

# **Insuring Defined-Benefit Plan Value – An Examination of the Survivor Benefit Plan (SBP) Decision<sup>1</sup>**

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## **Abstract**

We construct a Monte Carlo simulation model to describe the distributions and implied discount rate for participants of the U.S. Military Survivor Benefit Plan (SBP). Two recent changes have dramatically improved the value of the program. Our model demonstrates that the program is quite lucrative for most male retirees. In contrast, the program is less rewarding for female retirees, especially when they are somewhat younger than their spouse.

# **Insuring Defined-Benefit Plan Value – An Examination of the Survivor Benefit Plan (SBP) Decision**

## **I. Introduction**

The focus of this paper is on valuing the spousal insurance option of the U.S. military's defined-benefit retirement plan. The Survivor Benefit Plan (SBP) allows retirees to insure up to 55 percent of their retirement cash flow benefit for their spouse. More specifically, in valuing the benefit for the surviving spouse, we seek to inform the selection decision. We want to identify when insuring the retirement cash flow is worth the cost and under what circumstances. Since the program has recently experienced two important changes (DFAS, 2010), there is a need for new research to reassess the retiree SBP decision. The first change now allows retirees to stop paying insurance after 360 months; at that point insurance remains in force without further payment. The second change was even more significant: the Social Security offset, which in some cases could reduce the insured spouse's SBP payout by more than 35 percent after age of 62, was entirely removed.

Johnson, Uccello, and Goldwyn (2003) suggest that retiree survivor benefit decisions are generally rational. However, other studies suggest that retirees and their spouses would benefit from additional information concerning this important decision. For example, Aura (2001) finds that education level matters greatly; relative to annuitants with only a high school education, those with a college education are 13 to 20 percent more likely to opt for survivor benefits. In addition, Holden and Nicholson (1998) find that the survivor benefit decision is strongly affected by race. Holden and Zick (2000), using data from the early 1990s, find widow poverty rates can be reduced from 21 to 15.5 percent simply by increasing the election of survivor annuities.

## 1.1 Military retirement and the Survivor Benefit Plan

The spectrum of retirement options continues to change. For example, the number of workers who are covered under defined-benefit plans falls every year. The Center for Retirement Research at Boston College reports that the percentage of workers covered only by defined-benefit plans fell to 8 percent in 2006 from 23 percent in 1993 (Munnell, Aubry, and Muldoon, 2008). However, various government employees, both state and federal, continue to earn excellent defined-benefit retirements. One standout in the defined-benefit arena is the U.S. military. Those serving in the U.S. military have the opportunity to retire, in most cases, after 20 years of service. Retirees then receive an immediate lifetime annuity. The size and scope of military retirements is economically significant for the government as well as for the planning community that provides financial planning services to the group. The Department of Defense (DoD) reports nearly 1.9 million military retirees were drawing benefits in 2008; approximately \$50 billion in benefits was paid to military retirees and surviving annuitants in fiscal year 2009 (DoD, 2009).

The military retirement system is rather unique. First, military retirement is not subject to the Employee Retirement Income Security Act (ERISA). As such, the military program does not have the same vesting requirements as comparable civilian programs. One disadvantage of military retirement results from what is often called “cliff vesting,” where members accrue no benefits until the 20 year point. This characteristic creates various incentive structures for both managers and employees. However, the retirement benefits are perceived as quite generous. New retirees can generally depend on earning 50 percent of the average of their highest three years of base salary—bonuses and allowances such as housing and subsistence stipends are not

included in the calculation. Unless insured, this benefit is paid until the retiree dies; benefits do not pass on to a spouse or children.

The Survivor Benefit Plan offers the opportunity to immediately insure up to 55 percent of the retirement benefit. Specifically, military retirees face the question of whether or not to insure a portion of the retiree's retirement income by electing to take SBP. More accurately, the question is whether one should *opt out* of the benefit—SBP enrollment is the default for those retiring. Jennings and Reichenstein (2001) outline a method to value the retirement income stream from military retirement and discuss the portfolio and asset allocation implications. They include the impact of the reduced income stream produced by the cost of SBP, but do not specifically examine the SBP decision. In part, we build on their research. In this paper we identify and examine the factors to consider when making the SBP decision, and model and compare the costs and benefits of the program.

