DOES THE BALANCE OF POWER WITHIN A FAMILY MATTER? THE CASE OF THE RETIREMENT EQUITY ACT

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Abstract

This paper studies within-family decision making regarding investment in income protection for surviving spouses. A change in US pension law (the Retirement Equity Act of 1984) is used as an instrument to derive predictions both from a simple Nash-bargaining model of the household and from the classical single-utility-function model of the household. This law change gave spouses of married pension-plan participants the right to survivor benefits unless they explicitly waived this right. The predictions of the classical model are rejected in favor of the predictions of the Nash-bargaining model in the data.

JEL Classification: D1, J1.

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1 Introduction

Most economic theory assumes that household behavior is determined by a fully rational agent maximizing a single household utility function. While for most purposes this assumption has been proven to be an extremely powerful way of describing actual behavior, in recent decades there have been at least two sets of challenges to this model. The first, behavioral economics, challenges the rationality assumption. The second set of challenges questions the notion that the behavior of multi-person household can be described as decisions made by a (possibly benevolent) dictator within a household. It posits an alternative view: the decisions taken by a household can be characterized by a more complicated process that takes explicitly into account the multi-decision maker structure of the household. Both sets of challenges share the view that there are situations that merit analysis beyond this simple paradigm. This paper considers one such application, in which the single-utility function model is unsatisfactory: the analysis of a government policy intended to redistribute resources within a family.

The specific issue analyzed in this paper is a married couples' choice of the amount of survivor protection to be provided to a surviving spouse after the death of her partner.[1] The potential conflict of interest between spouses rises from the fact that providing protection to a surviving spouse is costly (e.g. life insurance is not free). This means that the more survivor protection is provided, the less resources the household has available in other states of the world. This simple observation, while potentially compatible with the single-utility-function framework, illustrates the potential for conflicting interests between spouses. More generally, many decisions within a household have a potential for conflict between spouses or between other members of the household.[2]

[1] From now on, we will use convention that the husband is the spouse who, having been the primary earner, is more likely to die earlier. While the reverse situation is relevant for some couples, this is still (especially for the cohorts used in the empirical analysis) overwhelmingly more typical. Furthermore, the law change that is studied in this paper, while written in gender-neutral terms, was explicitly targeted to increase the protection of widows after the death of their husbands.

[2] Some examples studied in the literature are labor supply and labor force participation decisions of spouses, consumption allocations between different goods, health and educational investments, bequests and child labor.

The application studied in this paper is the spousal signature requirements of the Retirement Equity Act (REA) of 1984. This requirement mandated that a married pension plan participant, when retiring, must choose his pension payment in a form of a joint-and-$\frac{1}{2}$ survivor annuity unless his spouse signs a notarized consent form waiving her right to this survivor protection.[3] The mandate affected only pension plan participants who started receiving their pensions after January 1, 1985.

In the theoretical part of the paper, a Nash-bargaining model of family decision making is used to analyze the specific effects of this law change for the selection of survivor annuities, life insurance holdings and savings. The law change is interpreted as having changed spouses' relative outside options. The model predicts that the law change would increase the selection of the survivor annuities and increase life insurance holdings for most households. The effect on the savings behavior is indeterminate. These predictions of the Nash-bargaining model are contrasted with the stark prediction of the classical model that the law would have had no effect since the household budget set is unchanged.[4] Thus this exogenous law change provides a well-identified empirical strategy for testing the predictions of the bargaining model against the predictions of the classical model.[5]

In the empirical part of the paper, several cross-section datasets are used to study these predictions. The effect on the survivor annuity selection is studied using the Current Population Survey (CPS) December 1989 Pension

[3] A joint–and-$\frac{1}{2}$ survivor annuity is an annuity that pays a fixed income stream as long as the primary annuitant (the pension plan participant) is alive and 50% of this stream as a survivor benefit for his spouse after his death as long as she is alive. A typical alternative to the survivor annuity is a single life annuity that pays a higher fixed income stream during the participant's lifetime. The terms "joint annuity" and "survivor annuity" are used interchangeably in this paper.

[4] Since the joint-and-$\frac{1}{2}$ survivor annuity was in the budget set by law (ERISA of 1974).

[5] Most of the existing literature that tries to test between alternative models of household behavior use as their identification sources variables that could easily be interpreted as being endogenous to the decision (like the relative income shares of the husband and wife). Thus, the rejections of the classical model in these papers can be due to this problem of identification strategy. This point is powerfully extended in Duflo (2000). Two studies that use similar natural experiment strategies as this paper are the Duflo paper and Lundberg, Pollak and Wales (1996). In the former the natural experiment was an expansion of pension benefits in South Africa. In the latter the natural experiment was a policy change in the UK, which changed the Child Benefit from tax credits to a direct payment to the mother. Interesting more structural tests of the model are derived in several papers by Chiappori and co-authors (e.g, Chiappori and Browning 1998). All three papers reject the classical single utility function view of the household.

Benefit Survey and combination of the Health and Retirement Survey (HRS) and the Assets and Health Dynamics Among the Oldest Old (AHEAD).[6] These results show that the law change increased the selection of survivor annuities by approximately 7 percentage points (a 10 percent increase). Results from HRS-AHEAD data indicate that the affected households increased their life insurance holding by approximately $5,000 (this corresponds to approximately 25% of median life insurance holdings of the affected group). These joint-annuitization and life insurance findings support the Nash-bargaining theory over the classical single utility maximization model.

2 Survivor protection: legislation and economic evidence

Protection of surviving spouses can be provided by several instruments: privately purchased annuities, survivor annuities from private pensions, public pensions (Social Security), life insurance and savings. It is worth noting that many of these instruments can used for motives other than survivor protection. Several authors have argued that bequest motives are important explanations for wealth accumulation (savings behavior) and for life insurance holdings (e.g., Bernheim 1991, Brown 1999, Kotlikoff 1998). Most households rely substantially on Social Security, which provides a real joint-annuity for married retirees. The surviving spouse in a typical married couple receives two thirds of the couple's Social Security benefits.[7]

Prior to REA, all private-sector and union pension plans in the United States were affected by the Employment Retirement Income Security Act

[6] When used together these datasets will be referred as HRS-AHEAD data. Preliminary release data from HRS wave 1998 is used and therefore the following disclaimer applies: "This analysis uses HRS Preliminary Release data. These data have not been cleaned and may contain errors that will be corrected in the final Public Release version of the dataset."

[7] This is the case when the Social Security benefits, both before and after the death of primary earner, are based on the earnings record of only one of the spouses. In that case the couple gets 150% of the Primary Insurance Amount (PIA) while the survivor gets 100% of the PIA. The replacement rate is lower for a two-earner couple.

(ERISA) of 1974.[8] With respect to survivor annuities, ERISA required that if the pension plan's primary form of pension payout was an annuity, then the default option for married participants must be a joint-and-$\frac{1}{2}$ survivor annuity.[9] Pension plan participants were free to choose other pay-out options without consulting their spouses. Holden and Nicholson (1998), using New Beneficiary Survey data, show that ERISA increased the selection of survivor annuities by married male pension plan participants from 48.1% to 63.9%. Unfortunately these data cannot be used to disentangle the two effects of ERISA: the mandate that survivor benefits must be an option (increased availability) and the effect of the default choice.[10]

The Retirement Equity Act (REA) of 1984 was a major revision of the original ERISA legislation. While it affected vesting requirements, minimum age requirements for pension plan participation, years of service calculations and other more administrative aspects of the covered pension plans, it also included two provisions that were explicitly meant to redistribute resources within a family.[11] It mandated the provision of pre-retirement and post-retirement survivor annuities unless the spouse affected signed a consent form in the presence of a notary public or a pension plan administrator.

The pre-retirement survivor annuity provision required that pension plans provide survivor coverage for a spouses if the participant died before his retirement unless the spouse waived this benefit. The decision to decline the pre-retirement annuity could be made at any time after the year of participant's 35th birthday and before his death. While the effects of the mandate to provide pre-retirement annuities is interesting, it is beyond scope of this paper.[12]

[8] ERISA created standards for several aspects of pension plans including fiduciary duty, vesting requirements and reporting requirements. Compliance with the ERISA regulations is required for a pension plan to enjoy beneficial tax treatment.

[9] Before ERISA pension plans were not required to provide survivor annuities.

[10] A recent paper by Madrian and Shea (2000) provides evidence on the effect of the default choice on the investment decision made by 401(k) plan participants. They find that the choice of default option has a significant effect on retirement related investment decisions.

[11] In the public discussion around that time, the Retirement Equity Act was also dubbed as the "Women's Pension Law".

[12] One justification for this choice is that the post-retirement annuity selection situation is such that the selection will have an immediate effect on household income, while the decision on the pre-retirement annuity would only affect the household income through change in pension benefits perhaps as late as 30 years from the selection date.

