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AVERAGE MARGINAL TAX RATES FROM SOCIAL SECURITY
AND THE INDIVIDUAL INCOME TAX

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ceiling

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In our previous paper (Barro & Sahasakul, 1983) we provided estimates of average marginal tax rates from the federal individual income tax for 1916-80. Now we supplement these figures to include the social security tax on labor earnings. With this addition, the included taxes comprise in 1980 72% of federal and 47% of total government receipts. If some non-tax items are excluded, the values are 75% and 52%, respectively.¹

In the main the social security levy is a flat-rate tax, paid partly by workers, partly by employers, and partly by self-employed persons. The computation of average marginal tax rates is simpler than in the case of the federal income tax, which has a graduated-rate structure and allows for numerous deductions from taxable income. The main complications that arise for the social-security tax are the following:

- For workers and self-employed persons with earnings above a ceiling value, the marginal tax rate is nil.
- The tax applies only to labor earnings (and to earnings from self-employment), rather than to total income.
- The employer and employee parts of the tax differ, because the employer's payments are not counted as part of the employee's taxable income.
- An individual's future social security benefits depend positively on that person's history of contributions. This element reduces the effective tax rate that an individual faces. In fact, Gordon (1982) argues that this consideration

¹The data are from U.S. Survey of Current Business, July 1983. If payments for unemployment insurance and workers' compensation are also treated as non-taxes, then the percentages become 78% and 54%.

is important for people who are close to retirement age. Generally, the inclusion of this effect would require forecasts of benefit schedules, as well as survival probabilities. It would also be necessary to include various complexities of the social-security law, such as the declining marginal effect of past covered earnings on benefits, the exclusion of some years of earnings from the formula, and the treatment of spouses and dependents. In any event, our subsequent calculations do not take account of the effects of social-security contributions on future benefits. Thus, by including only the tax aspects of these "contributions," we somewhat overstate the effective marginal tax rates from the social security program.

Theoretical Considerations

Let s_f be the tax rate (marginal and average) paid by a firm on workers' earnings. If profits are taxed at the rate τ_π , then the firm's after-tax profits are

$$(1) \quad \pi = (1 - \tau_\pi) [F(L) - wL(1 + s_f)] \quad ,$$

where L is the quantity of labor input, w is the real wage rate, and $F(L)$ is the production function. Maximization of profit implies

$$(2) \quad F' = w(1 + s_f) \quad ,$$

where F' is labor's marginal product.

The representative worker's total real income, Y , equals $wL + I$, where I is non-labor income. As in our previous paper, this income is spent

on consumption, C , or income taxes, T .² In addition, there is now the social security tax, $s_e \cdot wL$, where s_e is the employee's (marginal and average) contribution rate. Thus, we have

$$(3) \quad Y = wL + I = C + T + s_e \cdot wL \quad .$$

As before, income taxes T depend on taxable income, $Y - D$, where D is a broad concept of deductions. If utility depends positively on consumption and negatively on work, then the first-order condition for maximizing utility can be written as

$$(4) \quad \frac{-\partial U/\partial L}{\partial U/\partial C} = w(1 - T' - s_e) \quad ,$$

where T' is the marginal income-tax rate.

Substituting for w from equation (2) into equation (4) implies

$$(5) \quad \frac{-\partial U/\partial L}{\partial U/\partial C} = \frac{F'(1 - T' - s_e)}{(1 + s_f)} \quad .$$

Thus, equation (5) shows how the tax system creates a positive wedge between labor's marginal product, F' , and the utility rate of substitution between consumption and leisure, $-(\partial U/\partial L)/(\partial U/\partial C)$.

Let τ be the overall effective marginal tax rate on labor's marginal product, F' . Then we have from equation (5)

²For present purposes it is unnecessary for us to consider two categories of consumption--depending on the treatment by the tax law--as we did in the earlier paper. We also do not allow here for efforts aimed at avoiding income taxes.

$$(1 - \tau) = (1 - T' - s_e)/(1 + s_f) \quad ,$$

which implies

$$(6) \quad \tau = \frac{1}{(1+s_f)} \cdot (s_f + s_e + T') \quad .$$

Thus, the tax system effectively deflates labor's marginal product F' by the factor, $1 + s_f$ (see equation 2), and then applies the marginal tax rate, $s_f + s_e + T'$.³ If the social-security tax is not purely a flat-rate levy (because of the ceiling on taxable earnings in the U.S. system), then we can interpret s_f and s_e in equation (6) as the marginal social-security tax rates.

