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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 are 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 before age 60, we estimate the benefit of marriage to be \$8000/month. These estimates 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.

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 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 costs exceed the benefits of marriage in some cases such that there are small effects of the financial incentives in government programs on the decision of whether or when to marry..² Waite (1995) summarizes empirical research estimating that the benefits of marriage include improved health, earnings capacity, and children's well-being.³

² See Alm et al. (1999), Dickert-Conlin and Houser (2001), Ellwood (2000), Eissa and Hoynes (1999), 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. More generally, Smith, et al. (1991) find no evidence that economic well-being influences remarriage decisions of widows and widowers and Chevan (1996) finds that cohabiting is positively correlated with economic measures, including poverty and home ownership, for elderly over age 60.

³ 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.

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 earnings records are eligible for benefits at age 60, unless they remarry before that age.⁴ 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 (forthcoming) show that widows respond to these incentives with significantly lower marriage rates immediately prior to age 60 and an increase at age 60.⁵

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 \$8000/month.

The paper proceeds as follows: Section 2 describes the institutional details of the Social Security program that allows 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

⁴ 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 (2001)).

⁵ Baker, et al. (2002) show that 1980s changes in Canada that eliminated a loss of public pension benefits associated with remarriage increased the remarriage rates of widows and widowers.

Social Security-covered employment will potentially be eligible for *widow* benefits from Social Security when they reach age 60.⁶ 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) and therefore faces a financial penalty for marriage.

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).⁷ 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).⁸ 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, widow benefits are likely to be more generous than spouse benefits for two reasons. First, a widow cannot claim 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

⁶ 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 (2001) for more details. From Social Security's perspective, a widow attains age 60 "the first moment" of the day before her 60th birthday.

⁷ 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).

⁸ 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.

PIA, rather than 100 percent of her deceased 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.

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

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. In other words, the cost of marrying before age 60 was lower, all else equal, before 1979. Before 1965, widows lost eligibility for widow benefits if they remarried at any time.

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

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 is 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.

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 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 if she remarries) and if the expected benefit of marriage before 60 years of age is greater than the expected cost of foregone Social Security payments.¹⁰ 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 before age 60, let b be the monthly benefit of being married conditional on the widow finding a marriage match, a_{st} be the probability the potential spouse is alive in t months, and a_{wt} be the probability the widow is alive in t months. In addition, let m denote the number of months the widow expects to wait to remarry if she

¹⁰ Our current estimation strategy does not allow the probability of finding a match to depend on the Social Security benefits, but future versions of the paper will incorporate this.

delays marriage until after she turns 60 years of age. Therefore, the present discounted value of the expected benefit associated with marriage in a month before age 60, conditional on finding a match that month is

$$B = \sum_{t=0}^m D^t a_{st} a_{wt} b,$$

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 (m) 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 m months to remarry if $B < C$.¹¹

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 month prior to age 60 is $p[1-F(\hat{b})]$. The probability the widow does not marry that month is $(1-p)+pF(\hat{b})$: 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 a month 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 in the given month. Then, the probability the widow remarries j months after age 60 is $p+wq$.¹² 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" (i.e., a

¹¹ Note that if the widow finds someone and does not marry t' months before the age of 60, the widow will not marry t'' months before the age of 60 where $t' > t''$. This is the result of our assumption that b does not vary with time.

¹² Note that all these probabilities are conditional on the widow being alive and unmarried in that month.

widow) but also the probability her benefit of marrying is less than \hat{b} for that month. A description of its calculation is provided in the appendix.

The likelihood function is therefore:

$$\prod_{y=1,S=1} p[1-F(\hat{b})] \prod_{y=0,S=1} [(1-p)+pF(\hat{b})] \prod_{y=1,S=0} [p+ wq] \prod_{y=0,S=0} [1-p-wq]$$

where $y=1$ if the widow remarries in the month (0 otherwise) and $S=1$ if the widow is under 60 years of age (0 otherwise).¹³

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.

¹³ 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 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.

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. Conceptually, the probability a widow meets a match a month before her 60th birthday is not likely to differ significantly from the probability of a match immediately after turning 60 if bargaining is efficient.

We expect bargaining between widow and potential spouse to be relatively 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. In addition, the functional form assumptions we impose on the probability of a match restricts how the probability of a match can vary with the widow's age, which is less likely to be problematic with efficient bargaining.

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.

