Love At What Price?
Estimating the Value of Marriage[*]

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Abstract: Using a law within Social Security that provides clear financial incentives to delay marriage, we estimate the financial value of a month of marriage. Specifically, the law provides that widows who eligible for Social Security benefits on their deceased spouse's earnings records are eligible for benefits at age 60, unless they remarry before that age. If they remarry before that age, they cannot claim widow benefits and must wait until at least age 62 to claim spousal benefits on their new husband's record, which are typically less generous than widow benefits. To generate an estimate of what this behavior implies about the value of marriage, we use data from five panels of the Survey of Income and Program Participation linked to administrative data from Social Security. We estimate the cost of marrying before age 60 imposed by the Social Security program. We develop a model that reflects the institutional details of Social Security and generate a likelihood function that reflects that model. By taking advantage of the variation in these costs and when or whether widows remarry, we estimate the benefit of marriage to be approximately $5000 per month. These appear to be reasonable estimates in the context of the short length of time widows are willing to wait and the high value of Social Security benefits.

1. Introduction

> Much of the renewal of their [John and Alicia Nash] marriage has taken place since the Nobel [Prize in Economics]. … Now there is even some discussion of remarrying, although in what was perhaps an assertion of Nash's old insistence of "rationality," they gave up the idea up as impractical, as so many older couples have in light of the attendant tax and Social Security penalties. However, a certificate is not of real importance. They are a real couple again.
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> A Beautiful Mind: A biography of John Forbes Nash, Jr., (Nasar, Sylvia p. 386. 1998. Touchstone, New York, NY)

Becker (1973) formalized the economics of marriage with the straightforward model that a couple will marry if the utility of being in a marriage is greater than not being in the marriage. In Becker's model, the benefits of marriage include increased consumption due to the production of goods that are not available outside of a marriage. Likewise, if the utility outside of marriage is sufficiently high, a marriage will not occur. Income associated only with the unmarried state can be one such influence on the utility of an unmarried person. The above quote provides anecdotal evidence that income from taxes and government programs influence behavior. There is a large literature that documents these financial costs of marriage and estimates how a marginal change in the size of the marriage incentives would influence the decision of when or whether to marry or divorce. The consensus is that the financial incentives in government programs may cause the costs to exceed the benefits of marriage such that there are small effects on the decision of whether or when to marry.[1] Waite (1995) summarizes empirical research estimating that the benefits of marriage include improved health, earnings capacity, and children's well-being.[2]

Using a law within Social Security that provides clear financial incentives to delay marriage, we extend this literature and estimate the financial value of a month of marriage. Specifically, the law provides that widows who are eligible for Social Security benefits on their deceased spouse's

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[1] See Alm et al. (1999) and Moffitt (1998) for the effect on whether to marry and Alm and Whittington (1997), Sjoquist and Walker (1995) and Gelardi (1996) on the timing of marriage.

[2] She posits that this evidence generally remains even after controlling for the possibility that persons who are likely to have positive outcomes without marriage select into marriage.

earnings records are eligible for benefits at age 60, unless they remarry before that age.[3] If they remarry before that age, they cannot claim widow benefits and must wait until at least age 62 to claim spousal benefits on their new husband's record, which are typically less generous than widow benefits. Brien, Dickert-Conlin, and Weaver (2004) show that widows respond to these incentives with significantly lower marriage rates immediately prior to age 60 and an increase at age 60.[4]

To generate an estimate of what this behavior implies about the value of marriage, we use data from five panels of the Survey of Income and Program Participation (SIPP) linked to administrative data from Social Security. We estimate the cost of marrying before age 60 imposed by the Social Security program. By taking advantage of the variation in these costs and when or whether widows remarry before age 60, we estimate the benefit of marriage to be approximately $5000/month. These benefits include obvious financial benefits such as those resulting from household economies of scale and reduced health insurance costs, as well as the emotional benefits of a marriage commitment.

The paper proceeds as follows: Section 2 describes the institutional details of the Social Security program that allow us to identify our model. Section 3 describes a model of remarriage based on the institutional details and derives a likelihood function for estimating the value of marriage. Section 4 describes the SIPP data used to estimate the model and Section 5 reports results of the estimations. Section 6 concludes.

2. Institutional Details

Our identification of the benefit of marriage is based on a rule in Social Security that is arbitrarily tied to age 60 years. In particular, widows who were married to persons who worked in Social Security-covered employment will potentially be eligible for *widow* benefits from Social

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[3] Although these rules apply to widowers as well, we focus on widows because over 98 percent of survivor benefits are paid to women (see tables 5.A1 and 5.G3 in U.S. Social Security Administration (2002)).
[4] Baker, Hanna and Kantarevic (forthcoming) show 1980s changes in Canada that eliminated a loss of public pensions benefits associated with remarriage increased the remarriage rates of widows and widowers.

Security when they reach age 60.[5] The widow must be unmarried to claim widow benefits, unless

the marriage occurred after the widow attained age 60. In other words, a widow who claims the

benefits upon reaching age 60 and *then* remarries retains full claim on these benefits. However, a

widow who remarries before age 60 has no claim to the widow benefits (so long as the remarriage

remains intact).

Eligible widows who claim benefits at age 60 will receive a monthly benefit amount equal to

an actuarially fair percentage of the *deceased husband's* Primary Insurance Amount (PIA).[6] The

Social Security Administration (SSA) computes a person's PIA based on the person's average

earnings in Social Security covered employment. Deferring receipt of benefits until after age 60

entitles the woman to a higher monthly benefit; the monthly benefit is 100 percent of the deceased

husband's PIA if she defers receipt until the normal retirement age (NRA).[7] A woman who has been

widowed more than once can claim a benefit on the record of the deceased husband with the highest

PIA.

