The Mismatch Between Life Insurance Holdings and Financial Vulnerabilities: Evidence from the Health and Retirement Study

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This study examines life insurance holdings and financial vulnerabilities among couples approaching retirement age. Two separate concerns motivate our analysis. First, there are reasons to suspect that life insurance coverage may be poorly correlated with underlying financial vulnerabilities. A well-known insurance industry adage holds that life insurance is "sold and not bought." Alternatively, households may purchase long-term policies relatively early in life, and subsequently fail to adjust coverage appropriately because of inertia and/or other psychological considerations. Second, households that purchase little or no life insurance may leave either or both spouses at risk of serious financial consequences.

Past studies address the second issue, but provide little evidence concerning the first. Alan J. Auerbach and Kotlikoff (1987, 1991a, b) identified vulnerabilities by projecting the financial consequences of a spouse's death, while Karen C. Holden et al. (1986) and Michael D. Hurd and David A. Wise (1989) documented sharp declines in living standards among women whose husbands actually passed away. This study builds on Auerbach and Kotlikoff's work in four ways. First, we use recent, high-quality data from the 1992 wave of the Health and Retirement Study (HRS). Second, we estimate survival-contingent income streams more accurately through the use of Social Security earnings histories and a highly detailed benefits calculator.[1] Third, to evaluate the financial vulnerabilities of each household, we employ an elaborate life-cycle model that accounts for a broad array of demographic, economic, and financial factors not considered in previous research.[2] Fourth, we quantify the financial vulnerabilities that would have existed without insurance, and evaluate the extent to which actual insurance addressed those vulnerabilities, particularly for cases in which the potential financial consequences of a spouse's death were severe.

We adopt a concrete and easily understood yardstick for quantifying financial vulnerabilities: the percentage decline in an individual's sustainable living standard that would result from a spouse's death. The use of this yardstick permits us to make apples-to-apples comparisons of vulnerabilities across households, and to investigate correlations between vulnerabilities and insurance coverage. We also compare actual life insurance holdings to a natural benchmark, defined as the level of coverage required to assure survivors of no change in their sustainable living standard.

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[1] Social Security earnings histories are contained in a matched, supplemental data set, which we have used in compliance with confidentiality requirements and security restrictions.

[2] The model is embodied in financial planning software, Economic Security Planner (or ESPlanner), which was codeveloped by three of this paper's authors. Economic Security Planning, Inc. provides free copies of the software for academic research. For additional information, consult www.ESPlanner.com.

This benchmark is not intended as a definitive standard of adequacy or rationality; rational decision makers may elect to purchase either higher or lower levels of insurance. However, when combined with other evidence on household objectives, comparisons with the benchmark potentially shed light on the adequacy of life insurance coverage.

Averaged across our entire sample, the change in living standard that would result from a spouse's death is small both in absolute terms and relative to the average decline that would have occurred in the absence of insurance (henceforth, the *underlying* vulnerability). However, this average obscures a startling mismatch between life insurance holdings and underlying vulnerabilities. Relative to earnings, households with greater underlying vulnerabilities were not more likely to have life insurance protection, and did not purchase more insurance on average. As a result, many households had substantial uninsured exposures. The magnitude of uninsured financial vulnerabilities, as well as the proclivity to address any given degree of vulnerability by purchasing life insurance, varied systematically with individual and household characteristics, and displayed a systematic gender bias.

I. A Strategy for Measuring Financial Vulnerabilities

A. *Concepts*

We clarify our strategy for measuring financial vulnerabilities through an example. Imagine that a husband and wife each live for at most two years. Either may die before the second year. The household's well-being depends on consumption in each year and survival contingency. We allow for the possibility that some ongoing expenditures (e.g., housing) are either exogenous or determined early in life by "sticky" choices. We refer to these expenditures as "fixed consumption," and to residual spending as "variable consumption." Let y_1 denote initial assets plus first period earnings net of fixed consumption, and let y_{2s} denote second period earnings net of fixed consumption in state $s = W, H, B$, where the state identifies survivors (wife, W, husband, H, or both, B). The couple divides first-period resources between variable consumption, c_1, saving, A, and insurance premiums, $p_i L_i$, $i = H, W$, where L_i represents the second-period payment to i if his or her spouse dies, and p_i denotes the associated price per dollar of coverage. Assets A earn the rate of return r. The couple faces the following constraints: $c_1 = y_1 - A - p_W L_W - p_H L_H$, $c_{2B} = y_{2B} + A(1 + r)$, and $c_{2i} = y_{2i} + A(1 + r) + L_i$ for $i = W, H$, where c_{2i} denotes second-period variable consumption in state i (for the moment, we ignore nonnegativity restrictions on life insurance and assets). Defining $p_B \equiv (1 + r)^{-1} - p_W - p_H$, these equations imply:

$$(1)\quad c_1 + p_B c_{2B} + p_W c_{2W} + p_H c_{2H} = y_1 + p_B y_{2B} + p_W y_{2W} + p_H y_{2H} \equiv Y.$$

