SAVING AND LIFE INSURANCE HOLDINGS AT BOSTON UNIVERSITY - A UNIQUE CASE STUDY

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This study examines the saving and insurance behaviour of 386 Boston University (BU) employees who volunteered to receive financial planning based on ESPlanner (Economic Security Planner) – a detailed life-cycle financial planning model developed by Economic Security Planning, Inc. Because the employees received their own financial plan, they had a strong incentive to provide full and accurate financial information. Hence, the data appear to be of particularly high quality for studying saving and life insurance decisions.

ESPlanner recommends annual levels of consumption, saving, and life insurance holdings that smooth a household's living standard through time subject to the household not exceeding its self-ascribed borrowing limit. The programme treats housing and special expenditures as 'off-the-top', adjusts for economies in shared living and the relative costs of raising children, makes highly detailed tax and Social Security benefit calculations, and permits users who don't want a stable living standard to specify how they'd like their living standards to change through time.

Our findings are striking. First, the correlation between ESPlanner's saving and insurance prescriptions and the actual decisions being made by BU employees is very weak in the case of saving and essentially zero in the case of life insurance. Many employees are spending far more and saving far less than they should, while others are under-spending and over-saving. The same holds for life insurance. The degree of under-insurance seems particularly acute. Almost 13 per cent of those BU spouses who are secondary earners would experience a 40 per cent or greater drop in their living standards were their spouses to pass away in the near future. Another 13 per cent would experience a 20 to 40 per cent drop. Second, planning shortcomings are as common among high-income professors with significant financial knowledge as they are among low-income staff with limited financial knowledge. Third, two thirds of BU employees are not in a position to smooth their living standards without exceeding their debt limits.

Keywords: consumption; saving; life insurance; financial planning; wealth accumulation

JEL classifications: D1; E2; G0

I. Introduction

This study examines the saving and insurance behaviour of 268 married and 118 single Boston University (BU) employees who volunteered to receive financial planning based on *ESPlanner*™ (Economic Security Planner) – an elaborate life-cycle financial planning programme developed by Economic Security Planning, Inc. Study participants received their financial plan for free. They also were given the choice of receiving either a free copy of ESPlanner, together with their input file, or a cash payment that ranged from $25 to $100. Because the employees knew they were helping to generate their own financial plan, they had a strong incentive to provide full and accurate financial information. Hence, the data collected from the planning sessions appear to be of particularly high quality for studying saving and life insurance decisions.

ESPlanner solicits extensive and detailed demographic

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and financial data and uses these data to determine annual levels of consumption, saving, and life insurance holdings that smooth a household's living standard through time subject to the household not exceeding its self-declared borrowing limit.[1] The programme treats housing and special expenditures as 'off-the-top', adjusts for economies in shared living and the relative costs of raising children, makes highly detailed tax and Social Security benefit calculations, and permits users who don't want a stable living standard to specify how they'd like their living standard to change through time.

We take ESPlanner's consumption, saving, and life insurance recommendations as a reference point from which to consider actual choices of these variables. Large and widespread deviations of ESPlanner's recommended levels of consumption, saving, and life insurance from actual levels would suggest that BU employees are making significant financial planning mistakes. This, unfortunately, is exactly what we find. Indeed, the correlation between ESPlanner's saving and insurance prescriptions and the actual decisions being made by BU employees is very low in the case of consumption and saving and essentially zero in the case of life insurance. Many employees are spending much more and saving much less than they should, while others are under-spending and over-saving.

The same holds for life insurance. The degree of under-insurance is particularly worrisome. Almost 13 per cent of those BU spouses who are secondary earners would experience a 40 per cent or greater drop in their living standards were their partners to pass away in the near future. Another 13 per cent would experience a 20 to 40 per cent drop.

While one might expect that those BU employees who appear to be making financial mistakes would be less well educated or have less financial knowledge, this is not the case. Highly compensated professors with substantial knowledge of financial matters are just as likely as staff members with little financial acumen to make what appear to be inappropriate saving and insurance decisions.

In addition to studying saving and insurance behaviour, our study addresses a range of questions about household financial behaviour that have previously been hard to investigate. One example is the degree to which households face liquidity constraints. In our sample, 66.4 per cent of married couples and 67.8 per cent of singles are unable to smooth perfectly their living standards. Younger households with lower incomes and levels of regular assets are much more likely to be borrowing constrained. But borrowing constraints also limit the consumption smoothing of one third of older households with high incomes and large amounts of assets.

A second example is the degree to which BU's generous 403(b) retirement saving plan limits consumption smoothing. We considered a) eliminating the plan, but b) having the University increase each employee's direct pay by the amount it would otherwise have contributed to their 403(b) account. According to ESPlanner, this policy would increase the current consumption of married employees by 9.0 per cent and that of single employees by 20.4 per cent. Retirement consumption of married employees would decline by 8.0 per cent and that of single employees by 10.4 per cent.

A third example is the degree to which households differ with respect to the rates of return they expect to earn on their investments. Just over 80 per cent of BU employees used the programme's 3 per cent real return default assumption. Another 8 per cent set their real returns below 3 per cent, and the remainder set their real returns above 3 per cent, with only 1 per cent setting their real returns at 8 per cent or higher.

The paper proceeds with a review of the literature, an overview of ESPlanner, a description of the survey protocol and data collection, and a presentation of findings. The final section concludes with suggestions for future research.

Literature review

Bernheim, Carman, Gokhale, and Kotlikoff (2001) and Bernheim, Forni, Gokhale, and Kotlikoff (2003) use *ESPlanner* to examine life insurance holdings of respondents in the Survey of Consumer Finances (SCF) and the Health and Retirement Study (HRS), respectively. Both studies document a startling mismatch between the amounts of life insurance that individuals hold and the underlying insurance needs of their potential survivors. In particular, they find virtually no correlation between these two variables regardless of age, income, or other demographic or financial characteristics.

For those in need of insurance, these findings are troubling. Consider secondary earners in the SCF, which is a nationwide survey. In the absence of life insurance,

56 per cent of secondary earners would have experienced a 20 per cent or greater decline in living standard upon the death of a spouse. Actual life insurance holdings reduced the fraction of secondary earners exposed to such a severe decline in their living standards to 42 per cent. Thus, the overall impact of life insurance holdings on financial vulnerabilities among at-risk SCF households is modest. Roughly two-thirds of poverty among widows and more than one-third of poverty among widowers appears to reflect inadequate life insurance. While younger households are likely to have acquired/updated their life insurance holdings more recently than older ones, the evidence suggests that younger households are less adequately insured than older ones.

The results based on the Health and Retirement Study, which covers Americans approaching retirement, are much the same. Ignoring life insurance, 53 per cent of secondary earners would have experienced a 20 per cent or greater decline in their living standards had their spouses died at the time of the survey. Actual life insurance holdings reduced this figure to 36 per cent.

These findings resonate with those of Holden, Burkhauser, and Myers (1986) and Hurd and Wise [1989], who document sharp declines in living standards and increases in poverty rates (from 9 to 35 per cent) among women whose husbands had actually died. The findings also accord with those of Auerbach and Kotlikoff (1987, 1991a, 1991b), who analysed Retirement History Survey data gathered during the late 1960s. Auerbach and Kotlikoff report that roughly one-third of wives and secondary earners would have seen their living standards decline by 25 per cent or more had their spouses died at the time of the survey.

ESPlanner

ESPlanner uses dynamic programming to smooth a household's living standard over its life cycle to the extent possible without allowing the household to exceed its self-assessed debt limit. Formally, the programme's algorithm is equivalent to maximising the limit, as the coefficient of risk aversion goes to infinity, of a time-separable isoelastic utility function with period-specific weights.[2] This maximisation is taken with respect to annual consumption levels and annual term life insurance holdings of the household head and, if married, his or her spouse. Non-negativity constraints on life insurance and debt limits constrain these decisions.

In making its calculations, ESPlanner takes into account the non-fungible nature of housing, bequest plans, economies of shared living, the presence of children under age 19, and the desire of households to make 'off-the-top' expenditures on college tuition, weddings, and other special expenses. In addition, ESPlanner simultaneously calculates the amounts of life insurance needed by each spouse to guarantee that potential survivors suffer no decline in their living standards compared with what would otherwise be the case.

Life insurance amounts are calculated subject to non-negativity constraints. When the programme recommends zero life insurance, survivors will have the same or higher living standards than they enjoyed prior to the decedent's death. Life insurance recommendations at each age are also made for surviving spouses.[3] In this regard, the partner's life insurance recommendation takes into account the need for his (her) widow (widower) to pay an insurance premium on her (his) own insurance policies.

ESPlanner formulates its recommended time-paths of consumption expenditures, taxable saving, and term life insurance holdings in constant dollars of the current year. Consumption, in this context, is everything the household gets to spend after paying for its 'off-the-top' expenditures – its housing expenses, special expenditures, life insurance premiums, special bequests, taxes, and contributions, net of withdrawals, to tax-favoured accounts. Given the household's demographic information, preferences, and borrowing constraints, ESPlanner calculates the highest sustainable and smoothest possible living standard over time, leaving the household with zero terminal assets apart from the equity in homes that the household chooses not to sell.

