The Optimal Time for Claiming Social Security Benefits: A Methodological Note

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Abstract

The optimal age for initiating Social Security benefits and the initiation versus postponement of benefits decision are the subjects of a number of recent papers. It is generally agreed that an initiation versus postponement of benefits decision may have significant consequences, but there is less agreement about how to model the problem or measure its financial implications.

By law benefits are paid only to live beneficiaries. Thus, the anticipated future benefits should be weighted by the recipient’s survival probabilities – the probabilities that the recipient is alive when the benefits will actually be received. Many published papers argued that benefits will be received “on average” throughout the recipient expected remaining lifetime (ERL) and estimate the present value of Social Security benefits by discounting the cash flow through life expectancy. This paper will show that the preferred approach is to estimate the Expected Present Value (EPV) which weighs each future payment by the probability that it will be received. Based on survival probabilities and life expectancy tables that are compiled by the SSA the paper will demonstrate at the present value through life expectancy approach overstates the EPV by approximately 10%. Therefore, timing decisions that are not based on the EPV are probably suboptimal.
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Social Security Benefits (SSB) can be initiated at any age between 62 and 70. Retirees who choose to initiate SSB at a younger age receive all other things equal, smaller benefits than those who postpone initiation of benefits to a later age. However, the early initiators receive SSB for a longer period. The optimal timing for initiating SSB is the subject of many recent papers. It is generally agreed that the timing of an initiation versus postponement of benefits decision may have significant consequences, but there is less agreement about how to model the problem or measure its financial implications. All recent papers use present value (PV) calculation when they compare alternative future cash flows but they differ in the way they account for randomness of uncertain life time, see Docking, Fortin and Michelson (2013) for a recent literature review.

As SSB are paid only to live beneficiaries, each anticipated future payment should be weighted by the probabilities that it will actually be received, that is, the probability that the recipient or his/hers spouse will still be alive at the beginning of the period in which payment is due. In addition, the expected PV of any future cash flow is determined not only by its discount rate assumption and cash flow definitions, but also by the time horizon over which payments are assumed to be received.

Many papers assume that a recipient will receive SSB “on average” throughout the recipient expected remaining lifetime (ERL) and calculate a discounted present value using the ERL as the time horizon. The estimated present value of the future SSB is thus calculated by discounting the cash flow through life expectancy (DCFLE). Examples of papers using this
approach are Fraser, Jennings, and King (2000), McCormack and Perdue (2006), Spitzer (2006), Docking et al (2013) and many others.

An alternative way to define and evaluate the present value of SSB is Expected Present Value (EPV), also known as the Actuarial Present Value. The seminal paper that uses this approach (for the general case of demand for annuities) is Yaari (1965). The EPV weighs each future SSB payment by the probability that it will be received. Examples of papers using the EPV are Munnell and Soto (2007), Coile, Diamond, Gruber and Justen (2002) and Friedman and Phillips (2008 and 2010).

In this paper I will explain why the EPV method should be preferred to discounting the cash flow through life expectancy. Using survival probabilities and life expectancy tables that are compiled by the SSA the paper demonstrates that the ERL approach overstates the EPV by approximately 10%. It would follow, therefore, that decisions based on DCFLE are therefore suboptimal.

The DCFLE approach is even more problematic when the present value of SSB of married couples is evaluated. Depending on their earning histories, married couples can chose to receive SSB as two single retirees, as a retiree and a spouse, or as a surviving spouse. For the case of a heterogeneous marriage this paper will show that the EPV of SSB calculation, if estimated correctly, each term in the summation should include the probability that the husband and wife are jointly alive, the probability that husband is alive and the wife is dead and the probability that wife is alive and the husband is dead versa ( for same-sex marriage the words husband and wife should be replaced by spouse 1 and spouse 2). In this case the EPV cannot simply be approximated by the sum of the husband’s and wife’s DCFLE as was done, for
example, by McCormack and Perdue op. cit. and Docking, at al, op. cit. (these papers also
overlooked the potential surviving spouse benefits.).