## **2. The Survivor Benefit Program (SBP)**

### 2.1 General Decision Factors

The SBP decision occurs when the military member retires. If the SBP option is not selected and paid for, a retired military member's retirement income ceases upon their death. If SBP is chosen, the retiree can insure any *base* amount of their retirement pay (up to 100 percent). For every *base* dollar insured, a surviving spouse receives 55 cents. For example assume a retiree is receiving \$1000 a month and chooses to insure 100% of that amount. Once that retiree dies, their spouse will receive \$550 dollars each month. The premium for this insurance is set at 6.5 percent of the *base* amount insured. For example, if a retiree has a gross retirement benefit of \$1000/month, and elects to insure the entire amount, the retiree would pay an insurance amount of \$65/month. This payment is completely pre-tax, but reduces the retiree's

net pre-tax retirement from \$1000/month to \$935/month. Recapping, for each \$1000/month a retiree insures, the cost of insurance is \$65 (6.5 percent); for each \$1000/month that is insured, a survivor receives \$550 (55 percent). Table 1 lists the factors that must be considered in valuing the SBP.

Table 1

**U.S. Military Survivor Benefit Plan (SBP) Details**

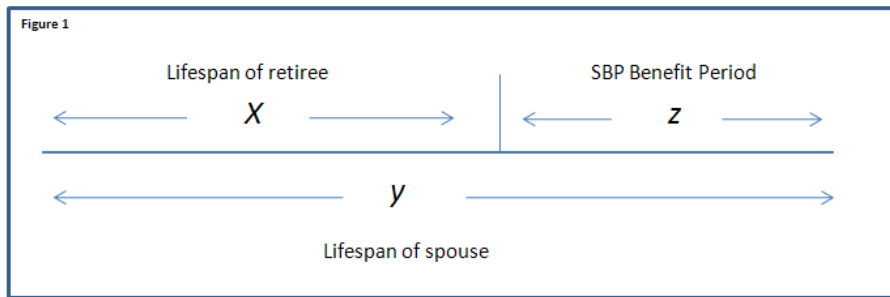
<b>Costs</b>
6.5% per dollar insured
Payment must start on retirement day
Payment ceases when either retiree or spouse dies
Payment ceases at 30 years if both retiree and spouse are still alive
Payment is pre-tax
Military retirement is increased by CPI-W each year; hence SBP payment increases by CPI-W each year (but stays at 6.5% of the dollar amount insured)
<b>Benefits</b>
55% per dollar insured
Benefit is taxable (but avoids payroll taxes)
Benefit is increased by CPI-W each year
Benefit ceases upon death of survivor

Each of the factors in Table 1 plays a role in the SBP election decision. Before retirees make a final decision, they should certainly consider the asset allocation implications discussed in Jennings and Reichenstein (2001); however, the asset allocation decision doesn't impact our analysis.

2.2. Individual Factors

Any insurance program decision must consider the health of those insured. In the case of SBP, it is the health and life expectancy of *both* the retiree and the surviving spouse. Using extreme examples to illustrate, if a recently retired couple lives together for 30 years and the spouse ultimately dies first, they will have paid premiums for 30 years and received no benefit.

In contrast, if a retiree dies in the first month of retirement and the spouse lives for 30 years, the program would provide an incredible financial return on investment. While both of these extremes are unlikely, they serve to provide a boundary or framework through which we quantify the SBP decision. Figure 1 provides a basic view of the situation.



The benefit of the SBP program is a function of the “gap” (labeled “z”), representing the difference in the lifespan of the spouse ( $y$ ), and that of the retiree ( $x$ ). As long as the time period  $z$  is positive (that is,  $y > x$ ), there will be some benefits received from SBP. The probability that SBP benefits will outweigh its costs increases with the duration of  $z$ , and decreases with increases in the duration of  $x$ .

For this paper we used the actuary tables provided by the Social Security Administration (SSA, 2006). These figures address the total population. It is critical for each retiree/beneficiary pair to modify these distributions with subjective probabilities concerning their own health and family circumstances. Limitations notwithstanding, our analysis serves as a starting point for a more informed SBP decision.

