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**Abstract**

Encouraging work at older ages is a critical policy goal for an aging society, but many features of the current system of benefits and taxes provide strong work disincentives. The implicit tax rate on work increases rapidly at older ages, approaching 50 percent for some workers by age 70. In addition, by age 65 people can typically receive nearly as much in retirement as they can by working. If older Americans could overcome these barriers and delay retirement, they could substantially improve their economic well-being at older ages. For example, many people could increase their annual consumption at older ages by more than 25 percent by simply retiring at age 67 instead of age 62.

## I. INTRODUCTION

One way of relieving the economic pressures created by an aging population would be to encourage workers to delay retirement. As society grows older, there is increasing concern about the ability of workers to pay enough taxes to support future retirees and other government functions. Over the next 50 years, for example, the number of Social Security beneficiaries per 100 workers will rise from 30 to 50, assuming current employment patterns persist (Board of Trustees 2004). By working longer, older Americans could limit the impact of these demographic trends. People who work an extra year produce goods and services that can support their own current consumption and help cover the costs of both retirement programs and other government efforts, while at the same time reducing tax pressures on younger workers to support them in retirement.

Enticing workers to delay retirement depends critically on the individual returns to work at older ages. As work pays more, in terms of current after-tax earnings and increments to future retirement benefits, people become increasingly willing to sacrifice leisure and remain at work to obtain richer consumption opportunities both today and later in retirement. Rising tax rates, however, tend to discourage work, by reducing the share of output that workers take home. Earnings at older ages can be taxed in the traditional way, with payments to the Internal Revenue Service (IRS), or they can be "taxed" through reductions in future Social Security and other retirement benefits. Generous Social Security and employer-provided pension benefits can also discourage work, since many people are reluctant to remain in the labor force if they could receive nearly as much by retiring as by working.

The complex interaction between wages, benefits, and taxes determine how much work pays at older ages. Working an additional year will generally increase future Social Security benefits, for example, but the relationship between work history and Social Security is complex, and sometimes depends on the spouse's employment. Those who have earned much less over their lifetimes than their spouses might not gain any additional Social Security benefits from an additional year of work, because they receive benefits based solely on their spouses' earnings. In addition, many traditional defined benefit (DB) plans penalize those who continue on the job after they qualify for full retirement benefits, reducing the lifetime benefits they receive from the plan. Many workers receive valuable health benefits from their employers, and the loss of these benefits when they retire can provide strong incentives to remain on the job, especially before they qualify for Medicare benefits at age 65. In addition, generous Social Security and private pension benefits can provide some retirees with as much income as they would take home if they were working, in part because Social Security benefits are not generally subject to federal taxes (except for those with high incomes). Workers, on the other hand, must pay income and payroll taxes on most of their earnings, reducing the returns to work.

This paper describes the combined impact of Social Security, typical employee benefits, and the tax system on the financial incentive to work for representative adults ages 55 and older. We construct three alternative measures of work incentives, each of which captures a different dimension of the returns to work. Our first measure is the tax rate on work, broadly defined to include traditional income and payroll taxes as well as changes in future Social Security benefits, employer-provided pension benefits, and health benefits associated with an additional year of employment. We then compute replacement rates, comparing net retirement income at particular

ages with the level of net income people would receive if they remained employed. Our final measure reports the impact of an extra year of work on total retirement wealth, which shows how much additional resources people could accumulate by delaying retirement. We also examine how work incentives vary by sex, Social Security take-up age, savings behavior, pension plan type, education, access to employer-sponsored health insurance and retiree health benefits, health status, and marital status.

## II. SOCIAL SECURITY, TAXES, AND EMPLOYEE BENEFITS

The provisions of Social Security, tax law, and employer benefit policies can exert powerful effects on the decision to work at older ages. The rules are complex, however, and the impact can vary by age, income, and marital status.

### Social Security

Social Security benefits depend in a complex way on one's own past employment and earnings history and one's spouse's earnings history. Individuals qualify for future benefits based on their own earnings once they complete 40 quarters of covered employment. Benefits are calculated in three steps, beginning with the computation of average indexed monthly earnings (AIME) from the highest 35 years of indexed earnings. The second step uses AIME to compute the primary insurance amount (PIA), the monthly benefit payable at the normal retirement age (NRA). The benefit formula is progressive, providing a higher PIA as a share of lifetime earnings for those with low lifetime earnings than for those with high lifetime earnings. The last step computes the actual Social Security benefit by applying actuarial adjustment factors to the PIA depending on the age of benefit take-up. Social Security reduces payments for those who collect benefits before the NRA and increases benefits for those who do not begin collecting until after the NRA, because those who retire late receive fewer monthly payments than they otherwise would have received.[1]

Social Security also pays auxiliary benefits to eligible spouses, divorced spouses, and survivors of retired workers, based on the (ex-)spouse's earnings. Divorced spouses qualify for benefits only if their marriages lasted for at least 10 years. Unless reduced for early retirement, benefits paid to current and divorced spouses equal one-half of PIA and benefits paid to survivors equal the deceased spouse's full PIA. Recipients of auxiliary benefits who also qualify for benefits based on their own employment are known as dually entitled beneficiaries. Their auxiliary benefits are reduced by the amount of benefits they receive as retired workers.

The impact of an additional year of work on future Social Security benefits depends on one's own earnings history, the spouse's earnings history, and the age one chooses to begin

[1] Social Security reduces benefits by 5/9 of 1 percent for each month that benefits are received before the NRA, up to 36 months. The benefit is further reduced by 5/12 of 1 percent for every month before the NRA in excess of 36. Benefits are increased by ¾ of 1 percent for each month that initial take-up exceeds the NRA, up to age 70. No credit is given for delaying initial take-up beyond age 70.

collecting benefits. Because AIME is based on a worker's highest 35 years of earnings, working an extra year will not raise future Social Security benefits unless current earnings exceed adjusted earnings in the least remunerative of the 35 years already used in the computation. In addition, those with substantially lower lifetime earnings than their spouses receive benefits based on their partners' earnings history, and gain no additional Social Security benefits from work.

Delaying benefit take-up increases the size of the monthly Social Security check for beneficiaries, up to age 70. Table 1 shows the effects of early and delayed Social Security take-up on benefits for a worker born in 1950, who faces an NRA of 66. If she claims Social Security benefits at age 62, the earliest age possible, her payments would amount to only 75 percent of her PIA. But she would receive 132 percent of her PIA if she delayed claiming benefits until age 70. (Delaying take-up beyond age 70 does not lead to any additional increases in benefits, however.) Thus, those who postpone collecting benefits until they leave the labor force will raise the value of their monthly benefit checks by working an extra year. But delaying take-up also reduces the number of payments they receive. The optimal age of take-up depends in part on mortality expectations: Those who survive until very advanced ages will gain more from claiming later than those who do not live as long. Recent evidence suggests that many beneficiaries could raise the value of their lifetime Social Security benefits by waiting to claim their benefits (Coile et al. 2002).

**Taxes**

Earnings are subject to both payroll and income taxes. Workers and their employers each pay a flat Social Security tax equal to 6.2 percent of earnings and a flat Medicare tax equal to 1.45 percent of earnings. Earnings above a specified level are exempt from Social Security taxes but not Medicare taxes. The taxable ceiling, which rises each year by the percentage change in the average economy-wide wage, is $87,900 in 2004. Although employers nominally pay half of the payroll tax, most economists believe that they reduce wages below the level they would have paid in the absence of the payroll tax to offset their share of the tax bill. Thus, workers ultimately pay the entire payroll tax themselves.

Workers also pay federal, state and local income tax on their earnings and some of their retirement benefits.[2] The federal income tax is progressive, exempting the first $15,900 of income in 2004 for married couples from taxation. Marginal tax rates in 2004 range from a low of 10 percent, for those with limited incomes, to a top rate of 35 percent for high-income taxpayers. Social Security benefits are generally not subject to the federal income tax, except for high-income beneficiaries, particularly those who continue to work or receive generous pension benefits. If adjusted gross income (AGI) plus tax-exempt interest income and one-half of Social Security benefits ("modified AGI") falls below $25,000 for single taxpayers or $32,000 for couples, beneficiaries pay no federal income taxes on their Social Security. However, up to 50 percent of Social Security income is taxable for single taxpayers with modified AGI between $25,000 and $34,000 (or between $32,000 and $44,000 for couples). Up to 85 percent of Social

[2] Forty-one states and the District of Columbia subject earnings to state income taxes (Tax Policy Center 2003). Many localities, however, do not tax the income of their residents.

Security income is taxable for single taxpayers with modified AGI over $34,000 (or $44,000 for couples). These income thresholds are fixed, and do not grow with wages or prices. As wages and Social Security benefits increase over time with prices and productivity, a growing share of beneficiaries will pay taxes on their Social Security benefits (Committee on Ways and Means 2000).

**Employee Benefits**

Employers typically offer their workers a combination of wages and nonwage benefits. Some nonwage benefits are mandated by law, such as the employer share of the payroll tax that finances Social Security and Medicare benefits. Most, however, are offered voluntarily by employers as part of the overall compensation package. Major nonwage benefits include health insurance coverage and pension plans, both of which can influence the decision to work.

*Health Benefits*

Almost two-thirds of employers offer health insurance benefits to their workers in 2004, at an average per worker monthly cost of about $300 for single coverage (Kaiser Family Foundation and Health Research and Educational Trust 2004). The average cost is higher for older workers, because they tend to use more health services than younger workers. Most employees who choose to participate in employer-sponsored health plans must make explicit contributions to offset part of the cost. The average monthly contribution in 2004 for single coverage reached nearly $50. The share of health insurance costs that workers explicitly pay themselves has little economic relevance, however, because workers implicitly pay the entire cost of their health benefits themselves. Basic economic theory predicts that employers in competitive labor markets pay compensation equal to their workers' productivity, and payments in the form of health benefits and other types of nonwage compensation are exactly offset by lower wages. Although anti-discrimination laws forbid firms from charging older workers higher contributions than younger workers, employers may compensate for the high cost of providing health benefits to older workers by limiting wage growth at older ages.

The most valuable aspect of employer health benefits for workers may be the access to group insurance plans that they provide. Nongroup insurance policies are typically more expensive than group policies. Nongroup plans are generally forced to charge relatively steep premiums to cover their high administrative expenses and the cost of adverse selection, which arises because they tend to attract intensive users of health services. When deciding whether to purchase policies, consumers weigh the benefits of coverage against the cost of insurance premiums. Because those with health problems are likely to use many health services, they stand to gain the most from insurance and thus are most likely to purchase coverage. Those in perfect health, on the other hand, who expect to use few services, stand to gain little, and thus are less likely to purchase coverage. High coverage rates among intensive users drive up costs for insurers and force them to raise premiums, squeezing moderate users out of the nongroup insurance pool. As this cycle continues, the market for nongroup coverage breaks down, narrowing to those with only the most expensive health problems.

One way insurance companies try to avoid this death spiral, as it is sometimes called, is by charging higher premiums to those with pre-existing health problems or denying them coverage altogether.[3] According to a study of the nongroup health insurance market in ten states, insurers often deny coverage for such health problems as rheumatoid arthritis, chronic headaches, kidney stones, angina, heart disease, and stroke (Chollet and Kirk 1998). The group market is especially advantageous to workers with health problems, because it is illegal for employers to deny them coverage or require them to make higher contributions than workers in good health.

Workers with employer health insurance generally forfeit their benefits when they retire, and the loss of access to the group insurance market raises the cost of retiring before age 65. At 65, however, virtually all Americans qualify for Medicare benefits, eliminating the need to obtain primary coverage in the nongroup market. Some beneficiaries obtain private supplemental coverage, often purchasing Medigap policies from insurance companies, to cover the high deductibles and copayments that Medicare charges and some of the services that are not included in Medicare's package of benefits.

Some employers offer retiree health benefits to their workers. These benefits generally allow workers to continue their employer health insurance coverage after they retire until they qualify for Medicare benefits at age 65. Some retiree health plans also supplement Medicare benefits after age 65. Workers with retiree health benefits do not lose access to the group market if they leave the labor force before qualifying for Medicare. Consequently, retiree health benefits reduce incentives to work.

Workers with employer-sponsored health coverage forfeit their Medicare benefits when they remain on the job beyond age 65. Federal law stipulates that employer-sponsored health insurance is the primary payer of medical expenses for active workers ages 65 and older. Medicare becomes secondary coverage, paying only for services not covered by the employer plan that are included in the Medicare benefits package. Because Medicare benefits are less generous than those offered by most employers, having Medicare as a secondary payer does not generally enhance insurance protection. The loss of primary Medicare coverage is an important cost of working beyond age 65.

*Pension Plans*

About one-half of full-time workers also participate in employer-sponsored pension plans (Copeland 2002). There are two general types of pensions: defined contribution (DC) plans and traditional DB plans. In DC plans, which include 401(k) plans and are now the most common type of retirement benefit, employers (and generally employees) make tax-deferred contributions to a retirement account in the participant's name, often specified as a particular share of salary or a given dollar amount. At retirement, workers receive the funds that have accumulated in their accounts, generally as lump-sum distributions (Johnson, Burman, and Kobes 2004), although they can use the proceeds to purchase annuities in the marketplace. Workers who leave the employer before the end of the vesting period, which by law may not exceed six years, forfeit at least some of the employer contributions to their plans. The income from these accounts is

[3] Some states require insurers to provide coverage to all who apply and forbid insurers from charging higher premiums to those with health problems.

taxable upon withdrawal. Workers face tax penalties if they withdraw funds before age 59 and one-half, but the penalties are waived if they receive their benefits as annuities.

Traditional DB plans provide workers with lifetime annuities that begin at retirement and promise benefits that are typically expressed as a multiple of years of service and earnings received near the end of the career (e.g., 1 percent of average salary received during the final three years on the job times the number of years of service). Plan participants cannot collect benefits until reaching the plan's retirement age, which varies across employers. Some plans allow workers to collect reduced benefits at specified early retirement ages. As in DC plans, workers in DB plans who leave the employer before they are fully vested lose at least some of their pension benefits. Income from DB plans is not taxable until it is received in retirement.

The value of future retirement benefits from DC plans generally increases smoothly over time. Future benefits grow each year by the value of employee and employer contributions to the plan and by the investment returns earned on the account balance. As long as market returns are relatively stable and participants and their employers contribute consistently over time, the account balance will increase steadily each year until retirement.

The growth pattern of future benefits is more erratic in DB plans, and can even decline at older ages. Pension wealth — the present discounted value of the stream of future expected benefits — tends to grow slowly in DB plans for young workers, but increases rapidly at older ages once workers approach the plan's retirement age. Pension wealth is minimal at younger ages because junior employees typically earn low wages and have completed only a few years of service. In addition, future benefits are discounted many years into the future. Wealth rises rapidly as workers age and accumulate substantial tenure. An additional year on the job increases traditional pension benefits not only by adding an additional percentage of pay, but also by raising the value of previous benefit accruals by a combination of real wage growth and inflation. This increment is often substantial for workers with lengthy job tenures. Pension wealth also increases as workers approach retirement age and benefits are no longer discounted far into the future.

Workers in traditional DB plans often lose pension wealth if they stay on the job beyond a certain age or seniority level. Growth in promised annual retirement benefits slows at older ages as wage growth declines. Some plans also cap the number of years of service that workers can credit toward their pensions, and others cap the share of pre-retirement earnings that the plan will replace in retirement. In addition, for every year that workers remain on the job past the plan's retirement age, they forego a year of retirement benefits. Pension wealth declines when the increase in annual benefits from an additional year of work is insufficient to offset the loss due to a reduction in the number of pension installments. Traditional DB plans, then, often introduce strong disincentives to work at older ages.

**Previous Literature**

Although numerous studies have examined how our system of taxes and transfers affects work incentives, previous research has not measured the combined impact of Social Security, taxes, and employee benefits on the returns to work at older ages. Gokhale, Kotlikoff, and

Sluchynsky (2002), for example, compare lifetime earnings for a representative two-earner couple to lifetime taxes and the lifetime value of transfer payments they lose because of work, and conclude that workers give up nearly 50 cents in tax payments and foregone transfers for every dollar they earn. The authors do not, however, examine returns to work at older ages, or how returns vary with age. A number of studies have investigated the impact of financial incentives on retirement behavior, especially the role of Social Security and employer-sponsored pension and health plans (Coile and Gruber 2004; Johnson, Davidoff, and Perese 2003; Lumsdaine, Stock, and Wise 1992, 1994; Samwick 1998; Stock and Wise 1990), but they have not focused on how total returns to work change as adults age. Our approach is similar to the analysis of Diamond and Gruber (1999), who compute implicit tax rates and replacement rates for prototypical workers, but they ignore the role of federal income taxes and employer-sponsored pension and health insurance plans, which have important effects on work incentives.

## III. ASSESSING RETURNS TO WORK

We construct three measures to evaluate how much work pays at older ages: the tax rate, the replacement rate, and the retirement wealth that accrues from an additional year of employment. Each measure captures a different dimension of work incentives. Taxes reduce the returns to work by lowering the share of output that workers take home. High replacement rates, which measure net retirement income as a share of the earnings people would have received if they remained employed, also reduce work incentives. Most people will choose leisure over work if they could receive nearly as much income when retired as when employed. But the replacement rate ignores the effect of work on future retirement benefits. An additional year of employment often increases future Social Security and pension benefits, and generates earnings that can finance additional consumption later in retirement. Measuring the impact of work on retirement wealth provides a broader estimate of how much work pays.

### Implicit Tax Rates

We define the tax that workers pay on their earnings as the difference between the amount of compensation employers pay and the total value of wages and nonwage benefits that workers take home. The implicit tax rate T at age *t* can be expressed as

$$(1) \qquad T_t = (C_t - P_t - SS_t + I_t + M_t - H_t)/C_t,$$

where $C_t$ is total compensation at age *t*, $P_t$ is take-home pay at age *t*, $SS_t$ is the marginal accrual in Social Security wealth from working at age *t*, $I_t$ is the marginal accrual at age *t* in lifetime federal income taxes on future Social Security and pension benefits, $M_t$ is the loss in Medicare benefits from working at age *t*, and $H_t$ is the savings from group health insurance at age *t*. Total compensation consists of cash earnings plus the employer's share of payroll taxes, health insurance premiums, and pension contributions. Take-home pay is total compensation less payroll taxes (both the employer and employee shares) and federal income taxes. The ratio of payroll and federal income taxes to total compensation is the standard measure of the tax rate.

We adjust the standard tax rate to account for the impact of changes in Social Security wealth and health insurance costs. The computation reduces the tax by the increase in the present discounted value (PDV) of future Social Security benefits associated with an additional year of work, but raises the tax measure by the PDV of future federal income taxes that will be paid on Social Security and pension benefits. We increase the tax measure for workers with employer health insurance by the value of Medicare benefits lost each year after age 65, because Medicare-eligible workers with employer health benefits must forego Medicare when they remain at work.[4] Finally, workers with employer health insurance coverage can obtain less expensive health benefits than those who are forced to turn to the costly and inefficient nongroup market. We reduce taxes for workers with employer health benefits by the value of the savings generated by access to the group insurance market. We view the increments to Social Security wealth, the loss of Medicare benefits, and the savings from access to group insurance as taxes (either positive or negative) because they alter net compensation without changing the amount paid by the employer.

