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SOCIAL SECURITY INCENTIVES FOR RETIREMENT

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Social Security Incentives for Retirement
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ABSTRACT

We present a detailed analysis of the incentives that Social Security provides for continued work at older ages. We do so using information on older males from the Health and Retirement Study over the 1980-1997 period to calculate the changes in the present discounted value of Social Security entitlements from additional work at each age. We find that the median male worker faces a small tax on work at ages 55-61, a near zero tax at ages 62-64, and a large tax at ages 65-69. However, there is significant heterogeneity in tax rates. We also document significant non-monotonicities in the accrual of Social Security entitlements with additional work, and suggest a more appropriate measure of incentive effects that considers accruals over not just the next year but future years as well.

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One of the most striking labor force phenomena of the second half of the twentieth century has been the rapid decline in the labor force participation rate of older men. In 1950, for example, 81% of 62 year old men were in the labor force; by 1995, this figure had fallen to 51%, though it has rebounded slightly in the past few years (Quinn, 1999). Declines have been seen for all groups of older men, as illustrated by Figure 1. For women, these declines with age have been offset by an overall rising trend in labor force participation, as shown in Figure 2.[1]

Much has been written about the proximate causes of this important trend among older men, and in particular about the role of the Social Security program. A large number of articles have documented pronounced "spikes" in retirement at ages 62 and 65, which correspond to the early and normal retirement ages for Social Security, respectively. While there are some other explanations for a spike at age 65, such as entitlement to health insurance under the Medicare program or rounding error in surveys, there is little reason to see a spike at 62 other than the Social Security program. Indeed, as Burtless and Moffitt (1984) document, this spike at age 62 only emerged after the early retirement eligibility age for men was introduced in 1961.

The presence of these strong patterns in retirement data suggest that SS is playing a critical role in determining retirement decisions. But in order to model the impact of SS reform on retirement behavior, it is critical to understand what this role is. The evidence of spikes at age 62, for example, is consistent with at least three alternative hypotheses. The first is that there is an actuarial unfairness built into the system penalizing work past age 62, so that there is a "tax"

[1] Both figures are from Diamond and Gruber (1998).

effect that leads workers to leave at that age.   The second is that workers are liquidity constrained; they would like to retire before age 62, but cannot because they are unable to borrow against their SS benefits and have no other source of retirement support. In this case, there will be a large exit at age 62 as benefits first become available. The third is that workers are myopic or information constrained; they either do not understand or do not appreciate the actuarial incentives for additional work past age 62, so they retire as soon as benefits become available.

The existing evidence would appear to refute the first explanation. Diamond and Gruber (1998) calculate for a typical individual the implicit tax on continued work at each age from the Social Security system and find that there is actually a small subsidy to continued work at age 62. There is some supportive evidence for the second view; Kahn (1988) finds that there is a pronounced spike in the retirement hazard at age 62 for those with low wealth, but that the much larger spike is at age 65 for those with higher wealth. There is little work on the third view, other than a recent careful exposition of the model by Diamond and Koszegi (1998).

This paper provides a more thorough investigation of the first effect, the tax effect, along four dimensions. First, we assess whether the tax rate Diamond and Gruber compute using a synthetic individual with annual earnings at the median of his cohort is similar to the tax rate of the real median person. We might expect a difference, as the shape of the earnings history is a significant determinant of SS incentives through the dropout years provision and this is not appropriately reflected with a synthetic earnings history. Second, we assess the distribution of retirement incentives across the population. Even if there is not a significant disincentive for the typical worker, disincentives for a large subset of workers could still be associated with a spike in the aggregate retirement data. Third, we assess the importance of considering incentives for retirement in the next year versus incentives for retirement over all possible years, drawing on the insights of the option value model of Stock and Wise (1990a, 1990b). Finally, we incorporate the role of private pensions, an important determinant of retirement for a large share of workers.

Our strategy is to apply the model of Diamond and Gruber to a set of real individuals, the older persons surveyed by the Health and Retirement Survey (HRS). This is a very rich survey with information on individual SS earnings histories, private pension plan details, and demographics. This data allows us to carefully compute the incentives for retirement from SS and pensions, both for the median individual and across the distribution.

Our paper proceeds as follows. We begin, in Part I, with background on the relevant institutional features of the SS system and the previous literature in this area. In Part II, we describe our data and empirical strategy. Part III presents our basic results for the accrual of Social Security wealth with additional work and the associated tax/subsidy relative to potential earnings, both on average and across the distribution. Part IV then highlights the fundamental weakness of simple one year accrual measures of this type: many Social Security wealth trajectories are non-monotonic, suggesting that the appropriate measure must look across all years to find the optimal retirement date. We then present calculations for what we label “peak value,” an incentive measure which provides a middle ground between accrual and the utility-based option value metric of Stock and Wise (1990a, 1990b) by comparing retirement wealth at the current retirement date to retirement wealth at its global maximum. In this section, we also extend the results to incorporate private pensions. Part V concludes by discussing the implications of our findings and the directions for future research.

Part I: Background

Institutional Features of Social Security

The Social Security system is financed by a payroll tax which is levied equally on workers and firms. The total payroll tax paid by each party is 7.65 percentage points; 5.3 percentage points are devoted to the Old Age and Survivors Insurance (OASI) program, with 0.9 percentage points funding the Disability Insurance (DI) system and 1.45 percentage points funding Medicare's Hospital Insurance (HI) program.[2] The payroll tax that funds OASI and DI is levied on earnings up to the taxable maximum, $72,600 in 1999; the HI tax is uncapped.

Individuals qualify for an OASI pension by working for 40 quarters in covered employment, which now encompasses most sectors of the economy. Benefits are determined in several steps. The first step is computation of the worker's Averaged Indexed Monthly Earnings (AIME), which is 1/12th of the average of the worker's annual earnings in covered employment, indexed by a national wage index. A key feature of this process is that additional higher earnings years can replace earlier lower earnings years, since only the highest 35 years of earnings are used in the calculation (the "dropout year provision").[3]

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[2] The total OASI +DI contribution rate has been 6.2% since 1990, although the division between the two parts has varied slightly from year to year; the OASI portion is 5.35% in 1999 and will be 5.3% starting in 2000.

[3] In particular, while earnings through age 59 are converted to real dollars for averaging, earnings after age 60 are treated nominally. There is a two-year lag in availability of the wage index, calling for a base in the year in which the worker turns 60 in order to be able to compute

The next step of the benefits calculation is to convert the AIME into the Primary Insurance Amount (PIA). This is done by applying a three-piece linear progressive schedule to an individual's average earnings, whereby 90 cents of the first dollar of earnings is converted to benefits, while only 15 cents of the last dollar of earnings (up to the taxable maximum) is so converted. As a result, the rate at which SS replaces past earnings (the "replacement rate") falls with the level of lifetime earnings. While up to 85% of SS benefits are subject to tax for retirees with sufficiently high incomes (couples with non-SS income above $32,000 in 1999), all of earnings are taxed (including the employee portion of the payroll tax), raising the effective replacement rate of the program.

The final step is to adjust the PIA based on the age at which benefits are first claimed. For workers commencing benefit receipt at the Normal Retirement Age (currently 65, but legislated to slowly increase to 67), the monthly benefit is the PIA. For workers claiming before the NRA, benefits are decreased by an actuarial reduction factor of 5/9 of one percent per month; thus, a worker claiming on his 62nd birthday receives 80% of the PIA.[4] Individuals can also delay the receipt of benefits beyond the NRA and receive a Delayed Retirement Credit (DRC). For

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benefits for workers retiring at their 62nd birthdays. While it would be possible to make adjustments as data become available, this is not done. This gap would become important if we had large and varying inflation rates.

[4] The reduction factor will be only 5/12 of one percent for months beyond 36 months before the NRA, which will become relevant once the delay in NRA becomes effective.

workers reaching age 65 in 1999, an additional 5.5% is paid for each year of delay; this amount will steadily increase until it reaches 8% per year in 2008.

While a worker may claim as early as age 62, receipt of SS benefits is conditioned on the "earnings test" until the worker reaches age 70. A worker age 62 to 65 may earn up to $9,600 in 1999 without the loss of any benefits, then benefits are reduced $1 for each $2 of earnings above this amount; for workers age 65 to 69, the earnings test floor is $15,500 and benefits are reduced at a rate of $1 for each $3 in earnings. Months of benefits lost through the earnings test are treated as delayed receipt, entitling the worker to a delayed retirement credit on the lost benefits when he does claim benefits. Despite this, the earnings test appears to have a pronounced effect on retirement decisions, with evidence of extreme "piling up" of the earnings distribution among elderly workers at the earnings test limit (Friedberg, 1998).

