Implicit Social Security Tax Rates
Over the Life Cycle

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Implicit Social Security Tax Rates over the Life Cycle

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Abstract

The U.S. Social Security benefit structure implicitly creates disincentives towards working long careers. Workers who are near retirement often gain little additional Social Security benefit from continued work because of particular features of the Social Security benefit formula. This paper develops a framework to examine these disincentives and applies it to a set of stylized workers, as well as to actual earnings records of primary and secondary earners. While the conventional wisdom is that net Social Security tax rates fall with age due to the discounting of future benefits for interest and mortality, this paper shows that the overwhelming pattern of implicit Social Security tax rates is increasing. The distinction comes mainly from incorporating two features of the system: only the highest 35 years of indexed earnings count towards Social Security benefits, and the benefit calculation does not distinguish between low-income earners who work long careers and high-income earners who work short careers. In addition, married couples face different incentives than single workers. Marriage reduces primary earners’ implicit tax rates, but raises the implicit tax rates faced by secondary earners. Because both older workers and secondary earners tend to have high labor supply elasticities, raising revenue from these workers has efficiency considerations.

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1 Introduction

The U.S. Social Security system provides old-age and survivors insurance benefits to almost 40 million qualified retirees and survivors. These benefit payments are essential to many, providing more than half of the total income of 65 percent of beneficiaries; for 21 percent of beneficiaries, Social Security is their only source of income. The system is financed by a flat payroll tax on earnings under a maximum earnings level, equal to $94,200 in 2006 and scheduled to increase to $97,500 in 2007. Over 70 percent of American workers pay more in Social Security payroll taxes than income taxes, making it important to understand the distortions embedded in the payroll tax and how these distortions vary over the life cycle.

The implicit Social Security tax rate is the Social Security taxes paid net of the benefits accrued from working an additional year, as a percentage of earnings. The Social Security benefit formula creates different patterns of benefit accruals for individuals depending on their age, level of earnings, work history, and marital status. This paper examines the ways in which the current benefit structure in Social Security creates disincentives towards working longer careers.

The Social Security actuarial deficit largely results from the decreasing number of workers supporting each beneficiary. This ratio, equal to 4.0 in 1965, has dropped to 3.3 in 2005 and is projected, under intermediate cost projections in the 2006 Trustees Report, to reach 2.0 in 2045. This decline is expected to occur not only because of the retirement of the baby boom generation, but also because of expectations of increasing life expectancy. An improvement in life expectancy without a corresponding increase in the retirement age contributes to the higher rate of growth in program costs relative to income, long after the baby boom generation’s retirement is complete.

Large distortions in the implicit Social Security tax rate could change the incentives for individuals to participate in the labor force. A Social Security system that gives incentives to workers to prolong their careers would benefit both the solvency of Social Security and workers alike. Estimates show that the additional Social Security taxes generated by an extra five years of work would cover more than half the shortfall in 2045, requiring smaller benefit cuts and/or tax increases to achieve solvency, and result in 25 percent higher income in retirement for workers (Butrica, Smith, and Stenerle 2006). Additional work would also increase general revenues through

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1 The Social Security maximum taxable earnings level, or earnings cap, grows with the average wage index as determined under automatic adjustment provisions of the Social Security Act.

2 According to an August 2003 report by the Congressional Budget Office, “Effective Federal Tax Rates 1997-2000.” Social Security payroll taxes are defined to be the sum of the employer and employee payroll tax.
higher federal and state income tax receipts.

Historically, there have been substantial improvements in life expectancy with accompanying advances in health status. Cutler, Liebman, and Smyth (2005) found that men age 68 in 2000 experience mortality risk similar to what men age 62 did in 1960, effectively making them six years “younger.” In terms of self-assessed health status, they find the difference is ten years. Shoven (2004) suggests that the age of elderly people is more appropriately measured by remaining life expectancy than by years since birth.

While these improvements in health status and life expectancy should enable individuals to sustain longer careers and delay retirement, the retirement age of men has not increased with life expectancy; in fact, men have been retiring earlier. Figure 1 shows the labor force participation rates of men in 1965 and 2003. The first graph shows that the median male retiree is leaving the labor force approximately three years younger than he was in 1965. After taking into account improvements in life expectancy during that time, the effect is even more dramatic – the median male retiree is spending roughly six additional years in retirement, an increase of 50 percent in the median length of retirement. About half of the increase was due to earlier retirement, and the other half due to life expectancy improvements.

Conventional wisdom regarding the net Social Security tax rate is that it declines with age. The argument contends that the distortion is equal to the full payroll tax rate in the beginning of one’s career (before the individual has worked long enough to qualify for benefits), and decreases as the individual is closer to receiving the benefits that are earned by additional contributions. However, while it is true that discounting for interest and mortality makes a given benefit earned at retirement worth more at age 60 than age 20, previous studies have ignored the fact that the amount of benefit that is accrued can change depending on the earnings record of the individual. The two primary features of the Social Security benefit formula that cause this are as follows:

1. The benefit formula does not distinguish between a high-income individual who works a short career, and a low-income individual who works a long career. Because Social Security is progressive, this implies that contributions early in a career generate benefits at a higher rate than contributions late in a career.

2. Only the highest 35 years of wage-indexed earnings are used in the benefit calculation. Once an individual has worked 35 years, his or her contributions only accrue benefits to the extent that the earnings in that year replace a lower earnings year.
Taking these features into account shows that older workers do, in fact, face relatively high implicit tax rates from Social Security, and thus large disincentives to continue participating in the labor force. Consequently, the Social Security benefit formula essentially creates disincentives toward working long careers. The potential benefits of a larger workforce and the relatively high labor supply elasticity of older workers suggests that this pattern of implicit tax rates is inefficient.

Implicit Social Security tax rates for married couples are more complex. Social Security provides spousal benefits to secondary workers, or the lower income earner in a couple, if the spousal
benefits exceed the benefits the secondary workers earned from their own earnings history. Thus the secondary workers’ earnings accrue benefits only to the extent that they exceed the spousal benefit. In addition, these benefits are paid as first-to-die joint life annuities which are worth less than single life annuities. Consequently, secondary earners face high implicit Social Security tax rates. Because benefits depend on the interactions of both workers’ earnings histories, implicit tax rates for secondary workers vary based on their perceptions of their spouses’ future earnings. Other important factors include the relative benefit amounts within the couple, the age difference within the couple, and the relative timing of their earnings. Because secondary earners, historically married women, tend to display high labor supply elasticities, their decisions to participate in the labor force may be heavily distorted by the high tax rates implied by the Social Security benefit formula.

Section 2 describes previous literature regarding Social Security work incentives over the life cycle. Section 3 calculates implicit tax rates for four stylized workers, and gives further discussion on the aspects of the Social Security benefit formula that create the increasing pattern and the differences from previous work on this subject. Section 4 repeats the implicit tax rate calculations on the actual earnings histories of a large sample of Social Security beneficiaries assuming they are single. Section 5 discusses the calculations for married couples and shows results for a simulated set of secondary workers, and Section 6 concludes.

2 Literature Review

This paper is most similar to Feldstein and Samwick’s (1992) study which computes net marginal Social Security tax rates for several demographic groups. The net marginal tax rate is the difference between the statutory tax rate and the additional benefits associated with an additional dollar of earnings. Feldstein and Samwick’s main findings are that net marginal Social Security tax rates differ greatly by age, sex, and marital status. They state:

Marginal tax rates decline sharply with age and increase dramatically with income.
For workers of a given age and income level, single workers face higher tax rates than workers with dependent spouses, and male workers face higher tax rates than female workers. (p. 1)
Many of these results will be confirmed in this paper. Because the Social Security system is progressive, workers with lower lifetime earnings accrue larger benefits relative to their income and thus face lower tax rates. Male workers have higher mortality risks which reduce the value of a given annuity income stream relative to female workers; therefore, they face higher tax rates. Workers with a dependent spouse face lower tax rates than single workers because the Social Security spousal benefit increases the benefit earned by an additional dollar of earnings by a factor of 1.5.