The amount of recommended consumption expenditures needed to achieve a given living standard varies from year to year in response to changes in the household's composition. It also rises when the household moves from a situation of being liquidity constrained to one of being unconstrained. Finally, recommended household consumption will change over time if users intentionally specify that they want their living standard to change, which, to repeat, they can do via the standard of living index.[4]

Because taxes and Social Security benefits make a critical difference to how much a household should consume, save, and insure, calculating these variables accurately is very important.[5] ESPlanner has highly

detailed federal income tax, state income tax, Social Security's payroll tax, and Social Security benefit calculators.[6]

2. A strategy for measuring financial vulnerabilities

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 (equivalently, they are within two years of maximum lifespan). Both are alive initially, but either may die before the second year. The household's wellbeing depends on consumption in the current year and in the following year in each survival contingency. As discussed further below, we allow for the possibility that certain expenditures (e.g., special expenditures and 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_iL_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: $c_1 = y_1 - A - p_WL_W - p_HL_H$, $c_{2B} = y_{2B} + A(1+r)$, 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 non-negativity restrictions on life insurance and assets). Defining $P_B = (1+r)^{-1} - P_W - P_H$, these equations imply:

$$c_1 + p_Bc_B + p_Wc_W + p_Hc_H = y_1 + p_By_B + p_Wy_W + p_Hy_H \equiv Y \quad (1)$$

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 2^{σ} because there are no children in this example. $\sigma = 0.678$ reflecting the assumption that living costs for a couple are 1.6 those of a single person. To maintain a living standard c^* for each person that is constant across time and states of nature (in this case, survivorship), the couple must spend $2^{\sigma}c^*$ whenever both spouses are alive and c^* when only one spouse is alive. From (1), we have

$$c^* = \frac{Y}{2^{\sigma}(1-p_B)+(p_W+p_H)} \quad (2)$$

The couple can guarantee that spouse j's death will not diminish i's living standard by purchasing a life insurance policy with a face value of $L_i = (c^* - y_{2i}) + (y_{2B} - 2^{\sigma}c^*)$.[7]

We measure underlying financial vulnerabilities by comparing an individual's highest sustainable living standard, c^*, with $c_i^n = y_{2i} + A(1+r)$, which represents the living standard he or she would enjoy if widowed, ignoring life insurance. We define the variable POTENTIAL IMPACT as $[(c_i^n / c_i^*) - 1] \times 100$, for $i = W, H$. This is a measure of the per cent by which the survivor's living standard would fall short of or exceed the couple's highest sustainable living standard *absent any insurance protection.*

Similarly, we measure uninsured financial vulnerabilities by comparing c^* with $c_i^a = y_{2i} + A(1+r) + L_i^a$, which represents the living standard the widow(er) would actually enjoy given actual life insurance coverage, L_i^a. We define the variable ACTUAL IMPACT as $[(c_i^a / c_i^*) - 1] \times 100$, for $i = W, H$. This is a measure of the per cent by which the survivor's living standard would fall short of or exceed the couple's highest sustainable living standard, *given actual levels of coverage.*[8]

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. They are also typically unable or at least very reluctant to purchase negative quantities of life insurance (buy annuities).[9] In solving for each household's highest sustainable living standard, we take these restrictions into account, smoothing consumption to the greatest extent possible.[10]

When the life insurance constraint binds, the recommended living standard for a survivor, c_i^* (where $i = H$ or W), may be greater than the recommended 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 recommendation by purchasing additional insurance ($L_i^a > L_i^*$), but also for constrained households that conform to the recommendation 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 $0 = L_i^a = L_i^*$. Since we wish to use ACTUAL IMPACT as a measure of the extent to which a household deviates from the consumption-smoothed (recommended) level, we select c_i^* rather than c_B^*. As a result, the value of POTENTIAL IMPACT is always non-positive (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 recommended insurance level, L_i^*, is zero.

One noteworthy difference between this and earlier studies of insurance adequacy is that key parameters such as maximum ages of life, planned retirement ages, future expected inflation, expected interest rates, the child-adult equivalency factors, planned future expenditures, funeral expenses, bequests, and, in particular, desired living standards of survivors are provided by the survey participants rather than assumed by the researcher. Hence, ESPlanner's calculated sustainable living standards of joint and survivor households is based on a much larger set of user-defined parameters than is usually the case in similar studies. The same remark applies to the programme's recommended profiles of life insurance, consumption, and saving designed to deliver the maximum sustainable living standards for intact and surviving households.

Findings

Characteristics of the BU sample

Tables 1 and 2 report general characteristics of our sample for married and single households, respectively. Consider first non-housing wealth. For married households the mean and median values of this variable equal $306,184 and $74,970, respectively. These figures exceed the corresponding national values of $256,570 and $18,060 calculated from the 1998 Survey of Consumer Finances.[11] For single households, mean non-housing wealth is $76,124, which is less than the national average of $94,101. However median non-housing wealth level for singles is $14,172 compared to a national median of $5,620. The smaller differences between means and medians in the BU sample suggests less dispersion in our sample than in the overall population.

The generally higher non-housing wealth level in the BU sample is consistent with the fact that well over 80 per cent of our sample respondents and their spouses hold college degrees compared to the national averages of 36

Table 1. Descriptive statistics for married households

Variable	Mean	Median
Non-housing net wealth	306,184	74,970
Primary home ownership	0.83	1.00
Primary home value	447,507	400,000
Household non-asset income	133,861	122,900
Number of children	1.05	1.00

Variable	Husband		Wife		Primary earner		Secondary earner	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Age	51	51	48	49	50	50	49	49
Non-white	0.131	0.000	0.135	0.000	0.135	0.000	0.131	0.000
College degree	0.878	1.000	0.861	1.000	0.906	1.000	0.833	1.000
Pension coverage	0.144	0.000	0.118	0.000	0.137	0.000	0.125	0.000
Non-asset income	90,169	77,500	43,692	39,000	98,170	84,869	35,692	31,250
Actual life ins.	304,712	191,668	128,823	69,374	317,367	211,209	116,168	46,748
Actual minus BU ins.	249,226	144,078	112,091	46,748	258,994	143,985	102,323	44,878
Benchmark life ins.	320,336	181,816	77,282	0	331,288	204,430	66,330	0
% change in living standard ignoring ins.	-8.78	0.00	-26.34	-17.94	-6.97	0.00	-28.14	-19.82
Actual % change in lving standard	2.32	1.67	-4.94	1.61	1.33	1.79	-3.95	0.96
% change in living standard ignoring BU ins.	0.26	0.39	-8.64	0.00	0.30	0.57	-8.68	0.00

Note: Actual and benchmark life insurance refer to insurance on the life of the individual listed at the top of the column. Changes in living standard for the spouse listed at the top of each column depend on insurance on the life of the other spouse.

Table 2. Descriptive statistics for single employees

	Mean	Median
Non-housing net wealth	76,124	14,172
Primary home ownership	0.44	0
Primary home value	214,880	200,000
Non-asset income	59,389	48,851
Age	44	45
Non-white	0.258	0
College degree	0.875	1
Pension coverage	0.085	0
Number of children	0.3	0
Recommended insurance	32,654	0
Actual insurance	109,317	52,000
BU insurance	56,495	500

per cent for married males, 29 per cent for married females, and 33 per cent for single household heads. As would be expected, married households have a much greater rate of home-ownership – 83 per cent – compared to that for single individuals – 44 per cent. The national rates of home-ownership for married and single households are 79 per cent and 49 per cent, respectively. A small fraction of BU sample households are covered under defined benefit pensions (14 per cent for married males and 9 per cent for single households). Finally, about 13 per cent of married households and 26 per cent of single households are non-white. The corresponding national percentages are 19 per cent and 27 per cent.

Panel 2 of table 1 indicates that for married households, average actual insurance ($304,712) falls just short of the average recommended level ($320,336) for husbands. BU automatically provides its employees with a minimum of one-year's salary in life insurance coverage. This reduces the amount of insurance purchases required to achieve a given living standard for surviving household members. Purchased insurance averaged $249,226 for husbands and $112,091 for wives. Husbands' median total insurance is larger than median recommended insurance. For wives, both mean and median total insurance exceed the respective mean and median recommended insurance levels. For singles, mean and median recommended insurance amounts are $32,654 and $0, while the mean and median of actual insurance are $109,317 and $52,000.

On average, husbands would face an 8.78 per cent living standard decline and wives a 26.34 per cent decline were their spouses to die completely uninsured. But, as indicated in the second from last row in table 1, given actual life insurance holdings, the husbands would, on average, be better off to the tune of 2.32 per cent, while the wives would, on average, be worse off by only 4.94 per cent. As a comparison of the husband and wife means in the last two rows indicates, BU's provision of life insurance appears to play a small role in reducing the financial risk of widowhood among our sample. Note also that the mean percentage change in living standard results for primary and secondary earners are quite similar to those for husbands and wives since most husbands are primary earners.

