Alternative Measures of Replacement Rates

Michael D. Hurd
RAND Corporation and NBER

Susann Rohwedder
RAND Corporation

Prepared for the 8th Annual Joint Conference of the Retirement Research Consortium
"Pathways to a Secure Retirement"
August 10-11, 2006
Washington, DC

The research reported herein was pursuant to a grant from the U.S. Social Security Administration (SSA) funded as part of the Retirement Research Consortium (RRC). The findings and conclusions expressed are solely those of the authors and do not represent the views of SSA, any agency of the Federal Government or the RRC. We gratefully acknowledge research support from the Social Security Administration via the Michigan Retirement Research Center, and additional support from the National Institute on Aging.

1. Introduction

The discussion of required resources in retirement is often expressed in terms of replacement rates of pre-retirement income. For example, many people think in terms of complete replacement of income or of some fixed fraction such as 80 percent. This kind of thinking is simplistic in that it makes no systematic accounting of

- the differing role of taxes for households at different points in the income distribution;
- work-related expenses;
- financing consumption out of savings;
- the time horizon or survival curve of the household;
- returns to scale in consumption: couples need to assess the risk of increased per capita spending once one of the partners dies;
- the changing consumption profile with age;
- a household's use of its increased leisure in retirement in ways that may either increase or decrease spending. For example some households may want to use their increased leisure time to engage in activities that are associated with elevated expenses such as travel, while some may engage in home production or more efficient shopping to reduce spending;

The overall goal of this paper is to define replacement rates that take into account many of these aspects. We define a wealth replacement rate that shows the amount by which bequeathable wealth either exceeds or falls short of the optimal amount of wealth. The optimal amount is the amount of wealth which allows consumption to follow its optimal path conditional on an observed starting value.

The resources are a combination of post-retirement income, housing wealth and nonhousing wealth. The replacement rates account for mortality, and, in the case of couples, the lifetime of the couple and the subsequent loss of returns-to-scale in consumption on the death of the first spouse. It recognizes that consumption need not be constant with age. It considers the role of housing both as a flow of consumption services and as a possible financial asset that can be used to finance nonhousing consumption.

Our implementation is a combination of model-based simulations and data-based simulations. The advantage of this approach is that we can account for more economic factors than we could were the analysis completely model based.

2. Conceptual framework

Our starting point is optimal consumption planning over the lifetime. For illustrative purposes, suppose someone begins work at 20 with zero wealth, and plans and executes an optimal life-cycle consumption path over his or her lifetime. Illustrative consumption and wealth paths are shown in Figure 1. Initially he or she consumes more than income. Thus, wealth (W) soon becomes negative. Eventually income increases, exceeding consumption (C) so that wealth begins to increase at about age 30. Saving continues and wealth becomes positive at about age 40. Consumption begins to decline when mortality risk becomes important. The worker retires at age *R* with maximum wealth and receives annuity A_t. He or she consumes until T when wealth is exhausted and then consumes A_t. These are the optimal consumption and wealth paths conditional on lifetime earnings and on annuities.

Now suppose that another person maintained the same consumption path but had lower income. Then the entire path of wealth would be lower as shown by the dotted line in Figure 2. At retirement the person would not be able to finance consumption until *T* but would exhaust wealth at about age 87. We would say that the observed consumption level at retirement is not optimal given the wealth and annuities at retirement.

This outcome is evidence for undersaving: wealth is too low to maintain the consumption path associated with observed consumption following retirement. Said differently, given the level of income over the lifetime, this worker over-consumed. We will test for this by finding whether consumption shortly following retirement is consistent with an optimal path over the rest of the lifetime. We ask: in our data set how many persons can afford the optimal path associated with the observed consumption level at retirement.

3. Data

Our analyses are based on HRS data and data from the Consumption and Activities Mail Survey (CAMS). The HRS is a biennial panel. Its first wave was conducted in 1992. The target population was the cohorts born in 1931-1941 (Juster and Suzman, 1995). Additional cohorts were added in 1993 and 1998 so that in 2000 it represented the population from the cohorts of 1947 or earlier. In 2004 more new cohorts were added making the HRS representative of the population 51 or older.

In October, 2001, CAMS wave 1 was mailed to 5,000 households selected at random from households that participated in HRS 2000. In households with couples it was sent to one of the two spouses at random. The fact that the sample was drawn from the HRS 2000 population allows linking the CAMS data to the vast amount of information collected in prior waves in the core survey on the same individuals and households. In October, 2003, CAMS wave 2 was sent to the same households. The structure of the questionnaire was almost the same so as to facilitate panel analysis. In this paper we will use data from both waves.

CAMS wave 1 consists of three parts. In Part A, the respondent is asked about the amount of time spent in each of 32 activities such as time spent watching TV or time spent preparing meals. Part B collects information on actual spending in each of 32 categories, as well as anticipated and recollected spending change at retirement (Hurd and Rohwedder, 2003). Part C asks about prescription drugs and current labor force status.

The instructions requested that for Part B the person most knowledgeable about the topics be involved in answering the questions. The addressee answered Part B in 88% of households, possibly with the assistance of the spouse; 5% of the cases report explicitly that the spouse answered the questions; 2% had their children or children-in-law of the addressee help out in answering the questions, and the remaining 5% was a mix of miscellaneous responses including nonresponse.

Of the 5,000 mailed-out questionnaires there were 3,866 returned questionnaires giving a unit response rate of 77.3 percent. To account for unit nonresponse, we use weights when calculating population averages.

The Consumer Expenditure Survey (CEX) is the survey in the U.S. that collects the most detailed and comprehensive information on total spending. But CAMS could not ask about spending in as many categories as the CEX, which in the recall component of the survey asks about approximately 260 categories. The design strategy adopted for CAMS was to choose spending categories starting from the CEX aggregate categories that are produced in CEX publications, so as to have direct comparability with the CEX. However, to reduce the burden to respondents the categories had to be aggregated further. The final questionnaire collected information on 6 big-ticket items (automobile; refrigerator; washer or dryer; dishwasher; television; computer) and on 26 non-durable spending categories.

