Smoking: Taxing Health and Social Security

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Cigarette smoking is the largest single health risk in the United States, accounting for approximately 440,000 deaths each year (U.S. Department of Health and Human Services [USDHHS] 2004b). The financial cost of smoking-attributable health care expenditures and lost productivity has been well documented (Centers for Disease Control and Prevention [CDC] 2003). In general, smokers have higher health care expenditures and more sick days than do nonsmokers (Max 2001). However, the effects of smoking-attributable mortality on income distributions are less well known.

Premature death attributable to smoking may redistribute Social Security income in unanticipated ways that affect behavior and reduce the economic well-being of smokers and their dependent spouses and children (Rice et al. 1986). Knowledge of how smoking redistributes both individual and household Social Security benefits and taxes is important not only from the perspectives of informing smoking cessation efforts (Rice et al. 1986) and evaluating proposals to improve family welfare through reductions in system inequities or promotion of social adequacy but also from the standpoint of managing the Social Security System's finances. Social Security is financed by a pay-as-you-go tax levied on earnings; thus, if the harmful health effects of smoking reduce individual or household hours of work, these effects have implications for the system's funding.

Economists employ the comprehensive marginal tax rate to assess the distortionary effect of taxation on labor supply and welfare (Armour and Pitts 2004). One important component of this comprehensive marginal tax rate in the United States is the Social Security payroll tax, which is assessed on individual earnings up to the annual taxable maximum. In 2002 approximately 94 percent of all U.S. workers earned less than the annual taxable maximum of $84,900, thus incurring an Old-Age and Survivors Insurance (OASI) Social Security payroll tax at the margin.[1] For these individuals, Social Security is a benefit tax for which an extra dollar of earnings may increase their future benefits at retirement. Therefore, the net marginal Social Security tax rate (NMSSTR)—defined

as the difference between the statutory payroll tax rate and the present value of the stream of future benefits to which an additional dollar of earnings entitles the covered worker—should be used in calculating the marginal tax rate for the purpose of assessing the effect of taxation on labor supply and welfare.[2]

Studies that have used the NMSSTR to examine the distributional effects of Social Security concluded that Social Security benefit and tax rules create NMSSTRs that treat workers differently depending on age, gender, race, dependency status, earnings, insurance status, and income-related life expectancy (for example, Aaron 1977; Browning 1985; Burkhauser and Turner 1985; Feldstein and Samwick 1992; Armour and Pitts 2004). To our knowledge, no study has looked at lifestyle and the harmful health effects of an addictive habit such as smoking on NMSSTR estimation. This study contributes to the literature by examining the distributional effects of smoking-attributable mortality on NMSSTR estimation.

Methods

Social Security benefit determination. The Social Security benefits to which a covered worker is entitled at retirement depend on lifetime earnings. Average indexed monthly earnings (AIME) is the measure of lifetime earnings on which benefits are based. Earnings are indexed by multiplying a worker's taxable earnings by an indexing factor for each year after 1950 through the indexing year. The indexing year is defined as the year a worker attains age sixty. The indexing factor for each year, t, is obtained by dividing average covered worker earnings in the indexing year, $\bar{E}_{60,t}$, by average covered worker earnings at each age, a, in each year, $\bar{E}_{a,t}$. The AIME for individuals retiring in year t is

$$(1) \quad AIME = \frac{1}{n}\frac{1}{12}\sum_{t\in A}\frac{\bar{E}_{60,t}}{\bar{E}_{a,t}}E_t + \sum_{t\in B}E_t.$$

For individuals attaining age sixty-two after 1991, the AIME is based on the highest thirty-five years of earnings. However, for each year a worker is born before 1929, the number of years, n, in the computation period is reduced by one. To convert the AIME from an annual to a monthly basis, it is divided by 12. E_t denotes worker earnings in year t. The set of all years through age sixty that will be counted among the highest thirty-five or n years of earnings is denoted by A. B denotes the set of years between age sixty and the year prior to retirement in which a year of unindexed earnings replaces a year of indexed earnings in the benefit formula.

Once the AIME is determined, the primary insurance amount (PIA)—the amount of monthly benefits payable at retirement—may be calculated.[3] The benefits formula for a covered worker attaining age sixty-two in 2002 is

$$(2) \quad PIA = [0.90 \times (AIME \leq \$592)] + [0.32 \times (\$592 < AIME \leq \$3,567)] + [0.15 \times (AIME > \$3,567)].$$

The PIA is composed of two parts: the bend points (the dollar amounts defining the AIME bracket in the benefit formula) and the marginal replacement rate (the applicable percentage used to determine the PIA).[4]

The benefit formula illustrates one fundamental feature of the system: the progressive structure of Social Security. Low-earning workers are afforded proportionately greater benefits with a marginal replacement rate of 90 percent when compared

with average-earning and high-earning workers, whose marginal replacement rates are 32 percent and 15 percent, respectively. Because the Social Security benefit formula classifies workers into one of three earnings groups, the NMSSTR by sex and age is calculated for a representative worker in each group.

Calculation of the NMSSTR. NMSSTRs by sex, age, and earnings classification are calculated under two alternative scenarios. The first scenario uses a common mortality assumption, and the second scenario accounts for smoking-attributable mortality in calculating the NMSSTR.