For married couples, how long SSB are received depends on their joint life expectancy, not their
individual life expectancy. While a 66 years old individual, at 66, may expect to live 18.5 more
years, the joint life expectancy of a couple (where both husband and wife are 66) of is 26.5
years -- one of them is likely to survive that long. Additionally, it should be noted that the
probability that either member of a couple will outlive its life expectancy is 50% but the
probability that the probability that both husband and wife will outlive their life expectancies is
75%.

This paper proceeds as follows: Section 2 discusses the difference between the EPV and
DCFLE methods for a single retiree and for married couples. Section 3 presents numerical
examples. An application of the EPV models to the SSB claiming of married couples of various
gender combinations is presented in Section 4. Summery and conclusions are presented in
Section 5.

2. Estimating Expected Present Value

2.1 A single retiree:

We need to determine the value of an income stream that depends on the recipient being
alive. Consider the following example. Sally is trying to determine when she should start
collecting Social Security. Her latest Social Security statement shows that if she retires at age
62, her monthly benefit will be $750. If she retires at age 66, her monthly benefit will be
$1,000, and if she postpones retirement to age 70 her monthly benefit will be $1,320. She has
enough income from other sources that she can wait the extra eight years if it would be more
beneficial to her. What should Sally do? On the one hand, she receives a much higher benefit if she waits. On the other hand, she may die before or soon after she reaches age 70. She can use a financial calculator or an Excel spreadsheet and compute the present value of the three alternative streams of payments, but how should she take her mortality into account? This is explained below.

Because the available Life Tables provide survival probabilities only for integer ages, I will assume that the benefits are paid once a year at the beginning of each year. Let $a(x,r)$ denote the actuarial present value of $1$ to be received each year for as long as the recipient is alive, $x =$ current age, and assume a real interest rate of $r$ per annum. Then $a(x,r)$ is calculated as

$$APV = a(x, r) = \sum_{t=x}^{\Omega} \frac{p(x, t)}{(1 + r)^t}$$

(1)

Where $p(x, t)$ is the probability that an individual aged $x$ will be alive at age $t$, and $\Omega =$ the oldest age in the life table (100). $p(x, t)$ is defined by

$$p(x, t) = \prod_{i=0}^{t-1} (1 - q_{x+i})$$

(2)

Where $q_x$ is the probability of dying between age $x$ and $x+1$ ($q_x$ is obtained from the life tables.) The value of life annuity is often approximated by arguing that income will be received on average through the expected remaining lifetime (ERL). Recall that the ERL of a 66 years old

\footnote{\text{The annual } p(x, t) \text{ can be converted to monthly probabilities by assuming that people are dying at a constant monthly rate between year } t \text{ and year } t+1. \text{ Increasing the granularity of the life table will make the calculations more cumbersome but will not affect the main results.}}
woman is. Let $T_x$ denote the remaining lifetime of an individual aged $x$; $T_x$ is a random variable whose expected value is $E(T_x)$.

Equation (1) is often approximated by Equation (3).

$$v(x, r) = \sum_{t=x}^{E(T_x)} \frac{1}{(1 + r)^t} + \sum_{t=E(T_x)+1}^{\infty} 0$$

This approximation requires two assumptions that are rarely stated: (1) All the payments until age $E(T_x)$ will be received with certainty, that is $p(x,t)=1$ for $t \geq E(T_x)$. (2) No payments past the expected remaining lifetime will be received, that is $p(x,t)=0$ for $t > E(T_x)+1$. The second sum in Equation (3) is redundant but is included here for ease of exposition.

According to Jensen’s Inequality, a well-known mathematical theorem, $v(x, r) > a(x, r)$. This means that using Equation (3) to approximate the APV will overstate it, see Milevski (2006), p.116. The magnitude of the bias is shown in Table 3.1, below.

