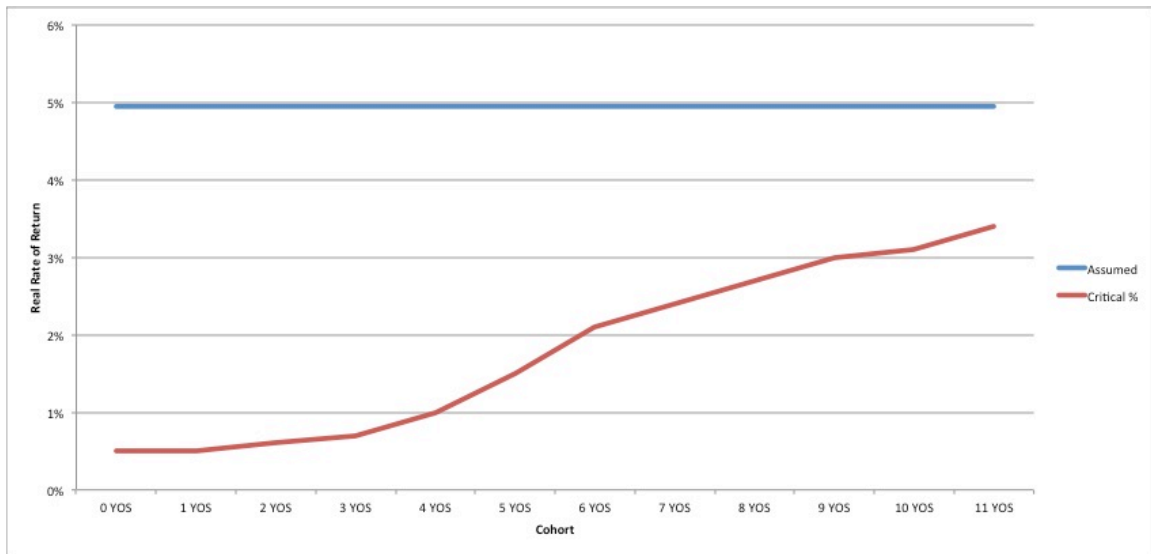
2.   Life Expectancy

Changing the life expectancy does not alter the valuation of either retirement system asymmetrically from the other. From a life expectancy of 60–100 years, the decision output remains the same for officers and enlisted.

3.   Personal Discount Rate

The effect of the time value of money plays a role in the NPV determination. The personal discount rate is set to 6.4 percent for officers and 12.7 percent for enlisted members in accordance with the RAND study, but an increase in the rate favors the blended system and a decrease benefits the legacy retirement system.

Enlisted service members in the 0–4 year cohorts change from a valuation that recommends the blended system to the legacy system when the personal discount rate is increased to at least the values in Table 9. Members in the 5–8 years of service cohorts should switch to the blended pension if the discount rate falls to at least the rates in Table 9 and members of the 9–11 years of service cohorts are unaffected.

For example, an enlisted member with two years of service should value the blended retirement system over the legacy pension assuming the 12.7 percent personal discount rate. This valuation hold true until the personal discount rate rises above 21.2 percent, at which point the member should value the legacy retirement higher than the blended system.

Officers in all cohorts receive the higher benefit from the legacy retirement system if the personal discount rate is increased to at least the values in Table 10. The critical discount rate drives both systems to a common "break-even" valuation as displayed in Figures 10 and 11.