Combining the core and marital history data, we construct a data set of women who were widows at any time between the ages of 55 and 60. We restrict our analysis to women who were widows during these ages because Brien, Dickert-Conlin, and Weaver (forthcoming) show that much of the behavioral response to the rule occurs very 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 the woman is widowed or, in other words, at risk for remarriage. The combined SIPP panels yield a sample of 6449 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

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* (U.S. Census Bureau 2001c).

the Summary Earnings Record (SER), which contains earnings histories.¹⁶ 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.¹⁷ Table 1 shows that we match 5573 (86 percent) widows to Social Security administrative records.

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 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. Table 1 shows that we have information on the deceased husband's PIA only for 3353 cases. We have information on the new husband's PIA for 147 cases and on both spouses for only 84 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

¹⁶ 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.

¹⁷ 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.

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 1989 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 currently 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 widows for whom SIPP imputed their marriage data because our analysis depends on the actual behavior of women. Our final sample has 1743 women who were widows between the ages of 55 and 60 years old.¹⁸

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. 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 2 shows that a total of 77 out of the 1743 women in our sample remarry before age 60. On average, women who remarry before age 60 are widowed at an earlier age, are more likely to be white, and are more likely to have at least a high school education than widows who do not marry before age 60. Note that only two percent of the widows who do not remarry before age 60 remarry after age 60. In addition, the estimated average Social Security Marriage Costs (this is the maximum

¹⁸ A few widows have more than one spell of widowhood between ages 55 and 60. In our current analysis, we only consider a widow's first spell, although we use data from her second spell if it is relevant.

costs faced by the women over the time period she is in the sample) exceed \$29,000 but are not statistically different for widows who remarry before age 60 relative to those who do not.

Figure 1 gives an indication of how the probability of remarriage changes by single 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 1.8 percent), but also declining over time, except for a noticeable increase age 60. This is consistent with the incentive in Social Security and previous work by Brien, Dickert-Conlin, and Weaver (forthcoming). The probabilities of remarriage are not statistically different from one year to the next, except in the case of age 60 relative to age 61, where the probability of remarriage falls from 1.3 to 0.7.

Panel A of Figure 1 also shows the mean (panel B shows the median) Social Security Marriage Cost, conditional on whether the woman remarries or not at each age. Again, this Social Security Cost is the maximum cost faced by the widow during her at risk period. For most ages before age 60, the cost of remarrying is greater for those who do not remarry than those who do. For 57 year old widows, the difference is statistically significant. The counterintuitive exception is age 59 where the Social Security Cost is \$34,046 for widows who marry and only \$32,641 for those who do not. However, this difference is not statistically significant and, of course, is unconditional on other observables.

The pattern is more expected in median Social Security Marriage Cost comparisons. In every age before age 60, the median cost of remarrying before age 60 is greater for those who do not remarry relative to those who do. At age 60, those who remarry have a higher median cost of remarrying before age 60 than those who do not, which is consistent with widow's with a higher cost of remarriage waiting to remarry.

There are still many observables that are unaccounted for in this analysis and Table 3 shows a simple linear probability model that regresses whether the widow remarries before age 60 on a set of

covariates that include the Social Security Cost, whether the widow is white, whether the widow has less than a high school degree or exactly a high school degree, what year the widow was born in, whether or not she has children and at what age she was widowed. The coefficient on the Social Security Cost is negative (-0.0007) statistically significant at the 6 percent level (s.e. = 0.0004). This suggests that a \$1,000 increase in the cost of remarriage, conditional on observables, reduces the probability a widow remarries by 0.0008 percentage points. Given that the mean Social Security Cost of marrying before age 60 is \$31,993 and that 4.4 percent of widows marry before age 60, this implies an elasticity of approximately 0.6. The coefficients on the other variables are also as expected. White widows are more likely to remarry before age 60 than non-white widows, widows with less than a high school degree are more likely to remarry before age 60. The probability of remarriage is increasing with the age that a woman became a widow, until that age reaches 46 and then the age of widowhood is negatively correlated with remarriage before age 60. (Recall, this is only a sample of women who were widows between ages 55 and 60).

