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# Is There a Retirement-Savings Puzzle?

By JAMES BANKS, RICHARD BLUNDELL, AND SARAH TANNER\*

*This paper addresses whether households save enough for their retirement. For successive date-of-birth cohorts we analyze income and expenditure patterns around the time of retirement. We find a fall in consumption as household heads retire which cannot be fully explained by a forward-looking consumption-smoothing model that accounts for expected demographic changes and mortality risk. Controlling for labor-market participation explains part, but not all, of this dip. We argue that the only way to reconcile fully the fall in consumption with the life-cycle hypothesis is with the systematic arrival of unexpected adverse information. (JEL D12, D91)*

Throughout the 1980's, governments introduced tax policies designed to encourage individual saving. These were, at least in part, motivated by the perception that households were not saving enough to provide adequately for their retirement. The main task of this paper is to examine the consumption of retiring households empirically and in particular the degree of consumption smoothing around the time of retirement. We are not the first to examine this issue. Daniel Hamermesh (1984), Jerry Hausman and Lynne Paquette (1987), and B. Douglas Bernheim (1993), among others, have claimed that agents are not saving enough to maintain their consumption levels after retirement. Showing that consump-

tion levels fall after retirement, however, is not sufficient evidence for retirement saving being too low—simple models predict that consumption should be smoothed across periods of predictably high and low income, but in general it is the marginal utility of consumption, not necessarily consumption itself, that is smoothed across time periods. Changes in family size, changes in the number of adult workers, mortality, and aging itself, for example, may systematically alter the marginal utility of consumption over the life cycle and lead to an optimal fall in consumption around retirement. So is there really a retirement-savings puzzle?

To address this question we use data on British households over the last 25 years. Previous research on these data suggests that by controlling adequately for demographics in preferences and nonseparabilities with labor supply, it is possible to explain observed age-consumption profiles for working-age households using the framework of the life-cycle model.<sup>1</sup> None of this research has looked at the consumption smoothing of households around the time of retirement. Institutional factors make Britain an interesting point of analysis. The fact that income in retirement relative to that in employment (i.e., the replacement rate) is typically lower than in the

\* Institute for Fiscal Studies, 7 Ridgmount Street, London WC1E 7AE, England; Blundell: Also Department of Economics, University College, Gower Street, London WC1E 6BT, England. This study forms part of the research program of the Economic and Social Research Centre (ESRC) for the Microeconomic Analysis of Fiscal Policy at the Institute for Fiscal Studies. We are grateful to the Leverhulme Trust for co-funding under the "Saving and Retirement Behaviour" project. Material from the Family Expenditure Survey made available by the Office for National Statistics (ONS) through the ESRC data archive has been used by permission of the controller of Her Majesty's Stationers Office. Neither the ONS nor the ESRC Data Archive bears any responsibility for the analysis or interpretation of the data reported here. Thanks are due to Orazio Attanasio, Martin Browning, Andrew Dilnot, Richard Disney, Mike Hurd, Tullio Jappelli, Costas Meghir, John Karl Scholz, and two anonymous referees for useful comments. The usual disclaimer applies.

<sup>1</sup> see Blundell et al. (1994) and Orazio P. Attanasio and Guglielmo Weber (1995), for example.

United States means that we can observe income falling rapidly as groups of households retire. Moreover, this has changed systematically across date-of-birth cohorts. Secondly, the fact that in the United States the bulk of medical costs are paid for by the state *only* after retirement creates a significant divergence between consumption and expenditure which affects only the elderly. Imputing the value of health care to the retired becomes an important issue. In Britain this issue does not arise to the same extent since state-provided health care is available at all ages. Much of consumption might also become subsidized on retirement—but again in Britain this only relates to some small health charges and to certain public transport fares.

After presenting evidence on the decline in consumption following retirement, with the analysis split by education group as well as date-of-birth cohort, we examine the likely causes of this decline. First we allow preferences (and hence changes in consumption) to depend on changes in family composition and age. A reduced level of expenditure may well be consistent with maintaining a constant level of marginal utility of consumption as individuals age. Axel H. Börsch-Supan and Konrad Stahl (1991) argue that the marginal utility derived from consumption diminishes among the “older” old (defined as those over 70) and that unexpected age and health-related consumption constraints can account for falling consumption and hence wealth accumulation during retirement.<sup>2</sup> However, this would have little implication for the consumption of most British households since retirement usually occurs at a younger age. Indeed, the predictions from a model of consumption growth that includes family size and age explain a substantial amount of the hump in consumption for working-age households, but cannot rationalize all of the dip in consumption growth at retirement observed in the data.

<sup>2</sup> Their argument is supported by cross section evidence from West Germany which shows expenditure on most items declining with age and increasing savings among the very old.

It is possible that mortality risk may induce additional effects on observed consumption growth—the sample may be getting systematically richer since survival is positively correlated with wealth or discount rates may rise as individuals come close to the end of their life cycles. The analysis we present considers the extent of differential mortality and, following Michael D. Hurd (1989), allows consumption growth to depend on average survival probabilities for each cohort. Although this is important, it cannot explain the puzzle.

A natural source of explanation lies in the direct impact of work on consumption—the consumption needs of households out of the labor market may well be less than those of workers. Instead of simply including a dummy variable to capture retirement we use unemployment directly as a control for the impact of the labor-market participation on consumption. Using observations on households with heads out of the labor market (both the unemployed and the retired), we allow consumption changes to depend on labor-market status as well as demographic variables. Allowing for labor-market status to be endogenous, consumption growth is shown to fall significantly with *anticipated* periods out of the labor market. This direct impact of work on consumption explains an important part, but not all, of the puzzle.

Of course, it may be that periods out of the labor market due to unemployment have a different direct impact on consumption than retirement. The data point to large falls in most consumption items at retirement, not just work-related expenditures. Expenditure reductions are larger than those for households entering unemployment, although income falls are smaller.

So how can the remaining drop in consumption be reconciled with standard theory? We argue that, unless we systematically mismeasure either consumption or expected mortality rates, the evidence points to the arrival of new and unfavorable information at retirement. (Of course, the puzzle could be generated by unanticipated early retirements, but in our sample cohorts retire quickly and close to

the mandatory age, suggesting this is not an explanation.) For example, there may be unexpected revisions to future pension wealth—we cite evidence below that these are strongly negative. There may also be unanticipated shocks to perceived lifetime needs (through health or life expectancy) occurring at the time of retirement as individuals associate less with younger working colleagues and mix instead with older people.

### I. The Empirical Puzzle

Many studies have argued that the failure of households to decumulate their asset holdings after their retirement is a puzzle that a simple life-cycle hypothesis cannot explain. Bernheim (1987), for example, found that individuals decumulated their assets at a low rate—less than 2 percent a year—and argued that the response of rates of decumulation to changes in annuitization could not be accounted for by the simple life-cycle hypothesis. But showing that households fail to run down their wealth in retirement is not necessarily evidence in favor of a puzzle. A failure to run down wealth levels would not imply a reduction in consumption if income levels are maintained throughout retirement. Alternatively, Hurd (1990) argued that the observed pattern of wealth decumulation was consistent with consumption smoothing if allowance was made for uncertainty over the date of death (see also James Davies, 1981). While such uncertainty might cause risk-neutral individuals to increase their current consumption so as not to die with unspent assets, risk-averse individuals will reduce current consumption to ensure that their wealth will stretch over a possibly longer and uncertain horizon and, thus, will begin to run down their wealth later, not necessarily at retirement.

There is also some indirect evidence showing that the desire to leave a bequest is an important motive for saving (see Laurence Kotlikoff and Laurence Summers, 1989). But according to the life-cycle hypothesis an anticipated bequest motive would entail a lower consumption path over a longer period of an individual's life span, not just wealth accumulation following retirement. In what follows we address these issues

by looking at income and consumption jointly rather than asset decumulation. By considering the paths of income and expenditure for different generations of households before and after their retirement we can look directly at the degree of consumption smoothing while controlling for factors such as retirement income and mortality risk.