**Replacement Rates**

The replacement rate at age *t* is set equal to the net income an individual would receive if retired at age *t*, divided by the net income he would receive if he remained at work at age *t*. Net income is the amount of money the individual brings home after taxes and health insurance premium expenses. For workers, it equals cash earnings plus Social Security benefits for those who take up benefits while still at work, less federal income tax payments and the worker's share of payroll taxes and contributions for health and pension benefits. For retirees, it equals Social Security and pension income less the cost of health insurance and federal income taxes. The replacement rate calculation is shown in equation 2:

$$(2) \qquad RR_t = NR_t/NW_t$$

where $RR_t$ is the replacement rate at age *t*, $NR_t$ is retirement income at age *t* after taxes and health insurance expenses, and $NW_t$ is income when employed at age *t*, minus taxes and health insurance expenses plus any Social Security benefits received.

**Retirement Wealth**

Our final measure is retirement wealth. As shown in equation 3, we define total wealth TW as the sum of Social Security wealth SW, pension wealth PW, after-tax earnings wealth EW, and the net value H of employer health benefits, less future income taxes T paid in retirement:

$$(3) \qquad TW_t = SW_t+PW_t+EW_t+H_t-T_t$$

We compute wealth at different possible values of the retirement age *t*. Each component of total wealth is measured as the PDV of the expected future stream of benefits or payments from age 55 until death, and then discounted to age 65. The value of employer health benefits H include

[4] We set M equal to zero for workers younger than 65 and those who lack employer-sponsored health insurance.

the PDV of employer contributions to the health plan and the savings that workers realize from access to the group insurance market, less the value of Medicare benefits lost by working beyond age 65. The computations assume a real interest rate of 2 percent. The measure shows how much an additional year of work would increase the level of resources (from earnings, pensions, Social Security, and health benefits) available to finance consumption after age 54, evaluated at age 65.

We also annuitize the value of retirement wealth, to show how real annual consumption from age 55 onward changes with an additional year of work. We take the level of retirement wealth that accumulates at every retirement age, and divide it by the real annuity factor for age 55. The resulting value of the annuity shows how much could be consumed every year from age 55 until death, if the retiree chose to equalize real annual consumption after age 54.

## IV. PROTOTYPES AND MEASURES

To illustrate work incentives at older ages, we estimate the returns to work for prototypical adults at each age between 55 and 70. We focus on a base case, defined as an unmarried man born in 1950 and thus 55 years old in 2005. He is in good health and subject to average mortality risks for his cohort. He has some post-secondary education but did not complete four years of college. He has worked continuously since age 22, has employer-sponsored health insurance but is not entitled to retiree health benefits, and has participated in a DC plan since age 35. Like others born in 1950, he can first collect full Social Security benefits at age 66 and reduced benefits at age 62. He does not save outside of Social Security or his employer's retirement plan. To examine the sensitivity of our findings, we also compute returns to work for other prototypes, which vary by sex, Social Security take-up age, savings behavior, pension plan type, education (and thus earnings), access to employer-sponsored health insurance and retiree health benefits, health status, and marital status. We report all financial amounts in constant 2004 dollars.

### Earnings and Social Security

Annual earning histories come from the Social Security Administration's Model of Income in the Near Term (MINT4). Earnings are based on the average of nonzero historical and projected earnings between ages 22 and 70 for workers born in 1951 by sex and education (Toder et al 2002).[5]

Based on these earnings, we compute Social Security benefits using a detailed calculator that incorporates the 2002 trustees' assumptions about future price and wage growth. We assume that the benefit take-up age is 62 or the age that our representative worker leaves the

[5] The original MINT4 earnings are for ages 22 through 67. For this analysis, we use MINT4 eamings between ages 22 and 62, and assume that earnings after age 62 increase by 1 percent per year in nominal terms. In the few cases where earnings in MINT4 decline from one age to the next before 62, we smooth earnings growth between the years in which earnings increase.

labor force, whichever comes later, but no later than age 70 (because there is no advantage to waiting past age 70 to claim benefits). An alternative scenario assumes that the worker never delays Social Security take-up beyond age 65. The calculator first establishes benefit eligibility based on personal characteristics such as age, number of covered quarters, disability status, marital status, and length of marriage. For those who qualify, the model computes Social Security benefits – either retired-worker, spouse, divorced spouse, or survivor benefits. The calculator then checks an individual's take-up age against his or her NRA, reducing benefits for those who retire before their NRA and increasing benefits for those who retire later.[6]

**Pension Benefits**

For the base-case worker, the employer contributes 8 percent of earnings each year to the DC plan and the worker contributes nothing. The account balance earns interest at the nominal rate of 5 percent per year. The worker fully vests after five years. He takes a single-life annuity at retirement, but his benefits are not indexed to inflation. We assume that benefits are fully subject to the federal income tax when he retires.[7] In an alternative scenario, we assume that the worker contributes 8 percent of his salary to the DC plan, in addition to the employer contributions. Another scenario considers a worker in a traditional DB plan that pays retirement benefits equal to 1 percent of average salary received during the final three years on the job times years of service. Full benefits are payable beginning at age 62, but participants can collect reduced benefits as young as age 55, as long as they have completed 25 years of service.[8] We assume that the worker joins the firm at age 35. (We examine workers participating in other types of plans in the appendix.)

**Payroll and Federal Income Taxes**

The analysis estimates federal payroll and income tax liabilities using the Urban-Brookings Tax Policy Center's microsimulation model. The model is a detailed tax calculator that captures most features of the federal individual income tax system. It reflects tax law as of July 1, 2004, as enacted through 2015, including the expiration of the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) tax cuts in 2010. For projections in 2016 and later, we hold constant the 2015 tax rates and adjust the brackets as appropriate for expected inflation. Parameters that are not currently indexed for inflation, including the Social Security taxation thresholds, are held at

[6] Our Social Security estimates are based on the assumption that current-law benefits will be payable throughout the projection period. However, the Social Security actuaries project that the program's trust funds will be exhausted by 2042 and that benefits would need to be reduced immediately by 12.4 percent in order for the trust funds to remain solvent (Board of Trustees 2004). Our estimates, then, may overstate future benefits, although leaders of both major political parties have promised to protect the benefits promised to Americans now nearing retirement.

[7] A portion of the benefits would not be taxable if the worker made after-tax contributions to the plan, but most workers contribute only before-tax dollars.

[8] The reduction factor is 4 percent per year.

their 2015 values. We do, however, price index the provisions of the alternative minimum tax (AMT) after 2015, even though these provisions are not currently indexed. Otherwise, many middle-class taxpayers would end up paying the AMT (Burman, Gale, and Rohaly 2003).[9] The analysis excludes state and local taxes.

**Health Insurance Costs**

Employer-sponsored health benefits affect work incentives by increasing total compensation, providing savings to workers who would otherwise purchase expensive nongroup insurance policies, and forcing workers ages 65 and older to give up Medicare benefits. In addition, required contributions for employer-sponsored coverage and premium levels for nongroup insurance, Medicare coverage, and Medigap policies influence the share of earnings that retirement income can replace net of health insurance costs. We estimate health insurance costs for each of our prototypes by combining data from several sources. We assume throughout that private insurance costs increase by 2 percent per year in real terms, and that the growth in Medicare costs follow the assumptions used by the Medicare trustees (Medicare Board of Trustees 2004).

Total compensation includes employer contributions to health benefits, which increase with the age of the worker because older adults are relatively heavy users of health services. We assume that the average contribution by the employers of our prototypical workers total $3,140 in 2004, the average across all employers in a recent survey (Kaiser Family Foundation and Health Research and Educational Trust 2004). We assume that this average amount corresponds to contributions for a worker who is 40 years old, the mean age of the labor force. We increase real costs by 1.4 percent per year of age, the average increment observed in a recent random sample of nongroup policies (Johnson, Moon, and Davidoff 2002). The annual contribution for a 54-year-old worker in 2004, then, would equal $3,815. Employee contributions for health insurance are set equal to $558 in 2004, the average annual value in the Kaiser survey (Kaiser Family Foundation and Health Research and Educational Trust 2004). We assume that all workers pay the same contribution, regardless of age (although contributions do increase over time with the growth in health care spending).

Savings from access to the group market equal the difference between the total cost of employer-sponsored insurance and the price older adults face in the private nongroup market. The total cost of employer coverage is the sum of employer contributions and employee contributions. Premiums in the nongroup market come from a survey of policies collected from an online insurance service (Johnson, Moon, and Davidoff 2002). Nongroup premiums vary by age, health status and tobacco use. Premiums are about twice as high for those with health problems as for those in good health.

[9] Inputs into the tax model include earnings, Social Security benefits, and pension benefits. Other inputs (specifically, interest and dividends, state and local taxes, property taxes, mortgage interest, and capital gains) are imputed from Statistics of Income (SOI) data by age, filing status, and income bracket for our base-case worker at age 55. We hold these imputed values constant in real terms for all workers at every age.

The value of Medicare benefits is set equal to average age-specific Medicare expenditures net of required premiums. Mean cost estimates by age for Medicare Part A (which primarily covers hospital stays) and Part B (which covers outpatient services) were provided by the Medicare actuaries.[10] We subtract the cost of Part B premiums paid by beneficiaries, which totaled $66.60 per month in 2004. We also include the value of Medicare Part D, which will partially cover prescription drug costs beginning in 2006. We value the drug benefits at three times the premiums paid by beneficiaries, which are set to cover 25 percent of program costs. The Medicare Board of Trustees (2004) projects Parts B and D premiums for future years.

Out-of-pocket insurance costs also affect replacement rates. When working, our base-case individual contributes to the cost of his employer-sponsored coverage. When retired, he makes premium payments for private nongroup coverage until he turns 65, and then pays Medicare premiums and purchases a Medigap policy. We set the cost of Medigap coverage equal to $1,433 in 2001, the average annual cost for a comprehensive plan (Chollet 2003).[11]

An alternative scenario focuses on an individual who receives retiree health benefits from his employer. We set contributions for retiree benefits before individuals qualify for Medicare at about $1,350 per year in 2002, the average amount paid for retiree benefits by respondents ages 55 to 64 in the Health and Retirement Study (HRS). Once they qualify for Medicare benefits at age 65, the annual cost drops to about $970 in 2002, again the mean value among covered HRS respondents.

## V. ESTIMATED TAX ON WORK AT OLDER AGES

Before examining how our comprehensive tax rate measure changes with age for our representative worker, we consider how federal income taxes and employee payroll taxes alone relate to earnings at older ages (see table 2). Workers are probably familiar with these taxes, which they regularly see deducted from their paychecks. Column 1 reports taxable earnings, which fall slowly with age in real terms because the steady but modest nominal wage increases experienced by our base-case worker fails to keep pace with inflation. As a result, he earns $12,000 less in real terms at age 70 than at age 55. Column 2 reports employee payroll taxes, set at 7.65 percent of earnings, and column 3 reports federal income taxes. At age 55, our representative worker pays 22.8 percent of his earnings to payroll and federal income taxes (column 6). At age 61 (in 2011), his direct tax rate increases to 23.7 percent, primarily because of the expiration of the tax cuts enacted during the George W. Bush administration. The tax rate then falls slowly as his real earnings decline.

This simple measure of the tax on work, which is the rate that most workers probably perceive themselves, is incomplete, because it ignores employer pension and health benefits, the employer share of the payroll tax, and the impact of continued employment on Social Security and Medicare benefits. Table 3 shows how our broader measure of the implicit tax rate on work

[10] Private communication.

[11] We assume that our representative individual purchases basic plan F, which covers Medicare deductibles and coinsurance but does not include drug benefits. The Medicare Modernization Act of 2003, which added prescription drug coverage to Medicare, forbids private Medigap policies from covering pharmaceutical costs.

changes with age. The table reports total compensation (column 5) and its components, the total tax on work (column 13) and its components, and the implicit tax rate (column 14).

Employer contributions to heath insurance and the pension plan and the employer's share of payroll taxes raise total compensation for our base-case worker. The share of total compensation paid in the form of cash wages falls steadily with age, because employers contribute more in health insurance premiums for older workers than younger workers. At age 55, total compensation exceeds wages by 23 percent, and non-cash compensation is divided fairly evenly between employer payroll taxes, health insurance contributions, and pension contributions. At age 70, by contrast, compensation exceeds wages by 36 percent, with health insurance contributions accounting for more than half of all non-cash compensation. Because of rising health insurance contributions, real total compensation falls more slowly with age than real cash earnings.

Changes in Social Security wealth substantially change the implicit tax rate over time. Through his mid 50s, Social Security wealth for our base-case individual grows rapidly with additional work. Each added year of employment replaces a year of zero earnings in the Social Security formula, substantially increasing future benefits. By age 57, however, our base-case worker — who has worked continuously since age 22 — has accumulated 35 years of covered employment, the maximum number of years in the benefits formula. Each additional year of employment increases future benefits only by the amount that earnings in the current year exceed indexed earnings in the least remunerative year. As a result, the real increment to Social Security wealth from an added year of employment declines from $5,400 at age 56 to $1,900 at age 57. It continues to fall through age 61.

From ages 62 to 69, Social Security raises monthly payments for those who delay claiming benefits, to compensate them for the reduction in the number of lifetime payments they will receive. As a result, our representative individual can generally raise his Social Security wealth by working an additional year at ages 62 to 66.[12] The increases in monthly payments, however, are insufficient to fully compensate single men who delay benefit take-up at ages 67 to 69. Although the actuarial adjustments are designed to be actuarially fair across the entire population, raising monthly payments just enough to offset exactly the reduction in the number of lifetime payments, they are not fair for single men, who have higher mortality rates than women. The loss of Social Security wealth increases the implicit tax rate on work by a few percentage points for single men in their late 60s.[13]

Even while our representative worker is in his mid 50s and Social Security wealth is growing, the increment to wealth falls short of the Social Security portion of his payroll taxes. The worker and his employer each pay 6.2 percent of cash wages to Social Security, amounting

[12] These findings are consistent with Coile et al. (2002), who found that many people can raise the value of lifetime benefits by postponing benefit take-up, even though the adjustments are designed to actuarially neutral.

[13] We assume that everyone takes up benefits by age 70, even if they remain at work, because Social Security does not increase payments for workers who wait that long to claim benefits. In fact, only a very few beneficiaries initially claim benefits at age 70 or later (Toder et al. 2002). Our representative individual would lose nearly $21,000 in Social Security wealth if he did not claim benefits by age 70. When he claims at age 70, he gains $300 in Social Security wealth by working an additional year.

to $6,324 in annual payments when he is 55. (Column 6 in table 3 shows total payroll taxes, including the portion that finances Medicare, not Social Security payroll taxes alone.) These tax payments are nearly $800 more than the increment to his Social Security wealth. At age 69, when he loses more than $4,300 in Social Security wealth by remaining at work, he pays more than $4,900 in annual Social Security taxes.[14]

Future income tax liabilities offset part of any increase in future retirement benefits associated with an additional year of work. As shown in column 9, increments to the PDV of lifetime federal tax liabilities are quite small between ages 55 and 61, because if he stopped working at a relatively young age his annual pension and (future) Social Security income would be modest and thus only lightly taxed. Each additional year of work would raise future retirement income and thus future tax liabilities, because of the progressivity of the tax code. For example, working an additional year at age 66 would raise the PDV of future income taxes by $3,400.

Employer health insurance coverage reduces the implicit tax workers pay before age 65, but raises it once they would otherwise qualify for Medicare coverage. Employer coverage allows workers to avoid the inefficient nongroup insurance market, where coverage is about 20 percent more expensive than in the group market. We estimate that access to the group insurance market saves our base-case worker in good health about $1,000 per year at age 55, reducing the implicit tax rate by 1.7 percentage points. Cost savings rise with age as expected health services use increases, reaching nearly $1,500 per year at age 64. These savings lower the implicit tax rate by 2.7 percentage points. Beginning at age 65, however, employer-sponsored coverage forces the worker to forfeit Medicare benefits. The annual value of these lost benefits amounts to $5,200 at age 65, increasing the implicit tax rate on work by 9.4 percentage points, and rises by age 70 to $7,700, equal to 14.5 percent of total compensation.[15]

The total implicit tax rate grows rapidly with age. At age 55, the implicit tax rate stands at only 14 percent, much less than the 23 percent rate reported in table 2 that most workers probably perceive themselves as paying. The implicit rate is relatively low at age 55 because our worker reaps tax bonuses from his growing Social Security wealth and savings from access to the group insurance market. The implicit tax rate grows to 22 percent by age 60 and to 24 percent by age 64, as the increment to Social Security wealth slows. With the loss of Medicare benefits, the tax rate soars to 39 percent by age 65, and generally increases thereafter, approaching 50 percent at age 70.

High tax rates provide strong disincentives to work at older ages. In combination with declining real wages, rising tax rates on work cut real net compensation for our base-case worker in half between ages 55 and 70. Work still "pays" at age 70: Real net compensation is substantial, and our worker takes home half of what he produces. But it pays much less than it did at younger ages, and many workers likely conclude that it does not pay enough to

[14] These comparisons do not necessarily imply that Social Security is a bad deal for our representative worker, however. Early in his career, the increment in Social Security wealth far exceeds his annual Social Security payroll taxes. Over his lifetime, he could receive more from Social Security than he puts in.

[15] Note that the value of employer health insurance contributions slightly exceeds the loss in Medicare benefits at every age, because the employer plan that our base-case worker receives is somewhat more generous than Medicare.

compensate them for their lost leisure time, especially if they place more value on leisurely pursuits as they grow older.

## VI. REPLACEMENT RATES

Computing replacement rates provides another measure of work incentives at older ages. Those who receive nearly as much income when retired as when employed may prefer to trade the relatively small financial advantage associated with work for the leisure of retirement.

Table 4 reports replacement rates for our base-case worker. Column 6 shows the worker's net income when employed, which equals cash earnings less federal income taxes and the employee share of payroll taxes and health insurance premiums, plus Social Security benefits for those who take up benefits while still at work.[16] Real net income when employed declines slowly with age through age 69 because wage growth at older ages for our representative worker fails to keep pace with inflation. At age 70, the worker receives Social Security benefits, in addition to his earnings, increasing his net income by about $28,000.

Column 11 reports net income when retired, during the first year of retirement. Net retirement income consists of Social Security and employer-sponsored pension benefits, less the cost of health insurance premiums and federal income taxes. We assume that our representative individual purchases a fixed annuity from his DC account balance when he retires. Income from Social Security is zero until he can collect benefits beginning at age 62. Annual health insurance premiums consist of the cost of purchasing comprehensive private nongroup coverage until age 65, and then consist of premiums for Medicare Parts B and D and for private Medigap coverage. The replacement rate (shown in column 12) is the ratio of his net retirement income to his net employment income, both measured at age t.

Before age 62, the replacement rate is low because our base-case individual does not save for retirement on his own, forcing him to rely only on pension income. For example, his income net of taxes and health insurance at age 55 amounts to nearly $39,000 if he is working. If he instead retires at age 55, he receives only $5,530 from his annuitized DC plan assets. He pays no federal income taxes, but he must pay $5,504 for private health insurance coverage, leaving him with only $26 in net retirement income. Because his pension income rises for every year that he delays retirement, he does somewhat better if he waits until age 61 to retire. He receives higher annuity payments because his DC account balance grows (with additional contributions and interest income) and he can annuitize his plan assets over fewer years.

The retirement outlook changes dramatically at age 62, when the worker can first claim Social Security benefits. His net retirement income increases from less than $2,000 at age 61 to almost $18,000 at age 62, raising the replacement rate to 53 percent. The net replacement rate also jumps at age 65, to 83 percent, with the drop in health insurance costs as our representative individual qualifies for Medicare and is able to forego his expensive primary nongroup coverage.

[16] We also subtract employee contributions to the DC plan, but our base-case worker does not contribute.