The NMSSTR is $\widetilde{T} = T - B_{PV}$. T denotes the OASI statutory rate, which is defined as the combined employee-employer legislated rate. The combined employee-employer tax rate was 10.6 percent in 2002.[5] This analysis assumes that the employee pays the tax.[6]

Primary beneficiary (single). The present value of the change in anticipated future benefits resulting from a $1 change in earnings is

$$(3) \quad B_{PV} = \frac{1}{n} \frac{\partial PIA}{\partial AIME} (1+g)^{\max(60-a)} i_{s,f,\tilde{t},t} \sum_{j=f}^{N} P_{s,t}(j|a)(1+r)^{a-j}.$$

The future benefits that an additional dollar of earnings entitles an individual to at retirement depend on the marginal replacement rate, $(\partial PIA)/(\partial AIME)$, and the age, a, at which the individual plans to retire. Workers are assumed to retire at the full benefit retirement age, f.[7] The indexing factor at each age, $(1 + g)^{\max(60-a)}$, is estimated assuming that earnings grow at a real rate of 1.1 percent.[8] The probability that an individual

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1. These figures are estimated from information in USDHHS (2004a, table 4.B4).
2. While many researchers recognize the link between the payroll tax levied on an additional dollar of earnings and anticipated future benefits, their analysis typically calculates the comprehensive marginal tax rate using the Social Security statutory rate; as a consequence, their results are overstated (Browning 1985; Burkhauser and Turner 1985).
3. The benefit amount that family members may receive each month is limited. The limit varies but generally equals about 150 to 180 percent of PIA. If the sum of the benefits payable to family members exceeds this limit, their benefits will be reduced. However, any benefits paid to a surviving divorced widow or widower do not count toward this maximum amount (see USDHHS 2004a).
4. The 1977 amendments to the Social Security Act indexed the benefit formula's bend points to the growth rate in average covered earnings. The marginal replacement rates were fixed at 90, 32, and 15 percent, respectively (see USDHHS 2004a).
5. The tax rate ignores the disability insurance (DI) and health insurance (HI) contribution rates. Including both rates increases the net marginal Social Security tax rate by the statutory amount. In 2002 the combined employee-employer DI and HI rates were 1.8 and 2.9 percent, respectively (see USDHHS 2004a).
6. Brittain (1972) found that the payroll tax reduced employee earnings by the full amount of the tax.
7. The formula in equation (3) estimates the actuarial present value of anticipated future benefits relative to some benchmark retirement age. The age chosen here, f, is defined as the full benefit retirement age, which corresponds to the age at which an individual is first eligible for retirement benefits without actuarial adjustment. Following legislation implemented in the 1983 amendments to the Social Security Act, the full benefit retirement age increased two months per year, from sixty-five to sixty-six, from 2000 to 2005. Between 2005 and 2016 the full benefit retirement age will remain at sixty-six. In 2017, the full benefit retirement age is scheduled to increase two months per year and will be fixed at age sixty-seven for those attaining age sixty-two after the year 2022. The retirement age for workers with a full benefit retirement age in terms of years and months is rounded to the next full year in all calculations.
8. The economic assumptions used in the calculations are based on the 2005 Social Security Board of Trustees' best-cost estimates (USDHHS 2005).

Table 1

Net Marginal Social Security Tax Rate Estimates for Single Beneficiaries and Primary Male Beneficiaries with a Dependent Spouse by Earnings Classification and Age in 2002

Age in 2002	Single female			Single male			Male beneficiary and dependent spouse			Uninsured female
	Low earning	Average earning	High earning	Low earning	Average earning	High earning	Low earning	Average earning	High earning	
35	–4.68	5.17	8.05	–2.11	6.08	8.48	–9.75	3.37	7.21	10.6
45	–8.24	3.90	7.46	–4.94	5.07	8.01	–13.54	2.02	6.58	10.6
55	–10.34	3.15	7.11	–9.22	3.55	7.30	–19.26	–0.02	5.62	10.6
65	–15.33	1.38	6.28	–17.86	0.48	5.86	–31.37	–4.32	3.60	10.6

Note: Workers are assumed to retire at the full benefit retirement age. Low-earning workers expect a marginal replacement rate of 0.9, and average- and high-earning workers expect rates of 0.32 and 0.15, respectively. A real discount rate of 3 percent is assumed. The growth rate in real earnings is set at 1.1 percent.

of sex s and age a in year t will be eligible for benefits at age f in year $\check{t}$ ($\check{t} = t + f - a$) is denoted by $i_{s,f,\check{t},t}$.[9] The probability of an individual of sex s surviving from age a to age j is denoted by $P_{s,t}(j|a)$. N is the age at which all persons are assumed to be dead and is set at 100 in all calculations. The rate at which a worker discounts future benefits, r, is set at 3 percent in all calculations.[10]

To illustrate, consider the case of a man who is fifty-five years old in 2002 and plans to retire at age sixty-six in 2011. Because he will attain age sixty-two after 1991, the AIME is based on the highest thirty-five years of earnings. Earnings through age sixty are indexed to the growth rate in average covered earnings. Assuming that real earnings grow at a rate of 1.1 percent annually, then $(1 + g)^{\max(60-55)} = 1.056$. An additional dollar of earnings at age fifty-five increases average indexed earnings by $\$(1/35)(1.056) \approx \$0.03$.

