

# Average marginal tax rates revisited: A comment<sup>1</sup>

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## Abstract

We show how Barro and Sahasakul (1986) and Stephenson's (1998) different methods for calculating time series of average marginal personal federal labor income tax rates are based on very different models of tax evasion and avoidance. One model assumes that taxable and untaxable income are (imperfectly) substitutable at the margin for all taxpayers, while the other assumes that substitution is not possible for any taxpayer, and that the average and marginal propensities to earn taxable income are the same. Using data provided in Stephenson we then update, for the years 1984-94, the Barro and Sahasakul comprehensive tax series based on the Barro and Sahasakul model of tax evasion and avoidance, and show how different it is from Stephenson's series for the same years. For example, Stephenson finds that from 1988-1994 the comprehensive average marginal income tax rate fell from 22.2% to 21.5% while Barro and Sahasakul's method implies that it rose from 30.3% to 32.1%.

## 1. Introduction

When calculating empirically relevant marginal income tax rates, one must confront the fact that not all income is taxed, and assumptions are required about the nature and costs of tax evasion and avoidance. How many taxpayers can evade or avoid taxes by substituting nontaxable for taxable income? If so, what are the costs of substitution, and are they the same for the average and marginal dollar of income?

Answers to these questions are required to calculate a taxpayer's marginal tax rate. Barro and Sahasakul's (1983) model implies one set of answers, which they use to compute time series of average marginal personal federal labor income tax rates for 1916-1980. Barro and Sahasakul (1986) update this series through 1983 and provide estimates of a comprehensive marginal tax rate including both social security and federal personal income taxes. Seater (1985) suggests

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<sup>1</sup>We wish to thank Frank Stephenson for helpful comments.

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that there are alternative models of nontaxable income, and provides an alternative marginal tax rate calculation.

Stephenson (1998) claims to update the Seater series and both Barro-Sahasakul series. He does indeed update the Seater series, essentially using Seater's formulas on more recent data.<sup>2</sup> He also updates the Barro-Sahasakul federal personal tax rate rates, essentially using Barro and Sahasakul's person tax formulas on more recent data.<sup>3</sup> However, he does not update the comprehensive Barro-Sahasakul series,<sup>4</sup> but rather uses a third method of calculation that is a combination of the Seater and Barro-Sahasakul formulas. The purpose of our comment is to: (a) show how Stephenson's comprehensive rate calculations are perhaps consistent with reasonable models of the behavioral effect of taxes, but none of them are consistent with the Barro-Sahasakul model, (b) show how both comprehensive rate calculations are consistent with the nontaxation of some personal income, and (c) provide readers with an update of the Barro-Sahasakul comprehensive rate series. In particular, Stephenson's calculations can be derived from a "nonsubstitution" model of nontaxable income, while the Barro and Sahasakul model has taxable and nontaxable income that are (imperfectly) substitutable at the margin for all taxpayers.

Not surprisingly, the nonsubstitution model implies lower marginal tax rates. By comparing Barro and Sahasakul's and Stephenson's comprehensive rate series, we also show how the

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<sup>2</sup>See Stephenson's Table 1, AMEITR series which updates Seater's Table 1, AMTRAGI series. Stephenson's Table 1, AMEITRPI series is similar to Seater's Table 1, AMTRGNP series, except that Stephenson uses personal income where Seater uses GNP.

<sup>3</sup>See Stephenson's Table 1, AMSITR series which update Barro and Sahasakul 1983, Table 2, 1<sup>st</sup> column and Barro and Sahasakul 1986, Table 2, column 1.

<sup>4</sup>In particular the 6<sup>th</sup> column of Barro and Sahasakul's (1986) Table 2, which they graph as a solid line in their Figure 1.

change over time in marginal federal tax rates during the Bush and Clinton administrations is positive according to the substitution model, and negative according to the nonsubstitution model, because of increases over time in both statutory tax rates and the fraction of personal income that was not taxable.

Section 2 presents a theoretical model of tax evasion and avoidance that embeds the substitution and nonsubstitution models as special cases. Section 3 describes the calculation methodology implied by the two special cases. Section 4 concludes with observations on the differences between the two series. The appendix repeats sections 2 and 3 with the more tedious formulas resulting from the inclusion of the social security tax, and, using the data provided by Stephenson, gives an update of the Barro and Sahasakul comprehensive series (which sums the marginal income tax and social security tax components) for the years 1984-94. We also suggest that the substitution and nonsubstitution models are extreme special cases, and that an important (although not easy) area for future research is to construct a time series of the fraction of taxpayers who can substitute taxable and nontaxable income at the margin.