The net replacement rate increases for our base case every year that he delays retirement through age 69, rising from 53 percent at age 62, to 83 percent at age 65, to 98 percent at age 67, to 116 percent at age 69. (The replacement rate declines to 73 percent at age 70, because our representative individual would receive Social Security benefits even if he remained at work.) Replacement rates in excess of 100 percent may pose serious obstacles to delaying retirement. It is difficult to convince people to continue working if they could receive just as much, or even more, income by retiring. Even those who face replacement rates of 75 percent would likely prefer to retire and enjoy more leisure than remain at work. Not surprisingly, retirement rates spike at ages 62 and 65 (Coile and Gruber 2004), when replacement rates also increase substantially.

## VII. IMPACT OF ADDITIONAL WORK ON RETIREMENT RESOURCES

Although high replacement rates in the initial year of retirement and rising tax rates discourage work at older ages, individuals could substantially increase their financial resources by delaying retirement. Table 5 reports net income at ages 65, 75, and 85, by retirement age. Our representative individual could raise his real annual income at age 75, net of health insurance premiums and federal taxes, by $10,000 by stopping work at age 65 instead of age 55. Delaying retirement another five years, until age 70, would raise annual net income at age 75 by an additional $12,000. Another way of measuring the value of additional work is by comparing old-age income to the net income our representative worker would have received had he worked at age 55. If he stopped working at age 55, he would replace only one-third of his potential age-55 earnings at age 75. This replacement rate would rise to 59 percent if he did not retire until age 65, and to 90 percent if he waited until age 70 to retire.

At any given retirement age, real net income at older ages falls over time, despite the inflation protection built into Social Security. The decline results primarily from rapid increases in Medicare and Medigap premiums, which grow faster than the rate of inflation. Real tax liabilities also rise, as inflation increases the share of Social Security benefits subject to the federal income tax. In addition, the annuity purchased by our representative individual with his DC plan assets does not increase with inflation. Real income in retirement would decline more slowly in our example if we assumed that he had purchased a price-indexed annuity, but these instruments are not very common. These results highlight the short-sightedness of focusing solely on replacement rates in the initial year of retirement, when inflation erodes the value of retirement income over time.

Working an additional year would also significantly raise retirement wealth (see table 6). If our base-case worker leaves the labor force at age 55, his retirement wealth, measured as of age 65 in 2004 dollars, would amount to $348,000. The value of future Social Security benefits would account for about two-thirds of wealth, and his DC plan assets would account for the remaining one-third. Because his annual retirement income would be low, he would incur no federal tax liabilities after he stopped working. If he could spread this wealth evenly over his life from age 55 until death, it would finance annual consumption of $20,700, measured at age 65.

Our representative worker could raise his retirement wealth by $69,000 by working just one more year, primarily through additional after-tax cash earnings. Employer contributions to

health insurance and savings from access to the group insurance market would also raise his wealth, as would increments to future Social Security and pension benefits. This additional wealth would increase consumption possibilities by $4,000 every year from age 55 to death.

Delaying retirement raises wealth at every age, but the incremental effect diminishes as workers grow older. For example, working at age 60 and retiring at age 61 raises wealth by only $53,000, compared with retiring at age 60, and working at age 65 and retiring the next year raises wealth by only $36,000, compared with retiring at age 65. The wealth increment from work drops sharply at age 65, because the loss of Medicare benefits beginning at this age eliminates nearly all of the health insurance advantages of continued employment. Nonetheless, the cumulative impact on retirement wealth from working late into one's 60s is substantial. By waiting until age 70 to retire, for example, our base-case worker would accumulate enough retirement wealth to finance a consumption stream of $64,000 per year from age 55 onward, more than three times as much as he could finance if he retired at age 55.

Figure 1 summarizes the three work incentive measures for our representative individual. The left panel shows the implicit tax rate, the middle panel shows the replacement rate, and the right panel shows net retirement wealth. The implicit tax rate on work increases sharply at older ages, more than tripling between ages 55 and 70, although it does not exceed 50 percent. The sharpest jump in the rate is at 65, an age at which many workers actually retire. The replacement rate rises with each additional year of work, up to age 70, and increases dramatically when Social Security benefits become available at age 62, another common retirement age. The replacement rate first exceeds 100 percent for those who retire at age 68. Rising tax rates and high replacement rates discourage work at older ages, but people can substantially increase their consumption opportunities in later life by delaying retirement. Retirement wealth increases steadily with each additional year of work, although the growth rate diminishes with age.

## VIII. INCENTIVES FOR ALTERNATIVE WORKERS

To test the sensitivity of our estimated work incentives to the characteristics of our base-case worker, we measure the returns to work for typical workers who differ from our base case by sex, Social Security take-up age, private savings, pension type, earnings level, access to retiree and employer-sponsored health insurance, health status, and marital status. Although the particular rates vary, our qualitative findings remain the same in all cases: Tax rates, replacement rates, and retirement wealth all increase with additional work, as described below. (Additional details on the returns to work for these alternative prototypes are reported in the appendix tables.)

### Sex

On average, women live longer than men. At age 55, among adults born in 1950, women are expected to outlive men by about 3.5 years (Bell and Miller 2002).[17] This scenario compares

[17] Gender differences in life expectancies narrow at older ages. At age 85, for example, women can expect to live only 1.5 years more than men (Bell and Miller 2002).

our representative single man with a single woman who is identical in all respects, except for her mortality expectations.

Mortality rates affect Social Security wealth, annual pension income, and annual income taxes paid in retirement. Although the representative man and woman we consider both pay the same payroll taxes and receive the same monthly Social Security benefits, her Social Security wealth is higher than his because of her longer life expectancy. Their pension wealth is identical since both of their employers contribute 8 percent of earnings each year to their DC plans. However, the annuity that each individual purchases with his or her DC plan assets is based on sex-specific survival probabilities. Consequently, the woman receives lower annual pension income (and faces lower income taxes) in retirement than the base-case man.

As shown in figure 2, lower mortality rates raise the returns to work. The gain in Social Security wealth and the decrease in lifetime federal taxes lowers her implicit tax rate by as many as 7 percentage points below the rate faced by the single man. At the same time, her relatively limited pension income reduces her replacement rates a few percentage points below the man's replacement rate. At age 55, her retirement income would not even be high enough to cover her health insurance premiums. Nonetheless, her replacement rate rises to 80 percent at age 65 and 103 percent at age 68, creating strong disincentives to work. Longer life expectancies for women increase net retirement wealth at all ages. At age 55, her net wealth is over $38,000 higher than our representative male worker. By age 70, the gender gap rises to over $63,000. But higher retirement wealth does not translate into better consumption opportunities for women at older ages, because they have to finance more years of consumption than men.

**Social Security Take-Up Age**

As noted earlier, the timing of Social Security benefit take-up affects the size of both current and future benefits, up to age 70. Here we compare our base-case worker who waits to take up Social Security benefits until he stops working (but not later than age 70) with a man and woman who each take up Social Security benefits by age 65, even if they remain at work (see figure 3). As Table 1 showed, claiming at age 65 reduces monthly benefits by 29 percent compared with claiming at age 70. However, the impact on Social Security wealth is more complicated. Although those who claim Social Security benefits at age 65 while they are still working will receive lower annual benefits than those who wait to claim, they will receive more payments over their lifetimes. Claiming benefits by age 65 instead of age 70 also raises income tax liabilities while working, because taxable income includes both earnings and some portion of Social Security benefits. Once early claimants stop working, however, they will pay lower income taxes than those who claim later, because their Social Security benefits will be lower.

Claiming benefits by age 65 instead of by age 70 raises the implicit tax rate on work at ages 65 to 68 for men, because current tax liabilities soar. At ages 69 and 70, however, single employed men can lower their implicit tax rates on work by taking up benefits at age 65. Single men lose thousands of dollars in Social Security wealth if they do not claim benefits at age 69, and 70-year-old workers pay higher taxes if they take-up benefits at age 70 than if they first receive them at age 65, because annual benefit payments are much larger for those who delay.

Single working women are always better off by waiting to claim, up to age 69, instead of taking up benefits at age 65. Because women have longer life expectancies than men, they gain more from the monthly benefit increases that Social Security provides to those who delay claiming beyond the NRA. (On average, across men and women combined, the delayed retirement credit at age 69 may be actuarially fair, increasing monthly payments just enough to offset exactly the reduction in the number of lifetime payments.) At age 70, however, women who wait to claim benefits face higher implicit tax rates on work than those who claim at age 65, because their relatively high benefit payments increase their marginal income tax rates.

Taking up Social Security benefits by age 65 rather than by age 70 substantially reduces replacement rates at ages 65 and later for our representative working man. Take-up at age 65 raises net income when working, because he now receives Social Security benefits in addition to his earnings. Although this additional income raises income tax liabilities, the gain in Social Security benefits more than offsets the increase in income taxes. Benefit take-up at age 65 also lowers the value of annual Social Security payments, reducing net income in retirement. By age 69, the replacement rate for our single man would be 50 percentage points lower if he claimed Social Security benefits at age 65 instead of at age 69.

**Savings Behavior**

Figure 4 shows the impact of private tax-deferred savings on work incentives. Our base-case worker does not accumulate any retirement savings outside of Social Security or his employer-sponsored retirement plan, and he does not make any contributions himself to his DC plan. His pension wealth derives solely from contributions made by his employer. We now consider an alternative scenario in which he contributes 8 percent of his gross earnings to his retirement plan, tax deferred, in addition to his employer's contributions.

The saver faces higher implicit tax rates on work and higher replacement rates in retirement than the base-case nonsaver. His tax-deferred DC plan contributions lower his federal income taxes while he works, but the relatively high pension benefits he receives in retirement raise the tax burden by even more when he stops working. These increased liabilities lower the increment in future Social Security benefits, raising the implicit tax rate on work by as many as 7 percentage points above the rate faced by the nonsaver. The relatively high pension income received by the saver also increases his replacement rates. At age 55, he can replace 15 percent of the net income he would have received by working, up from 0.1 percent for the nonsaver. The saver's replacement rate rises to 97 percent at age 64, and to 158 percent at age 69. At age 70 it falls back to 96 percent. Setting aside assets in tax-deferred savings vehicles increases net retirement wealth at all ages.

**Pension Plan Type**

DB pension plans often lower the returns to work at older ages. Figure 5 shows the annual increment to real pension wealth from an additional year of work for our base-case

worker, who participates in a DC plan, and for an otherwise identical worker who participates in a DB plan. As noted in section IV, the DB plan pays benefits equal to 1 percent of final average salary times years of service. The worker in our example qualifies for full benefits at age 62 and reduced benefits at age 60 (after 25 years of service). Real pension wealth in the DC plan grows steadily over time, increasing more slowly at older ages as real earnings decline. The pattern is much more erratic for the DB plan. The annual increment to DB wealth is about $10,000 when the worker is in his late 50s, and then spikes upward to $30,000 at age 60, when he qualifies for early retirement benefits. The annual wealth increment falls to $2,500 at age 61, and for every year he remains on the job after age 62 he loses about $10,000 in pension wealth.

The implicit tax rate faced by our DB plan participant drops sharply at age 59, as his pension wealth spikes, but then rises above the rate faced by the DC plan participant in later years (see figure 6). From ages 60 to 62, for example, the DB plan participant faces a tax rate of about 30 percent, because his compensation is reduced by the slow growth or loss of pension wealth. His tax rate jumps to 46 percent at age 65, and to 61 percent at age 70. The loss of DB pension wealth substantially reduces the growth in retirement wealth associated with an additional year of work at older ages.

Once the DB plan participant can claim his pension benefits, his replacement rate rises substantially above the rate for our base-case worker with a DC plan. Before the plan's early retirement age, the replacement rate is negative, because the DB plan participant has no income to cover his health insurance premiums. The replacement rate rises to 29 percent at age 60 when he can begin to collect reduced benefits. By the normal retirement age of 62, his replacement rate rises to 78 percent. It reaches a high of 131 percent by age 69, but then declines to 80 percent at age 70. These high replacement rates, in combination with steep tax rates and the loss of pension wealth, create strong disincentives to work for DB plan participants at older ages, and explain why workers with DB plans tend to retire earlier than those in DC plans (Friedberg and Webb 2003).

**Education and Earnings**

Next we consider the net impact of different earnings patterns on work. Our base-case worker has some post-secondary education (but less than four years of college) and earns $50,996 at age 55 (in 2004 dollars). At the same age, a typical male worker with less than a high school degree earns only $29,502, one with a high school degree earns $42,163, and another with a college education earns $75,066. As shown in figure 7, the implicit tax rate through age 65 increases with education and earnings, because of the progressivity in the federal income tax code and in the Social Security benefit formula, which disproportionately raises the accrual in Social Security wealth for those with limited earnings. The differences are muted after age 65, however, because workers at all earnings levels face the same absolute loss of Medicare benefits if they remain employed, and the loss is larger relative to earnings for those near the bottom of the earnings distribution. The increment to retirement wealth associated with additional work grows with education and earnings.

**Retiree Health Insurance Benefits**

The availability of retiree health benefits reduces the incentives to work before age 65. Workers at firms that offer retiree health benefits retain access to the group insurance market even if they retire before qualifying for Medicare benefits. Because they do not need to stay employed to avoid the inefficient nongroup market, the savings from access to the group market does not reduce the implicit tax they face on employment. Assuming our representative worker has access to retiree health benefits raises the tax on work by about 2 percentage points above the rate faced by our base-case worker, who loses his employer-sponsored coverage when he retires (see figure 8). Retiree health benefits also raise replacement rates before age 65, by reducing the cost of obtaining insurance coverage. The increase in the tax rate and the replacement rate both reduce incentives to work. In fact, workers with access to retiree health benefits generally retire earlier than other workers (Johnson, Davidoff, and Perese 2003). The availability of retiree benefits raises net retirement wealth at all ages, but the increment in wealth associated with an additional year of work is smaller than the increment when people must remain at work to get health benefits.

The lack of any health insurance coverage from an employer reduces the implicit tax on work after age 65, because workers without employer-sponsored coverage do not forfeit Medicare benefits by remaining at work. At younger ages, however, they face higher implicit tax rates than workers with employer coverage, because they do not gain the benefits of access to the group market by remaining in the labor force.

**Health Status**

The presence of health problems substantially raises returns to work for those with employer-sponsored heath benefits, as shown in figure 9. Workers who smoke or have health problems face lower implicit tax rates, because continued employment generates large savings in health insurance premiums through access to the group insurance. If they retired before qualifying for Medicare coverage, their health problems or smoking habit would force them to pay exorbitant premiums for nongroup coverage, assuming they do not qualify for Medicare's disability benefits. Those with health problems also face relatively low replacement rates before age 65, because they must purchase expensive nongroup coverage when they leave the labor force. Differences by health status in implicit tax and replacement rates disappear at age 65, when Medicare eligibility begins. Although people with health problems face strong financial incentives to work, they may be less productive and earn lower wages than those in good health.

**Marital Status**

Finally, we consider the impact of marital status on the costs and benefits of additional work (see figure 10). We compare our representative nonmarried man to another man identical in all respects except that he is married to a woman of the same age. We first assume that his wife does not work. In both the tax rate and replacement rate calculations, marriage affects only federal income taxes and Social Security benefits. The tax system provides a marriage bonus to

this particular couple, which pays lower taxes than our base-case worker simply because they are married. The married couple also benefits from the Social Security auxiliary spouse benefit. At age 62, the wife becomes entitled to spouse benefits based on her husband's earnings, even though she has never worked.[18] The combination of lower income taxes and a larger Social Security accrual lowers the implicit tax rate for the married worker with a nonworking spouse below the rate faced by our base-case single worker.

Implicit tax rates are significantly higher, however, for a married man whose wife works. We assume that the wife has the same earnings stream as the husband, and that she stops work and starts collecting Social Security and pension benefits at age 62. We treat the husband as the marginal worker, and measure the work incentives that he faces assuming that his wife's labor supply is fixed. Under these assumptions, his implicit tax rate is substantially higher than those for unmarried men and men married to women who do not work. From ages 55 to 63, the husband with the working wife pays higher income taxes and accrues less Social Security wealth with each additional year of employment than other workers, because of the progressivity of the tax code and the Social Security system.

Replacement rates after age 62 vary substantially by marital status. When married to a nonworking spouse, our representative individual replaces a relatively high share of his net employment income, because he receives Social Security benefits for his wife and pays relatively low taxes. His replacement rate is much lower, however, when he is married to a working spouse, because we only measure the incremental Social Security income that results from his work, given his wife's employment.

## IX. CONCLUSIONS

One way of relieving the economic pressures created by an aging population without cutting retirement benefits would be to encourage workers to delay retirement. Working longer increases the net output and productivity of the economy, generates additional payroll and income tax revenue, and reduces the average number of years in which people receive retirement benefits. As policymakers look for ways to discourage retirement, understanding the work incentives built into the current system of taxes and benefits becomes critical.

This study documents the obstacles to work at older ages created by our system of Social Security, federal income taxes, and employee benefits. The implicit tax rate on work increases rapidly at older ages, and by age 65 people can typically receive nearly as much in retirement as they can by working. If older Americans could overcome these barriers and delay retirement, they could substantially improve their economic well-being at older ages. For example, people could increase their annual consumption at older ages by more than 25 percent by simply retiring at age 67 instead of age 62. The increased tax revenues generated by this work could be used to support a wide range of government services, including public support for the aged.

[18] If the husband dies, the wife becomes entitled to widow benefits based on his earnings. These benefits are factored into our calculation of lifetime Social Security benefits, along with the husband and wife's individual survival probabilities.

Policy changes designed to elicit additional work effort from older Americans must address the high replacement rates that discourage many people from delaying retirement. A number of changes have already occurred that appear to encourage work at older ages. These include the growth in DC plans and decline in DB plans, erosion in retiree health insurance coverage, increases in Social Security's NRA, and reductions in the prevalence of Social Security auxiliary benefits as more married women work. However, existing changes are probably insufficient. Additional options to encourage work at older ages include:

- The creation of a payroll tax credit for older workers, which would encourage work by lowering both tax rates and replacement rates. This credit would not necessarily reduce total tax revenue, because it could draw substantial number of older workers into the labor market and lead to higher income tax revenue.
- Increases in the benefit entitlement age for both Social Security and Medicare. Indexing the NRA to changes in life expectancy is one reasonable approach, combined with protections for those with health problems. It would encourage work by lowering the replacement rate at relatively young ages.
- Reductions in benefits at younger ages in exchange for increases in benefits at older ages. This change would lower the replacement rate at initial benefit entitlement while preserving total Social Security wealth. It would encourage work while improving the economic status of the oldest Americans.
- Reductions in regulatory barriers to work at older ages. There are many regulatory barriers that employers face that discourage phased retirement (e.g. the tax code, the Employee Retirement Income Security Act of 1974 (ERISA), and the Age Discrimination in Employment Act (ADEA)). These regulations prevent workers from collecting their DB pensions while continuing to work for the plan sponsor, forcing workers to either retire or lose substantial pension wealth. Addressing these regulations may encourage more flexible work arrangements and continued work for older workers. Employers should also be given greater flexibility in limiting any rise in health costs simply because they hire older workers (Penner, Perun, and Steuerle 2002).
- The elimination of the requirement that Medicare serve as the secondary payer for workers with employer-sponsored coverage. The high cost of medical insurance for older workers discourages employers from retaining or hiring workers over age 65. Allowing Medicare to be the primary payer would lower employment costs and reduce the implicit tax rate faced by older workers, increasing work incentives at older ages.