We equate living standard with per capita variable consumption adjusted for family composition. To determine each individual's living standard when both are alive, we divide variable consumption by a factor 2^{α}. We assume that $0 < \alpha < 1$; the second inequality reflects economies of scale associated with shared living expenses. To maintain a living standard that is constant across time and states of nature, the couple must spend $2^{\alpha}C$ dollars in every period and state where both are alive for every C dollars in any state where only one survives. From (1), the household's highest sustainable living standard is:[3]

$$(2)\qquad c^* = \frac{Y}{2^{\alpha}(1 + p_B) + (p_W + p_H)}.$$

The couple can guarantee that spouse j's death will not diminish i's living standard from its highest sustainable level, c^*, by purchasing a life insurance policy with face value $L_i^* = (c^* - y_{2i}) + (y_{2B} - 2^{\alpha}c^*)$.

We measure underlying financial vulnerabilities by comparing an individual's highest sustainable living standard, c^*, with $c_i^n \equiv y_{2i} + A(1 + r)$, which represents the living standard he or she would enjoy if widowed, ignoring life insurance. We define the variable *IMPACT*

[3] In the special case where the household has Leontief preferences (defined over per capita adjusted expenditures), this is also the utility-maximizing outcome.

(ignoring insurance) as $\left(\frac{c_i^n}{c^*} - 1\right) \times 100$, $i = W, H$. This is a measure of the percent by which the survivor's actual living standard would, with no insurance protection, fall short of or exceed the couple's highest sustainable living standard. Similarly, we measure uninsured financial vulnerabilities by comparing c^* with $c_i^a \equiv y_{2i} + A(1 + r) + L_i^a$, which represents the living standard that the individual would actually enjoy if widowed, based on actual life insurance coverage, L_i^a. We define the variable *IMPACT* (actual) as $\left(\frac{c_i^a}{c^*} - 1\right) \times 100$. This is a measure of the percent by which the survivor's actual living standard would, given actual levels of coverage, fall short of or exceed the couple's highest sustainable living standard. The *IMPACT* variables are based on a concrete and easily understood yardstick for quantifying the consequences of a spouse's death.[4] We also compare actual life insurance holdings, L_i^a, with the benchmark level, L_i^*.

For the preceding example, we implicitly assumed that individuals could borrow at the rate r and issue survival-contingent claims at the prices p_H and p_W. As a practical matter, households encounter liquidity constraints and are typically unable to purchase negative quantities of (i.e., sell) life insurance.[5] In solving for each household's highest sustainable living standard, we take these restrictions into account, smoothing consumption to the greatest extent possible, given the constraints.[6]

Among older workers, binding nonnegativity constraints for life insurance holdings are far more common than binding liquidity constraints. When the life insurance constraint binds, the benchmark living standard for a survivor, c_i^* (where $i = H$ or W), may be greater than the benchmark living standard for the couple while both spouses are still alive, c_B^*. This observation raises the following practical issue: when calculating *IMPACT*, should we set $c^* = c_i^*$, or $c^* = c_B^*$? Were we to use c_B^*, actual *IMPACT* would be positive not only for households that depart from the benchmark by purchasing additional insurance ($L_i^a > L_i^*$), but also for constrained households that conform to the benchmark by purchasing no insurance ($L_i^a = L_i^* = 0$). In contrast, the use of c_i^* implies that actual *IMPACT* is positive when $L_i^a > L_i^*$ and zero when $L_i^a = L_i^* = 0$. Since we wish to use actual *IMPACT* as a measure of the extent to which a household deviates from the consumption-smoothed benchmark, we therefore select c_i^* rather than c_B^*. As a result, the value of *IMPACT* ignoring insurance is always nonpositive (even though, absent insurance, the survivor's material living standard might actually increase upon his or her spouse's death), and it equals zero whenever the corresponding benchmark insurance level, L_i^*, is zero.

B. *Implementation*

We actually evaluate each household's financial vulnerabilities using a more realistic and intricate life-cycle model. As mentioned previously, the model is embedded in a financial planning software program, Economic Security Planner (or ESPlanner), developed by some of this paper's authors. It includes a detailed and comprehensive Social Security benefits calculator (which is essential for computing survival-contingent income streams), as well as an elaborate representation of the federal and state personal income tax systems.

For our base-case calculations, we assume that each individual lives to a maximum age of 95. We include children as members of the household through age 18. We set α, the household scale economy parameter, equal to 0.678

[4] Note that, when actual life insurance is below the benchmark, the intact couple saves on insurance premiums, so its actual consumption exceeds c^*. Hence, the *IMPACT* variables understate the change in living standard that an individual experiences upon a spouse's death. However, since life insurance premiums typically account for a small fraction of expenditures, the degree of understatement is small.

[5] A nonnegativity constraint for life insurance purchases is equivalent to the restriction that life annuities are not available for purchase at the margin. For further discussion, see Menachem Yaari (1965), Kotlikoff and Avia Spivak (1981), and Bernheim (1987).