This paper will focus on the post-retirement survivor-annuities mandate. This requirement specified that employers must provide married participants with a notice form explaining the choice (typically between a single life annuity and a joint-and-survivor annuity; in some a cases lump-sum payment is also offered) and the rights of the parties involved at least 90 days before start of the pension payments. The mandated default form of joint-and-survivor annuity provided 50% of the benefit received when the participant was alive to his spouse after his death. This requirement affected all defined-benefit plans and most defined-contribution plans.[13] For the empirical part of the paper, it is important to note that state and local government pension plans were not affected by REA. The federal government pension plan had a similar requirement change effective at same time thanks to the Civil Service Retirement Spouse Equity Act of 1984.

For a typical retiring worker, the effect of selecting a joint-and-survivor annuity over a single life annuity is a reduction in pension benefits of approximately 10% (based on TIAA-CREF annuity pricing table, from TIAA-CREF 1996). Pensions where the payments had started before January 1, 1985, were unaffected by these survivor annuity requirements.

3 Theoretical models of household decision making and the Retirement Equity Act

Three simple models of household decision making are compared in this section with respect to their predictions on the effects of the signature requirement of the Retirement Equity Act. The models are the classical single utility function model, an "almost dictatorial" model and a Nash-bargaining model. Because each of these three models gives different predictions regarding the effects of the signature requirement they can be tested empirically.

[13] Among defined-contribution plans, all the money-purchase pension plans were affected by the provision. Under certain limited circumstances, profit-sharing and stock-bonus plans were not affected (Schechter 1985). It is also worthwhile to notice that the defined benefit plans that did not provide the option to annuitize the pension wealth were not affected by this requirement.

3.1 The economic environment

For simplicity a two-period structure of the world is assumed. In the first period, both spouses are alive with probability one. In the second period, the husband is alive with probability $(1-p)$ and the wife is alive with probability one. Period 1 in the model presents early retirement and period 2 late retirement. In the first period the household must decide how much of its endowment to consume now, and how much to allocate to different states of the world in period 2. A complete market structure is assumed, so the household can use risk-free bonds and life insurance to transfer resources to period 2 with no short-selling constraints.[14] Also for simplicity, the household decision-making process is assumed to be fully rational and the utility functions of household members (or the household utility function in the case of the classical model) are assumed to be of the time-separable expected utility form. Furthermore, household members are assumed to have no bequest motives.

The household is assumed to have an exogenously given endowment W. The complete and perfect nature of financial markets with no short-selling constraints imply that the source of the endowment is irrelevant to the choice set; only the actuarial present value of all income streams matters. Thus, for example, the fact that Social Security provides survivor annuities is irrelevant in this environment, since this can be fully undone by short sales of life insurance on the husband's life.[15]

3.2 Classical single utility function maximization

In this case, the household maximizes

$$\begin{aligned} U(c_1, B, I) &= u(c_1) + (1-p)v(B) + p\tilde{v}(B+I) \qquad (1) \\ \text{s.t.} \quad W &= c_1 + qI + \frac{1}{R}B, \end{aligned}$$

[14] In this environment, the same state space is spanned either by life-insurance and risk-free bonds or by single-life and joint-life annuities. In the real world the situation is more complicated, due to the lumpiness of the pension annuity selection, differences in the pricing of annuities and life insurance and rationing/non-linear pricing in the life insurance market.

[15] This implicitly assumes that the same pricing of social security is available in the market.

where c_1 is the current period consumption, B is the amount of the safe bond and I is the amount of life insurance, q is the price of life insurance and R is the real discount rate. Note that the utility function over consumption in period 2 is allowed to be state-dependent.

This model makes a stark prediction with respect to the signature requirement: it should have absolutely no effect on the decisions that the household makes since the budget set remains unaffected.[16]

3.3 "Almost Dictatorial" model

A slight generalization of the classical model has a (possibly altruistic) husband make all the economic decisions in the family, while the wife has her own utility function (that is irrelevant to the household's decisions). So while she has her own preferences, we observe only the choices made according to husband's preferences. Since the husband has ample tools in this model to undo any increase in joint annuitization by cancelling life insurance (or selling it short) he may choose not to bother to get his wife's signature to forego the survivor annuity. Instead he can completely offset this increase in survivor protection by cancelling his life insurance (or by short-selling life insurance). This simple model provides justification for the investigation, in the empirical part of the paper, of possible offsetting behavior on the life-insurance margin.

An extension of this model to the case in which the wife has a veto-right after the legislation on the annuity choice (but no say on any other decision of the household) and in which the short-selling constraints could bind, predicts that the legislation might have a real effect on the allocation of households resources, since the husband might not be able to completely undo the effect of increased annuitization. In this case, in the event of accepting the default allocation, life insurance holdings decline either fully

[16] This prediction holds as long as the law change does not change the utility function of the household. An alternative way to specify the decision problem is to parametrize the utility function differently in two states of the world: a separate utility function depending on whether the signature requirement is in effect. In first instance this looks similar to the classical introductory economics example on how preferences over sunlotion and umbrellas might change depending on the weather forecast. However, in this particular application the separately-parametrized utility function would be just an alternative way to parametrize the notion of bargaining power.

offsetting the change or reaching zero. This assumes the same pricing in pension alternatives and in market pricing of life insurance.

3.4 Bargaining model

The Nash bargaining models (Manser and Brown 1980, McElroy and Horney 1981) and, more generally, efficient contracting models (Chiappori 1988a) of household behavior have been a topic of research in several areas of economics in past fifteen years. The applications of these models or other more general models of household decision making to retirement-related topics are rare, two notable exceptions being Browning (2000) on the theory side and Lundberg and Ward-Batts (2000) on the empirical side.[17] The basic tenets of these models are that households have at least two decision makers with separate utility functions, and that the choices households make are Pareto-efficient.

This section presents a Nash-bargaining model, but the model presented can easily be understood to be just a special case of a more general efficient contracting model. All the results presented continue to hold in these more general models. In this sense, this paper does not engage in the debate of the relative merits of the Nash-bargaining assumption versus the efficient-contracting approach (Chiappori 1988b, McElroy and Horney 1990, Chiappori 1991). While the formal model is presented and solved in the Appendix, this section provides an informal discussion of its main assumptions and results.

In the Nash-bargaining model, both spouses are assumed to have utility functions over their own consumptions in different states of the world. While altruistic linkages between spouses are assumed away in this analysis, the results presented here apply as long as the altruistic linkages are not too strong.[18] Furthermore, it is assumed that the decision negotiated in period

[17] Browning (2000) models the decisions similar as studied in this paper as a non-cooperative game. Under the assumptions used, he finds that the Nash-equilibrium of the game can be Pareto-efficient. Lundberg and Ward-Batts (2000), on the other hand, find that variables plausibly correlated with the respective bargaining powers of the spouses (such as spouses' respective education levels and age difference between spouses), have an effect on the net worth of households in the first wave of the HRS.

[18] As long as on the margin both spouses would weakly prefer more of their own consumption in any state of the world over more of their partner's consumption in any state,

1 is honored in period 2, so there are no commitment problems across time-periods.

The key determinant of the Nash-bargaining solution is the outside option. This is defined as the utility level that the agent would attain should negotiations break down. In most of the Nash-bargaining literature on family decision making, the outside options are considered to be the spouses' respective utility levels in the case of divorce, given the institutional arrangement on the sharing of household resources, as in the original McElroy and Horney (1981) contribution. Lundberg and Pollak (1993) introduced the notion of a non-cooperative marriage as the outside option. In the context of this application, the non-cooperative marriage is the preferred interpretation. A non-cooperative marriage is interpreted in this context as a situation in which both spouses separately consume the income streams over which they have property rights, and do not optimally divide household chores. Although household chores are not explicitly modelled here, they represent one of the wife's bargaining chips: the threat of not providing household services to the husband is a potential instrument in her bargaining strategy.

In the bargaining context, the signature requirement of the Retirement Equity Act changes the relative outside options of the spouses by redistributing property rights on the income stream provided by the survivor annuity to the wife. Before the requirement, she does not have a claim on that income stream. This is equivalent to a redistribution from the husband's outside option to the wife's outside option.

Proposition 1. *REA increases the utility of wife and decreases the utility of husband.*

Proof: See Appendix.

This result is a direct consequence of the redistribution of outside options by REA. Since her outside option is higher when REA is in effect, her utility in the Nash-bargaining solution will be higher. Moreover, this result holds whether or not the household would have chosen the survivor annuity without REA. This is a general property of the standard Nash-bargaining solution: outside options always matter to the solution.

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the analysis goes through, although with more notation. Similarly, household public goods (a limit case of altruism) would only increase notation, but would not change the results presented here.

Proposition 2. *REA increases the amount of money transferred to the survivor state (the sum of survivor annuities and life insurance) and increases the wife's private consumption in periods 1 and 2. The effect on savings is ambiguous.*

Proof: See Appendix.