### 2.3. External Considerations

In addition to the life expectancy of the retiree/beneficiary pair, there are other factors that affect the SBP decision. For example, no financial analysis should be conducted without considering inflation. While most long-term inflation estimates are relatively low, the impacts can be considerable. Fortunately, we are able to deemphasize the role of inflation in our analysis

due to the nature of the SBP benefit. As noted in Table 1, a key attribute of the SBP program is that benefits paid to a beneficiary are indexed to inflation. That is, as the gross retirement pay increases with inflation, so too does the SBP benefit.

### **3. Simulation Model**

To explore the cost/benefit tradeoff for the SBP, we construct a Monte Carlo simulation constrained by the factors in Table 1. The primary goal of the simulation is to describe the distribution(s) for an outcome variable that is dependent on a number of random input variables. It is also important to describe the characteristics of those distributions. Specifically, we seek to find: 1) the implied discount rate associated with SBP premium payments and cash flows to beneficiaries; 2) the distributions describing the payment of SBP premiums; 3) the distributions describing SBP benefit payments; 4) the descriptive statistics generated from these distributions such as: the average number of years of SBP benefits per participant, the average number of years participants pay SBP premiums; and 5) the percentage of participants who earn at least the implied discount rate.

#### **3.1. Method Description**

Our simulation model uses the Social Security 2006 actuary tables. In agreement with Jennings and Reichenstein (2003), as informed by Stoller (1992), we employ the *expected future cash flows* method to estimate the value of SBP with our simulation. Our randomly generated sample size is 100,000, and we collect data from 10 iterations. Since the distributions produced depend on retiree and spouse ages and genders, we analyze and discuss three distinct scenarios: 1) a 45 year-old male retiree with a 45 year-old female spouse; 2) a 45 year-old female retiree with a 45 year-old male spouse; 3) a 45 year-old female retiree with a 48 year-old male spouse. The first two allow a direct comparison between male and female retirees; the third scenario



provides what is often considered a typical result, since the average husband is three years older than their spouse (more discussion later).

Starting with the ages of the retiree and spouse, random numbers are connected to the Social Security actuarial tables to simulate mortality. As noted above, each of the restrictions in Table 1 is built into the model. For each couple in a sample, the life expectancy numbers generated determine the cost and benefit of SBP for that couple. The results of the simulations are used to create the relevant distributions and descriptive statistics.

#### 4. Results

##### 4.1. Case 1: 45 year-old male retiree, 45 year-old female spouse

We begin by describing the results for a 45 year-old male retiree with a 45 year-old spouse. Our first distribution describes the number of years spouses outlive the retirees; we show that distribution in Figure 2.

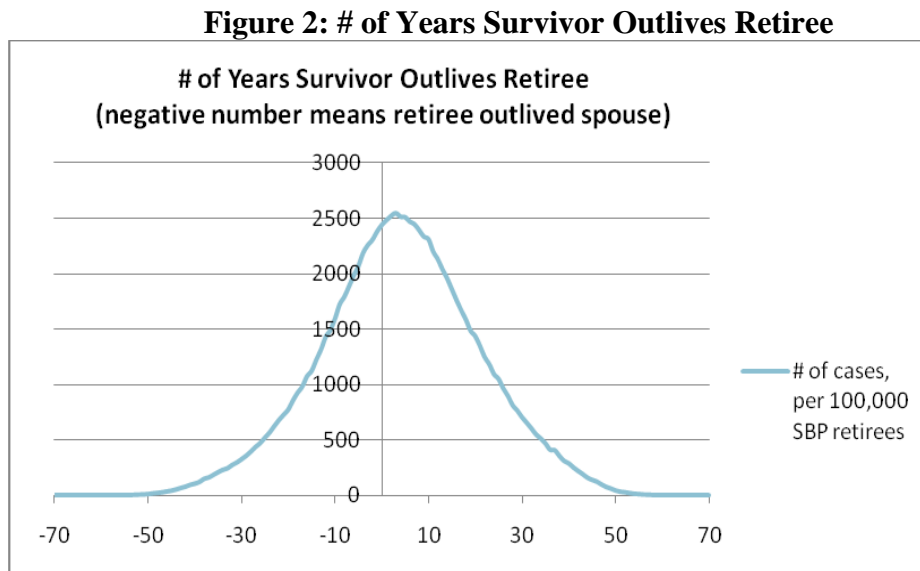


Figure 2 describes a situation where the spouse outlives the retiree 59.9 percent of the time; that implies that 40.1 percent of those paying into SBP under the Case 1 scenario (45 y/o

male; 45 y/o spouse) will never benefit from their premiums.<sup>3</sup> On average, across our entire sample, a female spouse will live 3.96 years longer than the male retiree. Note that this average includes the 40.1 percent of retirees who outlive their female spouse. To construct the expected benefits from SBP we need to extract from Figure 2 those instances where benefits are paid; this is done in Figure 3.