The median results on living standard changes indicate that, absent insurance, at least half the husbands would experience no drop in their living standards were they to become widowed. For wives, the story is different. Here half the wives would experience a 17.94 per cent or greater living standard decline in the absence of any insurance proceeds. The availability of life insurance changes this picture dramatically in the case of wives. Their median change in living standard from widowhood rises from negative 17.94 per cent to positive 1.61 per cent when we move from the potential change in their living standard to the actual change they'd experience. For husbands, actual life insurance moves the median from a zero per cent change to a positive 1.67 per cent change.

Thus, the impression one gets from these initial summary statistics is that life insurance protection is very important for most sample wives, but that they are, in general, receiving that protection. As we'll show below, this overall assessment masks a significant degree of underinsurance among a sizable minority of secondary earners, most of whom are wives.

ESPlanner's user inputs

Tables 3 and 4 show summary statistics of married and single households' choices of key ESPlanner parameters. In general the choices seem to span a reasonable range of alternatives. On the other hand, the default values may have influenced some of these choices. With the exception of the maximum age of life, each of the median values in the tables equals the default input value for the variable in question. The default value for the maximum age of life is 95. But the medians for both husbands and single respondents is 90.

For married households, mean funeral expenses average $5,428. For singles, they average $4,187. Most married households prefer to have survivors enjoy the same living standard as the joint household. Mean desired bequests for husbands and wives are $40,723 and $28,458 respectively. They are $28,123 for singles.

Table 3. Inputs of married households

Variable	Mean	Median	Max	Min
Wife				
Funeral expenses	5,428	5,000	20,000	0
Survivor living standard (%)	99.87	100.00	110.00	80.00
Special bequest	40,723	0	2,000,000	0
Maximum age	92	95	105	70
Retirement age	64	65	88	45
Tax-favoured interest rate	6.50	6.00	20.00	3.80
Husband				
Funeral expenses	5,343	5,000	20,000	0
Survivor living standard (%)	100.09	100.00	125.00	75.00
Special bequest	28,458	0	1,200,000	0
Maximum age	90	90	105	65
Retirement age	66	65	87	53
Tax-favoured interest rate	6.61	6.00	20.00%	3.80
Child-adult equivalence	0.7	0.7	1	0
Maximum indebtedness	1,318	0	150,000	0
Inflation	3.08	3.00	5.00	2.00
Interest rate	6.37	6.00	20.00	3.00
Percentage of SS cut	8.63	0.00	100.00	0.00
Economy of joint living	1.6	1.6	2	1.6

Table 4. Inputs of single households

Variable	Mean	Median	Max	Min
Child-adult equivalence	0.69	0.7	0.7	0.4
Maximum indebtedness[a]	2,146	0	100,000	0
Nominal interest rate	6.33	6	12	3
Tax-favoured interest rate	6.46	6	10	6
Inflation rate	3.04	3	5	2.5
Maximum age	90	90	112	70
Retirement age	66	65	80	56
Percentage of SS cut	11	0	100	0
Special bequest	28,123	0	1,000,000	0
Funeral expenses	4,187	5,000	12,000	0

Note: Maximum indebtedness refers to the most a household can borrow apart from borrowing against its home, i.e. apart from taking out a mortgage.

Husbands, wives, and singles entered maximum ages of life that averaged 90, 92, and 90, respectively. Singles and husbands expect, on average, to retire at age 66, while for wives the mean retirement age is 64. The youngest retirement age specified by the subjects is 45 (set by a wife) and the oldest is 87 (set by a husband).

All of these inputs seem to conform with demographic and behavioural norms of the US population. Other economic inputs also seem reasonable. On average, expected inflation is about 3 per cent per year, expected nominal rates of return on tax-favoured saving average just north of 6 per cent and, on average, households expect modest cuts in future Social Security benefits. On the other hand, based on their reported maximum indebtedness estimates, married households' estimates of their ability to borrow appear to be lower than prevailing debt levels in the United States, especially among a population as well educated and economically secure as the BU sample of married households. This estimate is higher for single households – as shown in table 4.

Again, these findings may be influenced by the default values for the economic inputs. They are 3 per cent for inflation, 6 per cent nominal rates of return on both regular assets and retirement account assets, and zero with respect to the maximum level of indebtedness. Table 5 shows that the fraction of those selecting extremely large or extremely small values for the different parameters is relatively small. For example, tables 5 and 6 show the distributions of nominal and real interest rates and the inflation rate selected by married and single households. More than three-fourths of the households selected the default values of these parameters.

Borrowing constraints

The first panel of table 7 shows the fraction of married borrowing-constrained households by age. A household is deemed to be borrowing constrained if its consumption cannot follow the household's desired growth path without infringing the user-specified borrowing limit at least once during the household's remaining lifetime. The fraction of borrowing constrained households is very high for young households and declines with age. All but one of the under-30 households is borrowing constrained. Even for those over age 70, the fraction of borrowing constrained households is quite large – over 40 per cent. Overall, two-thirds of the sample is borrowing constrained.

The second panel of table 7 suggests, as expected, that the incidence of borrowing constraints is more frequent among relatively low earning households. The third panel of table 7 suggests, again as expected, that low net worth households are more likely to face borrowing constraints. The three panels of table 8 repeat those of table 7 for single headed households. They show that the patterns of borrowing constraints by age, earnings, and net worth are similar to those of married households.

Table 9 reorganises the information of table 7. It shows the per cent of married households that are borrowing constrained and the average number of years for which

Table 5. Distributions of nominal interest, real interest, and inflation rates specified by married employees

	Distribution among those specifying a non-default value			Overall distribution		
	Number	Per cent	Cumulative per cent	Number	Per cent	Cumulative per cent
Nominal interest rate[a]						
<4%	3	5.08	5.08	3	1.12	1.12
4–5%	17	28.81	33.90	17	6.34	7.46
5–6%	0	0.00	0.00	209	77.99	85.45
6–7%	6	10.17	44.07	6	2.24	87.69
7–8%	15	25.42	69.49	15	5.6	93.28
8–9%	3	5.08	74.58	3	1.12	94.4
9–10%	10	16.95	91.53	10	3.73	98.13
10–11%	2	3.39	94.92	2	0.75	98.88
>11%	3	5.08	100	3	1.12	100
Total	59	100.00	100.00	268	100.00	100.00
Real interest rate[b]						
<1 %	2	3.28	3.28	2	0.75	0.75
1–2 %	9	14.75	18.03	9	3.36	4.1
2–3 %	13	21.31	39.34	13	4.85	8.96
3–4 %	7	11.48	50.82	214	79.85	88.81
4–5 %	2	3.28	54.1	2	0.75	89.55
5–6 %	13	21.31	75.41	13	4.85	94.4
6–7 %	3	4.92	80.33	3	1.12	95.52
7–8 %	9	14.75	95.08	9	3.36	98.88
>8 %	3	4.92	100	3	1.12	100
Total	61	100.00	100.00	268	100.00	100.00
Inflation rate[b]						
<2 %	1	5.00	5.00	1	0.37	0.37
2–3 %	1	5.00	10.00	249	92.99	93.36
3–4 %	12	60.00	70.00	12	4.43	97.79
4–5 %	2	10.00	80.00	2	0.74	98.52
>5 %	4	20.00	100.00	4	1.48	100.00
Total	20	100.00	100.00	268	100.00	100.00

Notes: (a) Default value is 6 per cent. (b) Default value is 3 per cent.

borrowing constraints bind by age, earnings, and wealth. Households that are young, have low net wealth, and earn relatively little are almost certain to be borrowing constrained for a large number of years. A smaller, but still quite high fraction of older, richer, and high-earning households are borrowing constrained, although their constraints bind for fewer years.

These points are illustrated by comparing a) married households less than 40 years old, with earnings below $80,000, who hold less than $10 in regular (non housing and non retirement account) assets with b) married households older than 50, with earnings in excess of $180,000, and with regular assets of $200,000 or more. In the former group 77 per cent are liquidity constrained for an average of twelve years. Among the latter group 35 per cent are liquidity constrained for an average of only one year. Table 10 repeats table 9, but for singles. The results are roughly similar to those in table 10.

Insurance adequacy

Table 11 considers life insurance adequacy. It shows that about two-thirds of wives and one-third of husbands would suffer some reduction in their living standards were their spouses to die immediately. More than a quarter of all wives would, in the absence of insurance, experience a 40 per cent or greater reduction in their living standards. Another 21 per cent of wives experience a 20 to 40 per cent reduction. In contrast, only 6 per cent of husbands face a reduction in living standards in excess of 40 per cent, and only 11 per cent face a reduction of 20 to 40 per cent.