#### A. *The Pattern of Income and Consumption Around Retirement*

The data we use in this paper are drawn from the 25 successive years of the *Family Expenditure Survey* (FES) from 1968 to 1992. The FES is an annual cross section survey of about 7,000 British households that collects detailed information on household characteristics, incomes, and expenditures. Since it is not a panel, we need to create a "pseudo-panel" to link the data over time and enable the investigation of dynamic relationships. This involves dividing households into groups according to their date of birth and then taking means within each cohort group and each time period to get a time series for each cohort (see Angus Deaton, 1985). Since the aim of this study is to consider consumption and income around the time of retirement, we use relatively small (four-year) date-of-birth bands into which to divide the households, thus limiting the dispersion of age within each cell. To keep the cell sizes large enough this definition requires taking annual, rather than quarterly, time averages. The resulting cohort data set therefore has 25 annual observations on each of 12 cohorts (see Table A1 in the Appendix for more details).

Although the retirement age in Britain is 65 for men and 60 for women, many individuals do not actually retire at those ages. We cannot simply compare consumption before and after these dates. The first point of analysis is therefore to investigate when cohorts actually retire. To do this we focus on cohorts for which we have more than a few years data on either side of the official retirement ages (those born between 1911 and 1926). The bold line, labelled "E," in Figure 1 shows the proportion of household heads in employment for each of these four cohorts as the average age of the cohort increases. Throughout this paper we

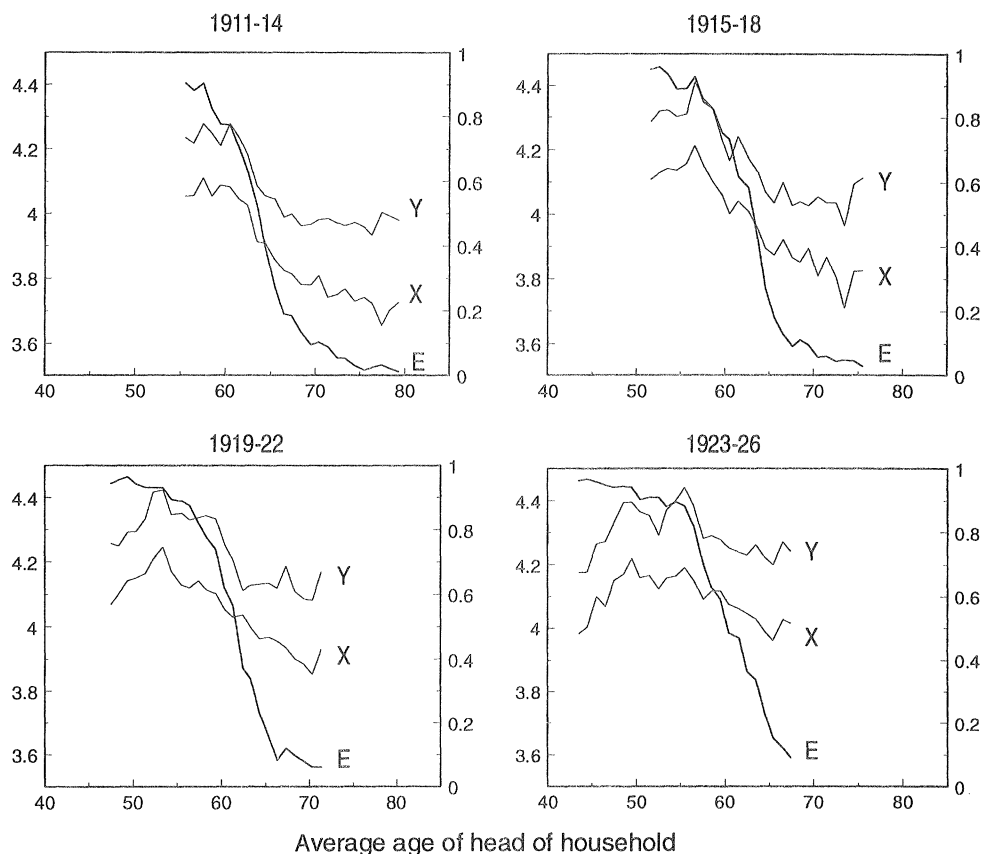


FIGURE 1. AVERAGE INCOME, EXPENDITURE, AND PROPORTION EMPLOYED FOR FOUR DATE-OF-BIRTH COHORTS, BY AGE OF HEAD

Notes: E—Proportion of heads in employment (right-hand scale). Y—Log weekly real household disposable income (left-hand scale). X—Log weekly real household nondurable expenditure (left-hand scale).

use the mean age of the heads of household in each cohort in each year as a reference age for that cohort. Even by age 60, a substantial proportion of each cohort is out of the labor market, and this proportion is higher for younger cohorts, as we would expect. Nearly 80 percent of household heads born between 1911–1914 are still working at age 60, compared with just over half those born between 1923–1926. Note that in this figure we do not distinguish between households that are out of the labor market for different reasons. There is a clear problem with assessing the labor-market status of individuals who are out of work close to their retirement dates. When it becomes im-

portant to distinguish between retirement and unemployment, below, we will use the FES *self-reported* employment status variable rather than any constructed employment code.

In the same figure, we look at the age profiles of log consumption and log income for each cohort as their age and employment status change.<sup>3</sup> To control for the effects of

<sup>3</sup> Since we have already split the sample by cohort, we cannot separately identify time from age effects on income. In the absence of cohort differences we could average by age to smooth out the time effects but, for incomes at least, these cohort effects are large so this option

different household sizes we equalize real consumption and real income using the simple equivalence scales estimated from FES data and described in Banks and Paul Johnson (1994).<sup>4</sup> Consumption and income fall for each cohort as the households retire. (Throughout this paper we define the retirement status of the household as that of the head only.) This pattern is much less pronounced for the younger cohorts, however. Comparing those born between 1911–1914 with those born between 1923–1926, there is evidence of a much higher income replacement rate for the younger households and a much smoother path of consumption as they retire. For households in the oldest cohort there is some evidence of a divergence between income and consumption as households age further. It is not surprising that income falls after retirement. When a household retires, its income becomes mainly composed of dissaving through pension payments, although other state benefits may be very important. What is surprising, however, is that consumption falls and that it appears to fall faster than income does. This means that cohorts are not running down their financial assets, and may even be resaving some of their income.

It is worth noting that these profiles do not imply large aggregate saving rates which would be in contradiction to the aggregate statistics for Britain in the 1970's and 1980's. This is primarily because the measure of total expenditure in these figures excludes spending on large household durables. Durable expenditures are typically not well recorded in diary surveys although, if anything, might be thought to fall when a household retires, which would further exaggerate the effects we find. To the extent that this is captured in our data, Figure A1 in the Appendix demonstrates that this is indeed the case. The reliability of trends

in FES data on aggregate spending and individual items, in comparison to other sources of information including National Accounts, is established in the study by Tanner (1997). Lump-sum payments at retirement could also distort the measurement of resources. However, evidence from the *Retirement Survey* (see Richard Disney et al. [1998], for a description) suggests that only one-fifth of British retirees receive a lump-sum payment on retirement and do not invest or annuitize it, and these lump sums tend to be small.

It is possible, however, that the presence of asset income in the income definition biases the time/age profiles and may explain the observed divergence between income and consumption. High real interest rates at the end of our sample period meant high income growth for the very rich, who have lower marginal propensities to consume, and this would tend to reduce consumption growth. If wealth holdings differ by education group (see, for example, Thad Mirer [1979]), then splitting the sample by education group before aggregating ought to provide some information on the extent of this problem. Indeed, if wealth and education are correlated then this might also go some way towards redressing the effects of differential mortality rates in the cohort aggregate profiles.