**Figure 3: Number of survivors receiving benefits, by number of years.**

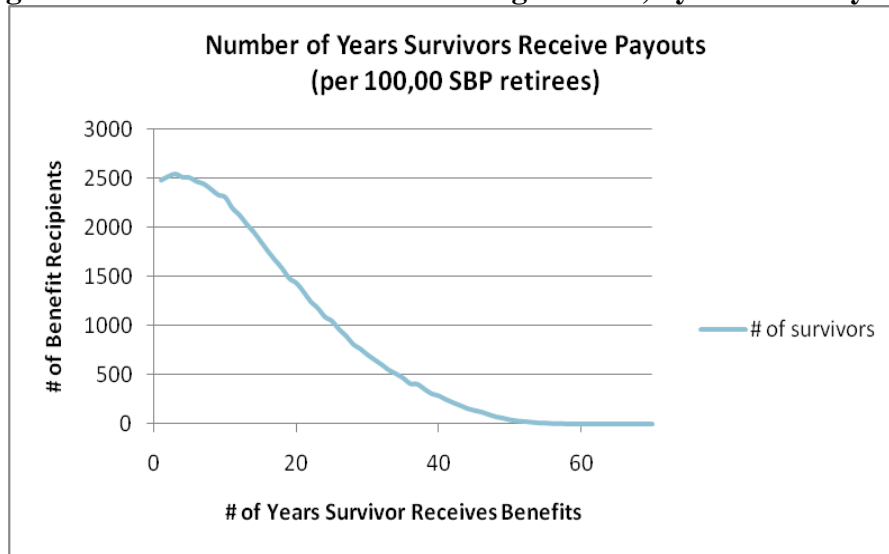
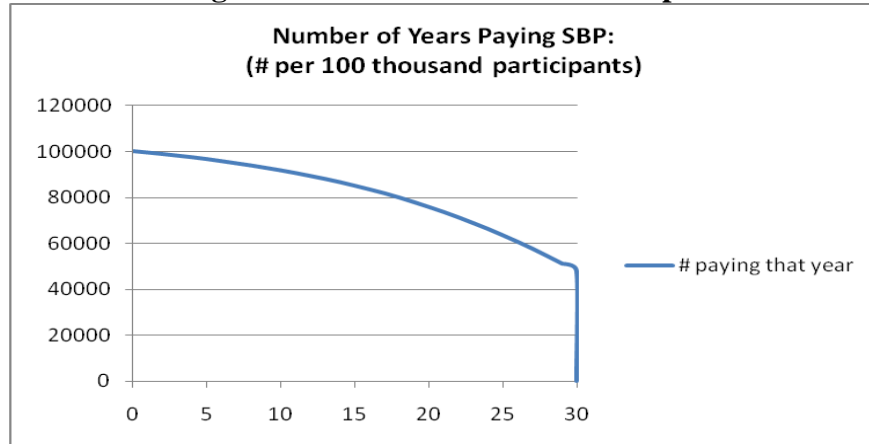


Figure 3 extracts those instances where the spouse outlives the retiree. While only 59.9 percent of spouses do so, the average spouse who outlives her husband does so by an additional 15 years, and could therefore collect 15 years of SBP benefits. When the 40.1 percent of spouses who collect no benefits (as noted earlier) are included, the average for all spouses is still 8.8 years of survivor benefits.

Next, using the age at which the retiree dies, the age at which the spouse dies, and the 30 year maximum for SBP premium payment, we construct a distribution showing how many retirees were still paying premiums, relative to the number of years since they retired. The result is shown in Figure 4.