Figures 1a and 1b present scatter plots of ACTUAL and POTENTIAL IMPACT for husbands and wives respectively. Because we use c_i^* rather than c_B^* as our

Table 6. Distributions of nominal interest, real interest, and inflation rates specified by single employees

	Distribution among those specifying a non-default value			Overall distribution		
	Number	Per cent	Cumulative per cent	Number	Per cent	Cumulative per cent
Nominal interest rate[a]						
<3%	1	5.26	5.26	1	0.85	0.85
3–4%						
4–5%	4	21.05	26.32	4	3.39	4.24
5–6%				99	83.9	88.14
6–7%						
7–8%	6	31.58	57.89	6	5.08	93.22
8–9%						
9–10%	7	36.84	94.74	7	5.93	99.15
10–11%						
>11%	1	5.26	100	1	0.85	100
Total	19	100	100	118	100	100
Real interest rate[b]						
<1 %	2	10	10	2	1.69	1.69
1–2 %	4	20	30	4	3.39	5.08
2–3 %	1	5	35	99	83.9	88.98
3–4 %						
4–5 %	5	25	60	5	4.24	93.22
5–6 %						
6–7 %	7	35	95	7	5.93	99.15
7–8 %						
>8 %	1	5	100	1	0.85	100
Total	20	100	100	118	100	100
Inflation rate[b]						
<3 %	1	25	25	115	97.46	97.46
3–4 %	1	25	50	1	0.85	98.31
>4 %	2	50	100	2	1.69	100
Total	4	100	100.00	118	100	100.00

Notes: (a) Default is 6 per cent. (b) Default value is 3 per cent. (c)

recommended level of consumption, POTENTIAL IMPACT is always negative or zero. Moreover, ACTUAL IMPACT cannot be less than POTENTIAL IMPACT. The cluster of points on the right vertical axis of the figures represents cases in which the surviving spouse would face either no impact from the death of his/her partner or a rise in his/her living standard.

The figures indicate that the vast majority of households have negative POTENTIAL IMPACT. Of these, about half have significant levels of POTENTIAL IMPACT (< –20 per cent) and about a quarter have severe POTENTIAL IMPACT (< –40 per cent). Second, the plot shows that very few of those with severe POTENTIAL IMPACT have positive ACTUAL IMPACT. Thus, insurance inadequacy seems to be greater among households where spouses are highly vulnerable. Third, the plots show that very few households purchase the 'correct' amount of insurance relative to our recommended level – that is, very few households are able to purchase life insurance to make ACTUAL IMPACT equal or close to zero.

Table 11 shows that, for both wives and husbands, the share of those with severe ACTUAL IMPACT is only half as large as the share of those with severe POTENTIAL IMPACT (13 per cent rather than 26 per cent for wives, and 3 per cent rather than 6 per cent for husbands). It also shows that BU-provided insurance contributes relatively little toward ameliorating financial vulnerability of surviving households. For example, the share of husbands facing severe vulnerability would decline by only 2.6 percentage points, and the share of those facing moderate vulnerability would be reduced by less than half a percentage point. The same conclusion applies to wives facing severe and moderate financial vulnerability.

Table 7. Number of married households that are liquidity constrained at least once by age, income, and net worth

	Total	Number constrained	Percentage
Age			
<30	24	23	95.83
30–40	49	45	91.84
40–50	88	62	70.45
50–60	76	35	46.05
>70	31	13	41.94
Total	268	178	66.00
Household earnings			
<$80K	60	40	66.67
$80–$120K	70	54	77.14
$120–$180K	85	55	64.71
>$180K	53	29	54.72
Total	268	178	66.00
Net worth			
<$10K	52	42	80.77
$10–$50K	59	51	86.44
$50–$100K	37	26	70.27
$100–$200K	32	23	71.88
>$200K	88	36	40.91
Total	268	178	66.00

Table 8. Number of single households that are liquidity constrained at least once by age, income, and net worth

	Total	Number constrained	Percentage
Age			
<30	22	21	95.45
30–40	28	25	89.29
40–50	24	11	45.83
50–60	35	21	60.00
>70	9	2	22.22
Total	118	80	67.80
Earnings			
<$40K	46	37	80.43
$40–$60K	30	19	63.33
$60–$80K	21	11	52.38
>$80K	21	13	61.90
Total	118	80	67.80
Net worth			
<$10K	55	42	76.36
$10–$50K	27	23	85.19
$50–$100K	9	5	55.56
$100–$200K	14	5	35.71
>$200K	13	5	38.46
Total	118	80	67.80

With actual insurance, only 13 per cent of wives and 7 per cent of husbands remain moderately financially vulnerable. Actual exposure to severe and moderate

Table 9. Percentage of married households that are liquidity constrained and average number of years constrained by age, earnings, and net worth

Age	Earnings	Net worth					Total
		<$10K	$10–$50K	$50–$100K	$100–$200K	>$200K	
<40	<$80K	77	100	0	100	0	88
		12	11	0	4	0	12
	$80–$120K	100	100	67	0	100	95
		10	13	2	0	2	10
	$120–$180	100	100	100	100	100	100
		5	4	6	2	4	4
	>$180K	100	0	100	0	75	88
		6	0	2	0	5	5
	Total	88	100	91	100	88	93
		11	10	4	3	4	9
40–50	<$80K	67	75	75	0	0	61
		3	4	4	0	0	3
	$80–$120K	75	89	100	40	100	81
		8	6	5	1	8	5
	$120–$180	80	67	100	100	64	77
		2	3	8	8	3	4
	>$180K	0	0	100	100	36	56
		0	0	1	7	3	4
	Total	75	76	90	76	54	70
		4	4	4	5	4	4
>50	<$80K	57	100	50	0	0	38
		8	5	1	0	0	4
	$80–$120K	80	100	25	67	38	55
		2	7	0	2	4	3
	$120–$180	100	57	57	60	24	43
		12	2	3	3	1	2
	>$180K	0	100	33	60	35	44
		0	1	1	3	1	2
	Total	71	75	44	62	27	45
		6	3	1	3	1	2

financial vulnerability is similar if we ignore BU insurance. About 52 per cent of surviving wives would enjoy higher living standards compared to their current living standard. The corresponding percentage for surviving husbands is 56 per cent.

The bottom panel of table 11 shows that almost half per cent of secondary earners would suffer living standard declines of 20 per cent or more in the absence of insurance covered. Insurance coverage lowers this figure from 50 per cent to 28 per cent. Non-BU insurance coverage accounts for the lion's share of this improvement.

Table 12 shows the mean value of IMPACT with no insurance, actual insurance, and actual less BU insurance. The first row shows that those wives with a POTENTIAL IMPACT of 40 per cent or greater would, on average, suffer a roughly 70 per cent reduction in

Table 10. Percentage of single households that are liquidity constrained and average number of years constrained by age, earnings, and net worth

Age	Earnings	Net worth					Total
		<$10K	$10–$50K	$50–$100K	$100–$200K	>$200K	
<40	<$40K	92	100	100	0	0	94
		8	19	57	0	0	11
	$40–$60K	100	100	0	0	0	92
		18	7	0	0	0	9
	$60–$80	100	100	0	0	100	100
		5	15	0	0	12	9
	>$80K	100	0	0	100	0	67
		47	0	0	3	0	17
	Total	94	93	100	50	100	92
		10	11	57	2	12	11
40–50	<$40K	50	0	0	0	0	29
		2	0	0	0	0	1
	$40–$60K	60	100	100	0	0	63
		5	9	1	0	0	5
	$60–$80	50	0	0	0	0	33
		1	0	0	0	0	0
	>$80K	0	0	0	100	50	50
		0	0	0	14	3	5
	Total	50	33	50	50	33	46
		3	3	1	7	2	3
>50	<$40K	50	100	100	0	0	75
		3	3	1	0	0	2
	$40–$60K	33	100	0	33	0	30
		2	1	0	0	0	1
	$60–$80	67	75	0	0	100	43
		3	3	0	0	14	3
	>$80K	100	100	100	50	40	67
		16	2	1	1	1	4
	Total	58	89	50	25	33	52
		5	2	1	0	2	2

their living standards absent any insurance on their husbands' lives. Mean ACTUAL IMPACT for these wives indicates that they remain exposed to a 38 per cent reduction in living standards despite the coverage on their husbands' lives. According to ESPlanner, these husbands should, on average, purchase more than $800,000 in coverage. But their actual coverage averages less than half that amount.

POTENTIAL IMPACT averages 60 per cent for husbands facing a potential living standard reduction of 40 per cent or more. After accounting for the insurance coverage on their wives' lives, they remain exposed to a 28 per cent reduction in living standards. Again, these wives' insurance coverage averages less than half the recommended amount of $348,000.

Among wives with moderate POTENTIAL IMPACT, insurance on husbands' lives cuts the reduction in their living standards as survivors from 31 per cent to 7 per cent. For husbands with moderate POTENTIAL IMPACT, the reduction in living standards as survivors falls from 30 per cent to 14 per cent.

Table 12 also shows that BU-provided insurance also makes little difference with respect to lowering actual vulnerability. For example, BU insurance reduces average IMPACT by just 5 percentage points for wives with severe POTENTIAL IMPACT and by just 4 percentage points for wives with severe POTENTIAL IMPACT. The reduction in IMPACT by BU-provided insurance on husbands with severe vulnerability is much greater (13 percentage points), but this is still only about one-fifth as large as their POTENTIAL IMPACT.