The reference period for the big-ticket items is "last 12 months," and for the non-durables it varied: the respondent could choose the reference period between "amount spent monthly" and "amount spent yearly" for regularly occurring expenditures like mortgage, rent, utilities, insurance, property taxes where there is little or no variation in amounts, and "amount spent last week," " amount spent last month," and "amount spent in last 12 months" for all other categories. For all non-durable categories there was a box to tick if "no money spent on this in last 12 months." The questionnaire had no explicit provision for "don't know" or "refuse" so as not to invite item nonresponse.

Table 1 shows the spending categories and the rate of item response. Item response in CAMS is much higher than it is for typical financial variables such as the components of wealth or income where it can be as low as 60%. A consequence of the high response rates is that 54% of households in CAMS wave 1 were complete reporters over all 32 categories of spending. An additional 26% had just one or two nonresponse items. Ninety percent of the sample were complete reporters of 26 categories or more. Furthermore, in the spending categories with the highest rate of nonresponse, we have information from the HRS core that we can use for imputation. For example, rent has almost the highest rate of nonresponse. However, we have responses in the HRS about homeownership which we can use with considerable confidence to impute rent. Of the 512 who were nonrespondents to the rent query, 427 owned a home in HRS 2000. We believe we can confidently impute zero rent to these households. Similarly among nonrespondents to the question about homeowners insurance and who owned a home with mortgage in 2000, 66% reported that their insurance was included in their mortgage payment. Apparently they did not respond in CAMS because they had already included that amount in the mortgage report.

Using the HRS core data we imputed (mostly zeros) for some households in up to 18 spending categories. The number of households imputed in a particular category ranged from just a few to 470. Based on these and similar imputations that use HRS core data to provide household-level information, 63.5% of CAMS respondents are complete reporters over all 32 categories of spending.[1]

A natural validation exercise for the spending data in CAMS is to compare them to the CEX. Table 2 has comparisons between spending in CAMS and spending in the CEX. The totals are rather close especially in view of the great disparity in the number of spending items queried.[2] In fact, in the top two age bands spending in CAMS is higher than in the CEX, and particularly in the top age band it is substantially higher. This difference is likely to be partly due to the problem of the reference person: the CEX uses that concept just as the CPS uses it whereas the HRS does not. A symptom is that

---

[1] Because of the small amount of item nonresponse that remains we used simple imputation methods from the mean of the reported amount. See Hurd and Rohwedder (2005) for further details.

[2] A common view in survey methodology is that the more detailed are the categories, the higher the total will be. Thus we would expect that CEX totals would be substantially greater than CAMS totals.

income as measured in the HRS is substantially higher than income as measured in the CEX probably reflecting a difference in the populations represented. This conclusion is reinforced by the close agreement of HRS income with CPS income.

4. Methods

From two waves of the CAMS data we calculate spending levels and spending change by marital status and age band. These totals are shown in Tables 3 and 4. Spending by couples aged 60-64 increased by 1.64% over two years or by about 0.82% per year.[3] We will use the changes to construct life-cycle consumption paths. Specifically we will begin with the observed consumption level at retirement age and then apply the observed rates of change to trace out a life-cycle path whose slope is given by the rates of change in Tables 3 and 4. For example, a couple aged 64 at baseline would increase its consumption by 0.82% as it aged from 64 to 65, by 0.27% as it aged from 65 to 66, by 0.82% as it aged from 66 to 67, and so forth. Whereas a model would specify that the slope of the consumption path depends on the interest rate, the subjective time-rate of discount, mortality risk and utility function parameters, we estimate these slopes directly from the data. Practically all model estimation uses the constant-relative-risk-aversion utility which specifies that the slope of log consumption is independent of the level. The observed paths do not necessarily have that shape.

Our method for finding replacement rates for singles can be illustrated as follows. We observe the resources at retirement of a single person. We ask: can the resources support the projected consumption path. The consumption path is anchored at the initial post-retirement consumption level and follows the path given by the slopes of consumption paths that we have estimated from the CAMS panel (Table 4). If the consumption path cannot be supported by the economic resources we find the level of bequeathable wealth that would permit the person to follow the optimal path. The wealth replacement rate is the ratio of actual wealth to this required wealth. If the replacement rate is greater than one, actual wealth is more than sufficient to finance the consumption path. If it is less than one, there is a wealth shortfall.

Because lifetime is uncertain, and wealth is not typically annuitized, we also find the resources that will permit the consumption path to be followed with a high degree of probability. Here the uncertainty is length of life, so the question is equivalent to finding whether the resources will sustain the path until advanced old age where the probability of survival is very small. Someone with a moderate level of pre-retirement consumption could sustain post-retirement consumption with a moderate level of Social Security benefits, some pension income and a moderate amount of wealth. Someone with low pre-retirement consumption may only need Social Security and a small amount of savings. These requirements are likely to differ substantially from what would be required to consume at the pre-retirement *income* level.

We do this calculation for each single person in our CAMS sample who is in his or her early retirement years.

For couples the basic method is similar. However, the consumption path followed while both spouses survive will differ from the consumption path of single persons, so it is separately estimated from the CAMS data (Table 3). The couple will follow that consumption path as long as both spouses survive, and then the surviving

[3] The “age” of a couple is the age of one of the spouses chosen at random.

spouse will switch to the consumption path of a single person. The shape of the single's path is estimated as described above, but the level will depend on returns-to-scale in consumption by the couple. At the death of the first spouse, the surviving spouse reduces consumption to the level specified by the returns-to-scale parameter. We assume a returns-to-scale parameter that is consistent with the literature and with practice. For example, the poverty line specifies that a couple with 1.26 times the income of a single person who is at the poverty line will also be at the poverty line. This implies that consumption by the surviving spouse should be 79% of consumption by the couple to equate effective consumption. A second calculation will use the returns-to-scale parameter implicit in the Social Security program: according to the relationship between a widow's benefit and a wife's benefit, a couple needs about 1.5 time the consumption of a single person. Thus consumption by the survivor should be about 0.67 of the consumption by the couple.