The difference between the terminology used in Feldstein and Samwick’s work and this paper merits some mention. While Feldstein and Samwick calculate “net marginal” tax rates, this paper focuses on “implicit” tax rates. The reason for this distinction is subtle. Feldstein and Samwick’s net marginal tax rates are what an individual faces if he or she earns one additional dollar in a year that is counted in the benefit calculation (i.e. one of the highest 35 years of wage-indexed earnings) and does not shift the individual to an earnings level with a lower replacement rate in the Social Security formula. On the other hand, the implicit tax rate is the additional net tax incurred, given the worker’s earnings history to that date. The implicit tax rate is relevant for the extensive decision of whether to work an additional year because it tells a worker, perhaps nearing retirement, what additional benefit will be received relative to the taxes that will be paid by extending his or her career one year. This paper argues that the additional benefit accrued from Social Security contributions depends heavily on the entire earnings history, and cannot be computed in isolation. As will be shown, the implicit tax rate does not generally decline sharply with age. Instead, a large portion of the taxes paid on earnings late in a worker’s career is often a pure tax. Despite the possibly limited interpretation of Feldstein and Samwick’s result, it remains an influential and heavily cited study. Their results have been taken to mean that there are large disincentives in Social Security towards working while young, and that the elderly face little distortion to their labor supply decision from Social Security.

In a follow-up paper to Feldstein and Samwick (1992), Cushing (2005) updates the earlier calculations of net marginal tax rates, and extends the analysis to incorporate cohort mortality, the pushing back of the Social Security normal retirement age, and most significantly, the Disability Income (DI) program which Feldstein and Samwick’s study does not consider. Cushing’s methodology of computing net marginal Social Security tax rates is identical to Feldstein and Samwick’s, and so the result of decreasing net marginal tax rates by age remains; however, he finds

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3 An example in the next section will relate the implicit tax rate to the intensive labor supply decision.
that the marginal benefits of an extra dollar of income under the DI program are much higher for younger workers relative to older workers. Therefore, net marginal DI tax rates increase with age. This result is because the young have a larger chance of becoming disabled at some point before retirement, their expected length of disability given a spell of disability occurs is longer, and their earnings have a larger effect on their benefits because disability benefits are based on a worker’s average earnings.\footnote{For example, the fifth year of earnings affects the worker’s average earnings more than the thirty-fifth year.} Lower net marginal tax rates for the young from the DI program coupled with higher net marginal tax rates from Old Age and Survivors Insurance (OASI) implies a flatter age profile of net marginal tax rates. This paper will argue that the DI program only reinforces the increasing tax rates from OASI.

There is research that finds that older workers face higher tax rates from Social Security. Butrica, Johnson, Smith, and Steuerle (2006) comprehensively evaluate a variety of programs and taxes that affect the work incentives of older workers by constructing three alternative measures of work incentives, including implicit tax rates. They identify large increases in the implicit tax rate, from 14.2 percent at age 55 to almost 50 percent at age 70, partly caused by institutional features in both Social Security and Medicare. While Butrica, Johnson, Smith, and Steuerle give a very exhaustive examination of several programs and their interactions, they only look at work incentives for ages 55 and older and use representative adult workers for their analysis. The representative worker in their base case begins working at age 22, and takes no career breaks. This paper extends their work by using actual work histories to understand the actual implicit Social Security tax rates that individuals have faced.

3 Stylized Workers

This section develops a framework to analyze the pattern of implicit taxes. We begin by looking at four stylized workers who have a smooth earnings pattern over their career. Throughout the analysis, benefit computations will be done under current 2006 benefit rules.\footnote{Using a consistent set of benefit rules allows the results to be comparable across different time periods and cohorts. While current benefit rules cannot persist because of the projected actuarial deficit, most of the analysis in this paper looks at historical earnings records.} Benefits are based on the Average Indexed Monthly Earnings (AIME), the monthly average of the 35 highest years of wage-indexed earnings that fall below the taxable maximum earnings amount. If an individual has not had 35 years of earnings, zeros enter the calculation of the average. The AIME is then
translated into a Primary Insurance Amount (PIA) through a nonlinear formula that encompasses the progressivity of the Social Security system. The PIA is the monthly benefit amount paid to a single worker if he or she retires at the Normal Retirement Age (NRA);\(^6\) retirement before or after the NRA requires the PIA to be actuarially adjusted. The PIA is equal to 90 percent of the first $656 of AIME, plus 32 percent of the amount between $3,955 and $656, plus 15 percent of the AIME above $3,955.\(^7\) The worker receives the PIA – indexed for inflation – every month from retirement until death.

Formally, the implicit Social Security tax rate for an individual at time \(t\) is defined as:

\[ \text{Implicit Social Security Tax Rate}_t = \frac{\text{Payroll Taxes}_t - 12\Delta PIA_t \cdot DAV_g(x, \text{NRA})}{Earnings_t} \]  

(1)

The value \(DAV_g(x, \text{NRA})\) refers to the deferred single life annuity value for an individual age \(x\) and gender \(g\) who begins receiving an annuity of one dollar per year at the Normal Retirement Age (NRA), indexed for inflation. Define \(PIA_t\) as the PIA for the worker evaluated using earnings through year \(t\), and zeros for future earnings years. The variable \(\Delta PIA_t\) is the amount by which the PIA increases due to the extra year of earnings in year \(t\). The PIA is a monthly benefit amount so it is multiplied by 12 to bring all terms to an annual basis.

The first term, \(\frac{\text{Payroll Taxes}_t}{Earnings_t}\), is a constant percentage equal to 10.6 percent, the sum of the employer and employee portion of the OASI tax.\(^8\) Therefore, the variation in the implicit tax rate comes from variation in \(\frac{12\Delta PIA_t \cdot DAV_g(x, \text{NRA})}{Earnings_t}\). As an individual gets older, the deferred annuity value increases due to discounting for both interest and mortality, as shown in Feldstein and Samwick. However, the additional benefit earned each year is non-increasing due to the concave shape of the PIA formula; therefore, the effect on the implicit tax rate is ambiguous. The calculations presented assume an aggregate wage growth rate of 3.5 percent, an inflation rate of 2.5 percent, and a discount rate of 4.5 percent.\(^9\) Benefit streams are discounted for mortality using the Social Security Administration’s intermediate scenario mortality rates.

\(^6\)The Social Security normal retirement age was equal to 65 for several years, but recently increased to 66 for cohorts born from 1943 to 1954. It is scheduled to increase to 67 for those born in 1960 and later.

\(^7\)The dollar amounts in the formula are commonly called “bend points” because when the formula is graphed, it looks like a series of line segments joined at these values. These bend points are for retirement benefits calculated in 2006; every year’s bend points are adjusted by the average wage index.

\(^8\)It is generally agreed that the employee bears both the employer and employee portion of the payroll tax. The DI tax rate adds an additional 2.4 percent to the employee and employer portion, making the entire OASDI tax equal to 15.4 percent. Further analysis focuses on the OASI program only.