The last two panels of table 12 divide the sample according to primary and secondary earners. It shows that spouses of primary earners in the POTENTIAL-IMPACT< –40 per cent category seem to be especially

Table 11. Distribution of changes in living standard for surviving spouses (per cent of observations)

Impact	Surviving wives			Surviving husbands			Surviving secondary earners			Surviving primary earners		
(%)	Ignoring ins.	With actual ins.	Ignoring BU ins.	Ignoring ins.	With actual ins.	Ignoring BU ins.	Ignoring ins.	With actual ins.	Ignoring BU ins.	Ignoring ins.	With actual ins.	Ignoring BU ins.
<–40	25.83	12.55	15.13	5.90	2.95	4.06	28.04	12.55	16.24	3.69	2.95	2.95
–40 to –20	21.40	12.92	12.55	11.44	7.01	6.64	21.77	15.13	14.39	11.07	4.80	4.80
–20 to 0	18.45	16.61	18.08	17.71	11.81	12.18	20.66	16.61	17.34	15.50	11.81	12.92
0	34.32	5.54	11.07	64.94	22.51	25.83	29.52	5.17	10.33	69.74	22.88	26.57
0 to 20		36.90	30.63		45.76	43.17		32.10	26.57		50.55	47.23
20 to 40		11.07	9.59		8.12	6.27		12.55	10.70		6.64	5.17
>40		4.43	2.95		1.85	1.85		5.90	4.43		0.37	0.37

Figure 1a. Actual vs potential impact on husband's living standard of his wife's death

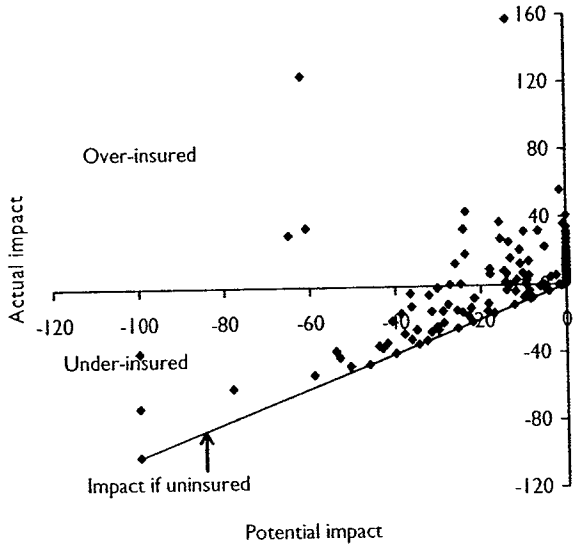
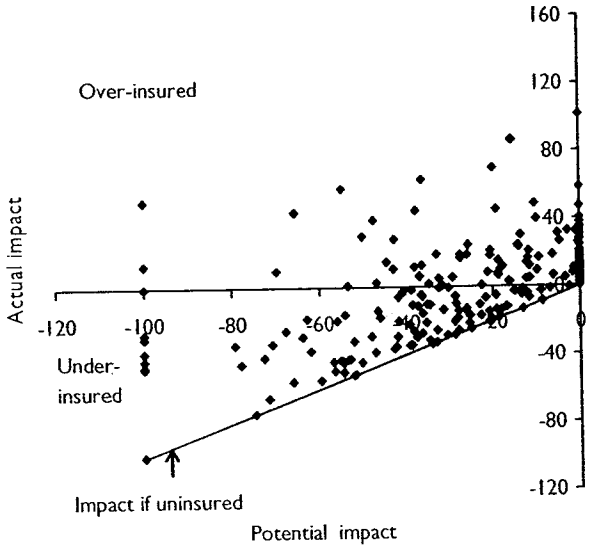


Figure 1b. Actual vs potential impact on wife's living standard of her husband's death



underinsured. Notwithstanding the insurance purchases on their spouses, these primary earners remain exposed to a 50 per cent reduction in living standards if their spouses die. Average insurance coverage for the secondary earners in such households is less than half of the average recommended amount.

Table 13 reports the fraction of households that deal with their financial vulnerability through the purchase of insurance for the full sample and several sub samples. It shows the fraction of households falling under two IMPACT thresholds: 40 per cent or greater (severe) and 20 per cent or greater (significant). For the entire sample, 28 per cent of secondary earners face POTENTIAL IMPACT greater than 40 per cent. Actual insurance purchases reduce this fraction to 12.6 per cent. Hence, as reported under the 'Frac. Addr' column, 55.2 per cent of secondary earners' severe POTENTIAL IMPACT is mitigated via holdings of life insurance. The corresponding figure for secondary earnings facing a significant impact is 45.2 per cent. For primary earners facing a severe POTENTIAL IMPACT, the extent of mitigation is only 20 per cent. It is 50 per cent for households with a 20-per cent-or-greater IMPACT.

The mitigation of POTENTIAL IMPACT via insurance purchases exhibits no significant pattern across earning groups. Spouses in low earning households are about as likely as those in high earning ones to mitigate secondary earners' POTENTIAL IMPACT. However, high income households where primary earners' face moderate levels of POTENTIAL IMPACT are generally more likely to mitigate this exposure, although sample sizes for such households are small. Dual-earning households are about as likely as single-earning ones to mitigate the POTENTIAL IMPACT of secondary earners. However, single-earning households are much less likely to mitigate the POTENTIAL IMPACT facing the primary earner.

The likelihood of secondary earners' POTENTIAL IMPACT being mitigated via insurance purchases is greater for households with a larger differential between primary and secondary earnings. The opposite holds in regard to mitigation of primary earners' POTENTIAL IMPACT: The likelihood of mitigation is greater the smaller the earnings differential between spouses.

The results suggest that secondary survivor's age is highly correlated with the likelihood of POTENTIAL IMPACT being mitigated. Young secondary earners have just over a 20-per cent likelihood of being protected via insurance coverage on the spouse's life. However, secondary earners closer to retirement age have a greater-than-two-thirds chance of being so protected. Secondary earners with children also have a higher likelihood of being protected, but only if their POTENTIAL IMPACT is severe. For secondary earners,

Table 12. Effect of life insurance on living standards of surviving spouses by level of vulnerability

Survivors	Impact range ignoring insurance	Mean impact (per cent)			Insurance holdings			
		Ignoring insurance	Actual insurance	Ignoring BU insurance	Per cent uninsured	Mean recommended	Mean actual	Mean actual less BU insurance
Wives	<–40%	–68.7	–38.4	–43.5	14.3	822,387	371,476	302,869
	–40% to –20%	–30.6	–7.3	–11.3	24.1	373,790	296,700	242,891
	–20% to 0%	–11.0	12.4	8.6	12.0	143,805	300,292	248,592
	0%	0.0	12.4	9.9	28.0	0	261,452	213,142
Husbands	<–40%	–60.9	–27.9	–40.7	12.5	348,379	121,218	88,497
	–40% to –20%	–29.5	–13.9	–15.9	45.2	328,063	170,954	151,655
	–20% to 0%	–10.2	8.4	6.3	33.3	108,323	179,295	158,749
	0%	0.0	6.3	5.2	65.9	0	108,329	94,542
Secondary earners	<–40%	–67.4	–34.7	–41.7	13.2	762,363	353,808	286,355
	–40% to –20%	–31.6	–7.4	–11.3	27.1	394,037	308,104	262,914
	–20% to 0%	–11.4	16.5	11.9	17.9	130,382	308,105	255,525
	0%	0.0	13.5	10.1	27.5	0	284,689	228,029
Primary earners	<–40%	–65.9	–49.5	–52.7	40.0	487,061	89,635	69,678
	–40% to –20%	–27.5	–14.0	–16.2	60.0	243,485	116,466	97,610
	–20% to 0%	–9.6	2.3	1.6	42.9	113,361	138,992	125,183
	0%	0.0	6.2	5.4	64.6	0	108,327	96,022

Table 13. Frequency of severe and significant living standard reductions for different types of surviving spouses

Characteristics of surviving spouses	Consequences for secondary earners						Consequences for primary earners					
	Severe(>40%)			Significant(>20%)			Severe(>40%)			Significant(>20%)		
	Freq. Actual	Freq. Ins.=0	Frac. Addr.	Freq. Actual	Freq. Ins.=0	Frac. Addr.	Freq. Actual	Freq. Ins.=0	Frac. Addr.	Freq. Actual	Freq. Ins.=0	Frac. Addr.
Full sample	12.6	28.0	0.552	27.3	49.8	0.452	3.0	3.7	0.201	7.4	14.8	0.500
HH earnings <$60K	16.0	40.0	0.600	36.0	64.0	0.438	12.0	12.0	0.000	28.0	36.0	0.222
HH earnings $60–$120K	17.9	33.0	0.457	37.7	50.9	0.259	3.8	5.7	0.334	10.4	18.9	0.450
HH earnings $120–$180K	7.0	22.1	0.684	16.3	48.8	0.667	1.2	1.2	0.000	1.2	10.5	0.889
HH earnings >$180K	9.3	22.2	0.583	20.4	42.6	0.522	0.0	0.0	0.000	1.9	3.7	0.500
Dual earners	12.2	26.5	0.540	29.1	52.9	0.450	4.2	5.3	0.200	9.5	20.1	0.526
Single earners	13.4	31.7	0.577	23.2	42.7	0.457	0.0	0.0	0.000	2.4	2.4	0.000
Earning diff. 1–1 to 2–1	10.4	18.3	0.429	27.8	41.7	0.333	6.1	7.8	0.222	14.8	29.6	0.500
Earning diff over 4–1	14.4	37.5	0.615	25.0	50.0	0.500	0.0	0.0	0.000	1.9	1.9	0.000
Age survivor: 20–29	33.3	42.9	0.222	66.7	81.0	0.177	16.7	16.7	0.000	33.3	33.3	0.000
Age survivor: 30–39	32.6	63.0	0.483	63.0	87.0	0.275	8.9	11.1	0.200	17.8	35.6	0.500
Age survivor: 40–49	10.1	29.1	0.652	25.3	55.7	0.545	1.3	0.0	0.000	5.3	18.4	0.714
Age survivor: 50–59	4.7	14.1	0.666	10.6	32.9	0.679	0.0	1.2	1.000	1.2	2.4	0.500
Age survivor: 60–69	0.0	6.5	1.000	3.2	16.1	0.800	0.0	2.7	1.000	2.7	5.4	0.500
No children	15.5	28.5	0.457	28.5	53.7	0.470	1.6	1.6	0.000	6.5	13.0	0.500
One or more children	10.1	27.7	0.634	26.4	46.6	0.435	4.1	5.4	0.251	8.1	16.2	0.501
Whites	11.3	25.9	0.564	25.0	46.7	0.465	3.3	4.3	0.224	6.6	14.15	0.534
Non-whites	18.8	43.8	0.571	50.0	78.12	0.360	3.1	3.1	0.000	15.62	18.75	0.167

