NBER WORKING PAPER SERIES

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Working Paper No. 3063

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
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August 1989

We are grateful to the National Institute of Aging, grant #AG06380-02, for research support. We thank Jinyong Cai and Jagadeesh Gokhale for outstanding research assistance. This paper is part of NBER's research program in Aging. Any opinions expressed are those of the author not those of the National Bureau of Economic Research.

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ABSTRACT

This paper examines whether middle age American households purchase adequate amounts of life insurance. The analysis is based on SRI International's 1980, 1982, and 1984 surveys of the financial positions of American households. Our findings indicate that a significant minority of American wives are highly under-insured with respect to the possible deaths of their husbands. Under the assumption that actuarially fair annuities are available we find that just over 30 percent of wives are inadequately insured, by which we mean they would suffer a loss in their rate of sustainable consumption of at least 30 percent in the event of being widowed. If one assumes that annuities are not available the fraction of wives who are inadequately insured is 24 percent. These findings on inadequate life insurance are even more striking if one focuses on those households in which over half of the couple's present expected value of resources is dependent on the husband's survival. The fraction of wives in such households who are inadequately insured is 41 percent if one assumes fair annuities are available, and 31 percent if one assumes annuities are unavailable. The problem of inadequate insurance is even more significant among households of more modest means. Almost half of wives in such households who are in need of life insurance protection are inadequately insured, and this statement holds regardless of whether fair annuities are available. The results of this paper together with those of the related literature strongly suggest that raising the share of social security benefits that are paid to surviving spouses as well as increasing in employer-provided group life insurance could have a very considerable impact on the alleviation of poverty among widows, especially elderly widows.

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I. Introduction

In 1987, a total of 7.1 trillion dollars of life insurance (measured at face value) was held by U.S. households. Yet, despite this large aggregate figure, there remains the question of whether insurance purchases are appropriate to individual circumstances. The familiar adage that life insurance is "sold, not bought" suggests a certain lack of information on the part of households concerning the function of life insurance and the appropriate level of coverage. How well households meet their insurance needs is an extremely important policy issue for it influences not only the incidence of poverty among widows, particularly elderly widows, but also the efficacy of social insurance schemes aimed at alleviating such poverty. If poverty of widows is merely an extension of their poverty while married, then social insurance aimed at the general problem of poverty may be most appropriate. However, if poverty among widows is attributable to insufficient insurance purchases by deceased spouses, then survivor insurance is the more appropriate policy response.

This paper asks whether households act rationally in purchasing life insurance. It extends our earlier analysis of this issue (Auerbach and Kotlikoff, 1987) through the use of a considerably richer data set and by considering the possibility that annuities are unavailable or too expensive to warrant its purchase. The new data are SRI International's 1980, 1982, and 1984 surveys of the financial positions of American households. While our

previous results were limited to young elderly households whose heads ranged from 58 to 65 in age, the present paper considers younger households whose heads are between 35 and 55 years old. Younger households are likely to have a greater fraction of their remaining lifetime resources tied up in human wealth and, as a consequence, may be in greater need of life insurance.

The findings in this study reinforce our previous finding about the pervasive inadequacy of insurance coverage. Under the assumption that actuarially fair annuities are available we find that just over 30 percent of wives are inadequately insured, by which we mean they would suffer a loss in their rate of sustainable consumption of at least 30 percent in the event of being widowed. If one assumes that annuities are not available the fraction of wives who are inadequately insured is 24 percent. These findings on inadequate life insurance are even more striking if one focuses on those households where the husband has no employer-provided group coverage and where the wife is at risk; "at risk" refers to a situation in which over half of the couple's present expected value of resources is tied up in income streams contingent on the husband's survival. The fraction of such wives who are inadequately insured is 41 percent, if one assumes fair annuities are available, and 31 percent, if one assumes annuities are not available. This degree of under-insurance suggests irrational decision-making or, at a minimum, imperfectly informed decision making.

The new data set has some special information bearing on the failure of households to insure adequately. The data indicate the way in which life insurance is obtained (provision of group insurance through employers versus individual purchase) and the frequency with which individual life insurance policies are updated. These data can be used to determine whether provision by employers of life insurance affects the total level of coverage and the

diligence of individual households in determining how much insurance to purchase. We find that group coverage does positively affect the level of total coverage; households with group policies are somewhat more adequately insured than those without, although over 26 percent of households with group policies still have inadequate coverage. The fact that households with group coverage are somewhat better insured is not surprising since many at risk households without group coverage hold little or no insurance and/or have not updated their insurance coverage for several years.

The data on adjustment of individual life insurance policies is quite telling. Just over 60 percent of the sample of all husbands and 63 percent of those husbands with no group insurance report they have not changed their individual life insurance policies in the last 5 years. Given that the data cover a period of rapid inflation, this seems prima facie evidence against a view of rational insurance purchase.

The paper proceeds in the second section with a brief summary of the findings of our previous paper and a discussion of several related papers. Section III discusses our method for assessing the adequacy of life insurance assuming the availability of actuarially fair annuities as well as life insurance. Section IV indicates how the method for assessing the adequacy of life insurance needs to be modified if annuities are not available. Specifically, we use a dynamic programming algorithm to deal with the case that annuities are not available and present results both for the cases that annuities are and are not available. Section V describes the SRI data and the construction of key variables. Section VI presents our findings on the adequacy of insurance, and Section VII concludes the paper.

II. Literature Review

The literature bearing on the adequacy of life insurance is, to our knowledge, rather limited. It appears that each of the relevant studies has focused on the elderly, and each has used the Retirement History Survey. As a group these analyses support a conclusion that inadequate purchase of life insurance is an important explanation for the poverty of elderly widows.

As in this paper, Auerbach and Kotlikoff (1987) consider the adequacy of life insurance by examining changes in the affordable standards of living of hypothetical widows before and after the hypothetical deaths of their husbands. Auerbach and Kotlikoff also consider changes in living standards of actual widows. Their procedure involves comparing 1) the constant and equal consumption streams that could be guaranteed for both the husband and wife, when they are both alive, if the couple purchased the appropriate amount of life insurance with 2) the constant consumption stream that an actual or hypothetical surviving widow would be able to finance based on the resources she has or would have upon the actual or hypothetical death of her spouse. These comparisons indicated that a quarter of all actual and hypothetical elderly widows and almost one half of the subset of these women who are at risk are significantly under-insured for the death of their husband in the sense that their affordable consumption stream did or would decline by at least 25 percent.

In addition to examining in this manner the adequacy of life insurance holdings, Auerbach and Kotlikoff construct an econometric model of life insurance demand and test whether the purchase of life insurance, inadequate though it may be, is influenced by the determinants suggested by economic theory. For example, do couples with most of their resources tied up in income streams that are contingent on the husband's survival purchase more life insurance than couples for whom this is not the case? Econometric

analysis of the demand for life insurance produces many results that are strikingly at odds with theoretical predictions. One example is the prediction that couples should offset government provision of survivor insurance through social security by reducing their own holdings of life insurance dollar for dollar. In contrast to the theoretical one-for-one offset, Auerbach and Kotlikoff report essentially no private offset to government provision of survivor insurance.