Assuming that the fifty-five-year-old man is a lifetime average wage earner, his marginal replacement rate is 0.32, and an extra dollar of earnings at age fifty-five would increase the PIA by $\$(0.03)(0.32) \approx \$0.0097$. The present value of the change in anticipated future benefits resulting from a $1 change in earnings is $0.0097 \sum_{j=66}^{N=100} P_{f,t}(j|55)(1+r)^{55-j}$. The discounted sum of survival probabilities for a man aged fifty-five is 7.838. Multiplying 0.076 (0.0097×7.838) by the probability that a fifty-five-year-old man will be eligible for Social Security benefits at the full benefit retirement age, 0.931, yields an estimate of $B_{PV} \approx 0.0705$. Subtracting 0.0705 from the statutory rate yields 0.0355, or 3.55 percent.

NMSSTRs for representative low-, average-, and high-earning workers by sex and select ages in 2002 are shown in Table 1. The estimates reveal that men and women at each age face an NMSSTR that is less than the statutory rate and that the NMSSTR declines with age. The age differential is the result of higher conditional survival probabilities and the fact that older workers have a shorter period over which to discount future benefits. Also, low-earning workers incur the lowest NMSSTR, as expected given the progressive nature of the benefit formula.

Across earning classes, women at most ages incur a lower NMSSTR than do men. The estimated NMSSTR for a low-earning woman aged fifty-five is 1.12 percentage points lower than the rate faced by her male counterpart (–10.34 percent compared with –9.22 percent). Gender differences in the NMSSTR are approximately 0.4 percentage points for average-earning individuals and 0.2 percentage points for high-

earning individuals aged fifty-five; this differential is attributable to the longer life expectancy of females. The NMSSTR for a woman aged sixty-five with average lifetime earnings is 0.9 percentage points higher than the rate for her male counterpart. Older women incur a higher NMSSTR because they have less of an attachment to the labor force and thus have a lower probability of being fully insured for benefits.[11]

Primary beneficiary and dependent spouse. Women who are married and do not work outside the home or fail to qualify for benefits based on their own earnings histories may qualify for dependent spouse benefits. Thus the present value of anticipated future benefits also depends on whether a primary beneficiary claims benefits for a dependent spouse.[12] A dependent spouse is entitled to an additional 50 percent of the primary beneficiary's benefit amount at retirement. In addition, if the primary beneficiary dies, the widow is entitled to 100 percent of the primary beneficiary's benefit.[13] The formula (obtained from Feldstein and Samwick 1992) for calculating the present value of the change in anticipated future benefits resulting from a $1 change in earnings for a male worker age a with a dependent spouse is shown in equation (4);

$$
\begin{aligned}
(4) \quad B_{PV} = & \sum_{j=a}^{N} P_{1,t}(j|a) - P_{1,t}(j+1|a) PIA(j,E_t) \sum_{j=\max(a,60)}^{N} P_{2,t}(j|a)(1+r)^{a-j} \\
& + \sum_{j=f}^{N} P_{1,t}(j|a) PIA(f,w)(1+r)^{a-j} \\
& + \sum_{j=f}^{N} 0.5 P_{1,t}(j|a) P_{2,t}(j|a) PIA(f,E_t)(1+r)^{a-j},
\end{aligned}
$$

where 1 = male, 2 = female, and a dependent wife is assumed to be the same age as her husband. The definitions of the other characters are identical to those for a single primary beneficiary.

The first term of equation (4) denotes the expected value of the widow's benefits conditional on the worker dying at age a. The second term denotes the expected

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9. To qualify for Social Security benefits, an individual must be fully insured. The measure used to determine whether a worker is eligible for retirement benefits is quarters of coverage. Under current legislation, a worker is fully insured if he obtains one quarter of coverage for each year after 1950 (or age twenty-one, if later) and before the year he dies, becomes disabled, or attains age sixty-two (USDHHS 2001). The minimum number of quarters required to be fully insured ranges from six to forty.

   Unpublished insurance rate estimates were provided by the Social Security Office of the Actuary. The data contained projections covering the period 2002 by sex and age for the number of fully insured workers as a percentage of the total population.

10. A rate of 3 percent was chosen to approximate an individual's rate of time preference. As before, this rate was chosen on the basis of recommendations contained in USDHHS (2005).

11. The probability that a man aged sixty-five was fully insured for benefits in the year 2002 was 0.929. In comparison, the probability that a sixty-five-year-old female was fully insured was 0.741. These unpublished estimates were provided by the Social Security Office of the Actuary.

12. The Social Security Administration estimates that, of the 21.4 million women aged sixty-two and older in 2000, 8.2 million were entitled to primary benefits only, 5.9 million were dually entitled, and 7.4 million were solely entitled to benefits as a dependent spouse and failed to qualify for benefits based on their own earnings history (USDHHS 2001).

13. Widows and widowers become eligible to receive survivor benefits at age sixty. However, children and disability may lower the age of eligibility. A detailed explanation of how these criteria may affect the age that survivors may be first eligible for benefits is contained in USDHHS (2001).

value of the primary beneficiary's retirement benefit conditional on attaining the full benefit retirement age, f. The third term denotes the expected value of the dependent spouse's benefit conditional on both parties reaching the full benefit retirement age.