\(^9\)These assumptions are comparable to Feldstein and Samwick (1992) who assume 1 percent real wage growth rate and a 2 percent real discount rate.
We first examine the pattern of implicit tax rates for four stylized male single workers. Three of the stylized workers have simulated earnings profiles equal to the average, the 10th percentile, or the 90th percentile earnings for his age. The earnings profiles were constructed by using Outgoing Rotation Groups\textsuperscript{10} from the 2001 and 2002 Current Population Survey to compute the wage for each of the three earnings levels within each age group, and determining a ratio of the earnings at each wage to the average wage across all age groups. This ratio is multiplied by the projected average wage in each year of the worker’s life to arrive at a wage for the worker. For example, consider an average male 30-year-old worker in 2000. The average annual wage in 2000 was $24,668. According to the Current Population Survey, a 30-year-old male earns 1.13 times the national average wage; therefore, his simulated wage would be $24,668*1.13=$27,875. Unlike most previous studies, the stylized workers constructed here have earnings profiles that assume that wages grow with both economy-wide wage growth, as well as with age or experience. The fourth stylized worker earns the taxable maximum in each year.

Each stylized worker is assumed to begin working at age 20, and begin collecting Social Security benefits at the normal retirement age. Suppose the worker has worked a given career length, and is considering extending his career by an additional year. The implicit tax rate tells the worker how much of his extra Social Security contributions is going towards additional Social Security benefits. In certain cases, the implicit Social Security tax may be negative, which means the worker is receiving more benefits (in present value terms) than he is paying in payroll taxes; thus, continued work is subsidized. The maximum implicit tax rate of 10.6 percent is faced when the worker is getting no additional benefit from his extra contributions.

Figure 2 displays the implicit Social Security tax rate for the four stylized workers over all possible career lengths.\textsuperscript{11} The average income earner spends the early part of his career earning a subsidy from working additional years. After 12 years, his implicit tax rate jumps up considerably, but then remains stable until he has worked 35 years, at which time he sees his tax rates approach the full tax of 10.6 percent. The low income earner starts off at the same subsidy rate, but stays there for longer than the average earner. After working for 28 years, he jumps up to a positive implicit tax rate, and his tax rates begin to climb after he has worked 35 years. The high income

\textsuperscript{10}Usual weekly earning questions are asked only of households in their 4th and 8th monthly interviews. New households enter each month, so one fourth of households are in an outgoing rotation each month.

\textsuperscript{11}The first ten years of work are not shown in Figure 2. During the first nine years, the worker is not yet eligible to receive Social Security benefits, and therefore faces the full tax rate of 10.6 percent. In the tenth year, every worker experiences a large subsidy because that year of contributions allows him or her to receive benefits.
earner never earns a subsidy, but otherwise follows a similar pattern. The fourth stylized worker who earns the taxable maximum each year faces the highest implicit tax rates.

Figure 2: Stylized Workers’ Implicit Tax Rates

![Graph showing implicit tax rates for stylized workers.](image)

Certain features of the benefit formula are responsible for these patterns. First, as mentioned before, the Social Security benefit formula does not distinguish between a high-income individual who worked a short career and a low-income individual who worked a long career. The AIME calculation contains zeros for individuals that have worked fewer than 35 years, for years in which they have no earnings. Therefore, the fewer years an individual works, the more the Social Security system treats him or her as a low-income earner by providing a higher replacement rate on those earnings. Contributions to the AIME early in the worker’s career are multiplied by the highest slope in the PIA formula, while later year contributions are multiplied by smaller slopes. We see the movement of the AIME from one segment of the PIA formula to the next clearly in the pattern of implicit tax rates. The first large jump experienced by the low income worker at year 28 and the average earner at year 12 represents the movement from the 90 percent slope to the 32 percent slope; the worker who earns the full earnings cap moves from the 32 percent slope to the 15 percent slope in year 25.

The second feature of the benefit calculation that is apparent in the graph, the large jumps in the implicit tax rates that occur after year 35, is a result of the fact that Social Security counts the highest 35 years of indexed earnings. Before a worker has accrued 35 years of earnings, each year of
work is replacing a zero in the calculation of the AIME. After 35 years, a year of work is replacing a lower earnings year and is only increasing the worker’s Social Security benefit to the extent that the new year of earnings is greater than the year that it is replacing. Because earnings are indexed to age 60, the disparity may not be as dramatic as otherwise. The result is that individuals who have worked more than 35 years often face high implicit tax rates.

Note that the decreasing pattern shown by Feldstein and Samwick (1992) is present in these calculations while the worker’s earnings keep him between the same set of bend points in the PIA formula. When the individual is closer to the NRA, the benefits are more valuable in present value terms because of discounting for interest and mortality. However, the overwhelming trend in Figure 2 shows that Social Security tax rates tend to increase over one’s career.

Suppose Social Security solvency were achieved immediately by either a permanent tax increase or benefit reduction. The tax increase necessary to make the system solvent for the infinite horizon is 3.7 percent, and implicit tax rates would simply increase by this amount. Alternately, Social Security could be brought into balance by an across-the-board benefit reduction of 22 percent. This policy would compress the pattern of implicit tax rates, raising the implicit tax rates faced early in a worker’s career, and leaving the highest implicit tax rates unchanged.

The implicit tax rates displayed in Figure 2 measure the distortions faced on the extensive margin of prolonging an individual’s career by one year. It may be that the tax rates that are important are those on the intensive margin. Suppose our stylized worker who earns the average wage is deciding whether to work additional hours in a given year. One measure he may be interested in is what net tax rate those extra earnings would be subject to, or the net marginal tax rate as defined by Feldstein and Samwick (1992). Another relevant measure is the net effective tax rate faced for that year, or the different average implicit tax rates he may face as a function of his earnings. These two measures were computed for each year of work for the average income earner and are summarized in Figure 3. For most years, both the net marginal and effective tax rates are flat across the level of earnings because no amount of earnings (less than the taxable maximum) makes the worker’s AIME high enough to cross a bend point in the PIA formula. With the exception of years where the worker’s AIME is lower than the first PIA bend point and after the individual has worked 35 years, the rates decrease with age because the worker is closer to retirement. For those years where the net effective and net marginal tax rates are flat, the results mirror Feldstein and Samwick (1992).
However, for certain years, the worker faces either an increasing or decreasing schedule of tax rates. The years in which the tax rates are not flat are shown in more detail in Figure 4. During the early part of the worker’s career, if he earns an income high enough to drive his AIME past the first bend point, he will face a higher net tax. In the twelfth year, this occurs when he has earned approximately 80 percent of the taxable maximum. In subsequent years, the threshold is lower because his AIME is higher at the start of each ensuing year. Conversely, in earnings years past the first 35, workers face a decreasing schedule of net tax rates. Low earnings in these later years are not high enough to replace a year of earnings in the AIME calculation, so the net tax rate is the maximum rate of 10.6 percent. Once the earnings are high enough to count in the highest 35 years of indexed earnings, there is a future benefit attached to working that year, and therefore the net tax is lower.