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**Table 1. Effects of Early or Delayed Social Security Take-Up on Benefits for a Worker Born in 1950**

| Social Security Retirement Age | Percent Reduction in Monthly Benefits | Benefits as a Share of PIA |
|---|---|---|
| **62** | 25% | 75% |
| **63** | 20 | 80 |
| **64** | 13 1/3 | 86 2/3 |
| **65** | 6 2/3 | 93 1/3 |
| **66** | **0** | **100** |
| **67** | -8 | 108 |
| **68** | -16 | 116 |
| **69** | -24 | 124 |
| **70** | -32 | 132 |

Source: Social Security Administration (2004).

**Table 2. Direct Tax on Work at Older Ages, Base Case**

| Age | Earnings | Employee Payroll Taxes | Federal Income Tax | Take-Home Pay | Tax on Work | Direct Tax Rate |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4)=(1)-(2)-(3) | (5)=(1)-(4) | (6)=(5)/(1) |
| **55** | $50,996 | $3,901 | $7,716 | $39,379 | $11,617 | 22.8% |
| **56** | 49,938 | 3,820 | 7,518 | 38,600 | 11,338 | 22.7 |
| **57** | 49,657 | 3,799 | 7,499 | 38,359 | 11,298 | 22.8 |
| **58** | 48,436 | 3,705 | 7,200 | 37,531 | 10,905 | 22.5 |
| **59** | 47,243 | 3,614 | 6,981 | 36,648 | 10,596 | 22.4 |
| **60** | 46,119 | 3,528 | 6,738 | 35,853 | 10,266 | 22.3 |
| **61** | 45,798 | 3,504 | 7,339 | 34,956 | 10,842 | 23.7 |
| **62** | 45,457 | 3,477 | 7,281 | 34,698 | 10,759 | 23.7 |
| **63** | 44,574 | 3,410 | 7,064 | 34,100 | 10,474 | 23.5 |
| **64** | 43,709 | 3,344 | 6,863 | 33,502 | 10,207 | 23.4 |
| **65** | 42,860 | 3,279 | 6,654 | 32,927 | 9,932 | 23.2 |
| **66** | 42,027 | 3,215 | 6,163 | 32,649 | 9,378 | 22.3 |
| **67** | 41,212 | 3,153 | 5,935 | 32,124 | 9,088 | 22.1 |
| **68** | 40,411 | 3,091 | 5,711 | 31,609 | 8,802 | 21.8 |
| **69** | 39,627 | 3,031 | 5,491 | 31,104 | 8,522 | 21.5 |
| **70** | 38,857 | 2,973 | 11,892 | 23,992 | 14,865 | 38.3 |

Notes: Urban Institute calculations based on a representative single male worker in good health with a DC pension plan and no retiree health insurance. Dollar amounts are in $2004.

**Table 3. Implicit Tax on Work at Older Ages, Base Case**

| Age | Earnings | Employer Payroll Taxes | Employer Health Ins. Contrib. | Employer Pension Contrib. | Total Compensation | Total Payroll Taxes | Federal Income Tax | Increment to SS Wealth | Increment to Lifetime Federal Taxes | Lost Medicare Benefits | Savings from Group Health Insurance | Net Compensation | Tax on Work | Implicit Tax Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5)= (1)+(2)+(3)+(4) | (6) | (7) | (8) | (9) | (10) | (11) | (12)= (5)-(6)-(7)+(8)-(9)-(10)+(11) | (13)= (5)-(12) | (14)= (13)/(5) |
| **55** | $50,996 | $3,901 | $3,889 | $4,080 | $62,866 | $7,802 | $7,716 | $5,533 | $0 | $0 | $1,046 | $53,926 | $8,939 | 14.2% |
| **56** | 49,938 | 3,820 | 4,020 | 3,995 | 61,773 | 7,640 | 7,518 | 5,367 | 0 | 0 | 1,084 | 53,065 | 8,707 | 14.1 |
| **57** | 49,657 | 3,799 | 4,155 | 3,973 | 61,583 | 7,597 | 7,499 | 1,887 | 0 | 0 | 1,123 | 49,496 | 12,086 | 19.6 |
| **58** | 48,436 | 3,705 | 4,295 | 3,875 | 60,311 | 7,411 | 7,200 | 1,314 | 171 | 0 | 1,163 | 48,007 | 12,304 | 20.4 |
| **59** | 47,243 | 3,614 | 4,440 | 3,779 | 59,077 | 7,228 | 6,981 | 934 | 416 | 0 | 1,205 | 46,590 | 12,487 | 21.1 |
| **60** | 46,119 | 3,528 | 4,589 | 3,689 | 57,925 | 7,056 | 6,738 | 452 | 461 | 0 | 1,232 | 45,354 | 12,571 | 21.7 |
| **61** | 45,798 | 3,504 | 4,744 | 3,664 | 57,709 | 7,007 | 7,339 | 239 | 417 | 0 | 1,293 | 44,478 | 13,231 | 22.9 |
| **62** | 45,457 | 3,477 | 4,904 | 3,637 | 57,474 | 6,955 | 7,281 | 370 | 1,671 | 0 | 1,356 | 43,292 | 14,182 | 24.7 |
| **63** | 44,574 | 3,410 | 5,069 | 3,566 | 56,619 | 6,820 | 7,064 | 3,760 | 3,054 | 0 | 1,421 | 44,862 | 11,756 | 20.8 |
| **64** | 43,709 | 3,344 | 5,240 | 3,497 | 55,789 | 6,687 | 6,863 | 1,724 | 3,024 | 0 | 1,493 | 42,432 | 13,357 | 23.9 |
| **65** | 42,860 | 3,279 | 5,416 | 3,429 | 54,984 | 6,558 | 6,654 | -138 | 3,122 | 5,178 | 0 | 33,334 | 21,650 | 39.4 |
| **66** | 42,027 | 3,215 | 5,900 | 3,362 | 54,504 | 6,430 | 6,163 | 1,242 | 3,403 | 5,641 | 0 | 34,109 | 20,395 | 37.4 |
| **67** | 41,212 | 3,153 | 6,414 | 3,297 | 54,076 | 6,305 | 5,935 | -771 | 2,993 | 6,132 | 0 | 31,940 | 22,136 | 40.9 |
| **68** | 40,411 | 3,091 | 6,940 | 3,233 | 53,675 | 6,183 | 5,711 | -2,602 | 2,613 | 6,635 | 0 | 29,932 | 23,743 | 44.2 |
| **69** | 39,627 | 3,031 | 7,480 | 3,170 | 53,308 | 6,063 | 5,491 | -4,340 | 2,256 | 7,151 | 0 | 28,007 | 25,301 | 47.5 |
| **70** | 38,857 | 2,973 | 8,033 | 3,109 | 52,971 | 5,945 | 11,892 | 313 | 1,028 | 7,680 | 0 | 26,739 | 26,232 | 49.5 |

Notes: Urban Institute calculations based on a representative single male worker in good health with a DC pension plan and no retiree health insurance. Dollar amounts are in $2004.

**Table 4. Replacement Rates at Older Ages, Base Case**

| | Net Income When Working, Age *t* | | | | | | Net Income When Retired, Age *t* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | Earnings (1) | Employee Payroll Taxes (2) | Employee Health Ins. Premiums (3) | Federal Income Tax (4) | Social Security (5) | Net Income (6)=(1)-(2)-(3)-(4)+(5) | Social Security (7) | Pensions (8) | Health Insurance Premiums (9) | Federal Income Tax (10) | Net Income (11)=(7)+(8)-(9)-(10) | Replacement Rate (12)=(11)/(6) |
| **55** | $50,996 | $3,901 | $569 | $7,716 | $0 | $38,810 | $0 | $5,530 | $5,504 | $0 | $26 | 0.1% |
| **56** | 49,938 | 3,820 | 580 | 7,518 | 0 | 38,019 | 0 | 6,011 | 5,684 | 0 | 327 | 0.9 |
| **57** | 49,657 | 3,799 | 592 | 7,499 | 0 | 37,767 | 0 | 6,522 | 5,870 | 0 | 653 | 1.7 |
| **58** | 48,436 | 3,705 | 603 | 7,200 | 0 | 36,928 | 0 | 7,063 | 6,061 | 0 | 1,001 | 2.7 |
| **59** | 47,243 | 3,614 | 615 | 6,981 | 0 | 36,033 | 0 | 7,633 | 6,260 | 66 | 1,307 | 3.6 |
| **60** | 46,119 | 3,528 | 627 | 6,738 | 0 | 35,226 | 0 | 8,237 | 6,448 | 132 | 1,657 | 4.7 |
| **61** | 45,798 | 3,504 | 639 | 7,339 | 0 | 34,317 | 0 | 8,883 | 6,675 | 283 | 1,925 | 5.6 |
| **62** | 45,457 | 3,477 | 651 | 7,281 | 0 | 34,046 | 15,667 | 9,574 | 6,911 | 393 | 17,937 | 52.7 |
| **63** | 44,574 | 3,410 | 664 | 7,064 | 0 | 33,436 | 16,726 | 10,308 | 7,154 | 514 | 19,366 | 57.9 |
| **64** | 43,709 | 3,344 | 677 | 6,863 | 0 | 32,825 | 18,135 | 11,089 | 7,410 | 792 | 21,022 | 64.0 |
| **65** | 42,860 | 3,279 | 690 | 6,654 | 0 | 32,237 | 19,547 | 11,919 | 3,639 | 1,074 | 26,754 | 83.0 |
| **66** | 42,027 | 3,215 | 703 | 6,163 | 0 | 31,946 | 20,961 | 12,800 | 3,739 | 1,229 | 28,793 | 90.1 |
| **67** | 41,212 | 3,153 | 717 | 5,935 | 0 | 31,407 | 22,653 | 13,736 | 3,841 | 1,672 | 30,876 | 98.3 |
| **68** | 40,411 | 3,091 | 731 | 5,711 | 0 | 30,878 | 24,351 | 14,736 | 3,947 | 2,130 | 33,010 | 106.9 |
| **69** | 39,627 | 3,031 | 745 | 5,491 | 0 | 30,359 | 26,058 | 15,810 | 4,057 | 2,607 | 35,204 | 116.0 |
| **70** | 38,857 | 2,973 | 760 | 11,892 | 27,767 | 51,000 | 27,767 | 16,974 | 4,179 | 3,108 | 37,455 | 73.4 |

Notes: Urban Institute calculations based on a representative single male worker in good health with a DC pension plan and no retiree health insurance. Dollar amounts are in $2004. The worker makes a health insurance contribution for the employer plan while working. He buys nongroup private health insurance when retired before age 65 and a Medigap policy after age 65.

**Table 5. Net Income at Ages 65, 75, and 85, by Retirement Age, Base Case**

| | Income Net of Federal Income Tax and Insurance Premiums, at Given Age | | | | | |
|---|---|---|---|---|---|---|
| | Dollar Amount | | | Pct. of Net Income at Age 55 When Working | | |
| Retirement Age | 65 | 75 | 85 | 65 | 75 | 85 |
| **55** | $15,157 | $12,897 | $10,679 | 39.1% | 33.2% | 27.5% |
| **57** | 16,874 | 14,348 | 11,934 | 43.5 | 37.0 | 30.7 |
| **60** | 19,056 | 16,063 | 13,276 | 49.1 | 41.4 | 34.2 |
| **62** | 20,508 | 17,338 | 14,236 | 52.8 | 44.7 | 36.7 |
| **65** | 26,754 | 22,920 | 19,342 | 68.9 | 59.1 | 49.8 |
| **67** | 32,237 | 27,256 | 23,313 | 83.1 | 70.2 | 60.1 |
| **70** | 32,237 | 34,790 | 30,143 | 83.1 | 89.6 | 77.7 |

Notes: Urban Institute calculations based on a representative single male worker in good health with a DC pension plan and no retiree health insurance. Dollar amounts are in $2004.

**Table 6. Retirement Wealth at Older Ages, Base Case**

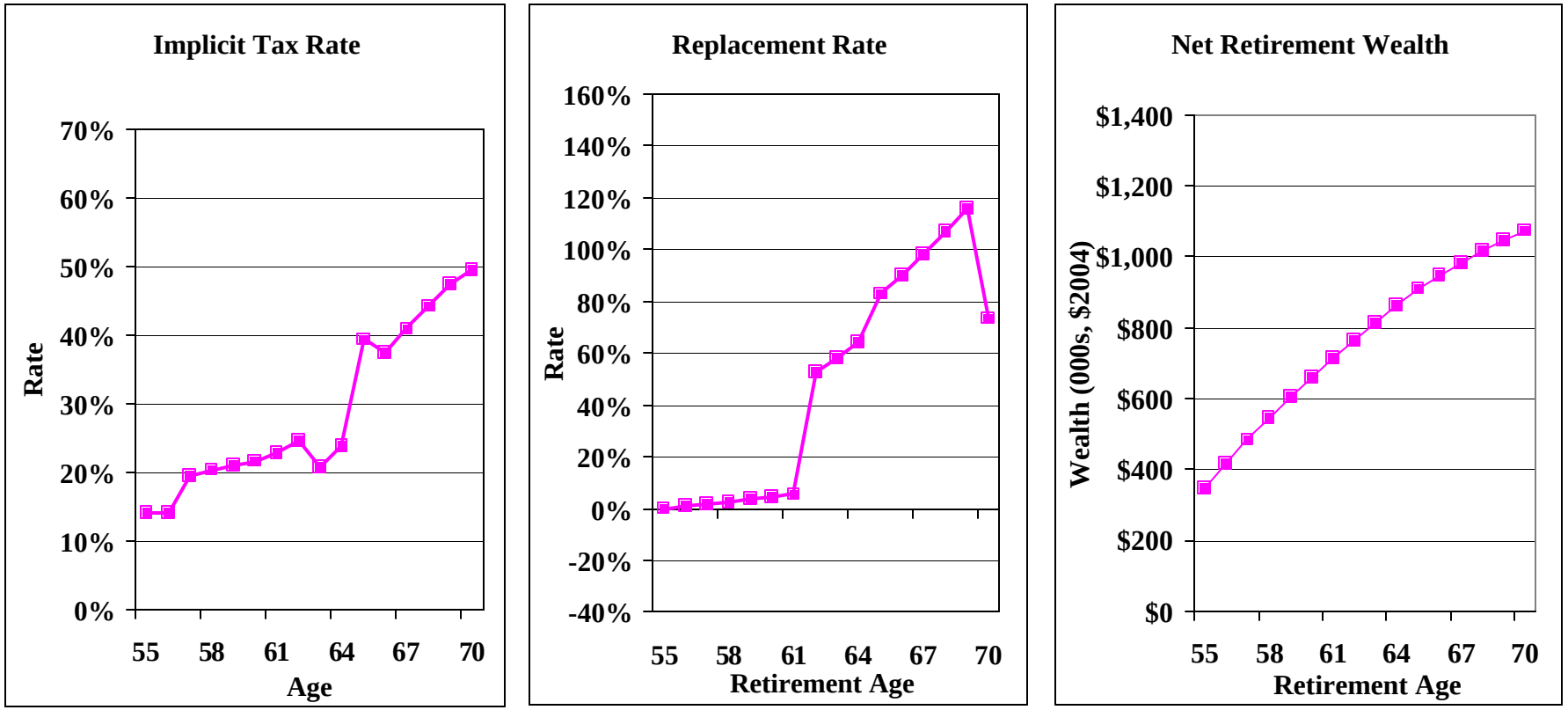
| Retirement Age | Social Security Wealth | Pension Wealth | Lifetime Federal Income Taxes | Additional Lifetime Net Earnings[a] | Additional Lifetime Savings in Health Insurance Costs[b] | Net Wealth | Increment to Wealth | Annual Consumption Stream |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6)=(1)+(2)-(3)+(4)+(5) | (7) | (8) |
| **55** | $234,553 | $113,678 | $0 | $0 | $0 | $348,231 | N/A | $20,650 |
| **56** | 240,086 | 118,381 | 0 | 52,759 | 6,010 | 417,235 | $69,004 | 24,742 |
| **57** | 245,453 | 122,962 | 0 | 103,454 | 12,057 | 483,926 | 66,691 | 28,697 |
| **58** | 247,340 | 127,351 | 0 | 152,848 | 18,137 | 545,677 | 61,751 | 32,359 |
| **59** | 248,654 | 131,534 | 171 | 200,216 | 24,247 | 604,479 | 58,803 | 35,846 |
| **60** | 249,588 | 135,530 | 587 | 245,557 | 30,381 | 660,469 | 55,990 | 39,166 |
| **61** | 250,039 | 139,417 | 1,048 | 289,037 | 36,518 | 713,962 | 53,493 | 42,338 |
| **62** | 250,278 | 143,205 | 1,465 | 330,667 | 42,685 | 765,369 | 51,407 | 45,387 |
| **63** | 250,648 | 146,828 | 3,136 | 371,178 | 48,877 | 814,394 | 49,025 | 48,294 |
| **64** | 254,408 | 150,309 | 6,190 | 410,204 | 55,086 | 863,816 | 49,422 | 51,225 |
| **65** | 256,132 | 153,654 | 9,213 | 447,786 | 61,305 | 909,664 | 45,848 | 53,944 |
| **66** | 255,994 | 156,865 | 12,335 | 483,993 | 61,517 | 946,033 | 36,369 | 56,100 |
| **67** | 257,235 | 159,944 | 15,738 | 519,153 | 61,739 | 982,334 | 36,301 | 58,253 |
| **68** | 256,464 | 162,899 | 18,731 | 553,061 | 61,971 | 1,015,664 | 33,330 | 60,229 |
| **69** | 253,862 | 165,730 | 21,343 | 585,760 | 62,211 | 1,046,220 | 30,556 | 62,041 |
| **70** | 249,522 | 168,454 | 23,600 | 617,296 | 62,460 | 1,074,133 | 27,913 | 63,697 |

Notes: Urban Institute calculations based on a representative single male worker in good health with a DC pension plan and no retiree health insurance. Wealth is reported in 2004 dollars and discounted to age 65.

a/ Additional lifetime net earnings is the present discounted value of after-tax earnings from age 55 until retirement.