A subsequent study by Hurd and Wise (1987) considers the high incidence of poverty among widows and asks whether a widow's poverty status arises as the direct result of the death of her husband. The authors show that this is definitely the case; they point out that while only 9 percent of their sample of couples (in which the husband subsequently dies) are poor, approximately 35 percent of subsequent widows in this sample are poor. One problem with the Hurd and Wise paper is that they compare poverty status based on income immediately before and immediately after the husband's death. As Burkhauser, Holden and Myers (1986) point out, surveys often incorrectly measure income in the year a spouse dies by ignoring the income received by the decedent spouse prior to that spouse's death. Indeed, according to Hurd and Wise the transition out of poverty of widows after their first year of reported poverty status is remarkably high. Hence, their analysis may overstate the number of widows who become impoverished through the death of a spouse.

In addition to examining changes in the incomes of new widows, Hurd and Wise compare the wealth of the couples in their sample with the wealth of the surviving widows from these couples. They point out that a large portion of the representative couple's wealth, including the present expected value of the husband's income stream, is lost when the husband dies. While this is true, it is to be expected and doesn't necessarily reflect inadequate holdings

of insurance; the reason is that when a family member dies the family's total expenditures ought also to fall. To pin down the inadequacy of insurance one needs to consider whether the wealth that remains after the husband dies is sufficient to maintain the widow's prior living standard - a calculation that Hurd and Wise fail to do. Notwithstanding this problem of interpretation, the Hurd and Wise data do convey a strong impression of inadequate life insurance holdings by many elderly couples.

Two papers by Holden, Burkhauser, and Myers (1986) and Myers, Burkhauser, and Holden (1986) that focus on the choice of pension survivor benefits also lend support for the view of inadequate life insurance protection for actual and potential widows. The two papers report that requiring all men with private pensions to choose a survivor benefit option rather than a single life annuity would have significantly mitigated the decline in living standards experienced by surviving widows whose deceased husbands were covered by private pensions.

Finally, Lewis (1989) considers the demand for life insurance, but only for 150 American households. His theoretical model collapses all future time periods into one period and fails to take into account the possibility that dependents, particular spouses, may die prior to the death of the household head. His empirical analysis depends on his particular assumptions about preferences, while our findings and the findings mentioned above are nonparametric, i.e., they are independent of the particular structure of preferences. Lewis reports that his model fits his data well, but it is difficult to compare our results with his because of differences in methodologies.

III. Assessing the Adequacy of Life Insurance when Annuities are Available

In this section we assume that households can purchase annuities at actuarially fair rates; the next section considers the case in which annuities are not available. The assumption that annuities are available and actuarially fair may seem unrealistic given that very few American households own private annuity policies. However, if one considers annuities that are provided in the form of private pensions, the fraction of American households with significant explicit private (non-social security) annuities rises to well over 50 percent. In addition, many, and perhaps, most American households may have implicit annuities provided in the form of insurance arrangements between themselves and their children. As Kotlikoff and Spivak (1981) point out, even a small number of children or other relatives can hedge almost all of the risk associated with outliving one's resources. Given the risk-sharing capacity of families and the fact that disproving such risk-sharing is quite difficult and has not occurred, the benchmark assumption of perfect annuity insurance seems well worth considering.

To determine whether household insurance purchases are adequate one must measure the extent to which insurance reduces the impact of resource changes associated with the death of a husband or wife. For example, consider a family in which only the husband works and assume the wife would not work if the husband dies. If the husband dies the consumable resources of the family will be reduced due to the loss of his future labor and the possible loss of pension income. They may also be reduced due to changes in the social security benefits to which the family is entitled. At the same time, the needs of the family will be lower, since the widow will require lower absolute expenditures to achieve the same standard of living previously enjoyed by the husband and wife. A simple test for the rationality of insurance coverage is to compare the increase in resources provided by insurance on the husband's

life (the difference between the face value and the cash value of all his life insurance) with the additional resources (beyond her earnings, pension benefits, social security benefits, and the couple's assets) his wife would need to sustain her current standard of living in the event of his death. We would expect husbands whose future labor income represents a significant fraction of the present expected value of family resources to hold substantial amounts of insurance. Wives in such families are clearly at risk in the sense that inadequate life insurance purchases means a considerable decline in their living standards in the event of their husbands' death.

The definition of living standard is, of course, somewhat arbitrary. In this paper, as in our earlier work, we define living standard as the sustained level of consumption of goods and services that can be guaranteed given the household's current assets and current and future labor income and net government transfers. Calculating this level both before and after the death of a spouse requires information on the couple's net worth, future labor earnings, private pensions, and social security benefits when both spouses are alive as well when one of the spouses is dead.

The size of consumption streams that can be financed from a given amount of resources depends on actuarial factors such as the interest rate, the extent to which annuities are available, mortality probabilities, and household economies of scale in joint consumption. Since many household goods and services are consumed jointly, "two can live cheaper than one." That is, a husband and wife may be able to enjoy the same standard of living at less than twice the cost of this standard to a single individual. The greater is the fraction of joint consumption, the greater the insurance needed to maintain a given standard of living of a single surviving spouse. In the extreme case in which all consumption is joint, it is necessary to insure

fully each spouse's survival-contingent income stream in order to maintain the surviving spouse's living standard. More generally, the necessary insurance level would equal the present expected value of this income stream less the reduction in necessary consumption spending occasioned by the individual's death.

Because we do not know precisely how much consumption is of the joint type, we present calculations based on the conservative assumption that no such economies of scale in consumption exist. This has the effect of understating (perhaps greatly) the degree of under-insurance, since we assume that, in event one spouse dies, family consumption spending can be cut in half without the surviving spouse suffering a decline in living standard.

The tables presented below that assume annuities are available compare pre- and post widowhood (widowerhood) standards of living, where standard of living is measured by the level annuity that could be financed with available resources. More precisely, we calculate the combined present expected value of resources of the couple before the hypothetical death of a spouse and compute the level annuity, A_m, that could be purchased for each spouse based on these resources and under the assumptions that annuities are actuarially fair and that each spouse receives an equal annuity. Next, we determine the annuity that could be afforded by the surviving spouse, A_s, based on the surviving spouse's present expected values of life insurance including the life insurance of the decedent spouse. The ratio of the second annuity to the first annuity, (A_s/A_m), which we refer to as the consumption ratio, is the measure used for the adequacy of insurance. We characterize insurance as inadequate only if this ratio is below .7.

The annuities are calculated in the following manner. Let PVR_m be the present expected value of resources a couple has when both members are alive. This variable equals:

$$(1) \qquad PVR_m = NW + PVE_h + PVE_w + PVB_h + PVB_w + PVS_h + PVS_w$$

In equation (1), NW stands for net worth, PVE for the present expected value of earnings of husband (h) and wife (w), PVB stands for the present expected value of each individual's social security and pension benefits, and PVS stands for the present expected value of each individual's survivor benefits, the additional social security and pension benefits received if the other spouse dies. NW includes the cash value of life insurance.

The effective term insurance amount, equal to the difference between face and cash values of life insurance, does not appear in (1) because the expression incorporates the assumption that insurance is actuarially fair. In this case, the present expected values of insurance proceeds and payments are equal and hence cancel in the expression.[1] Even though the insurance coverage does not appear directly in expression (1), the ability of households to purchase insurance is implicit in the conversion of future survival contingent earnings and benefit streams into components of total household wealth.