the rates of mitigation of POTENTIAL IMPACT through life insurance purchases are similar for white and non-white households. However, primary earners' POTENTIAL IMPACT is mitigated at a much higher rate among white households compared to non-white.

Saving behaviour

Actual versus recommended

Saving is a means of transferring resources from youth to old age. It also serves to smooth out fluctuations in consumption due to unforeseen declines in income or unanticipated increases in expenditures (such as out-of-pocket medical costs). In the current context, given information on a household's current net worth, projected earnings, projected off-the-top expenses (housing, planned vacations, etc.) and maximum borrowing ability, ESPlanner computes a saving trajectory that is implied by (required to achieve) the smoothest possible consumption path throughout the household's remaining lifetime. In order to remain on this consumption trajectory, the household's actual saving should match the 'recommended' level in the first year. If actual saving is less than that recommended, the household is consuming more than is consistent with smoothing consumption over its lifetime. If actual saving is greater than that recommended, the household is consuming less than it could without jeopardising its ability to consume in the future at the recommended level.

Table 14 shows that most married BU-employee

Table 14. Comparing current and recommended rates of saving for married households, per cent

Household total income		Age of BU employee					
		<30	30–40	40–50	50–60	>60	Total
<$80K	Current rate						
	Mean	4	5	9	−62	57	2
	Median	2	5	5	0	2	2
	Recommended saving rate						
	Mean	11	−2	−7	−81	−17	−18
	Median	9	0	1	0	−3	0
	Observations	10	13	16	11	10	60
$80–$120K	Current saving rate						
	Mean	3	2	−4	5	13	3
	Median	3	2	3	2	8	3
	Recommended rate						
	Mean	9	5	−10	−6	−25	−6
	Median	10	5	−1	1	−21	0
	Observations	8	11	23	18	10	70
$120–$160	Current rate						
	Mean	5	3	7	−2	10	3
	Median	5	5	5	6	9	6
	Recommended rate						
	Mean	−24	−3	−9	−27	−20	−17
	Median	−24	−2	−9	−1	−20	−5
	Observations	1	10	17	27	11	66
>$160K	Current rate						
	Mean	0	−22	−7	7	−112	−24
	Median	0	7	5	4	6	5
	Recommended rate						
	Mean	0	−27	−11	−7	−119	−33
	Median	0	0	2	0	−6	−2
	Observations	0	10	19	29	14	72
Total	Current rate						
	Mean	4	−2	1	−5	−17	−4
	Median	4	5	4	4	7	4
	Recommended rate						
	Mean	8	−6	−9	−23	−51	−19
	Median	9	0	−1	0	−9	−1
	Observations	19	44	75	85	45	268

Note: There are a few observations not shown with saving rates above 0.6 or below −0.6.

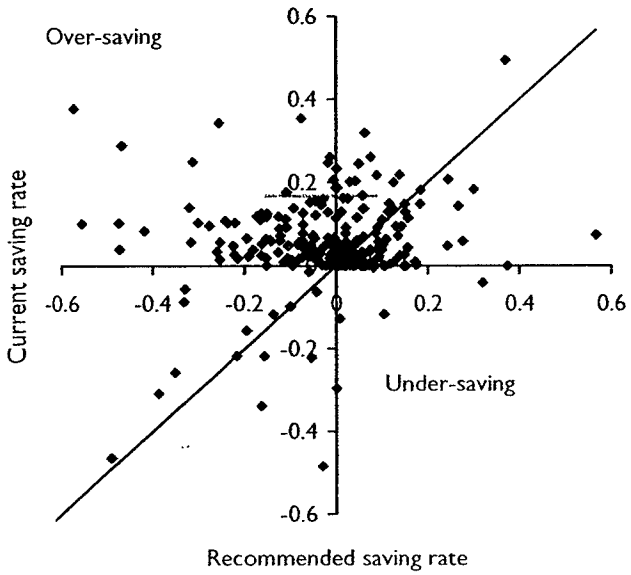
households are over-savers. The primary exception is low-income married households under 30 who under-save. Table 15 shows a similar pattern for single employees, although the degree of over-saving is generally smaller. Figures 2 and 3, which graph actual against recommended saving rates, indicate that very few sample households save very close to the amount needed to maintain a smooth consumption path over time. Indeed, the majority of households tend to over-save. This seems to contrast sharply with Bernheim (1991) and other studies that document pervasive under-saving on the part of US households. However, it should be noted that the BU employees analysed here are much better educated and economically much better-off than the average US household. In addition, the overwhelming majority (98 per cent) participate in a very generous employer-provided retirement plan.

The excess of average actual saving rates over average recommended rates in tables 14 and 15, however, hides considerable within-cell variation. Figures 2 and 3 indicate that a non-trivial fraction of households save less than the recommended amount: 80 out of 268 married households (30 per cent) and 45 out of 118 single households (38 per cent). Conditional on under-saving, the difference between actual and recommended households is quite large. For example, table 16 shows that married households earning less than $80,000 per year should be saving, on average, 17 per cent of their annual earnings to maintain their living standards through time. However, these households dissave at an average rate of 1 per cent per year. Table 17 shows also that among single households that dissave, those earning between $60,000 and $80,000 should save about 9 per cent of earnings each year to afford their sustainable

Table 15. Comparing current and recommended rates of saving for single households, per cent

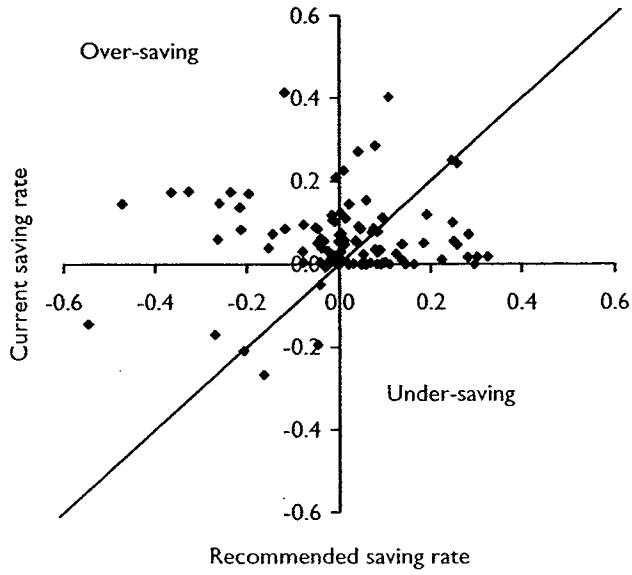
Household total income		Age of BU employee					
		<30	30–40	40–50	50–60	>60	Total
<$40K	Current rate						
	Mean	–13	4	13	6	0	–1
	Median	0	1	9	3	0	1
	Recommended rate						
	Mean	–7	12	5	5	0	2
	Median	0	9	5	1	0	4
	Observations	19	12	7	8	0	46
$40–$60K	Current rate						
	Mean	18	6	3	–33	7	–4
	Median	18	9	3	3	7	6
	Recommended rate						
	Mean	8	1	0	–48	–11	–13
	Median	8	4	1	–12	–11	1
	Observations	2	10	8	8	2	30
$60–$80	Current rate						
	Mean	9	8	1	7	7	6
	Median	9	0	0	6	7	6
	Recommended rate						
	Mean	4	11	–2	–3	–6	–1
	Median	4	5	2	–2	0	0
	Observations	1	3	3	9	5	21
>80K	Current rate						
	Mean	0	5	10	5	7	7
	Median	0	1	7	4	7	4
	Recommended rate						
	Mean	0	9	–1	–7	0	–2
	Median	0	6	1	–4	0	–1
	Observations	0	3	6	10	2	21
Total	Current rate						
	Mean	–9	5	7	–3	7	1
	Median	1	3	4	5	7	3
	Recommended rate						
	Mean	–5	8	1	–13	–6	–3
	Median	2	6	2	–2	0	0
	Observations	22	28	24	35	9	118

Figure 2. Current saving rate vs recommended saving rate (married)



Note: There are a few observations not shown with saving rates above 0.6 or below −0.6.