While remarriage before age 60 may terminate a widow's claim to widow benefits,

remarriage is likely to make the widow eligible for *spouse* benefits on her new husband's work

record. However, a financial penalty for marriage is still likely because widow benefits are typically

more generous than spouse benefits for two reasons. First, a widow cannot claim a spouse benefit

until age 62 (and, then, only if her husband receives a Social Security benefit). Second, Social

Security pays a higher rate for a widow benefit than a spouse benefit. A spouse benefit claimed at

the NRA is equal to 50 percent of her husband's PIA, rather than 100 percent of her deceased

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[5] For persons born after 1928, 40 "quarters" of work in Social Security covered employment are necessary for fully insured status. For those born in or prior to 1928, the number of required quarters is smaller. See U.S. Social Security Administration (2002) for more details. From Social Security's perspective, a widow attains age 60 "the first moment" of the day before her 60th birthday.

[6] For the actuarial adjustments of claiming Social Security benefits early, see U.S. Social Security Administration (2002). An exception exists if the deceased spouse claimed his benefit before reaching NRA. The widow is then eligible for the maximum of 82.5 percent of the workers PIA and the amount he would have been receiving if he were still alive (see Weaver 2001/2002).

[7] The NRA for widow(er) benefits is age 65 for those born before 1940. For later birth cohorts, the NRA is gradually rising to age 67.

husband's PIA (like widow benefits, Social Security actuarially reduces spouse benefits if claimed before the NRA). In sum, if a woman remarries someone with a PIA similar to that of her deceased husband, her spouse benefits are much lower than her widow benefits.[8]

The calculations are more complicated if a widow is insured for benefits in her own right, although these widows are still likely to face a lower Social Security benefit if they remarry before age 60. Specifically, a widow who worked enough in covered employment to be fully insured is eligible to receive a *retired-worker* benefit from Social Security. However, these benefits cannot be claimed until, at the earliest, age 62. In addition to being able to claim widow benefits two years earlier than retired worker benefits, widow benefits are also more generous if her deceased spouse's PIA exceeds her retired worker benefits. Social Security will pay the maximum of widow or own retired worker benefits, upon reaching age 62.[9]

In summary, Social Security pays the maximum benefits that a person is eligible for based on any sources of eligibility. This includes cases where a woman is widowed more than once; she is eligible for the maximum of her benefits based on her deceased spouses' records. This implies that a woman's earning history and her complete marital history, including the earnings histories of any spouses, are relevant. In addition, when considering the potential stream of Social Security benefits faced by widows, the earnings history, retirement status, and life expectancy of her potential spouse

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[8] The current law regarding widow benefits was passed in December 1977 and became effective in January 1979. Between 1965 and 1979, widows who remarried after age 60 could keep an amount equal to half of the deceased spouse's PIA. Before 1965, widows lost eligibility for widow benefits if they remarried at any time. Because very few widows in the latter panels of SIPP marry prior to 1979 and we are unsure when widows learn about the law change, our empirical estimations are based on widows who turned 56 years of age after 1978.
[9] Divorced women, who were married for at least 10 (20 before 1979) years to a man who worked in covered employment, are potentially eligible for a *surviving divorced spouse* benefit upon his death, which are essentially the same as widow benefits. This law became effective in 1984, prior to which, surviving divorced spouses were eligible only for spousal benefits on their ex-spouse's records. Our data do not allow us to explicitly identify surviving divorced spouses, therefore we do not directly consider them, unless they report that they are widows (Weaver 2000 shows that this is a fairly common occurrence) and even then we cannot be sure that they met the minimum marriage requirement.

are also relevant. The following section presents a model that reflects these institutional details and section 4 describes the data demands and assumptions needed to estimate this model.

3. Model

3.1 Decision to Remarry

We assume a widow will decide to remarry before she turns 60 years of age if she finds a *marriage match* (someone she is interested in being married to and vice versa, conditional on no loss in Social Security income if she remarries) and if the expected benefit of marriage is greater than the expected cost of foregone Social Security payments. If she finds a marriage match but this expected benefit is less than the expected cost, she will delay marriage until after her 60th birthday.

Let *C* denote the expected cost from Social Security associated with the widow remarrying prior to her 60th birthday, instead of waiting until after she turns 60 years of age. This expected cost depends on a number of factors including: (i) the life expectancy of the widow and her potential husband; (ii) whether the widow and potential husband plan to work after the widow turns 60; (iii) whether the widow plans to receive Social Security payments prior to age 65; and (iv) the Social Security payments associated with the widow's earnings, the earnings of the widow's prior spouse and the earnings of the widow's potential spouse.

As for the expected benefit associated with remarrying in a month prior to age 60, let *b* be the monthly benefit of being married conditional on the widow finding a marriage match, a_{si} be the probability the potential spouse is alive in month *i*, and a_{wi} be the probability the widow is alive in month *i*. The value *b* incorporates the emotional benefits of a marriage commitment as well as other financial benefits such as those associated with household economies of scale and health insurance. In addition, suppose the widow expects to remarry *t'* months after turning 60 years of age if she delays marriage. Therefore, conditional on finding a match, the present discounted value of the

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expected benefit associated with marriage t months prior to age 60 compared to t' months after turning 60 is

$$B = \sum_{i=720-t}^{720+t'} D^{i-720+t}\, a_{si}\, a_{wi}\, b,$$

where D is the monthly discount factor. Ceteris paribus, this expected benefit decreases as the widow approaches 60 years of age because the number of months the widow expects to wait to remarry $(t'-t)$ decreases. Conditional on finding a match, the widow will marry in a month prior to turning 60 years of age if $B>C$ and will wait to remarry if $B<C$.[10]

3.2 Likelihood Function

Let $F(b)$ denote the distribution function of b and $\hat{b}$ be the monthly benefit where $B=C$. With p being the probability that the widow finds a match, the probability the woman marries in a