Each of the present expected values appearing in expression (1) is based on information regarding each household's earnings and social security benefits, the assumed interest rate, and age- and sex-specific mortality probabilities. The interest rates and mortality probabilities are also used to calculate the annuities that each household could purchase for its members with the present expected value of resources PVR_m. If D_h and D_w are discount factors for husband and wife based on these variables, the actuarially fair level annuity for each that could be funded by PVR_m is:

$$(2) \qquad A_m = PVR_m/(D_h + D_w)$$

Expression (2) tells us how much each husband and wife could receive annually if they used all their wealth to purchase equal annuities. However, families can not convert future earnings streams of one member directly into annuitized consumption for the other. It is here that life insurance plays a role by permitting households to transfer resources from states in which a member is alive to states in which he or she is not. The extent to which this will be necessary may be seen by calculating comparable annuities for the cases when either the husband or wife is assumed to die. Let

$$(3) \qquad PVR_s = NW + PVE_s + PVB_s + PVS_s + I_d$$

In this expression, the first four variables on the right hand side are as defined in expression (1). Here, however, they are calculated for spouse s assuming the spouse's mate d has died. This has no effect on the value of net worth, but it does change the present expected value of the earnings and benefit streams. For example, the present expected value of s's survivor benefits increases, since they are no longer contingent upon the other spouse's death. The present expected value of s's earnings and own social security and pension benefits may change, too, if the labor supply behavior of s depends on whether s is widowed. The final term in expression (3), I_d, is the effective term value (face less cash value) of life insurance received upon the death of d. Note that NW should be understood to include the cash value of life insurance.

As in expression (2), we may define the maximum level annuity that the surviving spouse s can purchase with PVR_s by:

(4) $A_s = PVR_s/D_s$

where D_s is the same annuity discount factor that appears in expression (2) for the spouse s, equal to D_h or D_w. Assume for the moment that I_d equals zero. Then if A_m exceeds A_s, we may infer that d's life must be insured in order to maintain a constant level of consumption for s (i.e, for A_s=A_m).

IV. Assessing Insurance Adequacy when Annuities are Not Available

In comparing the consumption annuities based on (2) and (4) we implicitly assume that households can convert their present expected resources, PVR_m and PVR_s, into annuities on actuarially fair terms. While life insurance purchases are commonplace, the market for private annuities is less well developed.[2] The lack of an annuity market or a close substitute would pose no problem with respect to our analysis if the husband and wife have all their resources tied up in equal and constant survival-contingent income streams. For such couples these income streams are equivalent to annuities, and our measured values of A_m and A_s would equal the true values, where "true" refers to what is feasible given the annuity market imperfection. On the other hand if the couple or surviving spouse has resources not contingent on survival (such as assets) A_m and A_s will be overstated relative to their true values. A_m will also be overstated even in the case that all resources are tied up in survival contingent streams if one of the spouse's survival contingent income stream exceeds that of the other. In this the case the couple effectively needs to transfer, through life insurance, a portion of one spouse's survival contingent stream (the one that is larger) into a nonsurvival contingent resource in order to secure an equal consumption stream for the spouse with the smaller income stream. Since the true values of both A_m and A_s may be

less than their measured values if annuity markets are imperfect, the measured ratio of A_s to A_m based on the assumption that fair annuities are available may under- or overstate the true ratio.

In the case that annuities are unavailable the constant and equal (for both spouses) lifetime consumption stream, A_m, that can be afforded for the couple must be calculated using dynamic programming. In contrast, the affordable consumption stream for the surviving spouse, A_s, in the absence of annuities can be calculated using the formula in (4), but taking the numerator in (4) to be the present value (discounting only by the interest rate) of the surviving spouse's resources and taking the denominator in (4) to be the present value (discounting only by the interest rate) discount factor.[3]

Our calculation of A_m when annuities are not available proceeds as follows. First we write, in equation (5), the budget constraining the size of the constant affordable consumption stream, denoted A_m, of the couple if they both live to their maximum length of life.

$$(5) \qquad W_0R^n + [e_{hl} + e_{wl} - 2A_m - \pi_{hl}L_{hl} - \pi_{wl}L_{wl}]R^{n-1} + \ldots$$
$$+ [e_{hn-1} + e_{wn-1} - 2A_m - \pi_{hn-1}L_{hn-1} - \pi_{wn-1}L_{wn-1}]R + [e_{hn} + e_{wn} - 2A_m] = 0$$

In (5) W_0 is the couple's initial (referenced as time zero) wealth, n stands for the maximum number of years during which at least one of the spouses could be alive, R stands for one plus the interest rate, e_{hi} and e_{wi} stand, respectively, for the non-asset incomes of husbands and wives in period i, π_{hi} and π_{wi} are the respective period i life insurance premiums per dollar of face value of life insurance, and L_{hi} and L_{wi} are the period i face values of term (one period) life insurance purchased on the husband's and wife's lives respectively. The e_{hi} and e_{wi} should be understood to include social security retirement and dependent benefits as well as labor earnings.

To use (5) to help calculate L_{hn-1}, the husband's purchase of life insurance at time n-1, we note that the couple will only purchase life insurance on the husband's life (make L_{hn-1} positive) if the wife is also alive at n-1. If the wife is alive at n-1, the couple will set L_{hn-1} (assuming it is positive) such that if the husband dies the wife can afford to consume A_m in period n, thus:

$$(6) \qquad W_0R^n + [e_{h1} + e_{w1} - 2A_m - \pi_{h1}L_{h1} - \pi_{w1}L_{w1}]R^{n-1} + \ldots$$
$$+ [e_{hn-1} + e_{wn-1} - 2A_m - \pi_{hn-1}L_{hn-1} - \pi_{wn-1}L_{wn-1}]R + [e_{wn} + L_{hn-1} + S_{wn} - A_m] = 0$$

In (6) S_{wn} is the additional social security survivor benefit (above and beyond the wife's social security retirement benefit or dependent benefit) available to the wife at time n if the husband dies prior to time n.[4] Subtracting (6) from (5) yields:

$$(7) \qquad L_{hn-1} = e_{hn} - A_m - S_{wn}$$

The corresponding equation for L_{wn-1} is:

$$(8) \qquad L_{wn-1} = e_{wn} - A_m - S_{hn}$$

Now consider the possibility that the husband dies at the end of period n-2 and the wife is alive after n-2. To insure that the surviving wife can continue to consume A_m if this occurs the couple must choose L_{hn-2} and L_{wn-2} as well as their life insurance purchases prior to n-2 to satisfy:

$$(9) \qquad W_0R^n + [e_{h1} + e_{w1} - 2A_m - \pi_{h1}L_{h1} - \pi_{w1}L_{w1}]R^{n-1} + \ldots$$
$$+ [e_{hn-2} + e_{wn-2} - 2A_m - \pi_{hn-2}L_{hn-2} - \pi_{wn-2}L_{wn-2}]R^2 + [e_{wn-1} + L_{hn-2} + S_{wn-1} - A_m]R$$
$$+ [e_{wn} + S_{wn} - A_m] = 0$$

If we subtract (9) from (6) and subtract the analogous equations for the case the wife dies prior to the husband we find:

$$(10) \qquad L_{hn-2} = (R^{-1}-\pi_{hn-1})L_{hn-1} - \pi_{wn-1}L_{wn-1} + e_{hn-1} - S_{wn-1} - A_m$$

$$L_{wn-2} = (R^{-1}-\pi_{wn-1})L_{hn-1} - \pi_{hn-1}L_{hn-1} + e_{wn-1} - S_{hn-1} - A_m$$

Together with (7) and (8), the equations in (10) suggest a dynamic programming algorithm for solving for A_m when annuities are not available. The algorithm starts by choosing a guess for the value of A_m. Given this guess and our estimated values of non-asset income and survivor benefit streams, we use equations (7) and (8) to determine the period n-1 purchase of life insurance assuming the derived values of L_{hn-1} and L_{wn-1} are nonnegative. If either or both of the derived values are negative we have a situation in which the couple would like to purchase one or more annuities. In this case we set the values of L_{hn-1} and\or L_{wn-1} equal to zero; i.e., when a derived demand for life insurance is negative we constrain its purchase to be zero.