Proposition 2 basically restates Proposition 1. Since the bargaining power is tilted towards the wife with REA, the family will consume more items that enter positively into her utility function. Since life-insurance holdings and survivor annuities are perfect substitutes in this model, the prediction is only on the sum of these two.

In reality the choice of survivor annuity is a discrete choice the possible choices typically being no survivor benefits in the annuity and some selected levels of survivor annuity (say, 50% or 100% survivor annuity). Consider the following example: the 50% survivor annuity is the only form of survivor annuity available, and households continuously adjust their life-insurance holdings to arrive at the optimum.[19] Households can then be divided into three groups based on whether they would have chosen survivor benefits without REA and with REA. Table 1 Summarizes REA's effects on life-insurance holdings.

All these effects are derived from the effect of REA on the amount of resources transferred to the widowhood state (the sum of life insurance holdings and the survivor annuity).[20] This unambiguously increases due to REA, since it increases wife's threat point on the negotiation. The case of the

[19] In reality the pricing of survivor annuities and life insurance differs. Annuities from pension benefits (both single-life and survivor annuities) are calculated using unisex life tables. Life-insurance cost on the other hand is a function of several factors (including health status, gender and access to group life insurance plans). For many households the survivor annuities available through their pension plans are cheaper (especially for couples with no access to group life-insurance markets), so for these households foregoing survivor annuities in favor of holding similar amount of survivor protection through life insurance would not be rational unless there is a strategic reason for this. One strategic reason for holding life insurance instead of survivor benefits might be the fact that the husband could unilaterally cancel his life insurance policies in the future without consulting his wife whereas he would need his wife's consent to cancel the survivor annuity.

[20] In the empirical part of the paper this narrow notion of wealth available (sum of survivor annuities and life insurance) in the survivor state is also used. In practice, many of the household's assets (most wealth components) in the typical household would be available to the widow. However, in practice we don't know what happens to the differ-

Table 1. The effect of REA on life-insurance holdings for different types of households

Without REA	With REA	Effect on life insurance
No survivor annuity	No survivor annuity	Positive
No survivor annuity	Survivor annuity	Ambiguous
Survivor Annuity	Survivor annuity	Positive

group that would have not chosen a survivor annuity before REA nor after REA is the most intuitive. In this case, a story consistent with the bargaining model is that by promising more life insurance (and also more consumption in both periods) the husband "buys" the consent signature of his wife. In the second group, the effect on REA on the outside options is large enough to change their annuity choice. As shown in Appendix, it is perfectly possible that the redistribution of this outside option leads to a large change in the solution of the bargaining game.[21] Thus the effect on the life insurance holdings of the second group is ambiguous. For the third group, who would have already chosen survivor annuities without REA, the effect on life insurance comes also from the increased outside option of the wife. Even though she was sufficiently well off in the case of negotiation breakdown even before REA to force the husband to select an survivor annuity, the fact that REA gave her new property rights in the negotiation breakdown state, makes her even better off in the solution. This implies that the life insurance holdings must go up since her consumption goes up.[22]

ent components of the households assets after the husband's death, so using the narrow definition ensures that they are two state contingent assets that deliver income in the widowhood state.

[21] This can be illustrated by the following example: say that the value of the survivor annuity from the pension is \$10. The signature requirement redistributed this amount of outside option wealth from husband to wife. It is perfectly possibly that the value of wife's aggregate consumption across different states in the solution of the bargaining game changes by more than \$10. This can happen when the outside option utilities are very wealth elastic.

[22] No claim is made that Nash-bargaining or efficient-contracting models are the only sensible models that have these predictions. An alternative, more psychological oriented, model having similar predictions is the following. Suppose that before the REA's signature-requirement some husbands declined the survivor annuities without really acknowledging the consequences of the choice they made. Assume that the REA's signature requirement conveyed the information to the pension holder that the choice of survivor annuity was very important and forced him to seriously think about the consequences of his potential death to his wife. Thus instead of an effect through bargaining the REA migh had an effect by making agents to take more efficient action through providing more

4 Empirical Results

The predictions of the Nash-bargaining model are tested against the predictions of the classical single utility maximization model and the "almost dictatorial" model in this section. Outcomes studied from cross-sections of married couples include survivor annuity choice and life insurance holdings.[23] Identification strategy in these regressions is based on either the husband's birth year or the start-date of his pension. Where the data permit, households in which husband is not receiving pensions (and will not receive in the future) are used as a control group. This allows us to use both standard first-difference and difference-in-differences empirical strategies.

The data-sets used in this section include Health and Retirement Survey and Assets (HRS), Health Dynamics Among the Oldest Old (AHEAD), Current Population Survey (CPS) December 1989 Pension Benefit Survey and CPS March files from several years. Evidence from published tables on the annuity selections of TIAA-CREF participants are also presented.

4.1 Outcomes, population studied and empirical identification

The outcomes studied in this section are:

1. The probability (conditional on the husband having a pension) that the husband's pension provides survivor benefits;
2. The probability that the wife receives life insurance payments should her husband die;
3. The amount of life insurance protection.

The classical single utility function model gives a stark prediction that the law should not have affected any of these outcomes. The Nash-bargaining model predicts an increase in joint annuitization. Furthermore, for most

information.

[23] Results on household net worth were also studied. No effects of the legislation were found. This is not surprising, given that none of the models in the previous section make strong predictions about the savings behavior and that net worth is not necessarily very good proxy for savings behavior.

households[24] the Nash-bargaining model predicts increase in the life insurance holdings (so also the second and third outcomes should increase due to the legislation).[25]

The population studied is married couples whose husband was born between 1916-1919 (old group) or between 1924-1931 (young group). The reason for the omission of the 1920-1923 birth cohort is described later in this section. The sample (where the data allow this) was further restricted to married couples who were married when the husband turned 60 to eliminate couples who might have not been married at the time of the annuity selection. Due to relatively low number of couples marrying after age 60, this criterion has very little effect on the sample.

The receipt of pension income by the husband is the key quantity in the analyses.[26] When annuity choice is studied, only those who had pension income are included in the sample. When other outcomes are studied, the pension variable is used to divide the data into control and experimental groups. While using non-pension holders as a control group for pension holders is not an ideal control strategy, the inclusion of a rich set of covariates (like career high earnings of the spouses) should mitigate problems related to the differences between these groups.[27] Furthermore, the set of non-affected household in the control group includes many participants of defined contribution plans who chose to have their pension distributed as a lump sum instead of an annuity and who are a priori in many aspects more similar to the experimental group than the households where husband never had any pension coverage.

[24] That is, for households that did not change their annuity choice because of the law change. According to the estimates of this section, these households constitute approximately 93% of the households in which the husband has pension income.

[25] It would also be interesting to study the effects of the legislation on the outcomes of widows using data on transitions to widowhood. This was attempted using the Survey of Income and Program Participation panels from years 1985 to 1996 (10 different panels), but even these large data sets would give only 686 transitions that satisfy all the necessary age restrictions to be informative about the effects of the legislation. Unfortunately, with such small sample size, no statistically significant (nor of any consistent sign for the legislative effect) results were obtained.

[26] The cohorts studied are sufficiently old in the data (at least 66) to be very likely to have already started their pensions, which is important for our purposes, since it implies that they have already made their annuity selection.

[27] One would expect that the pension coverage is more likely for those who worked in highly unionized industries or in high paying professions.

For all outcomes the following regression is estimated using only households where the husband had pension income:

$$Y = \alpha + \beta * young + \eta * Z + \varepsilon, \tag{2}$$

where, Y is the dependent variable (either an indicator for survivor benefits from pension, or an indicator for having life insurance, or the amount of life insurance holdings), *young* is an indicator for the husband being young enough to be affected by the legislation and Z is the set of covariates.[28] The full covariate set in all these regressions includes non-linear controls for age differences between spouses, third-order polynomials in career high earnings of the spouses (including interaction terms), an indicator for wife having no work history, educational and race indicators and an indicator for the wife having a pension (or expecting one) of her own. The regressions are estimated with a varying number of covariates in the model. The model estimated is the standard first difference model (where the difference is with respect to birth cohort of the husband) and where β is the estimated effect of the legislation.

For outcomes other than annuity selection the following model using all the observations are estimated:[29]

$$\begin{aligned} Y &= \alpha + \beta_0 * young + \beta_1 * pension + \\ &\quad \beta_2 * (young * pension) + \eta * Z + \varepsilon, \end{aligned} \tag{3}$$

where *pension* is an indicator for husband having a pension and β_2 is the program effect. Here the full covariate set also indicators for the husband's birth year (since the identification is no longer based solely on the birth year).[30] This estimation strategy can be seen as a standard difference-in-differences strategy, where the first difference is between cohorts and the second is between pension statuses of the husband.

[28] Even though the dependent variable is in many cases a binary variable, these regressions were estimated using OLS. As a robustness check, they were also estimated as Probits. All the qualitative results of the analysis were unaffected by the choice between Probit and the linear probability model estimated by OLS.