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[10] To formalize the environment and the implicit assumptions when making this marginal benefit versus marginal cost comparison, consider the following. Suppose the present discounted value of the widow's expected monthly utility t months prior to age 60 if she has found a match and does not delay marriage until after age 60 is

$$\sum_{i=720-t}^{\infty} D^{i-720+t}\, EU_w(M, I_{ipm}, I_{iwm} + SS_{im})$$

where M indicates that the widow is married, I_{ipm} is the disposable income in month i of the potential spouse if he is married, I_{iwm} is the widow's disposable income (excluding social security) in month i if she is married, and SS_{im} is the widow's social security income in month i if she remarries prior to age 60. The present discounted value of the widow's expected monthly utility t months prior to age 60 if she has found a match and delays marriage until t' months after turning age 60 is

$$\sum_{i=720-t}^{720+t'} D^{i-720+t}\, EU_w(S, I_{ips}, I_{iws} + SS_{id}) + \sum_{i=720+t'}^{\infty} D^{i-720+t}\, EU_w(M, I_{ipm}, I_{iwm} + SS_{id})$$

where S indicates the widow is not married, I_{ips} is the disposable income in month i of the potential spouse if he is not married, I_{iws} is the widow's disposable income (excluding social security) in month i if she is not married, and SS_{id} is the widow's social security income in month i if she delays remarriage until after turning age 60. An analogous expression applies for the potential spouse's utility, $U_p(\bullet)$. Therefore, assuming income enters utility linearly, the sum of the widow's and potential spouse's expected utilities in month i if they are married and marry prior to 60 is $E[U_w(M)+U_p(M)+I_{ipm}+I_{iwm}+SS_{im}]$.

If utility is transferable and bargaining is efficient, the expected marginal benefit of marrying t months prior to the widow turning age 60 is

$$\sum_{i=720-t}^{720+t'} D^{i-720+t}\, E[U_w(M) + U_p(M) - U_w(S) - U_p(S) + I_{iwm} + I_{ipm} - I_{iws} - I_{ips}]$$

while the expected marginal cost is

$$\sum_{i=720-t}^{\infty} D^{i-720+t}\, E[SS_{id} - SS_{im}].$$

Assuming that the difference in disposable income is constant across months, we denote this expected marginal benefit as $\sum_{t=720-t}^{720+t'} D^{i-720+t}\, a_{si}\, a_{wi}\, b$ and this expected marginal cost as C.

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month prior to age 60 is $p[1\text{-}F(\hat{b})]$. The probability the widow does not marry that month is $(1\text{-}p)+p F(\hat{b})$: the probability the widow does not find a match plus the probability the widow finds a match but the benefit of marrying is less than the foregone Social Security payments.

As for *t'* months after the widow's 60th birthday, the probability that the widow marries is the probability a widow finds a match that month plus the probability the widow found a match prior to turning 60 and decides to delay marriage to that month. Letting *q* denote the probability a widow who has found a match before age 60 delays marriage until after age 60 and *w* denote the probability a widow who has found a match prior to turning 60 marries him *t'* months after turning 60. Then, the probability the widow remarries *t'* months after turning age 60 is $p+wq$.[11] The probability *q* is a function of not only the probabilities of the widow finding a match in each month prior to age 60 she was "at risk" (that is, a widow) but also the probability her benefit of marrying is less than $\hat{b}$ for that month. Based on the findings of Brien, Dickert-Conlin and Weaver (2004), we assume that those who delay marry within the first six months after turning 60 years of age. We also assume that when a widow is making the decision to delay, she does not know the exact month she will marry. However, she does have certain expectations over these first six months and decides whether to delay based on these expectations. We discuss how the widow forms these expectations in Section 5.

Given that there is no Social Security penalty, the probability a widow marries in a month between 60.5 and 62 years of age is simply the probability the widow finds a match, *p*.

The likelihood function is therefore:

$$\Pi_{y=1,\text{pre}60}\,[p(1\text{-}F(\hat{b}))]\;\Pi_{y=0,\text{pre}60}\,[(1\text{-}p)+p F(\hat{b})]\;\Pi_{y=1,60\text{-}60.5}\,[p+wq]$$
$$\Pi_{y=0,60\text{-}60.5}\,[1\text{-}p\text{-}wq]\;\Pi_{y=1,60.5\text{-}62}\,[p]\;\Pi_{y=0,60.5\text{-}62}\,[1\text{-}p]$$

where *y*=1 if the widow remarries in the month (0 otherwise).[12]

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[11] Note that all these probabilities are conditional on the widow being alive and unmarried in that month.

[12] Note that the likelihood function does not take into account the fact that the cost function is getting truncated each period – assuming that a widow and her potential spouse's benefits are constant across periods. Conditional on not

3.3 Interpreting the probability the widow has found someone and the benefit of marrying.

The interpretation of the model's parameters (specifically p and b) depends, in part, on the bargaining that occurs between the widow and potential spouse. Consider an illustrative case where the benefit of marrying before age 60 (relative to after age 60) for the widow is $700 and $500 for the potential spouse. Suppose the expected cost of marriage before age 60 is a $1000 loss in the widow's Social Security benefits. Ignoring the time value of money, the widow and potential spouse would remarry prior to the widow turning 60 years of age if the bargaining was efficient and we can interpret b as the joint benefit to both the widow and potential spouse.

However, if the bargaining is such that the widow cannot credibly commit to share the surplus associated with the higher Social Security payments (and thereby captures all of the $1,000 benefit from delaying marriage), then the widow would not be willing to remarry before turning 60 years of age. In this case of inefficient bargaining, we cannot interpret the estimated benefit as the joint benefit.

Bargaining will also influence the probability that the widow finds a match, p. Consider the above example. Ceteris paribus, the man would have more and the widow less incentive to marry each other before rather than after she turns 60, if the man did not receive any of the surplus associated with the higher Social Security benefits. In addition, whether the man is interested in marrying the widow before or after she turns 60 years of age depends not only on how the surplus associated with the Social Security benefits is divided but also on the size of the benefit.

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remarrying in month t, the density cost function is not f(b) in month $t+1$ because all of those with high benefits get married in month t. Because so few widows get remarried, we do not believe this truncation will appreciably affect the estimates.

We expect bargaining between widow and potential spouse to be efficient, and therefore we interpret our estimates of b as the sum of the widow's and potential spouse's monthly benefit of being married.[13]

4. Data and Summary Statistics

The data requirements are demanding for this project. Ideally, we would like the Social Security benefit stream if you remarry before age 60 and if you remarry after age 60. No data contain all of this, precisely because not everyone remarries. In addition, even for widows who do remarry, most survey data do not observe people over a long enough period to know their benefits under both scenarios.