Given the nonnegative values of L_{hn-1} and L_{wn-1} we calculate nonnegative values of L_{hn-2} and L_{wn-2} using (10) and the rule that any negative derived demand for life insurance is set to zero. Since the first order difference equations (10) relating life insurance in two adjacent periods holds for any two periods we can use (10) to calculate nonnegative values of life insurance for the husband and wife at each period between zero and n. However, these calculated values of the time paths of life insurance purchases depend on the guess of A_m, and the initial guess of A_m may not satisfy the budget constraint given in (5). Hence, we insert into (5) the calculated paths of life insurance purchases based on the initial guess of A_m and use the resulting equation to solve for a new value of A_m. We take as our second guess of A_m a

weighted average of the first guess and this value and procedure to calculate a second time path of life insurance purchases. We continue with this Guass-Seidel iteration until the guessed value of A_m equals the calculated value of A_m, i.e. until we reach a fixed point. In implementing this algorithm we assume that life insurance can be purchased on an actuarially fair basis, hence we set π_{hi} and π_{wi} equal to R^{-1} times the respective probabilities of the husband and wife dying in period i conditional on surviving through period i-1.

V . Data

Sample Selection

Our data come from three waves of the Survey of Consumer Financial Decisions conducted by SRI International. The surveys were conducted in 1980, 1982 and 1984, and are attractive because of the detailed information on assets and insurance and the oversampling of wealthy households. While there is some overlap among households covered by the three cross sections, there are few families for which usable records are available for more than one year. Therefore, our analysis simply pools the observations from the three waves of the survey. All variables are measured in constant 1985 dollars.

We consider only families in which both husband and wife are present in the household, the husband is working, and in which the husband is age 35 to 55. Given the method of reporting household income data, several records had to be eliminated due to our inability to distinguish between husband's and wife's labor income. The labor incomes of the husband and the wife are not separately reported in the surveys. Rather the surveys report total labor income and the share of total (labor plus nonlabor) income received by the husband, wife, and others. In selecting the sample we eliminate records in

which the income shares do not add up to 100 percent. We also delete observations in which the head's labor income is $5000 or less.

These sample selection criteria leave a total of 1243 observations: 447 from 1980, 439 from 1982 and 357 from 1984. Before turning to our results we briefly review the construction of variables needed to calculate the present expected values in expressions (1) and (3) and the consumption annuities in (2) and (4).

Net Worth

The SRI data include a fairly completed list of assets and liabilities. The asset data include the market values of ownership of businesses, real estate (including one's home), stocks, bonds, money market funds, checking and savings accounts, business enterprises, and annuities IRA/Keogh accounts, value of autos, RVs, boats, planes and tangible assets, employer-provided pension plans (available only for 1980 and 1982), and the cash value of life insurance. The liabilities include real estate mortgages, other home related loans, loans for autos, RVs, boats, planes, investment secured loans, all unsecured and other loans, borrowing on lines of credit, cash value loans, and credit card balances.

Present Expected Value of Earnings

Unfortunately the surveys report only current labor earnings. For our base case we assume that future earnings through age 65 (the assumed retirement age) equal current earnings adjusted for growth for both husbands and wives; hence, wives who are not working at the time of the survey are assigned human wealth of zero in the base case. As this assumption may bias our findings toward insurance inadequacy, we also consider alternative

assumptions concerning wives' future earnings. The assumed rate of growth of real earnings is zero percent. This assumption of a zero growth rate of real earnings biases our results toward a finding of greater insurance adequacy. To form the present expected value of human wealth for both the husband and wife we discount future real earnings streams at a 5 percent real rate of interest and apply the sex-specific mortality probabilities reported in Faber and Wade (1983).

The projection of future earnings based on current earnings may, of course, under- or overstate the individuals' true present expected value of earnings. The implication of this measurement problem for assessing insurance adequacy is particularly acute for wives who report they are not working at the time of the interview. Such wives may normally be in the labor force or may actively be engaged in unmeasured but valuable home production at the time of the survey. Alternatively, such wives may intend to work in the future if their husbands died. In either case, our estimate of the annuity ratio for hypothetical widows will overstate the problem of inadequate insurance. Hence, in addition to the base case, we consider two other assumptions about the future earnings of wives who report zero earnings. The first is that wives with zero reported earnings earn in each year in the future an amount equal to the earnings level predicted by a regression relating the earnings of working wives to their characteristics.[5] The second is that wives with zero reported earnings earn zero while their husbands are alive, but go to work if their husband dies earning the amount predicted by the working wives' earnings regression.

Pensions

Unfortunately, there is very limited information in the survey concerning private pensions and what information is available is available only for 1980

and 1982. For these years the questionnaire contains information on the value of employer pension plans, which we include in our measure of net worth for those years. These data appear to understate the amount of pension wealth. Since most pensions during this period did not offer automatic joint survivor benefits this understatement of pension wealth is likely to understate the need for life insurance by understating the resources lost upon a husband's death.

Taxes

In calculating the present expected values of the husband's and wife's future labor earnings, we reduced the projected stream of annual labor earnings by 20 percent. While this is a crude calculation it appears to be in the right order of magnitude for at least middle income households. The 20 percent figure, by the way, is meant to include both average federal income taxes, average employee social security taxes, and average state and local taxes. The 20 percent figure may be a bit high for low income (relative to our data) households, but if so, this will, by reducing the size of human wealth, lead to an overstatement of insurance adequacy for such households. For higher income households the simple 20 percent average tax rate adjustment may lead to a small overstatement of insurance inadequacy. Given that the problem of inadequate life insurance is most severe for poorer households this assumption appears to bias the findings toward greater insurance adequacy.

Present Expected Value of Social Security Benefits

The construction of social security wealth is based on projected past as well as future earnings streams of the husband and wife. Given these earnings streams we followed Social Security law as amended in 1983 in determining the

amount of retirement, dependent, and survivor benefits available to each spouse under each mortality contingency of the husband and wife. Each individual's future Social Security benefit is determined based on the individual's projected future and past earnings. The projected past earnings are determined by taking current earnings and reducing them in real terms according to the historical rate of growth of real compensation per hour in the business sector reported in The Economic Report of the President 1987.

Our procedure for computing social security wealth takes into account that each spouse's completed earnings history will depend on that spouse's date of death. This is important for computing the present expected value of survivor benefits when both members of the couple are still alive; for example, the survivor benefit available to a surviving wife at say age 66 will be based on a short earnings history if the husband died at a young age and a long earnings history if the husband died in his 60s. Our method of calculating survivor benefits properly adjusts for the probability that a spouse will die at an early age and, as a result, have a short earnings history.

Insurance

All three of the SRI surveys ask about the husband's and wife's individual insurance and the husband's group insurance. However, only the 1982 and 1984 surveys report the wife's group insurance.

VI. Findings

Characteristics of the Data

We begin with a table that provides an overall picture of the composition of household resources in the sample. Each column in Table 1 provides a

percentage breakdown of the resource variable PVR_m for families in a particular wealth range, starting in the first column with those families having between 100 thousand and 250 thousand dollars of total wealth[6] (4 percent of the sample) through those having between 250 and 500 thousand dollars of wealth (29 percent of the sample), between 500 thousand and 750 thousand (36 percent of the sample), between 750 thousand and 1 million dollars (18 percent of the sample) and more than 1 million dollars (13 percent). The table also displays for each wealth class the average face values of insurance for husbands. The face value of insurance coverage is not a component of a couple's overall wealth, PVR_m. We provide the insurance numbers to offer some initial insight into the patterns of insurance coverage and adequacy.