[29] The control group did not face the annuity selection, so they cannot be used a control for annuity selection.

[30] When birth year indicators are included in the regression they replace the variable *young* . However, due to the limited sample size, the interaction terms with *pension* - variable are not estimated separately for each birth year even in this case. Instead the interaction *young* $*$ *pension* is still used.

An exception to the empirical strategies described above is the annuity selection equation estimated from the CPS 1989 Pension Benefit Survey.[31] There an indicator variable for the pension starting after 1985 was used instead of the cohort proxy. This specification allows the use of the husband's birth year in the covariate set.

As described above, in most regressions the birth year of the husband is used as a proxy for whether the husband's pension started before January 1985. The empirical justification for this comes from the yearly March CPS files from 1976 to 1998. The probability of a pension income receipt from federal or private pensions is calculated for married males as a function of their age. These results are presented in the Figure 1. From these results we can deduce the information presented in the Table 2.

Table 2. Approximate propability of having a pension income as a function of the husband's age

Pension	Percent
At age 54	4%
At age 62	15%
At age 66	38%
Ever	40%

The evidence from this relatively-stable relationship across years seem to suggest that most of pension starts happen when husband is between 62 and 65. Based on that information the observations were divided into three categories according to the husband's age. These categories are presented in Table 3. Only the cohorts listed were used in the analysis.

[31] The described husband's birth cohort restrictions do not apply to this case either, since we do not have to rely on the birth cohort for identification with this data.

Table 3. Age cohorts.

Husband's Age on January 1, 1985	Status
54-61	"After" group (young)
62-65	Omitted middle group
66-69	"Before" group (old)

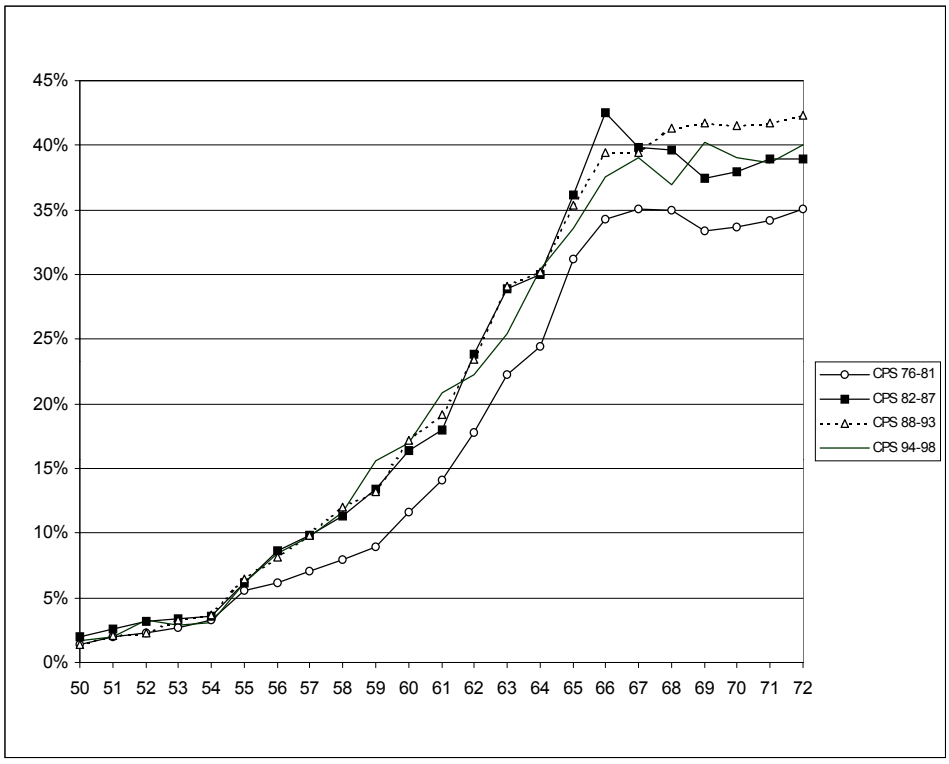

Figure 1: Probability of private, union or federal pension receipt for married men as function of age.

4.2 Data Sources

The Current Population Survey (CPS) December 1989 Pension Benefit Survey is a special supplement to the CPS collected for the purpose of analyzing the effects of the Retirement Equity Act. It includes detailed pension information (including the start date of benefits) and information on whether each pension provides survivor benefits. Because this survey was collected only four years after the law change it is subject to fewer sample selection problems than other datasets such as HRS-AHEAD.[32] Ideally one would like to analyze a question like selection of survivor annuities from flow data (or from a panel that tracks individuals as they make their choices). The downside of CPS 1989 data is that it does not include information on life insurance holdings, but it does include information on the career high earnings, which is a key covariate in the regressions.

The Health and Retirement Survey (HRS) and the Assets and Health Dynamics among Oldest of the Old (AHEAD) panels are the main sources of data in this paper. HRS and AHEAD started as separate panels in 1992 and 1993. AHEAD started as a panel survey of households in which at least one of the members was over 70 years old at the time of the first interview (born in 1923 or earlier). HRS started as a panel of households having at least one member born between 1931-1941. Before 1998 there was one additional AHEAD wave (1995) and two additional HRS waves (1994 and 1996). In the HRS 1998 these two panels were merged and additional cohorts were included in the panel to have a representative sample of households were at least one member was born before 1947. It is important to note that most individuals who are young enough to be affected by the law change are only part of the HRS 1998 data. The advantage of HRS-AHEAD data is the detailed information on the work histories, pensions and life insurance and assets holdings.

The HRS-AHEAD data were used in two separate ways in the empirical

[32] The mechanism for sample selection is the following: suppose husbands have private information on their life expectancy and this information enters into the decision whether to select survivor annuity (with these more likely to die soon more prone to select survivor annuities). Then any cross-section attempt to estimate the effect of the start year (or birth cohort group) on annuity selection will be biased since the earlier the start year is (or the older the birth cohort is), the higher the proportion of those who chose survivor annuities because of the private negative information on their life expectancy and have died before reaching the data collection. This leads to a bias towards the finding that among later pension starter a higher fraction choose survivor annuities.

analysis. A cross-sectional estimation of the effect of legislation uses the HRS 1998. However, the mortality bias for the older group could be significant in this approach, since the members of the older group would have to have lived to be 79-82 to be included in the sample. For this reason the effects of the law change are also estimated using data for the older group from the first wave of AHEAD and data from HRS 98 for the younger group. Although not a perfect solution , this approach could reduce the mortality bias substantially. Ideally one would like to compare similarly aged individuals at different times, but this is not possible given the existing datasets. The ages of the older and younger group at the times of different surveys is reported in Table 4.

Table 4. Age of the compared cohorts in the first wave of AHEAD and in the HRS 98. The preferred comparison is between the off-diagonal cells of this table

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Data-set	Age of the young	Age of the Old
AHEAD 1	62-69 (not part of the sample)	74-77
HRS 98	67-74	79-82

4.3 Results

4.3.1 Survivor Annuity Selection

Evidence on annuity selection are presented from three different data sources. The first data source is a published table of annuity choices by TIAA-CREF participants (TIAA-CREF 1996), where the data is tabulated according to the start year of the pension. The other data-sources are the CPS 1989 December Supplement and the HRS-AHEAD data, described above.

The evidence from TIAA-CREF flow data is presented in Figure 2. Between 1978 and 1994 selection of survivor annuities went from 56.5% to 74%, an increase of 17.5 percentage points. More than half of the total change (9 percentage points) occurred between 1984 and 1986. This suggest that while there was an pre-existing trend in the data, the legislation had a substantial effect on the selection of survivor annuities. Two caveats are in order here:

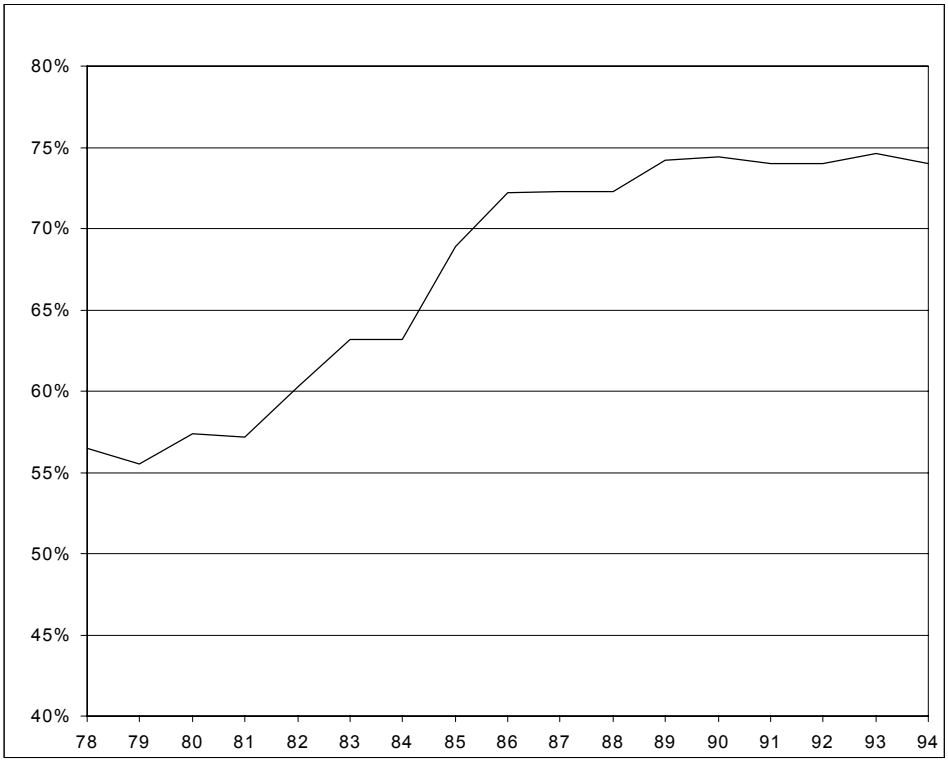


Figure 2: Percentage of male TIAA-CREF Participants choosing survivor annuities as a function of the year when started receiving benefits.

this data include also non-married participants and the workers from state universities (and certain church-run universities) who were not affected by the legislation.

The CPS 1989 December Supplement was used in a General Accounting Office Report (GAO 1992) studying the effects of REA on the selection of survivor annuities. Based on simple tabulation, the GAO estimated that the selection of survivor annuities increased by 15 percentage points after the legislation. Two caveats on the GAO analysis are in order. First, the GAO included all the observations in the analysis regardless of how long ago the selection was made, which can lead to a mortality bias. This choice would also attribute any effects of possible existing trends in the data to REA, while the exclusive use of more recent years (where data appears

Table 5: Probability that husband's pension provides survivor benefits
CPS 89 December Supplement

Start year of pension	Raw series	Regresssion adjusted		
79	65%	65%	65%	64%
80	74%	75%	74%	73%
81	67%	67%	66%	66%
82	66%	67%	66%	66%
83	71%	72%	70%	69%
84	71%	71%	71%	71%
85	68%	68%	67%	67%
86	72%	73%	72%	72%
87	76%	77%	75%	74%
88	84%	85%	83%	84%
89	81%	82%	79%	79%
Age dummies	No	Yes	Yes	Yes
Race	No	No	Yes	Yes
Education	No	No	Yes	Yes
Income variables	No	No	No	Yes

relatively stationary except for the effect of REA), should at least mitigate this problem. Secondly, the 15 percentage points increase in survivor annuity selection is based on a comparison of the highest after-legislation fraction of choosing survivor annuities (for years 1988-1989) with the average fraction of all before legislation choices. The use of this latest and highest value is only correct if the legislation took some time to have an effect on the choices. Since the sample sizes are small enough for the data to be fairly noisy, a more conservative estimate would use all years after 1985 to estimate the effect of the legislation and not the arbitrary highest.

Our estimates from CPS 1989 December Supplement are presented in Tables 5 and 6, and in Figure 3. The sample used differs from the GAO's study in that only observations in which the husband started his pension between 1979-1989 are used and federal employees are included in the sample since the law affecting them changed at the same time as REA was enacted (as explained in Section 2).[33] Across different specifications these results

[33] The inclusion of federal employees does not affect the qualitative estimates.

suggest that the selection of survivor annuities went up by 7 percentage points after the law change. This result is robust to the choice of covariate set and is statistically significant.[34]

The results from the HRS-AHEAD data are presented in Table 7. These estimates suggest that signature requirement increased the selection of survivor annuities by 5-10 percentage points. These results range from statistically insignificant to significant at the 1% level depending on the data used and the specification estimated.

The magnitude of estimated effect is not very large. This natural given that already before the legislation a majority of married husband were choosing survivor benefits (approximately 70 percent).[35]

Among the covariates, it is interesting to note that if the wife has a pension on her own or is expecting a pension, her husband is less likely to provide survivor benefits through his pension. This holds for both datasets and is statistically significant in both datasets.

Having higher education level (both for husband and wife) in general seem to imply that the selection of survivor benefits is more likely. These education effects are not always significant. In the preferred models (regression with all the covariates and in case of HRS-AHEAD comparing between AHEAD Wave 1 and HRS 98), the point estimate for the effect of education is approximately 13 (CPS) or 20 (HRS-AHEAD) percentage points increase in the probability of selecting survivor benefits when the comparison is between a couple where neither finished high school and a couple where both graduated college.

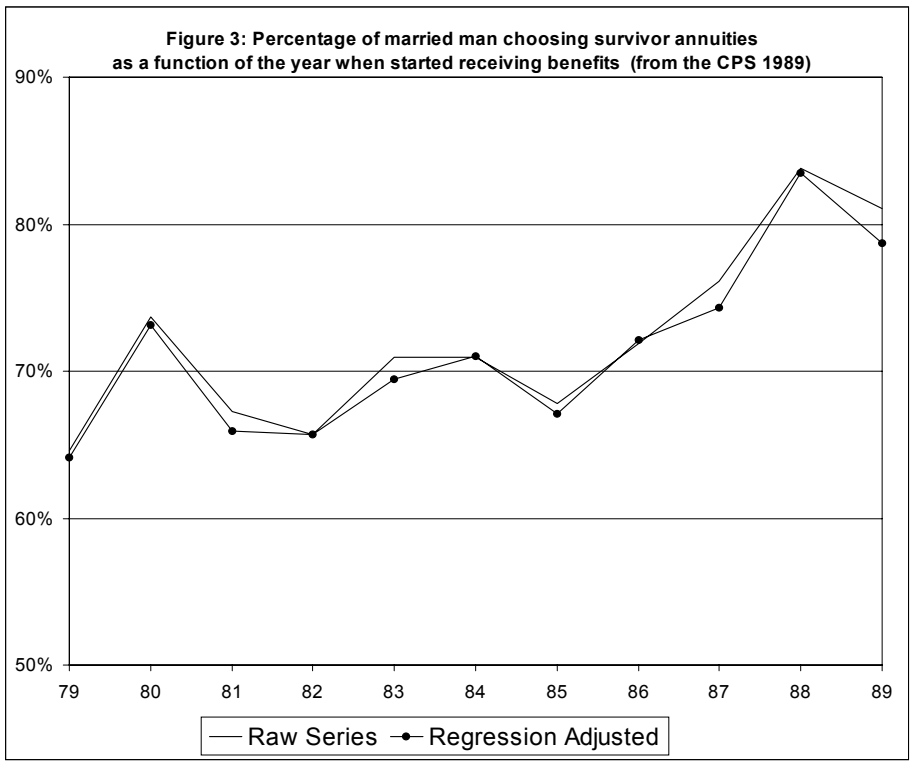
[34] A difference-in-differences strategy with CPS 1989 data was also tried, where the control group was state and local government workers who were not affected by the law changes. The estimates of the program effect were similar in magnitude as the first difference estimates but not statistically significant. This is probably due to the small sample of state and local workers in the data (328). It is thus not very surprising that the effects are made non-significant by the inclusion of the control group, since in practice the difference-in-differences estimator just subtracts a very noisy measure of change in proportion for state and local workers from the first difference estimate discussed in the preceding paragraph.

[35] In the HRS-AHEAD data the proportion selecting survivor benefits is on the average approximately 5 percentage points less than in CPS 1989. One possible interpretation for at least some of this difference is that HRS-AHEAD data, having been collected later than CPS 1989, suffers more from the mortality bias.

Table 6: Results on probability that husband's pension provides survivor benefits (CPS 89 December Supplement)

1985 or after	**0.069**	**0.071**	**0.070**	**0.063**
	(0.025)**	**(0.025)****	**(0.025)****	**(0.025)***
Husband black		0.027	0.042	0.046
		(0.060)	(0.058)	(0.059)
Husband hispanic		-0.012	0.017	0.014
		(0.081)	(0.084)	(0.084)
High-school husband			-0.022	-0.018
			(0.058)	(0.057)
High-school wife			0.012	0.023
			(0.046)	(0.046)
High-school both			0.036	0.033
			(0.068)	(0.068)
College husband			0.118	0.096
			(0.039)**	(0.039)*
College wife			0.088	0.106
			(0.064)	(0.063)
College both			-0.102	-0.110
			(0.086)	(0.085)
Wife has pension				-0.081
				(0.038)*
Age controls	No	Yes	Yes	Yes
Income variables	No	No	No	Yes
N	1540	1540	1540	1540
R2	0.0060	0.026	0.0409	0.0581

N.B ** and * indicate significance of coefficient at 5% and 1% confidence levels. Below the coefficient is its estimated standard error of the coefficient.