[6] Formally, one can think of the outcome that we identify as the limit of the solutions to a series of utility-maximization problems in which the intertemporal elasticity of substitution approaches zero. In the limit (the Leontief case), the household is actually indifferent with respect to the distribution of consumption across any years in which its living standard exceeds the minimum level.

(which implies that a two-adult household must spend 1.6 times as much as a one-adult household to achieve the same living standard),[7] and we use a child-adult-equivalency factor of 0.5.[8]

Our treatment of housing equity requires explanation. Unlike many other expenditures, housing outlays are not easily smoothed. It is difficult to scale mortgage, property tax, and insurance payments up and down with other expenditures. Cost and inconvenience discourage many households from moving or refinancing mortgages; others form psychological attachments to their homes, and resist changing residences prior to death (Steven Venti and Wise, 2002). For the HRS sample, roughly three-quarters of respondents reported that they planned to remain in their current home after retirement.[9] By the second wave of the HRS (April 1994 through December 1994), 83.8 percent of newly widowed women had not changed residence. Wave 3 (May 1996 through February 1997) contains information on residences for 62.3 percent of these initial widows; 82.7 percent had not moved. Wave 4 (February 1998 through March 1999) contains information on 56.3 percent of the initial widows; 92.6 percent had not moved. Moreover, few households access the equity in their homes through refinancing or reverse annuity mortgages (Andrew Caplin, 2002). Consequently, for our base-case calculations, we assume that couples and survivors remain in the same home until death, incurring all associated expenses (with appropriate tax treatment), and die with home equity intact.

Several potentially important factors are omitted from our analysis. We do not model uncertainty concerning future income and nondiscretionary expenses (e.g., medical care). Since small groups of individuals can share risks, the adverse effect of uncertainty on living standard is probably greater for widows and widowers than for couples. For this reason, our analysis tends to understate insurance needs. We also neglect the possibility that an individual might remarry after a spouse's death. The extent to which remarriage mitigates the financial consequences of a spouse's death depends on one's view of the marriage market.[10] In any case, remarriage is relatively uncommon for the age group we consider. By the second wave of the HRS, only 3.6 percent of newly widowed women had remarried. Wave 3 tracks marital status for 62.2 percent of these initial widows; 11.5 percent had remarried. Wave 4 tracks marital status on 56.7 percent of the initial widows; 10.6 percent had remarried. Of those widowed between waves 2 and 3, less than 1 percent had remarried by wave 3, and only 4.3 percent had married by wave 4.[11]

Our base-case calculations also ignore the possibility that shifts in labor force participation or in nonlabor income, such as assistance from relatives, might cushion the financial impact of a spouse's death. In practice, survivors do not significantly alter their labor force participation. Between the first two waves of the HRS survey, only 2.9 percent of newly widowed nonworking women went back to work, compared with 4.0 percent of nonworking nonwidows; 6.7 percent of newly widowed working women withdrew from the labor force, compared with 9.3 percent of working nonwidows. The net change in labor force participation differed only slightly for these two groups. Only 5.6 percent of new widows said that they increased their work hours; 4.2 percent said that they decreased their hours, and 90.2 percent reported no change. On average, reported employment fell by 2.8 hours per week for new widows, compared with 0.4 hours per week for nonwidows. Results for subsequent waves of the

[7] The OECD uses a value of 0.7 for α (see Stein Ringen, 1991). Roberton Williams et al. (1998) consider values of 0.5 both for α and for the child-adult equivalency factor.

[8] Our child-adult equivalency factor is that used by the OECD (see Ringen, 1991). Julie A. Nelson's (1992) work suggests a smaller value, but she considers total household expenditures whereas our child-adult equivalency factor applies only to nonhousing consumption expenditure; for our base-case results, we treat housing expenditure as inflexible. It appears from Nelson's work that a higher equivalency factor is appropriate for nonhousing expenditures.

[9] More specifically, 5,753 respondents said that they planned to stay in their current home after retirement, 180 said that the expected to divide time between their current home and another location, 2,192 said that they planned to move, 41 said that they had already moved, and 679 said that they did not know. In addition, 3,705 were not asked the question (mainly because they had already retired), and 102 were asked but did not answer.

[10] See Shelly Lundberg (1999) for a discussion.

[11] Wave 4 contains marital status information on 87.0 percent of women who were widowed between waves 2 and 3.

HRS are qualitatively similar. There is also little evidence that external support payments are significant in practice. Between the first two waves of the HRS, only 6.2 percent of new widows reported receiving any financial help from family members. Between the second and third waves, the figure was 7.5 percent; and between the third and fourth waves, it was only 2.5 percent. In many of these cases, support may have been modest and/or temporary.