Optimal tax theory suggests that older individuals, who most likely have higher elasticities of labor supply, should be taxed at lower rates than prime-age workers, who are more inelastic in their labor supply decisions. There is evidence that older workers have higher wage elasticities than prime-age workers (Friedberg (2000); Fenge, Uebelmesser, and Werding (2002)). Several economic models conclude that workers with higher elasticities should be taxed at lower rates (Fenge, Uebelmesser, and Werding (2002); Kremer (2001); Blomquist and Micheletto (2003); Erosa and Gervais (2002); Lozachmeur (2002); Boskin and Sheshinski (1983)). The intuition behind these models is simply that taxes on labor are more distortionary for individuals with higher labor supply elasticities, such as older workers, younger workers, and secondary earners.
There is evidence that suggests that workers do respond to Social Security incentives. The interaction between social security programs and retirement in twelve countries was studied extensively by several economists and published in Gruber and Wise ((1999), (2004)). In the first volume, it was found that several countries that were studied had strong disincentives against working embedded in their social security programs, and that there was a strong relationship between the early retirement incentives for the typical worker and labor force participation rates for older workers. The second volume presented the results of micro data studies in these countries and found that individuals whose continued work increases their “social security wealth,” or the value of their stream of retirement benefits, are more likely to retire later. The results were striking because they were present across countries with large cultural and institutional differences, and provide reason to believe that programs like Social Security do affect individual labor supply.
Examining these stylized workers give us strong evidence that implicit tax rates can increase over the life cycle. However, very few workers fit the stylized workers’ descriptions. First, the analysis above does not examine the pattern of implicit tax rates faced by women. Second, because the stylized workers take no career breaks, their ages and career lengths are perfectly correlated. While we would expect a strong association between the two, many individuals do take time out of the labor force for education, to raise children, or to take care of elderly parents. In addition, the stylized workers had smooth patterns of earnings while actual workers may experience considerable fluctuations in earnings from one year to the next. To address these issues, the next section of this paper examines implicit tax rates for a large sample of actual workers’ earnings histories.

4 Single Workers

The limitations of analyzing stylized workers are overcome by examining the full earnings histories of a large sample of Social Security beneficiaries. The source of the data is the Social Security Benefits and Earnings Public-Use File, 2004, which contains information on benefits and earnings below the taxable maximum for a 1% random sample of OASDI beneficiaries in December 2004. The full dataset consists of 472,511 individuals. This section focuses on the 125,829 beneficiaries born between 1910 and 1942 who were receiving retirement benefits based on their own earnings histories, and who began working in 1951 or later. Of the 125,829 individuals, 76,595 (or over 60 percent) are men. The marital history of this subsample is unknown, but in this section they are treated as single workers. Married couples, including secondary earners who were entitled to spousal benefits (often in addition to their own worker benefits), are examined in the next section.

Implicit Social Security tax rates were calculated for each worker at each year during his or her career assuming the worker retired at the normal retirement age. Thus, each worker has as many observations as years in which he or she had positive earnings. If, for example, the worker had a 31-year career, her implicit tax rate was calculated in years 10, 11, ..., 29, 30, and 31. Unlike the

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12 Annual earnings are not reported for years before 1951.
13 Each individual’s benefit was recalculated every year under 2006 benefit rules at the normal retirement age. Although most individuals did not retire exactly at the normal retirement age, these simplifying assumptions prevent the results from being muddled due to deductions and additions to the PIA for early or late retirement and differences in legislation. For more on the retirement incentives stemming from the early retirement deduction and the delayed retirement credit see Butrica, Johnson, Smith, and Steuerle (2006) and Coile and Gruber (2004).
14 Her implicit tax rate in years 1-9 is 10.6% because she does not yet have enough quarters of coverage to qualify for benefits.
stylized workers, her years of work are not necessarily perfectly correlated with her age. If she took
time off from the labor force between the 15th and 16th year of her career, she would not incur any
implicit tax from Social Security for those ages during which she did not participate in the labor
force.

The average career length for workers in the sample is 34 years (37 years for men, and 30 years
for women). As we found in the previous section, workers experience large jumps in their implicit
tax rates after they have worked for 35 years. The stylized worker hit this milestone at age 55.
When do the actual workers complete 35 years of work? Figure 5 shows that there is considerable
heterogeneity in the sample of workers. Of the 125,829 individuals in the sample, 54 percent (66
percent of men and 37 percent of women) work 35 years or more. The modal age for when men
have worked 35 years is age 52, while women are more evenly spread out between ages 52 and 62.

Figure 5: Distribution of 35-Year Career Age

The implicit tax rates are shown separately for men and women in Figure 6 by career length
and age, averaged over five- and ten-year intervals respectively. In both graphs, the pattern is clear:
implicit tax rates increase with age and career length. The results found for stylized workers in
the previous section continue to hold for workers with career breaks and real earnings histories. In
the early part of a worker’s career, work is heavily subsidized because Social Security treats these
workers as low lifetime earners. As additional earnings cause the worker’s AIME to increase, it
is likely to become larger than bend points in the PIA formula and the worker accrues smaller additional benefit from those earnings.

Figure 6: Average Implicit Social Security Tax Rates

(a) Average Implicit Social Security Tax Rates by Career Length

(b) Average Implicit Social Security Tax Rates by Age
Implicit tax rates faced by women tend to be lower than those faced by men, primarily due to the fact that the Social Security system is progressive and women in the sample tend to have lower earnings than men. Another large contributing factor is that women experience more favorable mortality and expect to receive benefits longer than men. To break down these two components, implicit tax rates were computed for women using male mortality. The average implicit tax rates for all men and women are 0.90 percent and -3.99 percent respectively, a difference of 4.89 percent. If implicit tax rates are computed for women using male mortality, their average implicit tax rate is -2.18 percent, 3.08 percent less than the average for men of 0.90. This calculation implies that roughly 40 percent of the difference between implicit tax rates for men and women is due to mortality differences, and the remaining amount stems from differences in the underlying earnings history.

The dispersion of implicit tax rates is shown in Figure 7. The graphs show the median, 25th and 75th percentiles, and the upper and lower adjacent values. Half of the individuals in each group are in the shaded region, with equal numbers above and below the median marker. While implicit tax rates for individuals in their 25th - 39th years of work are tightly distributed around the median, they vary more widely for workers during the early and late stages of their careers. Variation comes from different earning patterns which cause workers to cross bend points at different stages in their careers. The distributions by age groups vary not only because of underlying earnings profiles, but also because at a given age, the workers are at a different point in their careers due to career breaks and different start ages.

The data overwhelmingly show that primary or single workers face increasing implicit tax rates from Social Security over the life cycle, and thus large disincentives towards working long careers. One of the large jumps comes after 35 years of work, which over half of workers have hit by as young as age 54. It is important to note that this is not the only tax rates older workers are facing; it is in addition to the distortions in the income tax that also tend to increase by age. Marginal and average income tax rates by age, calculated by the NBER TAXSIM model on the CPS for March 1996, are summarized in Table 1. The implicit Social Security tax rates have an even

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15 The upper adjacent value is the largest data value $\leq Q_3 + 1.5(Q_3 - Q_1)$, where $Q_3$ is the third quartile and $Q_1$ is the first quartile. Similarly, the lower adjacent value is the smallest data value $\geq Q_1 - 1.5(Q_3 - Q_1)$.