Knowing the consumption path of the surviving spouse we find the expected present value of consumption for the lifetime of the couple and surviving spouse. We compare population averages of the expected present value of consumption with average resources at retirement to find whether the cohort can finance the expected consumption path. We can also find the fraction of households that can finance with, say, 95% probability their expected consumption path.

We construct a life-cycle consumption path based on observed consumption change in CAMS, but it is not based on a theoretical model. Nonetheless, these consumption paths are similar to theoretically based consumption paths. Figures 4 and 5 show consumption paths (normalized on consumption of 100 at age 65) based on CAMS and on life-cycle models estimated over wealth change. For couples the CAMS path shows slowly rising consumption until age 80 when consumption falls. The model shows greater consumption growth, and it is only after age 87 that consumption begins to decline. Because of mortality most weight would be placed on the younger ages where the paths are similar. Among singles the shapes of the paths are similar but the model-based path always lies above the CAMS-based path.

5. Model for singles

In this section we develop the ideas discussed previously a little more formally.

Suppose a single person retires at age R. Call that $t = 0$. He or she retires with real annuity S and nominal annuity P_0, the inflation rate is f, and the nominal interest rate F, which implies a real interest rate $r = F - f$. Then the real annuity at some later time t is $A_t = S_0 + \frac{P_0}{(1+f)^t}$. We construct the consumption path $\{c_t\}$ such that initial consumption, c_0, is given by observed consumption at or near retirement and $\frac{\Delta c}{c}$ is observed in the CAMS panel data in age bands. The situation is illustrated in Figure 3 for $R = 65$.

Consumption will follow this path until $c_T = A_T$, after which $c_t = A_t$. The present value of net spending (consumption minus annuities) is $PV_c = \sum_{t=1}^{T} \frac{c_t - A_t}{(1+r)^t}$. If PV_T equals initial wealth we say the consumption path is the "optimal" consumption path even though the shape is not derived from theory. By this we mean that the level is consistent with economic resources.[4]

We ask whether PV_c is less than or greater than initial wealth. If it is greater than initial bequeathable wealth, the optimal consumption path is feasible. The wealth replacement ratio is $\frac{w}{PV_c} = \frac{\text{actual wealth}}{\text{necessary wealth}}$ and if the optimal consumption is feasible the wealth replacement rate is greater than 1.0.

We define a consumption replacement rate which is similar to the income replacement rate: what fraction of initial consumption can be afforded by economic resources? To find the consumption replacement rate we find $\hat{c}_0$ such that the consumption path $\{c_t(\hat{c}_0)\}$ with initial consumption $\hat{c}_0$ is optimal; that is, the associated wealth replacement ratio is 1.0. $\hat{c}_0$ is found by searching: given some initial guess c^* find PV_{c^*} of the associated consumption path. If $PV_{c^*} > w$ reduce c^* and search again until $PV_{c^*} = w$. Once we have found the optimal consumption conditional on initial wealth $\hat{c}_0$ we calculate the consumption replacement ratio

$$\frac{\hat{c}_0}{c_0}$$

If this ratio is less than 1.0 the person cannot afford the optimal consumption path.

Calculating the consumption replacement rate in this way ignores the fact that someone may die before exhausting wealth even if on an unsustainable consumption path. We can find the probability that someone survives tot the age when wealth is exhausted by finding τ such that

$$\sum_{t=1}^{\tau} \frac{c_t(c_0) - A_t}{(1+r)^t} = w$$

τ is the age when wealth is exhausted. In a life table we find the probability of surviving to τ conditional on initial age R. This will give the probability of exhausting wealth before dying.

6. Model for Couples

We begin with C_0, which is observed consumption by a couple at baseline. Then we project consumption to the next period by $C_{t+1} = C_t(1+G_t)$ where G_t is the annual growth rate of consumption by couples as observed by age band between waves 1 and 2 of CAMS (Table 3). The associated wealth path is $W_{t+1} = W_t(1+r) - C_t + A_t$ where r is an assumed real rate of interest. The couples model differs from the singles model in that one spouse will die before the other and the surviving spouse will continue to consume, but the consumption level will change according to returns-to-scale. Suppose the husband dies. Then the widow will "inherit" wealth of couple, an annuity which is some fraction f_a of A_t (often 2/3), and an optimal consumption level that reflects returns-so-

[4] The path which is illustrated in Figure 3 is actually similar to a path derived from theory and estimated over wealth change data (Hurd, 1989).

scale. According to the poverty indicator, the widow would need 1/1.26 = 0.794 of the consumption of the couple; according to scaling of the wife's and widow's benefits in Social Security, the widow would need 1/1.5 = 0.667. Figure 6 shows an actual simulation under the assumption that both spouses are initially 65 and that the husband dies at age 80. Initial wealth is 500. Prior to age 80 consumption by the couple follows $C_{t+1} = C_t(1+G_t)$. Consumption declines when the husband dies because of returns-to-scale, and then it follows the path of singles. In the case shown, the couple and surviving spouse could just exactly afford the initial consumption of 54.15. Should the widow survive to 94, wealth would be exhausted.

Now suppose initial consumption is slightly greater at 55.5 as shown in Figure 7. Then the surviving spouse runs out of money at about 87. The present value of spending out of bequeathable wealth is given by the area between the consumption curve (both couple and widow) and the annuity curve (both couple and widow). In this case the excess present value of spending to age 94 is about 21.7 more than initial wealth so that the wealth shortfall rate is 21.7/500 = 4.3%.