The following results are illustrative.[12] Consider first a couple consisting of a 54-year-old man earning $45,000 per year, and a 50-year-old woman earning $25,000 per year. The man intends to retire at age 64, the woman at age 63. They have one 18-year-old child. The net value of their nonhousing assets is $50,000; in addition, they own a $100,000 home, and have an unpaid mortgage balance of $20,000. They expect their real earnings to grow at the rate of 1 percent per year until retirement. They also expect to earn a real after-tax return of 3 percent on their nonhousing investments. According to our model, this couple must purchase $133,500 in term insurance on the husband's life, and no insurance on the wife's life, to ensure each potential survivor of an undiminished living standard. Insurance on the husband changes with household characteristics as follows: it falls (rises) to $68,500 ($192,000) when the subjects' ages are increased (decreased) by four years; it falls (rises) to $70,500 ($195,000) when the husband's earnings are decreased (increased) by $15,000; it falls (rises) to $111,500 ($174,000) when the wife's earnings are increased to $30,000 (eliminated); it falls (rises) to $132,000 ($139,000) with the removal of the child (addition of a 16-year-old child); it falls (rises) to $125,000 ($143,500) when the baseline earnings growth rate is changed to 0 percent (2 percent); and it falls (rises) to $118,500 ($152,000) when the real interest rate is changed to 5 percent (1 percent). Insurance on the wife remains at zero in all cases, with the following exceptions: it rises to $28,000 when the husband's earnings are reduced to $30,000, and to $69,000 when the wife's earnings are increased to $30,000. In each case the direction of the change is sensible.

[12] For additional examples, and for comparisons with recommendations generated by Quicken Financial Planner, see Gokhale et al., 2001.

C. *Interpretation*

We do not regard our *IMPACT* variables as perfect measures of financial vulnerability. Our elaborate life-cycle model is still an abstraction, and we have imperfect information concerning the economic circumstances of each household. Nor do we regard the benchmark level of life insurance as an objective standard of adequacy or rationality. Optimal insurance coverage depends on a variety of considerations, including (but not limited to) the manner in which marginal utilities vary across survival states, the weights that households attach to the well-being of each family member, degrees of risk aversion, and the pricing of insurance policies. Consequently, it is possible to rationalize a wide range of behaviors.

Nevertheless, the absence of a significant correlation between life insurance and financial vulnerabilities (measured by *IMPACT*, ignoring insurance) would be difficult to reconcile with theories of rational financial behavior. Even if a household places less weight on the well-being of a particular spouse, and even if it must pay actuarially unfair rates, it should still obtain greater insurance protection when the spouse in question is exposed to more severe financial consequences. To explain the absence of a correlation, one would need to believe either that our measure of *IMPACT* (ignoring insurance) is largely unrelated to underlying vulnerabilities, or that marginal utilities vary in a way that just offsets the differences in measured vulnerabilities. Both possibilities strike us as improbable.

Evidence of widespread and substantial uninsured vulnerabilities (as measured by actual *IMPACT* or by the divergence of actual insurance from the benchmark) would also be more difficult to rationalize than it might at first appear. Most potential explanations presuppose that households deliberately choose different living standards for survivors. However, in practice, the vast majority of individuals who explicitly make this choice in the context of constructing personal financial plans elect to provide each potential survivor with the same living standard as the intact couple (Bernheim et al., 2002).[13] While it is perfectly rational for individuals to have other objectives, it is irrational for individuals with these objectives to purchase coverage that diverges significantly from our benchmark (assuming, of course, that the benchmark is derived from a model that reasonably approximates the household's opportunity set).

II. Data

The 1992 wave of the HRS (fielded between April 1992 and March 1993) surveyed over 7,000 households with at least one spouse between the ages of 51 and 61.[14] The data cover health status, income, wealth, pensions, Social Security benefits, demographics, education, housing, food consumption, family structure and transfers, current and past employment, retirement plans, cognition, health and life insurance, intra vivos gifts, inheritances, and bequests.[15] Accurate measurement of life insurance coverage is, of course, particularly critical for our analysis. Fortunately, the HRS data match up reasonably well with other sources of information concerning this variable.[16] Despite the survey's thoroughness, it was necessary to impute a number of household characteristics.[17]

We excluded couples for the following reasons: (a) Social Security earnings records were unavailable for either spouse; (b) a spouse provided inadequate information concerning life insurance policies; (c) a spouse refused to be interviewed; (d) a spouse was unemployed; or (e) the couple's reported economic resources were insufficient to support its fixed expenditures. Criterion (a) accounted for nearly 80 percent of excluded observations, and criterion (b) accounted for most of the others. Our final sample consists of 2,113 couples. Among husbands (wives), median age was 57 (54), median nonasset income was $36,077 ($12,763), 28.3 percent (20.5 percent) held college degrees, and 47.1 percent (36.3 percent) were covered by pensions. Just over 15 percent of husbands and wives were nonwhite. Twenty-three percent of couples had dependent children, and 93 percent were homeowners. Median nonhousing wealth was $48,500, and median home value was $85,000.