The table indicates several patterns regarding the composition of resources. First, the fraction of resources accounted for by net worth increases with total resources, rising from 10 percent for those with total resources of 100–250 thousand to 33 percent for those with resources above 1 million. Second, the fraction of total PVR_m accounted for by wives' human wealth also increases through the first four categories. The sum of these two components increases throughout, from 17 percent for the lowest resource group to 43 percent for the highest. Since these are the two major components of resources that do not decline when a husband dies, there is clearly a greater need for insurance to protect wives' consumption at lower wealth levels. An examination of insurance coverage, however, does not reflect this greater need. While husbands' human wealth accounts for 55 percent of family resources for the lowest resource group, declining to 50 percent for the highest resource group, the ratio of husbands' insurance to overall resources is 8 percent for the first group and 14 percent for the latter. Note that for

the lowest resource group only 15 percent of the husband's human wealth is insured on average. The corresponding figure for the highest resource group is 28 percent.

Table 2 presents the distribution of observations by age and PVR_m category. Among younger households, whose heads are age 35 to 39, insurance on the husband as a percentage of PVR_m is similar to that for the entire sample except for the lowest PVR_m class. For the five different PVR_m classes starting with the lowest, husbands' life insurance is 10 percent, 9 percent, 9 percent, 11 percent, and 17 percent of PVR_m. The corresponding percentages for the subsample age 50 to 55 are 5 percent, 8 percent, 9 percent, 11 percent, and 15 percent.

Table 2 also indicates the fraction of households in each cell who are at risk, where at risk means that over half of the household's PVR_m consists of income flows that are contingent on the husband's survival. Finally, it reports the fraction of households with positive life insurance on the husband's life. The table indicates that most (74% for the entire sample) households are at risk, and most (86% for the entire sample) have insurance on the husband's life. Among households falling in the lowest three PVR_m ranges the cell fraction at risk often exceeds the cell fraction with insurance on the husband.

Analysis of Insurance Adequacy

Hypothetical Widows Assuming Annuities are Available

In Table 3 we assume the availability of actuarially fair annuities and present consumption ratios for hypothetical widows under the base case assumption that future earnings equal current earnings adjusted for growth. A total of 15 percent of the potential widows have an annuity ratio (A_s/A_m) of

less than .5; 30 percent have a ratio below .7. Inadequate insurance holdings is more prevalent among the lower PVR_m groups. Of the 410 hypothetical widows from households with PVR_m less than $500,000, 19 percent have consumption ratios below .5, and 38 percent have ratios below .7. In contrast only 6 percent of the potential widows in the highest PVR_m have a ratio less than .5, and only 17 percent have ratios below .7.

The degree of measured insurance inadequacy depends on our estimate of the future earnings of nonworking wives. Table 4 shows the implications for the distribution of consumption ratios of assuming that wives with no reported earnings earn an amount predicted by an earnings regression both 1) when the husband is alive and when he is dead and 2) only after he is dead. Under the first alternative assumption (all wives always work) the percentage of widows with ratios below .7 drops from 30 percent in the base case to 19 percent. Under the second assumption (all widows work) the percentage below .7 totals 16 percent. While substantially smaller than the base case numbers, these figures still suggest an important minority of hypothetical widows are underinsured.

Tables 5 and 6 repeat Tables 3 and 4, but for 888 of the 1243 (71 percent) women who are at risk. Under the base case earnings assumption 20 percent of women at risk have consumption ratios below .5; 41 percent have ratios below .7. These figures can be compared with the 15 percent and 30 percent, the corresponding percentages for the entire sample in the base case. If one assumes that nonworking wives always work upon the deaths of their husbands, the fraction of wives with ratios below .5 drops from 20 percent to 6 percent, and the fraction below .7 drops from 41 percent to 23 percent.

In constrast to the earlier tables, Tables 5 and 6 seem more relevant to the issue of adequacy because they focus on those couples who have the

potential to make the mistake of underinsuring. But some of those couples at risk may not be making a voluntary decision about purchasing life insurance because their employers are providing them with life insurance. The subsample who permit the clearest test of rational insurance choice is, therefore, households in which wives are at risk, but which have no employer-provided group life insurance. Table 7 repeats Table 6 for this subsample of 382 observations. The results are striking. The base case fraction of wives with consumption ratios below .5 is 26 percent; the fraction with ratios below .7 is 51 percent. In other words, slightly more than half of households who need insurance and are not forced to hold insurance by their employers are inadequately insured. The fraction of this sample that is inadequately insured remains quite large even under the assumption that widows return to work; in this case 31 percent of the 382 wives have consumption ratios below .7.

Consumption Ratios of Hypothetical Widows When Annuities are Unavailable

Table 8 analyzes insurance adequacy when annuities are unavailable. The calculations are based on the dynamic programming algorithm of Section IV. Table 8 should be compared with Table 3; while Table 3, which assumes annuities are available, reports that 15 percent of wives have consumption ratios under .5 and 30 percent have consumption ratios under .7, the respective figures in Table 8 are 11 percent and 24 percent. Table 9 also assumes annuities are unavailable, but considers wives who are at risk. This table should be compared with Table 5. In Table 5, 20 percent of wives have consumption ratios below .5, and 41 percent have ratios below .7. The corresponding figures in Table 9 are 15 percent and 31 percent. Hence, the assumption that annuities are unavailable mitigates somewhat the picture of

insurance inadequacy, but even if one assumes that annuities, both explicit and implicit, are completely unavailable almost a third of wives who need insurance are inadequately insured. The picture of inadequate protection is particularly clear for poorer wives. According to either Tables 5 and 9 almost half of wives at risk who fall in the lowest two resource categories have consumption ratios below .7.

Hypothetical Widowers

In Table 10 we again assume that actuarially fair annuities are available and present the base case consumption ratios for the complete sample of hypothetical widowers based on the 1982 and 1984 surveys. Recall that the 1980 survey fails to ask about the wife's group insurance. Hence, there are only 796 observations, which corresponds to the entire sample of 1243 observations less the 447 observations for 1980. The results in Table 10 are also quite striking. Almost 90 percent of hypothetical widowers have consumption ratios above 1.25. Clearly, there is no evidence of inadequate insurance for this sample of husbands. Quite the contrary; the evidence indicates that despite the advances of females in the labor market, husbands remain the principal earners. While these numbers are sensitive to the assumption of whether or not currently nonworking wives work in the future, even if one imputes earnings for wives who report no earnings and assumes wives always work, the fraction of husbands with consumption ratios below .7 is less than 1 percent. This assumption does, however, significantly reduce the fraction of husbands whose ratio exceeds 1.75.

Adjustment of Individual Life Insurance Policies

Table 11 reports by age and PVR_m the fraction of the complete sample of husbands who report changing their individual life insurance policies within

the last five years. It also reports the fraction of recent adjusters for the subsample that does not have group insurance. In total only 40 percent of the sample reported altering their individual life insurance policies within the last five years. For middle age men between 45 and 54 the fraction is even smaller - less than 30 percent. The data suggest that people purchase their insurance in their 30s and then fail to adjust their holdings for quite a while. Given that the data cover a period during and immediately following a rapid inflation, these figures are even more surprising.

Those with group insurance may not need to adjust their insurance as often as those without group insurance. The extent of adjustment for the subsample of men who do not report group insurance is only marginally larger. Of the 542 men who do not have group insurance only 46 percent report changing their coverage within the last 5 years.