<sup>3</sup> The SBP program will cover a new spouse, but for the purposes of this article we will take the more conservative approach of ignoring additional marriages

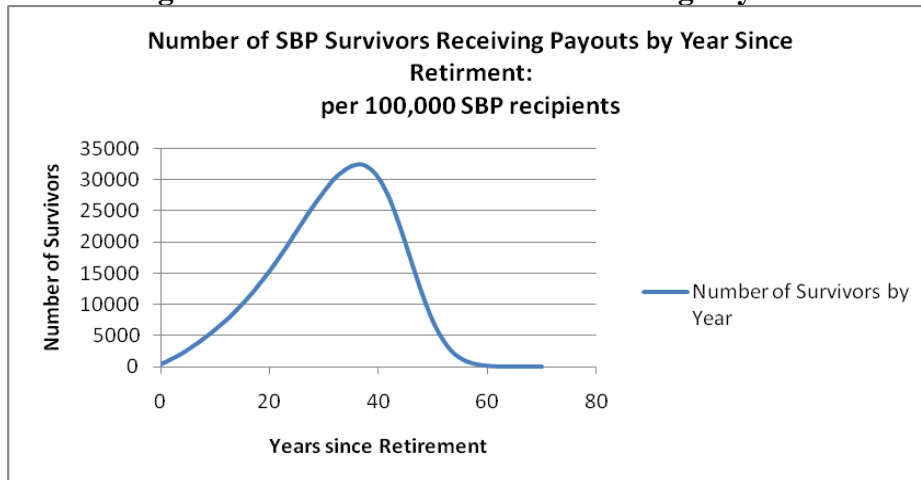
**Figure 4: Number of Years of SBP premiums**



The distribution in Figure 4 shows that the average retiree pays premiums for 24.1 years. (Since the 30 year maximum is a relatively recent change we also simulated this distribution without the 30 year truncation. Previously retirees could expect to pay premiums for 27.5 years, on average.) Figure 4 represents an early step in the estimation of the cost side of SBP.

To estimate the benefits side of SBP we create a distribution showing the timing of benefits. The results are depicted in Figure 5:

**Figure 5: Number of Survivors Receiving Payouts**



Not surprisingly, the distribution in Figure 5 shows the benefits from SBP generally occur much later than the costs (shown in Figure 4). This is more easily seen when we combine the two distributions in Figure 6.

**Figure 6: Timing of Benefits and Premiums by number of retirees or survivors**

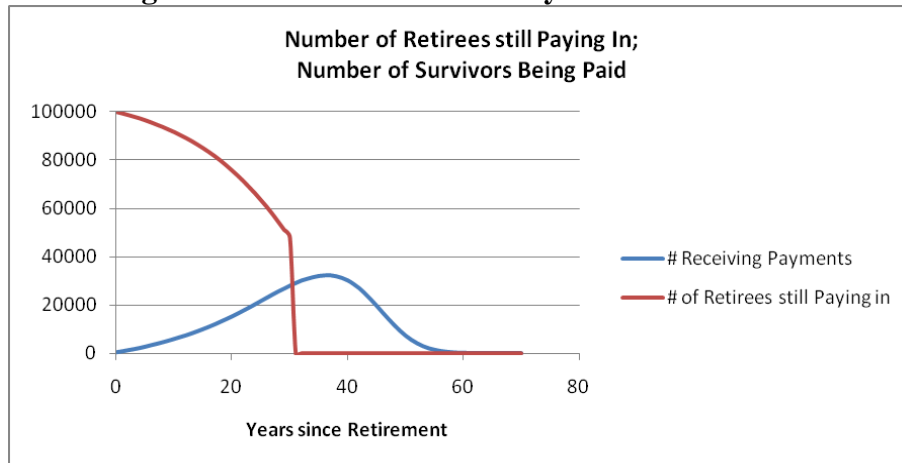
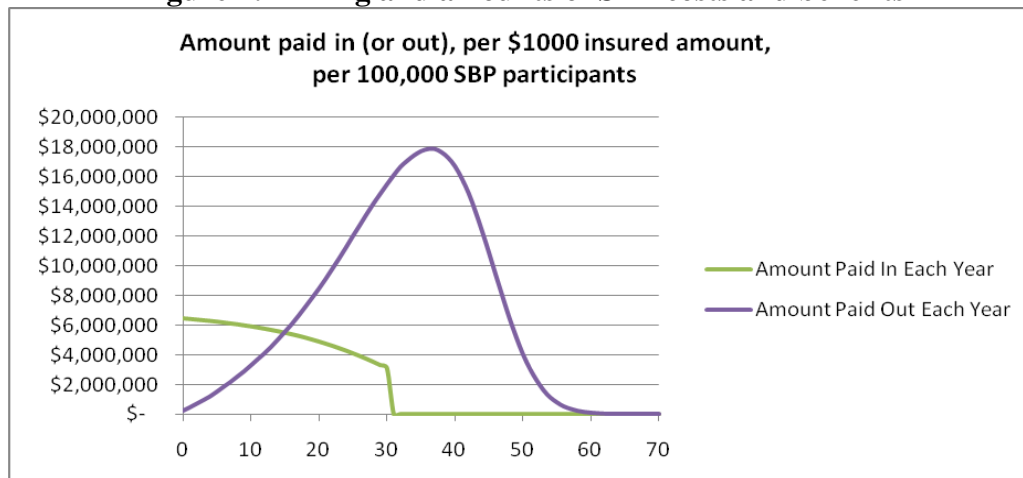