The foregoing assumes widowing at 80, but we need to allow random widowing. Take the same couple where both are initially 65. Randomly choose whether both, one or neither spouse survives with probabilities given by life table survival hazards. If both survive continue calculating the couple's consumption and wealth path. If the husband dies, we switch to the widow's consumption and wealth path and follow that as in the case of a single. We find the expected present value of spending in excess of annuities. If the wife dies we perform the same calculation. If both die, we stop the calculations.

The outcomes of one simulation are: Did household die with positive wealth? If so, how much compared with initial wealth. If not, what is the wealth shortfall.

By repeating the simulations a number of times for the same household we can find the probability that household will die with positive wealth or negative wealth and the distributions of those excess or shortfalls.

7. Results

Because we want to observe Social Security and pensions we select a sample shortly after retirement and of a sufficient age that they should be receiving Social Security if they are eligible. We select couples where one spouse is 66, 67, 68 or 69 in 2002 and the other is 62 or older; neither is working for pay; they were respondents in CAMS wave 1; and they were a couple in 2000-2004. We make the age restriction on the younger spouse because spouses younger than 62 would not yet be receiving Social Security benefits and so we would miss a significant fraction of retirement resources. We select singles who were 66-69.

Table 5 gives the initial conditions for couples and Table 6 gives them for singles. The tables show the distributions of initial consumption, Social Security income, pension income, and "excess" income which is Social Security plus pension income minus consumption. The last column is the distribution of total wealth.

We can already see that on average and for most of the distribution, couples have adequate resources to finance their consumption in retirement. For example, average consumption is $40.8 thousand, average annuity income (Social Security + pensions) is $32.8 thousand leaving just $8 thousand per year to be financed out of wealth, which is $525 thousand. At the median the numbers are smaller but just $5.8 thousand per year needs to be financed out of $263 thousand of wealth. Even at the 25th percentile consumption is just slightly more than income, so a small adjustment to spending or a small draw-down of wealth would permit consumption to be maintained.

The situation with singles is very different. At the mean wealth is adequate to finance excess spending, but at the median wealth could only finance about five years of excess spending. At the 25th and 10th percentiles consumption would have to be reduced substantially from their initial low levels.

We perform 10 simulations of the consumption and wealth paths of each married person who is in the age range 66-69. By consumption we mean the consumption by the couple as long as both spouses survive and the consumption by the survivor. Although we begin with 229 households as shown in Table 5, we only have 282 married persons who are age eligible (66-69), the other spouses being outside the given age range. The economic circumstances of the 282 age-eligible persons will enter the tables. In these simulations we use the poverty line returns-to-scale and assume that the annuity of the survivor is 2/3 the annuity of the couple.

According to the simulations about 78% of age-eligible married persons die while the household in which they live has positive wealth. The circumstances include both dying while still married and dying after widowing.

Table 8 shows the average resources and consumption of the households in which the 282 age-eligible persons live.[5] The table is person-based rather than household-based. Average resources are more than adequate to finance consumption: the average expected present value of annuities plus initial wealth is about $843 thousand per household and the average expected present value of consumption is $408 thousand per household. Median resources are sufficient to finance consumption: median resources are $632 thousand, but the median expected present value of consumption is just $327 thousand. Note that these are medians of the population distributions: the median household in the distribution of resources would not be the same household as the median at the distribution of the expected present value of consumption. Possibly more relevant is the median of the distribution of "excess" wealth: the median household had initial wealth that was about $244 thousand more than what was needed to finance its consumption. The last column of the table also shows average values over those in the 40-60th percentile of the distribution of excess wealth, the total expected present value of resources minus expected present value of consumption. Thus the averages are over the same households that are in the middle of the distribution of affordability of its initial consumption. We see that their average excess is about $249 thousand which is about 42% of total resources. Said differently, households in the middle of the distribution saved considerably more either through Social Security, pensions or private saving than necessary to finance their consumption level in retirement.

Table 9 shows similar results for singles. Resources are much lower than resources of couples: the average expected present value of annuities plus initial wealth is about $343 thousand per person. On average consumption can be financed out of resources: excess wealth is about $64 thousand. However, median resources are less than median consumption: median resources were just $206 thousand; yet the median

[5] Average initial wealth in this table varies from average initial wealth in Table 5 because this table has the average wealth of the household in which an age eligible person lives: if both spouses are age-eligible their wealth enters twice.

expected present value of consumption was about $224 thousand. Among those in the 40-60th percentile of the distribution of excess wealth average excess wealth is $9 thousand. The implication is that singles in the lower part of the excess wealth distribution will have to reduce consumption from the predicted path; or, said differently, their current consumption cannot be supported by their resources.

We have taken the consumption and wealth data at face value even though they have considerable measurement error. Although classical measurement error may produce good estimates of population averages, it can distort substantially the measurement of distributions. For example, suppose in the population all households were exactly consuming the proper amount given their wealth and annuities. But if wealth and consumption are measured with error it would appear that half are under-consuming and half are over-consuming. In particular people with negative wealth measurement error and positive consumption measurement error could appear to be substantially over-consuming. One method of accounting for measurement error is to group observations by some characteristic that is related to the outcome of interest but is not related to the observation error. In Tables 10 and 11 we have grouped by education level. Among couples we see a strong gradient by education level. Total resources increase from about $500 thousand among those lacking a high school education to $1,400 thousand among the college educated, a factor of about 2.8. Consumption increases from $306 thousand to $547 thousand, a factor of about 1.8. Thus those with less than high school education over-consume relative to those with a college education. However, even the lowest education group has excess wealth both at the mean and median. The column "% positive" shows the percent of people that die with positive wealth. Overall it is 78%, and it is only lower than average among the least educated.