OLS and Probit Estimation

Table 12 reports OLS and Probit regressions that "explain" who holds inadequate amounts of insurance. We use the word "explain" cautiously because some of the variables in these regressions, such as the group insurance dummies, are, arguably, endogenous. The dependent variable in the OLS is the wife's annuity ratio defined using current earnings and assuming fair annuities are available. The probability at issue in the Probit is the probability that the wife's annuity ratio is less than .70. The regressions include dummies for education, sex, the husband's occupation, and the wife's working status. They also include the ages of the husband and wife and the level of PVR_m.

There are a number of significant regressors in the OLS regression. The dummy for working wife suggests that the fact that a wife works raises,

ceteris paribus, her annuity ratio by almost .33. The variable WRAT that captures the ratio of the household's net worth to its PVR_m indicates that increasing the net worth share by .10 would raise the annuity ratio for the surviving wife by .14. The education dummies indicate that less educated households are somewhat less adequately insured than better educated households. Households with only group insurance or with some group insurance have larger consumption ratios; however, the size of the group dummies is not overwhelming. The fact that the group insurance dummy for those households with both group and nongroup insurance is significant suggests, in and of itself, that such households are not adjusting their insurance optimally at the margin. If they were, they would fully offset the provision of group insurance by their employer dollar for dollar by reducing their own positive purchase of individual life insurance. In this regard it is worth pointing out that of the 672 households reporting group insurance, 196 have only group insurance.

Surprisingly, nonwhite wives are more adequately insured than are white wives. This may reflect a more equal division of labor income within nonwhite households. Also surprising is the finding that those with more young children are less adequately insured than those with fewer children. Compared to the omitted group, households in which the husband is either a blue or white collar worker have less adequate consumption ratios. Finally, the effects of age of the husband and wife on the adequacy of insurance coverage are small.

Table 13 uses Probits to evaluate the affect of changes in the exogenous variables on the probability that insurance coverage is inadequate (defined here to be an A_s/A_m for the wife less than either .7 or less than .5). The table takes as its base case a couple in which 1) the wife's and husband's

ages and PVR_m equal the averages in the sample, 2) the wife works, 3) the wife's education is that of a high school graduate, 4) the husband's education is that of a high school graduate, 5) the husband is a blue collar worker, and 6) the couple is white. The table indicates in the first row the probability of underinsurance for households with these characteristics and then considers changes in each of these characteristics holding the other characteristics fixed. The table can easily be used to read off the effect of changes in explanatory variables on the probability of underinsurance.

Changes in the wife's work status clearly has a very large effect on the probability of underinsurance; the switch from working to nonworking status raises the probability that the annuity ratio is less than .7 from 21 percent to 71 percent. Other variables have less dramatic, but predictable effects on the probability of underinsurance. For example, if the wife has less than a full high school education, she is more likely (by almost 3 percentage points) to be underinsured.

VII. Conclusion

The findings in this paper suggest that somewhere between 30 and 40 percent of middle age American wives in need of life insurance protection are quite poorly insured. While this estimate may be biased upward because of errors in forecasting the earnings and remarriage potential of wives, it is biased downward because of the lack of adjustment for the economies of scale in shared living associated with marriage (two can live cheaper than one). Two additional reasons that the estimate may be biased downward are first, that we have made no adjustment for the consumption requirements of young children, and second, that we have excluded, because of the lack of data, most pension benefits. On balance, we believe our estimate of insurance inadequacy

understates the problem of inadequate life insurance holdings of American households. In addition, our estimate is an average across wealthy households and those of more modest means. For lower income households our estimate is that almost half of those wives in need of life insurance protection are inadequately insured.

The results of this paper together with those of our previous study and the related literature strongly suggest that increased levels of social security survivor insurance as well as increases in employer-provided group life insurance could have a very considerable impact on the alleviation of poverty among widows, especially elderly widows.

*Table 1 The Size and Composition of Resources and Insurance by PVR Class**

	PVR_m CLASS				
Variable	100K-250K	250K-500K	500K-750K	750K-1 MIL.K	1 MIL.K +
PVR_m					
average	205K	393K	614K	852K	1,522K
% of PVR_m	100%	100%	100%	100%	100%
HWH					
average	112K	211K	330K	446K	754K
% of PVR_m	55%	54%	54%	52%	50%
HWW					
average	14K	43K	96K	147K	154K
% of PVR_m	7%	11%	15%	17%	10%
SSWH					
average	31K	43K	49K	52K	53K
% of PVR_m	15%	11%	8%	6%	4%
SSWW					
average	27K	40K	50K	55K	56K
% of PVR_m	8%	7%	5%	4%	2%
NW					
average	21K	56K	91K	152K	505K
% of PVR_m	10%	14%	15%	18%	33%
IH					
average	17K	32K	57K	88K	212K
% of PVR_m	8%	8%	9%	10%	14

* Percentages may not sum to 100% due to rounding.
K stands for thousands of dollars.
PVR_m stands for the present expected value of the couple's resources.
HWH stands for the human wealth (present expected earnings) of the husband.
HWW stands for the human wealth (present expected earnings) of the wife.
SSWH stands for the social security wealth of the husband when both spouses are alive.
SSWW stands for the social security wealth of the wife when both spouses are alive.
NW stands for the couple's net worth.
IH stands for the face value of life insurance on the husband's life.

Table 2
Percentage at Risk and Percentage with Life Insurance by PVR_m and Age

	PVR_m CLASS					
Age Group	100K-250K	250K-500K	500K-750K	750K-1MIL.K	1 MIL.K +	Total
35-39						
# of obs.	17	92	126	82	48	365
% at risk	94%	86%	91%	68%	65%	81%
% with IH	76%	83%	85%	87%	98%	86%
40-44						
# of obs.	13	64	120	63	42	302
% at risk	69%	83%	81%	71%	64%	76%
% with IH	69%	75%	86%	90%	98%	85%
45-49						
# of obs.	8	91	98	46	34	277
% at risk	100%	89%	68%	63%	53%	73%
% with IH	50%	84%	91%	78%	88%	85%
50-55						
# of obs.	11	114	98	40	36	299
% at risk	81%	84%	57%	52%	50%	62%
% with IH	81%	86%	83%	100%	94%	89%
Total						
# of obs.	49	361	442	231	160	1243
% at risk	86%	81%	76%	65%	59%	74%
% with IH	71%	83%	86%	88%	95%	86%

PVR_m stands for the present expected value of the couple's resources.
IH stands for the face value of life insurance on the husband's life.

*Table 3**
Consumption Ratios for Wives using Current Earnings

	PVR_m CLASS					
A_s/A_m	100K-250K	250K-500K	500K-750K	750K-1 MIl.K	1 MIL.K +	Total
<.10						
# of obs.	0	1	0	0	0	1
col. %	0%	.3%	0%	0%	0%	0%
.10 to .20						
# of obs.	2	3	3	1	2	11
col. %	4%	1%	1%	0%	1%	1%
.20 to .30						
# of obs.	1	9	5	3	1	19
col. %	2%	2%	1%	1%	1%	2%
.30 to .40						
# of obs.	4	22	24	10	3	63
col. %	8%	6%	5%	4%	2%	5%
.40 to .50						
# of obs.	8	28	34	13	4	87
col. %	16%	8%	8%	6%	3%	7%
.50 to .60						
# of obs.	7	24	34	8	4	77
col. %	14%	7%	8%	3%	3%	6%
.60 to .70						
# of obs.	6	43	38	19	13	119
col. %	12%	12%	9%	8%	8%	10%
.70 to 1.00						
# of obs.	8	126	139	62	32	367
col. %	16%	35%	31%	27%	20%	30%
1.00 to 1.25						
# of obs.	8	68	113	70	41	300
col. %	16%	19%	26%	30%	26%	24%
1.25 +						
# of obs.	5	37	52	45	60	199
col. %	10%	10%	12%	19%	38%	16%
Total	49	361	442	231	160	1243

* Percentages may not sum to 100% due to rounding.
PVR_m stands for the present expected value of the couple's resources.