Much of this crude regression analysis captures the probability of remarriage. 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 of 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 Weibull distribution $1-\exp[-(b_i/\eta)^\alpha]$. We further assume that $\eta=\exp(\beta_\eta)$ and $\alpha=\exp(\beta_\alpha)$. We select the Weibull distribution because it restricts b_i to be

positive and the function forms for η and α also ensure they are positive.¹⁹ In addition, we do not allow the Weibull distribution to vary across widows (i.e., η and α are not functions 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 ensures that p_i is between zero and one. Finally, we assume that a widow, who meets a match prior to age 60 and waits until after she turns 60, marries in the first five months after turning 60 years of age and the probability of marrying in each of these five months is the same (i.e., $w=0.2$ for each month after age 60 years).²⁰

Our next task is to estimate the parameters, $\Omega = \{\beta_\eta, \beta_\alpha, \beta_p\}$, from the likelihood function. Table 4 presents the parameter estimates that maximize this likelihood function using the functional form assumptions above and only observations between 673 (age 56) and 725 (age 60 and 5 months).²¹ 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, number of children, education level and year of birth and current age.

Based on the parameter estimates in Table 4, the average probability that a widow meets a match in a given month between age 56 and 60.5 is 0.001. The very low probability of finding a match is expected based on the relatively few marriages we observe in the data. While few of the coefficient estimates associated with these widow specific variables are statistically significant, due to the few widows who remarry, these estimates suggest that the age at which the woman became a widow, the race of the widow and whether the widow has any children affect the probability of her finding a match. For example, the coefficients associated with the age the woman becoming a

¹⁹ The mean of the Weibull distribution is $\exp(\eta)\Gamma[(\alpha + 1)/\alpha]$ where Γ denotes the gamma distribution.

²⁰ While we select this five month window based on the empirical evidence presented in Brien, Dickert-Conlin and Weaver (forthcoming), we hope to estimate this probability distribution in a future revision of this paper.

²¹ We expect very few 55 year old widows to delay marriage until after 60 years of age just to collect the additional Social Security widow payments.

widow and this age squared indicate that a woman who became a widow at 54 years of age compared to 55 is, on average, 12.5 percent less likely to find a match in a given month. In addition, the probability a non-white widow finds a match is over three times less likely as the probability of a white widow finding a match and the probability a widow with any children finds a match is approximately four times less likely as the probability of a widow who is childless.

Table 4 also contains the estimates of the parameters of the Weibull distribution, β_η and β_α . These parameter estimates indicate that the average monthly benefit of being married when the widow has found a match is \$7,974. 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 approximately \$30,000 in our dataset and Brien, Dickert-Conlin and Weaver (forthcoming) provide evidence that there is a decrease in marriage rates for widows 59 years of age but not widows younger than 59.

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 \$8,000. 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.

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 efforts have attempted 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.²² 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.

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. In this version of the paper, we assume that the spouse we do not observe has the identical PIA as the spouse we do observe. All PIAs are in constant 2000 dollars. We include the probability that widow and potential spouse die, based on the 1995 SSA Trustees' report, intermediate mortality assumptions.²³ This varies by birth year and gender. We include the probability that widow and potential spouse work, based on age specific estimates from the Current Population Survey (CPS). We account for law changes in our estimates of the cost of remarrying before age 60.²⁴

When calculated the expected benefit, we make the following assumptions:

- a) The widow decisions as to 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 spouses' PIAs and her PIA).

²² 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-parent families to collect welfare benefits, while historically most benefits were available only to single-parent families.

²³ Many thanks to Courtney Coile for sharing these data with us.

²⁴ Specifically we treat the year 1978 and later as being under the current law because the current law was passed in 1977 and Brien et al. provide evidence that women responded to the law in 1978 in anticipation of its enactment in 1979. 1965?

- 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 dies at a certain age and the probability 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).
- e) The probability the widow and potential spouse work at different ages are based on those obtained from the CPS.

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 (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.

Widow remarries before age 60

if $j < 60$:

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

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) $\text{MAX} [.715W, V]+$

(Probability Potential Spouse is dead in month j)(Probability Potential Spouse is alive when widow turns 60 years of age) $\text{MAX} [.715W, V]+$

(Probability Potential Spouse is dead in month j)(Probability Potential Spouse is dead when widow turns 60 years of age) $\text{MAX} [.715W, V]$

Widow plans to remarry at age 60

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) $\text{MAX} [.715W, V] +$
 (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) $\text{MAX} [.715W, V, .5Z] +$
 (Probability Potential Spouse is dead in month j)(Probability Potential Spouse is alive when widow turns 60 years of age) $\text{MAX} [.715W, V, Z] +$
 (Probability Potential Spouse is dead in month j)(Probability Potential Spouse is dead when widow turns 60 years of age) $\text{MAX} [.715W, V]$

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. While the above calculation applies for those widows "at risk" after the 1979 law change, we do a similar calculation for those who were "at risk" prior to when the law change was public information.