Figure 3. Current saving rate vs recommended saving rate (single)



Note: There are a few observations not shown with saving rates above 0.6 or below −0.6.

living standard in the future. However, these households save nothing, on average.

Regression analysis of insurance adequacy

It is useful to recall that figures 1a and 1b indicated a rather weak correlation between recommended and actual insurance. In those figures, if everyone purchased recommended insurance, the dots would lie on the horizontal axis implying that those faced with the greatest vulnerabilities would purchase the most insurance. No such pattern is perceptible in the figures.

To assess the relationship between recommended and actual insurance, we first arrange households in ascending order of recommended insurance and group them into 4 categories with an equal number of households in each. For each category, we compute average levels of recommended and actual insurance. We also show group-specific averages of non-asset income (earnings) and age. It is evident from table 18 that both median and mean insurance levels are positively correlated across the household groupings. It is also clear that both recommended and actual insurance levels decline with age because younger households have more human capital to protect and older households have savings that can help them to self-insure. The table also shows that those with zero vulnerability (zero recommended insurance) also purchase substantial amounts of insurance, on average suggesting that actual purchases may not be based on a careful evaluation of insurance needs.

In addition, table 18 suggests that both recommended and actual insurance purchases are also positively correlated with earnings. To investigate whether recommended and actual insurance are positively correlated after controlling for earnings, we repeat the exercise of table 18 in table 19, but use recommended insurance per dollar of earnings as the sorting variable before dividing the observations into four groups. Table 19 shows group-specific average ratios of recommended and actual insurance coverage per dollar of earnings. After controlling for the influence of earnings in this manner, recommended and actual insurance levels are no longer positively correlated.

The recommended level of insurance incorporates all demographic (spouses' ages, number of children, children's ages etc.) and economic (earnings, wealth, spending plans, division of earnings between spouses etc.) information on a household. Hence, actual insurance should be fully explained by recommended insurance in a regression of the former on the latter. Stated differently, the coefficient on recommended insurance should equal unity.

Table 16. Comparing current and recommended rates of saving for married households: sub-sample that undersave, per cent

Household total income		Age of BU employee					
		<30	30–40	40–50	50–60	>60	Total
<$80K	Current rate						
	Mean	–1	2	3	–10	–2	–1
	Median	0	0	2	1	2	0
	Recommended saving rate						
	Mean	9	8	60	–4	16	17
	Median	12	4	19	4	13	7
	Observations	5	5	4	4	4	22
$80–$120K	Current saving rate						
	Mean	6	2	–7	1	20	1
	Median	4	2	1	0	20	1
	Recommended rate						
	Mean	12	10	5	5	22	9
	Median	13	8	5	3	22	8
	Observations	4	9	6	7	1	27
$120–$160	Current rate						
	Mean	0	–7	4	–4	–1	–2
	Median	0	0	0	2	0	0
	Recommended rate						
	Mean	0	3	8	3	15	8
	Median	0	15	6	6	11	6
	Observations	0	3	4	5	5	17
>$160K	Current rate						
	Mean	0	–66	6	2	–325	–88
	Median	0	0	6	2	6	2
	Recommended rate						
	Mean	0	–53	33	8	–272	–67
	Median	0	1	33	9	29	9
	Observations	0	5	2	10	5	22
Total	Current rate						
	Mean	2	–15	0	–1	–108	–22
	Median	0	0	2	1	0	1
	Recommended rate						
	Mean	11	–5	23	4	–80	–8
	Median	12	7	10	6	16	8
	Observations	9	22	16	26	15	88

The first panel of table 20 shows the results for three regression models – OLS, Tobit (to account for the fact that some households have zero recommended insurance), and median regression (to eliminate outlier effects). The null hypothesis is rejected decisively in all three cases. In each of these regressions, the coefficient on recommended insurance is significantly different from zero and suggests that actual insurance purchases increase by about 15 cents for each additional dollar of recommended insurance. The coefficient value is slightly smaller than earlier findings based on the Survey of Consumer Finances (Bernheim *et al.*, 2001).

The finding of a positive response of actual insurance to larger recommended insurance may simply arise as a result of the joint response of both to greater earnings. Higher earnings may (are likely to) have a positive impact on recommended insurance. If households mechanically increase insurance purchases because of an income effect, actual insurance may rise with income leading to the apparent positive response reported in the regressions in Panel A. To control for earnings, the second panel in table 20 reports regressions where both actual and recommended insurance levels are divided by household earnings. These regressions show that recommended insurance has little, if any, influence on

Table 17. Comparing current and recommended rates of saving for single households: sub-sample that undersave, per cent

Household total income		Age of BU employee					
		<30	30–40	40–50	50–60	>60	Total
<$40K	Current rate						
	Mean	-1	1	13	0	0	1
	Median	2	0	13	0	0	0
	Recommended rate						
	Mean	15	19	16	15	0	17
	Median	17	10	16	15	0	14
	Observations	10	7	2	3	0	22
$40–$60K	Current rate						
	Mean	8	2	7	-240	0	-52
	Median	8	4	4	-21	0	2
	Recommended rate						
	Mean	8	14	10	-228	0	-43
	Median	8	16	8	-21	0	8
	Observations	1	6	3	3	0	13
$60–$80	Current rate						
	Mean	0	0	0	2	0	0
	Median	0	0	0	2	0	0
	Recommended rate						
	Mean	0	5	4	30	5	9
	Median	0	5	4	30	5	5
	Observations	0	2	2	1	1	6
>80K	Current rate						
	Mean	0	1	2	0	0	1
	Median	0	1	2	0	0	1
	Recommended rate						
	Mean	0	23	8	6	0	11
	Median	0	23	8	6	0	8
	Observations	0	1	2	1	0	4
Total	Current rate						
	Mean	0	1	6	-90	0	-14
	Median	2	0	2	0	0	0
	Recommended rate						
	Mean	14	16	9	-75	5	-2
	Median	15	11	7	8	5	9
	Observations	11	16	9	8	1	45

actual insurance – suggesting that life insurance purchases do not result from a careful evaluation of the need for such insurance.[12]

Comparing actual and recommended consumption

Rational forward looking households would take account of all relevant information – such as their current assets, projected earnings, asset and other income, current and future planned/off-the-top expenditures when deciding on current expenditure on consumption. In most studies, the analyst does not have a clear idea about households' preferred consumption growth rates (that is, their rates of time preference) or the extent to which borrowing constraints are binding. In this study, however, households are asked about their rates of desired growth in their standards of living and the information is used to calculate their lifetime profile of consumption subject to the user-specified borrowing constraint. Hence, even if households are borrowing constrained, their actual and recommended consumption should match closely. In other words, their actual-consumption to income ratio should be identical to their recommended consumption to income ratio and a regression of the former against the latter should produce a coefficient of unity. However, the current study does not incorporate any information about households' perceived riskiness of future income and other projections. To the extent that these projections

Table 18. Average benchmark insurance, actual insurance, and earnings, and age for equal groupings of married households in the BU sample arranged in ascending order of benchmark insurance

Benchmark insurance range		Benchmark	Actual	Earnings	Age
0	Mean	0	417,103	154,914	58
	Median	0	237,014	135,600	58
0–$300K	Mean	157,590	382,122	114,578	52
	Median	170,102	315,083	105,172	52
$300–$600K	Mean	438,726	444,964	125,633	46
	Median	429,577	325,369	99,000	47
>$600K	Mean	1,012,724	497,975	135,624	39
	Median	889,575	373,987	124,000	39
Total	Mean	417,146	437,339	133,052	49
	Median	318,895	321,629	122,000	50

Table 19. Average benchmark and actual insurance per dollar of earnings, average earnings, and average age for equal groupings of married households in ascending order of benchmark insurance per dollar of earnings

Benchmark insurance range		Benchmark	Actual	Earnings	Age
0	Mean	0.00	2.63	154,914	58
	Median	0.00	1.75	135,600	58
0–2.5	Mean	1.35	3.04	145,055	53
	Median	1.44	3.01	131,250	53
2.5–6	Mean	4.20	4.12	132,122	46
	Median	4.09	3.19	128,216	47
>6	Mean	9.82	3.07	99,578	37
	Median	7.99	2.25	91,000	37
Total	Mean	3.82	3.21	133,052	49
	Median	2.45	2.56	122,000	50

Note: Each range includes approximately one quarter of the sample.

are viewed as risky, households may engage in precautionary saving that the model does not capture. Hence their actual consumption-to-income ratios may be somewhat smaller than their recommended ratios.