Table 4

Consumption Ratios for Wives under Alternative Earnings Assumptions

	Earnings Definition		
A_s/A_m	Base Case	All Wives always Work	All Widows Work
% <.50	15%	5%	4%
% .50-.70	16%	14%	12%
% .70-1.00	30%	36%	33%
% 1.00-1.25	24%	26%	29%
% 1.25+	16%	17%	22%

*Table 5**
*Consumption Ratios for Wives at Risk using Current Earnings**

	PVR_m CLASS					
A_s/A_m	100K-250K	250K-500K	500K-750K	750K-1 MIL.K	1 MIL.K +	Total
<.10						
# of obs.	0	1	0	0	0	1
col. %	0%	0%	0%	0%	0%	0%
.10 to .20						
# of obs.	2	3	3	1	2	11
col. %	6%	1%	1%	1%	2%	1%
.20 to .30						
# of obs.	1	9	5	3	1	19
col. %	3%	3%	2%	2%	1%	2%
.30 to .40						
# of obs.	3	22	24	10	3	62
col. %	9%	8%	7%	7%	3%	7%
.40 to .50						
# of obs.	8	28	34	13	4	87
col. %	25%	10%	10%	9%	4%	10%
.50 to .60						
# of obs.	5	24	34	8	4	75
col. %	16%	8%	10%	5%	4%	8%
.60 to .70						
# of obs.	2	41	38	19	13	113
col. %	6%	14%	12%	13%	14%	13%
.70 to 1.00						
# of obs.	5	117	132	59	30	343
col. %	16%	41%	40%	39%	33%	39%
1.00 to 1.25						
# of obs.	2	31	48	28	19	128
col. %	6%	11%	15%	19%	21%	14%
1.25 +						
# of obs.	4	9	11	10	15	49
col. %	13%	3%	3%	7%	16%	6%
Total	32	285	329	151	91	888

* Percentages may not sum to 100% due to rounding.

Table 6

Consumption Ratios for Wives at Risk
under Alternative Earnings Assumptions

	Earnings Definition		
A_s/A_m	Base Case	All Wives always Work	All Widows Work
% <.50	20%	7%	6%
% .50-.70	21%	21%	17%
% .70-1.00	39%	48%	45%
% 1.00-1.25	14%	17%	22%
% 1.25+	6%	6%	11%

Table 7

Consumption Ratios for Wives at Risk with no Group Insurance on Husband under Alternative Earnings Assumptions

	Earnings Definition		
A_s/A_m	Base Case	All Wives always Work	All Widows Work
<.50	26%	11%	8%
.50–.70	25%	28%	23%
.70–1.00	35%	46%	46%
1.00–1.25	10%	11%	17%
1.25+	3%	3%	5%

*Table 8** *Consumption Ratios for Wives Assuming Annuities are Unavailable and Base Case Earnings*

	PVR_m CLASS					
A_s/A_m	100K-250K	250K-500K	500K-750K	750K-1 MIl.K	1 MIL.K +	Total
<.10						
# of obs.	0	1	0	0	0	1
col. %	0%	.3%	0%	0%	0%	.1%
.10 to .20						
# of obs.	3	5	3	0	0	11
col. %	6%	1%	1%	0%	0%	1%
.20 to .30						
# of obs.	5	6	2	0	0	13
col. %	10%	2%	.5%	0%	0%	1%
.30 to .40						
# of obs.	6	21	14	3	1	45
col. %	12%	6%	3%	1%	1%	4%
.40 to .50						
# of obs.	9	25	30	7	0	71
col. %	18%	7%	7%	3%	0%	6%
.50 to .60						
# of obs.	6	42	25	8	1	82
col. %	12%	12%	6%	3%	1%	7%
.60 to .70						
# of obs.	5	30	31	10	1	77
col. %	10%	8%	7%	4%	1%	6%
.70 to 1.00						
# of obs.	7	79	125	50	8	269
col. %	14%	22%	28%	22%	5%	22%
1.00 to 1.25						
# of obs.	2	68	63	51	17	201
col. %	4%	19%	14%	22%	11%	16%
1.25 +						
# of obs.	6	84	149	102	132	473
col. %	12%	23%	34%	44%	82%	38%
Total	49	361	442	231	160	1243

* Percentages may not sum to 100% due to rounding.
PVR_m stands for the present expected value of the couple's resources.

Table 9 Consumption Ratios for Wives at Risk Assuming Annuities are Unavailable and Base Case Earnings**

	PVR_m CLASS					
A_s/A_m	100K-250K	250K-500K	500K-750K	750K-1 MIl.K	1 MIL.K +	Total
<.10						
# of obs.	0	1	0	0	0	1
col. %	0%	0%	0%	0%	0%	0%
.10 to .20						
# of obs.	3	5	3	0	0	11
col. %	9%	2%	1%	0%	0%	1%
.20 to .30						
# of obs.	5	6	2	0	0	9
col. %	16%	2%	1%	0%	0%	1%
.30 to .40						
# of obs.	4	21	[illegible]	5	1	43
col. %	13%	7%	4%	2%	1%	5%
.40 to .50						
# of obs.	7	24	30	7	0	68
col. %	22%	8%	9%	5%	0%	8%
.50 to .60						
# of obs.	4	40	25	8	1	78
col. %	13%	14%	8%	5%	1%	9%
.60 to .70						
# of obs.	2	24	30	10	1	67
col. %	6%	8%	9%	7%	1%	8%
.70 to 1.00						
# of obs.	2	67	111	40	8	228
col. %	6%	24%	34%	26%	9%	26%
1.00 to 1.25						
# of obs.	1	50	44	33	12	140
col. %	3%	18%	13%	22%	13%	16%
1.25 +						
# of obs.	4	47	70	50	68	239
col. %	13%	16%	21%	33%	75%	27%
Total	32	285	329	151	91	888

* Percentages may not sum to 100% due to rounding.

*Table 10**
Consumption Ratios for Husbands using Current Earnings

	PVR_m CLASS					
A_s/A_m	100K-250K	250K-500K	500K-750K	750K-1 MIL.K	1 MIL.K +	Total
<.5						
# of obs.	0	0	0	0	0	0
col. %	0%	0%	0%	0%	0%	0%
.50 to .60						
# of obs.	0	0	1	0	0	1
col. %	0%	0%	0%	0%	0%	0%
.60 to .70						
# of obs.	0	0	1	0	0	1
col. %	0%	0%	0%	0%	0%	0%
70 to 1.00						
# of obs.	0	5	3	2	2	12
col. %	0%	1%	1%	1%	2%	2%
1.00 to 1.25						
# of obs.	4	19	26	17	5	71
col. %	10%	7%	7%	8%	4%	9%
1.25 +						
# of obs.	30	207	247	125	102	711
col. %	90%	92%	91%	91%	94%	89%
Total	34	231	278	144	109	796

* Percentages may not sum to 100% due to rounding.
PVR_m stands for the present expected value of the couple's resources.