Because beneficiaries with a dependent spouse do not pay any additional taxes for the additional benefit, they incur a lower NMSSTR than do singles. The NMSSTR for an average-earning man aged fifty-five with a dependent spouse, assuming a discount rate of 3 percent, is –0.02 percent (see Table 1). This negative tax rate is a net marginal subsidy and is lower than the rate incurred by female dependent spouses, whose NMSSTR equals the statutory rate of 10.6 percent.

Premature death attributable to smoking may redistribute Social Security income in unanticipated ways that affect behavior and reduce the economic well-being of smokers and their dependents.

Smoking-attributable mortality. The progressivity of the Social Security benefit formula is based on a common mortality assumption. However, the literature contains evidence that smoking reduces life expectancy (USDHHS 2004b). Life tables published by the National Center for Health Statistics are used to construct and account for differences in life expectancy among current and former smokers as well as people who have never smoked in determining NMSSTRs. The approach utilizes the mortality ratios of Thun et al. (1997) and current and former smoking prevalence estimates for persons aged thirty-five through sixty-four made available by the CDC (2007). The method of estimation is described below.

Estimates of the total number of survivors, l_a, by sex, s, and exact age, a, are shown in Table 2. The probability of an individual of sex s surviving from age a to age j is $P_s(j|a) = l_j/l_a$. The mortality rate at each age is calculated by subtracting survival probabilities at each age from 1.

The mortality ratio, which is the ratio of one group's death rate to that of the population, was used to split the table into three categories: current smokers, former smokers, and those who never smoked. The mortality ratio (M) by smoking status (SS) at each age (a) is $M_{SS,a} = q_{SS,a}/q_{T,a}$. The mortality rate for the total population is $q_{T,a}$, and $q_{SS,a}$ denotes the mortality rate by smoking status. For example, the mortality rate for current smokers by sex and exact age is calculated as $q_{CS,a} = M_{CS,a} \times q_{T,a}$. For persons aged twenty-one through thirty-five, the mortality ratio for male and female current and former smokers was assumed to be 1. For men aged thirty-five and older, the mortality ratios for current smokers and former smokers were 2.30 and 1.46, respectively. For female current and former smokers aged thirty-five and older, the mortality ratios were 1.92 and 1.30, respectively.[14]

To determine the number of survivors by smoking class, we initially assumed that 23.2 percent of men were current smokers and 34.3 percent were former smokers. For women, we assumed that 18.7 percent were current smokers and 22.9 percent were former smokers.[15] We subtracted mortality rates by sex for current smokers from 1 and multiplied by the number of current smokers that survived to age $a - 1$ to estimate the number of current smokers by sex surviving to age a. The number of surviving former smokers by sex and age was calculated in a similar manner. The number of people who have never smoked of sex s surviving to age a was estimated by subtracting the number of current and former smokers from the total number of survivors. The number of survivors at each age in the three smoking classes, as shown in

14. Mortality ratios for current and former smokers were obtained from Thun et al. (1997).
15. Smoking prevalence data for current and former smokers were obtained from the CDC (2007).

Table 2
Life Tables Used in Net Marginal Social Security
Tax Rate Estimation of Survivors by Smoking Status

Age in 2002	Total population	Current smoker	Former smoker	Never smoked	Age in 2002	Total population	Current smoker	Former smoker	Never smoked
Females					**Females**				
20	98,922	18,538	22,604	57,780	61	90,138	15,614	20,076	54,448
21	98,877	18,530	22,593	57,754	62	89,374	15,360	19,854	54,159
22	98,827	18,520	22,582	57,725	63	88,552	15,089	19,617	53,846
23	98,781	18,512	22,571	57,698	64	87,657	14,796	19,359	53,502
24	98,736	18,503	22,561	57,672	65	86,680	14,479	19,079	53,122
25	98,688	18,494	22,550	57,644	66	85,631	14,143	18,779	52,709
26	98,639	18,485	22,539	57,615	67	84,512	13,788	18,460	52,264
27	98,589	18,476	22,528	57,586	68	83,281	13,402	18,110	51,768
28	98,539	18,466	22,516	57,557	69	81,982	13,001	17,743	51,238
29	98,483	18,456	22,503	57,524	70	80,556	12,567	17,342	50,647
30	98,424	18,445	22,490	57,489	71	79,026	12,109	16,914	50,004
31	98,362	18,433	22,476	57,453	72	77,410	11,633	16,464	49,313
32	98,296	18,421	22,461	57,415	73	75,666	11,130	15,982	48,554
33	98,225	18,407	22,444	57,373	74	73,802	10,604	15,470	47,729
34	98,148	18,393	22,427	57,328	75	71,800	10,051	14,924	46,824
35	98,064	18,363	22,402	57,299	76	69,639	9,470	14,340	45,828
36	97,970	18,329	22,374	57,267	77	67,366	8,877	13,732	44,757
37	97,869	18,293	22,344	57,232	78	64,935	8,262	13,088	43,585
38	97,759	18,253	22,311	57,195	79	62,372	7,636	12,416	42,320
39	97,640	18,210	22,276	57,153	80	59,621	6,989	11,704	40,928
40	97,500	18,160	22,234	57,105	81	56,681	6,327	10,954	39,400
41	97,355	18,109	22,192	57,055	82	53,660	5,680	10,195	37,785
42	97,194	18,051	22,144	56,999	83	50,324	5,002	9,371	35,951
43	97,023	17,990	22,093	56,940	84	47,075	4,382	8,585	34,109
44	96,830	17,921	22,036	56,873	85	43,542	3,751	7,747	32,045
45	96,627	17,849	21,976	56,802	86	39,919	3,151	6,909	29,859
46	96,405	17,770	21,910	56,724	87	36,246	2,595	6,083	27,569
47	96,176	17,689	21,843	56,644	88	32,571	2,090	5,281	25,201
48	95,928	17,602	21,769	56,557	89	28,943	1,643	4,516	22,784
49	95,654	17,505	21,689	56,460	90	25,411	1,258	3,800	20,354
50	95,364	17,403	21,603	56,357	91	22,024	936	3,141	17,947
51	95,059	17,297	21,513	56,249	92	18,828	675	2,549	15,604
52	94,724	17,179	21,415	56,130	93	15,862	471	2,027	13,364
53	94,380	17,060	21,314	56,007	94	13,158	317	1,578	11,264
54	93,989	16,924	21,199	55,866	95	10,737	205	1,200	9,332
55	93,572	16,780	21,077	55,716	96	8,613	127	892	7,594
56	93,095	16,616	20,937	55,542	97	6,785	75	646	6,064
57	92,629	16,456	20,801	55,372	98	5,245	42	455	4,747
58	92,084	16,270	20,642	55,172	99	3,977	23	312	3,642
59	91,491	16,069	20,469	54,953	100	2,954	12	208	2,735
60	90,826	15,845	20,275	54,706					