The SIPP data enable us to capture a great deal of this information. The SIPP consists of a series of nationally representative panels conducted between 1984 and 2000.[14] We use the 1990, 1991, 1992, 1993, and 1996 SIPP panels. The SIPP interviews respondents every four months for up to 48 months in the core interview.[15] Each interview gathers information about the previous four months, resulting in a continuous monthly record of changes in marital status, living arrangements, income, labor force participation, transfer program participation, and other demographics. In addition, the SIPP asks a series of special topic questions with each interview. In particular, in the second wave of the interview, there is a detailed marital history topical module that gathers retrospective information about dates that marriages began and ended and their reason for ending.

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[13] We implicitly make this assumption in footnote 10 when formalizing the environment.
[14] There were full SIPP panels for 1984, 1985, 1986, 1990, 1991, 1992, 1993 and 1996. The Census Bureau also started panels in 1988, 1989 and 2000 but lack of funding forced early termination. The 1996 panel runs into 2000.
[15] The SIPP divides households into four staggered rotation groups that are interviewed once every four months about their experiences during the past four months. A wave of the survey is completed when each of the rotation groups has been interviewed. The 1990 and 1991 panels each contain 8 waves; the 1992 panel contains 10 waves, the 1993 panel contains 9 waves and the 1996 panel contains 12 waves. These overlapping panels cover the period from October 1989 to November 1999. The Census Bureau weights the sample observations to be nationally representative. For more detail see the *SIPP Users' Guide* (http://www.sipp.census.gov/sipp/usrguide/sipp2001.pdf) for more details.

Combining the core and marital history data, we construct a data set of women who were widows at any time between the ages of 56 and 60. We restrict our analysis to women who were widows during these ages because Brien, Dickert-Conlin, and Weaver (2004) show that much of the behavioral response to the rule occurs relatively close to age 60. Most spells occurred before the core SIPP and are therefore identified with data in the retrospective topical module. The unit of observation in our data will be a person month for each month between age 56 and 62 the woman is widowed or, in other words, at risk for remarriage.[16] The combined SIPP panels yield a sample of 2,927 women with spells of widowhood. A major advantage of the SIPP is that respondents who report their Social Security number (SSN) can be matched to Social Security administrative records, such as the Master Beneficiary Record (MBR), which contains Social Security benefit payment information, and the Summary Earnings Record (SER), which contains earnings histories.[17] In some cases, the Social Security records extend beyond the end of the SIPP panel, increasing our likelihood of matching accurate Social Security data to the widows in our sample as they age into the Social Security system.[18]

If a widow worked a sufficient number of quarters to be covered by Social Security and is currently collecting Social Security, we have a PIA for her from the MBR data. In some cases, the MBR does not contain PIAs for the widow. This occurs if the widow is not eligible for benefits on her own earnings record due to an insufficient number of quarters of coverage, or if she has not started receiving Social Security benefits during the years included in the matched data. If the MBR does not contain the actual PIA for the latter reason, we can calculate a PIA using the Social Security formulas and data from the SER. For women without a sufficient number of quarters of coverage

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[16] We expect very few widows under 56 years of age to delay marriage until after 60 years of age just to collect the additional Social Security widow payments. We do not include widows over age 61 years of age because of our concern that the probability of a widow finding a match could vary significantly across months as the widow ages.

[17] We use the MBR part file for this analysis. The part file identifies the type of benefit and benefit amounts at three (four for 1996) points in time.

[18] These administrative records are not public access, but rather are available only to U.S. Census Bureau sworn agents with sensitivity clearance. Additionally the data must be used at a secure location - for example, the Social Security Administration.

according to the SER, the calculated PIA is zero. If a woman is currently married and her spouse provided a Social Security number to the survey, we obtain a PIA for him in the same way.

For a woman who has begun collecting Social Security benefits we may also be able to obtain the PIA of her deceased spouse or, if she remarried, her second spouse. If she is receiving widow or spousal benefits, the MBR includes the PIA of the spouse on whose record she is collecting benefits. We have information on the deceased husband's PIA only for 1,685 cases. We have information on the new husband's PIA for only 89 cases and on both spouses for only 35 cases.

The reasons for failing to identify a spouse's PIA include the following: (1) the woman is not claiming benefits during the sample; (2) the woman receives a retired worker benefit that exceeds any potential widow or spousal benefits; (3) the woman never claimed benefits on her first husband's record; 4) the woman did not have a spouse who was interviewed in the SIPP; (5) the spouse in the core SIPP did not have a Social Security number match; (6) the spouse did not work a sufficient number of quarters in covered employment.

Ultimately, we drop the 1,118 widows for whom we cannot recreate a PIA for either their deceased spouse or their new spouse, because the assumptions necessary to "estimate" husbands are beyond the scope of this project. Reasons (1) and (2) are the most common reasons for missing PIA information on the spouse, therefore we are dropping women with relatively high earnings or relatively young women. Finally, we drop the one widow for whom SIPP imputed her marriage data because our analysis depends on the actual behavior of women. Our final sample has 1,808 women who were widows between the ages of 56 and 60 years old.[19]

For each month the widow is at risk of remarriage before age 60, we calculate the PDV of the Social Security benefits conditional on the widow remarrying and the PDV of the Social Security benefits conditional on not remarrying (assuming, when data is unavailable, that the PIA for the

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[19] A few widows have more than one spell of widowhood between ages 56 and 62. In our current analysis, we only consider a widow's first spell.

deceased spouse and the potential spouse are the same).[20] The appendix contains a detailed

description of how we calculated these expected benefits. Our variable of interest is the *Social

Security Marriage Cost,* the difference between the PDV of Social Security benefits if the widow

remarries after age 60 and the PDV of Social Security benefits if she marries before age 60.