Table 11
Percentage of Husbands who Adjusted their Individual Life Insurance Policies in the last 5 Years by PVR_m and Age

	PVR_m CLASS					
Age Group	100K-250K	250K-500K	500K-750K	750K-1MIL.K	1 MIL.K +	Total
35-39						
% adjusting	53%	47%	52%	54%	60%	52%
% nongroup adjusting	47%	43%	49%	48%	58%	68%
40-44						
% adjusting	31%	38%	52%	49%	52%	47%
% nongroup adjusting	31%	38%	48%	44%	52%	45%
45-49						
% adjusting	50%	19%	34%	35%	41%	30%
% nongroup adjusting	38%	18%	33%	35%	38%	29%
50-55						
% adjusting	27%	30%	22%	30%	17%	26%
% nongroup adjusting	18%	29%	21%	25%	14%	23%
Total						
% adjusting	41%	33%	41%	45%	44%	40%
% nongroup adjusting	35%	31%	39%	40%	42%	37%

PVR_m stands for the present expected value of the couple's resources.
IH stands for the face value of life insurance on the husband's life.

Table 12

OLS on A_w/A_m and Probit on the Probability $A_w/A_m<.7$

	OLS		Probit	
Variable	Coefficient	t Statistic	Coefficient	t Statistic
CONST.	1.086	10.266	6.142	7.293
PVR	- 2.05E-08	- 0.866	- 0.179E-05	-7.627
AH	- 0.003	- 1.352	- 0.866E-01	-4.950
AW	0.004	1.671	- 0.865E-01	-5.620
RACE	- 0.117	- 2.479	1.098	2.250
EDH1	- 0.061	- 1.691	0.338	1.452
EDH2	- 0.078	- 2.891	0.400	2.400
EDW1	- 0.008	- 0.220	- 0.298	-1.219
EDW2	- 0.017	- 0.708	- 0.182	-1.143
O1	- 0.151	- 2.856	0.236	0.682
O2	- 0.138	- 2.610	0.532	1.547
NKID	- 0.026	- 3.888	0.117	2.579
WRAT	1.404	19.229	-6.559	-7.772
WW	- 0.326	- 17.974	0.794	6.687
G1	0.044	1.771	0.194	0.771
G2	0.127	6.729	0.125	0.623

PVR_m stands for the present expected value of the couple's resources. AH and AW are ages of husband and wife. RACE = 1 for white, 0 otherwise. NKIDS is number of children at home. WRAT is the ratio of the couple's networth, NW, to PVR_m. EH1,EH2 and EW1,EW2 are pairs of education dummies for husband and wife, respectively. EH1 and EW1 stands for less than high school education. EH2 and EW2 stands for completed high school education, but did not attend college. O1 and O2 are occupation dummies for husband. O1=1 if husband is white collar worker, 0 otherwise. O2=1 if husband is a blue collar worker, 0 otherwise. G1 =1 if husband has only group insurance, 0 otherwise. G2 = 1 for household where husband has group insurance and husband and\or wife also have individual insurance. WW = 0 if the wife works, 1 otherwise.

Table 13

Effects of Explanatory Variables on Probability $A_w/A_m<.5$ and $A_w/A_m<.7$

PVR_m	AH	AW	RACE	EH1	EH2	EW1	EW2	O1	O2	NKID	WRAT	WW	G1	G2	P<.7	P<.5
771k	44	41	1	0	1	0	1	0	1	2	.156	0	1	0	.177	.038
800k	44	41	1	0	1	0	1	0	1	2	.156	0	1	0	.178	.039
771k	49	41	1	0	1	0	1	0	1	2	.156	0	1	0	.198	.040
771k	44	46	1	0	1	0	1	0	1	2	.156	0	1	0	.140	.025
771k	44	41	0	0	1	0	1	0	1	2	.156	0	1	0	.067	.013
771k	44	41	1	1	0	0	1	0	1	2	.156	0	1	0	.093	.015
771k	44	41	1	0	0	0	1	0	1	2	.156	0	1	0	.139	.025
771k	44	41	1	0	1	1	0	0	1	2	.156	0	1	0	.245	.044
771k	44	41	1	0	1	0	0	0	1	2	.156	0	1	0	.159	.039
771k	44	41	1	0	1	0	1	1	0	2	.156	0	1	0	.117	.025
771k	44	41	1	0	1	0	1	0	0	3	.156	0	1	0	.107	.043
771k	44	41	1	0	1	0	1	0	1	2	.156	0	1	0	.208	.048
771k	44	41	1	0	1	0	1	0	1	2	.250	0	1	0	.066	.005
771k	44	41	1	0	1	0	1	0	1	2	.156	1	1	0	.713	.396
771k	44	41	1	0	1	0	1	0	1	2	.156	0	0	1	.249	.062
771k	44	41	1	0	1	0	1	0	1	2	.156	0	0	0	.202	.036

PVR_m stands for the present expected value of the couple's resources. AH and AW are ages of husband and wife. RACE = 1 for white, 0 otherwise. NKIDS is number of children at home. WRAT is the ratio of the couple's networth, NW, to PVR_m. EH1, EH2 and EW1, EW2 are pairs of education dummies for husband and wife, respectively. EH1 and EW1 stands for less than high school education. EH2 and EW2 stands for completed high school education, but did not attend college. O1 and O2 are occupation dummies for husband. O1=1 if husband is a white collar worker, 0 otherwise. O2=1 if husband is a blue collar worker, 0 otherwise. G1 =1 if husband has only group insurance, 0 otherwise. G2 = 1 for household where husband has group insurance and husband and\or wife also have individual insurance. WW = 0 if the wife works, 1 otherwise.

Notes

1. This could easily be generalized to the case of a fixed loading based on the insurance amount, in which case this additional cost would be subtracted from the present expected value of resources. For the sake of simplicity we do not pursue this issue here.

2. As demonstrated by Yarri (1966), the purchase of an annuity is formally equivalent to the sale of life insurance and vice versa. The fact that there is a well developed insurance market in the U.S. means that the market for sales of annuities is well developed. In contrast, the market for purchases of annuities is quite thin. The two markets are, however, segmented. Those selling annuities (buying life insurance) tend to be young and middle age, while those interested in buying annuities (selling life insurance) are older individuals. One possible explanation for the poor functioning of the annuity purchase market compared to the life insurance purchase market is that adverse selection due to asymetric information is a greater problem in the annuity purchase market.

3. In the case of a surviving spouse with no access to annuities and who does not wish to borrow against future earnings or other income, the spouse must arrange his or her consumption such that if the spouse lives till the last possible date of life the realized present value of the spouse's consumption equals the realized present value of the spouse's resouces where both of these present values are calculated as of the time the spouse becomes a widow or widower. Hence, even though the surviving spouse faces lifespan uncertainty the budget constraint is the same as that which arises if the spouse lived till the last possible date of life with certainty. The intuition here is that the spouse must consume taking into account the possibility of living to the last period in which case the present value budget constraint just described can not be violated.

4. The social security survivor benefit depends, in general, on the age at which the decedent spouse died because the age of death affects the decedent spouse's earnings record. Our calculations of survivor benefits take this feature of social security into account. However, to ease notation we do not index S_{wi} and S_{hi} by the age at which the spouse dies.

5. These characteristics are a polynomial in age, education dummies, occupation dummies, number of children.

6. In our sample there are no households with total resources below 100 thousand dollars.

7. The word explain is placed in quotations because not all of the right hand side regressors, for example the group insurance dummies, are necessarily exogenous.

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