In Figure 2 we break down the population into education groups to examine the extent of this aggregation bias using just one cohort for simplicity.<sup>5</sup> In the left panel we provide consumption and income profiles for the households who left school at the compulsory school leaving age (approximately 70 percent of the households), whereas in the right-hand panel we plot the same profiles for the rest of the sample, i.e., those who undertook some voluntary further education. There is more evidence of the decline in consumption around retirement for the former group of households (which might also be thought to have lower wealth, on average) and income continues to fall after retirement. Evidence of the divergence between income

is not open to us (although we will exploit this for components of consumption).

<sup>4</sup> The number of adult equivalents is computed using values of 0.6 for second or subsequent adults and 0.43 for each child. These values were estimated from 1992 FES data. The results that follow are robust to changes in the equivalence scales.

<sup>5</sup> In the FES the number of years of schooling was asked only from 1978, shortening the time series for this part of our analysis from 25 to 15 years.

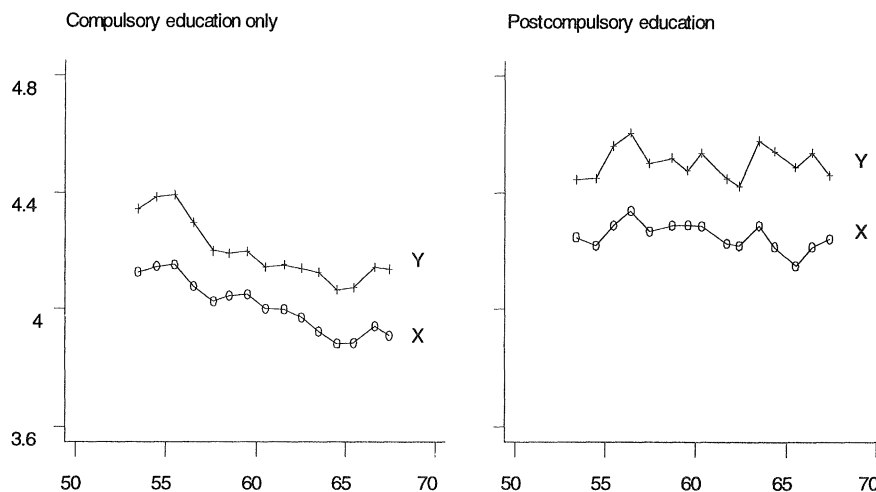


FIGURE 2. LOG INCOME (Y) AND LOG EXPENDITURE (X), BY AGE AND EDUCATION GROUPS  
HOUSEHOLDS BORN 1923-1926

and consumption remains for the better-educated households, although the cell sizes are much smaller and hence there is more noise. The next section sets up a framework in which we can address the degree to which the reduction in consumption is anticipated by retiring households.

#### B. Anticipated versus Unanticipated Changes in Consumption

The life-cycle model provides a natural setting in which to consider the anticipated effects of retirement on consumption growth. Assuming lifetime utility displays intertemporal additive separability, we can allow parameters to depend on the composition of a household and write:

$$(1) \quad U = \sum_{t=s}^T \frac{1}{1 + (\delta_0 + \delta'z_{1it})} u(C_{it}),$$

where  $T$  is the lifetime of the household and  $\delta_0 + \delta'z_{1it}$  is the discount rate for a household with characteristics  $z_{1it}$  including age, for example. Assuming within-period utility (or felicity) functions exhibit constant relative risk aversion (CRRA),  $u(C_{it})$  takes the form

$$(2) \quad u(C_{it}) = \frac{\exp(\theta_0 + \theta'z_{2it})}{1 - (\rho_0 + \rho'z_{3it})} C_{it}^{1 - (\rho_0 + \rho'z_{3it})}$$

in which  $\theta_0 + \theta'z_{2it}$  captures the way in which demographic variables,  $z_{2it}$ , scale within-period consumption and  $\rho_0 + \rho'z_{3it}$  reflects the degree of risk aversion for a household with demographic characteristics  $z_{3it}$ .

Equating expected marginal utilities between time periods yields the first-order condition for consumption growth over the life cycle (see Robert Hall [1978] or Martin Browning et al. [1985]). When demographics enter preferences in all places, the form of the consumption growth equation is<sup>6</sup>

$$(3) \quad \Delta \ln C_t = \alpha'_1 \Delta(z_{3t} \ln C_t) + \alpha'_2 \Delta z_{2t} \\ + \alpha'_3 z_{1t} + \alpha_4 r_t + \alpha_5 + \varepsilon_t,$$

<sup>6</sup> See, for example, Attanasio and Weber (1993). In our empirical investigation we initially assume that demographics only scale within-period consumption, and hence enter the consumption-growth equation in differences. In later sections we will allow interaction terms to control for demographic effects on the intertemporal elasticity of consumption.

where  $\alpha_1 = (-\rho/\rho_0)$ ,  $\alpha_2 = (-\theta/\rho_0)$ ,  $\alpha_3 = (-\delta/\rho_0)$ ,  $\alpha_4 = (-1/\rho_0)$ ,  $r_t$  is the real interest rate,  $\varepsilon_t$  is an expectation error such that  $E_{t-1}\varepsilon_t = 0$  and the intercept term  $\alpha_5$  therefore contains an adjustment for the log-linear approximation error as well as the household's discount rate  $\delta_0$ . The term  $\varepsilon_t$  will reflect, among other things, unpredictable shocks to interest rates, employment status, retirement income, or family composition.

The removal of  $i$  subscripts on the consumption and demographic terms signifies the switch to (exactly aggregated) cohort means that allows this equation to be estimated on the cohort-aggregated pseudo-panel data described in the previous section.<sup>7</sup> Fumio Hayashi (1987) established the need for a long time series in the estimation of consumption growth models of this type. We assume that the time series of 25 years of cross section data in our application is sufficiently long for the time average of  $\varepsilon_t$  to be close to zero. Given that our purpose in this paper is to consider deviations of actual consumption growth from the predictions of (3), the degree to which individual parameters are affected by the presence of approximation error is not a major issue.

As a baseline specification we estimate the consumption growth model in (3) using as a dependent variable the change in log nondurable expenditure, controlling for demographic composition by scaling expenditure by the number of adults and children as before. We also control for the effect of multiple (i.e., more than two) adults and allow a time-dependent discount rate by including the average age of the head of the household. This analysis corresponds to previous consumption growth models estimated using British data, which have shown that household composition is an important determinant of consumption paths (see Attanasio and Browning [1995], for example). The estimated consumption growth equation<sup>8</sup> is given by:

<sup>7</sup> It is quite possible that  $\varepsilon_t$  contains an MA(1) error reflecting the differencing of variables that are measured with error. This autocorrelation is accounted for in estimation by using, as instruments in a Generalized Methods of Moments estimation procedure, only variables lagged by at least two periods.

<sup>8</sup> All models are estimated using Instrumental Variables with instruments lagged at least two periods to allow

$$\begin{aligned} \Delta \ln C_t &= 0.619\Delta(\text{Multiple Adults})_t + 0.494r_t \\ &\quad 0.092 \qquad\qquad\qquad 0.068 \\ &\quad - 0.006(\text{Age of Head})_t; \\ &\quad 0.001 \\ &\quad \text{SC}(15) \quad 21.97 \\ &\quad \text{GR}^2 \quad 0.252 \end{aligned}$$

where standard errors, reported below the estimated coefficients, are robust to the presence of unknown heteroskedasticity and an MA(1) error term. The estimation controls for the endogeneity of the multiple adult and real interest rate variables<sup>9</sup> and allows the period  $t$  values of these variables to be uncertain at time  $t - 1$  when the planned level of  $C_t$  is chosen.

The estimated coefficient of 0.493 on the real interest rate yields an estimate of the coefficient of risk aversion of approximately  $-2$ ; the (anticipated) arrival of a third adult in the household causes consumption growth to increase temporarily, as expected. The negative age coefficient gives some support to the idea that discount rates rise with age.