Among singles we also see a strong gradient by education. Median excess wealth is approximately zero or negative for those lacking at least some college education.

The classification by education level confirms that variation in preparation for retirement is not just the result of measurement error. There is systematic variation by education level: at the average or median, those with less education are less well prepared.

7. Future research

The less well-to-do tend to die earlier than average. In a life-cycle model with forward looking behavior the less well-to-do would consume more than the average consumption level conditional on their resources because they expect to die sooner than average. However, our method, which is based on the population life table, does not take such behavior into account. To the extent that the less well-to-do adjust their consumption for their reduced life expectancy, our method overstates the resources required by them. We will address this issue by using life tables adjusted for socio-economic status.

Because we need to observe Social Security and pension income, and because we do not have a good method for accounting for earnings, we selected a sample in their late 60s who are not working. However, those still working in their late 60s tend to be better off than those retire, so we are not accounting for the entire distribution, and, in fact, we are underestimating the resources of the cohort. In future work we will take them into account.

We probably have missed some pension income and possible some Social Security income because people have not claimed them at the time we observe their income. We will use future waves of HRS when all pension and Social Security income will have been claimed to fill in such missing income.

Our method of assessing the adequacy of retirement resources involves comparing resources with spending levels and spending patterns that we observe in today's data. If spending requirements increase substantially faster than they have in the past, then resources *ex post* will look inadequate whereas *ex ante* they looked adequate. Out-of-pocket spending on health care is an obvious area where this could happen. Accounting for this would require the estimation of a model of consumption that includes health care expenses, and, most importantly, a sound method of forecasting what future health care expenses will be. Although the first type of model can be specified and possibly estimated from current economic theory and data, the second type of model is, to say the least, a daunting task. However, as shown in Figure 8, we do not yet see any dramatic increase in the share of the budget of the retired population that is spent on health care. Among those 65-74, the share has remained fairly constant at approximately 10.5%. For those 75 or over there has possibly been an upward trend, although it is small: in 1989 the share was 14.8% and in 2004 it was 15.5%. The implication is that a model that relies on historical data on budget shares would not forecast any dramatic increase in spending on health care.

8. Conclusion

We have found that on average those just past the usual retirement age are adequately prepared for retirement in that they will be able to follow a path of consumption that begins at their current level of consumption and then follows an age-pattern similar to that of current retirees. That pattern, incidentally, is similar to what would be found from a theoretically derived and estimated life-cycle model. Thus we do not find inadequate preparation for retirement on average or even at the median. This is not true, however, for all groups in the population. In particular, singles lacking a high school education are likely to be forced to reduce consumption: some 62% would have died with negative wealth had they followed the consumption path given by our data.[6] Future research will show the extent to which this percentage is over-estimated because we did not account for differential mortality.

[6] In our sample singles lacking a high school education are numerically a rather small group, but our selection does not result in a sample that is exactly population representative. The singles in our sample have about the same wealth and income levels as all singles 66-69, but the couples have less income although about the same wealth level. Thus, if anything, our overall sample has fewer resources that the population aged 66-69.

References (to be added)

Table 1

Item response rates (percent) in CAMS wave 1

Spending Category	
Big ticket item purchases	
Automobile or truck	96.4
Refrigerator	96.6
Washing machine/dryer	97.8
Dishwasher	97.7
Television	97.2
Computer	97.4
Payments	
Mortgage	92.2
Homeowner's or renter's insurance	88.7
Property tax	88.8
Rent	86.7
Electricity	92.4
Water	89.7
Heating fuel for the home	86.3
Telephone, cable, internet	93.9
Vehicle finance charges	86.2
Vehicle insurance	92.0
Health insurance	91.1
Spending	
Housekeeping, yard supplies	93.8
Home repairs and maintenance	93.9
Food and beverages	94.8
Dining/drinking out	94.8
Clothing and apparel	94.2
Gasoline	93.4
Vehicle maintenance	93.3
(Non-)Prescription medications	94.5
Health care services	93.7
Medical Supplies	92.1
Trips and Vacations	94.7
Tickets to movies, events etc.	95.0
Hobbies	94.2
Contributions	94.5
Cash or gifts to family/friends	94.2

Table 2
Comparison of CAMS and CEX spending and pre-tax income comparisons (dollars in thousands)

	55-64	65-74	75 or over
Spending CAMS	39.6	35.5	29.6
Spending CEX	40.9	31.7	22.8
Income HRS	60.1	43.3	27.1
Income CEX	52.0	32.4	22.3
Income CPS	63.5	42.0	28.3

Notes: CEX and CPS income for year 2001; CEX income full reporters only; HRS income for year 2001; spending for CAMS and CEX October, 2000-September, 2001.
Sources: CAMS: Authors' calculations; CEX: various tables found at http://www.bls.gov/cex/home.htm#tables

Table 3
Spending (thousands) CAMS waves 1 and 2 and percent change: couples

Age	N	Wave 1	Wave 2	Change
60-64	723	48.5	50.1	1.64
65-69	671	43.1	43.6	0.54
70-74	500	43.2	42.7	-0.51
75-79	289	40.8	42.5	2.09
80 or over	151	39.7	36.5	-4.26

Table 4
Spending (thousands) CAMS waves 1 and 2 and percent change: single

Age	N	Wave 1	Wave 2	Change
60-64	214	28.8	30.2	2.38
65-69	210	25.6	25.5	-0.28
70-74	150	26.3	27.1	1.48
75-79	163	24.8	24.5	-0.55
80-84	146	28.1	22.2	-11.77
85 +	134	28.3	23.8	-8.66

Table 5
Initial conditions among couples, thousands of 2004$
Number of households = 229