2.2 Married Retirees

Continuing our example but now we assume that Sally is married to Peter who never had to work for a living. Computing the EPV of the couple’s SSB is somewhat more complicated. As explain in the Appendix, Peter is eligible to receive spousal benefits of 50% of Sally’s SSB as long as they are both alive and if Peter survives Sally he will be eligible to receive 100% of her SSB.
Following Brown and Porteba (1999) the EPV of a joint and survivor annuity with a last survivor provision, is given in Equation 4.

let \( A \) denote the fixed benefit that is paid as long as both members of the couple are alive, and let \( p_m(x,t) \) denote the probability that the husband in the annuity-purchasing couple survives for at least \( t \) months after purchasing the annuity at age \( x \). In an analogous fashion, define \( p_f(x,t) \) as the \( t \)-period survival probability for his wife. The equation for EPV associated with a joint and survivor annuity contract is:

\[
EPV = \sum_{t=x}^{n} \left\{ 1.5A \times P_m(x,t) \times P_f(x,t) \right. \\
+ \left. A[P_m(x,t) \times (1 - P_f(x,t)) + P_f(x,t) \times (1 - P_m(x,t))] / (1 + r)^t \right\} 
\]  
\( (4) \)

Note that in Equation (4) the term \( P_m(x,t) \times P_f(x,t) \) is the probability that both husband and wife are jointly alive at time \( t \), the term \( P_f(x,t) \times (1 - P_m(x,t)) \) is the probability that wife is alive and husband is dead at time \( t \) and the term \( P_m(x,t) \times (1 - P_f(x,t)) \) is the probability that husband is alive and wife is dead at time \( t \).

Since using Equation (4) is somewhat tedious some researchers chose to evaluate the Social Security wealth of married couples by adding the \( \nu(x,r) \) of the husband to the \( \nu(x,r) \) of the wife. In addition to the bias noted earlier, this approach is problematic for another reason: Approximately 50% of husbands and 50% of wives will live to their respective life expectancies. However, the probability that the husband and wife will both reach their life expectancies is only 25% and the probability that at least one spouse will outlive his or her ERL is 75%. A numerical example for married couples is shown in Table 3.2, below.
3. Some Examples

3.1 Single Individuals

Table 3.1 contrasts the results of EPV and the DCFLE calculations for a 66 years old retiree who receives a $1,000 MONTHLY SSB. Because the US Life Tables are tabulated for integer years the calculations, it is assumed in the calculations that SSB are received as a single payments of $12,000 per year. The EPV and DCFLE values shown in the table were done assuming a 2% real interest rate, and life expectancy (ERL) of 66 years old males is 16.9 and of 66 years old females is 19.5. The results are consistent with the Jensen Inequality theorem which predicts that DCFLE overstates EPV. Therefore, if one accepts, consistent with economic theory, that EPV is the correct way to evaluate life-annuities then one must conclude that models based on DCFLE are less accurate.

|                | ERL  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>16.9</td>
</tr>
<tr>
<td>Female</td>
<td>19.5</td>
</tr>
<tr>
<td>EPV a(x,r)</td>
<td>$172,155</td>
</tr>
<tr>
<td>DCFLE v(x,r)</td>
<td>$179,217</td>
</tr>
<tr>
<td>Difference</td>
<td>$7,062</td>
</tr>
<tr>
<td>$193,023</td>
<td>$196,798</td>
</tr>
<tr>
<td>$3,775</td>
<td></td>
</tr>
</tbody>
</table>

1 the ERL are from Arias, National Vital Statistics Reports, Vol.62, No.7, January 6, 2014
3.2 Married Couples

3.2.1. Heterosexual Marriage

We now return to the example of Sally and Peter who were introduced in Section 2.2. Both Sally and Peter, the reader will recall, are 66 years old, Sally is the retiree and Peter is her never employed spouse. Based on these assumptions, as long as they are both alive they will together receive 150% of Sally’s SSB, but after one of them dies the surviving spouse will receive 100% of Sally’s SSB.

For the DCFLE calculation one needs to assume that the two spouses will live exactly to their respective expected remaining lives, but as stated earlier the probability of this happening is only 25%. For Sally and Peter their Social Security DCFLE are obtained from Table 3.1: as long as one of them is alive the couple will receive Sally’s SSB of $196,798 plus as long as Peter is alive the couple will receive his spousal benefits which are half of $179,217, or $89,609. Using the DCFLE method the couple’s SSB will be, therefore, $268,826. It is important to note that the preceding calculation assumes that Peter will die before Sally. If Sally dies before Peter he will be eligible to collect benefits as a surviving spouse but the DCFLE method is not suitable for such cases.

| Table 3.2: Present Value of Social Security Benefits of Married Couples evaluated at Age 66 |
|-----------------------------------------|---------------------------------|-----------------|
| EPV a (x,r) | DCFLE v(x,r) | Difference   |
| Male-Female  | $295,699      | $268,826      | $26,873       |
| Female-Female | $311,243      | $294,035      | $17,208       |
| Male-Male    | $279,645      | $268,824      | $10,821       |

The EPV calculations are more involved since they require the application of Equation 4 of section 2. The EPV calculations do not require any assumption about which spouse will be
the first to die and for how many years the surviving spouse will live as a widow or widower. Additionally the EPV can accommodate the surviving spouse benefits. The corresponding result for Sally and Peter are shown in the first row of Table 3.2.