III. Results

According to Table 1, the mean level of insurance held to protect husbands, wives, and primary earners exceeded the mean benchmark, while the mean level of insurance held to protect secondary earners fell short of the mean benchmark by only $8,022. In each case, median life insurance surpassed the median benchmark. The mean values of *IMPACT* (ignoring insurance) indicate significant underlying vulnerabilities. However, the mean values of *IMPACT* (actual) imply that life insurance reduces the average effect of a spouse's death on the survivor's living standard by nearly 75 percent for both husbands and wives. Insurance mitigated vulnerabilities to a smaller extent for secondary earners, who (on average) would have seen their living standards decline by 7 percent. From the median values of *IMPACT* (ignoring insurance), we can infer that significant underlying vulnerabilities are found in a minority of the couples studied. This finding reflects the fact that many older workers have relatively little human capital to protect.

The preceding discussion of means and medians masks a striking mismatch between insurance holdings and underlying vulnerabilities. At one extreme, 43 (49) percent of wives (husbands) were protected by life insurance even though they faced no underlying

[13] Even with risk aversion, such choices are reasonable if load factors are low. For evidence on load factors in the context of life annuities, see Olivia Mitchell et al. (1999).

[14] The HRS sampled 5,000 married couples in which both spouses responded, 200 married couples in which one spouse refused to answer, and 2,452 single individuals.

[15] Mitchell and James F. Moore (1997a, b) provide excellent descriptions of the HRS, in general, and the wealth accumulation of the HRS sample in particular.

[16] The Life Insurance Marketing and Research Organization (LIMRA) has published statistics on ownership of life insurance for 1984; see American Council of Life Insurance (1992). LIMRA classifies households by the age of the household head. The percentages of households for which at least one member owned individual or group life insurance were as follows: 71 percent for age 65 and over, 91 percent for ages 55 through 64, and 89 percent for ages 45–54. Average total coverage (inflated to 1992 dollars) among households with insurance was $17,959 for age 65 and over, $64,681 for ages 55 through 64, and $110,998 for ages 45 through 54. The HRS sample cuts across these three age groups. At least one household member owned insurance for 84 percent of HRS households, and average total coverage among households with insurance was $117,010.

[17] A description of our imputation procedures is posted on our academic web sites, and is also contained in an earlier version of this paper (Bernheim et al., 1999).

TABLE 1—INSURANCE HOLDINGS AND PERCENT CHANGES IN LIVING STANDARDS FOR SURVIVING SPOUSES

Panel A: Husbands and Wives

	Surviving individuals are:			
	Wives		Husbands	
Insurance on spouse	Benchmark	Actual	Benchmark	Actual
Mean	\$62,098	\$66,165	\$17,126	\$20,940
Median	\$0	\$25,000	\$0	\$ 4,991
IMPACT	Ignoring insurance	Actual	Ignoring insurance	Actual
Mean	−17.6	−4.49	−6.62	−1.81
Median	0.00	0.85	0.00	0.24
IMPACT frequency	Ignoring insurance	Actual	Ignoring insurance	Actual
< −40	16.85	11.03	6.44	5.06
−40 to −20	12.12	9.37	4.21	2.98
−20 to 0	18.13	15.95	7.76	6.96
0	52.91	10.03	81.59	32.28
0 to +20	—	43.59	—	49.93
+20 to +40	—	6.25	—	1.85
> +40	—	3.79	—	0.95

Panel B: Primary and Secondary Earners

	Surviving individuals are:			
	Secondary earners		Primary earners	
Insurance on	Benchmark	Actual	Benchmark	Actual
Mean	\$72,103	\$64,081	\$7,121	\$23,024
Median	\$ 1,688	\$24,176	\$0	\$ 5,000
IMPACT	Ignoring insurance	Actual	Ignoring insurance	Actual
Mean	−20.3	−7.00	−3.93	0.70
Median	−0.70	0.26	0.00	0.39
IMPACT frequency	Ignoring insurance	Actual	Ignoring insurance	Actual
< −40	20.26	13.54	3.03	2.56
−40 to −20	13.16	10.32	3.17	2.04
−20 to 0	17.13	15.76	8.76	7.15
0	49.46	9.56	85.04	32.75
0 to +20	—	41.55	—	51.96
+20 to +40	—	5.92	—	2.18
> +40	—	3.36	—	1.37

vulnerabilities.[18] Indeed, according to Table 1, more than half of both husbands and wives were protected by more insurance than was necessary to secure an undiminished living standard upon a spouse's death (those with actual *IMPACT* greater than zero).[19] At the other extreme, many households did little to mitigate substantial underlying vulnerabilities. According to Table 1, insurance reduced the fraction of

[18] This information is not contained in Table 1.

[19] As discussed previously, ignoring insurance, *IMPACT* is never strictly greater than zero. This reflects the fact that we have imposed a nonnegativity constraint on life insurance purchases. An individual's living standard may rise upon a spouse's death; however, without life insurance, it cannot exceed the living standard that he or she would enjoy as a survivor assuming implementation of the (constrained) benchmark financial plan. Note also that actual *IMPACT* is exactly equal to zero for a substantial fraction of the population. Generally, these are individuals for whom actual and benchmark levels of insurance protection are both zero.