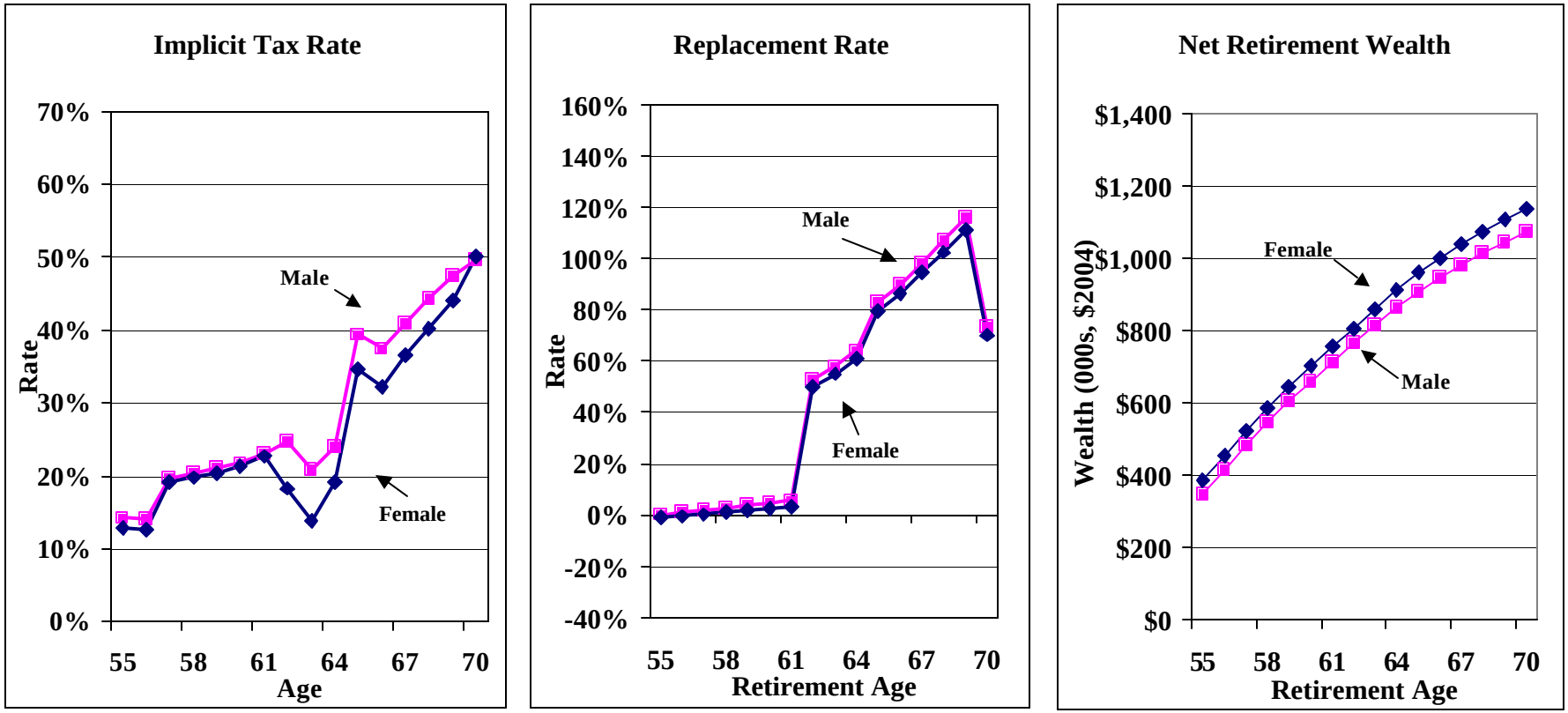
b/ Additional lifetime savings in health insurance costs is the present discounted value employer paid health insurance premiums plus the health insurance savings from access to group insurance compared to nongroup insurance less the loss of Medicare.

**Figure 1**
**Implicit Tax Rate, Replacement Rate, and Net Retirement Wealth by Age for the Base-Case Worker**



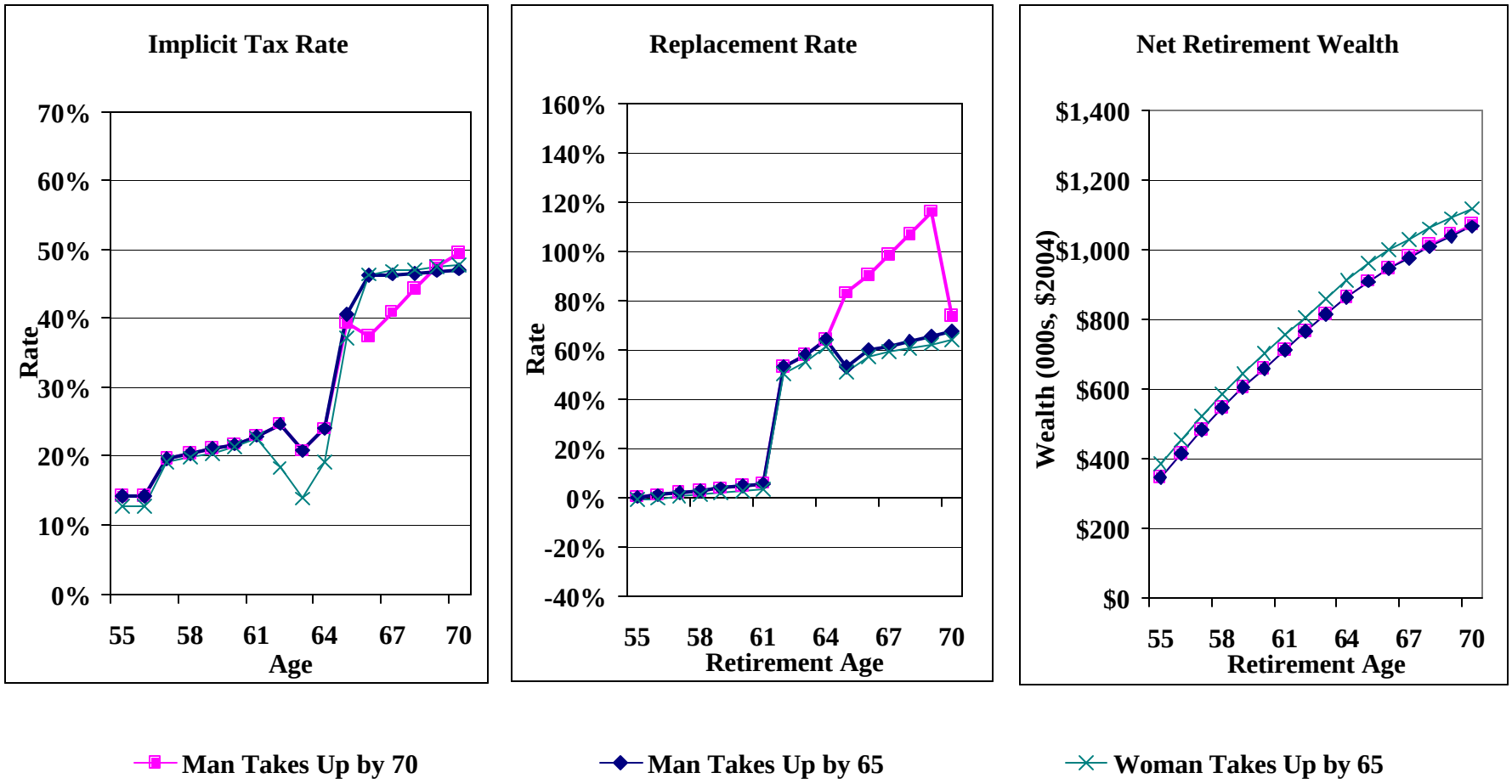

Notes: Urban Institute calculations based on a representative single male worker in good health with a DC pension plan and no retiree health insurance. Dollar amounts are in $2004.

**Figure 2**
**Implicit Tax Rate, Replacement Rate, and Net Retirement Wealth by Age and Sex**



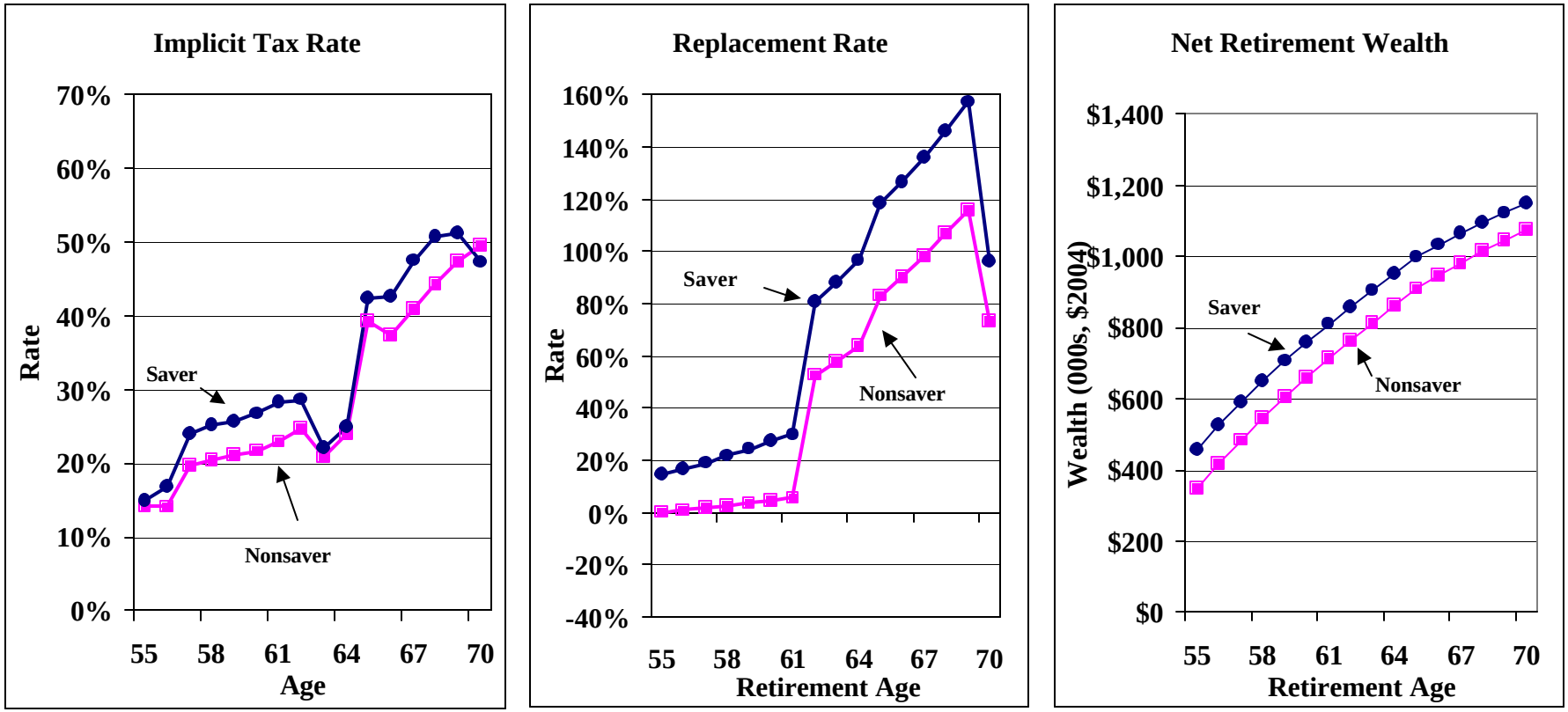

Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance. The single woman has the same earnings and pension as the single male. Dollar amounts are in $2004. Details are displayed in appendix table A1.

**Figure 3**
**Implicit Tax Rate, Replacement Rate, and Net Retirement Wealth**
**by Age, Sex, and Social Security Take-Up Age**



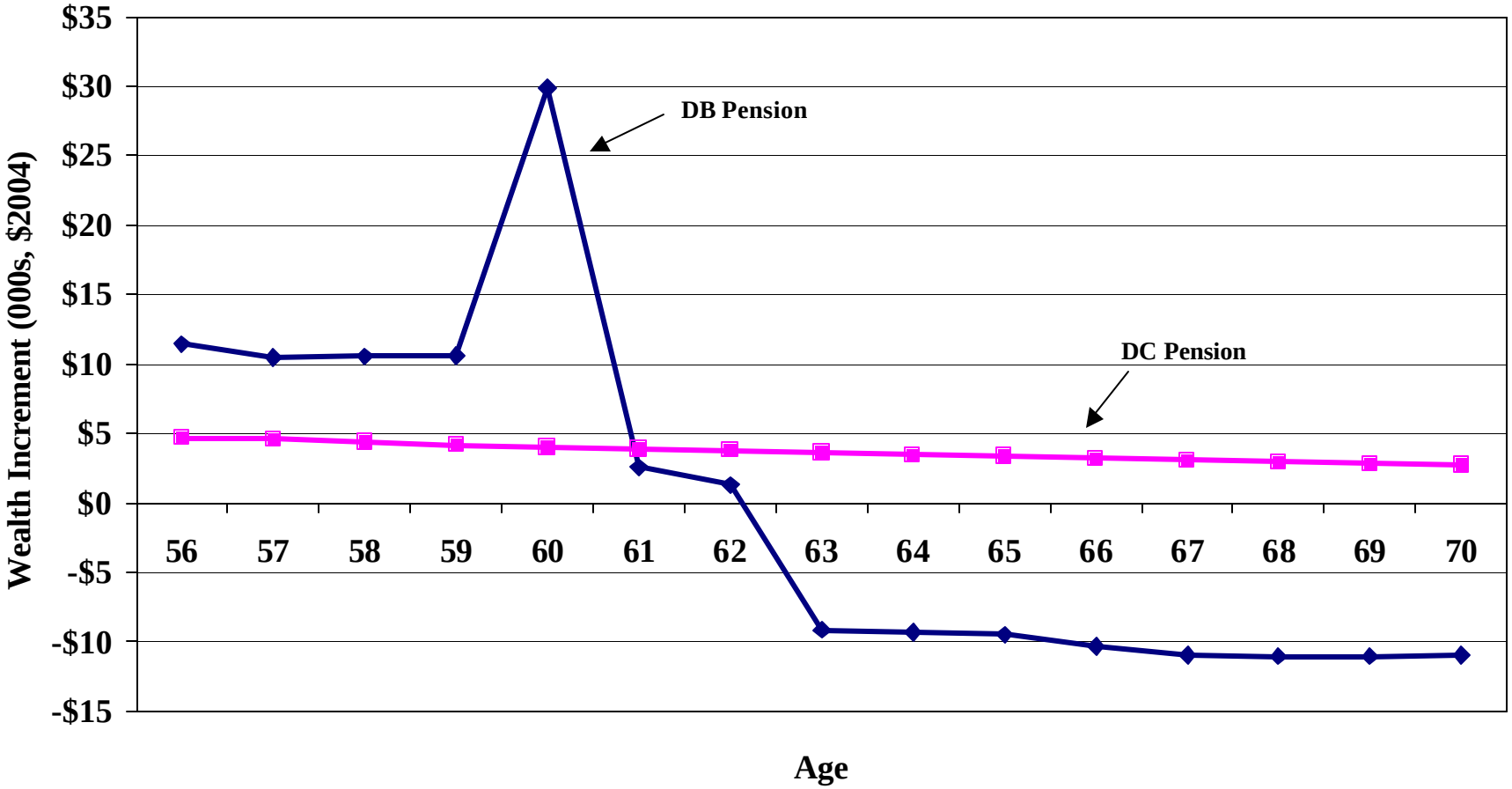

Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance. He takes up Social Security benefits by age 70. The other single male and female are identical to the base-case worker in all respects, except that they take up Social Security benefits by age 65. Dollar amounts are in $2004. Details are displayed in appendix table A2.

**Figure 4**
**Implicit Tax Rate, Replacement Rate, and Net Retirement Wealth by Age and Saving Behavior**



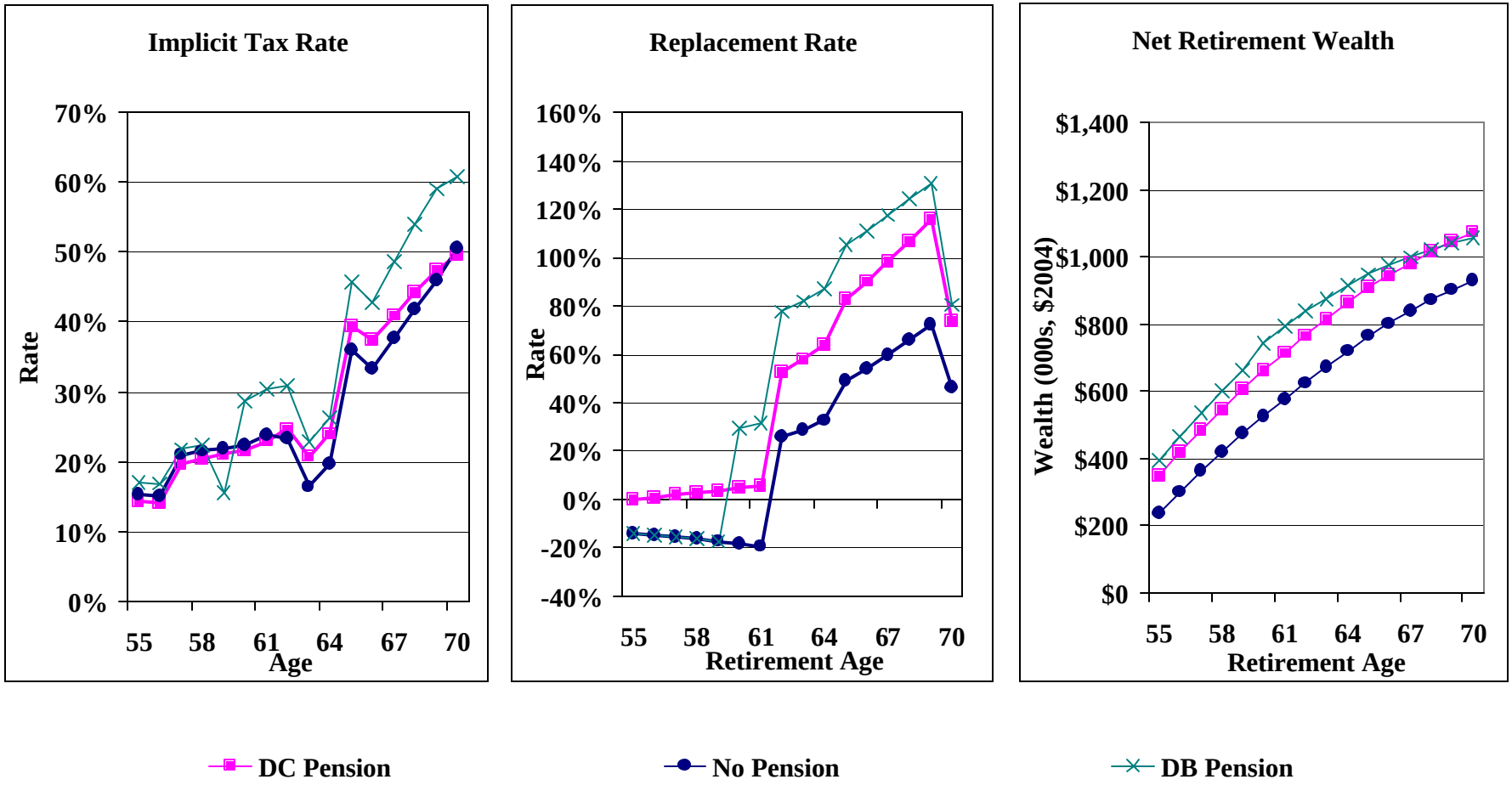

Notes: The base-case worker (nonsaver) is a single male in good health with a DC pension plan and no retiree health insurance. He has no tax-deferred savings outside his employer DC pension contributions. The saver contributes 8 percent of annual earnings to a tax-deferred retirement account. Dollar amounts are in $2004. Details are displayed in appendix table A3.