Also reported with this model are the Sargan Criterion (SC), i.e., the test statistic for over-identifying restrictions which, under the null, has an asymptotic  $\chi^2$  distribution with 15 degrees of freedom, and the IV goodness-of-fit measure,  $\text{GR}^2$ , from Hashem Pesaran and Richard Smith (1994).

The main difference between this baseline model and others estimated for Britain is that retired households have been kept in the

for the presence of an MA(1) error arising from the differencing of log expenditure. All specifications also include a constant term and a dummy to capture the effect of the 1980's.

<sup>9</sup> The instrument set contains age of head of household, per capita real GDP at age 20, a lag of the inflation rate, two-period lags of the interest rate, consumption growth, income growth, proportion of households with children, and change in mortality rate, and two- and three-period lags of proportion of households with multiple adults, proportion of heads and proportion of second adults unemployed, and proportion of heads and proportion of second adults retired.



sample, whereas previous studies have used working-age households only. Placing the model in a framework of anticipated and unanticipated consumption growth then allows us to consider differences between the two paths for retired households.

### C. The Postretirement Dip in Consumption Growth

The essence of our evaluation of the retirement-savings puzzle lies in consideration of the prediction error term from the estimated consumption growth model. According to life-cycle theory, the innovations to the consumption growth process,  $\varepsilon_{it}$ , relate directly to discounted future real income shocks. As a guide to this argument, consider the approximation<sup>10</sup>

$$(4) \quad \varepsilon_{it} \propto \frac{1}{1+r} \sum_{k=0}^{T-t} [(1+r)^{-k} \times (E_t - E_{t-1})y_{it+k}],$$

where  $y_{it+k}$  is the real income series. If the level of retirement income at period  $t$  is fully anticipated at period  $t-1$  then observed consumption growth should not react to the change in income. However, if income changes are partly unanticipated, as may be the case around the point of retirement, then they will enter  $\varepsilon_t$  and therefore influence the observed path of consumption growth and result in unanticipated consumption changes.

Another important distinction is between the permanent and transitory components of income shocks. We may write the process for income of household  $i$  in period  $t$  as:

$$(5) \quad y_{it} = y_{it}^P + u_{it},$$

where  $y_{it}^P$  represents the permanent component of income and  $u_{it}$  the transitory shock in period  $t$ . The permanent component is assumed to follow a random walk

$$(6) \quad y_{it}^P = y_{it-1}^P + v_{it}$$

so that the process for income becomes

$$(7) \quad y_{it} = y_{it-1} + u_{it} - u_{it-1} + v_{it}.$$

Using (4) and (7), for large  $T-t$ , we have

$$(8) \quad \varepsilon_{it} \propto v_{it} + \frac{r}{1+r} u_{it}.$$

That is, the consumption innovation is simply proportional to the sum of the annuity value (assuming no discounting) of the transitory shock and permanent shock.<sup>11</sup> Therefore, to the extent that income shocks associated with retirement and unemployment have different transitory and permanent components, they are appropriately accounted for in the consumption growth equation.

The predictions from the estimation of (3) can be used to obtain the expectation error

$$(9) \quad \varepsilon_{it} = c_{it} - E_{t-1}c_{it},$$

where  $E_{t-1}c_{it}$  measures the one-step-ahead predictions of consumption in period  $t$  given information available in period  $t-1$  which will include anticipated permanent and transitory changes to income. For example, retirement may correspond to an anticipated permanent reduction in income and as such should not enter the expectation error. Over the time series the errors in (9) should average to zero but will in any specific time period, as discussed above, represent the impact of unexpected news on consumption growth and could relate to news regarding future wealth, length of life, health, etc.

In Figure 3 we plot actual consumption growth and the one-step-ahead within-sample predictions of consumption growth by age, av-

<sup>10</sup> see Deaton and Christina Paxson (1994) for the exact derivation under quadratic preferences.

<sup>11</sup> The derivation of  $\varepsilon_{it}$  requires that the consumer can separately identify transitory  $u_{it}$  from permanent  $v_{it}$  income shocks which we assume throughout. For a more general model, see Blundell and Ian Preston (1998), for example.

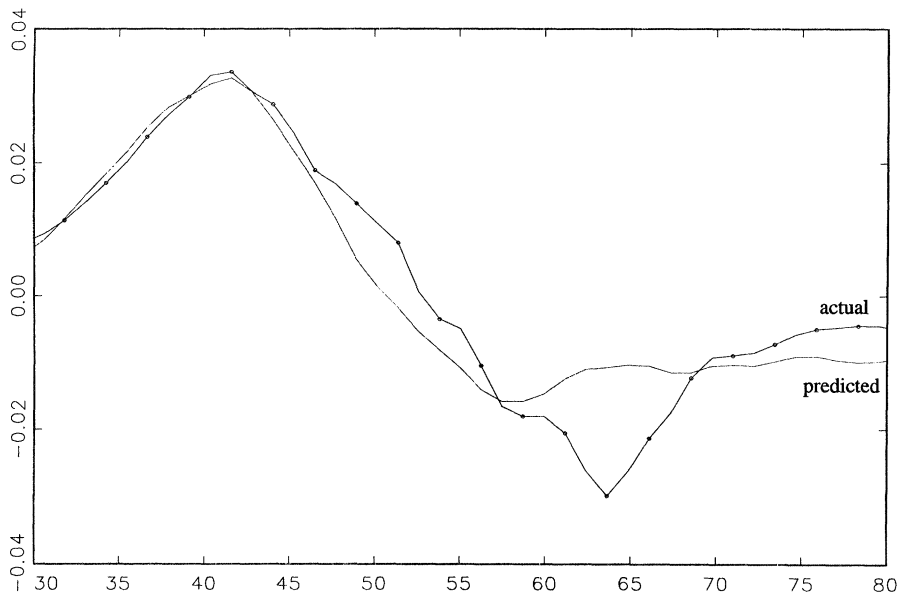


FIGURE 3. ACTUAL AND PREDICTED CONSUMPTION GROWTH, BY AGE  
DEMOGRAPHIC CONTROLS ONLY

eraging over cohorts.<sup>12</sup> The model predictions reflect well the positive consumption growth in midlife but at the time of retirement the predicted (i.e., anticipated) consumption growth does not fall by enough to match the observed postretirement dip in consumption growth in the data. Actual consumption falls by as much as 3 percent a year at age 63, but the predicted fall in consumption growth at this age is less than 1½ percent. Eventually consumption growth is restored to zero, but not until consumption has fallen by substantially more than the anticipated effects in the consumption growth equation would have predicted.

## II. Resolving the Puzzle

The results of the previous section have suggested that there is evidence of a

<sup>12</sup> In this figure we present nonparametric regressions of actual and “predicted” consumption growth against age to average over cohorts. We use an Adaptive Kernel estimator with a Gaussian Kernel; the bandwidth is chosen to be one-third of the Mean Integrated Squared Error (see Wolfgang Härdle, 1990).

retirement-savings puzzle. Either individuals are systematically making errors in their expectations of income in retirement, or their expectations are correct but their consumption and saving decisions are not fully captured by the life-cycle model as set out above. There are several ways in which we can enhance the simple model to try to explain consumption behavior for retiring households. We consider two extensions—allowing for mortality risk and incorporating labor-market-related costs.