For self-employed persons the formula is simpler. Namely, if s_s is the marginal contribution rate to social security, then the effective marginal tax rate τ_s is⁴

$$(7) \quad \tau_s = s_s + T' \quad .$$

Previously, we calculated weighted averages \bar{T}' of the marginal income-tax rates T' . We weighted either by adjusted gross income (AGI) or by

³Note that τ does not depend solely on the sum, $s_f + s_e$. That's because, unlike the worker's payments, the employer's payments are not part of the worker's tax base.

⁴If the marginal tax rates T' are equal, then the equation of τ_s from equation (7) to τ in equation (6) requires s_s to be less than $s_f + s_e$, as was true in the U.S. until 1984. For example, if $T' = .3$ and $s_f = s_e = .0665$ (the 1981 value), then the equalizing value for s_s is .106. The actual value of s_s for 1981 was .093. The social-security law passed in 1983 and effective in 1984^s sets the self-employed rate equal to the sum, $s_f + s_e$, but provides for some off-setting income-tax credits.

numbers of returns, and we computed arithmetic and geometric averages. Here, we consider only the series that we focused on earlier, which is the arithmetic average weighted by AGI.

Equations (6) and (7) tell us the necessary extensions to go from our previous measures \bar{T}' to weighted averages, $\bar{\tau}$, that include the social-security tax. Namely,⁵

$$(8) \quad \bar{\tau} \approx \bar{T}' + \Omega_1 \cdot \left(\frac{s_f + s_e}{1 + s_f} \right) + \Omega_2 \cdot s_s - \Omega_1 \cdot s_f \cdot \bar{T}'' \quad ,$$

where

- s_f , s_e and s_s are now the social-security contribution rates for persons with earnings below the taxable ceiling⁶

- Ω_1 is the ratio to aggregate AGI of the wage and salary income of workers with earnings below the ceiling,

- Ω_2 is the corresponding ratio for self-employed persons, and

- \bar{T}'' is the (weighted) average marginal tax rate for workers with earnings below the ceiling.

Note that the measure $\bar{\tau}$ depends on Ω_1 , which is the ratio of applicable salaries and wages to aggregate AGI rather than aggregate labor incomes. Thus, the index $\bar{\tau}$ tends to pick up effects of the social-security tax, which impinges on salaries and wages, on the generation of aggregate real income

⁵To get the last term, we approximate $T'/(1+s_f) \approx T'(1-s_f)$ in equation (6). This approximation is satisfactory for our data sample.

⁶Note that the social-security levy is a flat-rate tax in this range.

(as proxied by AGI).⁷ In order to study, for example, the choice of work effort, a different weighting pattern would likely be appropriate. Then the constructed \bar{T}' , which was weighted by shares of AGI, would also have to be modified. Analogous remarks apply to the self-employment part of equation (8).

Computations of Tax Rates

Table 1 shows the salaries and wages (column 1) and self-employment income (column 3) that accrue in each year to persons with earnings below the ceiling. (In column 4 the table shows the dollar value of the ceiling for each year.) These data, combined with values of aggregate AGI, which we used in our previous paper, allow us to calculate the weights Ω_1 and Ω_2 , which appear in equation (8). These weights are in columns 5 and 6 of Table 1.

For subsequent purposes the important variable is Ω_1 , the ratio to aggregate AGI of salaries and wages of persons below the ceiling. This ratio can be divided into two parts--first, the ratio of salaries and wages of persons below the ceiling to the aggregate of salaries and wages (column 2 of Table 1) and second, the ratio of aggregate salaries and wages to aggregate AGI. The latter ratio is highly stable about its mean value of .84. Hence, Ω_1 fluctuates mainly because of changes in the fraction of overall