16 TAXSIM is a microsimulation model of the U.S. federal and state income tax systems available at http://www.nber.org/~taxsim. The March 1996 CPS gives income and age data for 1995. The marginal rate is the average marginal rate calculated from a one percent change in all income items and personal itemized deductions. Negative rates that may come from the Earned Income Credit are included in the aggregate. All taxpayers are given the standard deduction only; without itemized deductions, the tax is overstated.
Figure 7: Distribution of Implicit Social Security Tax Rates

(a) Distribution of Implicit Social Security Tax Rates by Career Length

(b) Distribution of Implicit Social Security Tax Rates by Age
Table 1: Marginal and Average Income Tax Rates by Age

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<thead>
<tr>
<th>Age</th>
<th>Marginal Rate</th>
<th>Average Rate</th>
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<tr>
<td>15-19</td>
<td>13.7</td>
<td>2.2</td>
</tr>
<tr>
<td>20-24</td>
<td>18.5</td>
<td>7.1</td>
</tr>
<tr>
<td>25-29</td>
<td>22.3</td>
<td>11.6</td>
</tr>
<tr>
<td>30-34</td>
<td>24.7</td>
<td>13.7</td>
</tr>
<tr>
<td>35-39</td>
<td>26.1</td>
<td>15.2</td>
</tr>
<tr>
<td>40-44</td>
<td>26.8</td>
<td>16</td>
</tr>
<tr>
<td>45-49</td>
<td>27.5</td>
<td>17.2</td>
</tr>
<tr>
<td>50-54</td>
<td>27.4</td>
<td>17.6</td>
</tr>
<tr>
<td>55-59</td>
<td>27.1</td>
<td>17.6</td>
</tr>
<tr>
<td>60-64</td>
<td>26.5</td>
<td>17.1</td>
</tr>
<tr>
<td>65-69</td>
<td>26.3</td>
<td>16.1</td>
</tr>
<tr>
<td>70-74</td>
<td>23.7</td>
<td>13.6</td>
</tr>
<tr>
<td>75-79</td>
<td>21.7</td>
<td>11.9</td>
</tr>
<tr>
<td>80-84</td>
<td>21.2</td>
<td>12.3</td>
</tr>
</tbody>
</table>

Source: Calculations by the TAXSIM model, displayed at http://www.nber.org/~taxsim/byage/

more distortionary effect on the labor supply of older workers given the marginal tax rates faced in the income tax.

5 Married Couples

Spouses of workers who have been married for at least one year or unmarried divorced spouses who were married for at least ten years are entitled to receive spousal benefits from Social Security. Spousal benefits are equal to 50 percent of the primary earner’s PIA if taken at the secondary worker’s normal retirement age, where the secondary worker is the member of the couple with lower earnings. Upon the death of one spouse, the surviving spouse receives the highest PIA as a widow(er) benefit.

Define the primary earner’s PIA as $PIA_1$, and the secondary earner’s PIA as $PIA_2$. By definition, $PIA_1 > PIA_2$. The secondary earner receives benefits higher than the spousal benefit if $PIA_2 \geq \frac{1}{2} PIA_1$. Because the Social Security system is progressive, this does not mean that the secondary earner had to earn, on average, half of the primary earner’s income every year to earn more than the spousal benefit. In fact, the secondary earner could earn as little as one third of the primary earner and satisfy $PIA_2 \geq \frac{1}{2} PIA_1$. Figure 8 shows the relative AIME needed for different values of the primary worker’s AIME to meet the condition. The percentage varies depending on which segment of the PIA formula each worker is on.
Unfortunately, the Benefits and Earnings Public-Use File provides no way to link couples. However, the data do differentiate between the various categories of beneficiaries. Individuals in the “worker benefit only” category are primary workers, secondary workers who earned more than the spousal benefit, or single workers. Those who earn only spousal or widow(er) benefits do not receive any award from Social Security based on their own earnings record. Individuals who have an earnings record that qualifies them for their own Social Security payments and whose benefits are supplemented by a spousal or widow(er) benefit comprise the remaining two categories. Table 2 shows the breakdown of male and female beneficiaries into these groups. The vast majority of male beneficiaries fall into the “worker benefit only” category, but a significant percentage of female beneficiaries receive spousal and widow benefits in at least some capacity.

Table 2: Beneficiaries by Benefit Type

<table>
<thead>
<tr>
<th>Category</th>
<th>Females</th>
<th>Males</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worker benefit only</td>
<td>83,627</td>
<td>152,066</td>
<td>235,693</td>
</tr>
<tr>
<td>Spousal benefit only</td>
<td>24,368</td>
<td>404</td>
<td>24,772</td>
</tr>
<tr>
<td>Widow(er) benefit only</td>
<td>42,360</td>
<td>437</td>
<td>42,797</td>
</tr>
<tr>
<td>Worker+spousal benefit</td>
<td>25,897</td>
<td>261</td>
<td>26,158</td>
</tr>
<tr>
<td>Worker+widow(er) benefit</td>
<td>34,787</td>
<td>961</td>
<td>35,748</td>
</tr>
<tr>
<td>Total</td>
<td>211,039</td>
<td>154,129</td>
<td>365,168</td>
</tr>
</tbody>
</table>

Source: Benefits and Earnings Public-Use File, 2004

---

17 Social Security does not maintain records of marital status throughout each worker’s life.
18 This table excludes individuals receiving disability benefits.
Table 2 does not give an exact picture of the relative PIA amounts for the couple. This is because when one spouse dies, the widow(er) benefit is equal to the PIA of the primary earner, or $PIA_1$, and thus may change the composition of benefits. If the secondary earner dies first, the benefit paid to the primary earner does not change; it was $PIA_1$ before, and will be $PIA_1$ after. However, if the primary earner dies first, one of three things may occur:

1. If $PIA_2 = 0$, the secondary earner switches from only receiving a spousal benefit to only receiving a widow(er) benefit (equal to $PIA_1$).

2. If $0 < PIA_2 < \frac{1}{2} PIA_1$, the secondary earner switches from receiving a worker+spousal benefit to receiving a worker+widow(er) benefit (amounting to $PIA_1$).

3. If $\frac{1}{2} PIA_1 \leq PIA_2 < PIA_1$, the secondary earner switches from the “worker benefit only” category to receiving a worker+widow(er) benefit (amounting to $PIA_1$).

Using these facts, it is possible to back out the relative PIA amounts from the data. Table 3 summarizes the sample by relative PIA amounts. The table shows that over 99 percent of male beneficiaries in the sample are either single or have enough earnings to not qualify for spousal benefits, but this is true for only 48 percent of female beneficiaries in the sample. Almost one third of female beneficiaries in the sample do not qualify for any benefits on the basis of their own earnings record, and 20 percent would receive less from Social Security without the spousal benefit. Thus, the analysis in the previous section on single workers does not address the implicit tax rates faced by a large group of people whose benefits are at least partially based on their spouses’ earnings records. The composition of these three groups are likely to be in transition due to the dramatic changes in female labor force participation that have occurred in the latter half of the twentieth century.

Table 3: Beneficiaries by Relative PIAs

<table>
<thead>
<tr>
<th>Category</th>
<th>Females</th>
<th>Males</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary earner OR Secondary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>earner with $PIA_2 \geq \frac{1}{2} PIA_1$</td>
<td>101,467</td>
<td>152,945</td>
<td>254,412</td>
</tr>
<tr>
<td>Secondary earner with $PIA_2 = 0$</td>
<td>66,728</td>
<td>841</td>
<td>67,569</td>
</tr>
<tr>
<td>Secondary earner with $0 &lt; PIA_2 &lt; \frac{1}{2} PIA_1$</td>
<td>42,844</td>
<td>343</td>
<td>43,187</td>
</tr>
<tr>
<td>Total</td>
<td>211,039</td>
<td>154,129</td>
<td>365,168</td>
</tr>
</tbody>
</table>

Source: Benefits and Earnings Public-Use File, 2004
Implicit tax rates for married primary and secondary workers are calculated in a similar manner as single workers. The two major departures from the single worker framework are that the additional benefits accrued from an additional year of earnings differ for married primary and secondary workers, and the deferred annuity values must take into account that benefits are paid as joint life annuities rather than single life annuities. Equation 1 now becomes:

\[
\text{Implicit Social Security Tax Rate}_{i,t} = \frac{\text{Payroll Taxes}_{i,t} - 12\text{MMB}_{i,t}DAV_{i,g}(x, d, NRA)}{\text{Earnings}_{i,t}}
\]  

(2)

The subscript \(i\) denotes whether the worker is the primary earner \((i = 1)\) or the secondary earner \((i = 2)\). The term \(\text{MMB}_{i,t}\) is the marginal monthly benefit. This value is equal to the additional monthly benefit earned by working in year \(t\) for individual \(i\), and replaces \(\Delta PIA_t\) from Equation 1.