Table 9.   Enlisted Personal Discount Rate Sensitivity

Cohort	Critical %
0 YOS	24.9%
1 YOS	23.8%
2 YOS	21.2%
3 YOS	18.7%
4 YOS	16.0%
5 YOS	13.2%
6 YOS	**10.3%**
7 YOS	**7.4%**
8 YOS	**2.4%**
9 YOS	-
10 YOS	-
11 YOS	-

Figure 10.   Enlisted Personal Discount Rate Sensitivity
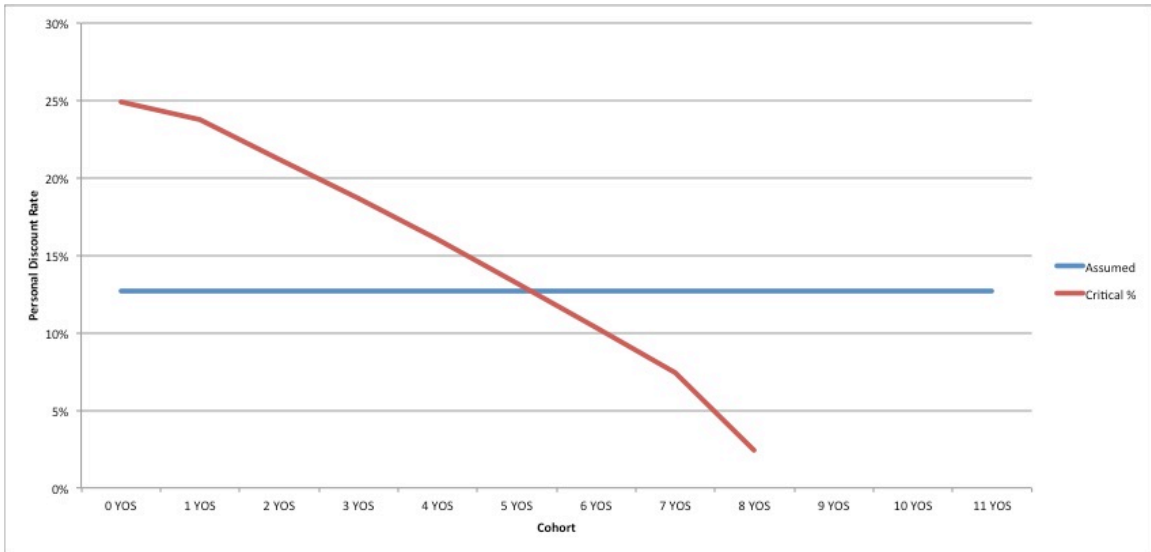
Table 10.   Officer Personal Discount Rate Sensitivity

Cohort	Critical %
0 YOS	20.4%
1 YOS	20.2%
2 YOS	20.0%
3 YOS	19.9%
4 YOS	18.7%
5 YOS	17.3%
6 YOS	16.1%
7 YOS	14.9%
8 YOS	14.0%
9 YOS	13.3%
10 YOS	12.6%
11 YOS	12.1%

Figure 11.   Officer Personal Discount Rate Sensitivity
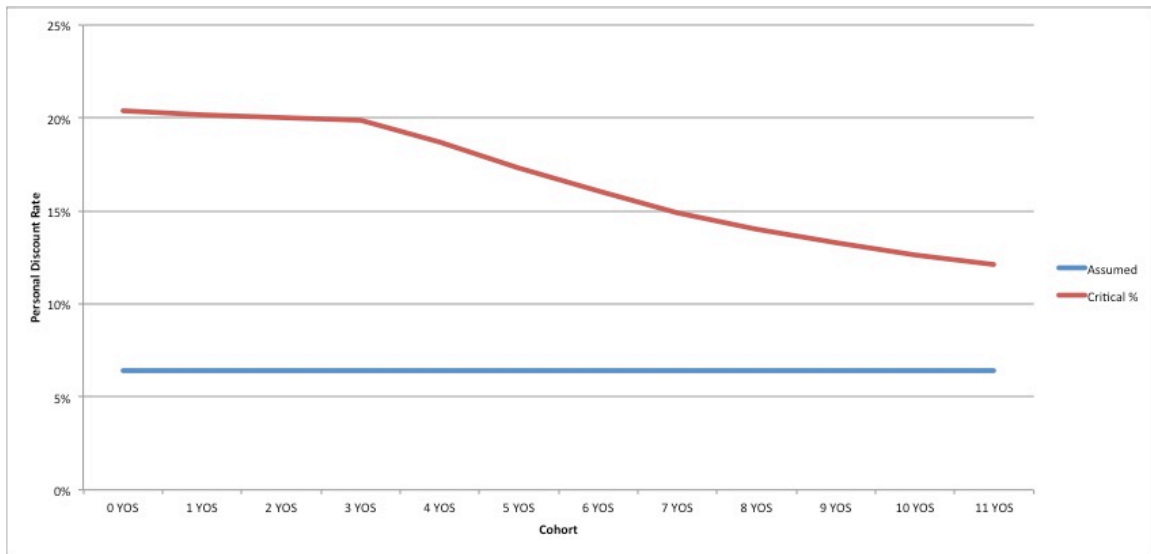
4.   Risk