(continued)

Table 2 (continued)

Age in 2002	Total population	Current smoker	Former smoker	Never smoked	Age in 2002	Total population	Current smoker	Former smoker	Never smoked
Males					**Males**				
20	98,436	22,778	33,724	41,934	61	83,612	16,028	26,805	40,779
21	98,299	22,746	33,677	41,875	62	82,483	15,530	26,276	40,677
22	98,157	22,714	33,629	41,815	63	81,255	14,998	25,705	40,552
23	98,021	22,682	33,582	41,757	64	79,946	14,442	25,101	40,403
24	97,882	22,650	33,534	41,698	65	78,556	13,865	24,463	40,228
25	97,746	22,618	33,488	41,640	66	77,071	13,262	23,788	40,021
26	97,614	22,588	33,443	41,584	67	75,501	12,641	23,081	39,779
27	97,479	22,557	33,396	41,526	68	73,809	11,989	22,326	39,494
28	97,352	22,527	33,353	41,472	69	72,012	11,318	21,532	39,162
29	97,225	22,498	33,309	41,418	70	70,087	10,622	20,692	38,773
30	97,091	22,467	33,263	41,361	71	68,039	9,908	19,809	38,322
31	96,954	22,435	33,216	41,302	72	65,864	9,180	18,884	37,800
32	96,813	22,403	33,168	41,242	73	63,621	8,461	17,945	37,215
33	96,678	22,371	33,122	41,185	74	61,202	7,721	16,949	36,532
34	96,526	22,336	33,070	41,120	75	58,680	6,989	15,930	35,761
35	96,367	22,251	32,990	41,125	76	56,028	6,262	14,878	34,887
36	96,196	22,161	32,905	41,131	77	53,251	5,549	13,802	33,901
37	96,016	22,065	32,815	41,136	78	50,398	4,865	12,722	32,811
38	95,823	21,963	32,719	41,141	79	47,454	4,211	11,637	31,606
39	95,610	21,851	32,612	41,147	80	44,370	3,582	10,533	30,255
40	95,381	21,731	32,498	41,152	81	41,252	3,003	9,452	28,797
41	95,128	21,598	32,373	41,157	82	38,102	2,475	8,399	27,228
42	94,859	21,458	32,239	41,163	83	34,798	1,982	7,335	25,481
43	94,577	21,311	32,099	41,167	84	31,719	1,578	6,388	23,753
44	94,266	21,150	31,945	41,171	85	28,478	1,207	5,435	21,836
45	93,929	20,976	31,778	41,175	86	25,296	897	4,548	19,851
46	93,569	20,791	31,600	41,178	87	22,212	646	3,739	17,828
47	93,171	20,587	31,404	41,179	88	19,266	449	3,015	15,803
48	92,755	20,376	31,199	41,180	89	16,494	300	2,381	13,812
49	92,296	20,144	30,974	41,178	90	13,925	193	1,840	11,893
50	91,809	19,900	30,735	41,174	91	11,585	118	1,388	10,078
51	91,286	19,639	30,480	41,167	92	9,490	69	1,022	8,399
52	90,722	19,360	30,205	41,157	93	7,648	38	732	6,877
53	90,138	19,073	29,921	41,144	94	6,059	20	510	5,529
54	89,505	18,765	29,614	41,126	95	4,715	10	345	4,360
55	88,850	18,449	29,298	41,103	96	3,601	4	226	3,371
56	88,102	18,092	28,938	41,072	97	2,698	2	143	2,553
57	87,369	17,746	28,586	41,037	98	1,982	1	88	1,894
58	86,542	17,360	28,191	40,991	99	1,426	0	52	1,374
59	85,644	16,945	27,764	40,935	100	1,005	0	29	975
60	84,637	16,487	27,287	40,863					

Note: "Survivors" refers to the number of persons by smoking status reaching age a during the year among the stationary population.