### A. Mortality Risk

Households with a higher survival probability are likely to forego consumption today in favor of consumption tomorrow. To allow for mortality risk we therefore follow the suggestion of Hurd (1989) and include a term in the change in the (exactly aggregated) logarithm of the survival probability,  $\Delta \ln a_t$ , computed from the life-expectancy tables for the United Kingdom (Office of Population Censuses and Surveys, 1987). The significance of

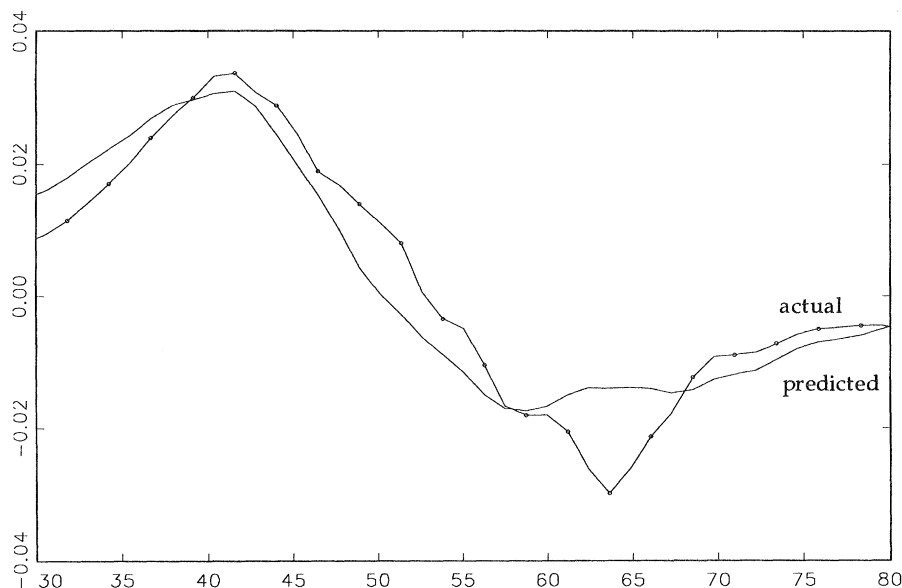


FIGURE 4. ACTUAL AND PREDICTED CONSUMPTION GROWTH, BY AGE  
CONTROLLING FOR DEMOGRAPHICS AND MORTALITY RISK

the survival probability term provides some confirmation of the importance of mortality risk in determining anticipated consumption growth.

$$\begin{aligned} \Delta \ln C_t &= 0.761 \Delta(\text{Multiple Adults})_t + 0.498 r_t \\ &\quad 0.081 \qquad\qquad\qquad 0.072 \\ &+ 3.070 \Delta \ln a_t \quad \text{SC}(13) \quad 22.39 \\ &\quad 0.735 \qquad\qquad\qquad \text{GR}^2 \quad 0.245. \end{aligned}$$

The survival term enters positively, as anticipated. Since our mortality term varies only with the age and sex of the head and not with wealth, income, or education there is little scope for both  $\Delta \ln a_t$  and age in the estimated equation. In what follows we omit age from our specifications but retain it as an instrument.

The important question is the extent to which controlling for differential mortality risk can remove the gap between unanticipated and anticipated consumption paths ob-

served in Figure 3. The revised consumption paths, estimated with the inclusion of the survival probability term, are presented in Figure 4. There is very little impact on the dip, although the increasing consumption growth for those over 70 years of age is pulled down by this adjustment as could be expected. It is interesting to note that older households are still observed to have negative consumption growth despite the sample getting richer, on average, over time.

At this point it would seem worth examining the sources of empirical bias that could result from differential mortality risk and evaluating their likely impact on our estimates. There are two types of bias resulting from mortality risk when estimating a consumption growth equation from pseudo-panel data of the type used here. The first is the standard attrition bias that would be found in individual panel data or pseudo-panel data whenever there is correlation between the survival probability across individuals and unexpected shocks to their consumption growth. This may well be important for consumption growth after retire-

ment since the wealthier may be expected to live longer and, as we have already argued, some shocks to consumption growth over this period have been wealth dependent.<sup>13</sup> The second source of potential bias is specific to pseudo-panel data and occurs where the population of survivors in any cohort is not drawn from the same distribution as those from the same cohort in the previous period (this could also occur for the same reasons as those causing the attrition bias in a standard panel data set). The average expectation error in the pseudo-panel growth equation will not necessarily be zero and may therefore bias the estimated growth equation.

As an inquiry into the potential seriousness of this bias we present Figure A2 in the Appendix—a plot of average years spent in education by age and cohort for those households over age 50. If less-educated (and, we assume, less-wealthy) households die earlier than the more educated, then the composition of the population of survivors from one period to the next will change and the average education of the cohort will rise as the cohort ages. Although there is some evidence of increasing noise as the older cohorts age, the only major upward drifts in average education happen after age 75—particularly for the oldest cohorts (who are aged 74 in 1979 when our education data begin).

These issues are further explored by excluding older households from the sample in estimating the consumption growth equations. The results of this experiment (presented in Table A2 in the Appendix) show that selecting only the younger groups, i.e., those less than 65 years of age, changes little except the parameter on the survival probability.

<sup>13</sup> Any correlation between consumption and exits from the sample will cause this bias. For example, if length of life was distributed randomly across the population one might think that agents who are likely to die soon will be spending more than those who expect to live longer, so as these individuals die out, consumption in the sample may fall. However, we expect the predominant correlation to be between high wealth and life expectancy, which would lead to estimates of consumption growth not falling by enough as households age. If this is the case the bias would strengthen the conclusions of our empirical results.

## B. Incorporating Labor-Market Status

When preferences for consumption depend directly on labor-market status, the life-cycle model suggests that there will be a predictable decline in expenditure when households leave the labor market. This decline is not necessarily associated with a decline in consumption services<sup>14</sup> or marginal utility. It is natural to ask whether the observed fall in expenditure at retirement simply reflects this predictable change in needs.

We control for the direct impact of retirement (and unemployment) on the marginal utility of consumption by introducing a dummy taking the value one if the head of the household is out of the labor market. The parameter on the change in this variable, appropriately instrumented, should give the anticipated effect on consumption growth associated with withdrawal from the labor market and therefore captures the planned adjustment of consumption to the retirement event. This is true when retirement is anticipated regardless of whether is a choice variable. In Figure 5 we show the proportion of households out of the labor market at each age, decomposed into those households with heads that are retired and those that are unemployed. On average, households begin to retire in their late 50's and most are retired by age 65. The revised consumption growth equation, taking account of labor-market status is:

$$\begin{aligned} \Delta \ln C_t &= 0.551 \Delta(\text{Multiple Adults}), \\ &0.098 \\ &+ 0.446r_t + 3.280 \Delta \ln a_t \\ &0.064 \quad 0.578 \\ &- 0.258 \Delta(\text{Head out of labor market}), \\ &0.067 \\ &\text{SC (14) 18.34} \\ &\text{GR}^2 0.267. \end{aligned}$$

<sup>14</sup> In the United Kingdom local public transport, for example, becomes largely free to individuals over state pension age.

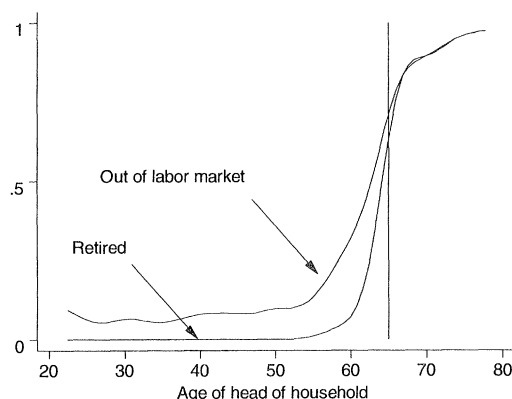


FIGURE 5. LABOR-MARKET STATUS OF HEAD OF HOUSEHOLD, BY AGE

As expected, the estimated coefficient on the labor-market dummy is negative and significant, and other parameters are largely unaffected by its introduction.

In Figure 6 we use this specification to analyze the dip in consumption growth. Labor-market status clearly has had an effect. Although some of the observed dip in consumption growth is accounted for by the one-step predictions of the model, the puzzle remains—anticipated consumption falls by around 2 percent per year between ages 60 and 65, whereas the fall in actual observed consumption growth is as much as 3 percent.