One of the most important features of Social Security is that it also provides benefits to dependents of covered workers. Spouses of SS beneficiaries receive a dependent spouse benefit equal to 50% of the worker's PIA, which is available once the worker has claimed benefits and the spouse has reached age 62; however, the spouse only receives the larger of this and her own entitlement as a worker.[5] Dependent children are also each eligible for 50% of the PIA, but the total family benefit cannot exceed a maximum which is roughly 175% of the PIA. Surviving spouses receive 100% of the PIA, beginning at age 60, although there is an actuarial reduction for claiming benefits before age 65 or if the worker had an actuarial reduction. In practice,

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[5] Spousal benefits can begin earlier if there is a dependent child in the household; spousal benefits are also subject to actuarial reduction if receipt commences before the spouse's NRA.

estimating a family's total benefits is complicated by the fact that both spouses may qualify for SS benefits as retired workers. Finally, benefit payments are adjusted for increases in the Consumer Price Index (CPI) after the worker has reached age 62; thus, Social Security provides a real annuity.

Previous Related Literature

There are two broad strands of the literature on Social Security that are related to this paper. The first strand attempts to document the labor force disincentives inherent in Social Security, or implicit SS "tax rates." Feldstein and Samwick (1992) model the tax rates on the marginal earnings decision for simulated workers of different ages, earnings, and marital status. They find that there are significant marginal tax rates on earnings for higher income workers and secondary earners, and for younger workers as well.[6]

A subsequent paper by Diamond and Gruber (1998) focuses more directly on tax rates on around the time of retirement. They build a simulation model similar to that used here and compute SS tax rates for simulated workers. As noted above, they find that for the median worker, there is little net incentive or disincentive for continued work at age 62, although there is a sizeable positive tax rate at age 65 and beyond due to the unfair Delayed Retirement Credit still in place. They also find that tax rates are higher for single workers, since they do not benefit from dependent and survivors benefits, and that tax rates are initially lower for low earners (who

[6] Earlier work by Blinder, Gordon, and Wise (1980, 1981) and Burkhauser and Turner (1981) calculates tax rates under the pre-1977 Social Security rules.

benefit from the redistributive nature of benefits) but eventually higher (since they are penalized more by actuarial unfairness after age 65).

While suggestive, both of these studies suffer from a key limitation: they do not consider the incentives facing real individuals. This is important because of the dropout years provision, which implies that the actual pattern of earnings, and not just the level of average or final earnings, matters for benefits determination. As we will show later, even for workers with the same average and final earnings, there is considerable heterogeneity in SS tax rates. By considering a real sample of individuals, we will be able to appropriately measure both the incentives for the median worker and the underlying heterogeneity in these incentives.

The second literature is that on the retirement effects of Social Security. A number of studies use aggregate information on the labor force behavior of workers at different ages, such as that documented in the introduction, to infer the role that is played by Social Security. Hurd (1990) and Ruhm (1994) emphasize the spike in the age pattern of retirement at age 62; as Hurd (1990) states, "there are no other institutional or economic reasons for the peak". Using precise quarterly data, Blau (1994) finds that almost one-quarter of the men remaining in the labor force at their 65th birthday retire within the next three months; this hazard rate is over 2.5 times as large as the rate in surrounding quarters. However, Lumsdaine and Wise (1994) document that this penalty alone cannot account for this "excess" retirement at age 65, nor can the incentives embedded in private pension plans or the availability of retirement health insurance through the Medicare program. This does not rule out a role for Social Security; by setting up the "focal point" of a normal retirement age, the program may be the causal factor in explaining this spike.

The main body of the retirement incentives literature attempts to specifically model the role that potential SS benefits play in determining retirement. The general strategy followed by this literature is to use micro-data sets with information on potential SS benefit determinants (earnings histories) or ex-post benefit levels to measure the incentives to retire across individuals in the data.[7] Then, retirement models are estimated as a function of these incentive measures. While the exact modeling technique differs substantially across papers,[8] the conclusions drawn are fairly similar: SS has large effects on retirement, but they are small relative to the trends over time documented in Figures 1 and 2. For example, Burtless (1986) found that the 20% benefit rise of the 1969 to 1972 period raised the probability of retirement at 62 and 65 by about 2 percentage points. Over this period, however, the labor force participation of older men fell by

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[7] The data used are generally the Retirement History Survey (Boskin and Hurd, 1978; Burtless, 1986; Burtless and Moffitt, 1984; Hurd and Boskin, 1984; Fields and Mitchell, 1984; Blau, 1994), although some authors have relied on the National Longitudinal Survey of Older Men (Diamond and Hausman, 1984), and recent work uses the Survey of Consumer Finances (Samwick, 1998).

[8] The earliest studies (Boskin and Hurd, 1978; Fields and Mitchell, 1984) used standard linear or non-linear regression techniques. Later research (Burtless, 1986; Burtless and Moffitt, 1984) used non-linear budget constraint estimation to capture the richness of Social Security's effects on the opportunity set. The most recent work (Diamond and Hausman, 1984; Hausman and Wise, 1985; Samwick, 1998; Blau, 1994) uses dynamic estimation of the retirement transition.

over 6%, so that SS can only explain about 1/3 of the change.[9]

This literature suffers from two important limitations. First, the key regressor, Social Security benefits, is a non-linear function of past earnings, and retirement propensities are clearly correlated with past earnings levels. This problem is common to the social insurance literature in the U.S.[10] But for other social insurance programs there is often variation along dimensions arguably exogenous to individual tastes, such as different legislative regimes across locations or within locations over time, that can be used to identify behavioral models. There is no comparable variation in Social Security, which is a nationally homogeneous program. Of course, this criticism does not necessarily imply that the estimates of this cross-sectional literature are flawed; as Hurd (1990) emphasizes, the non-linearities in the SS benefits determination process are unlikely to be correlated with retirement propensities. But there has been little serious effort to decompose the sources of variation in SS benefits in an effort to assess whether the determinants that drive retirement behavior are plausibly excluded from a retirement equation.[11]

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[9] One exception is Hurd and Boskin (1984), who claim that the large benefits increases of the 1968-1973 period can explain all of the change in labor force participation in those years.

[10] See Meyer (1989) for a careful discussion of this issue in the context of Unemployment Insurance (UI).

[11] At a minimum, one would want to include the level of lifetime earnings as a regressor, but most studies include only earnings in a recent year (ie. Boskin and Hurd, 1978; Burtless, 1986). In addition, even using a somewhat longer time frame for measuring the earnings control (as

This criticism is levied most compellingly by Krueger and Pischke (1992), who note that there is a unique "natural experiment" provided by the end of double-indexing for the "notch generation" that retired in the late 1970s and early 1980s. For this cohort, SS benefits were greatly reduced relative to what they would have expected based on the experience of the early-mid 1970s. Yet, the dramatic fall in labor force participation continued unabated in this era. This raises important questions about the identification of this cross-sectional literature.

The second problem with this literature is that it generally focuses on only one of the two key SS benefits variables, including SS benefits or wealth but ignoring the SS tax/subsidy rate documented above. In theory, as discussed above, both of these factors play an important role in determining retirement behavior. Studies which include the tax/subsidy rate find it to have a significant role in explaining retirement (Fields and Mitchell, 1984; Samwick, 1993); indeed, even in Krueger and Pischke's (1992) paper the accrual rate is often right-signed and significant, even as the wealth effect is insignificant. More recently, Stock and Wise (1990a, 1990b) note that the correct regressor for considering both SS and pension incentives for retirement is not the year to year accrual rate, but the return to working this year relative to retiring at some future optimal date.

Diamond and Hausman, 1984, do) does not solve the problem; one could imagine that certain features of the lifetime pattern of earnings are correlated with both benefit levels and retirement decisions, such as the ratio of earnings around age 62 to earnings at earlier ages (since individuals who have relatively high earnings at older ages may have better labor market opportunities around the age of retirement and therefore work longer).

Our findings are relevant to addressing both these shortcomings. To the extent that we find substantial variation in the retirement incentives facing workers under the SS system, even after conditioning on correlates of the retirement decision such as earnings, it suggests that there are significant non-linearities in the determination of SS incentives which can help identify retirement impacts. And we will compare the retirement incentives over the subsequent year with those over all future years, following the insights of Stock and Wise.

Part II: Data and Empirical Strategy

Data

Our data for this analysis comes from the Health and Retirement Study. The HRS is a survey of individuals aged 51-61 in 1992 with re-interviews every two years; the first two waves of the survey (1992 and 1994) and preliminary data for the third and fourth waves (1996 and 1998) are available at this time. Spouses of respondents are also interviewed, so the total age range covered by the survey is much wider.

A key feature of the HRS is that it includes Social Security earnings histories back to 1951 for most respondents. This provides two advantages for our empirical work. First, it allows us to appropriately calculate benefit entitlements, which depend (through the dropout year provision) on the entire history of earnings.[12] Second, it allows us to construct a large sample of person-year observations by using the earnings histories to compute SS retirement incentives and

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[12] Only earnings since 1950 are required to compute SS benefits for our sample's age range; the benefit rules specify that a shorter averaging period is used for persons born prior to 1929.

labor force participation at each age. We use all person-year observations on men age 55-69 for our analysis, subject to the exclusions detailed below.

Our sample is selected conditional on working, so that we examine the incentives for retirement conditional on being in the labor force. Work is defined in one of two ways. For those person-years before 1992, when we are using earnings histories, we define work as positive earnings in two consecutive years; if earnings are positive this year but zero the next, we consider the person to have retired this year. For person-years from 1992 onwards, when we have the actual survey responses, we cannot use this earnings-based definition, since we only have earnings at two year intervals. For this era, we use information on self-reported retirement status and dates of retirement to construct annual retirement measures. While these are somewhat different constructs, the retirement rates by age are similar across the two samples, so we combine them for precision purposes. We also only consider individuals before their first retirement; if a person who is categorized as retired reenters the labor force, the later observations are not used.

Our sample selection criteria are documented in Table 1. There are 6,173 men who participate in one or more waves of the HRS. We exclude 121 men who were born before 1922 and thus subject to different SS benefit rules. We lose an additional 1,747 men due to a lack SS earnings history data.[13] We lose 860 men who cease working prior to age 55, and an additional

[13]Individuals were required to sign a permission form in order for their SS records to be attached; approximately 75% of the sample gave permission. Haider and Solon (1999) find that willingness to give permission varies only weakly with observable characteristics.

214 men due to a lack of information on their wives' SS earnings histories (necessary due to the family structure of benefits).[14] The 3,231 remaining observations are converted into 18,903 person-year observations by creating one observation for each year from 1980 through 1997 in which the individual is between the ages of 55 and 69 and working. Finally, we lose 1,356 person-year observations where the individual is working after a previous retirement. The final sample size is 17,547 person-year observations.

Empirical Strategy

Our goal is to measure the retirement incentives inherent in SS and private pension systems. For the case of Social Security, we begin with the calculation of an individual's Social Security Wealth. The basis for this calculation is a simulation model that we have developed to compute for any individual their Social Security entitlement for any age of retirement. This is based on a careful modeling of Social Security benefits rules, and our simulation model has been cross-checked against the Social Security Administrations's ANYPIA model for accuracy.

The next step in our simulation is to take these monthly benefit entitlements and compute an expected net present discounted value of Social Security Wealth (SSW). This requires projecting benefits out until workers reach age 120, and then taking a weighted sum that discounts future benefits by both the individual discount rate and the probability that the worker

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[14] We keep observations for which the wife's SS earnings records are not available but we can ascertain from the self-reported labor force histories that the wife worked less than half as many years as the husband.

will live to a given future age. Our methodology for doing so is described in Appendix I. For the worker himself, this is fairly straightforward; it is simply a sum of future benefits, discounted backwards by time preference rates and mortality rates. For dependent and survivor benefits, it is more complicated, since we must account for the joint likelihood of survival of the worker and the dependent. In our base case, we use a real discount rate of 3%. To adjust for mortality prospects, we use the sex/age specific U.S. life tables from U.S. Department of Health and Human Services (1990).[15] All figures are discounted back to age 55 by both time preference rates and mortality risk.

For the output of the simulations, we calculate several different concepts. The first is the level of SSW. The second is the accrual, or the dollar change in SSW from the previous year. We then compute the "after-tax accrual", which subtracts from this dollar change the payroll taxes paid by the worker and his employer (assuming full tax incidence on wages). Finally, since it is natural to think about these incentives relative to the returns from additional work, we also follow Diamond and Gruber (1998) in calculating the implicit tax/subsidy rate on additional work, which normalizes the negative of the accrual by the potential wage for that year; a positive accrual implies a negative tax rate and vice versa. Thus, if the tax rate is positive, it implies that the SS system causes a disincentive to additional work through foregone SSW. To measure the full tax wedge, we use the gross wage in the denominator; under the assumption that the

[15] In principle, individual-specific mortality prospects should be used to compute SSW and related retirement incentives. In future work, we plan to use the richer information in the HRS on health and even subjective mortality evaluation to do these richer calculations.

employer portion of payroll taxes is reflected in wages, we increase reported wages by 6.2%.

For assessing the accrual rate and related concepts used later in the paper, we must project the worker's earnings over the next year (or all future years) if he continues to work. We considered a number of different projection methodologies, and found that the best predictive performance was from a model which simply grew earnings from the last observation by 1% real growth per year, so this is the assumption we use for our simulations.

For the purposes of the simulations below, we assume that workers claim SS benefits at the point of their retirement, or when they become eligible if they retire before the point of eligibility. In fact, this is not necessarily true; retirement and claiming are two distinct events, and for certain values of mortality prospects and discount rates it is optimal to delay claiming until some time after retirement (due to the actuarial adjustment of benefits). Coile, Diamond, Gruber, and Jousten (1999) investigate this issue in some detail, using simulation analysis to document the gains to delaying claiming and showing that a non-trivial share of individuals do delay claiming past age 62. In this case, our calculations will overstate any subsidies to continued work, since part of this subsidy will come from delayed claiming that could be obtained without delaying retirement.

Also, it is important to highlight that our work is focused on the impact of SS on the labor force participation decision. A separate and interesting issue is the impact of SS on the marginal labor supply decision among those participating in the labor force, which was the focus of the Feldstein and Samwick (1992) analysis. This is more complicated for those around retirement age, since it involves incorporating the role of the earnings test, which we avoid with our analysis of participation. This, in turn, would involve modeling expectations about the earnings test, since individuals appear not to understand that this is just a benefits delay instead of a benefits cut. This is clearly a fruitful avenue for further research.

Part III: Social Security Accruals and Tax/Subsidies

Median Worker

We begin by considering the incentives facing the median worker at each age. These results are presented in Table 2. Each row represents the incentives facing a worker whose last year of work is labeled in the first column; that is, the age 55 row represents the incentives facing a worker who decides to retire on his 56th birthday.[16] We show for each age the SSW, the accrual, the after-tax accrual, and tax/subsidy rate. In the final column, we show the tax/subsidy rate from Diamond and Gruber (1999), for comparison; their results are for a married male,

[16] The SSW value is calculated from the data for age 55, and is then constrained to follow the pattern of accruals from age 56 onwards. We do this because the actual median SSW at each age does not correspond to the accrual pattern. If we use the SSW of the person with the median accrual, the pattern of SSW is nonsensical (with large shifts from year to year), since that person is different at every year. If we use the median SSW across the sample in each year (picking the median SSW in our sample, and not the SSW of the median accrual person), the SSW rises substantially over all years, due to sample selection. Another alternative is to project retirement incentives out to age 69 for the sample working at age 55; doing so, we find that the median SSW follows the same pattern as accruals, and that the accrual and tax variables are very similar to what we report here.

which is appropriate since 90% of our sample is married.

We find that the median SSW for workers who retire on their 55th birthday is $154,928. SSW grows steadily through age 65, then declines. This is shown most clearly in the next column, which presents the benefit accruals at each age. From age 55-61, these accruals are positive due to the dropout year provision; the median worker is increasing his SSW by replacing lower earning years in his earnings average. These accruals then get much larger between ages 62-64, due to the actuarial adjustment. That is, the fact that accruals are larger after age 62 suggests that the actuarial adjustment is more than fair for the median worker; the gain to delaying receipt outweighs the fact that benefits are received for fewer years. At age 65 and thereafter, however, there are negative accruals for working additional years, as the delayed retirement credit is not sufficiently large to fairly compensate workers.

The next column amends the benefit accrual by incorporating the fact that the worker and his employer must pay payroll taxes for additional work. This reverses the signs on the accruals at ages 55-61, which are now negative, as the small benefit of AIME recomputation is outweighed by paying 12.4% of wages in tax. However, at ages 62-64, the larger benefit accruals approximately offset the taxes incurred through additional work, so that the after-tax accrual for the median person is near zero. The after-tax accrual then turns sharply negative from age 65 onwards.

The next column converts these after-tax accruals into tax/subsidy rates by dividing by the gross wage. There are positive taxes on work from age 55-61, but these taxes are significantly lower than the statutory 12.4% payroll tax rate, due to the benefit of additional earnings through the dropout year provision. The tax rate is near zero for the median worker at ages 62 and 63 and is 2.7% at age 64. From age 65 onwards, the tax rate is positive and very large. By age 68, the tax rate exceeds 30%; it drops back down again at age 69, but the samples at these ages in the HRS are very small.

These results are very similar to those in Diamond and Gruber, in spite of several important differences in methodology. First, Diamond and Gruber use a smooth age-earnings profile, which underestimates the value of the dropout year provision for people with real earnings trajectories with more variance. Second, Diamond and Gruber take an age 55 individual and simulate his incentives to work at each future age, while the current calculations potentially incorporate some selection effects by using only those individuals still working at each age. The most notable differences between the two sets of results are at age 55, where Diamond and Gruber find a subsidy to work (by construction, their individual replaces a zero year of earnings with his 55th year of work), and at age 62, where Diamond and Gruber find a subsidy of 2.8% and we find a zero tax rate. But the bottom line story is very similar: small taxes on work up through age 61, tax rates near zero at ages 62-64, and more sizeable taxes after age 65. Thus, we reaffirm the important conclusion of previous studies that the SS system does not place a significant tax on work at age 62 for the median worker.

Heterogeneity

As emphasized earlier, the incentives facing the median worker may mask considerable heterogeneity across the population in retirement incentives. Substantial heterogeneity may in turn be associated with an increase in retirement rates at age 62, even if the incentives are small for the median worker. If for example, there are large tax rates on work for 50% of the population, and small subsidies to work for 50% of the population, then there may be a zero tax rate for the median worker, but still potentially a large amount of retirement at age 62.

We explore the heterogeneity in incentives in Table 3, which shows the distribution of after-tax accruals and of tax/subsidy rates by age. As is immediately apparent, there is a substantial amount of heterogeneity in the accruals and tax rates. For example, from age 55-61, while the median tax rate is positive and non-trivial, roughly one-sixth of the sample actually has a subsidy to additional work. At age 62, while there is a zero tax rate for the median worker, 10% of the sample faces a tax rate of 6.8% or higher and the standard deviation of the tax rate is 17.8%. After age 65, while virtually all of the sample faces positive tax rates, there remains substantial variation in the magnitude of the tax rate; at age 65, the standard deviation is nearly twice as large as the median tax rate.

What explains this substantial heterogeneity in SS incentives? This is an important question for both understanding how SS incentives work and for considering the validity of empirical work which relies on SS incentives to identify retirement behavior. As highlighted by Krueger and Pischke's (1992) criticism of the previous literature, if the vast majority of the variation in these incentives comes from factors such as wages or marital status, which are themselves likely to be independently correlated with retirement decisions, we might worry that incentive measures are capturing these other aspects of retirement decisions. But if, as suggested by Hurd's (1990) rebuttal to this line of criticism, there are significant non-linearities and interactions otherwise (likely) uncorrelated with retirement that primarily identify the impact of these incentive measures, one might feel more confident about retirement estimates.

We next turn to regression modeling of SS accruals and tax/subsidy rates to address this question. We consider in turn various potential determinants of the variation in incentives:

- Age: as shown earlier, there is important variation in tax rates with age
- Earnings in the last year of work: this is the denominator of the tax rate, and will also enter through the dropout year provision. This may as a result have both linear and non-linear effects, so we try both a linear earnings term and an earnings quartic.
- AIME: Average lifetime earnings is the primary determinant of benefits. Once again, the effects will be non-linear, through the redistributive function that determines the PIA.
- Marital status and age difference with spouse: Marital status will be an important determinant of tax rates through the dependent benefits structure. In addition, larger the positive age difference between spouses (a larger number of years by which the husband is older), the larger the value of the dependent spouse and survivor benefits.
- Earnings in lowest year: In combination with earnings in the last year, earnings in the lowest year will determine the value of the dropout year provision. We also include the number of years in the 35-year earning history with earnings below current earnings.

The results of this exercise are shown in Table 4. We find that the explanatory power on the accrual is much more substantial than on the tax/subsidy rate, which is not surprising since the tax/subsidy rate introduces additional variation simply by normalizing by the wage. Thus, we focus on the accrual in our discussion.

Our overall conclusion is that, while these factors have some ability to explain accrual patterns, the overall explanatory power is small. Factors clearly (potentially) correlated with tastes for retirement such as age, current earnings, and lifetime earnings, even when the former is entered as a series of dummies and the latter as flexible cubic functions, explains less than 25% of the variation in accruals. Even if we include a full set of interactions of these cubic functions of earnings and AIME, we only explain 27% of the variation. Adding marital status, age difference with spouse, spouse's earnings, and the low earnings year explains only another 2% of variation. Thus there appears to be a substantial amount of variation in the accrual that is not explained by factors that would plausibly otherwise be correlated with retirement.

Part IV: Peak Value Calculations

Motivation

The results thus far have focused on one year accruals of SSW and the associated tax/subsidy rates on an additional year of work. As noted above, a key insight of Stock and Wise (1988) in the private pension context is that one-year forward measures of this type may be misleading if there are substantial incentives or disincentives for retirement in future years. This was a natural concern in the context of private pensions, which often have dramatic and explicit retirement incentives at certain ages, such as the plan's early and normal retirement age. But is this an important issue in the context of Social Security?

In fact, the critical importance of considering the entire future path of incentives is illustrated in Figure 3. This figure shows the most common patterns of after-tax SSW evolution (including payroll taxes paid for additional work) across our sample. In each figure, we graph for a group of workers the pattern of SSW evolution over all future years; this is done for the full cross-sectional sample, comparable to Table 2, where each worker contributes an observation for up to 14 years. Each observation is then the pattern of SSW from that year forward, based on that year's characteristics. Under each graph is a figure for the percentage of our full cross-sectional sample that is in each case, and the cumulative share across the cases. For example, as shown in panel 1, 1% of the sample has an SSW that is everywhere increasing; while panel 3 shows that 14% of the sample has an SSW that first rises, then falls. In each case, the length of each segment is defined by the median starting and ending age of the segment and the slope of the segment is determined by the median SSW at the beginning and end of the segment.

As these graphs illustrate, substantial non-monotonicities of the type seen for private pensions also exist for Social Security. For 38% of our sample, there is a local maximum that is not a global maximum. The most common pattern in the data (panel 2), which applies to 48% of the sample, is one where after-tax SSW is always declining. However, the second most common pattern (panel 6), which applies to 29% of the sample, is one where after-tax SSW declines from 55-61, rises from 62-64, then falls.

This is a striking finding, because it highlights an important weakness of the accrual measure. For any given year from age 55-61, a typical worker will be lose money on net through the Social Security system by working. But, by working, that worker is also buying an option on the more than fair actuarial adjustment that exists from age 62-64. Incorporating this option, as shown in panel 6, leads to the conclusion that there may overall be net subsidies to work before age 62 for many workers through the Social Security system.

Peak Value

To incorporate this feature into our incentive calculations, we move away from the accrual and tax/subsidy rate to a more forward looking measure of incentives, which we call "peak value." This is the value of continuing to work until the future year when SSW is maximized, or the difference between the expected PDV of SSW at its highest possible value in the future, and the expected PDV of SSW if you retire this year. So this is like the typical accrual concept, except that the individual looks forward to the optimal year, rather than just to next year. If the individual is at an age that is beyond the SSW optimum, then the peak value is the difference between retirement this year and next year, which is exactly the accrual rate. Once again, it is natural to think about this type of concept relative to potential earnings, but here what is relevant is the entire stream of earnings until the optimal SSW is reached. That is, if the optimum is $5000 higher than SSW today and is one year away, then this is a larger subsidy to continued work than if the optimum is higher by the same amount but is five years away. We therefore normalize this peak value by the expected PDV of wages over the period between this year and the year of maximal SSW. So this concept captures the benefits of continuing to work towards the peak SSW year, relative to earnings over that period.

We show our peak value calculations in Table 5. On a pre-tax basis, peak value is $22,426 at age 55 and falls steadily, becoming negative at age 65. For the median worker, post-tax peak value is negative at all ages except for 62-63. However, 30-40% of workers have a positive after-tax peak value at ages 55-61. For these workers, the option value of a more than fair actuarial adjustment after age 62 outweighs payroll tax payments before age 62. As a result, Social Security is actually providing a subsidy to additional work throughout all ages 55-64. This subsidy is rather small relative to earnings; the median after-tax peak value for those with positive values is about $3,000. After age 65, there is a negative return to additional work for the vast majority of workers.

Thus, viewed from a year-to-year perspective, the Social Security system taxes work between ages 55-61 at a modest rate for over 80% of workers; but, viewed from a more forward-looking perspective, there are actually modest subsidies at those ages for 30-40% of workers because workers are buying the option of delaying claiming at a more than actuarially fair rate. Of course, this conclusion is somewhat overstated, for two reasons. First, as noted above, exercising the option to delay claiming does not require additional work, simply delayed claiming. Second, for an individual who was planning to retire and claim at 62 for other reasons, there is no option value from delayed claiming. Thus, whether peak value is the relevant concept for actual retirement decisions at this age is an empirical question, and one which we plan to explore in further work. But the fact remains that this option exists and is not recognized by the accrual concept.

It is worth noting an apparent inconsistency between Table 2 and Table 5. As should be obvious, the peak value at any given age is just the sum of all future accruals to the year when SSW is maximized. Yet, the sum of the benefit accruals from age 55 forward in Table 2 is not equal to the age-55 pre-tax peak value from Table 5. The reason for this apparent inconsistency is simply composition effects; the median individuals at each age and across the two tables are different. There is no clear way to address this in the aggregate, while still representing the median values for our incentive variables of interest.

Instead, we illustrate that this is not a problem at the individual level in Table 6, where we show these concepts for a "typical" individual in our data set, who was age 55 in 1992 and who has roughly the median earnings of his age cohort in our data. For this individual, the sum of the benefit accruals from any given age forward to the peak of SSW (age 66) does equal the pre-tax peak value at that age. That is, at age 55, the peak value after-tax is $19,170, which is the sum of the after tax accruals from age 55 through age 66. Thus, for a "typical" individual, we see that there is no inconsistency across these concepts; it only arises when we try to compare sample medians across the concepts.

Heterogeneity

As with after-tax accruals, there is a substantial amount of heterogeneity in after-tax peak values, as illustrated in Table 7. At age 62, for example, the median after-tax peak value is $274. However, at that age 48% of the sample has peak values that are less than zero, the 90th percentile value is $6,299, and the standard deviation is $7,852, nearly 30 times the median.

The variation in peak values is more readily explained by the other factors that might naturally be included in a retirement model, as is shown in Table 8. For the after-tax peak value, including flexible functions of age, earnings, and AIME can explain about half of the variation; adding marital status, spousal characteristics, and lowest earnings year can explain another 3%. Still, a substantial share of the variation in peak value remains unexplained, suggesting that there is useful identifying variation available for inclusion in a retirement model.

Incorporating Private Pensions

We can also incorporate private pension incentives into our analysis. The HRS collected detailed pension determination information from employers for roughly 60% of the individuals with pensions in the sample.[17] They then used this information to create a pension benefits calculator that is comparable to the PIA simulation model we developed for Social Security. We use these calculated pension benefits at each retirement age to create an analogous set of retirement incentive variables which include pensions.

[17] Conversations with HRS staff indicate that HRS did not attempt to collect pension information for people in firms with under 100 employees and that the non-response rate among employers they did contact was about 30%.

The results of doing this for both of our incentive concepts (accrual and peak value) are presented in Table 9. The patterns of incentives by age for the median worker are very similar to those shown in Tables 2 and 5. This should not be surprising, as only 40% of our sample has pensions. Annual accruals are roughly $700 larger at ages 55-64 when pensions are included. The median tax/subsidy rate with pensions is roughly 2-3 percentage points lower at ages 55-64 than the median tax rate without pensions, and is similar at ages 65-69. With the inclusion of pension, the after-tax peak value is now often positive for the median person at ages 55-64.

Table 10 shows the impact of including pensions on the distribution of the incentive measures. There is a substantial increase in the variation for all measures, particularly at ages 55-61. For example, at age 60, the ratio of the standard deviation to the median is close to one for the tax rate in the no pensions case, but is above three in the with pensions case. For the peak value measures, there are similarly large increases in heterogeneity, particularly at younger ages. Thus, adding pensions to the analysis does not dramatically change the incentives at the median, but does add substantial variation to the distribution of incentives.

Part V: Conclusions

The substantial time series decline in older male labor force participation, as well as the striking correlation between the labor force departure rates of older workers and the early and normal retirement ages for Social Security, has motivated an enormous body of literature on how the Social Security program affects retirement. Yet, there has been little recognition of a fundamental mystery in the relationship between Social Security incentives and retirement behavior: there is no evidence of a substantial disincentive to continued work at age 62, despite the enormous increase in labor force exit at that age. This point was highlighted by Diamond and Gruber (1998), but this was based on a typical (simulated) individual.

In this paper, we have expanded on the earlier analysis in four ways. First, we have considered the impact of SS retirement incentives in real data, the HRS. We confirm in these data that there is fact no tax on work at ages 62-64 at the median, further heightening the disconnect between observed retirement patterns and the pattern of SS retirement incentives. Second, however, we have shown that there is a substantial amount of heterogeneity in these incentives across our sample, and that (for example) there is a net tax on work at age 62 for about one-half of our sample. This would be more consistent with a "spike" in the hazard rate at that age, if it is those individuals being taxed who are responding by retiring. We also show that factors that otherwise might be expected to naturally impact retirement decisions can explain only a small share of the variation in accruals, suggesting that these are fruitful regressors for explaining retirement decisions.

Third, we have suggested the focus on next-year measures such as accruals and tax/subsidy rates might be misleading, particularly at ages 55-61, because they ignore the option value of reaching age 62 and taking advantage of a (for many workers) more than fair actuarial adjustment. Thus, we also have considered a "peak value" concept which compares wealth accruals not between this year and next, but instead between this year and the year in which SSW reaches its peak. We find that using peak values instead of accruals leads to very similar results at the median after age 62, but to subsidies to work rather than taxes at ages 55-61 for a large share of the sample. Finally, we incorporate private pensions into our analysis; we find that the addition of pensions increases the return to additional work modestly at the median and substantially increases heterogeneity in the measures.

Our findings have two important implications for future empirical work on Social Security and retirement. First, our results suggest that if researchers are careful to condition on the determinants of both retirement and SS incentive measures, there is sufficient remaining variation to hopefully identify the impact of these measures on retirement decisions. Second, our results suggest that, even in a Social Security-only context, it is important to consider forward-looking measures of the type pioneered by Stock and Wise (1990a, 1990b). In preliminary work on retirement decisions (Coile and Gruber, 1999), we have found that these forward looking measures are indeed an important determinant of retirement behavior, while there is a much weaker relationship between retirement and accruals.

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Appendix

In this appendix, we provide the formula for the computation of SS wealth.

Notation:

t = year of observation

R = year of retirement

T = last year either spouse could be alive (max age is 120)

$pr_{h,s|t}$ = probability husband is alive at time s conditional on being alive at time t

$pr_{w,s|t}$ = probability wife is alive at time s conditional on being alive at time t

d = real discount rate (.03 in base case)

$age62_{h,s}$ = indicator variable equal to 1 if husband is age 62 or over at time s

$age62_{w,s}$ = indicator variable equal to 1 if wife is age 62 or over at time s

$age60_{h,s}$ = indicator variable equal to 1 if husband is age 60 or over at time s

$age60_{w,s}$ = indicator variable equal to 1 if wife is age 60 or over at time s

$rwb_{h,s}$ = retired worker benefit of husband if husband retires at time s

$rwb_{w,62}$ = retired worker benefit of wife if wife retires at age 62

$dsb_{h,62}$ = dependent spouse benefit of husband if wife retires at age 62

$dsb_{w,s}$ = dependent spouse benefit of wife if husband retires at time s

$svb_{h,s}$ = survivor benefit of husband if wife dies at time s

$svb_{w,s}$ = survivor benefit of wife if husband dies at time s

s, k = simple counting variables

Formula:

$$SSW_t(R) = \sum_{s=t}^{R-1} (1+d)^{-(s-t)} [pr_{h,s|t} * pr_{w,s|t} * age62_{w,s} * rwb_{w,62}$$

$$+(1-pr_{h,s|t}) * pr_{w,s|t} * age62_{w,s} * \max(rwb_{w,62}, \sum_{k=t}^{s-1} \frac{pr_{h,k|t} - pr_{h,(k+1)|t}}{pr_{h,t|t} - pr_{h,s|t}} svb_{w,k})]$$

$$+\sum_{s=R}^{T} (1+d)^{-(s-t)} [pr_{h,s|t} * pr_{w,s|t} * (age62_{h,s} * (rwb_{h,R} + age62_{w,s} * \max(0, dsb_{h,62} - rwb_{h,R}))$$

$$+age62_{w,s} * (rwb_{w,62} + age62_{h,s} * \max(0, dsb_{w,R} - rwb_{w,62})))$$

$$+pr_{h,s|t} * (1-pr_{w,s|t}) * age62_{h,s} * \max(rwb_{h,R}, \sum_{k=t}^{s-1} \frac{pr_{w,k|t} - pr_{w,(k+1)|t}}{pr_{w,t|t} - pr_{w,s|t}} svb_{h,k})$$

$$+(1-pr_{h,s|t}) * pr_{w,s|t} * age62_{w,s} * \max(rwb_{w,62}, \sum_{k=t}^{s-1} \frac{pr_{h,k|t} - pr_{h,(k+1)|t}}{pr_{h,t|t} - pr_{h,s|t}} svb_{w,k})]$$

Notes:

1. An important assumption built into the calculation is that the spouse retires at age 62.

2. The benefit variables (rwb, dsb, and svb) are adjusted appropriately for actuarial adjustment or delayed retirement credit. The adjustment depends on R, the birth year of each spouse (since SS rules differ by birth cohort), and age difference between the spouses. Where an individual first claims retired worker benefits and later tops them up to the level of the dependent spouse benefit, the appropriate actuarial adjustment is applied to each part of the total benefit.

3. Claiming is assumed to occur at first eligibility (the age of retirement or age 62, whichever is later). For simplicity, survivor benefits are assumed to be claimed no earlier than age 62, though individuals are allowed to claim them at age 60, or earlier if there are dependent children.