## Figure 5. Increment to Pension Wealth, by Plan Type



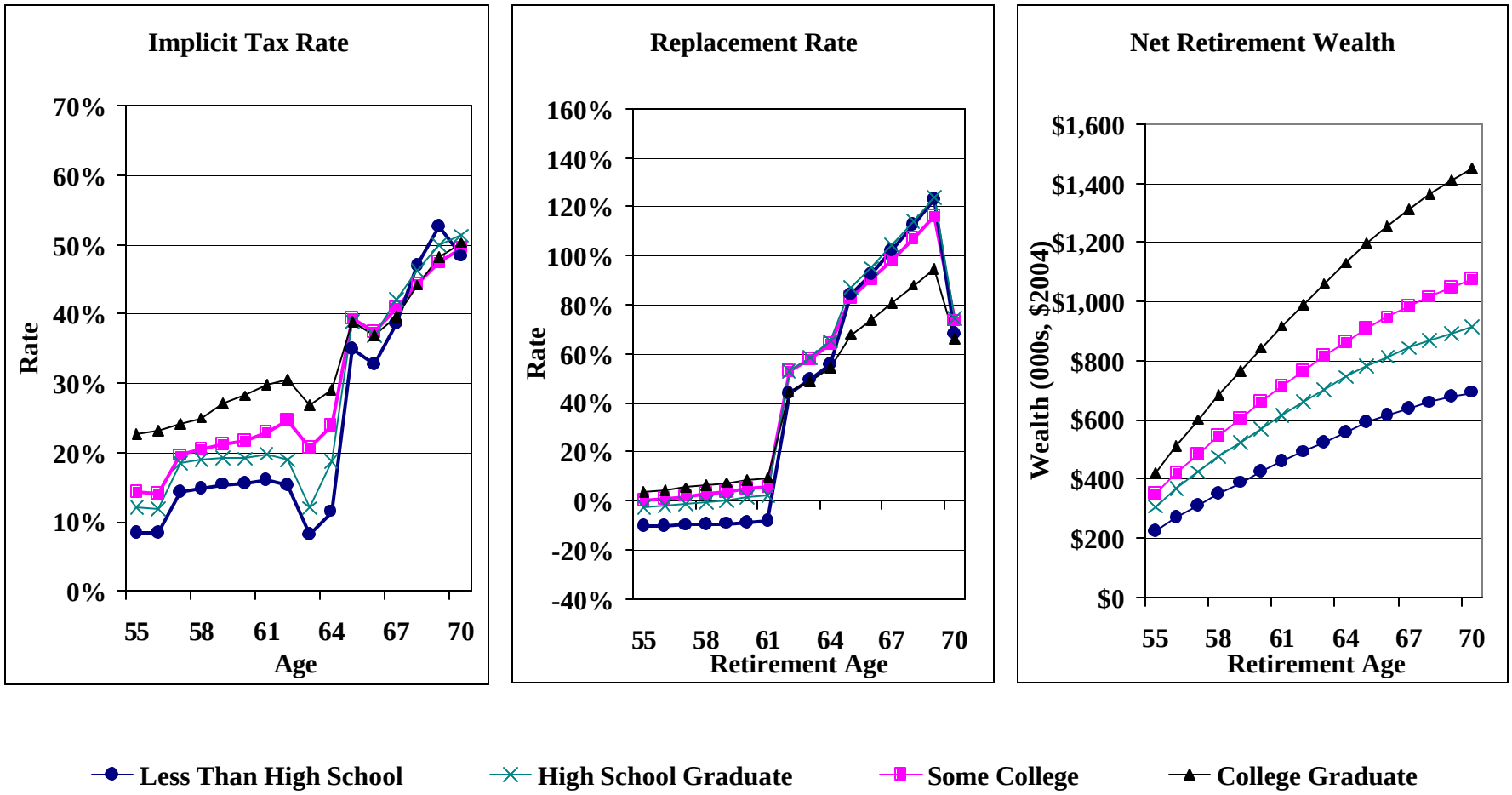

Note: The chart shows pension wealth for a man born in 1950 who began working for the employer at age 35. The DB plan pays benefits equal to the number of years of service times 1% of average salary earned during the last three years of service. Full benefits are paid beginning at age 62. Reduced benefits are available after 25 years of service, when the worker reaches age 60. Contributions to the DC plan total 8% of salary,

**Figure 6**
**Implicit Tax Rate, Replacement Rate, and Net Retirement Wealth by Age and Pension Type**



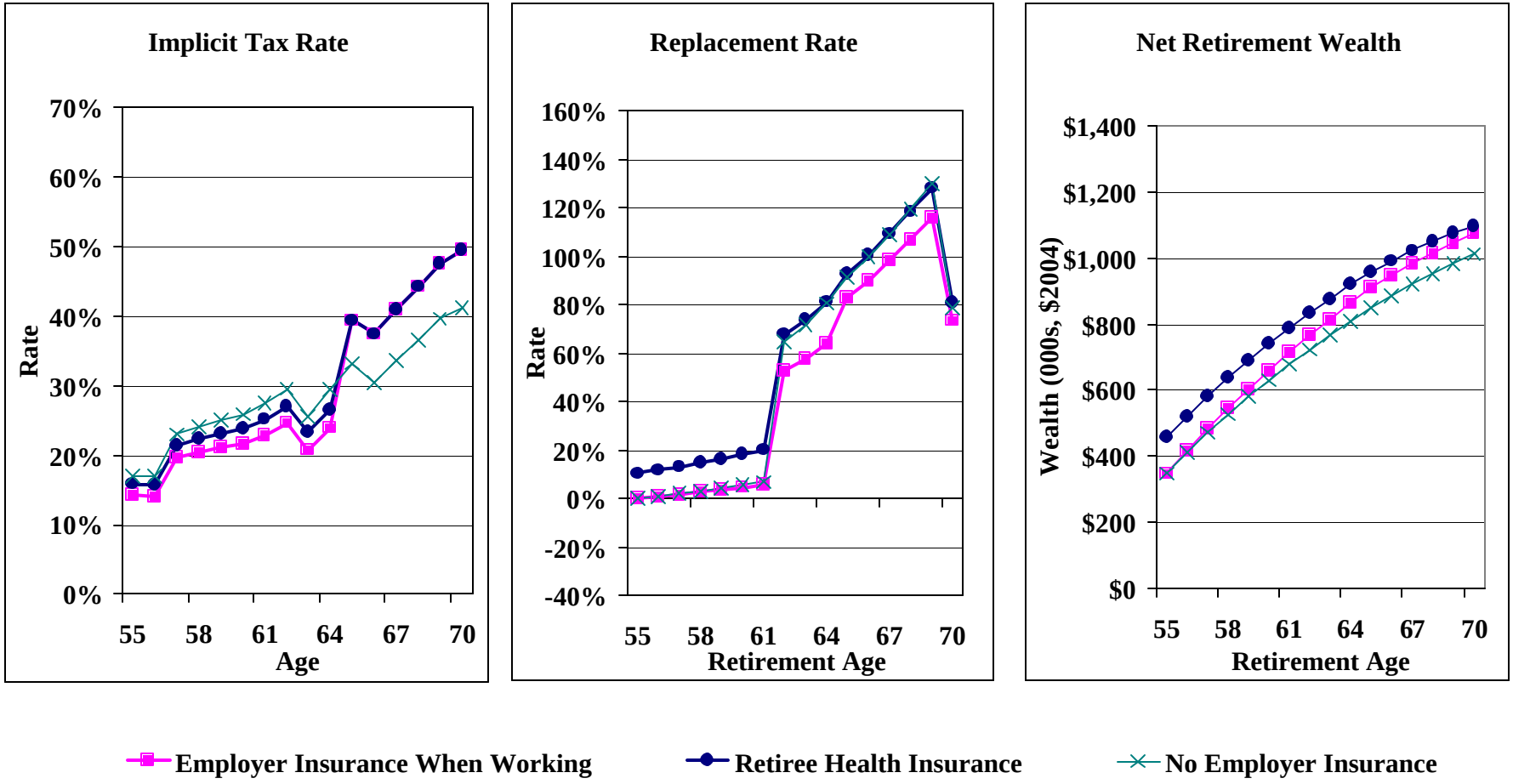

Notes: Our base-case worker has a DC pension. The DB pension is based on Plan A with early retirement available at age 60. The no pension worker has no pension or tax-deferred savings. Details are displayed in appendix table A4.

**Figure 7**
**Implicit Tax Rate, Replacement Rate, and Net Retirement Wealth**
**by Age and Educational Attainment**



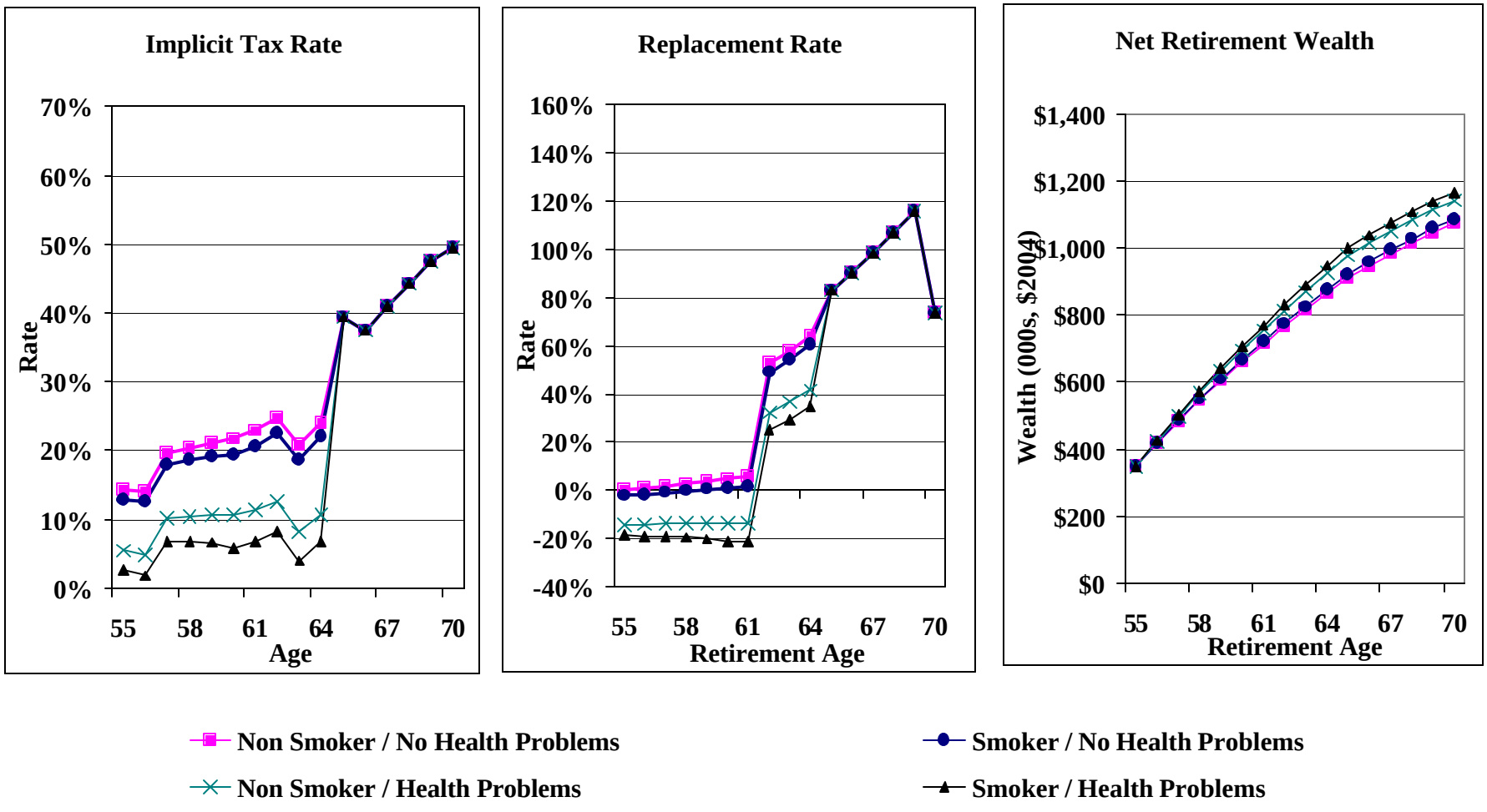

Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance. His earnings are for a male worker with some college education. Other earning profiles are consistent with historic earnings for males with other education levels. Dollar amounts are in $2004. Details are displayed in appendix table A5.

**Figure 8**
**Implicit Tax Rate, Replacement Rate, and Net Retirement Wealth by Age and Employer Health Insurance**



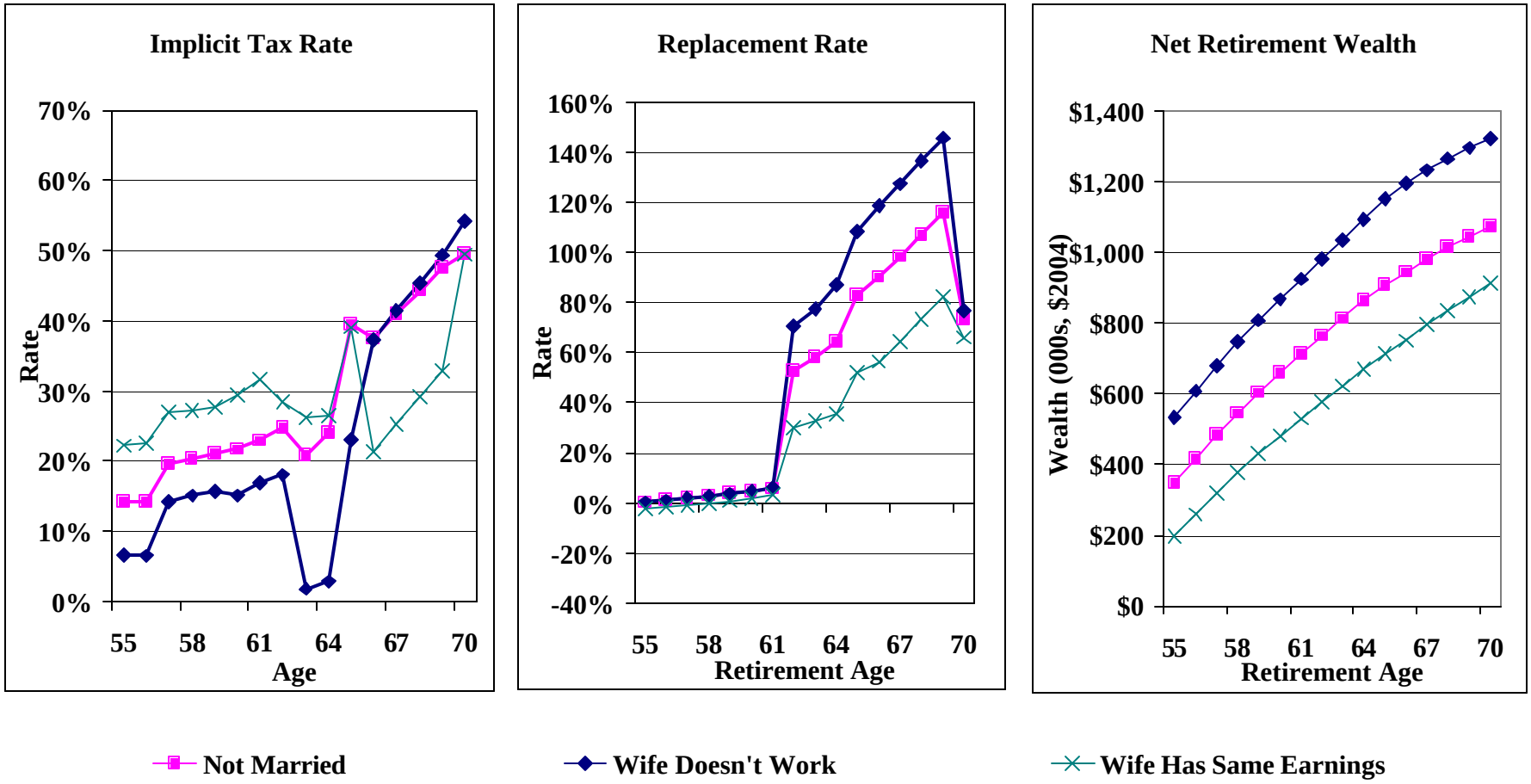

Notes: The base-case worker is a single male in good health with a DC pension plan. Dollar amounts are in $2004. Details are displayed in appendix table A6.

**Figure 9**
**Implicit Tax Rate, Replacement Rate, and Net Retirement Wealth by Age and Health Status**




Notes: The base-case worker is a single male with a DC pension plan and no retiree health insurance. Retired workers purchase nongroup insurance based on health status before age 65 when Medicare becomes available. Dollar amounts are in $2004. Estimates are for a single male with a DC pension plan and no retiree health insurance. Details are displayed in appendix table A7.

**Figure 10**
**Implicit Tax Rate, Replacement Rate, and Net Retirement Wealth**
**by Age and Marital Status and Spouse Earnings**




Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance. The married worker has the same earnings and pension as the single worker. In one case the married worker has a nonworking spouse. In the other case the husband and wife have identical earnings. Dollar amounts are in $2004. Details are displayed in appendix table A8.

**Appendix Table 1. Implicit Tax Rates, Replacement Rates, and Net Retirement Wealth by Age and Sex**

| | Implicit Tax Rate | | Replacement Rate | | Net Retirement Wealth (000s) | | Net Wealth Accrual | | Annual Consumption Stream | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Age** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| **55** | 14.2% | 12.8% | 0.1% | -1.2% | $348 | $386 | $69,004 | $69,906 | $20,650 | $20,911 |
| **56** | 14.1 | 12.7 | 0.9 | -0.6 | 417 | 456 | 66,691 | 67,565 | 24,742 | 24,694 |
| **57** | 19.6 | 19.1 | 1.7 | 0.1 | 484 | 524 | 61,751 | 62,058 | 28,697 | 28,349 |
| **58** | 20.4 | 19.8 | 2.7 | 0.9 | 546 | 586 | 58,803 | 59,189 | 32,359 | 31,707 |
| **59** | 21.1 | 20.3 | 3.6 | 1.7 | 604 | 645 | 55,990 | 56,457 | 35,846 | 34,910 |
| **60** | 21.7 | 21.4 | 4.7 | 2.6 | 660 | 702 | 53,493 | 53,693 | 39,166 | 37,965 |
| **61** | 22.9 | 22.7 | 5.6 | 3.3 | 714 | 755 | 51,407 | 51,555 | 42,338 | 40,870 |
| **62** | 24.7 | 18.3 | 52.7 | 50.1 | 765 | 807 | 49,025 | 52,698 | 45,387 | 43,660 |
| **63** | 20.8 | 13.8 | 57.9 | 55.1 | 814 | 860 | 49,422 | 53,338 | 48,294 | 46,511 |
| **64** | 23.9 | 19.2 | 64.0 | 61.1 | 864 | 913 | 45,848 | 48,509 | 51,225 | 49,397 |
| **65** | 39.4 | 34.7 | 83.0 | 79.6 | 910 | 961 | 36,369 | 38,949 | 53,944 | 52,022 |
| **66** | 37.4 | 32.2 | 90.1 | 86.4 | 946 | 1,000 | 36,301 | 39,137 | 56,100 | 54,130 |
| **67** | 40.9 | 36.5 | 98.3 | 94.4 | 982 | 1,040 | 33,330 | 35,734 | 58,253 | 56,247 |
| **68** | 44.2 | 40.3 | 106.9 | 102.5 | 1,016 | 1,075 | 30,556 | 32,688 | 60,229 | 58,181 |
| **69** | 47.5 | 44.0 | 116.0 | 111.1 | 1,046 | 1,108 | 27,913 | 29,749 | 62,041 | 59,949 |
| **70** | 49.5 | 50.1 | 73.4 | 70.2 | 1,074 | 1,138 | 26,570 | 26,276 | 63,697 | 61,559 |

Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance. The female worker has the same earnings and pension as the male worker.