Table 1 shows that a total of 96 (5.6 percent) out of the 1,808 widows in our sample remarry

between the time they enter our sample and age 62. A total of 63 of these women remarry before age

60, while 13 marry within 6 months of turning age 60. On average, women who never remarry are

more likely to have children (93 percent), be non-white (16 percent), and have lower education (42

percent have less than a high school education) than those who remarry. Widows who remarry

within 6 months after reaching age 60 are those who may have responded to the Social Security

incentives. They were widowed at slightly older ages than other widows in our sample and are more

likely to be non-white with lower levels of education relative to other widows who marry. Note,

however, that these women do not face economically or statistically different expected average

Social Security Marriage Costs (for this person level description, this is the expected Social Security

cost faced by the women if she married a month prior to turning 60 years of age[21]) than women who

do not marry or women who marry before age 60. In all cases the mean is approximately $31,000.

Unfortunately we do not have asset data contemporaneous with the widowhood spell, but

rather we have asset data at the time of the SIPP interview. However, these data reveal that the

monthly income derived from her own assets are much greater for those widows who marry after

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[20] Given our lack of data on both spouses in most cases, we assume that the PIA of the deceased spouse and the potential spouse are the same when we have information on only one of the spouses. We use PIA information from 84 widows that remarry between ages 55-63 (some of whom marry before 1979) for whom we have information on both spouses to consider the validity of this assumption. Of the 84 cases, 43 (41) involve widows marrying a spouse with a higher (lower) PIA than the widow's decease spouse. For 38.1 percent of these 84 widows, their old and new spouse's PIAs are within 10 percent of each other, with slightly more widows marrying men with higher PIAs than their deceased spouse. More than 55 percent marry someone whose PIA is within 25 percent of their deceased spouse.

[21] If the widow remarried before age 60, we use the average growth rate in her monthly penalty to estimate what her marriage penalty would have been a month prior to her turning 60 years of age. We do so to account for the possible selection that women with lower penalties are those who get married earlier.

turning 60 years of age: with average own asset income being $174 for those marrying the first six months after turning 60 and $300 for those marrying after these first six months, versus $88 for those remarrying under age 60 and $66 for those not marrying between 56 and 62 years old. The same pattern holds in joint (with spouse) assets for those who remarry between 56 and 62 years old. Upon further investigation, we conclude that age differences among SIPP respondents do not account for the differences. Finally, Table 1 indicates that the percent of widows who were ever on welfare is the lowest for those widows who remarry prior to age 60 and greatest for those widows who remarry the first six months after turning 60 years of age.

Figure 1 gives an indication of how the probability of remarriage changes with years of age, by computing the number of widows who remarry divided by the number at risk in each age category. When we look at remarriage by age, we see that the probability of remarriage is always low (never more than 1.6 percent), generally declining over time, except for a noticeable increase at age 60. This is consistent with the incentive in Social Security and previous work by Brien, Dickert-Conlin, and Weaver (2004).

Panel A of Figure 1 also shows the mean (panel B shows the median) expected Social Security Marriage Cost, conditional on whether the woman remarries or not at each age. Again, this Social Security Cost is the cost faced by the widow if she remarries the month prior to turning 60. For ages 57 and 58, the cost of remarrying is greater for those who do not remarry than those who do. A counterintuitive exception is age 59 where the Social Security Cost is $34,182 for widows who marry and only $31,358 for those who do not. However, this difference is not statistically significant and, of course, is unconditional on other observables. At age 60, those who remarry have a slightly higher mean cost of remarrying before age 60 than those who do not ($31,540 compared to $31,379), which is consistent with widow's with higher cost of remarriage waiting to remarry in direction but obviously not economically or statistically significant.

In the median value of the Social Security Cost of remarriage, Panel B, we see a more predictable, yet not striking pattern at ages 59 and 60. The median penalty for those who do not remarry is slightly higher than those who do remarry at age 59, and the direction reverses at age 60, where those who remarry faced higher penalties for remarrying before age 60 than those who did not remarry.

We now turn to estimating the likelihood function from Section 3 for a more clear separation of the probability of finding a match and the benefit of marriage.

5. Empirical Results

To estimate the likelihood function in Section 3 we must first specify the distribution from which the benefit of marriage is drawn as well as the functional forms for the probability of finding a match and the probability a widow who has found a match prior to age 60 marries him in a given month after turning 60 years of age. We assume that for each widow-month observation i, b_i is a realization of a random variable drawn from the exponential distribution $1-\exp(-b_i/\eta)$ and that $\eta=\exp(\beta_\eta)$. We select the exponential distribution because it restricts b_i to be positive and the function form for η to also ensure it is positive.[22] In addition, we do not allow the exponential distribution to vary across widows (that is, η is not a function of the widow characteristics). We further assume that $p_i=\exp(\beta_p x_p)/[1+\exp(\beta_p x_p)]$, where β_p is a vector of parameters to be estimated, and x_p is a vector of widow and month specific characteristics that may influence whether the widow finds a match. This functional form ensures that p_i is between zero and one. Finally, we assume that the probability a widow, who meets a match prior to age 60 and delays, marries in the t' month after turning 60 with probability $\exp\left(\beta_w t'\right) \Big/ \sum_{t'=1}^{6} \exp\left(\beta_w t'\right)$, where t' ranges from one to six. This functional form ensures that a widow, who delays, marries with probability one within the first six months after

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[22] The mean of the exponential distribution is η.

turning 60 years of age. By estimating this function, we are assuming that the expectations of all

widows who delay marriage are that they will wait an average of $\sum_{t'=1}^{6}(t')\exp(\beta_w t')\Big/\sum_{t'=1}^{6}\exp(\beta_w t')$

months to marry after turning 60 years of age.[23]

Our next task is to estimate the parameters, $\Omega=\{\beta_\eta, \beta_p, \beta_w\}$, from the likelihood function.

Table 2 presents the parameter estimates that maximize this likelihood function using the functional

form assumptions above and observations between age-month 673 (age 56) and 745 (age 62). In our

estimation, we allow the probability a widow marries to be correlated across her observations. We

also allow the probability of finding a match to vary based on the following widow characteristics

(x_p): the age most recently became a widow, race, children, education level, year of birth and current

age.