Source: Constructed from life tables published by the National Center for Health Statistics

Table 3

Net Marginal Social Security Tax Rate Estimates for Single Primary Beneficiaries by Sex, Smoking Status, Earnings Classification, and Age in 2002

Age in 2002	Current smoker			Former smoker			Never smoked		
	Low earning	Average earning	High earning	Low earning	Average earning	High earning	Low earning	Average earning	High earning
Females									
35	–0.14	6.78	8.81	–2.87	5.81	8.35	–6.84	4.40	7.69
45	–2.83	5.83	8.36	–6.09	4.67	7.82	–10.78	3.00	7.04
55	–4.77	5.13	8.04	–8.13	3.94	7.48	–12.86	2.26	6.69
65	–9.84	3.33	7.19	–13.13	2.16	6.64	–17.62	0.57	5.90
Males									
35	3.96	8.24	9.49	0.73	7.09	8.96	–7.68	4.10	7.55
45	2.21	7.62	9.20	–1.61	6.26	8.57	–11.16	2.86	6.97
55	–0.91	6.51	8.68	–5.37	4.92	7.94	–15.69	1.25	6.22
65	–8.84	3.69	7.36	–13.68	1.97	6.55	–23.50	–1.53	4.92

Note: Workers are assumed to retire at the full benefit retirement age. Low-earning workers expect a marginal replacement rate of 0.9, and average- and high-earning workers expect rates of 0.32 and 0.15, respectively. A real discount rate of 3 percent is assumed. The growth rate in real earnings is set at 1.1 percent.

Table 2, is then used to calculate the probability that a person age a will survive to age j. For each smoking class, the survival probabilities are in turn used to calculate B_{PV}.

NMSSTRs for single primary beneficiaries that account for smoking-attributable mortality by age, gender, and earnings class are shown in Table 3. As expected, a comparison of the results in Tables 1 and 3 reveals that a smoker's shorter life expectancy increases the NMSSTR at each age. A single male current smoker aged fifty-five with lifetime average earnings faces a net tax rate of 6.51 percent, which is approximately 3 percentage points higher than the rate estimated under the common mortality assumption (3.55 percent). The NMSSTR for a single male former smoker aged fifty-five with average lifetime earnings is 4.92 percent, which is approximately 1.4 percentage points higher than the rate estimated under the common mortality assumption. The NMSSTR for a single man aged fifty-five who never smoked with average lifetime earnings is 1.25 percent—5.3 percentage points lower than the rate for a current smoker and 3.7 percentage points lower than the rate for a fifty-five-year-old former smoker of the same age.

A single female current smoker aged fifty-five with lifetime average earnings faces an NMSSTR of 5.13 percent, which is approximately 1.4 percentage points lower than the rate estimated for a fifty-five-year-old current smoking man with lifetime average earnings. The gender differential in NMSSTRs for both current and former smokers at each age is larger than the differential estimated under the common mortality assumption. In addition, sixty-five-year-old female current and former smokers now incur a lower NMSSTR than do their male counterparts. These gender differences result from males smoking at higher rates than females and having a higher smoking-attributable mortality risk.

As shown in Table 4, a fifty-five-year-old male current smoker with lifetime average earnings and a dependent spouse who also smokes incurs an NMSSTR of 3.17 percent, which is more than 3 percentage points higher than the rate estimated under the common mortality assumption (–0.02). In addition, this rate is 1.69 percentage

Table 4

Net Marginal Social Security Tax Rate Estimates for Male Primary Beneficiaries with a Dependent Spouse by Earnings Classification, Smoking Status, and Age in 2002

Age in 2002	Primary beneficiary current smoker Dependent spouse			Primary beneficiary former smoker Dependent spouse			Primary beneficiary never smoked Dependent spouse		
	Currrent smoker	Former smoker	Never smoked	Current smoker	Former smoker	Never smoked	Current smoker	Former smoker	Never smoked
				Low earner					
35	–4.39	–6.41	–8.68	–5.56	–7.14	–8.97	–13.77	–15.42	–17.44
45	–6.53	–8.57	–10.87	–8.53	–10.18	–12.10	–18.21	–20.01	–22.22
55	–10.30	–12.38	–14.71	–13.31	–15.05	–17.05	–24.26	–26.21	–28.57
65	–20.90	–22.95	–25.18	–24.76	–26.51	–28.47	–35.42	–37.38	–39.68
				Average earner					
35	5.27	4.55	3.75	4.86	4.29	3.64	1.94	1.35	0.63
45	4.51	3.78	2.97	3.80	3.21	2.53	0.36	–0.28	–1.07
55	3.17	2.43	1.60	2.10	1.48	0.77	–1.80	–2.49	–3.33
65	–0.60	–1.33	–2.12	–1.97	–2.59	–3.29	–5.76	–6.46	–7.28
				High earner					
35	8.10	7.77	7.39	7.91	7.64	7.34	6.54	6.26	5.93
45	7.75	7.40	7.02	7.41	7.14	6.82	5.80	5.50	5.13
55	7.12	6.77	6.38	6.62	6.33	5.99	4.79	4.46	4.07
65	5.35	5.01	4.64	4.71	4.42	4.09	2.93	2.60	2.22