⁷Conceptually, for a family, we would count either one earner's salary and wages or two earners' salaries and wages, depending on whether one or both had earnings that were individually below the ceiling. But, for joint tax returns where total salaries and wages exceed the ceiling, the data do not allow us to tell whether there were multiple earners, one or both of which were separately above or below the ceiling. However, we do know the aggregate of salaries and wages and self-employment income that accrue to persons whose earnings are below the ceiling. These data are sufficient for most of our purposes.

salaries and wages that accrue to persons below the ceiling. This fraction depends in turn on the ceiling on earnings for social security in relation to the distribution of nominal earnings in the economy. For example, the decrease in Ω_1 from .46 in 1937 to .24 in 1965 corresponds to a decline in the ratio of salaries and wages for persons below the ceiling to total salaries and wages from .57 to .29. This behavior reflects the relatively slow increase in the dollar ceiling on earnings, which increases from \$3,000 in 1937 to only \$4,800 in 1965. However, the ceiling has risen more rapidly since 1965, reaching \$25,900 in 1980 (and \$32,400 in 1982). Hence, the ratio of salaries and wages for persons below the ceiling to total salaries and wages goes from .29 in 1965 to .65 in 1980 (and .68 in 1982). Correspondingly, Ω_1 increases from .24 in 1965 to .54 in 1980.

The values for $s_f = s_e$ and s_s for each year are also shown in Table 1. (These are nonzero only since the start of the social security program in 1937.) Thereby, we can calculate the second term, $\Omega_1(s_f + s_e)/(1 + s_f)$, and the third term, $\Omega_2 \cdot s_s$, on the right side of equation (8). The results appear in columns 2 and 3 of Table 2.

It is more complicated to calculate the final term of equation (8), which depends on the average marginal tax rate \bar{T}'' for workers with earnings below the ceiling. From the I.R.S.'s Statistics of Income, Individual Tax Returns for each year, we approximate the calculation of \bar{T}'' by using the marginal tax rates and associated values of AGI for the following filing units: First, we take all returns from AGI classes for which the average of salaries and wages per return is below the ceiling value. (For example, for 1980 when the ceiling on earnings is \$25,900, we go up to an AGI per return of

TABLE 1
SOCIAL SECURITY VARIABLES

	(1) Salaries & Wages Below Ceiling (\$ billion)	(2) (1) ÷ Total Salaries & Wages	(3) Self-Emp. Earnings Below Ceiling (\$ billion)	(4) Ceiling (\$)	(5) Ω_1	(6) Ω_2	(7) $s_f = s_e$	(8) s_s
1937	26.5	.57	-	3000	.46	-	1.0	0
8	23.7	.55	-	3000	.44	-	1.0	
9	26.6	.58	-	3000	.47	-	1.0	0
1940	29.4	.59	-	3000	.48	-	1.0	0
1	36.3	.58	-	3000	.48	-	1.0	0
2	42.2	.51	-	3000	.44	-	1.0	0
3	44.6	.42	-	3000	.38	-	1.0	0
4	42.9	.37	-	3000	.33	-	1.0	0
1945	43.9	.37	-	3000	.33	-	1.0	0
6	49.7	.44	-	3000	.37	-	1.0	0
7	49.5	.40	-	3000	.33	-	1.0	0
8	47.9	.35	-	3000	.29	-	1.0	0
9	46.6	.35	-	3000	.29	-	1.0	0
1950	45.7	.31	-	3000	.25	-	1.5	0
1	65.1	.38	4.3	3600	.32	.02	1.5	2.25
2	64.6	.35	4.3	3600	.30	.02	1.5	2.25
3	63.2	.32	4.2	3600	.27	.02	1.5	2.25
4	61.4	.31	4.3	3600	.27	.02	2.0	3.0
1955	79.1	.37	8.3	4200	.32	.03	2.0	3.0
6	81.2	.36	8.8	4200	.30	.03	2.0	3.0
7	84.5	.35	8.2	4200	.30	.03	2.25	3.375
8	82.9	.34	8.2	4200	.29	.03	2.25	3.375
9	101.4	.39	9.2	4800	.33	.03	2.5	3.75
1960	100.5	.37	9.0	4800	.32	.03	3.0	4.5
1	98.5	.35	9.1	4800	.30	.03	3.0	4.5
2	99.3	.33	8.5	4800	.28	.02	3.125	4.7
3	99.6	.32	8.1	4800	.27	.02	3.625	5.4
4	100.5	.30	7.7	4800	.25	.02	3.625	5.4
1965	103.7	.29	7.2	4800	.24	.02	3.625	5.4
6	166.4	.42	10.8	6600	.35	.02	4.2	6.15
7	168.4	.39	10.1	6600	.33	.02	4.4	6.4
8	214.6	.46	12.1	7800	.39	.02	4.4	6.4
9	214.6	.42	11.9	7800	.35	.02	4.8	6.9
1970	215.5	.39	11.2	7800	.34	.02	4.8	6.9
1	209.9	.36	11.1	7800	.31	.02	5.2	7.5
2	253.9	.40	13.5	9000	.34	.02	5.2	7.5
3	326.9	.47	16.3	10800	.39	.02	5.85	8.0
4	414.9	.54	19.8	13200	.46	.02	5.85	7.9