3.2.2. Same-Sex Marriage

The Defense of Marriage Act (DOMA) was overturned by the US Supreme Court in June 2003, and thus, in states where same-sex is legal the SSA permits same-sex couples to claim spousal and surviving spouse benefits. The calculations of SSB for the two newly recognized types of marriages are presented in the second and third rows of Table 3.2.

Assume for example, that Edith and Thea are a married couple, both aged 66. Edith is eligible to receive SSB of $1,000 a month based on her work history, but Thea, who has no work history and would not qualify for SSB on her own, would nevertheless be entitled to a $500 a month spousal benefits if and when Edith initiates SSB. The couple’s DCFLE may be obtained from Table 3.1 by multiplying the Female estimate by 1.5. The DCFLE for two men that are married to each other, Steve and Evan, both aged 66, one receiving SSB on his own and the other as a can be obtained from Table 3.1 by multiplying the DCFLE of a single man by 1.5. The EPV for same sex couple are calculated using a slight modification of Equation 4. It should be noted that the three rows of table 3.2 exhibit substantial differences, difference that can be attributed to the fact that women live longer than men.

4. Application: Should 66 Years Old Retirees Delay Claiming?

Tough Full Retirement Age (FRA) is presently 66, a retiree or a retired couple, who just turned 66 years of age may wish to consider postponing the initiation of SSB because for each
month of postponement until age 70 their future benefits increase at a rate of 2/3% a month for each monthly postponement up to a maximum of 32% if benefits are not initiated until the age of 70. A complete analysis of the optimal initiation age is beyond the scope of this article. Instead, in this section we demonstrate the use of the EPV method to calculate the rate of return on one-year postponement. The analysis is presented for the three hypothetical couples from Section 3.2.

As in Friedman and Phillips (2008), the internal rate of return (IRR) on a one-year postponement is found by searching for an IRR at which the value of the immediate annuity (the EPV of starting benefits at 66) equals the value of the deferred annuity (the EPV of starting and receiving increased benefits at age 67). When benefits are postponed by one year, our couples forfeit the SSB of $18,000 that they would have received if they claimed at 66, but upon reaching age 67 they would be eligible for an 8% higher SSB for life (That is, until the second spouse passes). The IRRs that was found through iterative search are shown in Table 4.1. Note that because women live, on average, longer than men, the IRR of Edith and Thea is higher than the IRR of Steve and Eva and the IRR of Sally and Peter falls in the middle.

| Table 4.1: Internal Rate of Return on a one year Postponement of SSB from age 66 for Married Couples |
|--------------------------------------------------|--------------------------------------------------|
| Male-Female                                    | 1.65%                                          |
| Female-Female                                  | 1.85%                                          |
| Male-Male                                      | 1.35%                                          |

The IRRs shown in the table can be used as a hurdle rate. That is, couples that can invest the age 66 SSB and earn a real rate of return higher than the IRR shown in table 4.1 should initiate SSB early. Couples that cannot earn the hurdle rate on their own investments may consider deferment.
A word of caution is in order. Buying an annuity is not the same as buying a bond. An annuity provides life-time income, an important consideration for healthy couples who can expect long life. On the other hand, couples who are not healthy or couples with strong bequest motive may choose to ignore the hurdle rate, see Friedman and Phillips (2010) for farther elaboration of this point.

5. Summary

This paper shows that the two methods of evaluating Social Security Wealth, i.e. the present value of Social Security retirement benefits lead to different results. The study argues that calculations by discounting the cash flow through life expectancy overstate the theoretically correct calculations of expected present value. Results for traditional and same-sex married couples demonstrate the use of the Expected Present Value Method.
Reference:


