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LONGITUDINAL EVIDENCE FROM INCOME TAX RECORDS**

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Abstract

We analyse a large longitudinal data file to determine who has retired and to assess how successful they are in maintaining their incomes after retirement. Our main conclusions are as follows. First, in the two years immediately after retirement the after-tax income replacement ratios average about two-thirds when calculated across all ages of retirement. Second, the ratios tend to increase with the age of retirement. Third, the ratios increase with years in retirement, at least in the first few years. Finally, income replacement ratios are highest in the lowest income quartile and generally decline as income increases; within each quartile the replacement ratios are higher for those who retired later than for those retired earlier.

Income Replacement in Retirement:

Longitudinal Evidence from Income Tax Records

Frank T. Denton, Ross Finnie, and Byron G Spencer[*]

1. Introduction

What is usually thought of as "retirement" is accompanied by a cessation of income from employment, or at least a major reduction. That may be offset in part by increases in income from other sources. The purpose of this study is to provide evidence on the extent to which retirees are able to maintain their pre-retirement income levels, whether through access to pensions, investment returns, or even continued (but reduced) employment.

Our concern here is not with the entire population of older people at different ages (as in many other studies), but specifically with those who have retired, using a strict earnings-based definition of the term. We limit our attention to individuals for whom there is evidence of significant labour force attachment when they were in their early fifties, retirement then being characterised by a subsequent cessation or loosening of that attachment, as indicated by a substantial and sustained drop in earnings. Our attention is focussed mostly on the extent to which income is replaced *on average*, but we consider also how replacement ratios differ by level of pre-retirement income distribution.

We draw on a large longitudinal data base of tax records to obtain measures of income before and after retirement. The data base provides detailed and accurate information on the incomes of almost five million individuals for periods as long as 25 years. It thus makes possible for us a new perspective on retirement. First, we are able to identify those who have actually retired, rather than relying on age alone or receipt of pension income as an indicator. Armed with knowledge of who has retired, we are then able to assess how income replacement varies with age at the time of retirement, and subsequently with the length of time since retiring. Furthermore, we can observe how patterns of income replacement differ among successive cohorts and how they vary across the income distribution.

2. Measures of Income Replacement

The reduction in earnings associated typically with retirement may be offset in greater or lesser degree by income in the form of pension benefits (whether through public or private plans) or income from other sources. However, the underlying concern is with *consumption* in retirement, or standard of living. One might accumulate assets (through saving) before retirement when income is high and then draw them down (through dissaving) after retirement, when income is reduced. That is the behaviour suggested by the basic life cycle model that originated with Modigliani and Brumsberg (1954), according to which one would expect to observe a relatively constant level of consumption before and after retirement even though income may be lower after retirement.

The life cycle model in its simplest form assumes perfect foresight about future income levels and expenditure requirements at each age, and the date of death; it assumes also that capital markets make it possible to borrow against future income. With those assumptions the level of consumption at each age can be shown to be independent of the level of income at that age, and measures of income replacement would not have particular meaning. However, as Smith (2003) observes, uncertainty about future income, health, and life expectancy, and limits on the ability to borrow, would induce a greater temporal

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alignment of consumption with income. Indeed, much empirical research indicates that consumption does fall after retirement (e.g., Bernheim, Skinner, and Weinberg, 2001; Denton, Mountain, and Spencer, 2006), perhaps by as much as the decline in disposable income (e.g., Banks, Blundell, and Tanner, 1998; Schwerdt, 2005). In that case the focus on measures of income replacement is indeed meaningful, and indicative of welfare loss. That view gains further support from Benartzi and Thaler (2007), who argue that few people, economists included, "spend much time calculating a personal optimal savings rate"; instead "most people cope by adopting simple ... rules of thumb".[1]

Income-based replacement ratios are widely used, in part because income is observed more readily, and also probably measured more accurately than consumption. A variety of such ratios are reported in the literature. (See Smith, 2003, and Hurd and Rohwedder, 2006, for reviews.) Some researchers focus on the fraction of before-retirement income that is replaced, others on after-tax income. Some work with family or household units, with or without adjustment for family size, others with individuals. In all cases, however, the underlying idea is to have an indicator of how well off individuals are after retirement as compared to when they were working.

It is usually argued that a somewhat lower level of income after retirement is consistent with maintaining one's pre-retirement standard of living. That is because various costs associated with employment (such as suitable attire and commuting to work) no longer apply, and other advantages may (e.g., tax rates may be lower, age-related tax credits may apply, employer deductions for future pensions and employment insurance would have ended, seniors' discounts on consumer purchases would apply, and there may be fewer dependents to support since children would usually have left home, and perhaps have completed postsecondary studies). Furthermore, one would no longer need to accumulate

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[1] A natural question to ask, then, is whether people (by rules of thumb or otherwise) do save enough during the working years to maintain consumption levels in the retirement years (e.g., Skinner, 2007). We are not able to address that question directly with the data available to us.

more private savings for retirement. Beyond that, time is freed up for more home production that can add to one's well-being even if it is not included in income, as measured. A replacement ratio of about 70 percent is often said to be sufficient to allow one's standard of living to be maintained in retirement. At the same time it is not obvious whether any such ratio should be based on income before or after tax; we provide both measures in what follows, and anticipate that those with lower levels of income before retirement (and correspondingly fewer assets) would need a somewhat higher replacement ratio than others with higher incomes.

Two Canadian studies that measure income replacement in retirement are those of Gower (1998) and LaRochelle-Côté, Myles and Picot (2008). Even though they employ quite different concepts, both refer to similar target replacement ratios: LaRochelle-Côté et al., referring to Schulz (1992, p 99), state that "Policy makers in the rich democracies have typically set a target replacement rate of from 65% to 75% for the average worker". Gower (1998, p 18) quotes the Canadian Department of Finance in stating that "between 60% and 70% of pre-retirement earnings is generally considered to be sufficient to avoid serious disruption of living standards".[2] Both studies draw too on the same longitudinal data base as we use in this study. Gower (1998) limits his analysis to those aged 55 and older in 1992 who had retired by 1995. He classifies as retired those whose total income in 1992 was derived mostly from employment, and who had some employment income in 1993 and none in 1995, and defines their replacement ratios as the ratios of after-retirement income, in 1995, to pre-retirement income, in 1992. His ratios are calculated separately for men and women, and (like ours) relate only to their individual incomes, not to family or household units. By contrast, the concern of LaRochelle-Côté et al. is with income replacement ratios for *families*; their analysis is limited to families in which at least

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[2] Of related interest, Alan, Atalay and Crossley (2007) have used evidence from household surveys to assess how well-off retired people think they are and whether or not they had sufficient means to maintain consumption levels; they conclude that most retired persons think of themselves as better off than standard economic measures indicate.

one individual had substantial employment income while of "prime age" (defined as having average annual earnings of at least $10,000, measured in 2005 constant dollars, when aged 54 to 56). However, they do not impose a retirement test. Instead, they calculate replacement ratios for successive cohorts that compare (adult-equivalent adjusted) family total income at later ages with income at prime age, using after-tax measures of income in each case. Allowance is made for changes in family composition, including death of family members, by comparing adult-equivalent adjusted measures of family income. The presumption is that an increasing fraction of each cohort would have retired as age increases, such that the ratios at sufficiently old ages would include few who had not retired.

It is not surprising that a study based on after-tax size-adjusted family income should find replacement ratios that are higher (close to 80 percent) than one based on the before-tax income of individuals (about 58 percent). We observe that both studies find, as expected, that replacement ratios vary inversely with the level of income before retirement, with many in the lowest income groups having replacement ratios in excess of 1.

3. Data and the Definition of Retirement

The analysis that follows is based on Statistics Canada's Longitudinal Administrative Databank, commonly known as the *LAD*. It consists of a random 20 percent sample of all taxpayers who filed Canadian income tax returns in any year, starting in 1980.[3] Information is added each year as new returns are filed, and the sample is augmented with 20 percent of first-time tax filers. Individuals are included for all years in which they filed tax returns. By 2006, the most recent year for which we have data from this source, there were more than 4.9 million individuals in the sample. Our concern here is with information at the

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[3] The following description is drawn largely from Statistics Canada's *Longitudinal Administrative Data Dictionary* (catalogue no. 12-585-XIE).

individual level, but other levels are available.[4]

The *LAD* contains mostly information taken directly from the tax returns.[5] That means that there is a detailed year-by-year record for each person of how much income of each type was received. From the returns we know also (as of December 31 of a tax year) age, sex, marital status, and place of residence – but little else.[6] For some purposes there is clearly more that one would like to know about the characteristics of those approaching retirement – level of education, industry of employment, occupation, etc. – but such information is not available in the *LAD.* Even so, the *LAD* has much to recommend it. Indeed, the very large sample size, its longitudinal nature, and the detailed and accurate information about income that it provides make it an appealing foundation for the analysis of income-based measures of retirement and well-being – of how well-off individuals are after retirement as compared to the period when they were working, how the patterns of retirement have changed over time for successive cohorts, and how they vary by level of income. We note that the *LAD* has been used to investigate a wide range of topics, including the distribution of earnings, poverty dynamics, and interprovincial mobility, among others, and in the two studies of income replacement mentioned above (Gower, 1998, and LaRochelle-Côté et al., 2008).

Our approach to the choice of observations is as follows. We take the notion of retirement to be irrelevant before the age of 50. We first select all tax filers aged 50 in 1982, and follow them until 2006 if they survived and continued to file income tax returns, or until

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[4] There are three such levels: spouse/parent, family, and child(ren).

[5] Some information is drawn from other administrative files, but nothing of particular relevance for the work reported here.

[6] There is an important exception. For immigrants who arrived in Canada in 1980 or later, the records include further information about their characteristics and intended destinations at the time of arrival. In addition, the main and secondary principal industry subsectors of employers have been included in the file starting in 2000, but no information is available relating to occupations of the employees.

they died or were otherwise lost from the sample because they failed to file returns.[7] We then do the same for tax filers aged 50 in 1983, tax filers aged 50 in 1984, and so on, thus building up income histories for a series of successive cohorts, each identified by the year in which it reached the age of 50. We exclude those few who died or were lost before reaching age 52. We exclude also individuals who had any income from farming or fishing at ages 50, 51, or 52, since the notion of retirement is conspicuously vague for those occupations. For each tax filer remaining in our observation set, average income from employment at ages 50 to 52 is then calculated as the arithmetic mean of the incomes at those three ages. In order to limit the analysis to individuals with significant labour market attachment, we exclude those for whom this average is less than $10,000, in constant dollar terms.[8] That figure is arbitrary, but it may be thought of as representing about the amount that would be earned by someone working roughly half-time at the minimum wage rate.

The next step is to identify those who have retired, as indicated by a major and sustained reduction in employment income. For each tax filer the ratio of employment income at each subsequent age to average employment income at ages 50-52, denoted by R, is calculated for each year for the maximum period permitted by the data. A tax filer is said to have retired at the age at which R first falls below a critical level, R^*, provided that

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[7] For this analysis income information is imputed for those few (about 0.8 percent of the sample) who failed to file income tax returns for either a single year or two years in a row, but then filed again. The imputation is based on a simple averaging of each component of the income information, including the total, as reported in the year preceding and the year following missing value(s). This is done to reduce possible sample selection bias related to occasional failure to file returns. Such imputation would be inappropriate if the typical reason for not filing was a much lower than average level of income in the affected year but we have no way of assessing whether that was the case.

[8] All income measures are adjusted for inflation using the consumer price index and expressed in dollars of 2006. Employment income includes net income from self-employment.

that condition continues to be satisfied in each of the subsequent two years.[9] In earlier work several values of R^* were considered, ranging from 0.00 to 0.50. (See Denton, Finnie and Spencer, 2009; see also Denton and Spencer, 2009, for a review of measures of retirement.) Thus, at one extreme, a person is deemed to have retired only if he/she has no income from employment ($R^* = 0.00$); at the other, the same person could be classified as retired even if income from employment was as much as half as great as its average level when he/she was 50-52 ($R^* \leq 0.50$). We have found that while the overall proportion retired was sensitive to the value of R^*, the age pattern of retirement was not. In consequence we focus attention on $R^* = 0.10$, and continue with that criterion throughout the paper. Thus, a person is deemed to have retired when his or her (real) income from employment falls below 10 percent of what it was at ages 50-52, and remains below for the following two years.

We note and emphasise that what we measure here is *first* retirement. It is possible that an individual may retire by our criterion, but subsequently return to work. However, the criterion is rather demanding, inasmuch as earned income must remain below the threshold ratio for three successive years. Analyses of multiple retirements, of bridging between "full employment" and "full retirement", and other dynamic aspects of retirement behaviour could be considered in further work. We note also that we are unable to distinguish whether retirement, as we measure it, is voluntary or involuntary.

Figure 1 shows the distribution of retirement ages for the 1982 cohort (the cohort that was 50 in 1982, that is). Among those who were employed at ages 50-52, women are

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[9] Note that this calculation tells us the age reached *during the first full year of retirement*, not age at the exact date of retirement within a year. A tax filer would be deemed to be retired at the youngest age x at which the specified condition is satisfied. By way of example, a person would be deemed to have retired at 63 if the retirement condition is satisfied at *each* of ages 63, 64, and 65. In addition, a person would be deemed to have retired at age 63 if the condition is satisfied at age 63 and the person is dead or lost from the sample at age 64, or it is satisfied at ages 63 and 64 and the person is dead or lost at age 65.

somewhat more likely to retire at younger ages, less likely at older ages, but the differences are small, perhaps surprisingly so. For both sexes the proportion of the cohort retiring at each age tends to increase up to age 61, then dips until age 64 before peaking again at age 66, after which it tails off sharply. (Note again that calculation here refers to age in the first full year of retirement, not age at the exact date of retirement.)

Our retirement criterion is based on *employment income* but our measures of income replacement are based on *total income*, from all sources.[10] We consider four income measures, over four different intervals. Two of the measures relate to the period before retirement: income at prime working age (defined here as ages 50-51) and income in the first two of the three years before retirement.[11] The two other measures relate to the period after retirement: shortly after retirement (the average based on post-retirement years 1 and 2) and, to the extent that data permit, half a decade after retirement (the average of post-retirement years 5 and 6). Replacement ratios are calculated based on relationships between the last two measures (income after retirement) and the first two (income before retirement). The calculations are made for both before-tax and after-tax average income, using the ratio of averages (rather than the average of ratios, which may be quite sensitive to individual outlier observations). In a few cases individuals report negative values of total income. Such cases usually involve losses incurred in income from self-employment or

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[10] Our definition of "total income from all sources" is similar to XTIRC, the definition preferred by the Small Area and Administrative Data Division of Statistics Canada that maintains the LAD (see Statistics Canada catalogue no. 12-585-XIE). However, it differs in that we deduct repayments of Old Age Security and Employment Insurance benefits. That is, we include OAS benefits received net of any amount repaid ("clawed back") when a taxfiler's net income before adjustments exceeds the allowed limit. Similarly, we include EI benefits received after deducting any amount that has to be repaid.

[11] We used *total income* averaged over two years (ages 50-51 as well as two year periods before and after retirement) when calculating measures of income replacement and *income from employment* averaged over three years of age, 50-52 when screening to select those with a sufficiently high level of labour force attachment that they would eventually retire.

from the rental of property; expenses incurred can exceed income in such cases. We have removed from our sample all individuals who reported negative incomes in *any* year of our data period.[12] That restriction resulted in a loss of about two percent of the 1982 cohort, three percent of the 1987 cohort and four percent of the 1992 cohort. Restricting the sample to those reporting positive income levels in all years, as we do here, has little impact on the age pattern of retirement, as shown in Figure 1.[13]

4. Income Replacement: The 1982 Male Cohort

We now consider how income changes after retirement, making comparisons based on before- and after-retirement levels.

A first look at the age profile of income is provided in Figure 2, which relates to the 1982

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[12] We have also excluded from analysis the much smaller number reporting a total income level of zero . The number excluded varies with the measure of income replacement that is used but is always small. As an indication, using the before-tax version of the second measure described below (i.e., income after retirement relative to income shortly before), we find that 1.5 percent of the 1982 cohort was excluded. That proportion increases steadily for later (i.e., younger) cohorts, for which progressively smaller fractions have retired, and reaches 7.5 percent for the 2001 cohort. An interesting observation is that there is a strong association between the age of retirement and the proportion having at least one year of negative income: the younger the age at which people retire the higher the proportion. That holds true for every cohort. A likely explanation is that earlier retirements are associated with subsequent self-employment and attendant losses, a hypothesis that could be investigated in further work.

[13] We have undertaken some preliminary work based on individual rather than cohort replacement ratios, and also considered medians based on such calculations. In doing so we were reassured to find that the main results reported here are not sensitive to the measures used. Future work may focus on modelling individual replacement ratios, and how they have changed. We observe also that separate treatment of the self-employed may be warranted in future research. Alternative definitions of retirement could be considered to accommodate the fact that negative income levels are not uncommon among people who are self-employed, as perhaps are sustained periods of low income, at least as compared to the employed. Related to this point, one might also wish to assess the extent of returning to employment, post-retirement.

male cohort – males of age 50 in 1982. The figure shows the average income before tax at each age, from 50 through 74, by age of retirement. Some in this cohort retired as young as 53, others at 54, and so on. The oldest age of retirement in the figure is 70. It is only because the sample on which this analysis is based is so large that we are able to provide income measures in such fine age detail. For example, the age patterns of income for those who retired at the youngest ages, 53 through 55, are based on almost 300 observations at each age, in most cases; even at the oldest ages they are based on well over 100 observations. In total there are more than 16,000 retirees in the cohort. Even so, caution should be exercised in interpreting the results; a small number of individuals with especially high income levels can have a large effect on an average.[14] Such effects are evident in the figure, but do not obscure the broad patterns.

The figure shows a sharp drop in (real) income immediately after retirement. Of particular interest, the decline appears to be about the same for those who retired in their mid-50s as for those who worked a decade longer. It appears also that there is a small but fairly persistent increase in the level of income in the years after retirement, a feature that again is largely independent of the age at which people retired. Finally, and perhaps surprisingly, while the circumstances may differ greatly among individuals, it appears that average income in the years just before retirement is also largely independent of the age of retirement. We explore these impressions in what follows and find that some important qualifications apply.

Table 1 provides further information. The columns labelled *a* through *d* record our four measures of average before-tax income for each age of retirement. Column *a* shows the average at ages 50-51. The second measure, in column *b,* shows average income in the first two of the three years preceding retirement (e.g., ages 60-61 for those who retired at

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[14] The plot for those who retired at age 54 is excluded; this group includes a small number of individuals whose income levels were extremely high at older ages, and hence had a marked impact on the average. Such outliers are not representative of the typical situation.

63) – a measure referred to hereafter as "income before retirement". (Only the first two of the three years are included in the calculation since the retirement may have commenced during the third year, in which case annual income in that year would likely have been reduced.) Column *c* shows average income in the two years after retirement (e.g., ages 64-65 for those who retired at 63), hereafter referred to as "income after retirement". Finally, column *d* shows the average income 5 and 6 years after retirement. The measures in columns *c* and *d* are not available at the oldest ages.

We note first some interesting features relating to pre-retirement income. Consider average income at ages 50-51, a measure at "prime age" that can be compared consistently across the various ages because it is observed at the same age for all individuals, regardless of when they retired. Based on the averages shown at the bottom of the table, for the 1982 male cohort we see that later retirement is associated with lower incomes at prime age, at least for those who retire before the age of 70. For example, average incomes at prime age are about 3 percent lower for those who retired at ages 65-69 than for those who retired ten years younger.

That result may seem surprising in that those with higher levels of education (and hence, typically, higher levels of income) generally have higher rates of labour force participation at each age. However, retirement is related not to the participation rates themselves but rather to *changes* in those rates. Using income as a rough reflection of education level, that suggests that changes in the rates are similar across education groups, but slightly higher for those with higher levels of education. The implication regarding education cannot be tested with the *LAD*, since level of education is not known, but we note that a similar result was found for the UK and Italy in a study which concluded that "in both countries high earners retire relatively early while those in the lowest income groups tend to retire later" (Gough, Adami, and Waters, 2008, p 167). While the differences here are not great – as stated, the prime age incomes of early retirees are only 3 percent higher than those of later retirees, on average.

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Interestingly enough, the situation is quite different for those who retired later, at ages 70-74: they had prime age incomes over 30 percent higher than the all-ages average. It seems likely that a selection process is at work: the late retirees may consist of a relatively high proportion of self-employed individuals, including those who became self-employed after retiring as career employees.[15]

A further observation is that income before retirement, at whatever age that occurs, tends to be lower (in real terms) than at prime age. That is true at almost all ages of retirement and, on average, the ratio *b/a* (shown in column *e)* decreases with age, at least for those who retire before their early 70s. We note that this does *not* necessarily indicate an age-related decline in income from employment since the comparison is not with earnings but with income from all sources. It may instead reflect a gradual withdrawal from income-earning activity as retirement approaches, with the extent of withdrawal increasing with the age of retirement. That is another matter that could be addressed in further research.

The last three columns of Table 1 show our measures of income replacement. The first, column *f*, shows the ratios of income after retirement to income at prime age. The last two (columns *g* and *h*) show ratios of income soon after retirement and half a decade after retirement to income before retirement. The first measure, in column *f*, has the lowest values, 0.57 when averaged over all ages of retirement. The next two measures, in *g* and *h*, are only slightly higher. We can see too that the replacement ratios generally increase with age of retirement, at least up to age 70. (They are especially low for those who retired

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[15] We have classified as self-employed those who had any income from self-employment at ages 50-52 (the age interval used in our work to assess who has retired). Using that definition almost one-third of males who retired after age 70 had been classified as self-employed, and almost 20 percent of females. At the same time, excluding the self-employed from Table 1 has only a modest impact on the average income values shown. However, it could be that the proportion with income from self-employment increases with age among those still classified as not retired: at older ages the self-employed might be increasingly drawn from the ranks of those who left career jobs as employees.

before age 56.)

Table 2 provides the same measures as Table 1, but based on income after tax rather than before. The after-tax ratios are higher, as expected, given the progressive income tax, and the difference increases with the length of the period of retirement.

Figure 3 shows the *c/b* ratios, both before and after tax, and brings out some important features of the income tax and pension systems. We note two. The first is the sustained increase in the ratio that starts with retirement at age 58 and continues to retirement at age 65. Those who retired at 58 would typically elect to receive their C/QPP pension benefits at age 60. The numerator (income at ages 59 and 60 for those who retired at age 58) would be somewhat higher for those who retired at 59 rather an 58, since with another year of contributions their C/QPP benefits would be higher as well. That effect would continue: retirement pension benefits would increase with age of retirement, on average, since the contributory period would be longer. The effect is further enhanced for those who retire at ages 63, 64, and 65, since their numerators (income one and two years after retirement) would now include OAS/GIS benefits, which commence at age 65. The after retirement income of those who retire at 66, 67, or 68 would already include OAS/GIS benefits, while the denominator (income before retirement) would become progressively higher with the age of retirement, thereby reducing the ratio as age increases. After age 68 the ratio is relatively constant, aside from what is perhaps sampling variability, since these considerations would no longer apply.

The second feature we note in Figure 3 is the difference between the before- and after-tax replacement ratios. The difference is fairly constant, at about 0.04, for those who retired at age 63 or younger. However, starting at age 64 the gap increases steadily, reaching 0.09 at age 67. That increase reflects the receipt of income-related OAS/GIS benefits and the

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"age amount" allowance, both of which take effect at 65.[16] They affect the numerator (income after retirement) starting at age 63. The gap diminishes steadily after age 67, as the gains are reflected more fully in the denominator (income before retirement). That these measures should reflect so effectively these aspects of the tax and transfer system attests to the quality of the data that underlie them.

Figure 4 shows the *c/b* and *d/b* income replacement ratios, in each case based on income after tax. We see again the sustained increase in the *c/b* ratio from retirement ages 58 through 65 and the subsequent decline to age 68. We note also the similar pattern in the *d/b* ratio, but starting a year later, at retirement age 59. That results from the different numerator – income half a decade after retirement – which would start to rise with eligibility for benefits that begin at age 65. Thus the main results hold up across alternative measures of income replacement and they differ in ways that reflect retirement-related institutional arrangements.

5. Income Replacement: The 1982 Female Cohort

Recall that all the women in the sample, like the men, had experienced significant labour force attachment: their average annual employment earnings were at least $10,000 (measured in dollars of 2006) when they were aged 50-52. However, the sample sizes for women are somewhat smaller, which (while expected) invites further caution in the interpretation of results.

Figure 5 shows the age-income profile for each age of retirement based on income before tax; it corresponds to Figure 2, which relates to men. The difference in income levels stands out: incomes at prime age are about 40 percent lower for women. However, the sharp decline in income associated with retirement looks much like that for men.

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[16] OAS benefits are "clawed back" for those with higher incomes and benefits received are taxable. Tax-free GIS benefits are paid only to OAS recipients with low incomes.

Tables 3 and 4 show the before- and after-tax measures for the 1982 female cohort. We find for males that income tends to decline somewhat after prime age, a difference that increases with age of retirement. For women we see the opposite: incomes are generally higher shortly before retirement than at prime age. The explanation for the difference is not clear. However, it may be associated with work histories: women in the 1982 cohort would, on average, have had much less labour force experience at age 50 than men, hence be much younger in a career sense, and therefore continue to experience gains in earnings. It may be associated also with a transition towards more full-time and less part-time work as their children come to need less care. Whatever the reason, we see that women who retired in their late 60s had incomes before retirement 9 percent *above* those in prime age, on average, while men had incomes 6 percent below.

As with men, before age 70 there is an inverse relationship for women between prime age income and age of retirement. The relationship is somewhat stronger for women than for men.

While women's average earnings before retirement are more than 40 percent lower than those of men, their replacement ratios, *c/b* and *d/b,* are somewhat higher. Even so, the age patterns are generally similar, as shown in Figures 6 and 7. The higher replacement ratios for women reflect the characteristics of the public-source income support system, which is geared to providing relatively high levels of support for those with lower incomes. Aside from level, the major difference is that the ratios increase more strongly with age of retirement for women. That is reflected in the differences between the male and female ratios; for example, for women the after-tax *d/b* ratio rises from 0.64 for those who retired before 60 to 0.84 for those who retired at ages 65-69. The corresponding rate for men rises from 0.61 to 0.70.

6. Income Replacement for Later Cohorts

We consider now the patterns of income replacement of later cohorts, and how they

differ from those the 1982 cohort. For this purpose we select those cohorts that reached age 50 five and ten years later – that is, in 1987 and 1992. The choice is arbitrary but it allows us to follow cohorts from age 50 to retirement at ages as old as 69 (the 1987 cohort) or 64 (the 1992 cohort).

We start by comparing the age distributions of retirement, as shown in Figure 8. The upper panel relates to the 1982 cohort, the middle panel to the 1987 cohort, and the bottom one to the 1992 cohort. To facilitate comparisons we show the age distribution of retirement over three age ranges: 53-64, 53-69, and 53-74. (Note that the horizontal scale changes from one vertical panel to the next.) Comparisons across all three cohorts are possible for the age range 53-64.

The first observation is that the age distributions of retirement for men and women are similar in each of the cohorts – remarkably so. The second is the notable trend in the age patterns towards earlier retirement among those who retired before age 65: for those in the 1982 cohort retirements at ages 61 through 64 accounted for just over 50 percent of all retirements, while for the 1987 and 1992 cohorts the proportion was only 40 percent. The peak for early retirement was clearly age 61 for the 1982 cohort, but for the 1992 cohort there was a second peak, at 56, and also "upticks" at both 53 and 64. This change in patterns is something that might be expected to have an impact on replacement ratios.[17]

What of the relationship between income before- and after-retirement and the age of retirement? Figures 9 and 10 show the profiles for all three cohorts, separately for men and women. The oldest observed age of retirement for all three cohorts is 69. Full tabular information for the two later cohorts is provided in Tables 5 through 12.

The evidence from the later male and female cohorts appears to be generally consistent

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[17] We note, however, that the tendency towards earlier retirement within the group of "early retirees" had little impact on the median age of retirement; see Denton, Finnie and Spencer (2009).

with our observations for the 1982 cohorts. We see the sharp drop in income associated precisely with age of retirement. We see also that for both males and females, at least those who retired before age 70, there is evidence in all three cases of an inverse relationship between age of retirement and prime-age income. The relationship is somewhat stronger for women: within each female cohort, income at prime age is a little higher for those who retired before age 60 rather than 60-64, and also for 65-69 rather than 60-64.

But what of income replacement? The replacement ratios for all cohorts fluctuate somewhat from one age of retirement to the next; averaging them within broader groups, as shown in the bottom panel of the tables, reduces the sampling variability. Generally speaking, the income replacement ratios tend to rise with age of retirement. That is true for both men and women in all cohorts, with the exception of the oldest (70-74) male age-of-retirement group. At the same time male replacement ratios tend to be somewhat lower than female ratios, especially for those who retired after age 59 or 60, when the public programs would have had immediate effect.

Figures 11 and 12 display the after-tax c/b and d/b ratios. The tendency for each of the replacement ratios to increase with age of retirement is evident, but much more strongly so for women than for men. Also clear in the case of women is the impact that features of the Canadian income support system have on the age pattern of replacement ratios. That impact appeared to be strong also for men in the 1982 cohort, but is less evident in the later cohorts. Further research is needed to understand the differences.

The male-female differences in replacement ratios are evident in Figure 13, as is their persistence from one cohort to another. The differences are quite small for those who retire before age 60, but otherwise tend to increase with age of retirement, again reflecting the extent to which the public income support system is directed towards older people with lower incomes.

7. Income Replacement Across the Income Distribution

To assess how retirement patterns vary with the pre-retirement level of income we classified those in our sample into income quartiles based on average employment income when aged 50-52. Table 13 provides a summary of how the income replacement ratio *c/b* varies by quartile. Average values of the ratios are shown separately for males and females for each of four groupings of the age of retirement – 53-59, 60-64, 65-69, and 70+ – and for all ages combined. The upper panel provides before-tax ratios, the middle panel after-tax ratios, and the lower panel shows the upper bounds of the ages 50-52 average employment income quartiles. Figure 14 plots the ratios calculated on an after-tax basis.

We would expect to find that replacement ratios generally decline with income, and that is typically what we see. Men in the first quartile had after-tax replacement ratios that were 12 to 26 percent higher than those in the fourth quartile, depending on the year and the age of retirement; for women the differences are less clear, especially for those retiring at the youngest ages. We would expect also to see that, within each quartile, the replacement ratios would be higher for those who retired later; that, too, is generally what we find. We find also that the difference in the ratios between retirement at, say, 65-69 and 53-59, diminishes as income increases.

Since women in each quartile had lower earnings than men, on average, we might expect to find that they would have higher replacement ratios. That, too, is what we find in most cases. While there are exceptions, especially for those who retired at the youngest ages, the replacement ratios for women generally exceed those for men, often by a wide margin.

8. Concluding Remarks

It is generally accepted that people prefer a constant standard of living to one that fluctuates. That preference applies to the years in retirement, when maintaining the pre-

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retirement standard is desired. Whether that goal is achieved may depend on the extent to which income is reduced at retirement, and the reduction may be greater than expected if there is an unanticipated decline in the value of income-producing assets accumulated while working. It may depend also on the ability or willingness of individuals to draw down their assets, a major component of which is typically owned housing. Beyond that, many have few assets on which to draw. Measures of income replacement, ratios of pre-retirement to post-retirement incomes, therefore provide useful information about well-being in retirement as compared to the period just before retirement.

Our concern here is not with the older population as a whole, but rather with those who have *retired*, and how successful they have been in maintaining their incomes (and hence their standards of living) after retirement. In that regard we are fortunate in being able to draw on a longitudinal data file that provides us with the basis for identifying those who have retired, the age at which their retirements took place, and their income levels year-by-year for an extended period, both before and after the retirement event. Furthermore, the file is large enough to permit analyses of how cohort retirement patterns and income replacement ratios have evolved over time, to allow us to consider men and women separately, and to examine differences across the income distribution.

We have restricted our measure of retirement to those who had significant labour force attachment when they were in their early 50s, as indicated by their level of earnings at that time. Their retirement is indicated by a substantial and sustained drop in earned income. Using that criterion we have found that the age distribution of retirement is similar for men and women, perhaps remarkably so. Age 66 was the most popular age of retirement (the first full year of retirement, that is) among those aged 50 in 1982, with an "early retirement" peak at age 61. That pattern continued for later cohorts, but the proportion waiting until 66 declined somewhat, and a further early retirement peak emerged at age 56. Women tend to retire a little younger than men, but the differences are small. A full analysis of the evolving patterns of retirement across successive cohorts is provided in Denton, Finnie and Spencer (2009).

Our major findings relate, however, to income replacement ratios, ratios of real (i.e., price deflated) incomes. We focus on these ratios for *individuals*, not families or households. In that way we are able to relate the measure of income replacement to those who have, in fact, retired. While our findings are largely descriptive, they provide, for the first time, basic information comparing income in retirement to income in the pre-retirement years, and show how patterns of income replacement differ, depending on gender, age at retirement, number of years in retirement, and the pre-retirement level of income. Future work may provide a deeper understanding of why the patterns have evolved as they have; at this stage our explanations are necessarily somewhat speculative.

Our main conclusions are as follows. First, in the two years immediately after retirement the after-tax income replacement ratios average about two-thirds when calculated across all ages of retirement. That is true of the oldest cohort, for which information about retirement is most complete, and a similar pattern appears to be sustained among younger cohorts, at least up to those ages at which retirement can be observed in the data. Our two-thirds ratio is somewhat lower than reported in the recent Canadian study by LaRochelle-Coté et al. (2008). In part that is because our ratios relate only to those who had significant labour force attachment when they were in their early 50s *and had subsequently retired*. By contrast, LaRochelle-Côté et al. report ratios that relate to age alone, and are not restricted to those who had in fact retired. But perhaps more importantly, our ratios are lower because the replacement measures relate to individual rather than family income. The majority of households, including those with retired people, have two or more persons. The ratios would be higher if allowance were made for economies of scale, reflecting the old (if somewhat hackneyed) idea that "two can live as cheaply as one". Both types of ratios are informative, in our view, and complement each other.

Our second finding, and one with no counterpart in the literature, is that the ratios tend to increase with the age of retirement. That is true for both men and women, with the exception of the oldest male age-of-retirement group (those who retired after 70; for them the ratios are about the same as for those who retired at ages 65-69). As one example,

for the cohorts aged 50 in 1982 and in 1987 the after-tax replacement ratios for those who retired between 65 and 69 are 12 to 17 percent higher than for those who retired before age 60. Our third major finding, also new, is that the ratios increase with years in retirement, at least in the first few years. Half a decade after retirement the average replacement ratio for men is about 5 percent higher than it was after two years; for women it is more than 10 percent higher. (All income measures are adjusted for inflation, so the gains are real, not nominal.)

Our fourth main finding relates to how replacement ratios vary across the income distribution. We find that they are highest in the lowest income quartile and generally decline as income increases; that is as one would expect with a public income security system that directs support to those with lower income levels. For example, in the lowest quartile the after-tax income replacement ratio that compares income shortly after retirement to shortly before averages about 0.74 for women and 0.68 for men, exceeding the ratio for those in the highest income quartile by about 14 percent for women and 15 for men. We find also that within each quartile the replacement ratios are higher for those who retired later than for those retired earlier.

What explains these patterns? As stated, any explanation at this stage is somewhat speculative, but it appears that they reflect, in large part, features of our income support system, especially those relating to the age of eligibility for C/QPP pension benefits and OAS/GIS benefits. Features of the system explain also why the replacement ratios for women are higher than for men: the public income support system is designed to provide relatively larger transfers to those whose pre-retirement income levels are lower. These findings point to the importance of the system in maintaining post-retirement incomes in old age. We observe also that the (somewhat surprising) post-retirement increase in the replacement ratio could be explained in part by the delayed receipt of pensions, and/or by our focus on *individual* rather than *household* ratios. For example, survivor pension benefits and the income from assets previously in the hands of a now-deceased spouse would increase the income of the survivor. Future work may assess the importance of the death

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of a spouse in this regard.

We conclude by noting two other of the many topics that could be addressed in future research. While we have focussed attention on the average income from *all* sources, or *average total income.* It is evident that the *sources* of income change after retirement, since income from employment may be greatly reduced, to zero in many cases, while income in the form of pension benefits will increase and income from investments may play a larger role. Future work might explore how the *composition* of total income changes in the years after retirement for those who have in fact retired, and how it differs by age of retirement and position in the income distribution. The fine quality of the income information in the *LAD* and the sheer size of the sample should facilitate this kind of analysis.

In addition, our concern so far has been to provide a description of *how* income changes at retirement, how replacement rates change with age in the post-retirement period, and whether the patterns differ across cohorts. Another direction for future research would be the modelling of these processes to address the question of *why* the changes have occurred, taking into account the inevitably endogenous relationship between age of retirement and income in retirement. That is a possible extension of our work in a broader research agenda.

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Figure 1: Distribution of Age at Retirement, 1982 Cohort
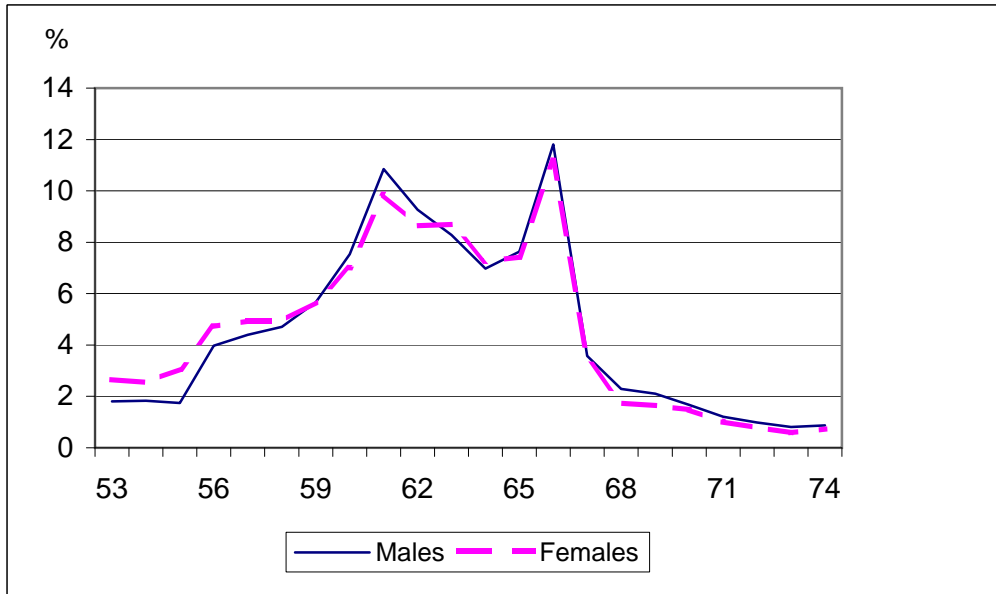
Figure 2: Average Income Before Tax, by Age and Age of Retirement, 1982 Cohort, Males
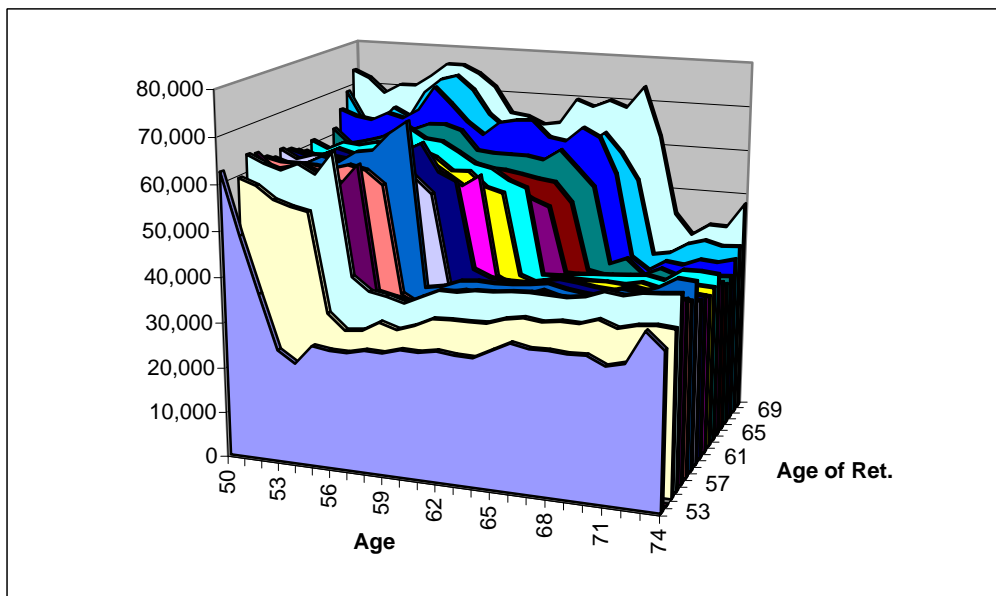
Note: Income is in constant dollars, using 2006 as the base. The plot for those who retired at age 54 is excluded.

Figure 3: Replacement Ratio c/b, by Age of Retirement, 1982 Cohort, Males
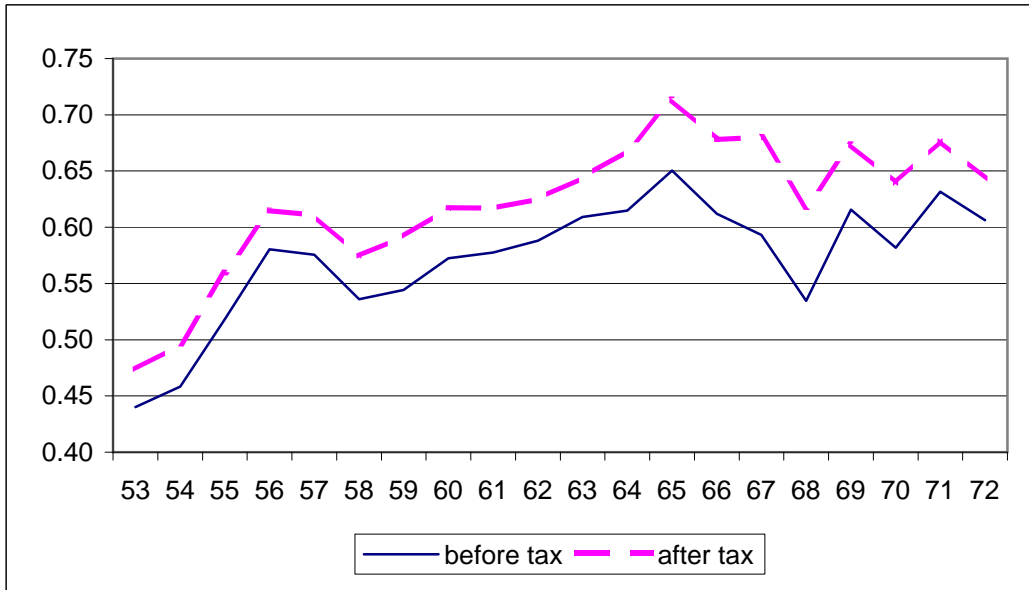
Figure 4: After-tax Income Replacement Ratios, by Age of Retirement, 1982 Cohort, Males
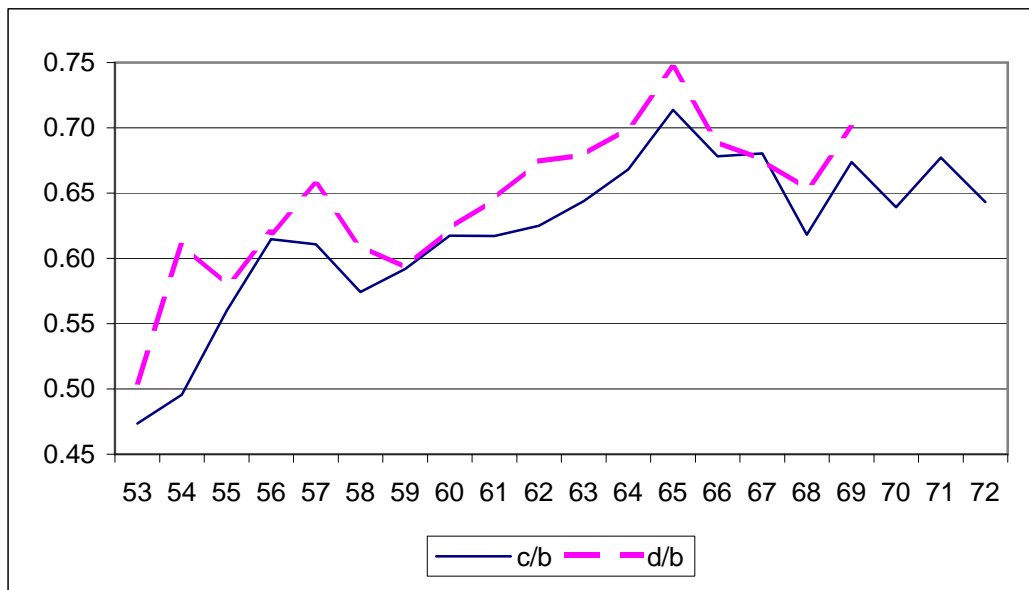
Figure 5: Average Income Before Tax, by Age and Age of Retirement, 1982 Cohort, Females
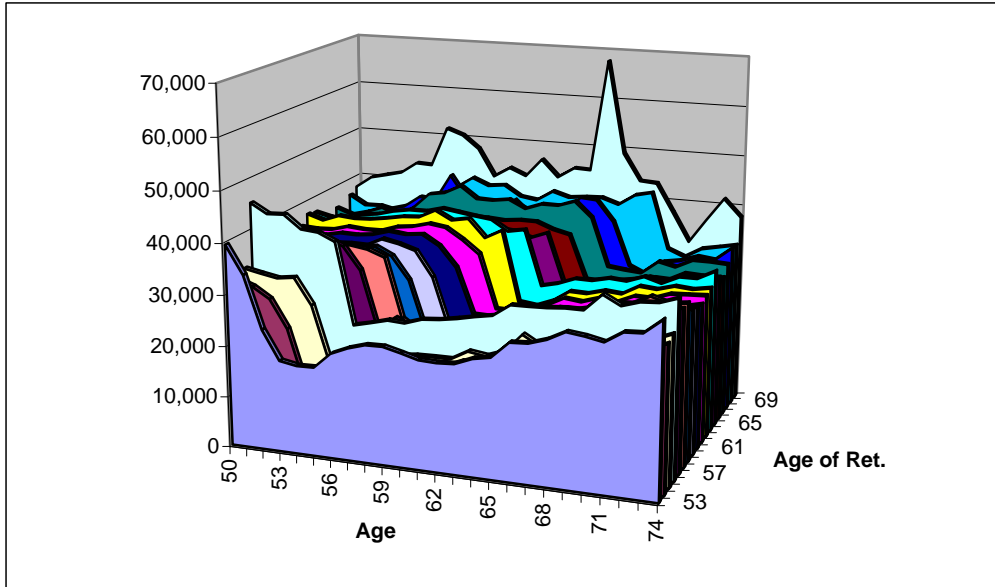
Figure 6: Replacement Ratio c/b, by Age of Retirement, 1982 Cohort, Females

Figure 7: After-tax Income Replacement Ratios, by Age of Retirement, 1982 Cohort, Females
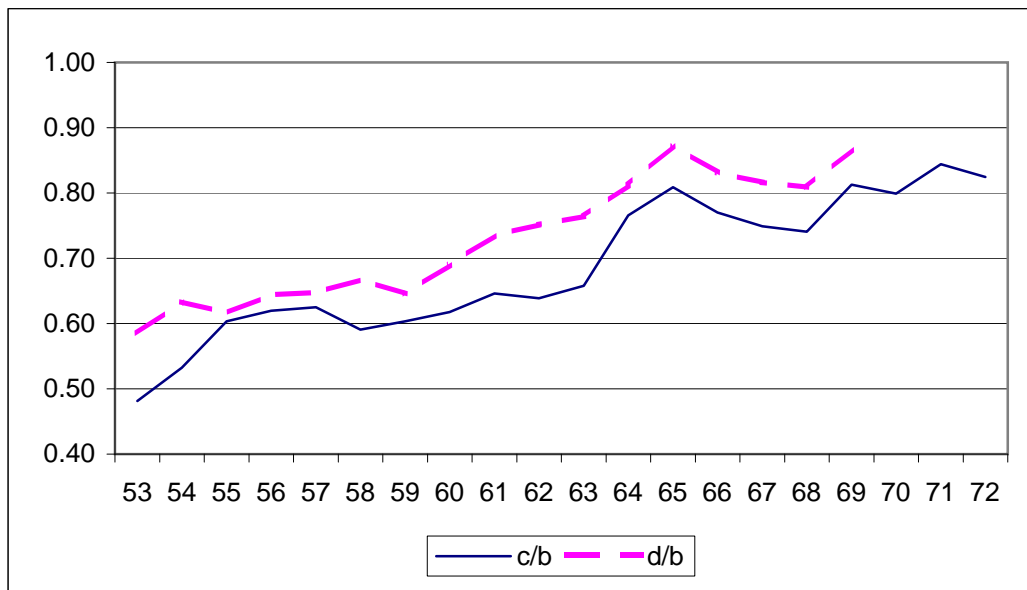
Figure 8: Distribution of Age at Retirement by Sex, Selected Cohorts

Ages 53-64　　　　**Ages 53-69**　　　　**Ages 53-74**

1982　　　　**1982**　　　　**1982**
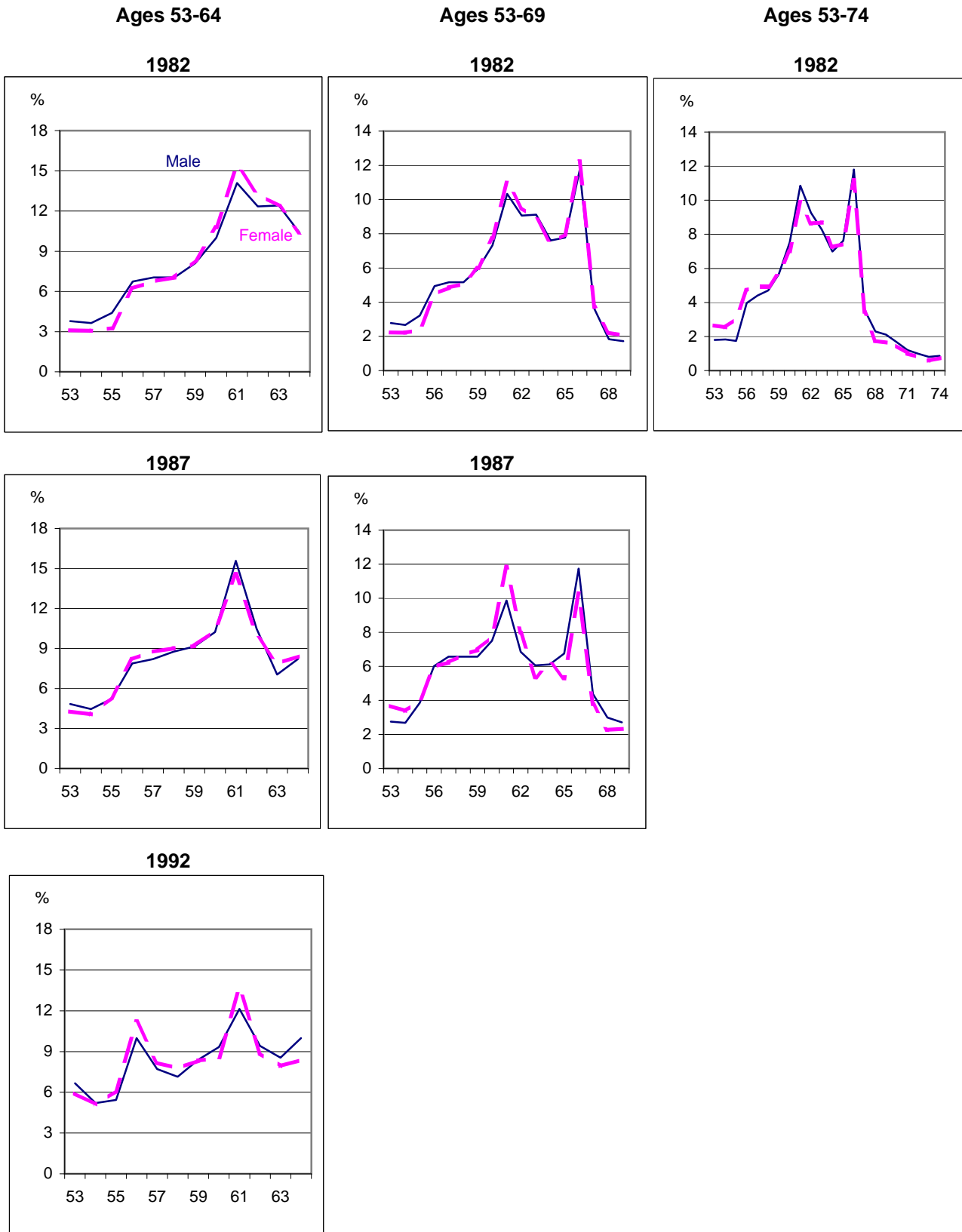
1987　　　　**1987**

1992

Figure 9: Average Income Before Tax, by Age and Age of Retirement, Selected Cohorts, Males

1982
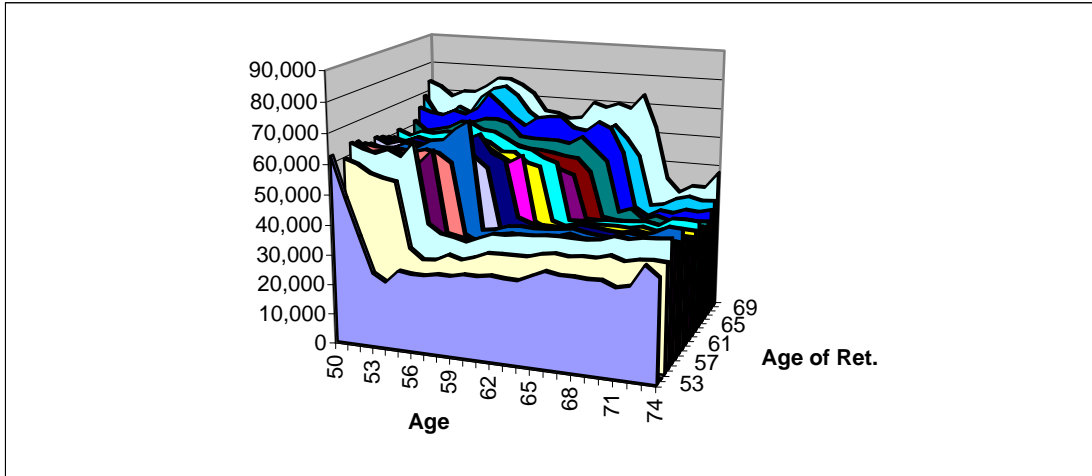
1987
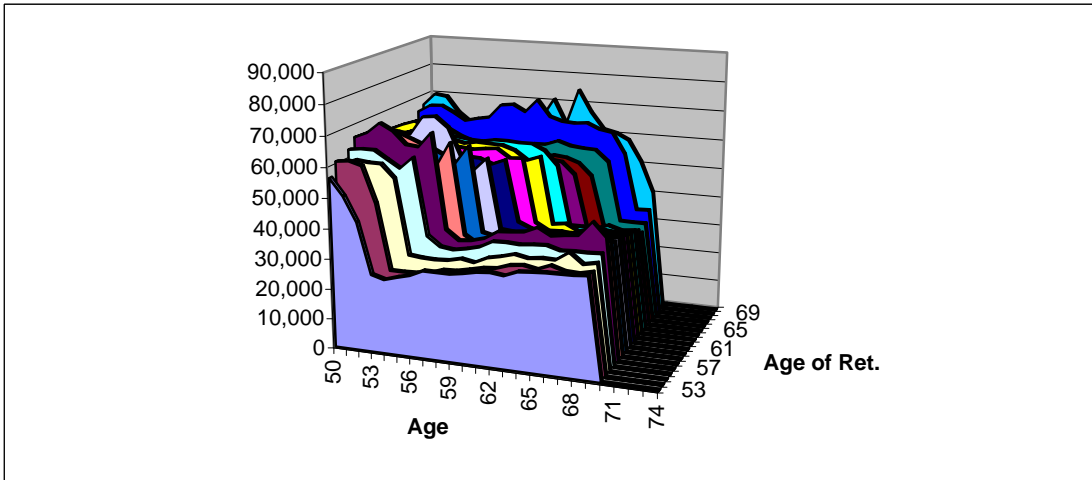
1992
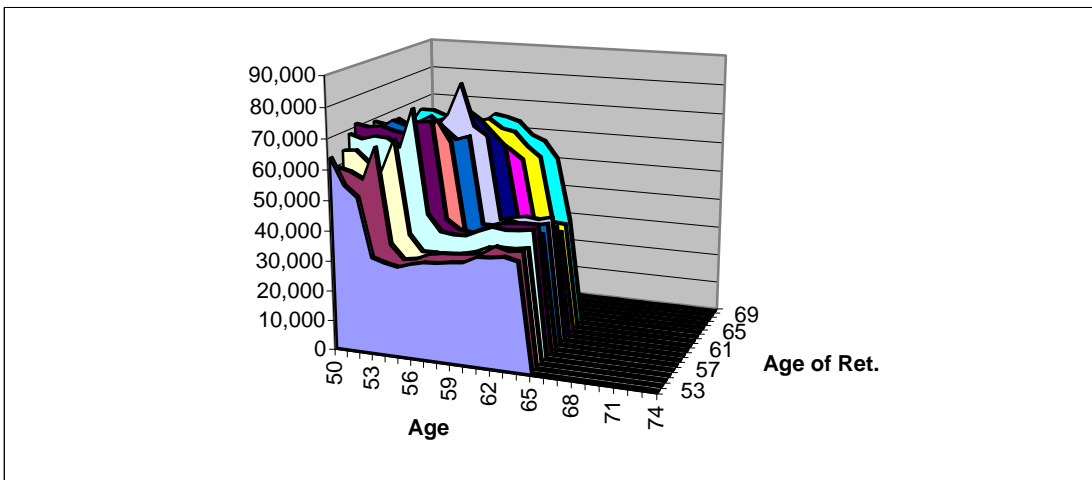
Note: Income is in constant dollars, using 2006 as the base. The plot for the 1982 cohort excludes those
    who retired at age 54.
Source: Longitudinal Administrative Databank

Figure 10: Average Income Before Tax, by Age and Age of Retirement, Selected Cohorts, Females

1982
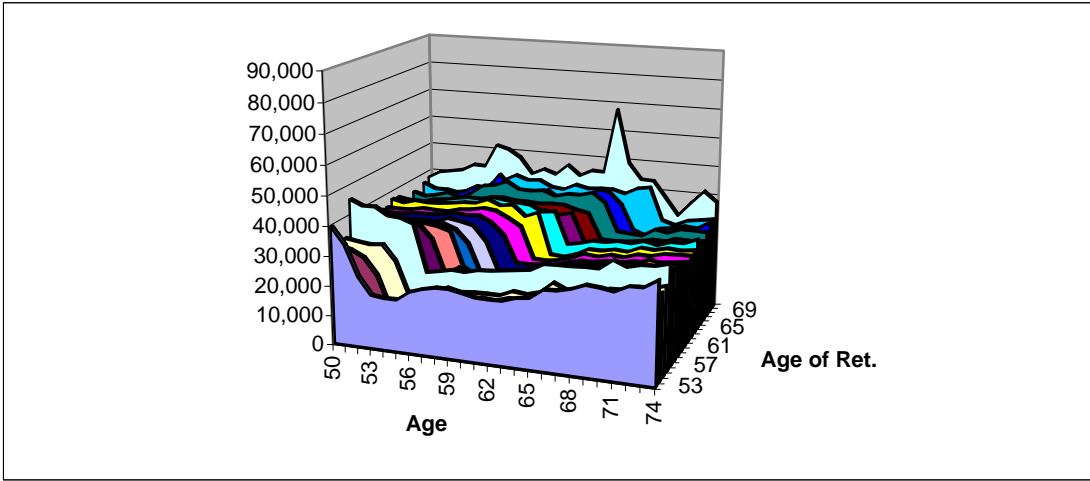
1987
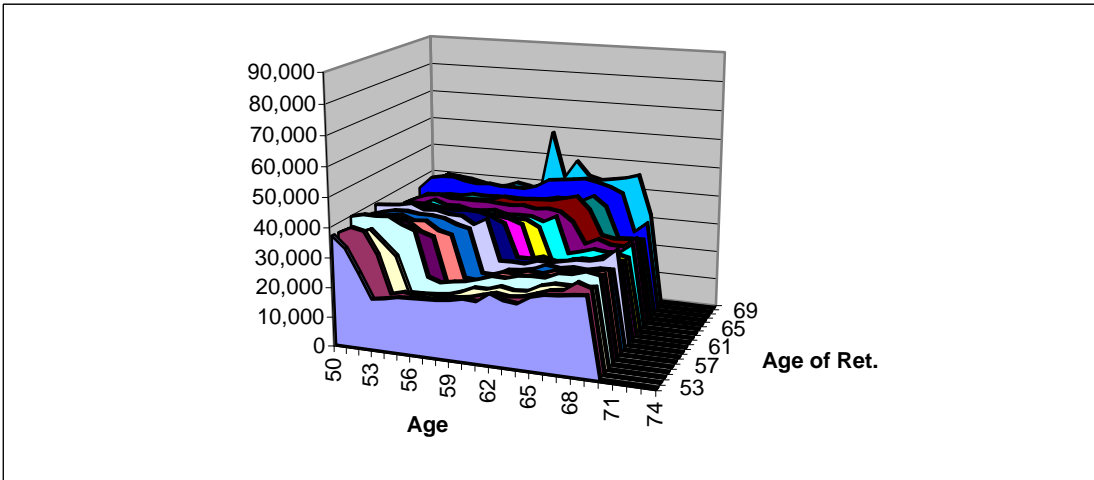
1992
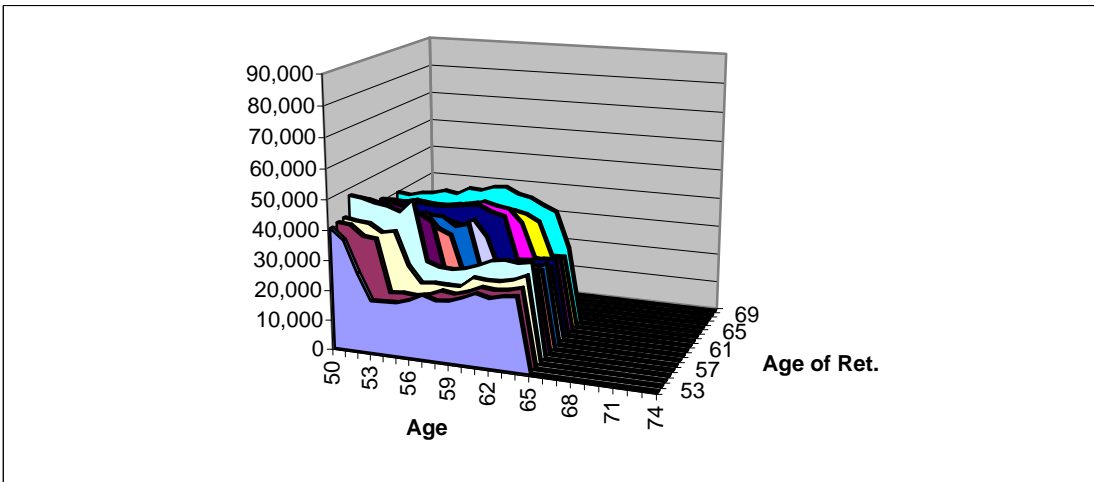
Note: Income is in constant dollars, using 2006 as the base.
Source: Longitudinal Administrative Databank

Figure 11: After-tax Income Replacement Ratio c/b, by Age of Retirement, Selected Cohorts, by Sex

Males
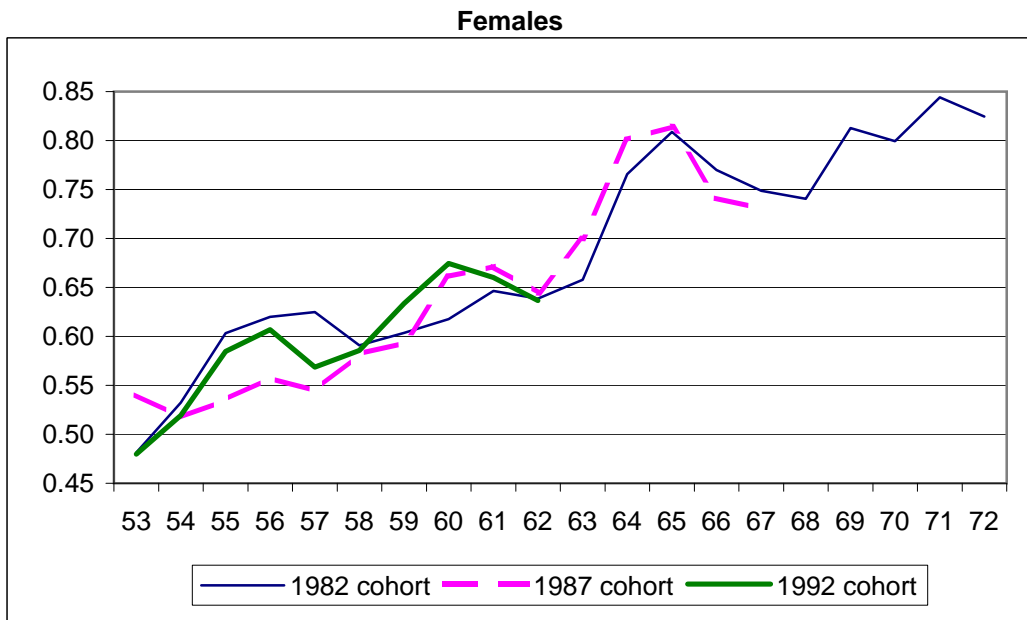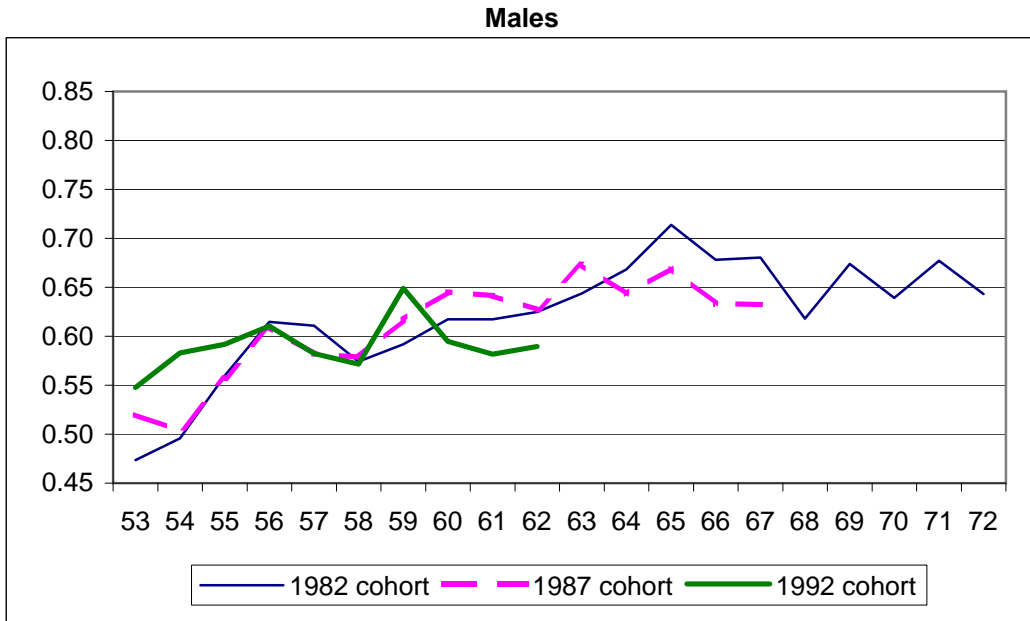
Females

Figure 12: After-tax Income Replacement Ratio d/b, by Age of Retirement, Selected Cohorts, by Sex

Males
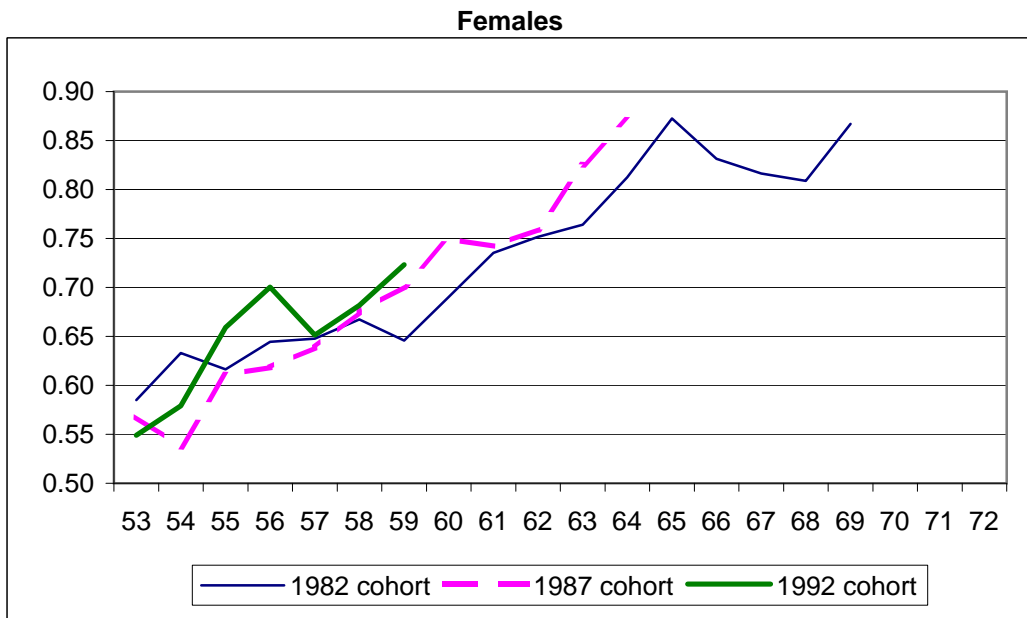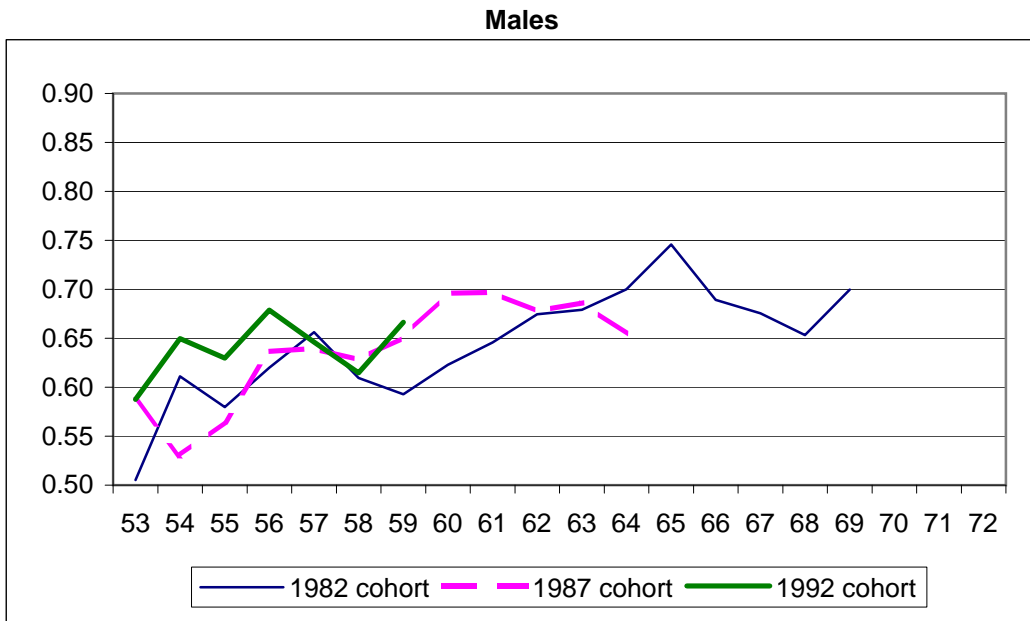
Females

Figure 13: After-tax Income Replacement Ratios, by Age of Retirement, Selected Cohorts,
Male-Female Comparisons

c/b ratios   **d/b ratios**

1982 cohort   **1982 cohort**

1987 cohort   **1987 cohort**

1992 cohort   **1992 cohort**
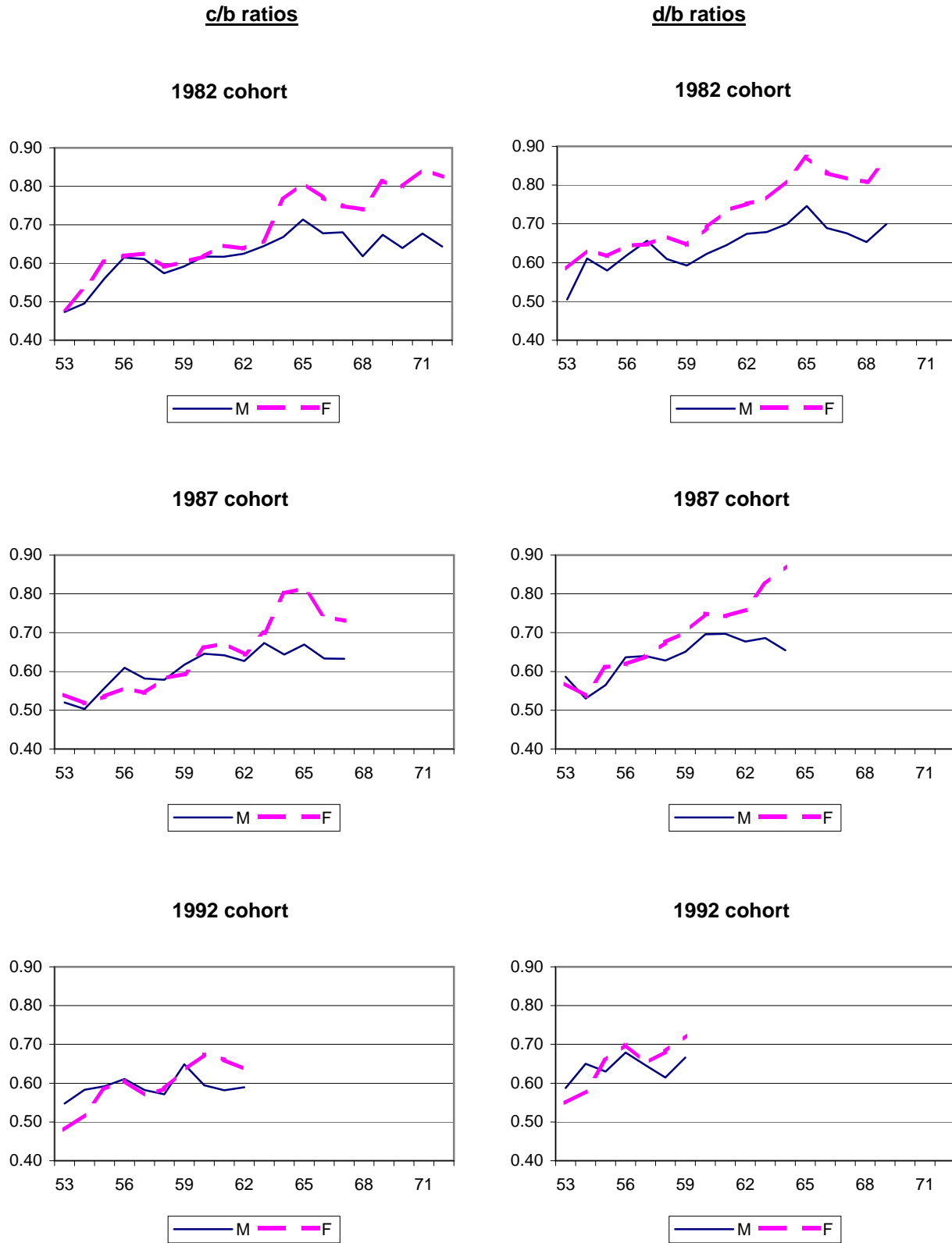
Figure 14: After-tax Income Replacement Ratio c/b, by Age Group and Income Quartile, Selected Cohorts

Table 1: Income and Income Replacement by Age of Retirement: 1982 Male Cohort, Based on Income Before Tax

AR: Age of Retirement	# of obs	Average income measures					Income replacement ratios		
		a	b	c	d	e	f	g	h
		50-51	AR-2,3	AR+1,2	AR+5,6	b/a	c/a	c/b	d/b
53	290	55,800	55,800	24,550	26,550	1.00	0.44	0.44	0.48
54	295	57,650	51,600	23,650	31,350	0.90	0.41	0.46	0.61
55	280	58,800	54,800	28,400	30,250	0.93	0.48	0.52	0.55
56	640	62,950	61,600	35,750	37,000	0.98	0.57	0.58	0.60
57	710	61,650	58,900	33,900	36,800	0.96	0.55	0.58	0.62
58	760	61,250	60,900	32,650	35,400	0.99	0.53	0.54	0.58
59	915	60,100	66,050	35,950	37,000	1.10	0.60	0.54	0.56
60	1,215	60,900	59,750	34,200	34,700	0.98	0.56	0.57	0.58
61	1,750	60,600	61,550	35,550	36,550	1.02	0.59	0.58	0.59
62	1,495	59,350	56,100	33,000	34,600	0.95	0.56	0.59	0.62
63	1,335	58,350	55,650	33,900	34,950	0.95	0.58	0.61	0.63
64	1,125	59,950	56,200	34,550	35,650	0.94	0.58	0.61	0.63
65	1,230	57,300	51,350	33,400	33,850	0.90	0.58	0.65	0.66
66	1,905	56,250	53,750	32,900	32,500	0.96	0.58	0.61	0.60
67	575	59,650	58,150	34,500	33,750	0.97	0.58	0.59	0.58
68	370	64,500	63,800	34,100	36,250	0.99	0.53	0.53	0.57
69	340	65,600	60,900	37,500	39,050	0.93	0.57	0.62	0.64
70	270	72,550	71,000	41,300		0.98	0.57	0.58	
71	195	79,650	69,500	43,900		0.87	0.55	0.63	
72	160	78,400	79,400	48,150		1.01	0.61	0.61	
73	130	84,900	92,100			1.08			
74	140	69,750	92,950			1.33			
ages 53-59	3,890	60,477	60,337	32,572	34,958	1.00	0.54	0.54	0.58
ages 60-64	6,920	59,843	58,049	34,281	35,349	0.97	0.57	0.59	0.61
ages 65-69	4,420	58,394	55,046	33,702	33,856	0.94	0.58	0.61	0.62
ages 70-74	895	76,499	78,673	43,865		1.03	0.58	0.60	
ages 53+	16,125	60,523	58,922	34,078	34,816	0.97	0.57	0.59	0.60

Note: Based on special tabulations of the Longitudinal Administrative Databank. The number of observations and average income values have been rounded. The number of observations applies to all values in each row. The age intervals that are included in the weighted averages reported at the bottom of the table differ depending on data availability.

Note: AR-2,3, AR+1,2, and AR+5,6 indicate number of years before (-) or after (+) retirement.

Table 2: Income and Income Replacement by Age of Retirement: 1982 Male Cohort,
Based on Income After Tax

AR: Age of Retirement	# of obs	Average income measures				Income replacement ratios			
		a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	290	44,450	44,450	21,050	22,450	1.00	0.47	0.47	0.51
54	295	44,950	40,750	20,200	24,900	0.91	0.45	0.50	0.61
55	280	45,550	42,700	23,900	24,750	0.94	0.52	0.56	0.58
56	640	49,450	47,750	29,350	29,600	0.97	0.59	0.61	0.62
57	710	48,600	45,100	27,550	29,600	0.93	0.57	0.61	0.66
58	760	48,350	46,750	26,850	28,500	0.97	0.56	0.57	0.61
59	915	47,300	48,750	28,850	28,900	1.03	0.61	0.59	0.59
60	1,215	47,800	44,950	27,750	28,000	0.94	0.58	0.62	0.62
61	1,750	47,600	45,850	28,300	29,600	0.96	0.59	0.62	0.65
62	1,495	47,000	42,400	26,500	28,600	0.90	0.56	0.63	0.67
63	1,335	46,200	42,550	27,400	28,900	0.92	0.59	0.64	0.68
64	1,125	47,100	42,650	28,500	29,850	0.91	0.61	0.67	0.70
65	1,230	45,700	38,950	27,800	29,050	0.85	0.61	0.71	0.75
66	1,905	44,750	40,850	27,700	28,150	0.91	0.62	0.68	0.69
67	575	47,350	42,850	29,150	28,950	0.91	0.62	0.68	0.68
68	370	50,100	47,000	29,050	30,700	0.94	0.58	0.62	0.65
69	340	50,750	46,450	31,300	32,500	0.92	0.62	0.67	0.70
70	270	54,650	52,950	33,850		0.97	0.62	0.64	
71	195	61,000	52,950	35,850		0.87	0.59	0.68	
72	160	59,550	60,400	38,850		1.01	0.65	0.64	
73	130	62,350	67,000			1.07			
74	140	54,400	63,100			1.16			
ages 53-59	3,890	47,580	46,166	26,710	27,982	0.97	0.56	0.58	0.61
ages 60-64	6,920	47,154	43,790	27,673	29,009	0.93	0.59	0.63	0.66
ages 65-69	4,420	46,262	41,527	28,306	29,053	0.90	0.61	0.68	0.70
ages 70-74	895	57,989	57,910	35,754		1.00	0.62	0.65	
ages 53+	16,125	47,614	44,526	27,932	28,759	0.93	0.59	0.63	0.66

Note: See note to Table 1.

Table 3: Income and Income Replacement by Age of Retirement: 1982 Female Cohort,
Based on Income Before Tax

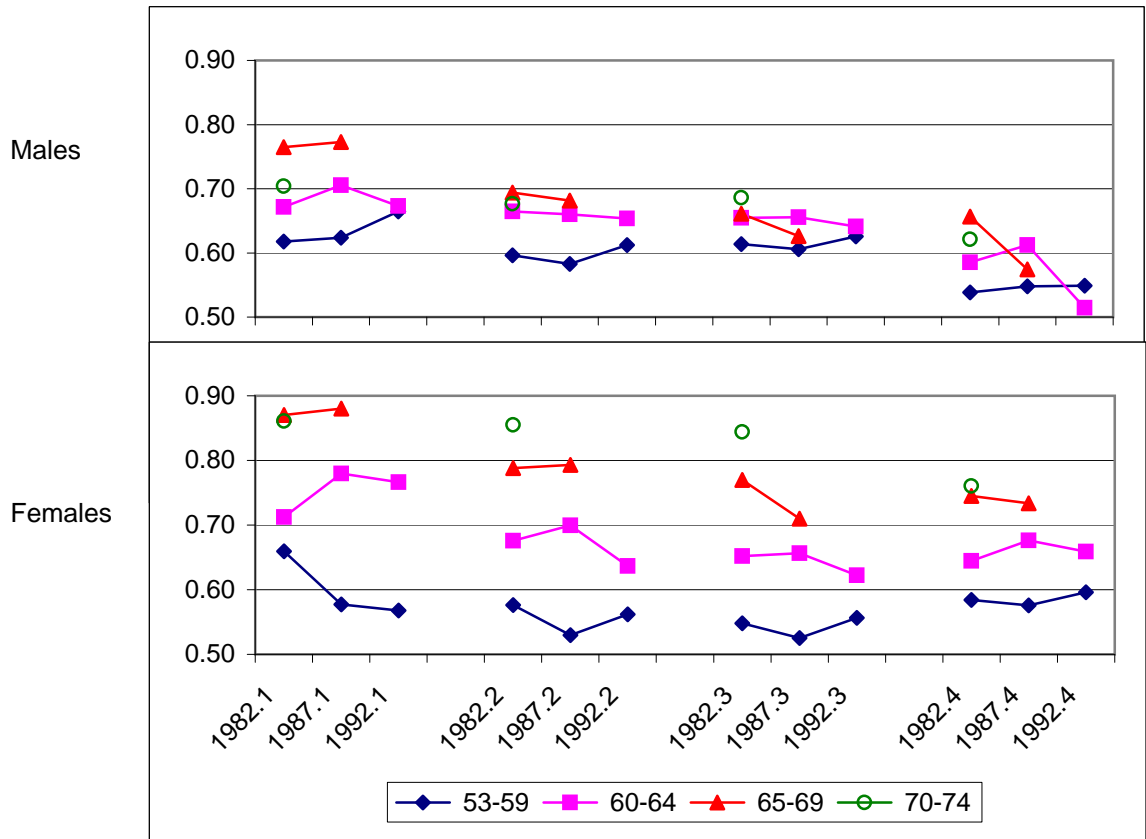| AR: | | Average income measures | | | | | Income replacement ratios | | |
Age of Retirement	# of obs	a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	250	36,750	36,750	17,450	22,500	1.00	0.47	0.47	0.61
54	240	31,400	29,750	15,250	18,700	0.95	0.49	0.51	0.63
55	290	32,750	32,050	18,650	19,400	0.98	0.57	0.58	0.61
56	445	44,150	40,650	24,250	25,750	0.92	0.55	0.60	0.63
57	465	38,300	37,950	23,200	23,850	0.99	0.61	0.61	0.63
58	465	37,450	36,350	20,950	23,850	0.97	0.56	0.58	0.66
59	535	35,850	35,000	20,400	22,250	0.98	0.57	0.58	0.64
60	660	34,200	35,200	20,650	22,950	1.03	0.60	0.59	0.65
61	930	35,250	36,100	22,050	24,500	1.02	0.63	0.61	0.68
62	815	35,300	36,850	22,600	25,800	1.04	0.64	0.61	0.70
63	820	36,700	37,400	23,450	26,750	1.02	0.64	0.63	0.72
64	685	36,400	37,450	27,350	28,650	1.03	0.75	0.73	0.77
65	700	34,550	35,050	26,700	28,350	1.01	0.77	0.76	0.81
66	1,055	33,350	36,350	25,850	27,650	1.09	0.78	0.71	0.76
67	325	34,700	40,400	27,550	30,150	1.16	0.79	0.68	0.75
68	165	32,600	40,850	27,600	30,700	1.25	0.85	0.68	0.75
69	155	35,550	39,850	30,300	32,650	1.12	0.85	0.76	0.82
70	140	38,750	46,450	34,350		1.20	0.89	0.74	
71	95	42,850	43,150	34,450		1.01	0.80	0.80	
72	75	37,700	47,250	37,300		1.25	0.99	0.79	
73	55	44,150	57,900			1.31			
74	70	38,350	53,800			1.40			
ages 53-59	2,690	37,276	36,054	20,694	22,781	0.97	0.55	0.57	0.63
ages 60-64	3,910	35,589	36,614	23,150	25,708	1.03	0.65	0.63	0.70
ages 65-69	2,400	33,973	37,055	26,736	28,725	1.09	0.79	0.72	0.78
ages 70-74	435	40,083	48,498	35,094		1.21	0.89	0.77	
ages 53+	9,435	35,866	37,114	23,763	25,638	1.04	0.67	0.64	0.70

Note: See note to Table 1.

Table 4: Income and Income Replacement by Age of Retirement: 1982 Female Cohort,
         Based on Income After Tax

AR: Age of Retirement	# of obs	Average income measures					Income replacement ratios		
		a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	250	30,850	30,850	14,850	18,050	1.00	0.48	0.48	0.59
54	240	26,700	25,350	13,500	16,050	0.95	0.51	0.53	0.63
55	290	28,050	27,100	16,350	16,700	0.97	0.58	0.60	0.62
56	445	35,500	32,750	20,300	21,100	0.92	0.57	0.62	0.64
57	465	31,800	30,650	19,150	19,850	0.96	0.60	0.62	0.65
58	465	31,250	29,450	17,400	19,650	0.94	0.56	0.59	0.67
59	535	30,050	28,500	17,200	18,400	0.95	0.57	0.60	0.65
60	660	28,900	28,250	17,450	19,500	0.98	0.60	0.62	0.69
61	930	29,500	28,700	18,550	21,100	0.97	0.63	0.65	0.74
62	815	29,800	29,600	18,900	22,250	0.99	0.63	0.64	0.75
63	820	30,650	30,100	19,800	23,000	0.98	0.65	0.66	0.76
64	685	30,400	30,100	23,050	24,450	0.99	0.76	0.77	0.81
65	700	29,050	28,250	22,850	24,650	0.97	0.79	0.81	0.87
66	1,055	28,500	29,350	22,600	24,400	1.03	0.79	0.77	0.83
67	325	29,250	31,850	23,850	26,000	1.09	0.82	0.75	0.82
68	165	27,850	32,950	24,400	26,650	1.18	0.88	0.74	0.81
69	155	30,200	32,300	26,250	28,000	1.07	0.87	0.81	0.87
70	140	32,100	36,600	29,250		1.14	0.91	0.80	
71	95	35,100	34,950	29,500		1.00	0.84	0.84	
72	75	32,250	38,200	31,500		1.18	0.98	0.82	
73	55	35,650	44,100			1.24			
74	70	32,000	42,650			1.33			
ages 53-59	2,690	31,021	29,525	17,444	18,888	0.95	0.56	0.59	0.64
ages 60-64	3,910	29,860	29,351	19,488	22,055	0.98	0.65	0.66	0.75
ages 65-69	2,400	28,827	29,806	23,202	25,077	1.03	0.80	0.78	0.84
ages 70-74	435	33,214	38,437	29,871		1.16	0.91	0.82	
ages 53+	9,435	30,083	29,935	20,200	21,914	1.00	0.67	0.68	0.74

Note: See note to Table 1.

Table 5: Income and Income Replacement by Age of Retirement: 1987 Male Cohort,
         Based on Income Before Tax

AR: Age of Retirement	# of obs	Average income measures				Income replacement ratios			
		a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	395	53,550	53,550	25,350	29,100	1.00	0.47	0.47	0.54
54	385	60,850	60,500	26,450	28,600	0.99	0.43	0.44	0.47
55	555	59,700	59,900	30,150	30,950	1.00	0.51	0.50	0.52
56	865	62,750	59,000	32,800	35,550	0.94	0.52	0.56	0.60
57	945	66,550	64,300	34,550	38,850	0.97	0.52	0.54	0.60
58	945	64,100	60,700	33,350	36,600	0.95	0.52	0.55	0.60
59	945	61,700	58,850	34,700	36,000	0.95	0.56	0.59	0.61
60	1,080	64,700	56,450	35,100	35,950	0.87	0.54	0.62	0.64
61	1,420	60,700	56,700	34,700	35,100	0.93	0.57	0.61	0.62
62	985	61,300	58,650	33,750	34,950	0.96	0.55	0.58	0.60
63	870	63,900	57,400	34,200	34,200	0.90	0.54	0.60	0.60
64	880	62,550	59,500	33,400	33,750	0.95	0.53	0.56	0.57
65	970	57,900	54,300	31,850		0.94	0.55	0.59	
66	1,690	56,250	53,750	30,300		0.96	0.54	0.56	
67	630	60,250	57,000	32,700		0.95	0.54	0.57	
68	430	65,950	62,700			0.95			
69	390	68,450	60,200			0.88			
ages 53-59	5,035	62,316	60,072	32,226	34,906	0.96	0.52	0.54	0.58
ages 60-64	5,235	62,481	57,602	34,302	34,871	0.92	0.55	0.60	0.61
ages 65-69	4,110	59,425	55,926	31,217		0.94	0.54	0.57	
ages 53+	14,380	61,550	57,988	32,783	34,888	0.94	0.54	0.57	0.59

Note: See note to Table 1.

Table 6: Income and Income Replacement by Age of Retirement: 1987 Male Cohort,
Based on Income After Tax

| AR: | | Average income measures | | | | Income replacement ratios | | | |
Age of Retirement	# of obs	a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	395	41,450	41,450	21,550	24,300	1.00	0.52	0.52	0.59
54	385	44,800	44,700	22,500	23,700	1.00	0.50	0.50	0.53
55	555	45,100	44,950	25,050	25,400	1.00	0.56	0.56	0.57
56	865	46,900	43,900	26,750	27,950	0.94	0.57	0.61	0.64
57	945	49,700	47,600	27,700	30,450	0.96	0.56	0.58	0.64
58	945	48,000	45,700	26,450	28,700	0.95	0.55	0.58	0.63
59	945	46,600	44,400	27,400	28,900	0.95	0.59	0.62	0.65
60	1,080	48,000	42,600	27,500	29,650	0.89	0.57	0.65	0.70
61	1,420	45,600	42,550	27,300	29,650	0.93	0.60	0.64	0.70
62	985	46,100	43,850	27,500	29,700	0.95	0.60	0.63	0.68
63	870	47,850	42,700	28,750	29,300	0.89	0.60	0.67	0.69
64	880	46,900	44,300	28,500	29,000	0.94	0.61	0.64	0.65
65	970	44,450	41,600	27,850		0.94	0.63	0.67	
66	1,690	43,400	42,000	26,600		0.97	0.61	0.63	
67	630	45,450	44,900	28,400		0.99	0.62	0.63	
68	430	49,200	49,000			1.00			
69	390	51,350	47,000			0.92			
ages 53-59	5,035	46,789	45,011	26,074	27,846	0.96	0.56	0.58	0.62
ages 60-64	5,235	46,782	43,124	27,822	29,492	0.92	0.59	0.65	0.68
ages 65-69	4,110	45,323	43,557	27,313		0.96	0.62	0.64	
ages 53+	14,380	46,367	43,908	27,049	28,685	0.95	0.59	0.62	0.65

Note: See note to Table 1.