TABLE 2—EFFECT OF LIFE INSURANCE ON PERCENT CHANGES IN LIVING STANDARDS FOR SURVIVING SPOUSES, BY LEVEL OF VULNERABILITY

	Range for *IMPACT*,	Mean *IMPACT*		Insurance holdings		
Surviving spouses are:	ignoring insurance	Ignoring insurance	Actual insurance	Percent uninsured*	Mean benchmark	Mean actual
Wives	< −40	−72.6	−50.5	27.5	234,189	59,961
	−40 to −20	−29.5	−15.6	22.7	119,120	59,494
	0 to −20	−9.7	4.1	21.4	45,293	63,319
	0	0.0	9.8	19.0	0	70,643
Husbands	< −40	−72.8	−62.6	46.3	171,016	22,568
	−40 to −20	−28.1	−16.0	33.7	89,554	29,700
	0 to −20	−9.7	−0.1	26.8	30,241	26,103
	0	0.0	3.6	39.6	0	19,868
Secondary earners	< −40	−72.7	−52.7	30.1	238,327	52,835
	−40 to −20	−29.3	−14.9	22.7	122,388	59,065
	0 to −20	−9.8	4.7	20.4	45,101	62,279
	0	0.0	9.7	19.3	0	70,645
Primary earners	< −40	−72.5	−61.6	50.0	72,271	28,156
	−40 to −20	−28.5	−19.2	37.3	66,287	21,698
	0 to −20	−9.4	−0.8	28.1	32,324	32,363
	0	0.0	3.8	38.5	0	21,929

* The benchmark percent uninsured is 0 percent for those with *IMPACT*, ignoring insurance, less than 0, and 100 percent for *IMPACT*, ignoring insurance, equal to 0.

individuals at risk of severe financial consequences (defined as a decline in living standard of 40 percent or greater) from 16.9 percent to 11.0 percent for wives, from 20.3 percent to 13.5 percent for secondary earners, from 6.4 percent to 5.1 percent for husbands, and from 3.0 percent to 2.6 percent for primary earners. Similarly, insurance reduced the fractions of individuals at risk of significant financial consequences (defined as a decline in living standard of 20 percent or greater) from 29.0 percent to 20.4 percent for wives, from 33.4 percent to 23.9 percent for secondary earners, from 10.7 percent to 8.0 percent for husbands, and from 6.2 percent to 4.6 percent for primary earners; these reductions are generally in the range of only 25 to 30 percent.

For some individuals, the potential financial consequences of a spouse's death are severe in absolute terms. Based on the 1992 poverty thresholds published by the U.S. Census Bureau, poverty rates among surviving wives (husbands) would have been 16.3 (8.3) percent with no insurance coverage, 14.3 (7.6) percent with actual insurance coverage, and 9.2 (7.1) percent with benchmark insurance coverage. Thus, 35.7 percent of poverty among surviving women (5.1 of 14.3 percentage points) and 6.6 percent of poverty among surviving men (0.5 out of 7.6 percentage points) resulted from a failure to ensure an undiminished living standard through insurance. Insurance eliminated only 28 percent of the avoidable poverty among surviving women (2.0 out of 7.1 percentage points), and 58 percent of the avoidable poverty among surviving men (0.7 out of 1.2 percentage points).

In Table 2, we subdivide the population based on underlying financial exposure, measured by the value of *IMPACT*, ignoring insurance. For each subgroup, we calculate the means of both *IMPACT* variables, as well as statistics describing insurance holdings. The likelihood of having no life insurance protection was greatest for those with the largest exposures. In a probit regression explaining whether the couple held insurance on the primary earner's life as a function of *IMPACT* for the secondary earner (ignoring insurance), the slope coefficient was 0.00525 (σ = 0.00097). For a similar probit regression explaining whether the couple held insurance on the secondary earner's life as a function of *IMPACT* for the primary earner (ignoring insurance), the slope coefficient was 0.00267 (σ = 0.00194). The positive coefficients indicate that those with lower vulnerabilities are more likely to have insurance protection.

The average level of protection for secondary earners falls monotonically with the degree of underlying vulnerability (see Table 2). For primary earners, there is no obvious relation between average insurance holdings and underlying vulnerabilities. For each observation, we computed the ratio of insurance on the primary earner's life to the primary earner's annual wages, and regressed this on *IMPACT* for the secondary earner (ignoring insurance). The slope coefficient was 0.0261 (σ = 0.0095). In a similar regression of the insurance-to-earnings ratio for the secondary earner on *IMPACT* for the primary earner (ignoring insurance), the slope coefficient was 0.0491 (σ = 0.0638). The positive coefficients indicate that those with smaller vulnerabilities do not hold less insurance on average.