## **2. Theory**

### *A. The Firm*

The firm employs hours of labor at wage  $w$  in a single input production function  $F(L)$  to maximize profits, which are taxed at rate  $\gamma$ . In order to focus on the calculations used by Barro, Sahasakul, and Stephenson, we do not explicitly model tax avoidance by the firm. The firm's problem, then, is

$$\max p = (1 - g)[F(L) - wL]$$

which at the optimum must satisfy

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$$w = F'(L) \tag{1}$$

### B. The household

Household  $i$  enjoys “earned income”  $w_i L_i$  which comes from hours  $L_i$  supplied to the labor market, which pays pretax wage rate  $w_i$ .  $i$  also enjoys “unearned income” in the amount  $k_i$ , for a total pretax income of  $y_i = w_i L_i + k_i$ . Households are liable for personal income taxes.<sup>5</sup> Tax authorities distinguish not only between “earned” and “unearned” income, but also taxable income  $x$  from nontaxable income  $n$ . For household  $i$  we have:

$$y_i = w_i L_i + k_i = x_i + n_i$$

“Nontaxable income” includes “hidden” income in those cases where a taxpayer is obligated to pay tax on some income but does not do so and is not caught by the tax authority, and includes “deductions” in those cases where the tax authority observes the income but as a rule does not tax income of that type (e.g., income used to purchase certain fringe benefits from an employer). Henceforth, we use the terms “nontaxable income” and “deductions” interchangeably, and draw readers’ attention to the distinction only when it is important for the analysis.<sup>6</sup>

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<sup>5</sup>We, Barro-Sahasakul, and Stephenson include Social Security taxes in our numerical calculations, but we omit them from our main text to emphasize the conceptual differences between Barro-Sahasakul’s and Stephenson’s calculations. See our appendix.

<sup>6</sup>An alternative approach to modeling nontaxed income is to model multiple consumption goods, some of which are tax-favored. Seater (1985, p. 131) has some discussion of this approach, and suggests that Barro and Sahasakul’s marginal tax rate calculations might be reduced by multiplying by the fraction of consumption expenditure that is not favored.

Personal income taxes are a continuous function  $T(x)$  of a household's taxable income  $x$ , a function which is strictly increasing and convex.<sup>7</sup> Since  $T$  is convex, it might be said that the tax system is "progressive" – marginal tax rates rise with taxable income – but we shall see that average tax rates (i.e., the ratio of  $T$  to  $y$ ) may fall with total income when nontaxable income rises rapidly enough.

Nontaxable income  $n$  is a choice variable. Obviously  $n$  is costly for the government, but we also allow deductions to be costly for the household. In particular, deductions in the amount  $n$  reduce a household's effective consumption by the amount  $N(n)$ , so household  $i$ 's budget constraint is:

$$c_i = w_i L_i + k_i - T(w_i L_i + k_i - n_i) - N_i(n_i) \quad (2)$$

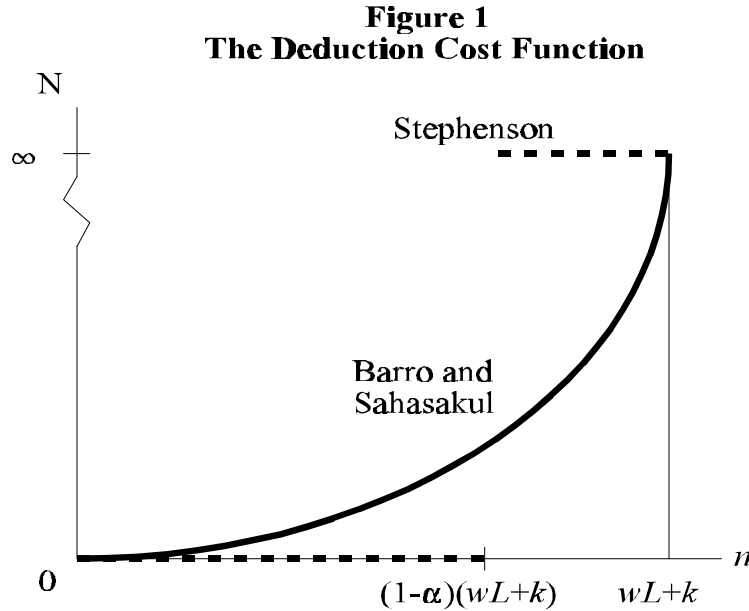
where  $c_i$  denotes household consumption. The household chooses its labor  $L$ , consumption  $c$ , and nontaxable income  $n$  to maximize its utility  $u(c, L)$  subject to (2). The costs of nontaxable income might be interpreted as an equilibrium reduction in total income (e.g., as municipal bond yields are reduced below taxable bond yields), or as excess consumption of deductible items (e.g., health insurance or owner-occupied housing), or as expected IRS penalties for being caught hiding income.

The main differences between the Barro-Sahasakul and Stephenson calculations can be understood in terms of the deduction cost function  $N$ . Barro and Sahasakul (1983, p. 425) assume that  $N$  is increasing and convex (weakly over some initial standard deduction, and strictly thereafter), as shown by the solid line in Figure 1, for *all taxpayers* up to  $n = wL + k$ , and

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<sup>7</sup>While it is not literally true that the personal income tax rate is a continuous function of income, we suppose like Barro and Sahasakul that  $T$  has enough steps to be reasonable approximated as continuous.

infinite thereafter<sup>8</sup>. An alternative assumption, and one we suggest to be consistent with Stephenson’s calculations, is that  $N$  is zero on  $n \in [0, (1-\alpha)(wL+k)]$  and infinite on  $n \in [(1-\alpha)(wL+k), \infty]$  for some constant  $\alpha$ , as shown by the dashed line in Figure 1.



We refer to the special case represented by the solid line as the “substitution” case, and to that represented by the dashed line as the “nonsubstitution” case.

*C. Individual and Aggregate Tax Rates: The Substitution Case*

In the substitution case, the equilibrium wedge between household  $i$ ’s marginal rate of substitution and marginal product of labor can be calculated as:

$$-\frac{U_{Li}}{U_{Ci}} \frac{1}{F'(L_i)} = 1 - N'(n_i) \tag{3}$$

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<sup>8</sup>Barro and Sahasakul assume that deductions are a concave function  $f$  of resources spent on tax avoidance, which is equivalent to assuming that the cost of avoidance is convex in deductions.

Like Barro and Sahasakul, and Stephenson, we refer to household  $i$ 's marginal labor income tax rate as one minus this wedge. We denote that rate as  $\tau_i$ .

Households can be partitioned according to whether they have any taxable income. If a household has taxable income, its optimal nontaxable income is interior with the marginal cost of deductions equated to the combined statutory tax rate:

$$N_i'(n_i) = T_i'(x_i) \quad (4)$$

This delivers four important results for households with taxable income:

- (i)  $i$ 's marginal tax rate can be computed with only statutory tax rates:

$$t_i = T'(x_i) \quad (5)$$

- (ii)  $i$ 's marginal tax rate is positive  
 (iii)  $i$ 's taxable income is less than  $i$ 's total income  
 (iv)  $i$ 's nontaxable income increases with  $i$ 's total income<sup>9</sup>

(5) can also be interpreted as an *individual's* average marginal tax rate, with weights determined by the individual's share of taxable income in total income, and where our notation allows for different marginal tax rates on taxable and nontaxable income:

$$\tau_i = [x_i T'(x_i) + n_i N'(n_i)]/y_i \quad (5)'$$

Since the household's optimal policy involves  $N_i'(n_i) = T_i'(x_i)$ , and  $y_i = x_i + n_i$ , (5)' is the same as (5), but it allows us to generalize to households without taxable income, and to

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<sup>9</sup>This follows from (4) and the identity  $y_i = x_i + n_i$ .

understand differences between Stephenson's and Barro and Sahasakul's calculations.

For households without taxable income, the marginal tax rate is

$$t_i = N'(y_i) \leq T'(0). \quad (5)$$

Obviously, such a household's taxable income is less than its total income. Also notice that its marginal tax rate may be positive, although it is bounded above by the statutory rate. Finally, notice that (5) is a special case of (5)' with  $x_i = 0$ .

*D. Individual and Aggregate Tax Rates: The Nonsubstitution Case*

Here the optimal nontaxable income for household  $i$  is trivial – set  $n_i = (1-\alpha_i)(w_iL_i + k)$  – and  $\alpha_i$  is the individual's ratio of taxable to total income. Imposing this optimal tax avoidance, household  $i$ 's budget constraint is:

$$c_i = w_iL_i + k_i - T(\alpha_i(w_iL_i + k_i)) \quad (2)'$$

and  $i$ 's marginal tax rate is clearly:

$$t_i = \alpha_i T'(x_i) \quad (6)$$

which is similar to (5), except that  $T'$  is multiplied by the ratio of taxable to total income,  $\alpha$ .

Notice the relationship between the nonsubstitution model's (6) and the substitution model's (5)'. (5)' and (6) are the same only in two special cases: (a) the marginal tax rate on nontaxable income is zero for all taxpayers (regardless of whether they have taxable income), or (b) all income is taxable.