4. The calculations including pensions are analogous, except that pension receipt commences as soon as the individual retires (not at age 62).

Table 1:
Sample for Analysis

Category	Number of Obs		Obs Lost	
	Obs	**Person-Year Obs**	**Obs**	**Person-Year Obs**
Men in HRS, ages 55-69, 1980-1997	6,173	40,614	--	--
Drop if born pre-1922	6,052	39,658	121	956
Drop if missing earnings history	4,305	29,110	1,747	10,548
Drop if not working	3,445	20,059	860	9,051
Drop if missing spouse earnings history	3,231	18,903	214	1,156
Drop if re-enter labor force	3,231	**17,547**	--	1,356

Notes:
(1) Obs is the number of persons for which we have data in the HRS.
(2) Person-year obs is the number of person-year observations for which we have data.
(3) Each row in the first two columns shows the number of observations after the exclusion labelled in that row. Each row in the second two columns shows the number of observations lost through the exclusion labelled in that row.

Table 2:
Accrual and Tax Rate, Medians by Age

Age	Obs	SSW	Benefit Accrual	After-Tax Accrual	Tax Rate	Diamond/ Gruber Tax Rate
55	2,811	154,928	2,277	-933	0.047	-0.022
56	2,746	157,205	2,136	-1,136	0.052	0.046
57	2,444	159,341	1,958	-1,314	0.057	0.060
58	2,131	161,299	1,791	-1,517	0.061	0.069
59	1,822	163,090	1,687	-1,781	0.067	0.072
60	1,547	164,777	1,563	-1,848	0.073	0.071
61	1,252	166,340	1,643	-1,848	0.073	0.064
62	1,010	167,983	3,855	-48	0.002	-0.028
63	688	171,838	4,019	46	-0.001	-0.005
64	443	175,857	2,849	-843	0.027	0.031
65	313	178,706	-902	-4,831	0.145	0.188
66	159	177,804	-2,074	-5,833	0.176	0.225
67	91	175,730	-2,908	-6,418	0.249	0.269
68	57	172,822	-4,190	-6,989	0.334	0.439
69	33	168,632	-4,043	-7,138	0.252	0.455

Notes:
(1) Each row reflects the incentives workers face for continued work that year (e.g., the age 55 row is the incentive to delay retirement until age 56).
(2) SSW is the NPDV of Social Security Wealth at the beginning of the year.
(3) Benefit accrual is the change in SSW that results from working that year.
(4) After-tax accrual is the benefit accrual net of SS taxes paid during the year.
(5) Tax rate is the negative of the after-tax accrual divided by annual earnings.
(6) Diamond-Gruber tax rate replicates results from Table 1 in Diamond and Gruber (1999).

Table 3:
Heterogeneity in Accrual and Tax Rate

Age	After-Tax Accrual			Tax Rate			% With
	10th%	90th%	Std. Dev.	10th%	90th%	Std. Dev.	Tax < 0
55	-3,977	92	2,553	-0.003	0.090	0.059	0.175
56	-4,100	154	3,416	-0.006	0.093	0.073	0.176
57	-4,205	178	3,492	-0.008	0.098	0.081	0.152
58	-4,342	212	2,778	-0.010	0.103	0.069	0.144
59	-4,476	212	3,458	-0.012	0.109	0.076	0.135
60	-4,478	272	4,005	-0.014	0.116	0.073	0.140
61	-4,365	340	4,971	-0.017	0.113	0.076	0.150
62	-1,592	2,291	2,945	-0.139	0.068	0.178	0.493
63	-1,657	2,490	2,888	-0.156	0.089	0.172	0.515
64	-2,497	1,628	1,985	-0.110	0.117	0.161	0.336
65	-7,462	-882	4,196	0.044	0.556	0.268	0.058
66	-8,365	-1,591	3,073	0.093	0.771	0.290	0.050
67	-8,627	-1,321	11,069	0.117	1.000	0.386	0.055
68	-9,391	-2,010	3,397	0.117	1.000	0.351	0.053
69	-9,878	-278	3,630	0.117	1.000	0.360	0.061

Notes:
(1) This table shows the 10th and 90th percentiles and the standard deviation of the distribution of after-tax accruals and tax rates, as well as (in the last column) the percent of the sample with negative tax rates.
(2) For a description of the incentive variables, see notes to Table 2.

Table 4:
Variance Decomposition, Accrual and Tax Rate

Variable	**After-Tax Accrual**		**Tax Rate**	
	R-squared of Variable	**Cumulative R-squared**	**R-squared of Variable**	**Cumulative R-squared**
Age dummies	0.062	--	0.044	--
Earnings	0.087	0.155	0.000	0.045
Earnings quartic	0.092	0.158	0.000	0.045
AIME	0.156	0.230	0.012	0.059
AIME quartic	0.171	0.238	0.015	0.064
Earn*AIME quartic	0.198	0.266	0.039	0.081
Married, agediff	0.002	0.270	0.001	0.082
Spouse earn*AIME^4	0.169	0.280	0.033	0.110
Low earn year	0.074	0.284	0.010	0.110

Notes:
(1) The second and fourth columns of the table show the R-squared from regressions of the after-tax accrual or tax rate on the variable in the first column; the third and fifth column show the cumulative R-squared from including that variable and all previous variables in the regression.
(2) Low earn year includes earning in lowest year and number of years with earnings below current years.
(3) For a description of the incentive variables, see notes to Table 2.

Table 5:
Peak Value, Medians by Age

Age	Obs	SSW	Peak Value Pre-Tax	Peak Value After-Tax	% with After-Tax PV>0
55	2,811	154,928	22,426	-820	0.307
56	2,746	157,205	20,477	-1,018	0.292
57	2,444	159,341	18,339	-1,213	0.275
58	2,131	161,299	16,395	-1,399	0.282
59	1,822	163,090	15,228	-1,675	0.288
60	1,547	164,777	13,500	-1,701	0.326
61	1,252	166,340	12,245	-1,694	0.380
62	1,010	167,983	10,812	192	0.525
63	688	171,838	7,652	170	0.538
64	443	175,857	3,280	-758	0.359
65	313	178,706	-864	-4,808	0.077
66	159	177,804	-1,984	-5,799	0.069
67	91	175,730	-2,908	-6,418	0.066
68	57	172,822	-4,190	-6,989	0.053
69	33	168,632	-4,043	-7,138	0.061

Notes:
(1) Peak value is the change in SSW that results from working to the age at which SSW is maximized (if peak has passed, PV is the after-tax accrual).
(2) PV pre-tax excludes SS payroll taxes, PV after-tax is net of taxes.

Table 6:
Accrual and Peak Value for Sample Observation

Age	Benefit Accrual	After-Tax Accrual	Tax Rate	Peak Value Pre-Tax	Peak Value After-Tax
55	2,120	-1,388	0.046	19,170	-1,388
56	2,093	-1,218	0.041	17,050	-1,218
57	2,029	-1,159	0.039	14,957	-1,159
58	1,730	-1,360	0.046	12,928	-1,360
59	1,018	-1,996	0.066	11,198	-1,996
60	674	-2,287	0.074	10,180	-2,287
61	781	-2,077	0.066	9,505	-2,077
62	2,863	110	-0.003	8,725	274
63	2,817	164	-0.005	5,862	164
64	1,747	-804	0.025	3,045	-804
65	999	-1,451	0.045	1,297	-1,451
66	298	-2,052	0.063	298	-2,052
67	-368	-2,621	0.080	-368	-2,621
68	-960	-3,116	0.094	-960	-3,116
69	-1,480	-3,540	0.112	-1,480	-3,540

Notes:
(1) Table shows the incentives for one sample observation.
(2) For a description of the incentive variables, see notes to Tables 2 and 5.

Table 7:
Heterogeneity in Peak Value

Age	Peak Value After-Tax			% With
	10th%	90th%	Std. Dev.	PV>0
55	-3,936	3,441	8,027	0.307
56	-4,081	4,095	8,384	0.292
57	-4,171	4,808	8,019	0.275
58	-4,310	5,221	8,260	0.282
59	-4,443	5,587	8,803	0.288
60	-4,441	6,589	9,435	0.326
61	-4,338	6,690	9,400	0.380
62	-1,515	6,299	7,852	0.525
63	-1,484	4,628	7,527	0.538
64	-2,428	2,023	5,684	0.359
65	-7,462	-215	7,943	0.077
66	-8,365	-994	10,680	0.069
67	-8,627	-1,200	12,274	0.066
68	-9,391	-2,010	3,849	0.053
69	-9,878	-278	3,630	0.061

Notes:
(1) For a description of the incentive variables, see notes to Table 5.