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Table 1
Sample Selection from SIPP panels

	SIPP Panel					
	1990	1991	1992	1993	1996	All
Number of observations with						
Former husband's PIA	719	422	651	612	1033	3437
Current husband's PIA	39	25	43	45	74	226
Husband information available						
No husband PIAs	468	299	324	329	569	1989
Former husband's PIA only	711	412	631	593	1006	3353
Current husband's PIA only	32	16	23	26	50	147
Former and current husband's	8	10	20	19	27	84
Included in our sample	751	438	674	638	1083	3584
Excluded from our sample						
Due to no SSN match	138	118	135	147	338	876
Due to no husband PIA info	468	299	324	329	569	1989
Total SIPP sample	1357	855	1133	1114	1990	6449

Source: Authors' calculations from 1990, 1991, 1992, 1993 and 1996 SIPPs matched with Social Security Administrative records.

Table 2
Descriptive Statistics of Selected Variables
Mean (Standard Deviation) [Median]

	Remarry before age 60	Do not remarry before age 60
Year of birth	1927.88 (4.37)	1928.11 (5.11)
Age widowed (in years)	49.10* (6.11)	50.61 (7.36)
# of children	3.16 (1.68)	3.42 (1.76)
Social Security Marriage Cost (maximum for all years at risk of remarriage)	\$29,811.26 (11287.61)	\$32,094.58 (12291.84)
Married after age 60 (while still in sample)	0.00 (0.00)	0.02 (0.15)
% white	0.97*** (0.16)	0.84 (0.36)
% w/ < 12 years of education	0.27** (0.45)	0.41 (0.49)
% w/ 12 years of education	0.44 (0.50)	0.39 (0.49)
n	77	1666

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 55 and 60.

Notes: Statistically significantly different at the 1 percent level ***; 5 percent level **; 10 percent level *.

Table 3
Dependent Variable: Marry Before Age 60
Linear Probability Model

Social Security Marriage Cost (\$1000)	-0.0008* (0.0004)
White (1 = yes)	0.0437*** (0.0143)
< HS Degree (1 = yes)	-0.0330** (0.0136)
HS Degree (1 = yes)	-0.0171 (0.0135)
Birth Year	-0.0008 (0.0100)
Any Children (1 = yes)	0.0379 (0.0340)
# of Children is Missing from Data (1 = yes)	-0.0436 (0.0401)
Age Widowed (years)	-0.0185** (0.0062)
Age Widowed (years) squared	-0.0002*** (0.0001)
Constant	0.1335*** (0.0519)
N	1743

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 55 and 60. Not in sample for ages after they marry.

Notes: Omitted education category is more than high school. Omitted categories for children is "No Children". Birth years range from 1921 to 1940.