The parameter estimates for our preferred specification are contained in column (1) of Table

2. This specification allows the probability of finding a match to be a function of the age the women

most recently became a widow, this age squared, whether the widow has not completed high school

and whether the widow completed high school but did not obtain additional education. More

importantly, it allows this probability to be quadratic with respect to the widow's age (in months) as

well as to have a discrete change at age 60 (720 months). We expect a discrete change in the

probability a widow finds a match at age 60 because new eligibility for widow benefits may prompt a

lifestyle change.

Based on the coefficient estimates in column (1), the average probability that a widow finds a

match in a given month between age 56 and 62 is 0.0011. The very low probability of finding a

match is expected based on the relatively few marriages we observe in the data. In addition, the

estimates suggest that the probability a non-white widow finds a match is 82 percent lower than the

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[23] While this specification restricts the expectations of all widows to be the same, it allows these expectations to be estimated using the data.

probability of a white widow finding a match and the probability a widow with any children finds a match is approximately 66 percent lower than the probability of a widow who is childless. The coefficient estimates also indicate that widows with more education are more likely to find a match. Finally, the estimates suggest that the probability of finding a match depends on the widow's age and this probability decreases significantly when the widow turns 60 years of age. The coefficients associated with the age month of the widow and this age squared indicate that a widow who just turned 57 years of age has a probability of finding a match in that month of 0.00166 compared to 0.00148 (0.00151) the month after turning 58 (59) years of age. While these coefficients are statistically significant, they do not result in a significant change in the probability of finding a match across months (except when the widow turns 60 years of age).

Column (1) also contains the estimate of β_w for our preferred specification. This parameter estimate of -0.252, while not statistically significant, suggests that the probability of remarrying in each of the six months after turning 60 is decreasing for widows who delay marriage. Specifically, this estimate suggests that a widow who delays will marry in the first through sixth month after turning 60 years of age with probability 0.29, 0.22, 0.17, 0.13, 0.10 and 0.08, respectively.

Finally, Column (1) contains the parameter estimate for the exponential distribution, β_η. This parameter estimate indicates that the average monthly benefit of being married when the widow has found a match is \$5,601.[24] This relatively large average monthly benefit is expected based on the fact that the widows' forgone Social Security payments associated with getting married before age 60 average slightly over \$30,000 in our dataset and evidence that widows do not delay more than one year in response to the Social Security incentive (Brien, Dickert-Conlin and Weaver, 2004).

The last two columns of Table 2 provide estimates for different specifications of the probability of finding a match. Column (2) restricts the probability of finding a match to be linear

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[24] This parameter estimate is not precisely measured which is most likely due to the relatively few number of marriages. At one standard error above the point estimate (-0.580+0.523), the monthly benefit of being married is slightly less is \$9,446 while the monthly benefit is \$3,319 for one standard error below.

with respect to the widow's age in months (while still allowing a discrete change at age 60). Column (3) allows a discrete change not only at 60 years of age but also at the other age years. In both of these alternative specifications, the estimates of β_p and β_w are similar to those of our preferred specification. The only appreciable change from the original estimate is the estimate of the average monthly benefit of being married for the second specification ($4,180).

6. Conclusion

Relying on a Social Security rule that increases the incentive for remaining unmarried until at least age 60, we estimate that the benefit of a month of marriage is approximately $5,000. This appears to be a reasonable estimate in the context of the short length of time widows are willing to wait and the high value of Social Security benefits.

In the larger context, widows are not representative. They may have a differential value of marriage than younger persons who are making decisions about child bearing and labor supply and have different attitudes about cohabitation, the outside option for marriage. However, the fact that they are making fewer life-changing decisions about child bearing and labor supply helps us to isolate the marriage response to the cost imposed by the government program on marriage.

Recent public policy attempts to reduce some of the costs of marriage with the explicit or implicit goal that a lower cost of marriage will increase the number of people enjoying the benefits.[25] These estimates of the high benefits of marriage provide some insight into why previous changes in the costs of marriage are estimated to have little effect on marriage behavior.

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[25] Tax laws signed under President Bush have all reduced the marriage penalty implicit in the income tax system. The 1996 Welfare Reforms included many provisions that allowed two-family parents to collect welfare benefits, while historically most benefits were available only to single parent families.

Appendix

Social Security Benefit Associated with Remarriage

Clearly, we need to know a PIA for the former spouse and for the potential spouse, yet we do not have this for most women. When calculated the expected benefit, we make the following assumptions:

a) The widow's decision regarding when to begin collecting Social Security payments associated with her earnings, her deceased spouse earnings and her potential spouse earnings is based on maximizing the expected present discounted value of the payments. Assuming that the Social Security payments are actuarially fair, we calculate this expected present discounted value when the widow collects benefits associated with her prior spouse at age 60 and collects benefits associated with her potential spouse [or her own benefits, if they are greater] at age 65 (assuming that these benefits are the greatest for her given her spouse's PIAs and her PIA).
b) For cases where we do not observe the widow's Social Security benefits associated with the potential spouse (deceased spouse) we assume they are equal to the benefits associated with the deceased spouse's (potential spouse's) earnings.
c) The potential spouse is the same age as the widow.
d) The probability a widow and the potential spouse dies at a certain age is based on the mortality rates in the 1995 SSA Trustee's report (conditional on when born, age and gender). These vary by year and gener [26]
e) The probability the widow and potential spouse work at different ages are based on those +obtained from the CPS.

All PIAs are in constant 2000 dollars.

In this calculation we do not account for the following behavioral issues.

1. Decision of widow to work or not.
2. Decision of widow to remarry is not based on health of potential spouse (or her health for that matter).
3. When to start collecting Social Security is not a function of potential spouse's or widow's health.

Let V denote the widow's monthly Primary Insurance Amount (PIA) associated with her earnings, W denote the widow's monthly PIA associated with her deceased spouse's earnings and Z denote the widow's monthly PIA associated with her potential spouse's earnings.