Table 8:
Variance Decomposition, Peak Value

Variable	Peak Value After-Tax	
	R-squared of Variable	Cumulative R-squared
Full Sample		
Age dummies	0.014	--
Earnings	0.024	0.040
Earnings quartic	0.025	0.041
AIME	0.254	0.318
AIME quartic	0.297	0.350
Earn*AIME quartic	0.473	0.491
Married, agediff	0.006	0.497
Spouse earn*AIME^4	0.162	0.518
Low earn year	0.100	0.521

Notes:
(1) See notes to Table 4 for description of table layout.
(2) Low earn year includes earning in lowest year and number of years with earnings below current earnings.
(3) For a description of the incentive variables, see notes to Table 5.

Table 9:
Peak Value Including Pensions, Medians by Age

Age	Obs	SSW	Accrual After-Tax	Tax Rate	Peak Value Pre-Tax	Peak Value After-Tax
55	2,811	183,138	-342	0.019	28,417	326
56	2,746	185,767	-381	0.018	25,843	197
57	2,444	188,380	-540	0.032	23,120	-61
58	2,131	190,675	-649	0.040	20,524	-18
59	1,822	192,781	-857	0.047	18,757	-90
60	1,547	194,637	-956	0.051	16,518	329
61	1,252	196,384	-1,003	0.053	14,341	1,143
62	1,010	198,149	672	-0.030	11,431	1,857
63	688	202,891	662	-0.025	7,949	863
64	443	208,312	-381	0.014	3,382	-172
65	313	212,733	-4,237	0.145	-774	-4,179
66	159	211,980	-5,384	0.189	-1,984	-5,369
67	91	210,024	-6,201	0.246	-3,538	-6,137
68	57	207,164	-6,916	0.344	-4,330	-6,916
69	33	203,236	-7,138	0.278	-4,452	-7,138

Notes:
(1) For a description of the incentive variables, see notes to Tables 2 and 5. These results differ through the inclusion of pension incentives as well as Social Security program incentives.

Table 10:
Heterogeneity in Peak Value and Accrual, Including Pensions

Age	Accrual After-Tax			Tax Rate			% With	Peak Value After-Tax			% With
	10th%	90th%	Std. Dev.	10th%	90th%	Std. Dev.	Tax<0	10th%	90th%	Std. Dev.	PV<0
55	-3,700	6,213	12,980	-0.177	0.091	0.195	0.366	-3,511	73,702	63,294	0.454
56	-3,701	6,914	10,779	-0.191	0.093	0.181	0.381	-3,570	69,620	57,529	0.476
57	-3,954	6,506	11,202	-0.185	0.100	0.186	0.340	-3,739	58,252	50,959	0.505
58	-4,158	6,517	9,477	-0.182	0.109	0.194	0.334	-3,973	50,340	38,199	0.501
59	-4,436	6,054	11,703	-0.171	0.117	0.189	0.323	-4,251	41,994	34,032	0.504
60	-4,410	5,021	9,189	-0.147	0.117	0.177	0.312	-4,245	34,273	29,530	0.483
61	-4,373	5,339	9,833	-0.149	0.117	0.166	0.322	-4,210	30,574	27,320	0.446
62	-1,677	6,512	7,269	-0.283	0.081	0.216	0.615	-1,495	24,078	21,155	0.347
63	-2,085	5,669	7,410	-0.272	0.106	0.214	0.606	-1,815	17,647	19,821	0.362
64	-2,637	4,540	7,662	-0.188	0.123	0.211	0.447	-2,535	8,479	16,403	0.517
65	-7,762	657	9,306	-0.028	0.556	0.304	0.121	-7,702	1,949	14,390	0.853
66	-9,392	11	5,459	-0.003	0.771	0.308	0.101	-9,392	987	13,680	0.874
67	-9,039	358	11,588	-0.015	1.000	0.403	0.121	-9,039	1,590	14,935	0.857
68	-10,830	-485	11,266	0.067	1.000	0.396	0.053	-10,830	-485	11,267	0.947
69	-10,370	-278	4,407	0.109	1.000	0.358	0.061	-10,370	-278	4,407	0.939

Notes:
(1) For a description of the incentive variables, see notes to Tables 2 and 5. These results differ through the inclusion of pension incentives as well as Social Security program incentives.