TABLE 1—Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1975	430.6	.53	21.1	14100	.45	.02	5.85	7.9
6	477.0	.54	24.0	15300	.45	.02	5.85	7.9
7	528.9	.54	26.0	16500	.45	.02	5.85	7.9
8	591.1	.53	36.5	17700	.45	.03	6.05	8.1
9	778.8	.63	47.1	22900	.53	.03	6.13	8.1
1980	878.8	.65	50.9	25900	.54	.03	6.13	8.1
1	999.3	.67	57.2	29700	.56	.03	6.65	9.3
2	1067.2	.68	59.2	32400			6.7	9.35

- Column 1: Total salaries and wages of persons whose salaries and wages fall below the ceiling.
- Column 2: Column 1/total salaries and wages. The denominator is from U.S. Dept. of Commerce, National Income and Product Accounts of the U.S., 1929-1976, and U.S. Survey of Current Business, July 1983.
- Column 3: Total earnings from self-employment for those whose earnings fall below the ceiling.
- Column 4: The ceiling on taxable salaries and wages or self-employment earnings for social security purposes.
- Column 5: Ω_1 = Col. (1)/total adjusted gross income
- Column 6: Ω_2 = Col. (3)/total adjusted gross income
- Column 7: $s_f = s_e$: social security tax rates on employers and employees
- Column 8: s_s : social security tax rate on self-employed persons

Source: U.S. Department of Health and Human Services, Social Security Administration, Social Security Bulletin, Annual Statistical Supplement, various issues. Figures for columns (1) and (3) for 1978-82 were provided by Anthony Pellechio.

\$30,000.) Then we include enough additional joint returns from AGI classes where the average of salaries and wages per return is above the ceiling, so as to exhaust the known total of salaries and wages that accrues to persons with earnings below the ceiling. However, we carry out this calculation by using the lowest possible AGI classes--that is, we assume that low numbers for individuals' salaries and wages correspond to low numbers for AGI per return. There is some approximation here, since some of the low values for salaries and wages may come from either multi-earner families or families with high non-labor income, which would have high marginal tax rates. But some experimentation indicates that the potential error is quantitatively unimportant. Column 4 of Table 2 shows the resulting calculation for the final term, $-\Omega_1 s_f \bar{T}''$, in equation (8). Note that this term--which reflects the exclusion of firms' social security payments from workers' taxable income--is always below .01 in magnitude.

Our previous estimates of the average marginal tax rate when weighted by AGI, \bar{T}' , appear in column 1 of Table 2. We consider only the values since 1937, because the social security tax is nil for earlier years. The overall modification to incorporate the social-security tax--the sum of columns 2, 3 and 4 in Table 2--appears in column 5 of the table (labeled SS). Then the sum of columns 1 and 5 gives us the average marginal tax rate $\bar{\tau}$ from the federal individual income tax and the social security tax. These values are in column 6 of the table. Figure 1 shows the average marginal tax rate from the individual income tax \bar{T}' (column 1 of Table 2), the overall effect from social security SS (column 5), and the combined average marginal tax rate $\bar{\tau}$ (column 6).