**Appendix Table 2. Implicit Tax Rates, Replacement Rates, and Net Retirement Wealth by Age, Sex, and Social Security Take-Up Age**

| | Implicit Tax Rate | | | Replacement Rate | | |
|---|---|---|---|---|---|---|
| Age | Man Takes Up SS by 70 | Man Takes Up SS by 65 | Woman Takes Up SS by 65 | Man Takes Up SS by 70 | Man Takes Up SS by 65 | Woman Takes Up SS by 65 |
| 55 | 14.2% | 14.2% | 12.8% | 0.1% | 0.1% | -1.2% |
| 56 | 14.1 | 14.1 | 12.7 | 0.9 | 0.9 | -0.6 |
| 57 | 19.6 | 19.6 | 19.1 | 1.7 | 1.7 | 0.1 |
| 58 | 20.4 | 20.4 | 19.8 | 2.7 | 2.7 | 0.9 |
| 59 | 21.1 | 21.1 | 20.3 | 3.6 | 3.6 | 1.7 |
| 60 | 21.7 | 21.7 | 21.4 | 4.7 | 4.7 | 2.6 |
| 61 | 22.9 | 22.9 | 22.7 | 5.6 | 5.6 | 3.3 |
| 62 | 24.7 | 24.7 | 18.3 | 52.7 | 52.7 | 50.1 |
| 63 | 20.8 | 20.8 | 13.8 | 57.9 | 57.9 | 55.1 |
| 64 | 23.9 | 23.9 | 19.2 | 64.0 | 64.0 | 61.1 |
| 65 | 39.4 | 40.6 | 37.1 | 83.0 | 52.9 | 50.8 |
| 66 | 37.4 | 46.2 | 46.3 | 90.1 | 59.7 | 57.2 |
| 67 | 40.9 | 46.3 | 46.9 | 98.3 | 61.5 | 58.9 |
| 68 | 44.2 | 46.5 | 47.1 | 106.9 | 63.4 | 60.5 |
| 69 | 47.5 | 46.8 | 47.5 | 116.0 | 65.4 | 62.2 |
| 70 | 49.5 | 47.1 | 47.7 | 73.4 | 67.6 | 64.0 |

| | Net Retirement Wealth (000s) | | | Net Wealth Accrual | | | Annual Consumption Stream | | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Man Takes Up SS by 70 | Man Takes Up SS by 65 | Woman Takes Up SS by 65 | Man Takes Up SS by 70 | Man Takes Up SS by 65 | Woman Takes Up SS by 65 | Man Takes Up SS by 70 | Man Takes Up SS by 65 | Woman Takes Up SS by 65 |
| 55 | $348 | $348 | $386 | $69,004 | $69,004 | $69,906 | $20,650 | $20,650 | $20,911 |
| 56 | 417 | 417 | 456 | 66,691 | 66,691 | 67,565 | 24,742 | 24,742 | 24,694 |
| 57 | 484 | 484 | 524 | 61,751 | 61,751 | 62,058 | 28,697 | 28,697 | 28,349 |
| 58 | 546 | 546 | 586 | 58,803 | 58,803 | 59,189 | 32,359 | 32,359 | 31,707 |
| 59 | 604 | 604 | 645 | 55,990 | 55,990 | 56,457 | 35,846 | 35,846 | 34,910 |
| 60 | 660 | 660 | 702 | 53,493 | 53,493 | 53,693 | 39,166 | 39,166 | 37,965 |
| 61 | 714 | 714 | 755 | 51,407 | 51,407 | 51,555 | 42,338 | 42,338 | 40,870 |
| 62 | 765 | 765 | 807 | 49,025 | 49,025 | 52,698 | 45,387 | 45,387 | 43,660 |
| 63 | 814 | 814 | 860 | 49,422 | 49,422 | 53,338 | 48,294 | 48,294 | 46,511 |
| 64 | 864 | 864 | 913 | 45,848 | 45,848 | 48,509 | 51,225 | 51,225 | 49,397 |
| 65 | 910 | 910 | 961 | 36,369 | 35,676 | 37,602 | 53,944 | 53,944 | 52,022 |
| 66 | 946 | 945 | 999 | 36,301 | 31,624 | 31,535 | 56,100 | 56,059 | 54,057 |
| 67 | 982 | 977 | 1,031 | 33,330 | 30,601 | 30,301 | 58,253 | 57,935 | 55,763 |
| 68 | 1,016 | 1,008 | 1,061 | 30,556 | 29,614 | 29,294 | 60,229 | 59,749 | 57,403 |
| 69 | 1,046 | 1,037 | 1,090 | 27,913 | 28,616 | 28,281 | 62,041 | 61,505 | 58,988 |
| 70 | 1,074 | 1,066 | 1,118 | 26,570 | 27,697 | 27,356 | 63,697 | 63,202 | 60,518 |

Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance. He takes up Social Security benefits by age 70. The other single male and female are identical to the base-case worker in all respects, except that they take up Social Security benefits by age 65. Dollar amounts are in $2004.

**Appendix Table 3. Implicit Tax Rates, Replacement Rates, and Net Retirement Wealth by Age and Saver Status**

| | Implicit Tax Rate | | Replacement Rate | | Net Retirement Wealth (000s) | | Net Wealth Accrual | | Annual Consumption Stream | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Age** | **Non Saver** | **Saver** | **Non Saver** | **Saver** | **Non Saver** | **Saver** | **Non Saver** | **Saver** | **Non Saver** | **Saver** |
| **55** | 14.2% | 14.9% | 0.1% | 14.6% | $348 | $459 | $69,004 | $68,514 | $20,650 | $27,192 |
| **56** | 14.1 | 16.9 | 0.9 | 16.8 | 417 | 527 | 66,691 | 64,948 | 24,742 | 31,255 |
| **57** | 19.6 | 24.0 | 1.7 | 19.0 | 484 | 592 | 61,751 | 58,972 | 28,697 | 35,106 |
| **58** | 20.4 | 25.2 | 2.7 | 21.8 | 546 | 651 | 58,803 | 55,792 | 32,359 | 38,603 |
| **59** | 21.1 | 25.7 | 3.6 | 24.4 | 604 | 707 | 55,990 | 53,158 | 35,846 | 41,912 |
| **60** | 21.7 | 26.8 | 4.7 | 27.5 | 660 | 760 | 53,493 | 50,466 | 39,166 | 45,064 |
| **61** | 22.9 | 28.3 | 5.6 | 29.9 | 714 | 810 | 51,407 | 48,196 | 42,338 | 48,057 |
| **62** | 24.7 | 28.7 | 52.7 | 81.0 | 765 | 859 | 49,025 | 46,562 | 45,387 | 50,915 |
| **63** | 20.8 | 22.1 | 57.9 | 88.0 | 814 | 905 | 49,422 | 48,471 | 48,294 | 53,676 |
| **64** | 23.9 | 25.0 | 64.0 | 96.6 | 864 | 954 | 45,848 | 45,063 | 51,225 | 56,550 |
| **65** | 39.4 | 42.3 | 83.0 | 118.3 | 910 | 999 | 36,369 | 34,546 | 53,944 | 59,223 |
| **66** | 37.4 | 42.6 | 90.1 | 126.4 | 946 | 1,033 | 36,301 | 33,217 | 56,100 | 61,271 |
| **67** | 40.9 | 47.5 | 98.3 | 135.9 | 982 | 1,066 | 33,330 | 29,534 | 58,253 | 63,241 |
| **68** | 44.2 | 50.7 | 106.9 | 146.0 | 1,016 | 1,096 | 30,556 | 26,821 | 60,229 | 64,992 |
| **69** | 47.5 | 51.3 | 116.0 | 157.3 | 1,046 | 1,123 | 27,913 | 25,611 | 62,041 | 66,583 |
| **70** | 49.5 | 47.3 | 73.4 | 96.4 | 1,074 | 1,148 | 26,570 | 27,456 | 63,697 | 68,102 |

Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance and no tax-deferred savings outside his employer DC pension contributions. The saver contributes 8 percent of annual earnings to a tax-deferred retirement account. Dollar amounts are in $2004.

**Appendix Table 4. Implicit Tax Rates, Replacement Rates, and Net Retirement Wealth by Age and Pension Type**

| | Implicit Tax Rate | | | | | | | Replacement Rate | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | DC Plan | No Pensio | DB Plan A | DB Plan B | DB Plan C | DB Plan D | DB Plan E | DC Plan | No Pension | DB Plan A | DB Plan B | DB Plan C | DB Plan D | DB Plan E |
| 55 | 14.2% | 15.2% | 16.9% | 16.9% | 16.7% | 14.0% | 14.0% | 0.1% | -14.2% | -14.2% | -14.2% | -14.2% | -14.2% | -14.2% |
| 56 | 14.1 | 15.1 | 16.9 | 16.9 | 16.6 | 13.8 | 13.8 | 0.9 | -15.0 | -15.0 | -15.0 | -15.0 | -15.0 | -15.0 |
| 57 | 19.6 | 21.0 | 21.7 | 21.7 | 21.7 | 19.4 | 19.4 | 1.7 | -15.5 | -15.5 | -15.5 | -15.5 | -15.5 | -15.5 |
| 58 | 20.4 | 21.5 | 22.3 | 22.3 | 22.3 | 20.0 | 20.0 | 2.7 | -16.4 | -16.4 | -16.4 | -16.4 | -16.4 | -16.4 |
| 59 | 21.1 | 21.8 | 15.6 | 22.8 | 22.7 | 17.7 | 20.3 | 3.6 | -17.4 | -17.4 | -17.4 | -17.4 | -17.4 | -17.4 |
| 60 | 21.7 | 22.3 | 28.7 | 23.3 | 23.1 | 22.5 | 20.7 | 4.7 | -18.3 | 29.3 | -18.3 | -18.3 | 4.1 | -18.3 |
| 61 | 22.9 | 23.7 | 30.3 | 24.5 | 24.3 | 23.8 | 22.0 | 5.6 | -19.5 | 31.4 | -19.5 | -19.5 | 4.8 | -19.5 |
| 62 | 24.7 | 23.2 | 30.9 | 30.9 | 25.3 | 25.3 | 25.3 | 52.7 | 25.7 | 77.6 | 77.6 | 25.7 | 51.5 | 51.5 |
| 63 | 20.8 | 16.4 | 22.8 | 22.8 | 20.0 | 19.7 | 19.7 | 57.9 | 28.6 | 81.8 | 81.8 | 28.6 | 55.3 | 55.3 |
| 64 | 23.9 | 19.8 | 26.2 | 26.2 | 23.0 | 24.5 | 24.5 | 64.0 | 32.7 | 87.2 | 87.2 | 32.7 | 60.2 | 60.2 |
| 65 | 39.4 | 35.9 | 45.7 | 45.7 | 45.7 | 42.2 | 42.2 | 83.0 | 49.3 | 105.2 | 105.2 | 105.2 | 77.4 | 77.4 |
| 66 | 37.4 | 33.2 | 42.9 | 42.9 | 42.9 | 39.8 | 39.8 | 90.1 | 53.9 | 110.9 | 110.9 | 110.9 | 82.7 | 82.7 |
| 67 | 40.9 | 37.7 | 48.7 | 48.7 | 48.7 | 44.8 | 44.8 | 98.3 | 59.9 | 117.6 | 117.6 | 117.6 | 89.2 | 89.2 |
| 68 | 44.2 | 41.9 | 54.1 | 54.1 | 54.1 | 49.1 | 49.1 | 106.9 | 66.1 | 124.0 | 124.0 | 124.0 | 95.8 | 95.8 |
| 69 | 47.5 | 46.0 | 59.0 | 59.0 | 59.0 | 53.0 | 53.0 | 116.0 | 72.5 | 130.7 | 130.7 | 130.7 | 102.3 | 102.3 |
| 70 | 49.5 | 50.5 | 60.8 | 60.8 | 60.8 | 55.6 | 55.6 | 73.4 | 46.3 | 80.4 | 80.4 | 80.4 | 63.8 | 63.8 |

| | Net Retirement Wealth (000s) | | | | | | | Net Wealth Accrual | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | DC Plan | No Pensio | DB Plan A | DB Plan B | DB Plan C | DB Plan D | DB Plan E | DC Plan | No Pension | DB Plan A | DB Plan B | DB Plan C | DB Plan D | DB Plan E |
| 55 | $348 | $235 | $393 | $393 | $357 | $307 | $307 | $69,004 | $64,301 | $72,797 | $72,797 | $70,777 | $69,340 | $69,340 |
| 56 | 417 | 299 | 465 | 465 | 427 | 377 | 377 | 66,691 | 62,110 | 69,782 | 69,782 | 67,938 | 67,257 | 67,257 |
| 57 | 484 | 361 | 535 | 535 | 495 | 444 | 444 | 61,751 | 57,361 | 65,177 | 65,177 | 63,296 | 62,454 | 62,454 |
| 58 | 546 | 418 | 600 | 600 | 559 | 506 | 506 | 58,803 | 54,791 | 62,563 | 62,563 | 60,672 | 59,804 | 59,804 |
| 59 | 604 | 473 | 663 | 663 | 619 | 566 | 566 | 55,990 | 52,409 | 81,049 | 60,095 | 58,255 | 66,002 | 57,414 |
| 60 | 660 | 526 | 744 | 723 | 678 | 632 | 624 | 53,493 | 50,068 | 48,438 | 58,323 | 56,408 | 51,112 | 55,180 |
| 61 | 714 | 576 | 792 | 781 | 734 | 683 | 679 | 51,407 | 48,036 | 45,379 | 56,448 | 54,498 | 48,697 | 53,218 |
| 62 | 765 | 624 | 838 | 838 | 789 | 732 | 732 | 49,025 | 47,074 | 36,639 | 36,639 | 52,943 | 43,040 | 43,040 |
| 63 | 814 | 671 | 874 | 874 | 841 | 775 | 775 | 49,422 | 48,994 | 38,419 | 38,419 | 54,872 | 43,905 | 43,905 |
| 64 | 864 | 720 | 913 | 913 | 896 | 819 | 819 | 45,848 | 45,526 | 35,155 | 35,155 | 51,698 | 39,708 | 39,708 |
| 65 | 910 | 765 | 948 | 948 | 948 | 859 | 859 | 36,369 | 36,279 | 25,629 | 25,629 | 25,629 | 30,405 | 30,405 |
| 66 | 946 | 802 | 974 | 974 | 974 | 889 | 889 | 36,301 | 36,624 | 25,433 | 25,433 | 25,433 | 30,441 | 30,441 |
| 67 | 982 | 838 | 999 | 999 | 999 | 920 | 920 | 33,330 | 33,368 | 22,120 | 22,120 | 22,120 | 27,149 | 27,149 |
| 68 | 1,016 | 871 | 1,021 | 1,021 | 1,021 | 947 | 947 | 30,556 | 30,338 | 19,137 | 19,137 | 19,137 | 24,253 | 24,253 |
| 69 | 1,046 | 902 | 1,040 | 1,040 | 1,040 | 971 | 971 | 27,913 | 27,444 | 16,421 | 16,421 | 16,421 | 21,635 | 21,635 |
| 70 | 1,074 | 929 | 1,057 | 1,057 | 1,057 | 993 | 993 | 26,570 | 24,991 | 15,604 | 15,604 | 15,604 | 20,338 | 20,338 |

| | Annual Consumption Stream | | | | | | |
|---|---|---|---|---|---|---|---|
| DC Plan | No Pension | DB Plan A | DB Plan B | DB Plan C | DB Plan D | DB Plan E |
| $20,650 | $13,909 | $23,283 | $23,283 | $21,151 | $18,230 | $18,230 |
| 24,742 | 17,722 | 27,600 | 27,600 | 25,348 | 22,342 | 22,342 |
| 28,697 | 21,405 | 31,738 | 31,738 | 29,377 | 26,330 | 26,330 |
| 32,359 | 24,807 | 35,603 | 35,603 | 33,130 | 30,034 | 30,034 |
| 35,846 | 28,056 | 39,313 | 39,313 | 36,728 | 33,580 | 33,580 |
| 39,166 | 31,164 | 44,119 | 42,877 | 40,182 | 37,494 | 36,985 |
| 42,338 | 34,133 | 46,992 | 46,335 | 43,527 | 40,525 | 40,257 |
| 45,387 | 36,982 | 49,683 | 49,683 | 46,759 | 43,413 | 43,413 |
| 48,294 | 39,773 | 51,856 | 51,856 | 49,899 | 45,965 | 45,965 |
| 51,225 | 42,678 | 54,134 | 54,134 | 53,153 | 48,569 | 48,569 |
| 53,944 | 45,378 | 56,218 | 56,218 | 56,218 | 50,924 | 50,924 |
| 56,100 | 47,530 | 57,738 | 57,738 | 57,738 | 52,727 | 52,727 |
| 58,253 | 49,701 | 59,246 | 59,246 | 59,246 | 54,532 | 54,532 |
| 60,229 | 51,680 | 60,558 | 60,558 | 60,558 | 56,142 | 56,142 |
| 62,041 | 53,479 | 61,693 | 61,693 | 61,693 | 57,580 | 57,580 |
| 63,697 | 55,107 | 62,667 | 62,667 | 62,667 | 58,863 | 58,863 |

outside his employer DC pension contributions. DB plans A, B, and C pay benefits equal to 1 percent of final three years of earnings times years of service. Plans A and B pay full benefits beginning at age 62, but Plan C does not pay benefits until age 65. Plan A also offers early retirement benefits as early age age 55 after 25 years of service. Plans D and E base benefits on career earnings, not the final three years of service. Both pay full