Figure 1: Historical Trends in LFP of Older Men

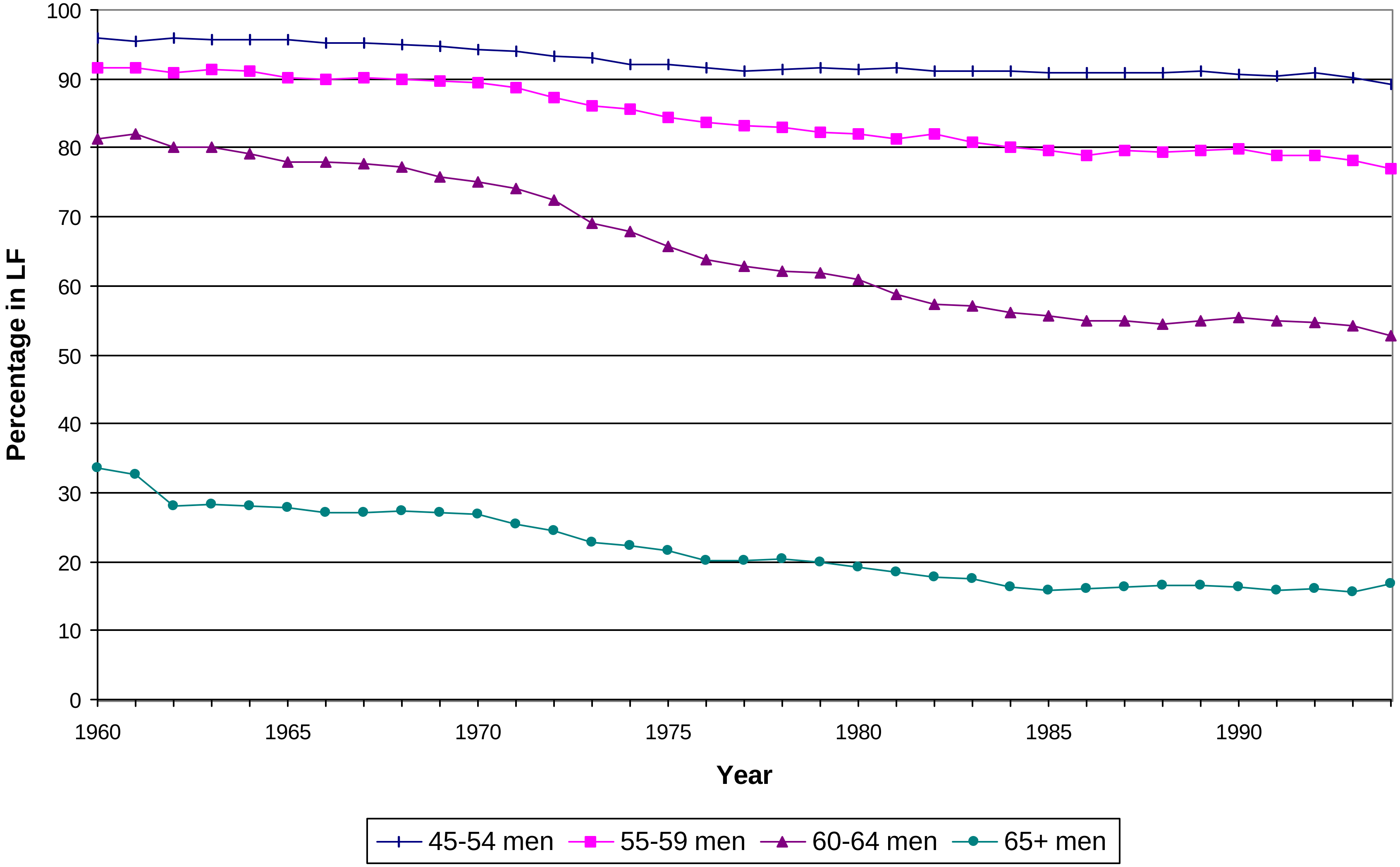


Figure 2: Historical Trends in LFP of Older Women

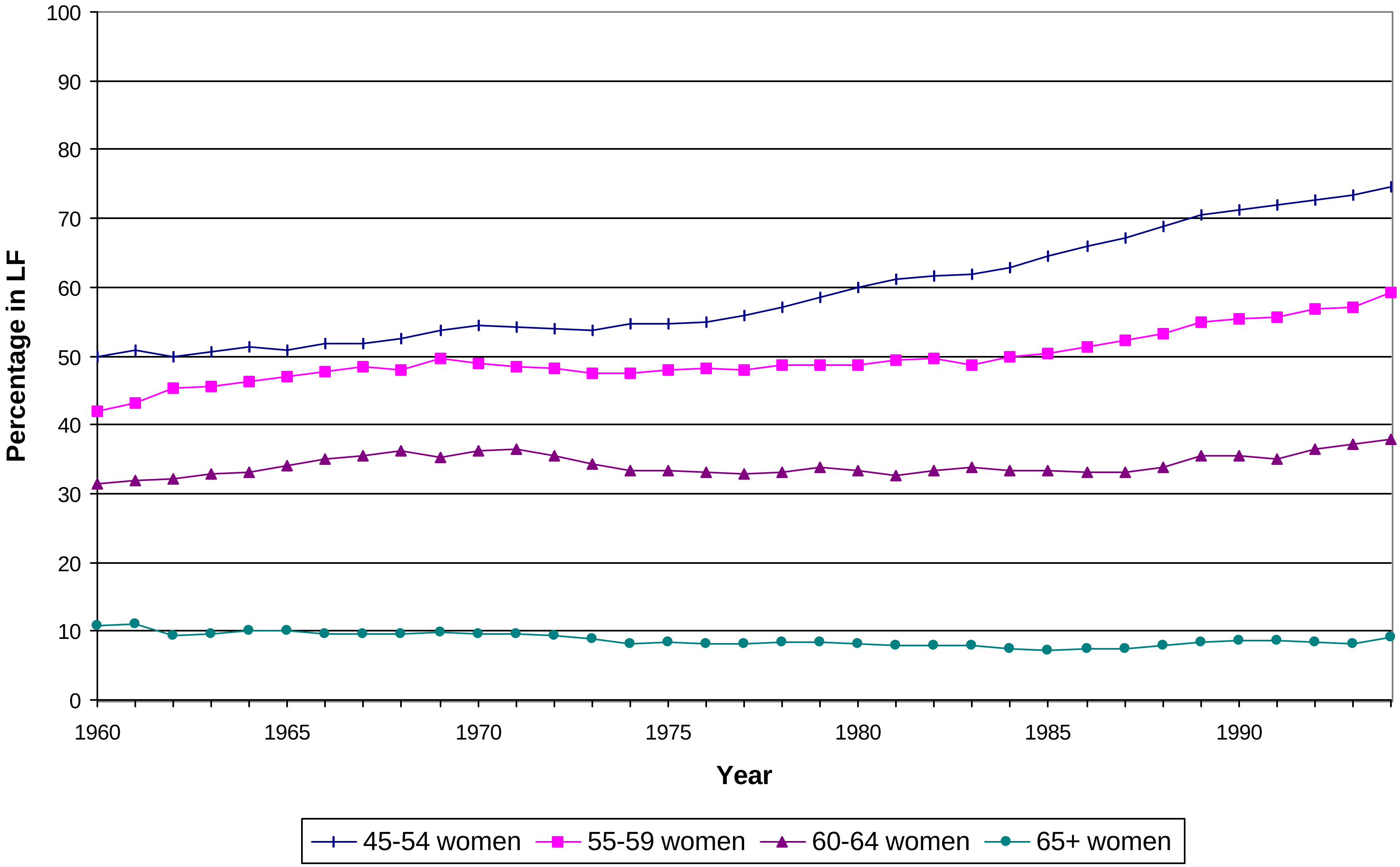
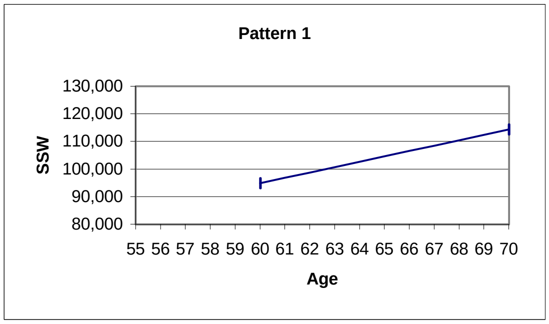
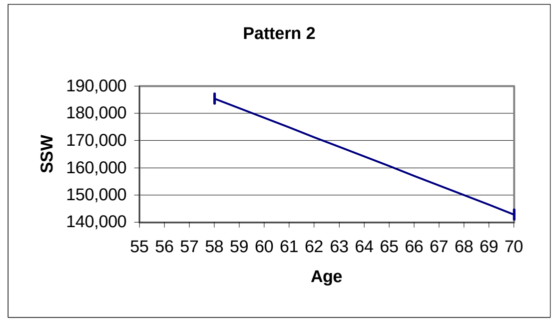


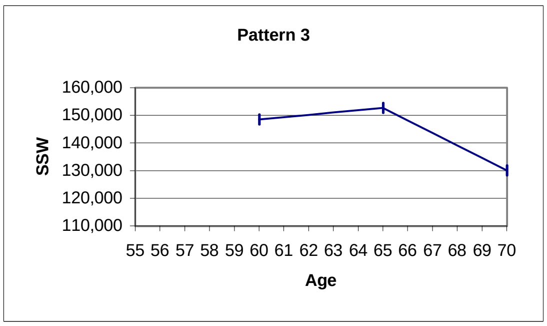
Figure 3: After-Tax SSW Patterns



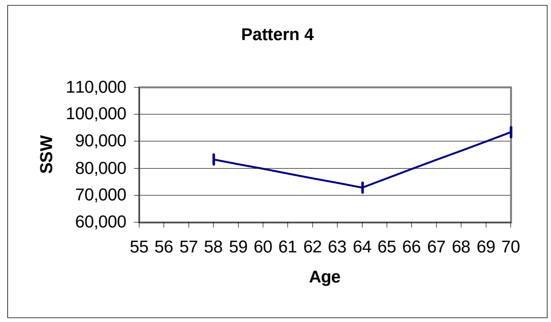
Percent=1.0, Cumulative Percent=1.0



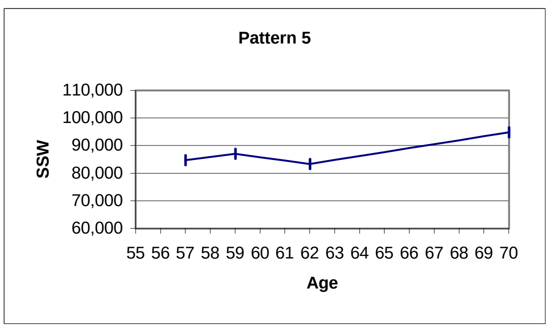
Percent=47.7, Cumulative Percent=48.7



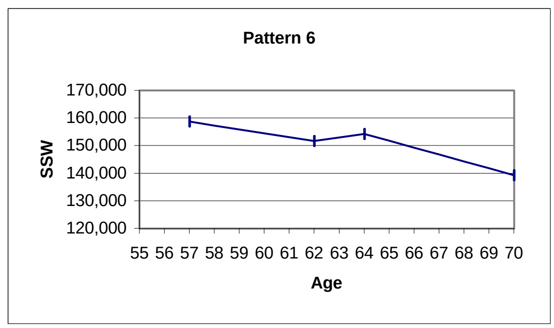
Percent=13.6, Cumulative Percent=62.3



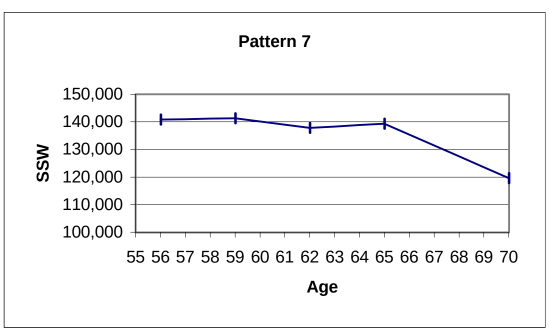
Percent=1.8, Cumulative Percent=64.1



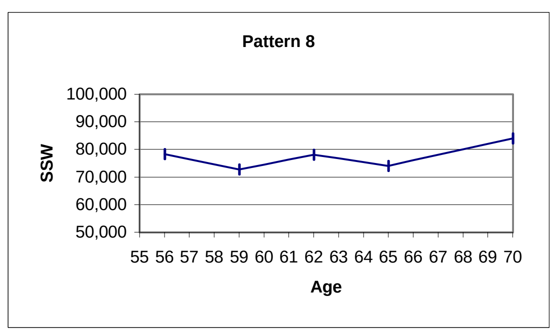
Percent=0.2, Cumulative Percent=64.3



Percent=29.0, Cumulative Percent=93.3



Percent=4.1, Cumulative Percent=97.4



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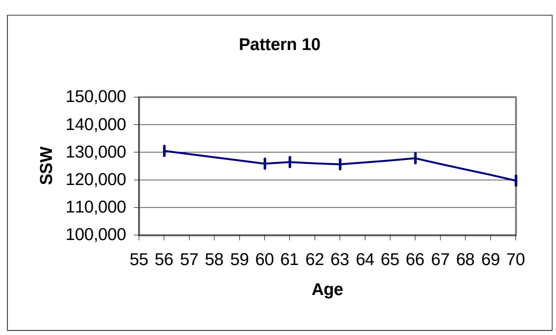

Percent=2.0, Cumulative Percent=99.7