Percentile	Consumption	Social Security	Pension	Total annuity	Excess income	Wealth
10%	18.0	9.3	0.0	12.8	-5.2	14.9
25%	23.6	14.8	0.0	19.4	-4.2	83.5
50%	33.7	18.7	7.7	27.9	-5.8	262.8
75%	50.0	22.4	22.8	42.1	-7.9	669.0
90%	69.3	25.8	37.2	58.2	-11.1	1154.1
Mean	40.8	18.3	14.5	32.8	-8.0	525.1

Table 6
Initial conditions among singles, thousands of 2004$
N = 210

Percentile	Consumption	Social Security	Pension	Total annuity	Excess spending	Wealth
10%	10.3	3.0	0.0	4.7	-5.6	0.0
25%	14.5	6.9	0.0	7.6	-6.9	4.0
50%	21.6	9.7	0.0	11.0	-10.5	55.8
75%	29.7	11.9	6.0	16.9	-12.8	235.6
90%	42.6	14.4	14.8	25.4	-17.3	568.6
Mean	25.8	9.2	5.2	14.3	-11.4	183.9

Table 8
Couples, thousands 2004$
Number of persons = 282

	Mean	Median	Mean 40-60
Initial wealth	530.1	262.8	291.5
Present value annuities	312.9	268.6	308.6
Total resources	843.0	631.6	600.1
Present value consumption	408.2	326.8	351.5
Excess wealth	434.8	244.3	248.7

Table 9
Singles, thousands 2004$
N = 210

	Mean	Median	Mean 40-60
Initial wealth	183.9	55.8	56.0
Present value annuities	159.4	127.3	120.6
Total resources	343.3	205.8	176.6
Present value consumption	279.8	224.0	167.6
Excess wealth	63.5	5.7	9.1

Table 10
Couples, thousands 2004$

	N	% positive	mean initial wealth	mean P.V. annuities	mean P.V. consumption	mean excess wealth	median excess wealth
Less than high-school	61	67.5%	296.0	208.1	305.9	198.3	77.4
High-school	118	81.3%	416.5	320.4	384.2	352.7	240.7
Some college	47	79.1%	531.8	349.2	436.4	444.6	289.5
College and above	56	83.2%	1022.9	381.0	546.6	857.3	519.8
All	282	78.3%	530.1	312.9	408.2	434.8	244.3

Table 11
Singles, thousands 2004$

	N	% positive	mean initial wealth	mean P.V. annuities	mean P.V. consumption	mean excess wealth	median excess wealth
Less than high-school	58	37.6%	40.1	107.5	225.1	-77.5	-29.6
High-school	83	52.2%	170.0	158.2	267.7	60.5	6.1
Some college	45	60.9%	285.3	169.8	303.0	152.1	45.9
College and above	24	68.8%	388.9	269.7	410.2	248.4	80.2
All	210	51.9%	183.9	159.4	279.8	63.5	15.0