Figure 6 moves us forward in terms of comparing the costs and benefits of SBP, but the areas under each curve do not represent dollar amounts, hence they don't provide a sense of the relative dollar costs and benefits of SBP. We next utilize the results of the simulation to translate the probability distributions from Figure 6 into dollar values. Specifically, we generate the estimated costs by summing the premiums paid for the participants in our distribution and aggregate estimated benefits in a similar manner. We show the result in Figure 7.

**Figure 7: Timing and amounts of SBP costs and benefits**



A cursory examination of Figure 7 shows the area under the benefits curve is substantially larger than the area described by the costs curve. Since both cash flows are already

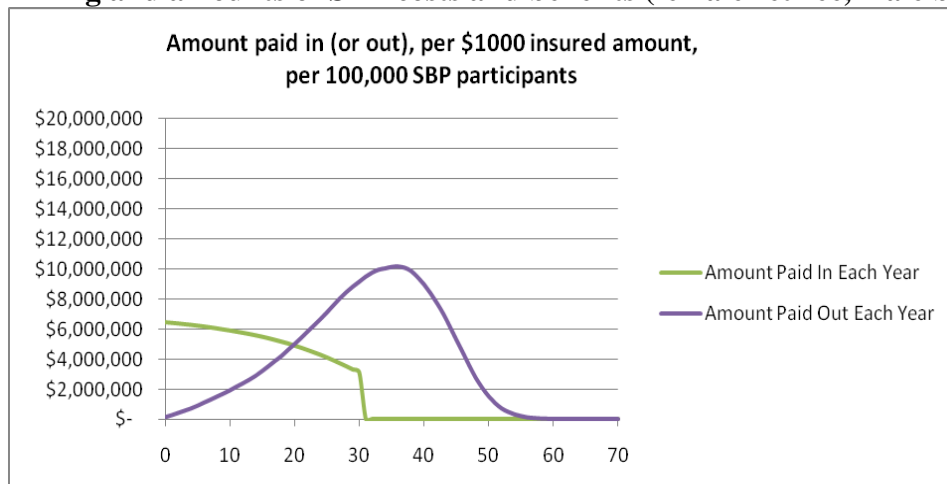
adjusted for inflation, we conclude there is substantial real return here. To compute the implied rate of return, we solve for the interest rate that makes the present value of the premiums equal to the present value of the benefits received by the surviving spouse. This comparison is examined at the time of the SBP decision.<sup>4</sup>

For Case 1, that of a 45 year-old male retiree and a 45 year-old female spouse, the relevant discount factor is just over 6.8 percent. As an after-inflation (real) return, this is an impressive return for a government guaranteed contract. According to Siegel (2008), returns from the stock market over the last 80 years have been less than 6.8 percent. Hence the real return in this case is greater than the historical real return from stocks. Note that due to a significant skew in the benefits distribution, only a little more than 25.9 percent of SBP participants will actually earn the 6.83 percent real return on their SBP payments. However, many of those earn substantially more than 6.83 percent.

#### 4.2. Case 2: 45 year-old female retiree, 45 year-old male spouse

Figure 8 replicates Figure 7 but reverses the genders of the retiree and spouse.

**Figure 8: Timing and amounts of SBP costs and benefits (female retiree, male beneficiary)**



<sup>4</sup> The present value of premiums paid is simply the present value of an annuity. We find the present value of the benefit stream as the present value of an annuity over the period when benefits are paid; further discounted as a lump sum over a period equal to the timeframe over which the premiums were paid.