Define \(PIA_{1,t}\) and \(PIA_{2,t}\) as the PIA’s for primary and secondary workers evaluated using earnings through year \(t\), and zeros for future earnings years. The value of the marginal monthly benefit remains \(\Delta PIA_{1,t}\) for the primary worker, but for the secondary worker, the additional benefit earned from working in year \(t\) is determined by how much the amount the secondary worker’s PIA is greater than the spousal benefit in years \(t\) and \(t-1\). The spousal benefit is paid regardless of the secondary worker’s earnings, and is only augmented by the amount the secondary worker’s PIA exceeds the spousal benefit. Therefore, the marginal monthly benefit formulas for married primary and secondary workers are:

\[
\text{MMB}_{1,t} = PIA_{1,t} - PIA_{1,t-1} = \Delta PIA_{1,t}
\]  

(3)

\[
\text{MMB}_{2,t} = \max(PIA_{2,t} - \text{spousal benefit}, 0) - \max(PIA_{2,t-1} - \text{spousal benefit}, 0)
\]

\[= \Delta \max(PIA_{2,t} - \text{spousal benefit}, 0) \]  

(4)

Ex-post, it is straightforward to determine what implicit tax rate from Social Security the secondary worker faced. At the point of retirement, if the secondary worker’s earnings did not increase his or her benefit over the spousal benefit, all of the secondary worker’s contributions were a pure tax. If \(PIA_2 \geq \frac{1}{2} PIA_1\), the benefit amount greater than the spousal benefit would be compared to the Social Security taxes paid to determine the implicit tax rate the secondary worker faced.

However, during the workers’ careers, the secondary worker’s perceptions regarding the couple’s
future earnings have a large effect on the implicit tax rates the secondary worker perceives. The value of the marginal monthly benefit is determined for four possible scenarios. Under Scenario One, secondary workers assume the couple’s earnings will be such that \( PIA_{2,NRA} < \frac{1}{2} PIA_{1,NRA} \). The secondary worker never believes his or her contributions are increasing his or her benefits, and therefore assumes that \( PIA_{2,t} < \text{spousal benefit} \):

\[
M MB_{2,t} = \max(PIA_{2,t} - \text{spousal benefit}, 0) - \max(PIA_{2,t-1} - \text{spousal benefit}, 0)
\]

\[
= 0 - 0 = 0
\]

Under Scenario Two, the secondary worker perceives that his or her PIA will be greater than the spousal benefit. Therefore, it is assumed that \( PIA_{2,t} \) is always at least as great as the spousal benefit:

\[
M MB_{2,t} = \max(PIA_{2,t} - \text{spousal benefit}, 0) - \max(PIA_{2,t-1} - \text{spousal benefit}, 0)
\]

\[
= (PIA_{2,t} - \text{spousal benefit}) - (PIA_{2,t-1} - \text{spousal benefit})
\]

\[
= PIA_{2,t} - PIA_{2,t-1}
\]

Note that the marginal monthly benefit for the secondary worker in this scenario is the same as it would be if the secondary worker were single.

Under Scenario Three, secondary workers have perfect foresight about their spouse’s earnings. The secondary worker’s marginal monthly benefit is the excess of his or her PIA over the spousal benefit calculated from the primary worker’s ultimate PIA at retirement:

\[
M MB_{2,t} = \max(PIA_{2,t} - \text{spousal benefit}, 0) - \max(PIA_{2,t-1} - \text{spousal benefit}, 0)
\]

\[
= \max(PIA_{2,t} - \frac{1}{2} PIA_{1,NRA}, 0) - \max(PIA_{2,t-1} - \frac{1}{2} PIA_{1,NRA}, 0)
\]

This scenario will be referred to as the perfect foresight scenario. Note that because \( PIA_{1,t} \) is non-decreasing in \( t \), once the secondary earner’s PIA is higher than the assumed spousal benefit of \( \frac{1}{2} PIA_{1,NRA} \), it will remain higher than the spousal benefit for all future years.

In the last scenario, Scenario Four, secondary workers forecast the primary worker to have zero earnings in the future. The secondary worker’s marginal monthly benefit is the excess of his or her
PIA over the spousal benefit calculated from the primary worker’s PIA in that year:

\[
MB_{2,t} = \max(PIA_{2,t} - \text{spousal benefit}, 0) - \max(PIA_{2,t-1} - \text{spousal benefit}, 0)
\]

\[
= \max(PIA_{2,t} - \frac{1}{2}PIA_{1,t}, 0) - \max(PIA_{2,t-1} - \frac{1}{2}PIA_{1,t-1}, 0)
\]

This assumption may encompass the risk of unemployment, disability or death of the primary worker. This scenario will be referred to as the zero earnings scenario. The assumed spousal benefits and the resulting marginal monthly benefits for the secondary worker under the four scenarios are summarized in Table 4.

<table>
<thead>
<tr>
<th>Assumed Scenario</th>
<th>Assumed Spousal Benefit</th>
<th>(MB_{2,t})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario One</td>
<td>greater than (PIA_{2,t})</td>
<td>0</td>
</tr>
<tr>
<td>Scenario Two</td>
<td>less than (PIA_{2,t})</td>
<td>(\Delta PIA_{2,t})</td>
</tr>
<tr>
<td>Scenario Three</td>
<td>(\frac{1}{2}PIA_{1,NRA})</td>
<td>(\Delta \max(PIA_{2,t} - \frac{1}{2}PIA_{1,NRA}, 0))</td>
</tr>
<tr>
<td>Scenario Four</td>
<td>(\frac{1}{7}PIA_{1,t})</td>
<td>(\Delta \max(PIA_{2,t} - \frac{1}{2}PIA_{1,t}, 0))</td>
</tr>
</tbody>
</table>

The deferred annuity values for married couples are different than those for single workers. The value \(DAV_{i,g}(x, d, NRA)\) is now a joint inflation-indexed life annuity factor and depends on whether the worker is the primary or secondary earner, the worker’s age and gender, and the age difference between the husband and wife. While single workers simply receive their PIA as a single life annuity, married couples receive \(PIA_1 + \max(\frac{1}{2}PIA_1, PIA_2)\) from retirement until the first death, and then \(PIA_1\) from the first death until the second death. The benefits attributable to the primary worker’s earnings are \(PIA_1\) paid as a second-to-die life annuity, and \(\frac{1}{2}PIA_1\) paid as a first-to-die life annuity. The deferred annuity values for the primary worker must also take into account that \(PIA_1\) is paid to the surviving spouse in the event that either spouse dies before retirement. The secondary worker earned benefits equal to \(\max(PIA_2 - \text{spousal benefit}, 0)\) which are paid as a first-to-die life annuity. First-to-die and second-to-die annuity values depend on the age difference within the couple. The deferred annuity value formulas are detailed in Appendix 1.

Primary earners in a married couple are more heavily subsidized than single workers because \(DAV_{i,g}(x, d, NRA)\) for the married primary worker is significantly greater than \(DAV_g(x, NRA)\) for the corresponding single worker. However, secondary earners face higher implicit Social Security tax rates than if they were single workers, both because their deferred annuity values are smaller.
than for the corresponding single worker, and because their marginal monthly benefit is at most what it would have been for a single worker with the same earnings history. In total, the married couple is at least as well off as they would be if they were instead two single workers, but the incentives for the primary and secondary workers as measured by the implicit tax rate are very different.