If couples hold insurance to moderate the financial consequences of a spouse's death, then the difference between our two *IMPACT* variables (actual and ignoring insurance) should be larger for those with greater vulnerabilities. The figures in Table 2 display a somewhat weak correlation. However, in simple regressions of *IMPACT* (actual insurance) on *IMPACT* (ignoring insurance), the coefficients of the latter variable are 0.918 (σ = 0.018) for primary earners, and 0.874 (σ = 0.018) for secondary earners. In analogous median regressions, the corresponding coefficients are 1.01 (0.018) for primary earners, and 1.01 (0.026) for secondary earners. The ordinary least-squares (OLS) regressions suggest that, on the margin, life insurance holdings offset perhaps 10 percent of the variation in financial vulnerabilities, while the median regressions imply that insurance coverage is unrelated to the degree of financial vulnerability. When we restrict attention to those for whom living standards would actually decline (absent insurance) upon a spouse's death, the corresponding OLS coefficients are 1.01 (σ = 0.039) for primary earners, and 0.913 (σ = 0.031) for secondary earners, while the corresponding median regression coefficients are 1.04 (σ = 0.009) for primary earners, and 1.10 (σ = 0.020) for secondary earners. Consequently, for those at risk of some reduction in living standard, insurance coverage bears very little relation to the degree of financial vulnerability.

We draw two other conclusions from Table 2. First, life insurance had at most a moderate impact on financial exposures among the at-risk population. For severely at-risk wives, insurance reduced the average consequences of a spouse's death (mean *IMPACT*) by only 30 percent, from −72.6 to −50.5 percent. These same households would have needed to hold an average of $234,189 to assure each surviving secondary earner of an undiminished living standard, but held on average roughly one-quarter of this amount ($59,961).

Second, for a fixed level of financial exposure, households were more inclined to protect wives and secondary earners than to protect husbands and primary earners. For example, among severely at-risk individuals, 27.5 percent of wives had no insurance protection, compared with 46.3 percent of husbands. For severely at-risk wives, insurance reduced mean *IMPACT* by 22.1 percentage points (from −72.6 percent to −50.5 percent), compared with 10.2 percentage points (from −72.8 percent to −62.6 percent) for husbands.

Table 3 provides disaggregated results for various population subgroups. To conserve space, we confine our attention to primary and secondary earners (results for husbands and wives are similar). In addition to reporting the percentage of each subgroup with severe and significant exposures based on *IMPACT* with actual insurance (Percent Actual) and on *IMPACT* ignoring insurance (Percent Ins = 0), we also report the fractional reduction in each exposure rate resulting from insurance coverage (Percent Addr.).[20]

Significant and severe uninsured financial vulnerabilities were more common among low-income households, couples with disparate earnings, relatively young households, couples with dependent children, and especially nonwhites. The likelihood of having a substantial uninsured vulnerability declines monotonically with the affected individual's age. For secondary earners, the frequency of vulnerability is nonmonotonic in total household earnings. Con-

[20] Formally, Percent Addr. (percent addressed) = [(Percent Ins = 0) − (Percent Actual)]/(Percent Ins = 0).

TABLE 3—FREQUENCY OF SEVERE AND SIGNIFICANT FINANCIAL CONSEQUENCES FOR SURVIVING SPOUSES: SELECTED POPULATION SUBGROUPS

	Consequences for secondary earners						Consequences for primary earners					
	Severe (>40 percent)			Significant (>20 percent)			Severe (>40 percent)			Significant (>20 percent)		
	Percent actual	Percent ins = 0	Frac. addr.	Percent actual	Percent ins = 0	Frac. addr.	Percent actual	Percent ins = 0	Frac. addr.	Percent actual	Percent ins = 0	Frac. addr.
Full sample	13.5	20.3	0.335	23.9	33.4	0.284	2.56	3.03	0.16	4.60	6.20	0.258
HH earnings <$45K	20.5	26.9	0.238	31.0	40.0	0.225	5.36	5.83	0.08	7.93	9.56	0.171
HH earnings $45–$100K	7.62	15.1	0.495	17.3	28.4	0.391	0.68	1.25	0.46	2.51	4.15	0.395
HH earnings >$100K	14.2	18.4	0.228	27.1	31.7	0.145	0.46	0.46	0.00	1.38	2.75	0.498
Dual earners	12.1	18.5	0.346	22.8	32.4	0.296	3.11	3.64	0.15	5.63	7.51	0.250
Single earners	19.6	27.6	0.290	28.4	37.7	0.247	0.24	0.49	0.51	0.24	0.73	0.671
Earnings differential 1–1 to 2–1	8.58	12.6	0.319	17.6	25.2	0.302	5.53	6.36	0.13	10.7	14.0	0.236
Earnings differential over 4–1	18.6	27.6	0.326	29.6	40.3	0.266	0.32	0.54	0.41	0.32	0.64	0.500
Age of survivor: 40–49	16.0	27.7	0.422	30.2	44.3	0.318	6.60	7.55	0.13	11.3	11.3	0.000
Age of survivor: 50–59	14.2	20.9	0.321	25.1	35.0	0.283	2.53	2.97	0.15	4.49	6.22	0.278
Age of survivor: 60–69	8.88	12.5	0.29	14.1	19.8	0.288	1.35	1.86	0.27	3.21	4.91	0.346
No children	12.3	18.8	0.346	22.7	31.6	0.282	2.27	2.78	0.18	4.20	5.78	0.273
One or more child	19.8	27.6	0.283	29.9	42.8	0.301	4.02	4.31	0.07	6.61	8.33	0.206
Whites	11.2	17.9	0.374	21.0	31.0	0.323	1.90	2.23	0.15	3.69	5.08	0.274
Nonwhites	26.3	33.1	0.205	39.6	46.8	0.154	6.19	7.43	0.17	9.60	12.4	0.226