In Figure 8, the difference in the areas under the two curves is less dramatic than what we observed in Figure 7. While the amount paid into SBP is about the same, 45 year-old female retirees are more likely than 45 year-old male retirees to hit the 30 year maximum payoff. This fact is offset by the increased likelihood that their spouse will die before the 30 year maximum is reached. The expected SBP payout (benefits), however, is significantly reduced. With genders reversed, the retiree is expected to outlive their spouse approximately 59.9 percent of the time. As a result, the discount rate falls to approximately 3.1 percent.

#### 4.3 Case 3: 45 year-old female retiree and 48 year-old male spouse

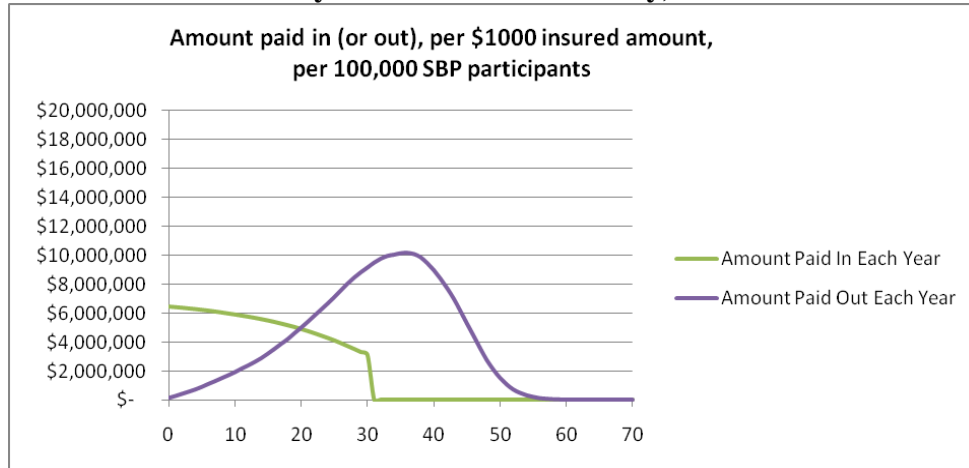
The potential benefits from SBP for female retirees diminish when one considers the typical age difference between spouses. Table 2 shows census figures for the age differences between spouses. This data, which applies to the US population, implies a typical age difference of just short of three years; more specifically, for an average couple, the male tends to be almost three years older than the female. Naturally this has important implications for our analysis.

Figure 9 displays how the two cash flow streams change from Figure 8.

Table 2

<b>Distribution of Spousal Ages</b>		
<b>Based on Census table FG3 (2002) (Per 100k marriages)</b>		
<b>Husband</b>	20+ years older	1.0%
	15-19 years older	1.6%
	10-14 years older	4.9%
	6-9 years older	12.2%
	4-5 years older	13.4%
	2-3 years older	21.7%
<b>Husband and wife within 1 year</b>		32.2%
<b>Wife</b>	2-3 years older	6.4%
	4-5 years older	2.9%
	6-9 years older	2.6%
	10-14 years older	0.9%
	15-19 years older	0.2%
	20+ years older	0.2%

**Figure 9: Timing and amounts of SBP costs and benefits (45 year-old female retiree, 48 year-old male beneficiary)**



The age difference reduces the premiums paid in somewhat, with the average number of years paid-in declining to approximately 23.3 years. While this is significant, the biggest change is in the decline in the expected payout of SBP benefits. The retiree can now be expected to outlive their spouse approximately 66.6 percent of the time. Note that this percentage is much closer to that cited by Social Security administration researchers than the 59.9% figure found in Case 2 above. For example, Bridges and Choudary (2005) suggest that wives outlive their husbands about 75 percent of the time.

For Case 3, the implied discount rate explaining the two cash flows in Figure 9 now declines to approximately 2.03 percent, a rate that might be achieved using Treasury Inflation Protected Securities (TIPS). Absent personal health or trust considerations, the typical three year difference appears to define an important break point in terms of whether female retirees should opt for the SBP plan. Table 3 summarizes each of the three cases examined.