The expected present discounted value t month prior to the widow turning 60 years of age of her Social Security payments j months after turning 60 years of age depends if the widow remarries prior to age 60. This is the probability the widow is alive and eligible to collect Social Security benefits

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[26] Many thanks to Courtney Coile for sharing these data with us.

(i.e., not earning over \$10,400 annually) in month *j* times the following expressions, depending on whether the widow remarries before age 60 and whether the widow is between age 60 and 65 or over age 65.

<u>Widow remarries before age 60</u>

if j<60:

(Probability Potential Spouse is dead in month *j*)(Probability Potential Spouse is dead when widow turns 60 years of age) MAX[.715W,.715Z]

if j>60:

(Probability Potential Spouse is alive in month *j*)(Probability Widow is not eligible for the payments associated with Potential Spouse's PIA in month j conditional on Potential Spouse being alive) V+
(Probability Potential Spouse is alive in month *j*)(Probability Widow is eligible for the payments associated with Potential Spouse's PIA in month j conditional on Potential Spouse being alive) MAX[.715W,V]+
(Probability Potential Spouse is dead in month *j*)(Probability Potential Spouse is alive when widow turns 60 years of age) MAX[.715W,V]+
(Probability Potential Spouse is dead in month *j*)(Probability Potential Spouse is dead when widow turns 60 years of age) MAX[.715W,V]

<u>Widow plans to remarry at age 60</u>
if j<60:

.715W

if j>60:

(Probability Potential Spouse is alive in month *j*)(Probability Widow is not eligible for the payments associated with Potential Spouse's PIA in month j conditional on Potential Spouse being alive) MAX[.715W,V]+
(Probability Potential Spouse is alive in month *j*)(Probability Widow is eligible for the payments associated with Potential Spouse's PIA in month j conditional on Potential Spouse being alive) MAX[.715W,V,.5Z]+
(Probability Potential Spouse is dead in month j)(Probability Potential Spouse is alive when widow turns 60 years of age) MAX[.715W,V,Z]+
(Probability Potential Spouse is dead in month j)(Probability Potential Spouse is dead when widow turns 60 years of age) MAX[.715W,V]

Taking the expected present discounted value of the expected Social Security payments for all months *j* if the widow remarries after age 60 and subtracting it from the expected present discounted value if the widow remarries prior to age 60, we obtain the expected benefit associated with the widow delaying marriage.

There were a few cases where the expected present discounted value is greater if the widow begins to collect Social Security on her earnings at age 62. We take this into account when deriving the expected by assuming that the widow maximizes here present discounted value of her Social Security payments when deciding at what age to collect her Social Security payments.

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Table 1
Descriptive Statistics of Selected Variables
Mean (Standard Deviation) [Median]

	Do Not Remarry [56-62) years of age	Remarry [56-60) years of age	Remarry [60-60.5] years of age	Remarry (60.5-62) years of age
Year of Birth	1928	1928	1926	1926
	(5)	(4)	(5)	(5)
Age widowed (in years)	50.67	49.32	53.69	51.90
	(7.32)	(6.45)	(6.47)	(7.45)
% with children	0.93	0.92	0.85	0.80
	(0.26)	(0.27)	(0.38)	(0.41)
% with missing information on children	0.05	0.03	0.15	0.05
	(0.22)	(0.18)	(0.38)	(0.22)
% non-white	0.16	0.03	0.08	0.00
	(0.36)	(0.18)	(0.28)	(0.00)
% w/<12 years of education	0.42	0.29	0.38	0.35
	(0.49)	(0.46)	(0.51)	(0.49)
% w/12 years of education	0.39	0.41	0.46	0.40
	(0.49)	(0.50)	(0.52)	(0.50)
Expected SS Marriage Cost (month prior to turning age 60)	31,278	31,828	31,118	26,691
	(13,756)	(15,414)	(12,986)	(15,220)
	[31,538]	[35,146]	[34,404]	[24,633]
Joint Asset Income (monthly dollars– at time of interview)	38	3	17	68
	(114)	(42)	(41)	(279)
Own Asset Income (monthly dollars– at time of interview)	66	88	174	300
	(182)	(333)	(551)	(912)
% Ever on Welfare (at time of interview)	0.08	0.13	0.15	0.10
	(0.27)	(0.34)	(0.38)	(0.31)
Age at Interview (in years)	65.6	65.5	66.6	66.8
	(4.84)	(4.94)	(5.25)	(4.88)
n	1,712	63	13	20

Source: Authors' calculations from 1990, 1991, 1992, 1993 and 1996 core and topical module SIPPs matched with Social Security Administrative records. Women who were widows between the ages of 56 and 60.

TABLE 2
Marriage Model Estimates

|	(1)	(2)	(3)
Probability of Finding a Match (p):			
Age Became Widow	-0.036	-0.032	-0.028
	(0.137)	(0.137)	(0.138)
(Age Became Widow)^2	0.0005	0.0004	0.0004
	(0.0015)	(0.0015)	(0.0015)
Race Indicator Variable (0 if white, 1 otherwise)	-1.690**	-1.702**	-1.689**
	(0.581)	(0.582)	(0.581)
Widow has a least one child (Indicator Variable)	-1.092**	-1.079**	-1.087**
	(0.421)	(0.420)	(0.419)
Missing information on whether widow has a child (Indicator Variable)	-1.031*	-1.027*	-1.022*
	(0.620)	(0.621)	(0.619)
Widow did not complete high school (Indicator Variable)	-0.564**	-0.565**	-0.563**
	(0.266)	(0.267)	(0.267)
Widow completed high school but did not have additional education (Indicator Variable)	-0.350	-0.351	-0.348
	(0.255)	(0.256)	(0.255)
Year of Birth	-0.035	-0.034	-0.034
	(0.023)	(0.022)	(0.022)
Widow is at Least 60 Years of Age (Indicator Variable)	-1.695**	-1.591**	
	(0.283)	(0.255)	
Widow is 57 Years of Age (Indicator Variable)			-0.831**
			(0.391)
Widow is 58 Years of Age (Indicator Variable)			-1.322**
			(0.527)
Widow is 59 Years of Age (Indicator Variable)			-1.317**
			(0.657)
Widow is 60 Years of Age (Indicator Variable)			-2.890**
			(0.591)
Widow is 61 Years of Age (Indicator Variable)			-3.180**
			(0.985)
Age in Months	-0.669**	0.017**	0.039**
	(0.131)	(0.007)	(0.015)
(Age in Months)^2	0.00049**		
	(0.00009)		
Constant	293.144	48.146	35.138
	(.)	(44.585)	(46.230)
β_w			
Constant	-0.252	-0.231	-0.335
	(0.295)	(0.298)	(0.392)
β_η			
Constant	-0.580	-0.872*	-0.566
	(0.523)	(0.460)	(0.602)
Observations	97,780	97,780	97,780
Log Likelihood	-749.41	-750.55	-746.98
Mean Monthly Benefit of Being Married	$5,601	$4,180	$5,680