### III. Comparing Retirement and Unemployment

An attraction of the above approach to evaluating the impact of retirement through the labor-market status dummy is that we follow cohorts through periods of unemployment and retirement. By imposing the same impact on marginal utility of consumption we are less subject to the criticism of introducing a dummy to overfit the data and solve the puzzle. However, it may be that the simple “out of the labor market” effect is not sufficient to capture completely household preferences as they retire. In what follows we present some descriptive analysis of the size of consumption changes, both for total expenditure and constituent components, as households retire or

become unemployed. We then consider the model of consumption growth that allows retirement and unemployment to affect separately preferences and compare the predictions of this model with the outturn observed in the data.

We begin by considering the magnitude of falls in consumption as employment and retirement status change. We analyze periods of unemployment in addition to retirement to see if we can evaluate whether the effect of retirement on consumption can be captured wholly by the effects of the household being out of the labor market, or whether there is an additional effect associated only with retirement. In Table 1 we present OLS estimates of changes in per capita consumption and per capita income regressed on changes in unemployment and retirement—merely to assess the magnitudes of raw differences between the two effects.

The first two columns show that the average income of a cohort falls more with a change in the proportion unemployed than with a change in the proportion in retirement. The reverse is true for consumption. For example, the results imply that a 1-percentage-point rise in the proportion retired is associated with a 0.352-percent fall in average consumption, whereas the effect is only 0.227 percent for a change in the unemployment rate of 1 percentage point. Conditioning on changes in income, the effect of unemployment on total

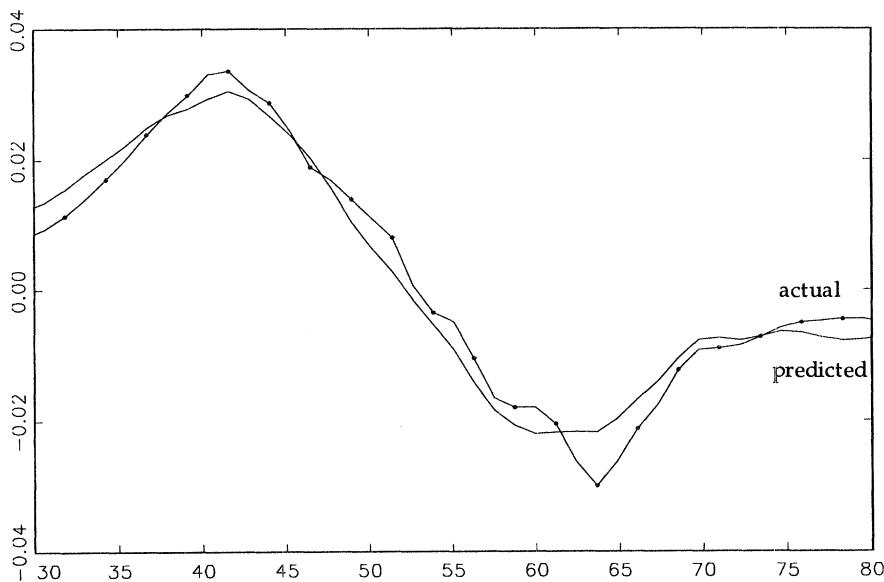


FIGURE 6. ACTUAL AND PREDICTED CONSUMPTION GROWTH, BY AGE CONTROLLING FOR DEMOGRAPHICS, MORTALITY RISK, AND LABOR SUPPLY

consumption is positive while there is no significant effect of retirement. This suggests, insofar as the fall in income is not completely matched by the fall in consumption, that the unemployed are partially smoothing their consumption. What is surprising is that this does not happen *more* in the case of retirement. Retirement *would* seem to be a more predictable event and may well be an endogenous decision for many individuals so that unanticipated negative wealth effects can be avoided.

In the last column of Table 1 we consider the possibility that the differences between the unemployed and retired are related to age, due, for example, to an experience effect in substituting leisure for consumption or alternatively to shocks to income or employment being more likely to be permanent for older households. We split the unemployed into those aged less than 50 and those over 50 and once again look at the effect on changes in log consumption controlling for changes in income. The old unemployed do indeed behave more like the retired than their younger unemployed counterparts—the younger unemployed

smooth their consumption more. But, in practice it is difficult to distinguish between the old unemployed and the retired. For example, in Britain, of those born between 1919–1923, more than half of those unemployed over the age of 55 do not return to work (Disney et al., 1994). Adding further interactions, for example between income and unemployment changes, does not alter these conclusions.

Our earlier discussion has suggested that the fall in consumption at retirement may reflect the permanent decline in work-related expenditures. To analyze this further we decompose consumption into three different categories to reflect those goods that are likely to be work related (canteen and restaurant meals, transport, and adult clothing), those that are basic necessities (food consumed in the home and domestic fuel), and the remainder of nondurable items (personal and household services, entertainment, etc).

In Figure 7 we plot age profiles for two of these commodity groups: work-related goods food and basic items. The figure shows that

TABLE 1—CHANGES IN CONSUMPTION WITH RETIREMENT AND UNEMPLOYMENT

	$\Delta \text{Log income}$	$\Delta \text{Log consumption}$	$\Delta \text{Log consumption}$	$\Delta \text{Log consumption}$
$\Delta \text{Unemployment}$	-0.824 <i>0.098</i>	-0.227 <i>0.091</i>	0.190 <i>0.085</i>	—
$\Delta \text{Retired}$	-0.605 <i>0.066</i>	-0.352 <i>0.062</i>	-0.045 <i>0.059</i>	-0.054 <i>0.089</i>
$\Delta \text{Log income}$	—	—	0.507 <i>0.046</i>	0.514 <i>0.047</i>
$\Delta \text{Unemployed} * \text{Age} < 51$	—	—	—	0.318 <i>0.150</i>
$\Delta \text{Unemployed} * \text{Age} > 50$	—	—	—	0.147 <i>0.095</i>

Note: Standard errors in italics.

spending (per adult equivalent) on work-related commodities falls among retiring households as anticipated. However the figure also shows that even expenditure on basic necessities falls at and after retirement, and that this is attributable mainly to a fall in spending on food consumed in the home.<sup>15</sup>

Table 2 examines this further. Parameter estimates are presented for changes in basic expenditure items and changes in spending on work-related items associated with retirement and unemployment. The first two columns show estimates for the changes in the logarithm of basic expenditures as the proportion of unemployed and retired changes; in the second of the two we condition on changes in total household expenditure. The third and fourth columns present the same analysis for work-related costs. There is a shift in consumption expenditures at retirement away from work-related goods.<sup>16</sup> The fact that unemployment has a smaller negative effect in column 3 on work-related expenditures may be explained by the search costs of looking for work. Columns 1 and 3, that control for changes in total expenditure, show that the dif-

ferences between the retired and unemployed households can be largely explained by changes in the total consumption levels between these two groups.

#### A. Consumption Growth with Retirement and Unemployment

A natural extension to our consumption growth equation is to separate out anticipated unemployment and retirement. The following specification retains the out-of-labor market dummy variable as before, but introduces an extra labor-market variable taking the value one if the head of the household is unemployed:

$$\begin{aligned} \Delta \ln C_t &= 0.577\Delta(\text{Multiple Adults})_t + 0.471r_t \\ &\quad 0.111 \qquad\qquad\qquad 0.071 \\ &+ 3.125\Delta \ln a_t \\ &\quad 0.613 \\ &- 0.225\Delta(\text{Head out of labor market})_t \\ &\quad 0.085 \\ &+ 0.129\Delta(\text{Head unemployed})_t; \\ &\quad 0.115 \end{aligned}$$

$$\begin{aligned} \text{SC}(13) &16.84 \\ \text{GR}^2 &0.270. \end{aligned}$$

<sup>15</sup> This comparison is also useful since food expenditure is the primary consumption information available in the *Panel Study of Income Dynamics* (PSID).

<sup>16</sup> And hence retirement is not separable from the disaggregated consumption items.