Note: Workers are assumed to retire at the full benefit retirement age. Low-earnings workers expect a marginal replacement rate of 0.9, and average- and high-earning workers expect rates of 0.32 and 0.15, respectively. A real discount rate of 3 percent is assumed. The growth rate in real earnings is set at 1.1 percent.

points higher than the rate incurred by a fifty-five-year-old male former smoker with lifetime average earnings and a dependent spouse who formerly smoked (1.48 percent) and approximately 5.5 percentage points higher than the rate incurred by a fifty-five-year-old male who never smoked with lifetime average earnings and a dependent spouse who never smoked (–2.49 percent).

Results and Discussion

As previous studies have shown, we find that Social Security treats single people and dual-income couples less equitably than single-income couples. This study's results add to previous findings by showing that NMSSTRs also vary by smoking status.[16] The higher tax rates that smokers incur may reduce their labor supply.[17] Given that Social Security is financed by a payroll tax on earnings, any reduction in the labor supply will have implications for the system's funding. However, the aggregate effect of smoking on the OASI Trust Fund's finances would depend on how smoking redistributes benefits from smokers to people who never smoked and the resulting labor supply response to changes in marginal tax rates.

While Social Security has reduced poverty among elderly Americans, young widows are at increased risk of living in poverty because of the premature death of their spouse (Redja 1994; Engelhardt and Gruber 2004; Sevak, Weir, and Willis 2004). Many individuals who smoke die prematurely. Approximately 536,000 adults in the

United States under age sixty-five died of smoking-attributable illnesses between 1997 and 2001.[18] Widows with no children under age sixteen in their care who were married to fully insured workers who died prematurely may be ineligible for Social Security benefits until they reach age sixty. Estimates suggest that 15 percent of women aged fifty-four, too young to qualify for Social Security benefits, fall into poverty following the death of their husband (Sevak, Weir, and Willis 2004).[19] As a result, it has been suggested that Social Security is failing to live up to one of its primary goals—providing adequate survivors insurance for older low-earning Americans (Gustman and Steinmeier 2002). One proposal to improve Social Security's adequacy is to lower the eligibility age for widows from sixty years to fifty-five years (Redja 1994).[20] In addition to the establishment of private accounts, two of the three plans proposed by the President's Commission to Strengthen Social Security (2001) recommended an increase in benefits for low-earning widows and widowers.

Because low-earning workers are more likely to smoke and smokers are more likely than people who have never smoked to die prematurely, an unintended distributional effect of enacting proposals that would reduce widows' retirement age or increase retirement benefits among low-earning widows and widowers would be to redistribute benefits from people who have never smoked to smokers, thus benefiting behavior that is detrimental to health. As with life insurance, perhaps this unintended effect could be offset by smokers' paying a higher premium, in this case a smoker's insurance tax rate. The revenue generated from a tax levied on current smokers could be added to the OASI Trust Fund and used to reduce financial hardship currently faced by young widows and widowers by paying increased benefits or paying benefits at an earlier age. In addition, the higher tax penalty associated with smoking may increase cessation. The aggregate impact of such a change on the various trust fund finances would be a valuable addition to the debates surrounding the system's solvency and ways to reduce poverty among widows and widowers.

16. It has been suggested that premature deaths attributable to smoking save Social Security money (Shoven, Sundberg, and Bunker 1987). One should not infer from these results that because smokers incur a higher NMSSTR they pay more than their fair share to Social Security; the higher NMSSTR may cause smokers to reduce their labor supply and thereby reduce Social Security contributions. In addition, Social Security disability payments to persons with smoking-attributable diseases and payments to dependents and survivors of deceased smokers will offset reductions in future system liabilities that stem from smoking-attributable death.
17. In addition to reducing hours of work, an increase in taxes may decrease labor force participation. Specifically, smoking may lead to a reduction in labor supply through early retirement. Retirement studies have typically used average life expectancy by age as opposed to predictions based on health status in their analysis (Social Security Advisory Council 1997). Those smokers in poor health who retire early may be responding to financial incentives that are masked in analyses that use average life expectancies.
18. These estimates are unpublished and were estimated from Smoking-Attributable Mortality Morbidity and Economic Cost (SAMMEC) data maintained by the Office on Smoking and Health at the CDC. SAMMEC estimates are available at <http://apps.nccd.cdc.gov/sammec/>.
19. We do not know how many widows under age sixty are ineligible for benefits. However, we do know that in the year 2000, 45,680 widows received benefits because they had a child under age sixteen in their care (USDHHS 2001, table 5.F1).
20. It is unclear why age fifty-five is recommended. Widows under age fifty-five whose eligibility is based solely on age would continue to be ineligible for Social Security benefits, and the system would fail to live up to one of its main goals of providing adequate retirement security. Additional information on proposals aimed at changing Social Security survivorship benefits and poverty among widows is available from Anzick and Weaver (2001).