Figure 1

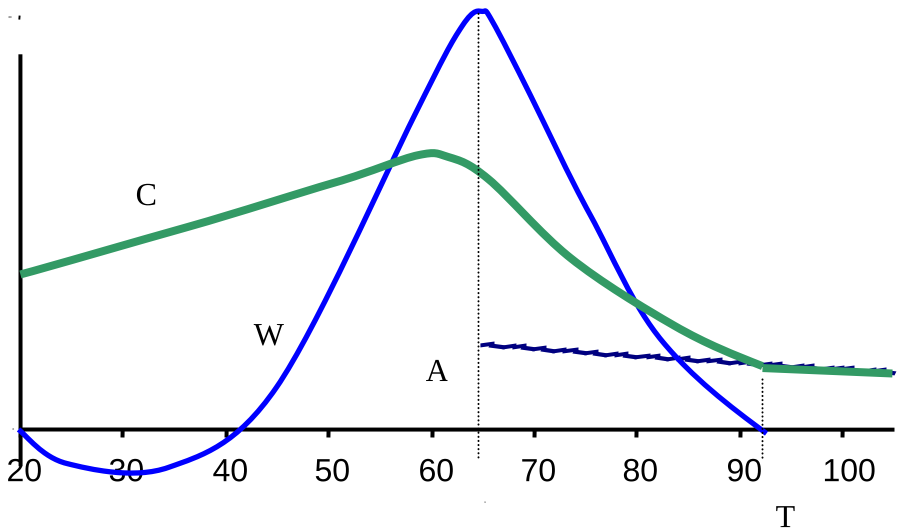


Figure 2

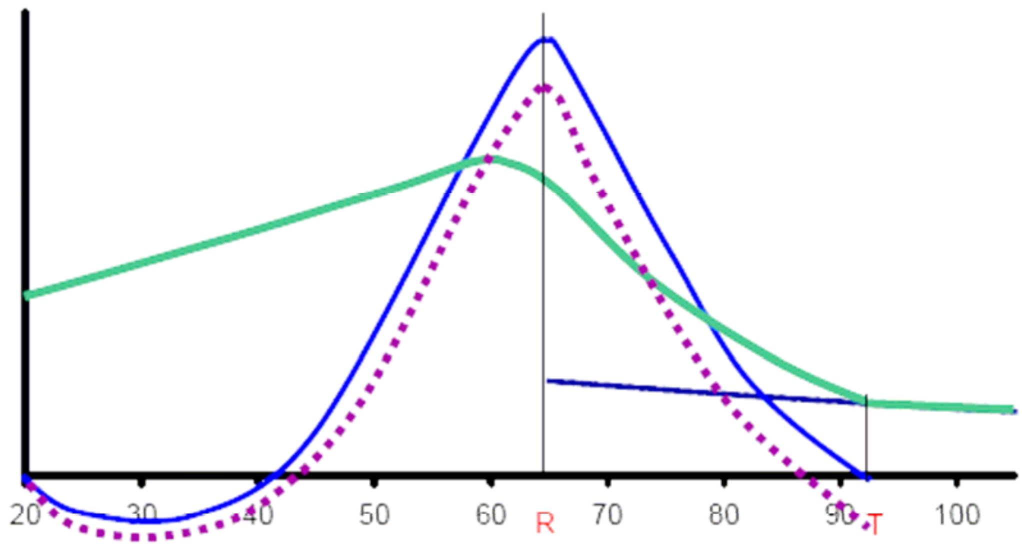


Figure 3

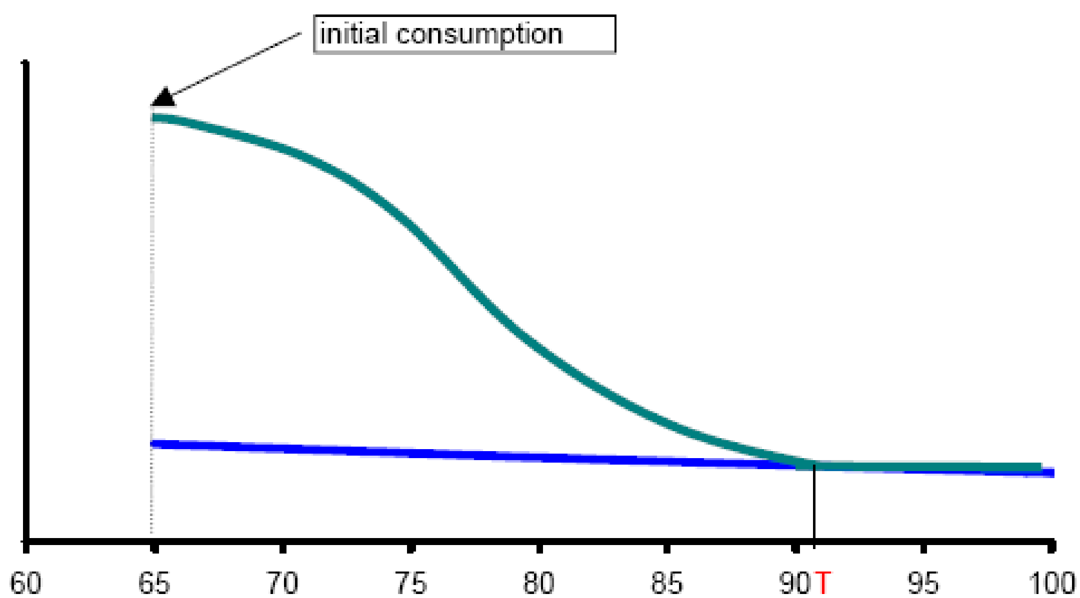


Figure 4

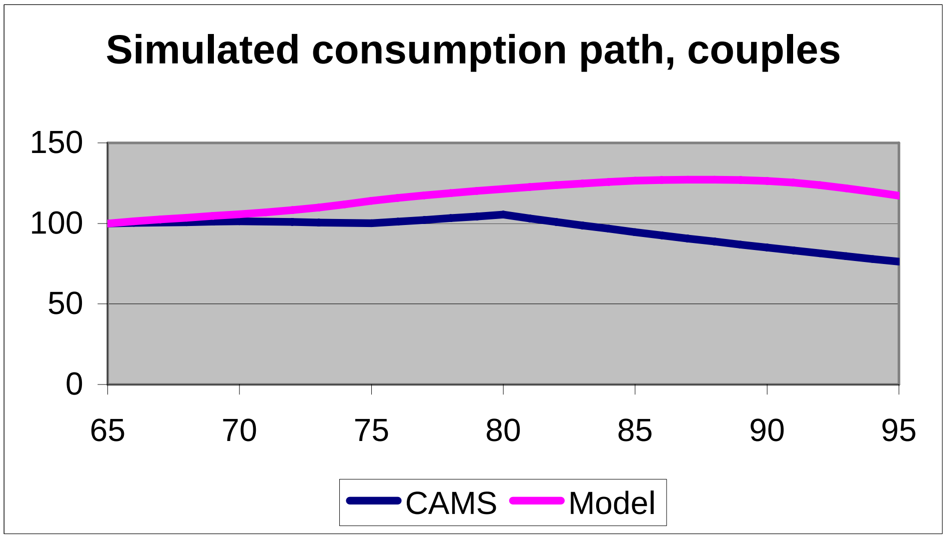


Figure 5

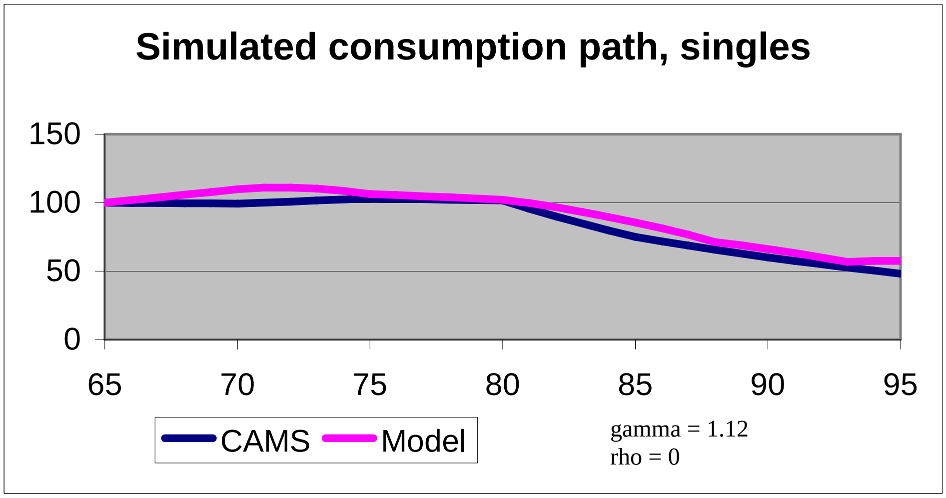


Figure 6