TABLE 2
AVERAGE MARGINAL TAX RATES

	\bar{T}'	(2) $\Omega_1 \frac{(s_f + s_e)}{(1 + s_f)}$	(3) $\Omega_2 \cdot s_s$	(4) $-\Omega_1 \cdot s_f \cdot \bar{T}''$	(5) SS	(6) $\bar{\tau}$
1937	.046	.009	0	-.000	.009	.055
8	.034	.009	0	-.000	.009	.043
9	.038	.009	0	-.000	.009	.047
1940	.056	.010	0	-.000	.009	.065
1	.113	.010	0	-.000	.009	.123
2	.192	.009	0	-.001	.008	.200
3	.209	.007	0	-.001	.007	.216
4	.252	.007	0	-.001	.006	.258
1945	.257	.006	0	-.001	.006	.262
6	.226	.007	0	-.000	.007	.233
7	.226	.006	0	-.000	.006	.232
8	.180	.006	0	-.000	.006	.185
9	.175	.006	0	-.000	.005	.180
1950	.196	.008	0	-.000	.007	.202
1	.231	.010	.000	-.001	.009	.240
2	.251	.009	.000	-.001	.008	.259
3	.249	.008	.000	-.001	.008	.257
4	.222	.010	.001	-.001	.010	.231
1955	.228	.012	.001	-.001	.012	.240
6	.232	.012	.001	-.001	.012	.243
7	.233	.013	.001	-.001	.013	.246
8	.229	.013	.001	-.001	.013	.242
9	.236	.016	.001	-.001	.016	.252
1960	.234	.018	.001	-.002	.018	.253
1	.240	.017	.001	-.002	.017	.257
2	.244	.017	.001	-.002	.017	.260
3	.247	.019	.001	-.002	.018	.265
4	.221	.018	.001	-.001	.017	.238
1965	.212	.017	.001	-.001	.016	.229
6	.217	.028	.001	-.002	.028	.245
7	.223	.028	.001	-.002	.027	.250
8	.252	.032	.001	-.003	.031	.283
9	.261	.032	.001	-.003	.031	.292
1970	.243	.031	.001	-.003	.029	.272
1	.239	.031	.001	-.003	.029	.268
2	.242	.034	.001	-.003	.032	.274
3	.250	.044	.002	-.004	.041	.291
4	.257	.050	.002	-.004	.048	.305

TABLE 2--Continued

	(1)	(2)	(3)	(4)	(5)	(6)
1975	.263	.050	.002	-.005	.047	.310
6	.273	.050	.002	-.005	.046	.319
7	.281	.050	.002	-.005	.047	.328
8	.310	.052	.002	-.006	.047	.357
9	.289	.061	.003	-.007	.057	.346
1980	.304	.062	.002	-.008	.057	.362
1		.070	.003			

Column 1: $\bar{\tau}$ is the average marginal income-tax rate, weighted by adjusted gross income, from Barro and Sahasakul (1983, Table 2, column 1).

Columns 2-4: Calculated with data from Table 1.

Column 5: SS = column 2 + column 3 + column 4

Column 6: $\bar{\tau}$ = column 1 + column 5

Consider the overall effects from the inclusion of social security, as shown in column 5 of Table 2 and in Figure 1. The social security term SS is in the neighborhood of 1% from 1937 until 1958, reaches 2% in 1960, 3% in 1966, 4% in 1973, 5% in 1974, and 6% in 1979. Thus, the inclusion of this term produces a combined average marginal tax rate $\bar{\tau}$ that rises more steeply than the income-tax rate \bar{T} , especially since 1965. Instead of rising from 21% in 1965 to 30% in 1980, we find that the average marginal tax rate $\bar{\tau}$ goes from 23% to 36%.