Table 5

Net Marginal Social Security Tax Rate Estimates for Average Earner Primary Beneficiaries and Dependents by Sex, Smoking Status, and Age in 2002

| Age in 2002 | Primary beneficiary | | | | | | Smoking status of male primary beneficiary and dependent spouse | | |
| | Single female | | | Single male | | | | | |
	Current smoker	Former smoker	Never smoked	Current smoker	Former smoker	Never smoked	Both current smokers	Both former smokers	Both never smoked
				2.2 percent discount rate					
35	5.83	4.56	2.69	7.69	6.23	2.35	5.34	4.30	0.50
45	5.08	3.68	1.64	7.19	5.59	1.52	4.68	3.35	−0.95
55	4.76	3.42	1.50	6.28	4.54	0.45	3.49	1.83	−2.88
65	3.42	2.18	0.47	3.85	2.08	−1.58	0.07	−1.84	−6.32
				3.0 percent discount rate					
35	7.07	6.17	4.87	8.42	7.35	4.59	5.67	4.77	1.38
45	6.18	5.11	3.57	7.84	6.58	3.44	4.97	3.76	−0.19
55	5.54	4.44	2.89	6.81	5.35	1.95	3.73	2.17	−2.28
65	3.88	2.79	1.32	4.20	2.61	−0.62	0.24	−1.60	−5.94
				3.7 percent discount rate					
35	7.87	7.21	6.25	8.90	8.09	6.02	5.90	5.09	1.96
45	6.95	6.10	4.89	8.30	7.28	4.77	5.18	4.06	0.34
55	6.13	5.20	3.90	7.22	5.95	3.06	3.92	2.43	−1.83
65	4.25	3.28	1.97	4.49	3.04	0.13	0.38	−1.42	−5.63

Note: Workers are assumed to retire at the full benefit retirement age. Average-earning workers expect a marginal replacement rate of 0.32. The growth rate in real earnings is set at 1.1 percent. Estimates account for smoking-attributable mortality and taxation of benefits.

As in previous studies, these results are limited in that they are based on hypothetical workers; thus, the relative importance of various economic assumptions and differences is an empirical question.[21] Because analysis with money flows over time may be sensitive to the choice of discount rate, selective results shown in Tables 1, 3, and 4 for workers with average lifetime earnings were reestimated under alternative discount rate assumptions. As shown in Table 5, a lower discount rate reduces the NMSSTR at each age.[22]

Although the calculations presented are complex, they oversimplify the Social Security program in a number of ways. First, we focus on OASI and ignored the DI and HI components of Social Security. Second, we ignore benefits for dependent children of young widows or widowers. Third, we ignore the possibility of divorce and remarriage. Fourth, the employer portion of the payroll tax is tax exempt, and given the progressive nature of income taxation, this exemption disproportionately benefits higher-earning individuals. Thus, the NMSSTR for high-earning individuals may be lower than the estimates reported. Fifth, smoking prevalence is held constant across earnings classes. Because lower-earning individuals have a higher smoking prevalence than do higher-earning individuals, low-earning individuals' NMSSTRs may be higher than the rates reported whereas average- and high-earning individuals may have NMSSTRs that are lower than the rates reported.

A final potential limitation to our results is that the mortality risk measures used to account for the mortality difference among current and former smokers are adjusted

for sex and age only. Other risk factors such as educational status, diet, and alcohol consumption that are correlated with smoking were unaccounted for in the mortality risk measure that was used. As a consequence, the NMSSTR estimates may overstate the tax penalty associated with smoking (Shoven, Sundberg, and Bunker 1987; Thun et al. 1997). However, this limitation may not pose too great a problem because evidence in the literature suggests that when behavioral and demographic factors correlated with smoking were taken into account, the higher mortality risks faced by smokers did not change much (Malarcher et al. 2000; Thun et al. 1997).

Conclusion

The analyses reveal that smokers will incur higher net marginal tax rates than people who never smoked and may reduce their labor supply.[23] Any reduction in labor supply among smokers will have implications for the system's funding. Knowledge of the distributional effects of smoking on Social Security is important not only from the standpoint of the system's funding but also from the perspective of informing smoking cessation efforts (Rice et al. 1986). People can avoid higher net marginal tax rates by never smoking or reduce them by quitting smoking. Finally, smoking status should be considered in assessing Social Security legislative proposals designed to reduce system inequities or promote social adequacy—in particular, amendments designed to reduce poverty among young widows and widowers. Failure to do so may unintentionally promote behavior that is detrimental to health.

21. However, this methodology is the best one can do since the actual data are unavailable (Garrett 1995). For a discussion of the usefulness of results based on hypothetical worker data, see Leimer (1995).
22. The calculations shown in Tables 1, 3, and 4 ignored the personal income tax bracket at which Social Security retirement benefits will be taxed during retirement. Thus, the estimates shown in Table 5 assumed that Social Security benefits will be subject to a federal income tax rate of 15 percent. For a single male current smoker aged fifty-five, assuming a discount rate of 3 percent, taxation of benefits increased his NMSSTR by 0.3 percentage points (6.51 percent versus 6.81 percent).
23. The evidence is mixed on the impact of Social Security on the labor supply although the predominant research in this area has focused on the labor supply responses of older workers (Krueger and Meyer 2002).

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