If working in year \( t \) contributes to benefits, the marginal monthly benefit is greater than zero and the implicit Social Security tax rate is less than the full 10.6 percent. Implicit Social Security tax rates for secondary earners vary depending on the assumed scenario regarding the primary worker’s future earnings, the relative earnings levels for the two members of the couple, the timing of those earnings, the age difference within the couple, and which segment of the PIA formula each earner is on. The implicit tax rates a secondary earner faces also depend on the expected length of marriage and probabilities of divorce, although these characteristics are not explicitly addressed here.

Under Scenario One, the secondary earner’s marginal monthly benefit is always zero, and therefore always faces the maximum implicit tax rate of 10.6 percent. Under Scenario Two, the secondary earner perceives that he or she will earn more than the spousal benefit. Thus, the secondary worker’s marginal monthly benefit is the same as what it would have been had he or she been single, but is only payable as a first-to-die life annuity. The marginal monthly benefit is therefore worth less in expected present value, and the secondary worker under Scenario Two faces slightly higher implicit tax rates than the corresponding single worker. The secondary worker experiences jumps in implicit tax rates that occur when earnings cause his or her AIME to cross bend points in the PIA formula or after 35 years of work, as shown in previous sections.

The amount by which the secondary earner’s implicit tax rates under Scenario Two are higher than the corresponding single worker’s implicit tax rates depends on the gender of the secondary worker and the age difference between the primary and secondary worker. Consider a couple where the husband and wife are born in the same year. The value of a first-to-die life annuity for the couple is closer to the value of the husband’s single life annuity than the value of the wife’s single life annuity since male mortality rates are higher than female mortality rates. Thus the difference between a female secondary worker’s implicit tax rates and her corresponding single worker tax rates is larger than the difference would be if the secondary worker were male. If the male is older than the female, this effect is exaggerated because the difference in mortality rates between the
husband and wife is even greater.

In the perfect foresight scenario, secondary earners always begin by facing the maximum possible implicit tax rate of 10.6 percent. Before they earn enough for their PIA to be larger than half of their spouse’s final PIA, their contributions do not increase the benefits they will receive. Let $T^*$ denote the year $t$ where $PIA_{2,t}$ is greater than $\frac{1}{2}PIA_{1,NRA}$, the maximum spousal benefit, for all $t \geq T^*$. Once the secondary worker crosses this threshold (if ever), the marginal monthly benefit is the same as if the secondary worker were single. Therefore, after this point, the secondary worker’s implicit tax rates exactly track what they look like under Scenario Two, i.e. they are slightly higher than the corresponding single worker’s implicit tax rates. The point in secondary workers’ careers where they stop facing the full tax rate and move towards the schedule under Scenario Two is determined by the relative level of the secondary worker’s earnings compared to the primary worker’s earnings, and the timing in which they are earned. If the secondary worker’s benefit never exceeds the spousal benefit, the implicit tax rate is flat at 10.6 percent over the worker’s entire career.

The zero earnings scenario is more difficult to characterize. Here, the relative timing and levels of both the primary and secondary workers’ earnings are the main determinants of the pattern of implicit tax rates for the secondary worker. The secondary worker’s implicit tax rate at time $t$ varies widely depending on whether $MMB_{2,t} = \max(PIA_{2,t} - \frac{1}{2}PIA_{1,t}, 0) - \max(PIA_{2,t-1} - \frac{1}{2}PIA_{1,t-1}, 0)$ is positive or negative. The marginal monthly benefit can be negative if the secondary worker’s PIA was larger than the assumed spousal benefit in time $t-1$, but smaller in time $t$. In such years, the implicit tax rate is larger than 10.6 percent. The marginal monthly benefit is bounded above by $\Delta PIA_{2,t}$; thus the minimum implicit tax rates under the zero earnings scenario are those in Scenario Two.

Because the data do not identify couples, a small collection of simulated couples is constructed to illustrate the different possible patterns of implicit Social Security tax rates that secondary earners may face. Each member of the constructed couple comes from the Benefits and Earnings Public-Use File. These pairs are chosen because they demonstrate some of the features mentioned earlier, but are by no means an exhaustive set of prototypes. Three simulated couples – A, B, and C – are examined by looking at implicit tax rates for the primary worker, and for the secondary worker under Scenarios Two, Three, and Four detailed above. The primary workers in each couple are workers A1, B1, and C1, and the secondary workers are A2, B2, and C2. Additional details
about the workers used in this section are available in Appendix 2.

Simulated Couple A consists of a male and female, both born in 1939. Their final PIAs are such that the female secondary worker earns worker only benefits, i.e. \( PIA_{2,NRA} > \frac{1}{2} PIA_{1,NRA} \). The man worked a 47-year career, while the woman worked 43 years, taking a career break from age 33 to 36. Their implicit tax rates are shown in Figure 9. Under Scenario Two, the gap between the secondary worker’s implicit tax rates and the corresponding single worker’s tax rates is large since the secondary worker is female. Under perfect foresight, the secondary worker faces the full OASI tax rate of 10.6 percent until \( T^* = 1992 \), or the secondary earner’s 32nd year of work. Under the zero earnings assumption, the secondary worker’s implicit tax rates oscillate based on the relative amounts of the primary and secondary earnings.

Simulated Couple B provides an example of a couple where the secondary earner did not earn more than the spousal benefit, so \( PIA_{2,NRA} < \frac{1}{2} PIA_{1,NRA} \). Therefore, \( T^* \) does not exist. The male primary earner, born in 1941, worked for 46 years; the female secondary earner was also born in 1941, but worked 24 years. In this example, the secondary earner took a 14-year-long career break from ages 25 through 38. The graphs of implicit tax rates are shown in Figure 10. Under Scenario Two, the implicit tax rates are shifted up from the corresponding single worker’s implicit tax rates similar to Worker A2. With perfect foresight, the secondary earner always perceives that she is facing the full tax rate. Under the zero earnings assumption, the implicit tax rate is almost always flat at 10.6 percent, but \( MMB_{2,t} \) is different from zero during the last few years of her career. The implicit tax rate dips during a year where the secondary worker’s earnings generate a PIA greater than the spousal benefit calculated in that year, but in the following year, her husband’s earnings (and consequently the spousal benefit) are high enough to eliminate this benefit.

The last example, Simulated Couple C, consists of a female primary earner born in 1939, and a male secondary earner born in 1931. Similar to the first couple, their final PIAs are such that \( PIA_{2,NRA} > \frac{1}{2} PIA_{1,NRA} \). Both the primary and secondary workers had long careers of 49 and 53 years respectively. Their implicit tax rates under different assumptions are shown in Figure 11. Note that the secondary worker’s implicit tax rates are shifted up by a smaller amount than Workers A2 and B2 under Scenario Two. This is because the secondary worker is male, and the shift due to the different deferred annuity factors is small. Under the perfect foresight scenario, the secondary worker spends his first 22 years of work facing the full tax rate. His implicit tax rates again fluctuate considerably under the zero earnings scenario.
Figure 9: Simulated Couple A's Implicit Tax Rates Under Different Scenarios

(a) Worker A1

(b) Worker A2 - Scenario Two

(c) Worker A2 - Scenario Three (Perfect Foresight)

(d) Worker A2 - Scenario Four (Zero Earnings)
Figure 10: Simulated Couple B’s Implicit Tax Rates Under Different Scenarios

(a) Worker B1

(b) Worker B2 - Scenario Two

(c) Worker B2 - Scenario Three (Perfect Foresight)

(d) Worker B2 - Scenario Four (Zero Earnings)
Figure 11: Simulated Couple C’s Implicit Tax Rates Under Different Scenarios

(a) Worker C1

(b) Worker C2 - Scenario Two

(c) Worker C2 - Scenario Three (Perfect Foresight)

(d) Worker C2 - Scenario Four (Zero Earnings)
These three examples show the range of implicit tax rates that secondary workers face. Around one fifth of female beneficiaries (and 12 percent of all beneficiaries) in the sample are secondary earners whose benefits were less than the spousal benefit, and experienced tax rates similar to Simulated Couple B. Approximately 70 percent of the sample did not receive spousal benefits. Those who were single workers faced implicit tax rates described in Sections 3 and 4, and the married workers resembled Simulated Couples A and C. The remaining 18 percent of the sample had no earnings, and therefore no implicit tax rates. In general, primary earners in married couples are more heavily subsidized than single workers, and secondary earners face significantly higher implicit tax rates than they would have had they been single. While the couple is at least as well off by being married (and in most cases better off), from an efficiency standpoint, high implicit tax rates for secondary earners may not be desirable if these individuals have high labor supply elasticities.