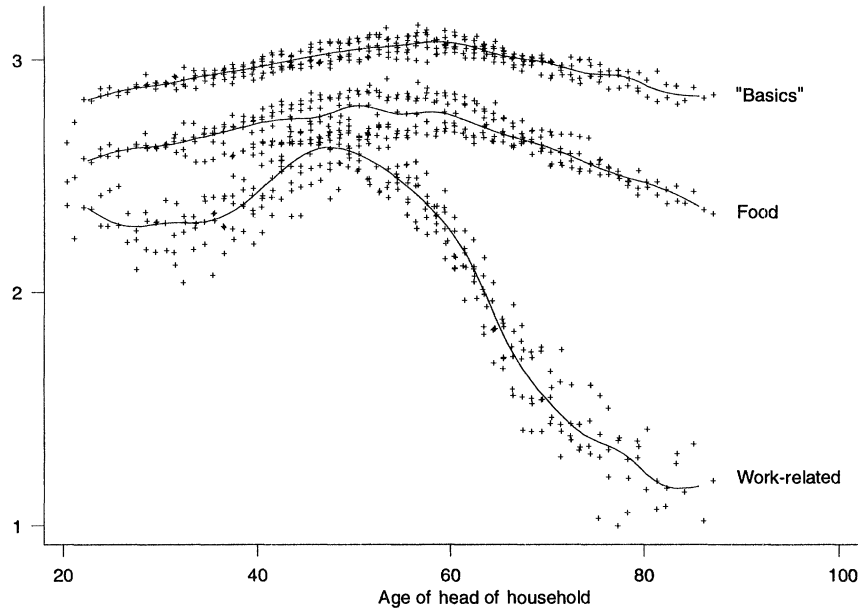


FIGURE 7. SPENDING ON FOOD, BASIC ITEMS, AND WORK-RELATED COSTS

TABLE 2—CHANGES IN COMPONENTS OF CONSUMPTION AT RETIREMENT

	$\Delta \ln B$	$\Delta \ln B$	$\Delta \ln W$	$\Delta \ln W$
$\Delta$ Unemployed	-0.076 <i>0.061</i>	-0.001 <i>0.053</i>	-0.516 <i>0.204</i>	-0.160 <i>0.149</i>
$\Delta$ Retired	-0.134 <i>0.041</i>	-0.017 <i>0.037</i>	-0.704 <i>0.139</i>	-0.153 <i>0.106</i>
$\Delta \ln C$		0.331 <i>0.034</i>		1.566 <i>0.096</i>

Notes: Standard errors in italics.  $\ln B$  is the log of “basic expenditure” on food consumed in the home and domestic energy.  $\ln W$  is the log of “work-related expenditures” on canteen and restaurant meals, transport, and adult clothing.

Although there is not a statistically significant difference between the retired and unemployed households (the specification is set up so that the  $t$ -ratio on head unemployed also gives the test of equality of effects between the retired and the unemployed), the point estimates would imply that planned consumption falls by more for households

that expect to retire. Figure 8 shows the paths of actual and anticipated consumption growth using the above model, controlling separately for unemployment and retirement. The revised model now predicts the hump in consumption during middle age very well, and the divergence between actual and anticipated consumption profiles can be reconciled to a greater degree—consumption is predicted to fall by just over 2 percent a year at age 63, compared to an actual fall of around 3 percent.<sup>17</sup> Controlling for the impact of anticipated changes in labor-market participation on consumption growth

<sup>17</sup> We also consider how our results could be affected by choosing to allow the demographic and labor-market variables to affect the household’s intertemporal elasticity of substitution as opposed to simply scaling consumption expenditures. Using plausible values for consumption the results are quantitatively similar—the implied fall in consumption growth for those leaving the labor market is diminished for those going into unemployment as opposed to retirement. Results for this model are available from the authors on request.



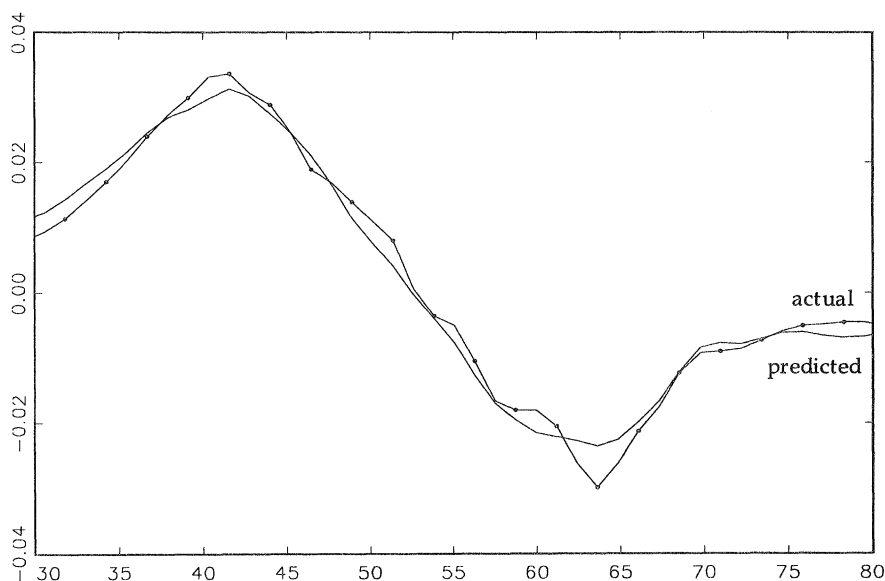


FIGURE 8. ACTUAL AND PREDICTED CONSUMPTION GROWTH, BY AGE CONTROLLING FOR DEMOGRAPHICS, RETIREMENT, AND UNEMPLOYMENT

explains an important part, but not all, of the puzzle.

#### IV. Conclusions

This paper has shown that a significant proportion of the fall in consumption that occurs around retirement can be explained within the life-cycle model in terms of anticipated changes in household demographics and labor-market status—i.e., through the non-separability of consumption from leisure. However, there remains an important proportion of the fall in consumption that is still unexplained. Whereas the anticipated fall in consumption growth is around 2 percent, actual consumption growth at retirement falls by as much as 3 percent.

What else within the life-cycle model could explain this remaining dip in consumption growth? The following three possible explanations can be ruled out. Liquidity constraints are typically important when income rises but not when income is falling. If liquidity constraints were anticipated there should have been more pre-

retirement saving. Second, early retirement may be associated with a reduced income until the full pension age but consumption should only fall if the early retirement was unexpected. Finally, income risk may be resolved at retirement—especially for those whose retirement salary is closely related to their final earnings or the prevailing interest rate. When risk is reduced, consumption growth should fall but this should be caused by a rise in current consumption not a fall in future consumption, an explanation at odds with observed behavior.

This evidence strongly suggests that there are unanticipated shocks occurring around the time of retirement. One explanation may be found in the increasing body of evidence that individuals underestimate their future pension entitlements. Andrew Dilnot et al. (1994) provide evidence from the *Retirement Survey* that, for 40 percent of individuals, retirement income was less than they had expected; only one-tenth of the sample had pension income that exceeded their preretirement expectations. Moreover, in the United States the President's Commission on Pension Policy found evidence

of a substantial “expectations gap.” There may also be other informational shocks occurring at the time of retirement. As we mentioned above, expectations of the implications of illness or bad health might change following retirement

as an individual’s peer group changes. Both of these could be explained by a change of information at retirement rather than necessarily reflecting a lack of rationality in consumption choices over the life cycle.

## APPENDIX

Tables A1 and A2 and Figures A1 and A2 appear below.