The element of risk is incorporated into the model by comparing the cohort retention rate with the rate at 20 years of service. A risk multiplier with a low value indicates that the cliff-vested pension is less like to be realized in an individual career.

Enlisted members in the 0–5 years of service cohorts benefit from the legacy pension system if the risk percentage rises to at least the amount in Table 11. Those in the 6–11 years of service cohorts should switch to the blended system if the rates fall below the values shown in Table 11.

For example, an enlisted member with two years of service should value the blended retirement system over the legacy pension assuming the 12.9 percent historical retention risk derived from the career survival curve. This valuation hold true until the retention risk rises above 28.9 percent, at which point the member should value the legacy retirement higher than the blended system.

Officers change from the blended system to the legacy system when the likelihood of attaining 20 years of service is more probable. In order to value the legacy system, the risk percentage would need to rise to at least the values in Table 12. As in the other sensitivity categories, the critical risk rate forces the systems to a near equal value as displayed in Figures 12 and 13.

Table 11.   Enlisted Risk Sensitivity

Cohort	Historical %	Critical %
0 YOS	8.8%	28.9%
1 YOS	9.9%	28.7%
2 YOS	12.9%	28.9%
3 YOS	16.8%	29.2%
4 YOS	22.1%	29.7%
5 YOS	27.9%	29.1%
6 YOS	34.4%	**28.5%**
7 YOS	41.1%	**28.0%**
8 YOS	48.9%	**27.7%**
9 YOS	55.8%	**27.2%**
10 YOS	62.0%	**26.7%**
11 YOS	66.6%	**25.8%**

Figure 12.   Enlisted Risk Sensitivity
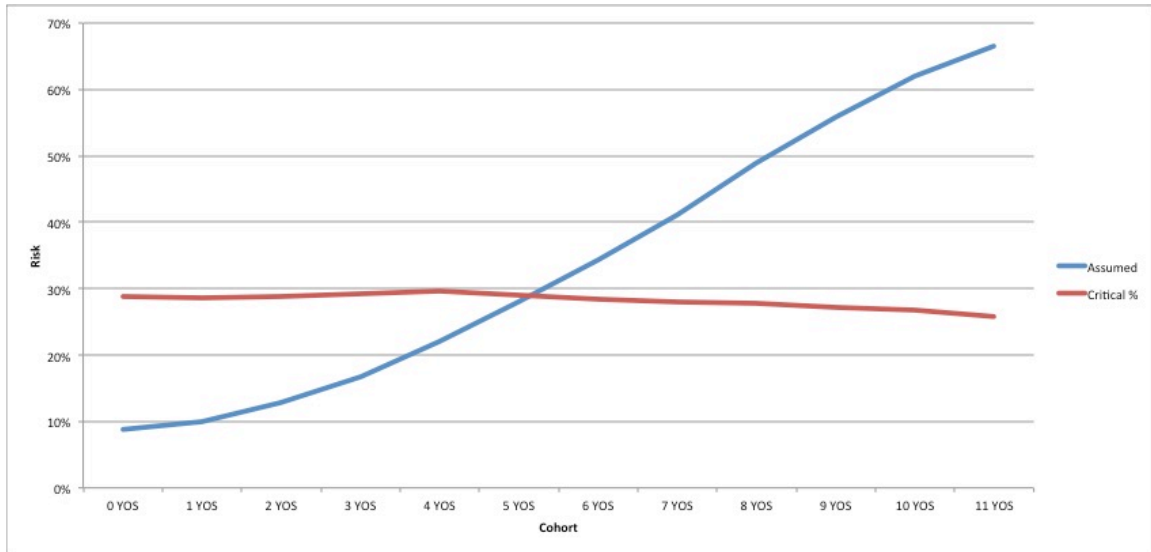
Table 12.   Officer Risk Sensitivity