Tables 21 and 22 report results from univariate regressions of actual consumption-to-income ratio against the recommended ratio for married and single households respectively. The coefficient for married households is very small – between 0.16 and 0.23 across the three regression specifications shown in the tables. That on singles is closer to a value one might expect based on the earlier discussion: between 0.58 and 0.85. That the coefficient for married households is so low is surprising because, other things equal, one would expect married households to face lower household earnings uncertainty given that there are (potentially) two earning members.[13]

3. Conclusion

This study compiles a unique data set of BU-employee households and uses it to conduct a detailed analysis of life insurance adequacy and saving behaviour. To do so, the study makes use of ESPlanner – a detailed financial planning software package developed by three of the paper's authors. The data set constructed here contains detailed responses to several variables that analysts

Table 20. Simple regression analysis for married households

Analysis	Constant	Recommended amount
Panel A: Dependent variable: total household insurance holdings		
OLS	376777.1	0.1427
	(34249.3)	(0.0572)
Tobit	363618.1	0.1518
	(35436.1)	(0.0590)
Median regression	266209.0	0.1353
	(28238.2)	(0.0450)
Panel B: Dependent variable: ratio of total household insurance holdings to household earnings		
OLS	3.1048	0.0187
	(0.2269)	(0.0408)
Tobit	3.0497	0.0172
	(0.2351)	(0.0425)
Median regression	2.3770	0.0459
	(0.2544)	(0.0445)

Note: Standard errors in parentheses.

Table 21. Consumption–income ratio regressions for married couples

Analysis	Constant	Recommended
OLS	0.2623	0.2282
	(0.0168)	(0.0275)
Tobit	0.2621	0.2282
	(0.0168)	(0.0275)
Median regression	0.2979	0.1567
	(0.0198)	(0.0324)

Note: Standard errors in parentheses.

Table 22. Consumption–income ratio regressions for singles

Analysis	Constant	Recommended
OLS	0.0470	0.8505
	(0.0285)	(0.0524)
Tobit	0.0403	0.8499
	(0.0285)	(0.0524)
Median regression	0.1502	0.5827
	(0.0230)	(0.0425)

Note: Standard errors in parentheses.

would like to observe, but usually cannot.[14] Moreover, because the participants received their own financial plan in exchange for participation, they had strong incentive to provide accurate information.

Participation in the study was voluntary. Hence, the sample of households is not necessarily representative of the US population. Indeed, it seems to differ from the US population along several dimensions; the BU sample of households earns more, is wealthier, and is better educated than American adults on average. Hence, the results may at most be taken as roughly describing the situation of the upper middle class of the US population.

The study compares recommended levels of insurance, saving, and consumption generated by ESPlanner with actual levels of these variables as reported by participants. The recommended levels are based on a calculation of the maximum sustainable level of consumption that a household can achieve given its inputs for family composition, initial assets, earnings, retirement ages, special expenditures, housing plans etc. The life-cycle profile of maximum sustainable consumption is also influenced by whether a user-specified borrowing constraint binds in a particular period.

As might be expected for such a sample, a very high fraction of young households is borrowing constrained and, although this fraction declines with age, it is still quite high for the oldest households. In particular the results suggest that low-earning and low-net-worth households are more frequently borrowing constrained. The results on insurance (in)adequacy are quite striking. On the whole, about two-thirds of wives and one-third of husbands would suffer some loss in their living standards were their spouses to die immediately. About a quarter of wives would experience a severe decline in their living standards – by 40 per cent or more. Another 21 per cent of wives would suffer a moderate – between 20 and 40 per cent – decline in their living standards. In contrast, only 6 per cent of husbands would suffer a severe loss and only 11 per cent would suffer a moderate loss of living standards if their wives died immediately. Tabulations of the results by primary and secondary earners show that 28 per cent of secondary earners face severe financial vulnerability. Actual insurance holdings by their spouses remove only about half of such secondary earners from the category of severe financial vulnerability. The results on insurance inadequacy

among BU households are consistent with findings of other studies by the authors.

In contrast, the findings on savings adequacy do not confirm those of other studies – notably. This study finds that BU households tend to over-save, in general, relative to the recommended saving based on ESPlanner's consumption smoothing approach. However, a non-trivial fraction of households – 30 per cent of married households and 38 per cent of single ones – save less than their recommended levels. Conditional on undersaving, the difference between actual and recommended saving is quite large – especially among the low earning households. Whereas these households should be saving about 10 per cent or more of their earnings, their actual saving rates are zero or negative.

A simple cross-tabulation of recommended and actual insurance as shares of household earnings reveals that recommended and actual insurance do not correlate very well. This conclusion is confirmed by regression results indicating that actual insurance holdings do not vary with recommended levels in accordance with theoretical expectation. Finally, regression analysis of BU employees' consumption behaviour suggests that married households, but not single households, consume much less than recommended levels, possibly because they perceive greater future uncertainties in the projected economic and demographic situations.

NOTES

1 These data include ages of the household head and spouse, maximum ages of life of the household head and spouse, the ages of children under 19, current market values of regular and retirement account assets, current and future levels of wage and self-employment earnings, current and future special expenditures, current and future special receipts, current housing and future housing plans, current and future receipt of pension benefits, desired bequests, expected funeral costs, borrowing limits, desired future living standard changes, desired changes in survivors' living standards, actual current saving, actual current life insurance holdings, intended dates of withdrawal from retirement accounts, current and projected contributions to retirement accounts, expected nominal rates of return on regular and retirement account assets, the expected rate of inflation, current Social Security benefits, past and future Social Security-covered earnings, the degree of economies in shared living, projected future cuts in Social Security benefits, and the costs of supporting children relative to adults.

2 The period-specific weights incorporate two elements. The first is the number of equivalent adults projected to be living in the household in a given year adjusted for economies in shared living. The second is the programme's *Standard of Living Index*. The number of equivalent adults adjusted for economies in shared living is given by $(N+dK)^{\sigma}$, where N is 1 in the case of singles and 2 in the case of married couples, σ determines the degree of economies in shared living, d is the child-adult equivalency factor, and K is the number of children. A value of σ equal to 1 implies no economies in shared living. A value of σ equal to 0 implies perfect economies in shared living. Our default value for σ of 0.678072 implies that raising the number of equivalent adults from 1 to 2 raises the value of the formula from 1 to 1.6. The standard of living index can be specified at a different value for each future year. The index permits the household to tell the programme whether it wants to have the same living standard in all future years, in which case the index is left at 100 for all future years, or whether it wants its living standard to vary through time, in which case the index values are set above or below 100. The index value for the current year is fixed at 100, so the user is actually specifying the desired living standard in a particular year relative to its living standard in the current year.

3 The life insurance recommendations for survivors are determined separately depending on when the survivor first becomes widowed.

4 ESPlanner's algorithm is complicated. But users can check ESPlanner's reports to see that, given their data inputs, preferences, and borrowing constraints, the programme recommends the highest and smoothest possible living standard over time. They can also readily verify that the recommended life insurance amounts will preserve the living standards of survivors and that zero life insurance is recommended only if survivors will enjoy higher living standards if the potential decedent in question passes away.

5 See Gokhale, Kotlikoff, and Warshawsky (2001).

6 ESPlanner's federal and state income-tax calculators determine whether the household should itemise its deductions, computes deductions and exemptions, deducts from taxable income contributions to tax-deferred retirement accounts, includes in taxable income withdrawals from such accounts as well as the taxable component of Social Security benefits, and calculates total tax liabilities after all applicable refundable and non refundable tax credits. These calculations are made separately for each year that the couple is alive as well as for each year a survivor may be alive. Moreover, tax and benefit calculations for surviving wives (husbands) are made separately for each possible date of death of the husband (wife), i.e., ESPlanner considers each date the husband (wife) might die and calculates the taxes and benefits a surviving wife (husband) would pay and receive in each of her (his) remaining years of life were she (he) to continue to survive. In calculating Social Security retirement benefits, survivor benefits, mother and father benefits, children benefits, spousal benefits, and divorcee benefits, ESPlanner takes into account the system's eligibility requirements, wage indexation of earnings histories, inflation indexation of benefits, early retirement benefit reduction factors, recomputation of benefits, the delayed retirement credit, family benefit maximums, and the recently modified earnings test.

7 This is the utility-maximising outcome in the case that the household has Leontief preferences defined over per capita expenditures adjusted for economies in shared living.

8 Note that when actual life insurance is below the benchmark, the intact couple saves on life insurance premiums, so the actual living standard per spouse exceeds c^*. Hence the difference between the two impact variables understates somewhat the change in living standard that an individual

experiences upon a spouse's death.

9 A non-negativity 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 Yaari (1965), Kotlikoff and Spivak (1981), and Bernheim (1987).

10 Formally, one can think of the outcome that we identify as the limit of the solutions to a series of utility maximisation 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.

11 All national statistics reported in this section are computed from the 1998 Survey of Consumer Finances. In our computations, we define non-housing wealth as financial plus non-financial assets minus equity in residential property.

12 We conducted similar regressions separately on husbands' and wives' insurance purchases and found essentially similar results. Our earlier draft of this study Bernheim *et al.* (2002) includes additional regression analyses that help explain departures of actual from recommended levels of life insurance.

13 Bernheim *et al.* (2002) report additional regressions that explore the impact of household characteristics on the deviation of actual from recommended consumption levels.

14 These include expected maximum age of life, planned retirement ages, future expected inflation and expected interest rates, child-adult equivalency factors, planned future special expenditures, desired funeral expenses, desired bequests, and, in particular, desired growth in living standards and desired (relative) levels of survivors' living standards.

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