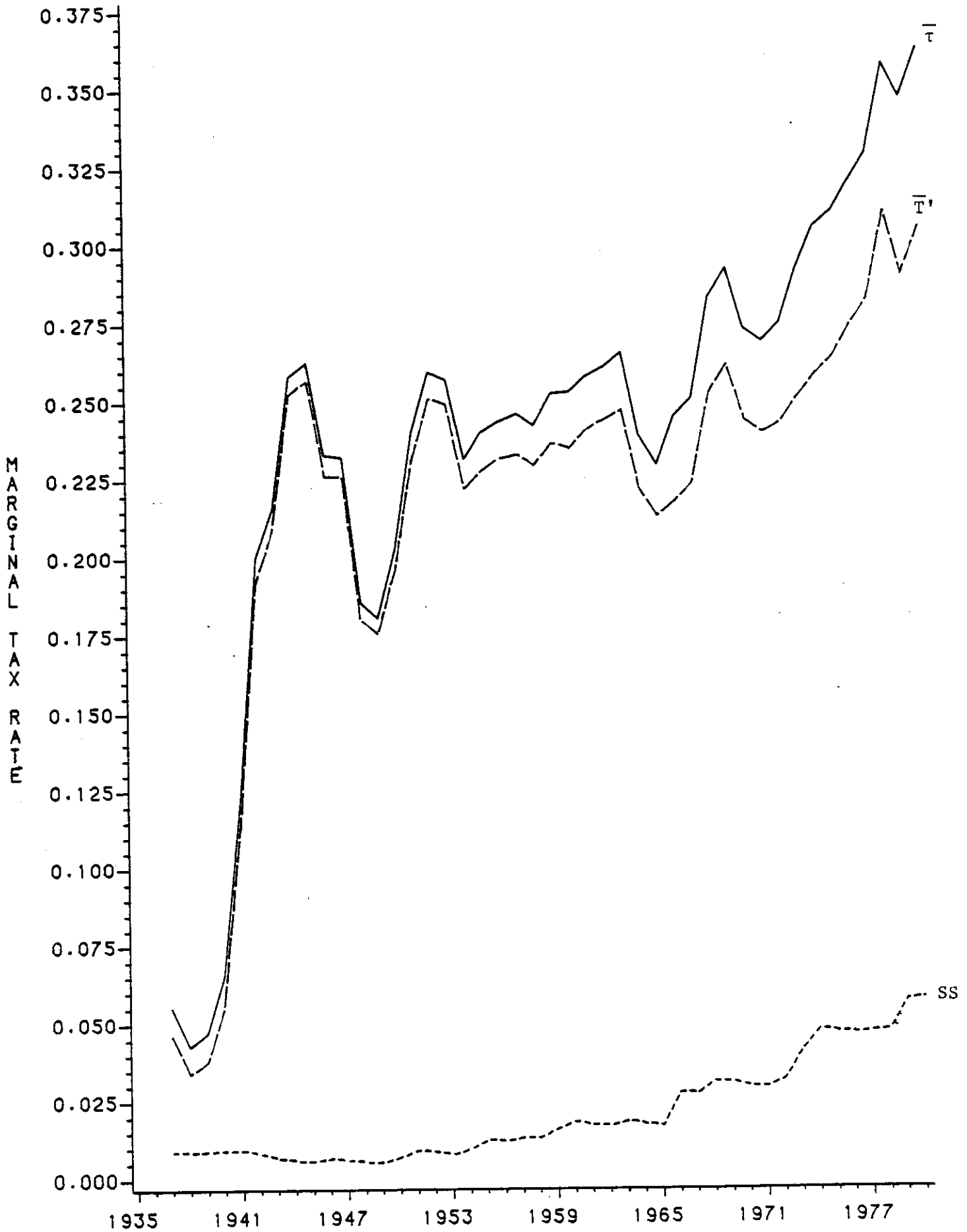


Figure 1

Average Marginal Tax Rates

The overall effect from social security on the average marginal tax rate, SS, is always much less than the rate on employees below the ceiling, $(s_f + s_e)/(1 + s_f)$. Primarily this difference arises because Ω_1 -- the ratio of salaries and wages below the ceiling to aggregate AGI -- is much less than unity. As mentioned before, the variations in Ω_1 derive mainly from changes in the ratio of salaries and wages below the ceiling to total salaries and wages, which appears in column 2 of Table 1. (The ratio of total salaries and wages to total AGI is relatively stable with a mean value of .84.) In other words, the key factor is the variations in salaries and wages that accrue to persons above the ceiling, who face a zero marginal tax rate from social security.

For example, in 1965 only 29% of total salaries and wages accrued to persons below the ceiling. If there had been no ceiling (and unrealistically, if the rate of tax, $s_f = s_e$, were unchanged), then the overall effect of social security, SS, would have increased by a factor of 3.5 from .016 to .056.