TABLE A1—NUMBER OF HOUSEHOLDS IN *FAMILY EXPENDITURE SURVEY*, BY DATE OF BIRTH AND YEAR OF SURVEY

Oldest Youngest Year	Date of birth of head of household											
	1903	1907	1911	1915	1919	1923	1927	1931	1935	1939	1943	1947
	1	2	3	4	5	6	7	8	9	10	11	12
1968	<i>501</i>	531	526	454	555	552	469	461	494	452	325	51
1969	<i>506</i>	497	488	484	531	503	480	463	472	425	364	117
1970	<i>464</i>	447	466	384	446	444	447	447	384	387	401	219
1971	<i>480</i>	500	533	459	515	504	480	444	490	446	484	303
1972	<i>444</i>	478	472	436	519	461	498	466	447	482	511	344
1973	<i>458</i>	521	513	425	531	496	412	437	443	433	476	456
1974	<i>415</i>	507	454	419	450	449	383	426	453	451	462	443
1975	<i>397</i>	510	527	425	472	487	408	448	455	477	547	536
1976	<i>430</i>	490	515	421	501	480	405	441	426	468	504	535
1977	<i>366</i>	485	497	456	465	475	428	438	440	459	523	577
1978	<i>360</i>	408	480	427	482	484	440	392	422	428	482	625
1979	<i>329</i>	441	450	359	461	406	394	378	407	431	486	559
1980	<i>297</i>	395	474	424	440	455	412	400	420	446	559	537
1981	<i>316</i>	439	493	441	528	481	435	437	449	487	596	632
1982	<i>286</i>	370	456	428	460	475	456	442	434	477	551	615
1983	<i>256</i>	351	448	404	456	437	402	390	416	443	493	596
1984	<i>206</i>	335	392	426	498	470	428	399	386	460	485	566
1985	<i>198</i>	337	441	384	472	454	408	382	412	419	483	607
1986	<i>199</i>	288	382	387	495	427	370	400	417	412	518	543
1987	<i>176</i>	259	350	402	536	460	426	367	412	403	499	594
1988	<i>146</i>	292	359	365	464	460	395	386	399	437	527	552
1989	<i>130</i>	221	330	386	488	456	430	411	402	398	507	551
1990	<i>112</i>	216	313	324	443	424	400	379	384	351	447	525
1991	<i>101</i>	186	315	327	419	416	408	373	395	376	472	441
1992	<i>79</i>	155	264	321	416	480	403	387	394	397	480	566

Note: Numbers in italics represent years in which some cohort members are over age 65.

TABLE A2—THE EFFECTS OF MORTALITY: CONSUMPTION GROWTH EQUATIONS,  
DROPPING SUCCESSIVELY YOUNGER HOUSEHOLDS

	All households	Households aged <85 only	Households aged <75 only	Households aged <65 only
$\Delta$ Multiple adult	0.604 <i>0.099</i>	0.551 <i>0.097</i>	0.507 <i>0.095</i>	0.504 <i>0.136</i>
$\Delta$ Out of labor market	-0.242 <i>0.069</i>	-0.258 <i>0.067</i>	-0.241 <i>0.065</i>	-0.033 <i>0.185</i>
$\Delta \ln a_t$	2.663 <i>0.465</i>	3.279 <i>0.577</i>	4.489 <i>1.037</i>	12.380 <i>8.780</i>
$r_t$	0.451 <i>0.065</i>	0.447 <i>0.063</i>	0.467 <i>0.065</i>	0.536 <i>0.082</i>
SC (14 degrees of freedom)	19.02	18.37	21.27	22.77
GR <sup>2</sup>	0.256	0.267	0.301	0.319

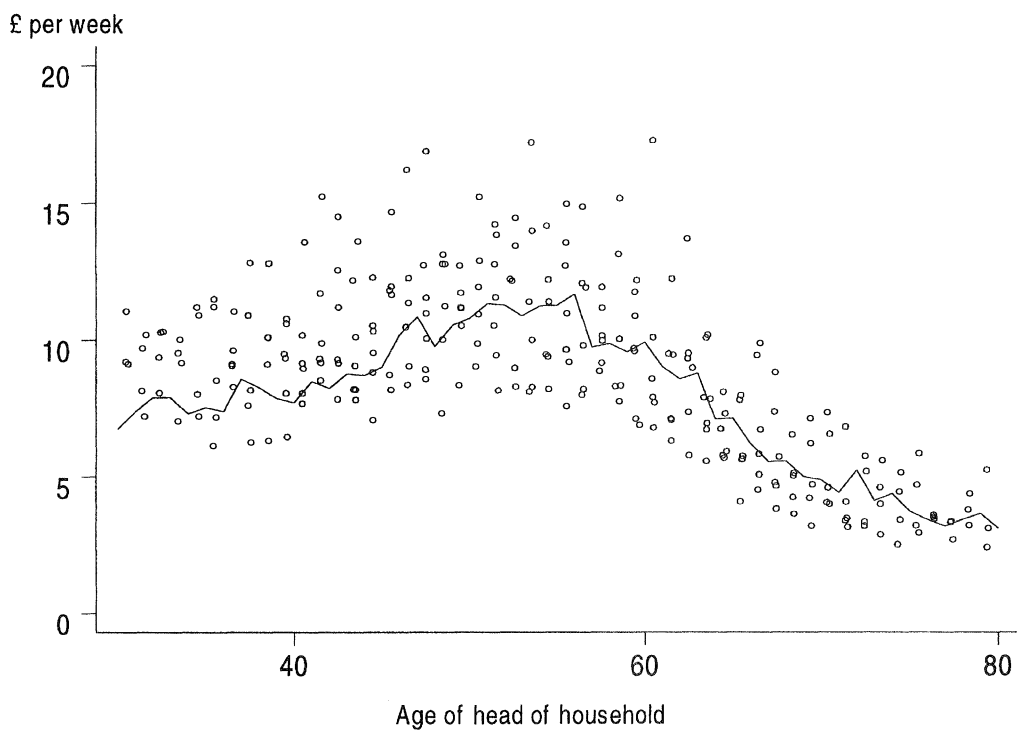


FIGURE A1. SPENDING ON DURABLE GOODS

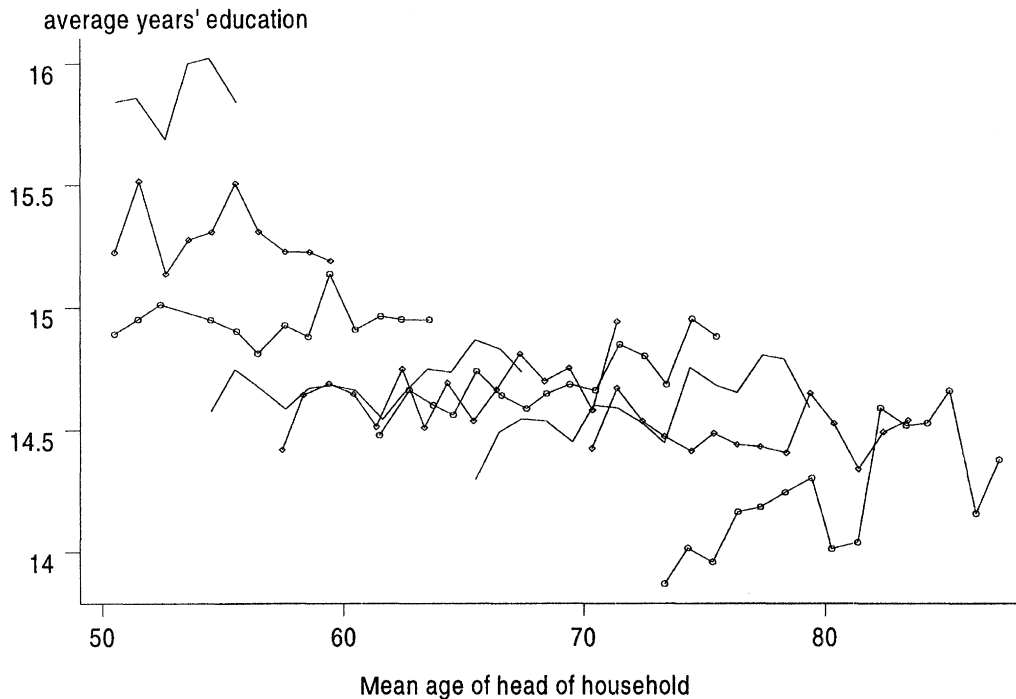


FIGURE A2. NUMBER OF YEARS OF EDUCATION, BY COHORT

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