Cohort	Historical %	Critical %
0 YOS	21.0%	65.7%
1 YOS	21.5%	65.7%
2 YOS	21.9%	65.7%
3 YOS	22.1%	65.7%
4 YOS	26.7%	69.8%
5 YOS	31.8%	72.7%
6 YOS	37.4%	76.3%
7 YOS	44.0%	80.9%
8 YOS	50.6%	85.7%
9 YOS	56.7%	90.0%
10 YOS	62.8%	94.3%
11 YOS	67.1%	96.4%

Figure 13.   Officer Risk Sensitivity
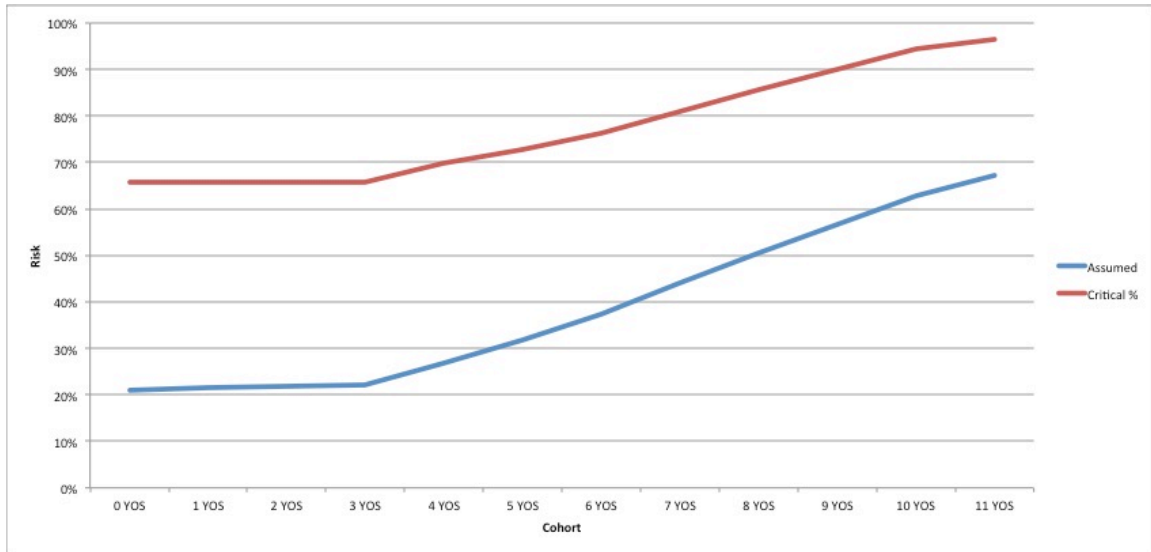
5. Continuation Pay Multiplier

The continuation pay bonus used in the model is 3.37 times pay for enlisted members and 14 times pay for officers. These levels are projected by the RAND Corporation and subject to change at service discretion to meet force requirements. Higher rates increase the value of the blended system over the legacy pension.

For enlisted members, there is no change to the NPV output for the cohorts with 0–4 years of service. The 5 years of service cohort changes from the blended to the legacy system if the multiplier is reduced below 2.5 and the 6–11 cohorts change from the legacy system to the blended pension if the multiplier is increased to at least the values displayed in Table 13.