These results on increased joint-annuitization are consistent with the bargaining model and with the "almost dictatorial" model. They constitute a rejection of the standard single-utility function model of the household. However, the magnitude of estimated effect is not very large. This natural given that already before the legislation a majority of married husband were choosing survivor benefits (approximately 70 percent).

4.3.2 Probability of having life insurance protection for the wife

From HRS-AHEAD first-difference and difference-in-differences models were estimated for the probability that the husband has life insurance policy in which the wife is listed among the beneficiaries. With the exception of

Table 7: Results on the probability that husband's pension provides survivor benefits
From HRS-AHEAD

	Comparison between Crossection 1993 and 1998			Crossection in 1998		
Husband young	**0.048**	**0.082**	**0.077**	**0.047**	**0.091**	**0.101**
	(0.038)	**(0.043)**	**(0.047)**	**(0.044)**	**(0.048)**	**(0.050)***
Husband black		0.081	0.105		0.051	0.073
		(0.060)	(0.062)		(0.063)	(0.065)
Husband hispanic		-0.040	-0.046		-0.122	-0.122
		(0.097)	(0.097)		(0.103)	(0.103)
High-school husband		0.072	0.076		0.121	0.120
		(0.053)	(0.054)		(0.053)*	(0.055)*
High-school wife		0.142	0.162		0.097	0.111
		(0.057)*	(0.056)**		(0.060)	(0.060)
High-school both		-0.113	-0.136		-0.076	-0.089
		(0.074)	(0.074)		(0.079)	(0.079)
College husband		0.079	0.077		0.014	0.012
		(0.052)	(0.053)		(0.055)	(0.056)
College wife		-0.081	-0.077		-0.080	-0.073
		(0.075)	(0.076)		(0.078)	(0.081)
College both		0.086	0.094		0.141	0.144
		(0.091)	(0.091)		(0.094)	(0.096)
Wife has pension			-0.101			-0.082
			(0.039)*			(0.040)*
Age controls	No	Yes	Yes	No	Yes	Yes
Income variables	No	No	Yes	No	No	Yes
N	1001	1001	999	913	913	911
R2	0.0021	0.0403	0.0579	0.0014	0.0541	0.0707

Probability that husband's pension provides survivor benefits		
Age in 1985		
54-61	69.1%	
66-69	64.3%	from 1993 data
66-69	64.5%	from 1998 data

Table 8: Results on life insurance holding probability (HRS-AHEAD)

	Across 1993 and 1998 crossections				1998 Cross section comparison			
	OLS D	OLS DD	OLS DD	OLS DD	OLS D	OLS DD	OLS DD	OLS DD
Husband young	**0.081**	0.111	n.a.	n.a.	**0.036**	0.057	n.a.	n.a.
	(0.032)*	(0.041)**			**(0.035)**	(0.047)		
Husband has pension		0.156	0.129	0.126		0.147	0.128	0.116
		(0.047)**	(0.046)**	(0.047)**		(0.054)**	(0.054)*	(0.056)*
Young*Pension		**-0.030**	**-0.018**	**-0.020**		**-0.021**	**-0.014**	**-0.007**
		(0.052)	**(0.051)**	**(0.052)**		**(0.059)**	**(0.058)**	**(0.060)**
Husband black			-0.005	0.008			-0.025	-0.010
			(0.042)	(0.042)			(0.044)	(0.044)
Husband hispanic			-0.398	-0.391			-0.359	-0.343
			(0.048)**	(0.049)**			(0.054)**	(0.055)**
High-school husband			0.048	0.042			0.048	0.038
			(0.034)	(0.035)			(0.035)	(0.036)
High-school wife			0.044	0.048			0.093	0.093
			(0.036)	(0.036)			(0.034)**	(0.034)**
High-school both			-0.020	-0.033			-0.068	-0.077
			(0.048)	(0.048)			(0.047)	(0.048)
College husband			0.037	0.034			0.029	0.031
			(0.035)	(0.036)			(0.036)	(0.037)
College wife			-0.005	0.003			-0.016	-0.009
			(0.044)	(0.045)			(0.042)	(0.044)
College both			-0.028	-0.035			-0.047	-0.057
			(0.058)	(0.059)			(0.058)	(0.059)
Wife has pension				-0.018				-0.004
				(0.026)				(0.025)
Age indicators	No	No	Yes	Yes	No	No	Yes	Yes
Age difference controls	No	No	Yes	Yes	No	No	Yes	Yes
Income variables	No	No	No	Yes	No	No	No	Yes
N	1039	1952	1951	1937	951	1775	1775	1761
R2	0.0088	0.0347	0.0768	0.0867	0.0014	0.0258	0.0678	0.0759

Across 1993 and 1998 crossections		
% Insured:	Young	Old
Pension	84.23%	76.15%
No Pensior	71.64%	60.58%

1998 Cross section comparison		
% Insured:	Young	Old
Pension	84.23%	80.63%
No Pensior	71.64%	65.98%

the first-difference estimator across HRS and AHEAD data (in which the old group is from AHEAD Wave 1), no significant effect on this margin is found. The point estimates from difference-in-difference models are slightly negative, but given their standard errors, they are consistent also with large positive effects. The results are presented in Table 8.

It is interesting to note that the probability of having life insurance is significantly higher across all specifications for households in which husband has pension income. This might reflect better access to the group life insurance market through former employers. Other significant result is that husband being Hispanic has a huge negative effect on the probability of having life-insurance. This is consistent with the results of Bernheim et al (1999) who find using the first wave of the HRS (1992) that non-white households are more likely to be underinsured.[36] However, the effect of husband being African-American on the probability of having life insurance is approximately zero.

The results on education are mostly non-significant, with high school education (either for the wife or the husband) increasing the probability of having life insurance. The effect of having college education is more mixed, but given the precision of the effects-of-education coefficients, these results are only tentative in nature. In the preferred model (regression with all the covariates, comparing between AHEAD Wave 1 and HRS 98), the point estimate for the effect of education is approximately 9 percentage points increase in the probability of life insurance protection when the comparison is between a couple where neither finished high school and a couple where both graduated college.

4.3.3 The Amount of life insurance Protection

From HRS-AHEAD both first difference and difference in differences models were estimated for the value of life insurance protection of life insurance plans where the wife is listed as a beneficiary (note that zero values were included since that is a valid amount of life insurance protection).[37] Three

[36] Underinsured in their vocabulary means having less life insurance protection than their behavioral model would predict being optimal. Thus the use of the term underinsurance carries a normative judgement.

[37] Missing values in the face value of life insurance pose an interesting problem in the analysis. For many observations in the HRS-AHEAD data, we know that they have life

Table 9: Life insurance amount results using 1993 and 1998 crossections (HRS-AHEAD)

	OLS D	OLS DD	OLS DD	OLS DD	Median reg D	Median reg DD	Median reg DD	Median reg DD	Robust Reg D	Robust Reg DD	Robust Reg DD	Robust Reg DD
Husband young	**37,185.462**	24,956.330	n.a.	n.a.	**15,659.852**	10,773.234	n.a.	n.a.	**12,031.057**	3,739.170	n.a.	n.a.
	(5,905.807)**	(9,661.471)**			**(841.741)****	(959.363)**			**(1,581.502)****	(1,148.021)**		
Husband has pension		-9,895.871	-14,727.409	-12,816.467		2,000.000	-39.188	-661.479		1,647.565	268.599	-153.718
		(8,523.627)	(7,989.421)	(8,825.748)		(1,118.612)	(2,129.841)	(1,107.338)		(1,350.176)	(1,570.093)	(1,637.515)
Young*Pension		**12,229.132**	**14,155.032**	**13,478.126**		**4,886.617**	**6,237.144**	**4,845.562**		**3,684.131**	**4,421.906**	**4,383.408**
		(11,323.758)	**(10,304.998)**	**(11,130.498)**		**(1,282.542)****	**(2,444.490)***	**(1,272.804)****		**(1,562.734)***	**(1,813.430)***	**(1,890.033)***
Husband black			-9,363.551	-4,046.618			-2,039.188	-178.680			-2,138.969	-1,975.167
			(5,012.271)	(5,147.707)			(2,067.775)	(1,087.196)			(1,494.719)	(1,552.004)
Husband hispanic			-21,884.450	-14,158.959			-7,968.092	-7,831.364			-7,448.204	-7,037.358
			(8,611.852)*	(9,052.596)			(2,189.340)**	(1,182.851)**			(1,685.539)**	(1,781.282)**
High-school husband			3,129.930	-3,331.329			5,928.904	4,161.788			5,136.367	5,283.787
			(5,971.746)	(6,702.440)			(1,803.552)**	(945.250)**			(1,373.905)**	(1,430.461)**
High-school wife			13,432.459	10,139.216			2,925.263	3,084.158			2,768.627	3,417.458
			(10,238.713)	(10,876.410)			(1,856.171)	(961.626)**			(1,374.732)*	(1,442.147)*
High-school both			3,169.180	1,980.287			-3,814.979	-1,959.553			-4,760.755	-5,931.171
			(11,344.515)	(11,403.460)			(2,490.935)	(1,284.063)			(1,863.863)*	(1,940.228)**
College husband			28,442.115	25,321.739			11,659.309	9,822.155			3,977.370	3,733.811
			(8,692.671)**	(8,985.464)**			(1,902.612)**	(992.255)**			(1,430.883)**	(1,489.322)*
College wife			-838.795	3,018.680			-1,149.473	-1,563.503			-1,430.924	-1,556.881
			(10,192.748)	(9,649.425)			(2,330.926)	(1,217.864)			(1,723.367)	(1,818.470)
College both			18,275.738	10,059.038			4,029.352	2,746.726			515.159	674.868
			(19,346.756)	(18,145.503)			(3,164.835)	(1,639.574)			(2,354.479)	(2,449.064)
Wife has pension				-12,774.010				84.218				-223.803
				(5,716.142)*				(715.171)				(1,097.241)
Age indicators	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Age difference controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Income variables	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
N	912	1714	1713	1700	912	1714	1713	1700	912	1714	1713	1700
R2	0.0281	0.0215	0.0967	0.1348								