Standard errors are in parentheses. * Statistically significant at the .10 level. * Statistically significant at the .05 level.

Figure 1 – Descriptive Statistics of Expected Present Discounted Value of Social Security Cost of Marriage and Percent Remarrying by Age

Panel A – Mean Expected PDV of SS Cost
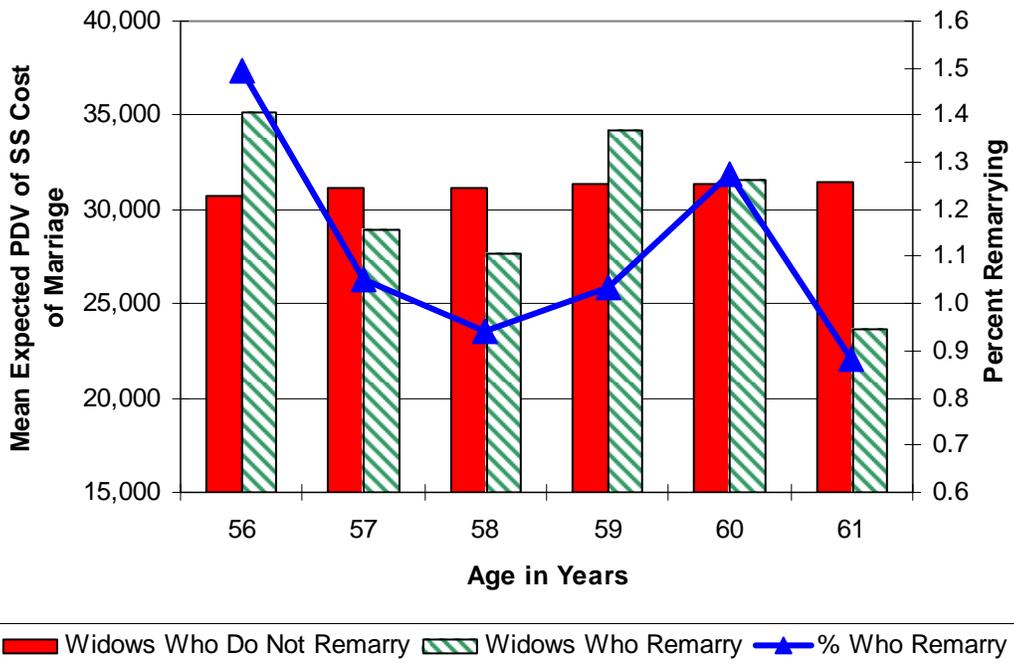
Panel B - Median Expected PDV of SS Cost
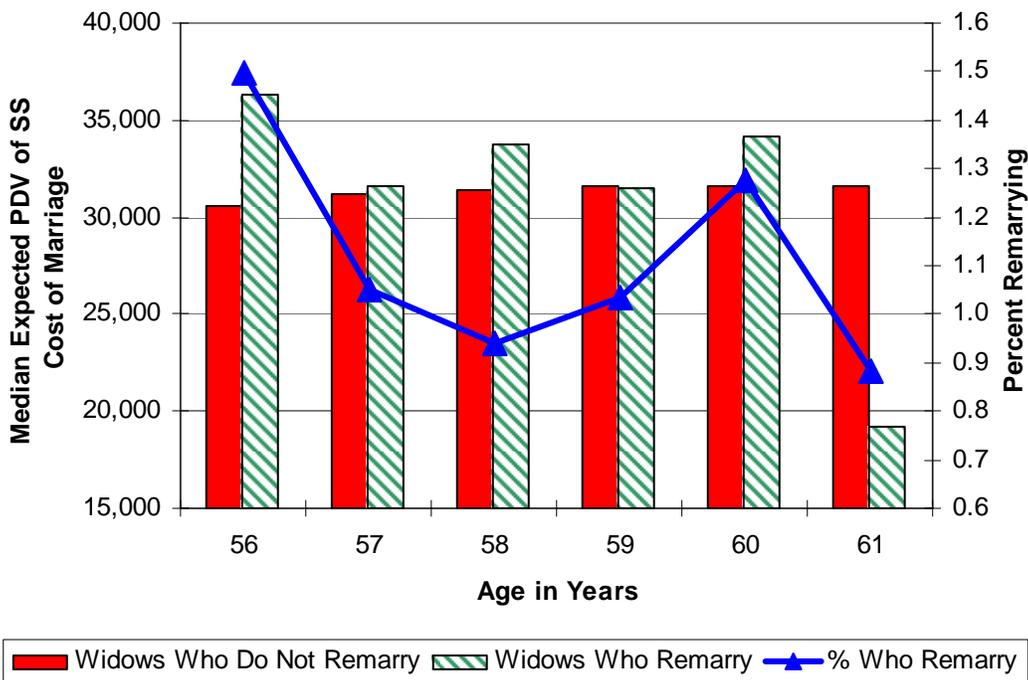
Source: Authors' calculations from 1990, 1991, 1992, 1993 and 1996 core and topical module SIPPs matched with Social Security Administrative records. Women who were widows between the ages of 56 and 60. Not in sample for ages after they marry.