For example, an enlisted member with 5 years of service should value the blended retirement system over the legacy pension assuming the 3.37 percent CP multiplier. This valuation hold true until the CP multiplier drops to below 2.5 percent, at which point the member should value the legacy retirement higher than the blended system as displayed in Figure 14.

Officer cohorts with 0–5 years of service are unaffected by changes to the multiplier as displayed in Figure 15. However, those in the 6–11 YOS cohorts change to the legacy system if the multiplier is reduced to the values shown in Table 14.

Table 13.   Enlisted CP Multiplier Sensitivity

Cohort	Multiplier
0 YOS	-
1 YOS	-
2 YOS	-
3 YOS	-
4 YOS	-
5 YOS	**2.5**
6 YOS	6.7
7 YOS	9.6
8 YOS	11.8
9 YOS	13.4
10 YOS	14.5
11 YOS	15.3

Figure 14.   Enlisted CP Multiplier Sensitivity
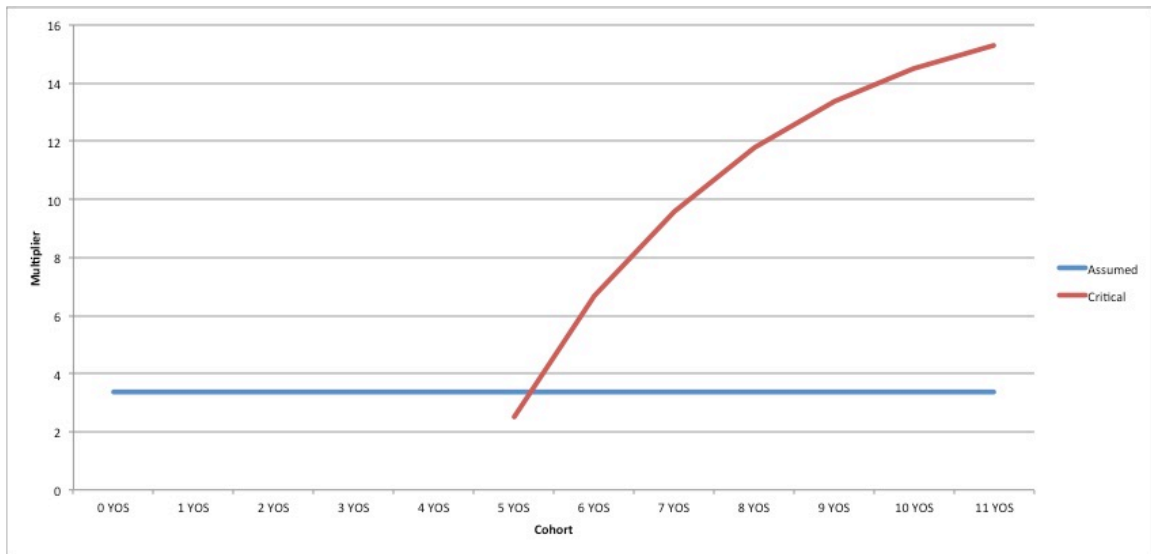
Table 14.   Officer CP Multiplier Sensitivity

Cohort	Multiplier
0 YOS	-
1 YOS	-
2 YOS	-
3 YOS	-
4 YOS	-
5 YOS	-
6 YOS	0.9
7 YOS	3.4
8 YOS	5.3
9 YOS	6.6
10 YOS	7.7
11 YOS	8.5