		Young	Old
Insurance holdings:	Pension	52374.449	15188.989
(Average)	No Pension	50041.19	25084.86

		Young	Old
Insurance holdings:	Pension	20659.847	5000
(median)	No Pension	13773.23	3000

different statistical models were estimated: standard linear regression by OLS, median regression and a version of robust regression that uses biweight-weighting scheme to downweight outliers (Hamilton 1991). The latter two models are estimated to ensure that the results are not driven by small number of outliers. The results are presented in Tables 9 and 10.

The results for life insurance protection seem to imply that the law change increased by approximately \$5,000 (preferred median regression estimate).[38] The magnitude and significance of this estimate varies across different models, the OLS estimates being significantly larger but statistically non-significant and the robust regression results being smaller than those of the median regression.[39] The results from the median regressions are always statistically different from zero as are the results from the robust regressions when the model is estimated using both AHEAD Wave 1 and HRS 98. This result of increased life insurance protection is consistent with the Nash-bargaining model of household behavior and inconsistent with both the classical model and the "almost dictatorial model".[40]

insurance, but we do not know the face value of the plan. The results reported here don't use these observations. However, similar results were obtained by imputing the median of the positive life insurance values for the missing value. This suggest that the tendency not to report value of life insurance seems to be uncorrelated with the treatment variable $young * pension$.

[38] This would correspond roughly to 10 times the husband's median monthly pension.

[39] The fact that we find a positive results on the average life insurance holdings, but no effect on the probability of having life insurance is not consistent with the Nash-bargaining model if we take the point estimates to be the true values. This observation is not very damaging to the empirical validity of the Nash-bargaining model and could be just due to sample variation (remember that the point estimate for the effect on the probability of having life insurance is very imprecise). The Nash-bargaining model predicts that every household (with the potential exception of the approximately 7% of the households who changed their annuity choice) should increase their life insurance holdings. For many households the non-negativity constraint of life insurance holdings is binding in reality (this constraint was not taken into account in the model). It is possible that for many of them the change brought on by REA is small enough not to make them hold positive amounts of life insurance. For the households already holding life insurance, the Nash-model predicts that all of them should increase their life insurance holdings. Thus it should be easier to detect the change in the latter variable. In statistical terms this is similar as saying that converting life insurance holdings into a binary variable uses less efficiently the sample information available on the life insurance holdings, since the conversion discards relevant information.

[40] Some authors (e.g. Turner 1988) have argued that the increase in selection of joint annuities around 1985 was not caused by the requirements of Retirement Equity Act, but by the Supreme Courts Decision in 1983 to require the use of unisex life table in the calculation of the annuity payments from employer-provided pensions. For male pension

Table 10: Life insurance amount results using 1998 crossection (HRS)

	OLS D	OLS DD	OLS DD	OLS DD	Median reg D	Median reg DD	Median reg DD	Median reg DD	Robust Reg D	Robust Reg DD	Robust Reg DD	Robust Reg DD
Husband young	**28,202.546**	-585.300	n.a.	n.a.	**12,395.911**	6,886.617	n.a.	n.a.	**6,873.738**	2,195.847	n.a.	n.a.
	(6,760.103)**	(17,465.504)			**(2,954.140)****	(1,416.107)**			**(2,345.072)****	(1,822.806)		
Husband has pension		-26,454.586	-35,323.447	-33,756.858		1,377.323	-0.000	-745.529		3,714.970	2,542.788	1,878.060
		(17,180.202)	(18,878.829)	(18,557.501)		(1,797.494)	(1,925.219)	(3,209.627)		(2,294.503)	(2,573.848)	(2,618.758)
Young*Pension		**28,787.847**	**34,127.810**	**33,959.225**		**5,509.294**	**6,404.554**	**4,588.787**		**2,460.857**	**2,737.920**	**2,585.394**
		(18,728.290)	**(19,325.734)**	**(19,137.056)**		**(1,976.796)****	**(2,119.746)****	**(3,521.359)**		**(2,523.150)**	**(2,824.718)**	**(2,859.573)**
Husband black			-13,112.811	-5,652.229			-3,512.174	-1,861.604			-3,102.313	-2,432.792
			(5,943.428)*	(6,212.863)			(1,686.443)*	(2,777.350)			(2,091.742)	(2,124.104)
Husband hispanic			-25,189.170	-14,664.508			-7,644.145	-6,570.810			-8,719.416	-7,475.919
			(9,807.562)*	(10,414.785)			(1,683.434)**	(3,018.710)*			(2,291.073)**	(2,385.527)**
High-school husband			432.456	-7,784.032			5,509.293	4,559.857			7,194.872	6,964.499
			(6,634.096)	(7,730.620)			(1,400.115)**	(2,344.456)			(1,872.373)**	(1,905.172)**
High-school wife			11,236.829	6,402.499			6,129.090	4,269.108			4,844.650	4,970.961
			(13,325.993)	(14,219.194)			(1,457.242)**	(2,451.877)			(1,914.688)*	(1,963.913)*
High-school both			6,575.707	2,309.992			-619.796	-1,816.170			-6,217.093	-7,185.276
			(14,216.740)	(14,113.131)			(1,949.681)	(3,270.401)			(2,581.363)*	(2,624.747)**
College husband			30,126.298	24,455.865			16,527.882	14,831.021			3,278.478	2,498.609
			(8,961.092)**	(9,010.794)**			(1,489.923)**	(2,492.455)**			(1,978.258)	(2,015.114)
College wife			391.064	5,879.602			-5,991.357	-2,736.745			-2,350.724	-2,348.648
			(12,936.525)	(12,678.150)			(1,776.522)**	(3,017.036)			(2,331.768)	(2,412.538)
College both			21,403.354	11,679.094			1,239.591	-2,207.748			1,307.337	753.699
			(22,563.956)	(19,976.943)			(2,413.179)	(4,005.006)			(3,169.226)	(3,222.674)
Wife has pension				-13,949.524				1,570.228				-194.161
				(7,185.000)				(1,752.966)				(1,427.726)
Age indicators	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Age difference controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Income variables	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
N	814	1545	1545	1532	814	1545	1545	1532	814	1545	1545	1532
R2	0.01	0.005	0.0753	0.1325								

		Young	Old
Insurance holdings:	Pension	52374.4498	24171.9
(Average)	No Pension	50041.1898	50626.49

	Young	Old
Insurance holdings:	20659.851	8263.94
(median)	13773.234	6886.617

Similar results as in the previous section regarding the covariates hold for these regressions. Husband being Hispanic has a negative effect on the amount life insurance protection (approximately $7,000 less in the median regression case). This effect is significant across specifications .Now also having African-American husband is weakly related to less insurance coverage. In the preferred formulation, where the AHEAD Wave 1 is used for the older cohort, this effect is not statistically significant. When the pure cross section model from HRS 98 is estimated, the effect is significant. The magnitude of this effect varies across specifications in the median regression case from $100 less insurance to $3,500 less insurance coverage. As in the previous section, these results are consistent with the findings of Bernheim et al (1999).

The effect of education of the spouses on the amount of life insurance holdings is generally positive (although not all the coefficients estimated are significantly different from zero). In the preferred model (median regression with all the covariates, comparing between AHEAD Wave 1 and HRS 98), the point estimate for the effect of education is approximately $16,000 increase in the life insurance holdings when the comparison is between a couple where neither finished high school and a couple where both graduated college.

A general point about all the models estimated (survivor annuity choice, and the probability and the amount of life insurance) is that the covariates have surprisingly little effect on either the magnitude or the significance of the estimated program effect. This is evidence for the control strategy used here being successful, at least in the observable-characteristics-space, the differences (or differential trends) between control group and experimental group do not seem to be driving our results.