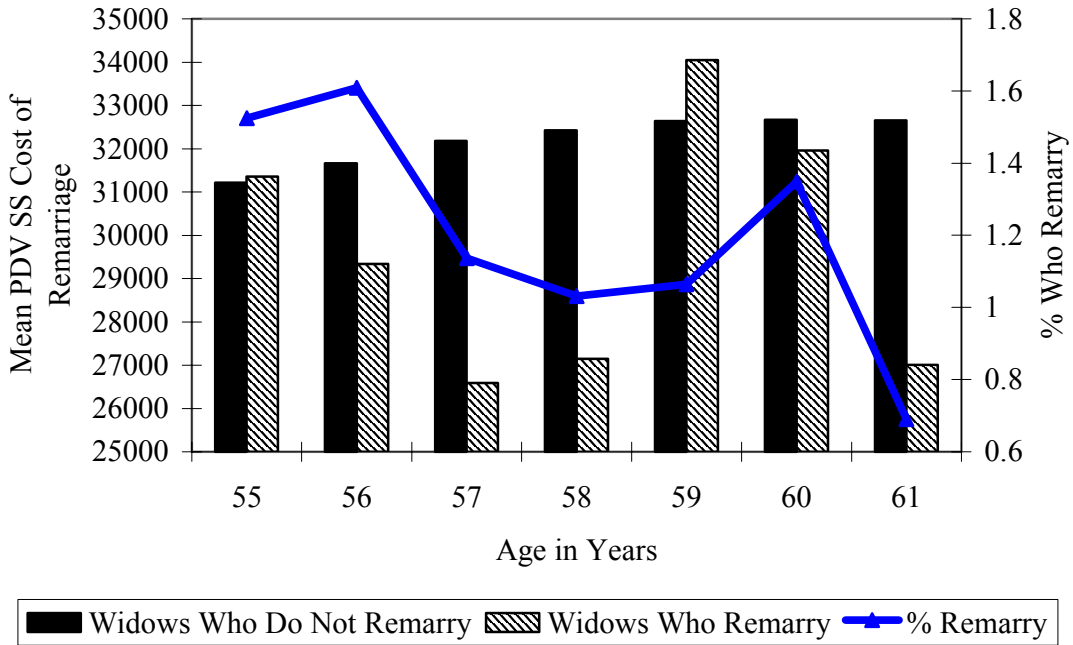
TABLE 4
Marriage Model Estimates

	Coefficient Estimates
Probability of Finding a Match (p):	
Age Became Widow	-0.466* (0.272)
(Age Became Widow) ²	0.005* (0.003)
Race Indicator Variable (1 if white, 0 otherwise)	-1.201 (1.025)
Widow has a least one child (Indicator Variable)	-1.481* (0.807)
Missing information on whether widow has a child (Indicator Variable)	-1.475 (1.256)
Widow did not complete high school (Indicator Variable)	-0.326 (0.581)
Widow completed high school but did not have additional education (Indicator Variable)	-0.199 (0.576)
Year of Birth	-0.099 (0.070)
Age in Months	0.010 (0.015)
Constant	187 (137)
α	
Constant	-0.017 (0.562)
η	
Constant	2.069* (1.102)
Observations	19,555
Log Likelihood	-182.53

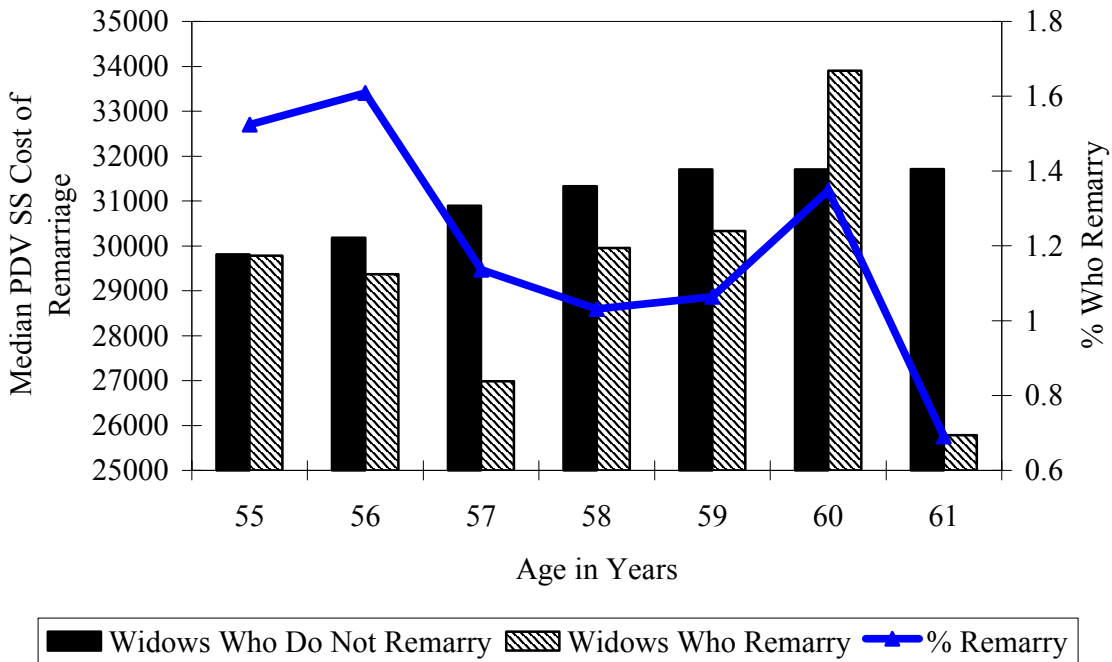
Standard errors are in parentheses. * Statistically significant at the .10 level.

Figure 1

Panel A



Panel B



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 55 and 60. Not in sample for ages after they marry.

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