Figure 15.   Officer CP Multiplier Sensitivity
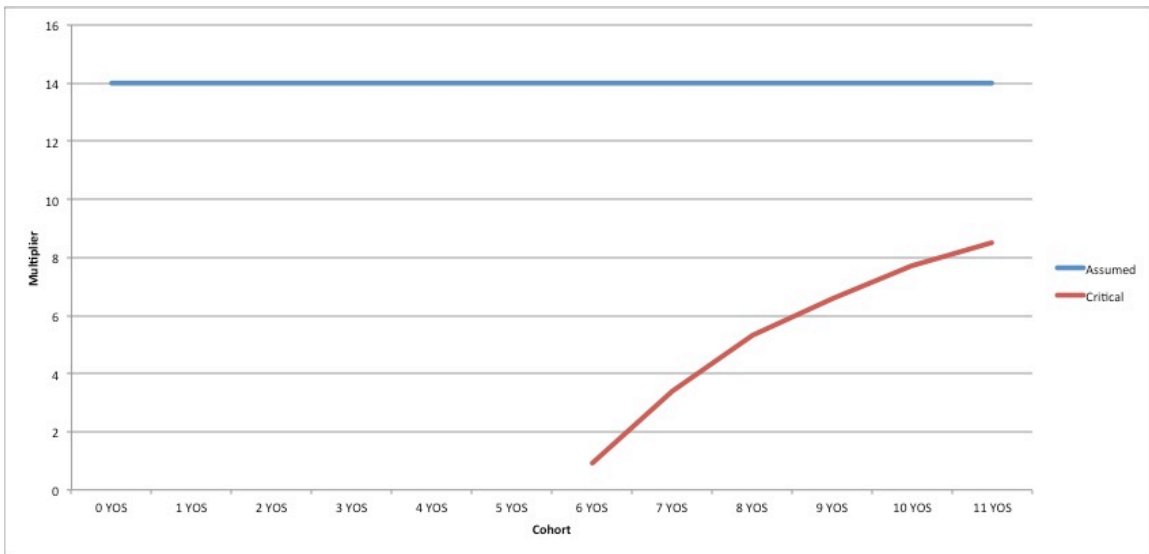
6. 401(k) Contribution

Part of the blended retirement system is the matched 401(k) requiring the service member to contribute personal income, which is then matched by the government in the TSP account. The government contributes one percent as a minimum and up to five percent based on the amount the service member invests. The model assumes a three percent contribution by the service member (four percent provided by the government) but different amounts yield different valuations.

The officer NPV decision outputs do not change between one percent and five percent, but some of the enlisted outputs do as seen in Figure 16. The outcome for the 0 years of service and 6–11 years of service are unaffected by the contribution percentage. However, the legacy retirement system becomes the more valuable choice when the personal contribution percentage is reduced for the 1–5 years of service cohorts as displayed in Table 15.

For example, an enlisted member with two years of service should value the blended retirement system over the legacy pension assuming the three percent personal contribution. This valuation hold true until the personal contribution drops to zero percent, at which point the member should value the legacy retirement higher than the blended system.

Table 15.   Enlisted 401(k) Contribution Sensitivity

Cohort	Contribution %
0 YOS	-
1 YOS	0
2 YOS	0
3 YOS	1
4 YOS	1
5 YOS	2
6 YOS	-
7 YOS	-
8 YOS	-
9 YOS	-
10 YOS	-
11 YOS	-