On the other hand, the rapid increase of the ceiling in recent years has made this effect less important. In 1980, where the ratio of salaries and wages to the total is .65, a removal of the ceiling (with contribution rates held fixed) would have raised the effect from social security, SS, by a factor of 1.5 from .057 to .086.

Table 4 compares the social security tax with the federal individual income tax for selected years. Notice that the ratio of revenues raised by social security to that from the income tax (shown in column 5) rises from .07 in 1945 to .63 in 1975, but falls somewhat since then.

Column 6 of the table shows a crude measure of the relative "efficiencies" of the two types of taxes. This measure is the revenue raised from social

TABLE 4

A COMPARISON OF THE SOCIAL SECURITY TAX WITH THE INCOME TAX

	(1)	(2)	(3)	(4)	(5)	(6)
	<u>Social Security</u>		<u>Federal Individual Income Tax</u>		Ratio of Revenues (col.1/col.3)	"Efficiency" Ratio (col.5× col.4 ÷col.2)
	Revenues (\$ bill.)	Contrib.to Avg.Marg. Tax Rate	Revenues (\$ bill.)	Contrib.to Avg.Marg. Tax Rate		
1940	0.66	.009	1.01	.056	.65	4.1
1945	1.26	.006	18.5	.257	.07	2.9
1950	2.62	.007	17.4	.196	.15	4.2
1955	5.95	.012	30.4	.228	.20	3.7
1960	12.0	.019	41.8	.233	.29	3.5
1965	17.7	.017	51.1	.211	.35	4.3
1970	38.9	.031	88.8	.241	.44	3.4
1975	75.6	.049	120.8	.261	.63	3.3
1980	140.2	.061	250.9	.300	.56	2.7
1982	178.5		296.7		.60	

Note: Column 2 = $SS(\text{column 5 of Table 2}) + \frac{1}{2} \Omega_1 \cdot s_f \cdot \bar{T}$ (column 4 of Table 2).

Column 4 = $\bar{T}'(\text{column 1 of Table 2}) - \frac{1}{2} \Omega_1 \cdot s_f \cdot \bar{T}$.

Columns 1 and 3 are from U.S. Commerce Dept., U.S. Survey of Current Business, July 1983, and National Income & Product Accounts of the U.S., 1929-1976.

security divided by the contributions of this levy to the overall average marginal tax rate,⁸ expressed as a ratio to the corresponding figure for the income tax. On this basis the social security tax looks strikingly more efficient--specifically, in 1980 it generates almost 3 times as much revenue per unit of average marginal tax rate as that for the income tax. In 1965 the corresponding number was 4.3. The main reason for the decline in this number since 1965 is the sharp rise in the ceiling on earnings, which has a positive effect on the average marginal tax rate from social security, relative to the revenue generated.

The social security levy turns out to be relatively "efficient" because it combines two features of a tax-rate schedule that have been stressed in the literature on optimal taxation. First, it is flat-rate levy (on labor earnings and income from self-employment) in the range where the tax rate is positive. The shift to a flat-rate income tax has been proposed by, among others, Friedman (1962, Chapter X) and Hall and Rabushka (1983). (Surprisingly, these authors do not seem to mention that, in the social-security tax, we already have a close approximation to the flat-rate income tax.) In comparison with a graduated-rate system, the flat-rate levy generates the same amount of revenues at a lower average marginal tax rate.⁹ Second, as advocated on theoretical grounds by Mirrlees (1971), the social-security tax has a zero marginal rate at the top. However, as noted before, the rapid increase of the ceiling in recent years has made this feature less important than it used to be.

⁸It is unclear how to allocate the cross-term, $-\Omega_1 \cdot s_f \cdot \bar{T}$ " (column 4 of Table 2), between the two levies, although this term is quantitatively unimportant. The figures shown in Table 4 allocate half of this term to each type of tax.

⁹A "simple" way to shift to a flat-rate tax on labor income would be the following: (1) abolish all social security benefits, (2) abolish the federal individual income tax, and (3) retain the social security tax but at a higher rate (in the neighborhood of 10% for firms and employees, rather than the present 7%).

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