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participants this made joint life annuities relatively less expensive as compared with the single life annuity. However, the increase in life-insurance holdings would be hard to justify based on the unisex decision reasoning, since life insurance and survivor annuities are near-perfect substitutes. In a classical model of household behavior, if we assume that life insurance and survivor annuities are Hicksian substitutes, then life insurance holdings should go down when the price of survivor annuities goes down, unless the income effect dominates. Furthermore, the price shock for most pension plans was likely to be small since the unisex decision called for the use of unisex tables within each pension plan, so that the unisex table used could incorporate the gender composition of the risk pool in the calculation.

5 Conclusion

This paper presented a tractable Nash-bargaining model for household decision making over survivor protection. The model made two specific predictions regarding the effects of the Retirement Equity Act on the choices that households make: the selection of joint-annuities would increase, and, for most households, life-insurance holdings would increase. These predictions are in stark contrast with the predictions of the classical single-utility-function maximization model. Using several microdata sources it is shown the predictions of the Nash-bargaining model are confirmed. This constitutes a rejection of the single-utility maximization model of household behavior in this decision-making realm.

These results imply that the change in the selection of survivor annuities were not the only effect of the Retirement Equity Act. The increase in life-insurance holdings through the household bargaining mechanism, while increasing income security for widows, was neither foreseen nor intended by the legislation. In this, there is an important lesson for policy making that targets the resource allocation within a family. Because we do not yet fully understand the decision-making dynamics in the family, policies can have unanticipated effects due to the household decision-making process. The model and the empirical results presented here take the literature one step closer to understanding this process and its implications.

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Appendix: Results relating to the Nash-bargaining model

The bargaining solution maximizes (subject to the household budget constraint):

$$\left(u^f(c_1^f) + (1-p)v^f(c_2^f) + p\tilde{v}^f(\hat{c}_2^f) - h^f\right) * \\ \left(u^m(c_1^m) + (1-p)v^m(c_2^m) - h^m\right), \tag{4}$$

where h^f and h^m are the outside options of the wife and husband and c_1^f, c_2^f and $\hat{c}_2^f$ are respectively, first-period consumption, second-period consumption in the state where husband is alive, and second-period consumption in the wife's widowhood. In all proofs below we assume that utility functions are concave and twice differentiable and that there is some marital surplus to be shared in the optimum (so the outside options do not bind).[41]

Lemma 1 states an obvious feature of the Nash-bargaining solution.

Lemma 1. *Each agent's utility is increasing in his outside option and decreasing in his partner's outside option.*

Proof: Define the utility possibility frontier by $g^f = K(g^m)$, where g^f and g^m are the utility levels of the wife and husband respectively. Now the maximization can be written as

$$\max_{g^n}(K(g^m) - h^f)(g^m - h^m). \tag{5}$$

From the first order condition and from the fact that $K' \leq 0$ it follows that g^m is increasing in h^m and decreasing in h^f.

[41] The assumption that the family members' utility functions are of time-separable expected utility form is not crucial to the results. An alternative way to obtain the results of this appendix would be to assume that each partner has a general utility function over their own consumption (with no within family externalities) and to break down the process into two components: wealth sharing between spouses and individual utility maximization for given individual wealth share. The additional assumption needed is that the individual utility functions are such that the utility maximization for a single individual having same preferences generates demand functions that are increasing in lifetime wealth.

To save on notation we will introduce a notational device that also highlights the link between Nash-bargaining solution and the efficient-contracting solution by writing the problem in the general form (originally from Chiappori 1988a).

Lemma 2. *Any Nash-bargaining solution in which the outside options do not bind is also a solution to maximization of a weighted sum of utilities:*

$$\begin{aligned} & u^f(c_1^f) + (1-p)v^f(c_2^f) + p\tilde{v}^f(\hat{c}_2^f) + \\ & \lambda\left(u^m(c_1^m) + (1-p)v^m(c_2^m)\right), \end{aligned} \tag{6}$$

where

$$\lambda = \frac{g^m - h^m}{g^f - h^f} \tag{7}$$

and g^m and g^f are now the utility levels attained by the husband and wife in the Nash-bargaining solution.

Proof: The maximization of the Equation 6 has same first-order condition as the Nash-bargaining solution.

Lemma 3. *In the solution of maximization of Equation 6, the husband's utility is increasing in λ.*

Proof: Similar to the proof of Lemma 1.

Proposition 1. *REA increases the utility of wife and decreases the utility of husband.*

Proof: Since REA increases the wife's outside option and decreases the husband's outside option, the results follows from Lemma 1.

Since from Lemmas 1 and 3 it follows that increasing the wife's (husband's) outside option has qualitatively similar effect as a decrease (increase) of λ Proposition 2 will be proved using the weighted sum of utilities form of the problem.

Proposition 2. *REA increases the amount of money transferred to the survivor state (the sum of survivor annuities and life insurance) and increase*

the wife's private consumption in periods 1 and 2. The effect on savings is ambiguous.

Proof: Consider the maximization of Equation 6 subject to a budget constraint. The first-order conditions can be written as:

$$\begin{aligned} u^{f\prime} &= \frac{v^{f\prime}}{p(c_2)} \\ u^{f\prime} &= \frac{\hat{v}^{f\prime}}{p(\hat{c}_2)} \\ u^{f\prime} &= \lambda u^{m\prime} \\ u^{f\prime} &= \lambda \frac{v^{m\prime}}{p(c_2)}, \end{aligned} \tag{8}$$

where first-period consumption is the numeraire and the p function gives the price of each consumption good in terms of first-period consumption. For concave u and v functions and for an unchanged budget set, an decrease in λ will unambiguously increase c_1^f, c_2^f and $\hat{c}_2^f$ and also decrease c_1^m and c_2^m. The effect on savings (defined as resources not consumed during period 1) depends on the relative magnitudes of the second derivatives of u^f and u^m functions, since these quantities determine whether the wife's consumption in period 1 will increase by more than the husband's consumption in period 1 will decrease.[42]

Lemma 4: *A redistribution of wealth between spouses in the state where the negotiation breaks down can lead to changes in the allocation of total consumption that is either smaller or larger than the amount redistributed.*

Proof: As in lemma 1, write the optimization problem as

$$\max_{g^m}(K(g^m) - h^f((1-\alpha)W))(g^m - h^m(\alpha W)), \tag{9}$$

[42] An alternative way to prove the first part of Proposition 2, that also highlights the structure of the model considered here, is the following. Since the utility functions of the spouses are not interdependent and all the solutions considered are Pareto-efficient, we can consider the solution as a two-stage procedure, where in stage 1 the wealth is distributed within the family and in stage 2 both spouses make independently their consumption and investment decisions. Now the effect of the REA can be seen as a transfer of income to the wife. Given the additive separable structure of the individual utility functions, all the components of the individual demands are normal (increasing in wealth). Hence all the husband's demand components decrease (since husband gets less money) and all the wife's demand components increase.

where now the outside options are functions of the wealth-sharing rule of the household should the negotiation break down. Redistributing wealth towards the husband is an increase in α. Now it is clear that the comparative statics of g^m with respect to α depend (for a given utility possibility frontier) on the magnitude of the first derivatives of the h^f and h^m functions. The larger these derivatives are, the more g^m (and the consumption components of the husband) will respond. The response is zero if the derivatives are zero and increases without bound when the derivatives jointly go to infinity, so the magnitude of the effect of redistribution is not restricted by our assumptions.

Lemma 4 provides justification for the result that households which, due to the REA, changed their annuity selection, could also have increased the life-insurance holdings (so that provision of a given amount of survivor protection in the case of negotiation breakdown can lead to a larger increase of survivor protection in the optimum). With our assumptions, the effect of a small redistribution of the of outside options can have any size effect on the solution, from negligible to huge.

However, there exists a special case where we can derive stronger result than the ambiguity result of Lemma 4. Let g^m, g^f, h^m and h^f still be the utility levels, but now expressed as indirect utilities over wealth that the spouses command in the solution of the bargaining and in the negotiation-breakdown-case. Furthermore assume that $h^m(W^m) = g^m(W^m) - a^m$ and $h^f(W^f) = g^f(W^f) - a^f$, where a^m and a^f are just additive constant (additive utility of being in the cooperative marriage).[43] Now it is a relatively easy calculation to show that if $g^m(W^m) = W^m$ and $g^f(W^f) = W^f$, then a redistribution of \$1 in the outside option case leads to a redistribution of \$1 in the solution. Furthermore, since all demand components are normal, it leads to a change in every demand component that is less than \$1. Thus under this special case, the REA should decrease life insurance holdings for the households that change their annuity selection.

[43] The assumption that indirect utility function could be expressed as simply the wealth level is, as longs as we don't consider price changes, only an assumption about the right cardinalization of the preferences for the Nash-bargaining solution and not an assumption about the underlying preference structure over the different consumption goods.