Figure 16.   Enlisted 401(k) Contribution Sensitivity
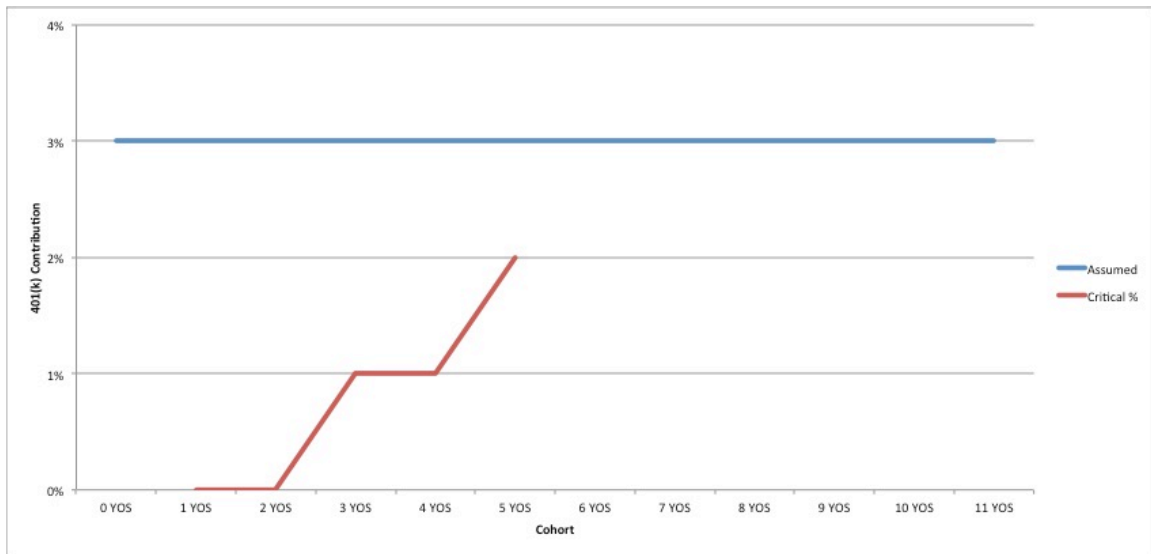
C. SUMMARY

When the blended retirement system becomes available in January 2018, if service members prioritize the value of the two systems, incorporating the time value of money and risk, the following actions are recommended:

- Enlisted with less than six years of service: **Switch to the blended system**

- Enlisted with six or more years of service: **Remain with the legacy system**

- Officers: **Switch to the blended system**

Projected market return, the personal discount rate, career retention rates, the continuation pay multiplier, and the 401(k) contribution amount affect the valuation in this thesis to varying degrees. All valuations are dependent on the validity of the assumptions made in this model, consistent with the assumptions made by the retirement commission and RAND.

V.   CONCLUSION

The Von Neumann–Morgenstern utility theorem stipulates that a rational decision maker faced with outcomes of different choices will prefer actions that maximize expected utility (2007). This assumes the actor is rational and has the information to make the decision, which is not always the case. If specified axioms are satisfied, the value associated with that choice is the statistical expectation of the valuation of the outcome of that gamble. The decision to remain with the legacy retirement system or switch to the blended system requires easy to understand data, tailored to each individual in order to facilitate rational behavior (Briggs, 2015).

The outputs of this model are not in units that make sense when held in isolation and require a fundamental understanding of finance and behavioral economics. Net present value is an analytical construct which is only used to compare the two options of the mutually exclusive pensions. In addition, the service member must embrace the reality that certain variables in the calculations are not guaranteed. Interest rates, market returns and even life expectancy are all outside the influence of the member but have significant implications in the calculations. Some of the variables in the model are nebulous at best and contentious at worst, relying on generalized data based upon demographic stereotypes. However, this is the best lens if the education provided explains concepts like the personal discount rate and career retention curves.

The results of this analysis suggest that the blended retirement system is the best choice for the majority of service members who have the option to switch in 2018. Without exception, those not intending to stay until 20 years of service should move to the new system. Of the remaining population, everyone other than enlisted members with six or more years of service benefit from the switch. However, the purpose of this thesis is not to provide an absolute solution for the looming decision facing service members in 2018. It is rather a perspective based on generalized data that facilitates a baseline course of action and creates discussion for a very personal choice.

Financial education is the critical first step in the process of aiding service members in the decision to stay with the old or switch to the new retirement system. There is an opportunity to make this decision easier for service members through a web-based and user-friendly calculator developed for use after the financial literacy training is complete.

Some of the variables are highly correlated to demographic categories and it is therefore recommended to incorporate data like service, age, race, gender, education, marital status, and career specialty. These data points individualize the personal discount rate and retention curves used in the valuation model, providing better information on the margin. Service members will also have more confidence in the quality of the result produced by the model because they are not generalized across a very diverse population.

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