ditional upon the existence of a significant or severe vulnerability, households in the upper and lower tails of the income distribution, older households, and nonwhites were less likely to moderate the financial consequences of a spouse's death through life insurance. Households were less likely to address severe vulnerabilities for primary earners.

Quantile regressions of *IMPACT* (actual) on various individual and household characteristics (omitted) reveal no significant relation to self-assessed measures of survival probabilities. This implies that low levels of insurance are not attributable to optimism concerning longevity. Fixing insurance premiums, an increase in perceived longevity is equivalent to an increase in the implied load factor. Consequently, this finding also casts doubt on the view that high load factors account for substantial uninsured vulnerabilities.

IV. Robustness

We have examined the sensitivity of our findings to a variety of alternative assumptions. Changes in the real interest rate (3 ± 2 percent), baseline wage growth rate (1 ± 1 percent), maximum life span (90 ± 5 years), consumption growth rate (0 ± 1 percent),[21] and net wealth (±20 percent due to possible over- or underreporting) are relatively inconsequential.[22] In several cases, this reflects the opposing effects of offsetting forces. For example, a reduction in maximum life span reduces the resources that a survivor needs to achieve a given living standard, but increases the living standard that the intact couple can achieve from available resources. For secondary earners, the frequencies of exposure to severe and significant financial consequences (13.5 and 23.9 percent,

[21] The consumption growth rate refers to steepness of the sustainable living standard trajectory. For our base case, we compute the highest living standard that is sustainable throughout life in all contingencies; this corresponds to a consumption growth rate of zero. For sufficiently patient (impatient) households, it may be more natural to construct benchmarks based on a rising (falling) living standard trajectory.

[22] In almost all cases, the fractions with significant (13.5 percent for the base case) and severe (23.9 percent for the base case) vulnerabilities change by 1 percentage point or less. The only exceptions were as follows: with a wage growth rate of 2 percent, the fraction with significant vulnerabilities increased by 1.1 percentage point; with a 20-percent reduction in wealth, the fractions with significant and severe vulnerabilities rose by 1.3 points and 1.5 points, respectively.

respectively, in the base case) fall to 10.7 percent and 16.0 percent, respectively, in the absence of household scale economies (an extreme and implausible assumption), and rise to 17.5 percent and 32.0 percent, respectively, when we reduce the rate of pension survivor benefits from 100 to 50 percent.

Since some widows do move, we examine sensitivity to two alternative assumptions concerning housing. For the first, we adopt the extreme position that housing consumption is completely flexible, and that housing equity is a perfect substitute for other forms of wealth. For the second alternative, we adopt an intermediate position: a survivor downsizes the couple's primary residence by 30 percent, but thereafter avoids using housing equity to finance ordinary living expenses.[23] The overall frequencies of severe and significant exposures fall dramatically with the first alternative (to 6.0 and 12.2 percent, respectively), but only slightly with the second alternative (to 12.9 and 22.9 percent, respectively).

To evaluate the importance of possible changes in labor force participation, we consider an extreme alternative assumption: all survivors work full time. We impute full-time earnings based on regressions of earnings on demographic characteristics, estimated separately for fully employed men and women. A survivor's contingent earnings are set equal to the maximum of imputed earnings and actual earnings. Due to familiar sample selection problems, this procedure tends to overstate potential earnings for nonworkers; it therefore understates survivors' financial vulnerabilities. The overall frequencies of severe and significant financial exposures decline moderately, to 9.9 percent and 19.3 percent, respectively. This is not surprising, as financial vulnerabilities are common even among dual-earner couples (recall Table 3).

Although the estimated fractions of individuals with substantial uninsured financial vulnerabilities are sensitive to certain assumptions, we continue to find little or no correlation between insurance coverage and underlying vulnerabilities in all of these instances.

[23] In this exercise, we assume that the financing for the new house is the same as the continuation financing for the old house. Consequently, upon a spouse's death, the decline in home equity equals the reduction in the value of the home, and there is an offsetting increase in nonhousing assets; mortgage payments are unchanged, but other housing expenses fall by 30 percent.

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