Table 3

### Summary of Results

	Implied discount rate	Average # of years paying into SBP	Average # of years receiving SBP benefits	Spouse outlives retiree (time)
<b>Case 1</b> 45 y/o male retiree; 45 y/o female spouse	6.83%	24.1	8.81	59.9%
<b>Case 2</b> 45 y/o female retiree; 45 y/o male spouse	3.10%	24.1	4.84	40.1%
<b>Case 3</b> 45 y/o female retiree; 48 y/o male spouse	2.03%	23.3	3.79	33.4%

## 5.0 Implications for Retirees & Planners

Our results create useful numeric and graphical representations for the SBP decision. These results will greatly help retirees to understand the program; they will also help planners explain the program. However, our results are a starting point. As noted above, personal considerations are critical in any retirement decision. Significant medical conditions can easily overwhelm the general results demonstrated here. Furthermore, in rare cases where the retiree has a child after the age of 38, or has a child with significant disabilities, a special program covering children could again change the general situation described here.

Finally, further research is needed to construct tables that better describe couples. In using the Social Security tables there is an assumption that deaths are independent. However, research on couples suggests that spouses influence one another in terms of longevity. For example, Drefahl (2010) found that married men generally live longer than single men. The research of Neimann and Dortmann (2010) produced similar findings; specifically, married men seemed to be more attentive to medical issues, exercise, and diet. Building these interdependencies into the SBP decision analysis would improve the discussion.



## References

Aura, S.P. 2001. Does the balance of power within a family matter? The case of the retirement equity act. Working paper n.202, Innocenzo Gasparini Institute for Economic Research (IGIER).

Bridges, B., and Choudhury, S. (2005). Social Security as a Retirement Resource for Near-Retirees. ORES Working Paper Series, Social Security Administration, Office of Research, Evaluation, and Statistics.

Census website, Table FG3. (2002). Married Couple Family Groups, by Presence of Own Children/1/ Under 18, and Age, Earnings, Education, and Race and Hispanic Origin/2/ of Both Spouses. See: <http://www.census.gov/population/socdemo/hh-fam/cps2002/tabFG3.pdf>

DFAS (Defense Finance and Accounting Service) website (2010). The change to a 30 year maximum payment is explained at: <http://www.dfas.mil/rna-news/october2008/paid-uprsfppandsbpupdate.html>. The change to SBP social security offset is explained at: <http://www.dfas.mil/rna-news/may2007/sbpannuity.html>

DOD, 2009. Fiscal year 2009 military retirement fund audited financial statements. See: <http://actuary.defense.gov/cfo2009.pdf>

Drefahl, Sven. (2010). How does the age gap between partners affect their survival? *Demography*, Volume 47(2), 313-326.

Holden, K.C. and Sean Nicholson , (1998) "Selection of a Joint-and-Survivor Pension" Discussion Paper no. 1175-98, University of Wisconsin, Institute for Research on Poverty

Holden, K.C. and Cathleen Zick (2000)"Distributional Changes in Income and Wealth upon Widowhood: Implications for Private Insurance and Public Policy." In: Retirement Needs Framework, SOA Monograph M-RS00-1. Schaumburg, Ill.: Society of Actuaries

Jennings, W.W., and Reichenstein, W. (2001). The Value of Retirement Income Streams: The Value of Military Retirement. *Financial Services Review*, 10(1), 19-35.

Jennings, W.W., and Reichenstein, W. (2003) Valuing Defined-Benefit Plans. *Financial Services Review*, 12(3), 179-199.

Johnson, R.W., Uccello, C. E., and Goldwyn, J.H. (2003). Single life vs. joint and survivor pension payout options: How do married retirees choose?. Final report to the Society of Actuaries and the Actuarial Foundation

Munnell, A.H, Aubry, J., and Muldoon, D. (2008). The Financial crisis and private defined benefit plans. Center for Retirement Research, IB, Number 8-18.

Neimann, Stefanie, and Dortmund, T. James, J. (2010). Honey, Why Don't You See a Doctor? Proceedings, Royal Economic Society Annual Conference.

Siegel, J. J. (2008). *Stocks for the Long Run*. New York: McGraw-Hill.

Social Security Administration. (2006). *Period Life Table, 2006*. Actuarial publications. See: <http://www.ssa.gov/OACT/STATS/table4c6.html>

Stoller, M.A. (1992). Estimating the present value of pensions: Why different estimators get varying results. *Journal of Legal Economics*, 2, 49-61.