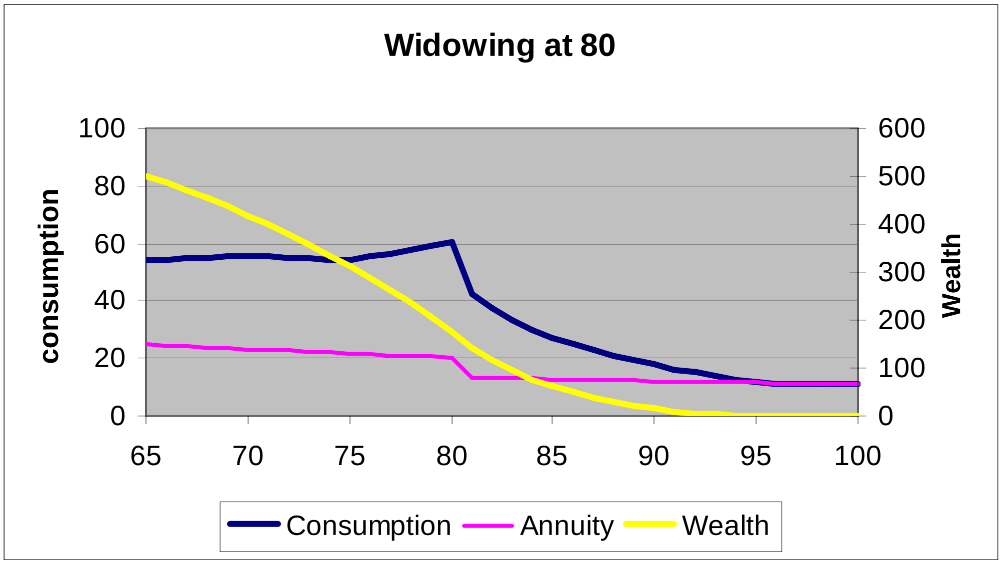


Figure 7

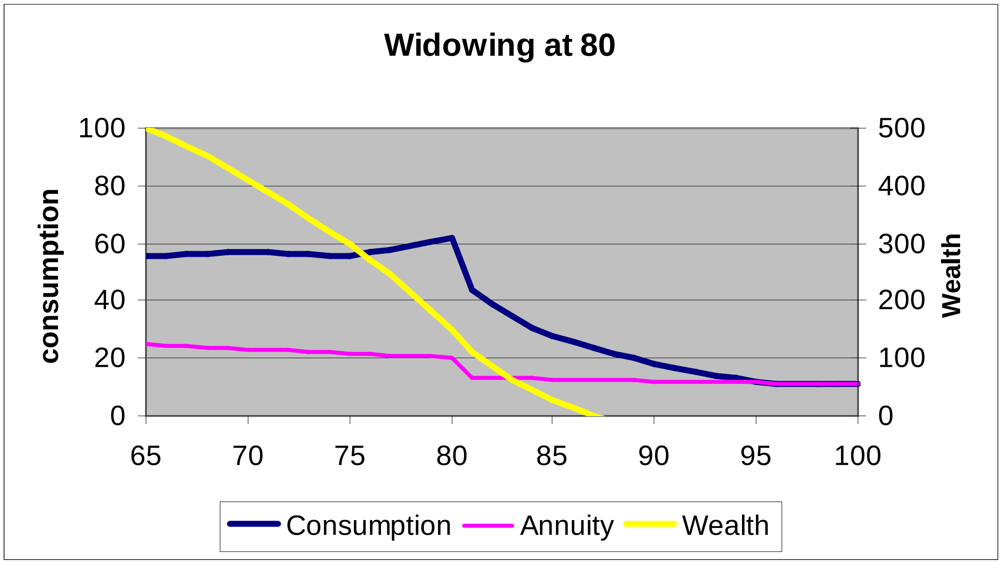
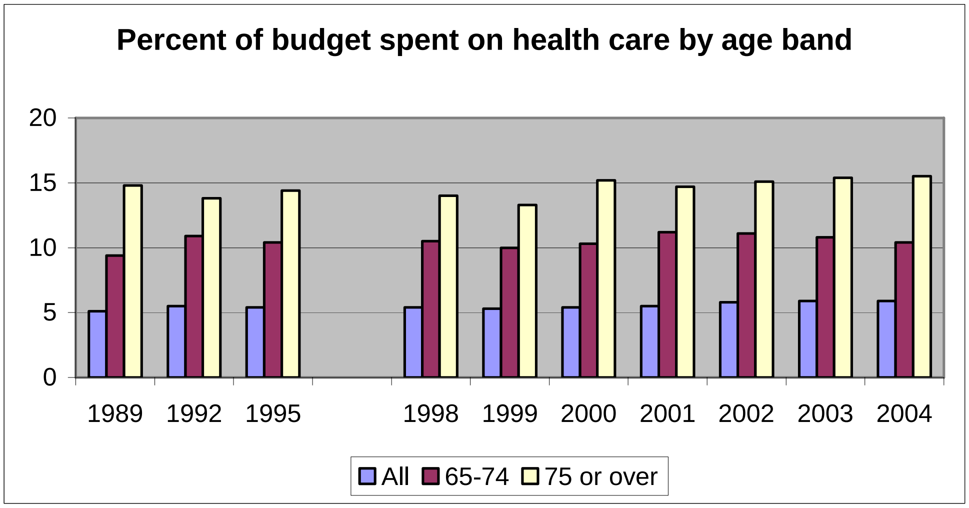


Figure 8


Percent of budget spent on health care by age band
20
15
10
5
0
1989
1992
1995
1998
1999
2000
2001
2002
2003
2004
All
65-74
75 or over