**Appendix Table 5. Implicit Tax Rates, Replacement Rates, and Net Retirement Wealth by Age and Education**

| | Earnings | | | | Implicit Tax Rate | | | | Replacement Rate | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | Some College | < HS | HS Grad | College Grad | Some College | < HS | HS Grad | College Grad | Some College | < HS | HS Grad | College Grad |
| 55 | $50,996 | $29,502 | $42,163 | $75,066 | 14.2% | 8.5% | 12.1% | 22.7% | 0.1% | -10.3% | -2.8% | 3.6% |
| 56 | 49,938 | 28,929 | 41,304 | 73,945 | 14.1 | 8.4 | 11.8 | 23.1 | 0.9 | -10.2 | -2.2 | 4.4 |
| 57 | 49,657 | 28,368 | 40,300 | 72,415 | 19.6 | 14.4 | 18.4 | 24.2 | 1.7 | -9.9 | -1.5 | 5.4 |
| 58 | 48,436 | 27,817 | 39,319 | 71,423 | 20.4 | 14.8 | 18.9 | 25.0 | 2.7 | -9.6 | -0.7 | 6.5 |
| 59 | 47,243 | 27,277 | 38,362 | 71,631 | 21.1 | 15.4 | 19.3 | 27.1 | 3.6 | -9.2 | 0.2 | 7.3 |
| 60 | 46,119 | 26,747 | 37,426 | 71,990 | 21.7 | 15.5 | 19.1 | 28.2 | 4.7 | -8.7 | 1.3 | 8.5 |
| 61 | 45,798 | 26,228 | 36,514 | 72,267 | 22.9 | 16.0 | 19.8 | 29.8 | 5.6 | -8.4 | 2.2 | 9.4 |
| 62 | 45,457 | 25,718 | 35,621 | 72,467 | 24.7 | 15.3 | 18.9 | 30.6 | 52.7 | 43.9 | 53.1 | 44.6 |
| 63 | 44,574 | 25,219 | 34,930 | 71,060 | 20.8 | 8.1 | 12.0 | 26.8 | 57.9 | 49.2 | 58.4 | 48.9 |
| 64 | 43,709 | 24,729 | 34,251 | 69,680 | 23.9 | 11.5 | 18.8 | 29.0 | 64.0 | 55.9 | 65.1 | 54.1 |
| 65 | 42,860 | 24,249 | 33,587 | 68,327 | 39.4 | 35.0 | 38.8 | 38.8 | 83.0 | 84.1 | 87.2 | 67.7 |
| 66 | 42,027 | 23,778 | 32,935 | 67,000 | 37.4 | 32.7 | 36.9 | 36.8 | 90.1 | 92.2 | 95.0 | 73.7 |
| 67 | 41,212 | 23,316 | 32,295 | 65,700 | 40.9 | 38.6 | 42.1 | 39.6 | 98.3 | 102.4 | 104.2 | 80.7 |
| 68 | 40,411 | 22,863 | 31,668 | 64,423 | 44.2 | 46.9 | 46.3 | 44.1 | 106.9 | 112.6 | 113.7 | 87.9 |
| 69 | 39,627 | 22,420 | 31,053 | 63,173 | 47.5 | 52.6 | 49.9 | 48.2 | 116.0 | 122.8 | 123.5 | 94.5 |
| 70 | 38,857 | 21,985 | 30,450 | 61,946 | 49.5 | 48.3 | 51.3 | 50.2 | 73.4 | 68.1 | 74.6 | 66.1 |

| | Net Retirement Wealth (000s) | | | | Net Wealth Accrual | | | | Annual Consumption Stream | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | Some College | < HS | HS Grad | College Grad | Some College | < HS | HS Grad | College Grad | Some College | < HS | HS Grad | College Grad |
| 55 | $348 | $223 | $306 | $420 | $69,004 | $44,283 | $59,115 | $91,331 | $20,650 | $13,203 | $18,117 | $24,923 |
| 56 | 417 | 267 | 365 | 512 | 66,691 | 42,873 | 57,204 | 88,016 | 24,742 | 15,829 | 21,623 | 30,339 |
| 57 | 484 | 310 | 422 | 600 | 61,751 | 39,249 | 51,657 | 83,824 | 28,697 | 18,371 | 25,015 | 35,558 |
| 58 | 546 | 349 | 473 | 683 | 58,803 | 37,748 | 49,380 | 80,621 | 32,359 | 20,699 | 28,078 | 40,529 |
| 59 | 604 | 387 | 523 | 764 | 55,990 | 36,258 | 47,222 | 77,489 | 35,846 | 22,937 | 31,006 | 45,310 |
| 60 | 660 | 423 | 570 | 842 | 53,493 | 34,959 | 45,421 | 75,400 | 39,166 | 25,087 | 33,807 | 49,905 |
| 61 | 714 | 458 | 616 | 917 | 51,407 | 33,573 | 43,240 | 72,660 | 42,338 | 27,160 | 36,500 | 54,376 |
| 62 | 765 | 492 | 659 | 990 | 49,025 | 32,651 | 41,955 | 70,620 | 45,387 | 29,151 | 39,064 | 58,685 |
| 63 | 814 | 524 | 701 | 1,060 | 49,422 | 33,954 | 43,559 | 71,180 | 48,294 | 31,088 | 41,552 | 62,873 |
| 64 | 864 | 558 | 744 | 1,131 | 45,848 | 31,682 | 39,016 | 66,627 | 51,225 | 33,101 | 44,135 | 67,094 |
| 65 | 910 | 590 | 783 | 1,198 | 36,369 | 23,464 | 29,452 | 56,539 | 53,944 | 34,980 | 46,449 | 71,045 |
| 66 | 946 | 613 | 813 | 1,255 | 36,301 | 23,695 | 29,444 | 56,273 | 56,100 | 36,371 | 48,196 | 74,398 |
| 67 | 982 | 637 | 842 | 1,311 | 33,330 | 21,212 | 26,364 | 52,193 | 58,253 | 37,776 | 49,942 | 77,735 |
| 68 | 1,016 | 658 | 869 | 1,363 | 30,556 | 18,010 | 23,811 | 46,753 | 60,229 | 39,034 | 51,505 | 80,830 |
| 69 | 1,046 | 676 | 892 | 1,410 | 27,913 | 15,668 | 21,594 | 41,848 | 62,041 | 40,102 | 52,917 | 83,602 |
| 70 | 1,074 | 692 | 914 | 1,452 | 26,570 | 16,889 | 20,862 | 39,541 | 63,697 | 41,031 | 54,198 | 86,084 |

Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance. His earnings are for a male worker with some college education. Other earning profiles are consistent with historic earnings for males with other education levels. Dollar amounts are in $2004.

**Appendix Table 6. Implicit Tax Rates, Replacement Rates, and Net Retirement Wealth by Age and Health Insurance Status**

| | Implicit Tax Rate | | | Replacement Rate | | |
|---|---|---|---|---|---|---|
| Age | Employer Insurance When Working | Retiree Insurance | No Employer Insurance | Employer Insurance When Working | Retiree Insurance | No Employer Insurance |
| **55** | 14.2% | 15.9% | 16.9% | 0.1% | 10.4% | 0.1% |
| **56** | 14.1 | 15.9 | 17.0 | 0.9 | 11.8 | 1.0 |
| **57** | 19.6 | 21.4 | 23.0 | 1.7 | 13.1 | 2.0 |
| **58** | 20.4 | 22.3 | 24.0 | 2.7 | 14.8 | 3.2 |
| **59** | 21.1 | 23.2 | 25.1 | 3.6 | 16.5 | 4.3 |
| **60** | 21.7 | 23.8 | 25.9 | 4.7 | 18.3 | 5.6 |
| **61** | 22.9 | 25.2 | 27.4 | 5.6 | 20.1 | 6.8 |
| **62** | 24.7 | 27.0 | 29.6 | 52.7 | 67.9 | 64.6 |
| **63** | 20.8 | 23.3 | 25.6 | 57.9 | 74.0 | 71.9 |
| **64** | 23.9 | 26.6 | 29.4 | 64.0 | 81.1 | 80.6 |
| **65** | 39.4 | 39.4 | 33.2 | 83.0 | 93.1 | 91.3 |
| **66** | 37.4 | 37.4 | 30.4 | 90.1 | 100.7 | 99.6 |
| **67** | 40.9 | 40.9 | 33.6 | 98.3 | 109.4 | 109.2 |
| **68** | 44.2 | 44.2 | 36.6 | 106.9 | 118.5 | 119.3 |
| **69** | 47.5 | 47.5 | 39.6 | 116.0 | 128.2 | 130.2 |
| **70** | 49.5 | 49.5 | 41.3 | 73.4 | 81.0 | 78.7 |

| | Net Retirement Wealth (000s) | | | Net Wealth Accrual | | | Annual Consumption Stream | | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Employer Insurance When Working | Retiree Insurance | No Employer Insurance | Employer Insurance When Working | Retiree Insurance | No Employer Insurance | Employer Insurance When Working | Retiree Insurance | No Employer Insurance |
| **55** | $348 | $459 | $348 | $69,004 | $62,994 | $62,994 | $20,650 | $27,227 | $20,650 |
| **56** | 417 | 522 | 411 | 66,691 | 60,643 | 60,643 | 24,742 | 30,963 | 24,386 |
| **57** | 484 | 583 | 472 | 61,751 | 55,671 | 55,671 | 28,697 | 34,559 | 27,982 |
| **58** | 546 | 638 | 528 | 58,803 | 52,693 | 52,693 | 32,359 | 37,860 | 31,283 |
| **59** | 604 | 691 | 580 | 55,990 | 49,856 | 49,856 | 35,846 | 40,985 | 34,408 |
| **60** | 660 | 741 | 630 | 53,493 | 47,356 | 47,356 | 39,166 | 43,942 | 37,365 |
| **61** | 714 | 788 | 677 | 51,407 | 45,240 | 45,240 | 42,338 | 46,750 | 40,173 |
| **62** | 765 | 834 | 723 | 49,025 | 42,834 | 42,834 | 45,387 | 49,433 | 42,856 |
| **63** | 814 | 876 | 766 | 49,422 | 43,213 | 43,213 | 48,294 | 51,973 | 45,396 |
| **64** | 864 | 920 | 809 | 45,848 | 39,628 | 39,628 | 51,225 | 54,535 | 47,958 |
| **65** | 910 | 959 | 848 | 36,369 | 31,546 | 36,157 | 53,944 | 56,885 | 50,308 |
| **66** | 946 | 991 | 885 | 36,301 | 31,245 | 36,079 | 56,100 | 58,756 | 52,452 |
| **67** | 982 | 1,022 | 921 | 33,330 | 28,051 | 33,098 | 58,253 | 60,609 | 54,592 |
| **68** | 1,016 | 1,050 | 954 | 30,556 | 25,080 | 30,315 | 60,229 | 62,272 | 56,555 |
| **69** | 1,046 | 1,075 | 984 | 27,913 | 22,263 | 27,664 | 62,041 | 63,759 | 58,352 |
| **70** | 1,074 | 1,097 | 1,012 | 26,570 | 20,771 | 26,315 | 63,697 | 65,080 | 59,993 |

Notes: The base-case worker is a single male in good health with a DC pension plan. He has employer-sponsored health insurance but only while employer. Dollar amounts are in $2004.

**Appendix Table 7. Implicit Tax Rates, Replacement Rates, and Net Retirement Wealth by Age and Health Status**

| | Implicit Tax Rate | | | | Replacement Rate | | | |
|---|---|---|---|---|---|---|---|---|
| Age | Non Smoker / No Health Problems | Smoker / No Health Problems | Non Smoker / Health Problems | Smoker / Health Problems | Non Smoker / No Health Problems | Smoker / No Health Problems | Non Smoker / Health Problems | Smoker / Health Problems |
| 55 | 14.2% | 12.8% | 5.5% | 2.6% | 0.1% | -2.2% | -14.1% | -18.7% |
| 56 | 14.1 | 12.6 | 4.9 | 1.8 | 0.9 | -1.6 | -14.1 | -19.1 |
| 57 | 19.6 | 18.0 | 10.1 | 6.8 | 1.7 | -1.0 | -13.8 | -19.2 |
| 58 | 20.4 | 18.6 | 10.4 | 6.8 | 2.7 | -0.2 | -13.7 | -19.6 |
| 59 | 21.1 | 19.2 | 10.6 | 6.6 | 3.6 | 0.4 | -13.7 | -20.2 |
| 60 | 21.7 | 19.3 | 10.6 | 5.8 | 4.7 | 0.8 | -13.5 | -21.4 |
| 61 | 22.9 | 20.7 | 11.4 | 6.8 | 5.6 | 1.8 | -13.8 | -21.5 |
| 62 | 24.7 | 22.5 | 12.7 | 8.3 | 52.7 | 49.0 | 32.4 | 25.1 |
| 63 | 20.8 | 18.7 | 8.1 | 4.0 | 57.9 | 54.4 | 36.5 | 29.5 |
| 64 | 23.9 | 22.0 | 10.7 | 6.7 | 64.0 | 60.7 | 41.5 | 34.7 |
| 65 | 39.4 | 39.4 | 39.4 | 39.4 | 83.0 | 83.0 | 83.0 | 83.0 |
| 66 | 37.4 | 37.4 | 37.4 | 37.4 | 90.1 | 90.1 | 90.1 | 90.1 |
| 67 | 40.9 | 40.9 | 40.9 | 40.9 | 98.3 | 98.3 | 98.3 | 98.3 |
| 68 | 44.2 | 44.2 | 44.2 | 44.2 | 106.9 | 106.9 | 106.9 | 106.9 |
| 69 | 47.5 | 47.5 | 47.5 | 47.5 | 116.0 | 116.0 | 116.0 | 116.0 |
| 70 | 49.5 | 49.5 | 49.5 | 49.5 | 73.4 | 73.4 | 73.4 | 73.4 |

| | Net Retirement Wealth (000s) | | | | Net Wealth Accrual | | | | Annual Consumption Stream | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | Non Smoker / No Health Problems | Smoker / No Health Problems | Non Smoker / Health Problems | Smoker / Health Problems | Non Smoker / No Health Problems | Smoker / No Health Problems | Non Smoker / Health Problems | Smoker / Health Problems | Non Smoker / No Health Problems | Smoker / No Health Problems | Non Smoker / Health Problems | Smoker / Health Problems |
| 55 | $348 | $348 | $348 | $348 | $69,004 | $70,089 | $75,717 | $77,877 | $20,650 | $20,650 | $20,650 | $20,650 |
| 56 | 417 | 418 | 424 | 426 | 66,691 | 67,819 | 73,429 | 75,681 | 24,742 | 24,807 | 25,140 | 25,268 |
| 57 | 484 | 486 | 497 | 502 | 61,751 | 62,922 | 68,513 | 70,855 | 28,697 | 28,828 | 29,495 | 29,756 |
| 58 | 546 | 549 | 566 | 573 | 58,803 | 60,017 | 65,583 | 68,015 | 32,359 | 32,560 | 33,558 | 33,958 |
| 59 | 604 | 609 | 631 | 641 | 55,990 | 57,246 | 62,783 | 65,305 | 35,846 | 36,119 | 37,447 | 37,991 |
| 60 | 660 | 666 | 694 | 706 | 53,493 | 54,935 | 60,266 | 63,175 | 39,166 | 39,513 | 41,170 | 41,864 |
| 61 | 714 | 721 | 755 | 769 | 51,407 | 52,745 | 58,209 | 60,904 | 42,338 | 42,771 | 44,744 | 45,610 |
| 62 | 765 | 774 | 813 | 830 | 49,025 | 50,260 | 55,849 | 58,330 | 45,387 | 45,899 | 48,195 | 49,222 |
| 63 | 814 | 824 | 869 | 888 | 49,422 | 50,551 | 56,259 | 58,525 | 48,294 | 48,879 | 51,507 | 52,681 |
| 64 | 864 | 875 | 925 | 947 | 45,848 | 46,870 | 52,692 | 54,736 | 51,225 | 51,877 | 54,843 | 56,152 |
| 65 | 910 | 922 | 978 | 1,002 | 36,369 | 36,369 | 36,369 | 36,369 | 53,944 | 54,656 | 57,968 | 59,397 |
| 66 | 946 | 958 | 1,014 | 1,038 | 36,301 | 36,301 | 36,301 | 36,301 | 56,100 | 56,813 | 60,125 | 61,554 |
| 67 | 982 | 994 | 1,050 | 1,074 | 33,330 | 33,330 | 33,330 | 33,330 | 58,253 | 58,966 | 62,277 | 63,707 |
| 68 | 1,016 | 1,028 | 1,084 | 1,108 | 30,556 | 30,556 | 30,556 | 30,556 | 60,229 | 60,942 | 64,254 | 65,683 |
| 69 | 1,046 | 1,058 | 1,114 | 1,138 | 27,913 | 27,913 | 27,913 | 27,913 | 62,041 | 62,754 | 66,066 | 67,495 |
| 70 | 1,074 | 1,086 | 1,142 | 1,166 | 26,570 | 26,570 | 26,570 | 26,570 | 63,697 | 64,410 | 67,721 | 69,151 |

Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance. Health status varies for the alternate workers. Retired workers purchase nongroup insurance based on health status before age 65 when Medicare becomes available. Dollar amounts are in $2004.

**Appendix Table 8. Implicit Tax Rates, Replacement Rates, and Net Retirement Wealth by Age, Marital Status and Spouse Earnings**

| | Implicit Tax Rate | | | Replacement Rate | | |
|---|---|---|---|---|---|---|
| Age | Not Married | Wife Doesn't Work | Wife Has Same Earnings | Not Married | Wife Doesn't Work | Wife Has Same Earnings |
| 55 | 14.2% | 6.5% | 22.2% | 0.1% | 0.1% | -2.3% |
| 56 | 14.1 | 6.5 | 22.5 | 0.9 | 0.8 | -1.7 |
| 57 | 19.6 | 14.2 | 26.9 | 1.7 | 1.6 | -0.9 |
| 58 | 20.4 | 15.0 | 27.3 | 2.7 | 2.5 | -0.2 |
| 59 | 21.1 | 15.6 | 27.8 | 3.6 | 3.5 | 0.7 |
| 60 | 21.7 | 15.0 | 29.5 | 4.7 | 4.7 | 1.7 |
| 61 | 22.9 | 16.8 | 31.7 | 5.6 | 6.0 | 2.9 |
| 62 | 24.7 | 18.0 | 28.3 | 52.7 | 70.4 | 29.9 |
| 63 | 20.8 | 1.8 | 26.1 | 57.9 | 77.6 | 32.7 |
| 64 | 23.9 | 2.8 | 26.6 | 64.0 | 87.2 | 35.6 |
| 65 | 39.4 | 23.0 | 39.1 | 83.0 | 108.4 | 52.1 |
| 66 | 37.4 | 37.3 | 21.3 | 90.1 | 118.5 | 56.4 |
| 67 | 40.9 | 41.5 | 25.3 | 98.3 | 127.3 | 64.5 |
| 68 | 44.2 | 45.4 | 29.1 | 106.9 | 136.2 | 73.1 |
| 69 | 47.5 | 49.4 | 32.9 | 116.0 | 145.7 | 82.1 |
| 70 | 49.5 | 54.3 | 49.4 | 73.4 | 76.7 | 66.0 |

| | Net Retirement Wealth (000s) | | | Net Wealth Accrual | | | Annual Consumption Stream | | |
|---|---|---|---|---|---|---|---|---|---|
| Age | Not Married | Wife Doesn't Work | Wife Has Same Earnings | Not Married | Wife Doesn't Work | Wife Has Same Earnings | Not Married | Wife Doesn't Work | Wife Has Same Earnings |
| 55 | $348 | $535 | $196 | $69,004 | $74,447 | $63,202 | $20,650 | $31,708 | $11,620 |
| 56 | 417 | 609 | 259 | 66,691 | 71,946 | 60,888 | 24,742 | 36,123 | 15,368 |
| 57 | 484 | 681 | 320 | 61,751 | 65,604 | 56,770 | 28,697 | 40,390 | 18,978 |
| 58 | 546 | 747 | 377 | 58,803 | 62,447 | 54,167 | 32,359 | 44,280 | 22,345 |
| 59 | 604 | 809 | 431 | 55,990 | 59,619 | 51,651 | 35,846 | 47,983 | 25,557 |
| 60 | 660 | 869 | 483 | 53,493 | 57,622 | 48,632 | 39,166 | 51,519 | 28,620 |
| 61 | 714 | 926 | 531 | 51,407 | 55,114 | 46,030 | 42,338 | 54,936 | 31,504 |
| 62 | 765 | 982 | 577 | 49,025 | 53,011 | 46,786 | 45,387 | 58,204 | 34,233 |
| 63 | 814 | 1,035 | 624 | 49,422 | 60,248 | 46,292 | 48,294 | 61,347 | 37,008 |
| 64 | 864 | 1,095 | 670 | 45,848 | 57,680 | 44,341 | 51,225 | 64,920 | 39,753 |
| 65 | 910 | 1,152 | 715 | 36,369 | 45,381 | 36,517 | 53,944 | 68,341 | 42,382 |
| 66 | 946 | 1,198 | 751 | 36,301 | 36,351 | 45,104 | 56,100 | 71,032 | 44,548 |
| 67 | 982 | 1,234 | 796 | 33,330 | 32,946 | 41,844 | 58,253 | 73,187 | 47,223 |
| 68 | 1,016 | 1,267 | 838 | 30,556 | 29,839 | 38,783 | 60,229 | 75,141 | 49,704 |
| 69 | 1,046 | 1,297 | 877 | 27,913 | 26,764 | 35,824 | 62,041 | 76,911 | 52,004 |
| 70 | 1,074 | 1,324 | 913 | 26,570 | 23,853 | 26,779 | 63,697 | 78,498 | 54,128 |

Notes: The base-case worker is a single male in good health with a DC pension plan and no retiree health insurance. The married worker has the same earnings and pension as the single worker. In one case the married worker has a nonworking spouse. In the other case the husband and wife have identical earnings. Dollar amounts are in $2004.

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