Table 7: Income and Income Replacement by Age of Retirement: 1987 Female Cohort, Based on Income Before Tax

AR: Age of Retirement	# of obs	Average income measures				Income replacement ratios			
		a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	380	35,100	35,100	18,250	19,300	1.00	0.52	0.52	0.55
54	350	37,850	38,450	18,700	19,250	1.02	0.49	0.49	0.50
55	410	35,100	35,500	17,750	20,800	1.01	0.51	0.50	0.59
56	620	40,300	39,850	20,850	23,900	0.99	0.52	0.52	0.60
57	645	38,550	37,100	19,100	23,000	0.96	0.50	0.51	0.62
58	690	37,450	36,550	20,600	23,950	0.98	0.55	0.56	0.66
59	720	37,600	37,250	21,550	24,950	0.99	0.57	0.58	0.67
60	805	39,350	36,850	24,000	25,750	0.94	0.61	0.65	0.70
61	1,225	37,600	38,100	24,900	25,650	1.01	0.66	0.65	0.67
62	825	35,900	36,400	21,950	24,750	1.01	0.61	0.60	0.68
63	555	34,950	35,000	22,050	25,650	1.00	0.63	0.63	0.73
64	645	34,950	34,250	24,950	27,050	0.98	0.71	0.73	0.79
65	550	35,100	36,600	27,100		1.04	0.77	0.74	
66	1,065	34,450	40,400	27,350		1.17	0.79	0.68	
67	390	34,200	39,200	26,450		1.15	0.77	0.67	
68	235	38,350	43,500			1.13			
69	240	37,050	45,000			1.21			
ages 53-59	3,815	37,678	37,228	19,852	22,737	0.99	0.53	0.53	0.61
ages 60-64	4,055	36,817	36,469	23,739	25,709	0.99	0.65	0.65	0.71
ages 65-69	2,480	35,176	40,107	27,106		1.14	0.78	0.69	
ages 53+	10,350	36,741	37,621	22,921	24,269	1.03	0.63	0.61	0.66

Note: See note to Table 1.

Table 8: Income and Income Replacement by Age of Retirement: 1987 Female Cohort,
Based on Income After Tax

AR: Age of Retirement	# of obs	Average income measures					Income replacement ratios		
		a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	380	28,700	28,700	15,500	16,300	1.00	0.54	0.54	0.57
54	350	30,400	30,350	15,700	16,300	1.00	0.52	0.52	0.54
55	410	28,500	28,400	15,200	17,350	1.00	0.53	0.54	0.61
56	620	32,100	31,300	17,450	19,350	0.98	0.54	0.56	0.62
57	645	30,950	29,750	16,200	19,000	0.96	0.52	0.54	0.64
58	690	30,250	29,550	17,200	19,950	0.98	0.57	0.58	0.68
59	720	30,400	30,100	17,850	21,100	0.99	0.59	0.59	0.70
60	805	31,300	29,500	19,500	22,100	0.94	0.62	0.66	0.75
61	1,225	30,050	30,450	20,450	22,600	1.01	0.68	0.67	0.74
62	825	29,100	29,250	18,850	22,200	1.01	0.65	0.64	0.76
63	555	28,400	28,300	19,800	23,350	1.00	0.70	0.70	0.83
64	645	28,400	27,900	22,350	24,300	0.98	0.79	0.80	0.87
65	550	28,700	29,600	24,100		1.03	0.84	0.81	
66	1,065	28,350	32,850	24,350		1.16	0.86	0.74	
67	390	28,000	32,450	23,700		1.16	0.85	0.73	
68	235	31,200	36,050			1.16			
69	240	29,850	37,600			1.26			
ages 53-59	3,815	30,369	29,837	16,672	18,931	0.98	0.55	0.56	0.63
ages 60-64	4,055	29,617	29,317	20,149	22,792	0.99	0.68	0.69	0.78
ages 65-69	2,480	28,788	32,829	24,155		1.14	0.85	0.76	
ages 53+	10,350	29,695	30,350	19,619	20,921	1.02	0.66	0.65	0.71

Note: See note to Table 1.

Table 9: Income and Income Replacement by Age of Retirement: 1992 Male Cohort,
Based on Income Before Tax

AR:		Average income measures					Income replacement ratios		
Age of Retirement	# of obs	a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	760	59,300	59,300	30,350	32,550	1.00	0.51	0.51	0.55
54	595	58,950	57,350	31,450	34,750	0.97	0.53	0.55	0.61
55	620	64,200	59,600	33,000	34,100	0.93	0.51	0.55	0.57
56	1,140	67,850	66,850	38,500	41,200	0.99	0.57	0.58	0.62
57	880	70,600	71,000	38,400	42,250	1.01	0.54	0.54	0.60
58	815	65,800	70,100	35,800	38,800	1.07	0.54	0.51	0.55
59	960	67,900	67,950	39,550	40,350	1.00	0.58	0.58	0.59
60	1,065	68,700	76,950	40,850		1.12	0.59	0.53	
61	1,385	63,300	69,450	36,700		1.10	0.58	0.53	
62	1,075	63,300	62,400	34,250		0.99	0.54	0.55	
63	975	63,100	63,800			1.01			
64	1,140	65,450	63,600			0.97			
ages 53-59	5,770	65,552	65,372	35,887	38,312	1.00	0.55	0.55	0.59
ages 60-64	5,640	64,720	67,363	37,207		1.04	0.57	0.54	
ages 53+	11,410	65,141	66,356	36,387	38,312	1.02	0.56	0.54	0.59

Note: See note to Table 1.

Table 10: Income and Income Replacement by Age of Retirement: 1992 Male Cohort,
Based on Income After Tax

AR:		Average income measures					Income replacement ratios		
Age of Retirement	# of obs	a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	760	45,100	45,100	24,700	26,500	1.00	0.55	0.55	0.59
54	595	44,200	43,400	25,300	28,200	0.98	0.57	0.58	0.65
55	620	47,000	44,450	26,300	28,000	0.95	0.56	0.59	0.63
56	1,140	49,300	48,250	29,450	32,750	0.98	0.60	0.61	0.68
57	880	51,300	51,850	30,200	33,500	1.01	0.59	0.58	0.65
58	815	48,450	51,000	29,150	31,350	1.05	0.60	0.57	0.61
59	960	49,400	49,150	31,900	32,750	0.99	0.65	0.65	0.67
60	1,065	49,750	55,050	32,750		1.11	0.66	0.59	
61	1,385	46,350	51,400	29,900		1.11	0.65	0.58	
62	1,075	46,350	48,100	28,350		1.04	0.61	0.59	
63	975	46,700	49,250			1.05			
64	1,140	47,850	48,850			1.02			
ages 53-59	5,770	48,175	48,014	28,538	30,864	1.00	0.59	0.59	0.64
ages 60-64	5,640	47,356	50,573	30,288		1.07	0.64	0.59	
ages 53+	11,410	47,770	49,279	29,202	30,864	1.03	0.61	0.59	0.64

Note: See note to Table 1.

Table 11: Income and Income Replacement by Age of Retirement: 1992 Female Cohort,
Based on Income Before Tax

AR:		Average income measures					Income replacement ratios		
Age of Retirement	# of obs	a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	585	38,600	38,600	17,900	20,900	1.00	0.46	0.46	0.54
54	505	40,800	38,950	19,650	21,800	0.95	0.48	0.50	0.56
55	605	41,050	39,000	22,550	24,350	0.95	0.55	0.58	0.62
56	1,110	47,400	44,550	26,550	29,800	0.94	0.56	0.60	0.67
57	810	45,700	43,300	23,800	26,350	0.95	0.52	0.55	0.61
58	770	40,900	39,150	21,300	24,900	0.96	0.52	0.54	0.64
59	825	39,900	38,050	22,500	25,800	0.95	0.56	0.59	0.68
60	845	38,700	37,050	23,350		0.96	0.60	0.63	
61	1,355	40,900	40,950	25,250		1.00	0.62	0.62	
62	880	39,050	40,650	24,400		1.04	0.62	0.60	
63	785	37,600	38,250			1.02			
64	830	39,600	41,200			1.04			
ages 53-59	5,210	42,622	40,673	22,601	25,498	0.96	0.53	0.55	0.63
ages 60-64	4,695	39,376	39,785	24,486		1.01	0.62	0.62	
ages 53+	9,905	41,083	40,252	23,301	25,498	0.98	0.56	0.58	0.63

Note: See note to Table 1.

Table 12: Income and Income Replacement by Age of Retirement: 1992 Female Cohort,
Based on Income After Tax

AR:		Average income measures					Income replacement ratios		
Age of Retirement	# of obs	a 50-51	b AR-2,3	c AR+1,2	d AR+5,6	e b/a	f c/a	g c/b	h d/b
53	585	31,050	31,050	14,900	17,050	1.00	0.48	0.48	0.55
54	505	32,200	31,000	16,100	17,950	0.96	0.50	0.52	0.58
55	605	32,150	30,950	18,100	20,400	0.96	0.56	0.58	0.66
56	1,110	36,100	34,200	20,750	23,950	0.95	0.57	0.61	0.70
57	810	35,400	33,850	19,250	22,050	0.96	0.54	0.57	0.65
58	770	32,400	31,250	18,300	21,300	0.96	0.56	0.59	0.68
59	825	31,500	30,150	19,100	21,800	0.96	0.61	0.63	0.72
60	845	30,750	29,650	20,000		0.96	0.65	0.67	
61	1,355	32,100	32,500	21,450		1.01	0.67	0.66	
62	880	31,100	33,300	21,200		1.07	0.68	0.64	
63	785	30,200	31,750			1.05			
64	830	31,600	33,550			1.06			
ages 53-59	5,210	33,312	32,027	18,478	21,154	0.96	0.55	0.58	0.66
ages 60-64	4,695	31,264	32,197	20,981		1.03	0.67	0.66	
ages 53+	9,905	32,341	32,108	19,408	21,154	0.99	0.60	0.61	0.66

Note: See note to Table 1.

Table 13: Income Replacement Ratio c/b, by Age Group and Income Quartile, Selected Cohorts

	Q1			Q2			Q3			Q4		
	1982.1	1987.1	1992.1	1982.2	1987.2	1992.2	1982.3	1987.3	1992.3	1982.4	1987.4	1992.4
Before tax												
Male												
53-59	0.58	0.58	0.62	0.55	0.54	0.57	0.58	0.57	0.59	0.50	0.51	0.50
60-64	0.61	0.65	0.62	0.61	0.61	0.61	0.61	0.61	0.60	0.56	0.56	0.46
65-69	0.68	0.69		0.62	0.61		0.60	0.56		0.60	0.51	
70-74	0.65			0.63			0.64			0.58		
All ages	0.62	0.63	0.62	0.61	0.59	0.59	0.60	0.58	0.59	0.55	0.53	0.48
Female												
53-59	0.66	0.56	0.55	0.56	0.50	0.54	0.53	0.50	0.54	0.57	0.55	0.57
60-64	0.67	0.73	0.73	0.63	0.65	0.59	0.62	0.62	0.58	0.63	0.65	0.62
65-69	0.80	0.81		0.72	0.72		0.71	0.65		0.70	0.68	
70-74	0.82			0.80			0.80			0.71		
All ages	0.70	0.67	0.61	0.64	0.61	0.56	0.63	0.59	0.56	0.63	0.62	0.59
After tax												
Male												
53-59	0.62	0.62	0.66	0.60	0.58	0.61	0.61	0.61	0.63	0.54	0.55	0.55
60-64	0.67	0.71	0.67	0.66	0.66	0.65	0.65	0.66	0.64	0.59	0.61	0.51
65-69	0.76	0.77		0.69	0.68		0.66	0.63		0.66	0.57	
70-74	0.70			0.68			0.69			0.62		
All ages	0.68	0.69	0.67	0.66	0.64	0.63	0.65	0.63	0.63	0.59	0.58	0.54
Female												
53-59	0.66	0.58	0.57	0.58	0.53	0.56	0.55	0.53	0.56	0.58	0.58	0.60
60-64	0.71	0.78	0.77	0.68	0.70	0.64	0.65	0.66	0.62	0.64	0.68	0.66
65-69	0.87	0.88		0.79	0.79		0.77	0.71		0.75	0.73	
70-74	0.86			0.85			0.84			0.76		
All ages	0.74	0.71	0.64	0.69	0.66	0.59	0.67	0.62	0.58	0.65	0.65	0.62
Upper bounds of quartiles (2006 constant dollars)												
Male	33,500	34,800	32,800	49,200	51,400	51,000	66,300	70,000	72,500	--	--	--
Female	17,300	18,500	19,800	26,800	28,600	31,400	37,900	40,300	46,000	--	--	--

Note: Replacement ratios in the "All ages" row are based on the age groups shown for each cohort.

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