6 Conclusion

This paper challenges the prevailing view that the Social Security system creates net tax rates that decrease over time by using methodology that incorporates two important features of the benefit calculation: only the highest 35 years of indexed earnings are used to determine benefits, and the formula does not distinguish between lifetime low-income earners and those who work short careers at high wages. While the present value of a given retirement benefit amount is larger when earned closer to the retirement age due to discounting for interest and mortality, crossing bend points in the PIA formula and working for more than 35 years can cause implicit tax rates to increase sharply throughout an individual’s career. The overwhelming upward trend in implicit tax rates is demonstrated using four stylized workers, and is confirmed for a large sample of actual earnings histories. Cross-country evidence suggests that the pattern of social security wealth accrual affects workers’ retirement decisions.

Married couples face very different implicit tax rates than single workers. Primary earners face lower implicit tax rates than if they were single due to the spousal benefit paid based on their earnings, and because their benefits are paid as joint life second-to-die annuities rather than single life annuities. Secondary earners can follow various patterns of implicit Social Security tax rates over their life cycles, but their implicit tax rates are always higher than if they were single. Their earnings generate benefits only when they are greater than the spousal benefit, and are paid as
first-to-die life annuities which are worth less than single life annuities. Secondary workers represent a significant fraction of the female beneficiaries in the data. Their implicit tax rates vary depending on the assumptions made about future earnings, the relative earning amounts within the couple, how progressively both earners are treated by the PIA formula, the age difference within the couple, and the timing of the couple’s earnings. Further analysis using matched couples’ earnings histories may shed more light on these issues.

Workers with long careers tend to face high implicit Social Security tax rates near retirement, while workers with short careers are often subsidized by the Social Security system. Some distortion is necessary in any program that redistributes income from workers to retirees using a tax on wages; however, the distortions in the current system are enhanced because the high implicit Social Security tax rates affect older workers and secondary workers, both groups with relatively high labor supply elasticities.

In related work, Goda, Shoven, and Slavov (2006) show that three policy changes could alter the structure of implicit tax rates. The three changes examined include increasing the number of years of earnings used in the Social Security benefit calculation from 35 to 40; allowing workers who have worked 40 years to be exempt from payroll taxes; and distinguishing between lifetime low-income earners and high-income earners who worked short careers. These reforms can be achieved in a revenue-neutral manner involving some redistribution from individuals who work short careers to individuals who work long careers, and would make progress in removing the disincentives in Social Security towards long careers.
Appendix 1: Deferred Annuity Values for Single Workers and Married Couples

Let $k p^g_x$ denote the probability that an individual age $x$ and gender $g$ lives to age $x + k$. The maximum possible age is $N$, i.e. $N - x p^g_x = 0$. Define $v = \frac{1}{1+r}$ and $\tilde{v} = \frac{1+i}{1+r}$ where $i$ is the inflation rate and $r$ is the discount rate.

A single worker’s Social Security benefit is paid as a single inflation-indexed life annuity. It is assumed that the individual retires at the normal retirement age (NRA), or if he is past the normal retirement age, that he retires immediately. Let $T = \max(x, \text{NRA})$. The value of a deferred single life annuity for an individual age $x$ at time $t$ that pays $1$ per year from retirement until death is given by:

$$DAV_g(x, \text{NRA}) = T - x p^g_x v^{T-x} \sum_{k=0}^{N-T} \tilde{v}^k k p^g_T$$

Joint life annuities for couples can be either second-to-die inflation-indexed life annuities payable until the second death, or first-to-die inflation-indexed life annuities payable until the first death. Married couples receive the primary worker’s PIA as a second-to-die life annuity, but spousal benefits and the excess of the secondary worker’s PIA over the spousal benefit (if any) is paid as a first-to-die life annuity. Consider a married couple at time $t$ where the primary worker is age $x$ and gender $g_1$ and the secondary worker is age $y$ and gender $g_2$. Let $d = x - y$ be the age difference between the primary and secondary worker. The assumed retirement ages are $T_1 = \max(x, \text{NRA})$ and $T_2 = \max(y, \text{NRA})$. The value of a deferred annuity factor for the primary worker’s earned benefit is equal to:

$$DAV_{1,g}(x, d, \text{NRA}) = T_1 - x p^g_1 \cdot T_2 - x p^g_{2-d} \cdot v^{T_1-x} \left[ \sum_{k=0}^{N-T_1} \tilde{v}^k \left( k p^g_{T_1} + k p^g_{T_1-d} - k p^g_{T_1} \cdot k p^g_{T_1-d} \right) \right]$$

$$+ \frac{1}{2} \cdot T_2 - (x-d) p^g_1 \cdot T_2 - (x-d) p^g_{2-d} \cdot v^{T_2-(x-d)} \left[ \sum_{k=0}^{N-T_2} \tilde{v}^k \left( k p^g_{T_2+d} \cdot k p^g_{T_2} \right) \right]$$

$$+ (1 - T_2 - (x-d) p^g_1) T_2 - (x-d) p^g_{2-d} \cdot v^{T_2-(x-d)} \left[ \sum_{k=0}^{N-T_2} \tilde{v}^k \cdot k p^g_{T_2} \right]$$

$$+ T_1 - x p^g_1 (1 - T_1 - x p^g_{2-d}) \cdot v^{T_1-x} \left[ \sum_{k=0}^{N-T_1} \tilde{v}^k p^g_T \right]$$

(A2)
The first term represents the value of the second-to-die life annuity for the primary worker’s benefit, multiplied by the probability that both the primary and secondary earner live to the primary worker’s retirement age. The second term gives the value of the spousal benefits paid as a first-to-die life annuity, multiplied by the probability the primary and secondary worker live to the secondary worker’s retirement age. The third and fourth terms consist of the single life annuity paid to one spouse if the other spouse died before his or her retirement age, multiplied by the probability that this occurs.

For a secondary worker, the value of the deferred annuity factor is:

$$DAV_{2,g}(y, d, NRA) = T_{2-y}^{p_g^{q_1}} \cdot T_{2-y}^{p_g^{q_2}} \cdot v^{T_{2-y}} \sum_{k=0}^{N-T_2} v^k k^{p_g^{q_1}} (k^{p_g^{q_2}})$$ (A3)

The value of the deferred life annuity factor in Equation A3 is similar to the second term in Equation A2. It is equal to the probability the primary and secondary worker live to the secondary worker’s retirement age, multiplied by the value of a first-to-die life annuity for the couple.
## Appendix 2: Simulated Couples A, B, and C

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Source: Benefits and Earnings Public-Use File, 2004

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References