### 3. Calculation

Like Barro and Sahasakul, and Stephenson, our empirical work begins with a number of simplifications. First, dynamic incentive effects of work, and dynamic provisions of the tax code, are ignored. Second, the function  $T$  is measured only according to the federal personal income tax, ignores federal subsidy programs (such as unemployment or social security benefits) and state taxes, ignores consumption and excise taxes, and ignores labor market regulations which also might drive a wedge between the marginal product of labor and the marginal value of time.

When moving from (5)' or (6), which describes an individual's marginal tax rate, to cross-household averages, a decision must be made about how to weight each household's tax rate in the average. One approach is to weight all households equally. This approach is certainly useful for some studies of taxes, and is one of the approaches taken by Barro, Sahasakul, and Stephenson.

A second approach, the one which we will focus on, is to weight by total income. This has a practical difficulty that all total income is not reported to the IRS – just taxable income plus some components of nontaxable income. This difficulty might be circumvented by supposing that total income is proportional to adjusted gross income (AGI) for tax filers, which is the approach of both Barro-Sahasakul and Stephenson. The average marginal income tax rate *among filers* can then be represented by:

$$\bar{T}' = \frac{\sum_i y_i [\alpha_i T'(x_i) + (1 - \alpha_i) N'(n_i)]}{\sum_i y_i} \quad (7)$$

where  $\alpha_i$  represents the fraction of the household's total income that is taxed.

It is conceivable that for some households the tax rate exceeds the marginal cost of tax avoidance for all levels of income. To account for the presence of these non-filers, the average marginal income tax rate of filers is averaged with the average marginal cost of deductions for non-filers,  $\bar{N}'$ :

$$\bar{T}' = \Omega_1 \bar{T}' + (1 - \Omega_1) \bar{N}' \quad (8)$$

where  $\Omega_1$  is the ratio of reported income earned by filers to the sum of reported income by filers and income earned by nonfilers. Unfortunately, the marginal cost of tax avoidance is unobserved and could be anywhere from zero to the actual tax rate. An assumption about its level will be necessary whenever  $\Omega_1 < 1$ . The calculations of Barro-Sahasakul and Stephenson thereby combine either the substitution or nonsubstitution model with assumptions about  $N'$  for nonfilers and assumptions required to measure  $\Omega_1$ .

#### A. *Barro and Sahasakul*

To make the calculation (8), Barro and Sahasakul take their substitution model, and some additional assumptions, which together can be summarized as:

$$(i) \quad \Omega_1 = \begin{cases} \frac{AGI}{PI^*.79} & \text{for } 1916-1946 \\ 1 & \text{for } 1947-1994 \end{cases}$$

$$(ii) \quad N' = 0 \text{ for nonfilers}$$

(iii) Filers can substitute non-taxable for taxable income, or in other words,  $N' = T'$  for filers

Post-1946, the presence of non-filers is assumed by Barro and Sahasakul in (i) to be insignificant, and they set  $\Omega_1 = 1$  for this period. From 1916-46, the presence of non-filers is significant as evidenced by the low ratio of filed returns to number of households (Barro and Sahasakul 1983, p. 432). During the post-war period, the ratio of *AGI* to *PI* is stable around 0.79, and Barro and Sahasakul assume that, in absence of the additional presence of non-filers, this relationship would have held in the pre-war period as well. If this is true, then deviations of *AGI/PI* pre-1946 from .79 are attributable to the presence of non-filers. Thus, the fraction of income earned by those filing tax returns should equal  $(AGI/PI)/.79$ , and the weights on each tax bracket would then be as a fraction of  $PI*.79$  rather than *AGI*.

*B. Stephenson*

Stephenson in calculating (8) implicitly takes the nonsubstitution model, and some additional assumptions, which together can be summarized as:

$$(i) \quad \Omega_1 = \begin{cases} \frac{AGI}{PI*.79} & \text{for } 1916-1946 \\ 1 & \text{for } 1947-1994 \end{cases}$$

$$(ii) \quad N' = 0 \text{ for non-filers and filers up to } (1-\alpha_i)(w_i L_i + k_i)$$

$$(iii) \quad \alpha_i = AGI/PI \quad i$$

Assumptions (ii) and (iii) represent the key differences between the Stephenson and Barro-Sahasakul versions, as they posit that all individuals are identically endowed with set proportions of taxable and non-taxable income and cannot substitute non-taxable for taxable income at the

margin. (iii) also presents us with an important relationship between the Stephenson and Barro-Sahasakul version of the average marginal income tax rate<sup>10</sup>:

$$\bar{\tau}_{STEPH}^I = \bar{\tau}_{B-S}^I * \frac{AGI}{PI} \quad (9)$$

Table 1 reproduces each term in (9) as given by Stephenson.

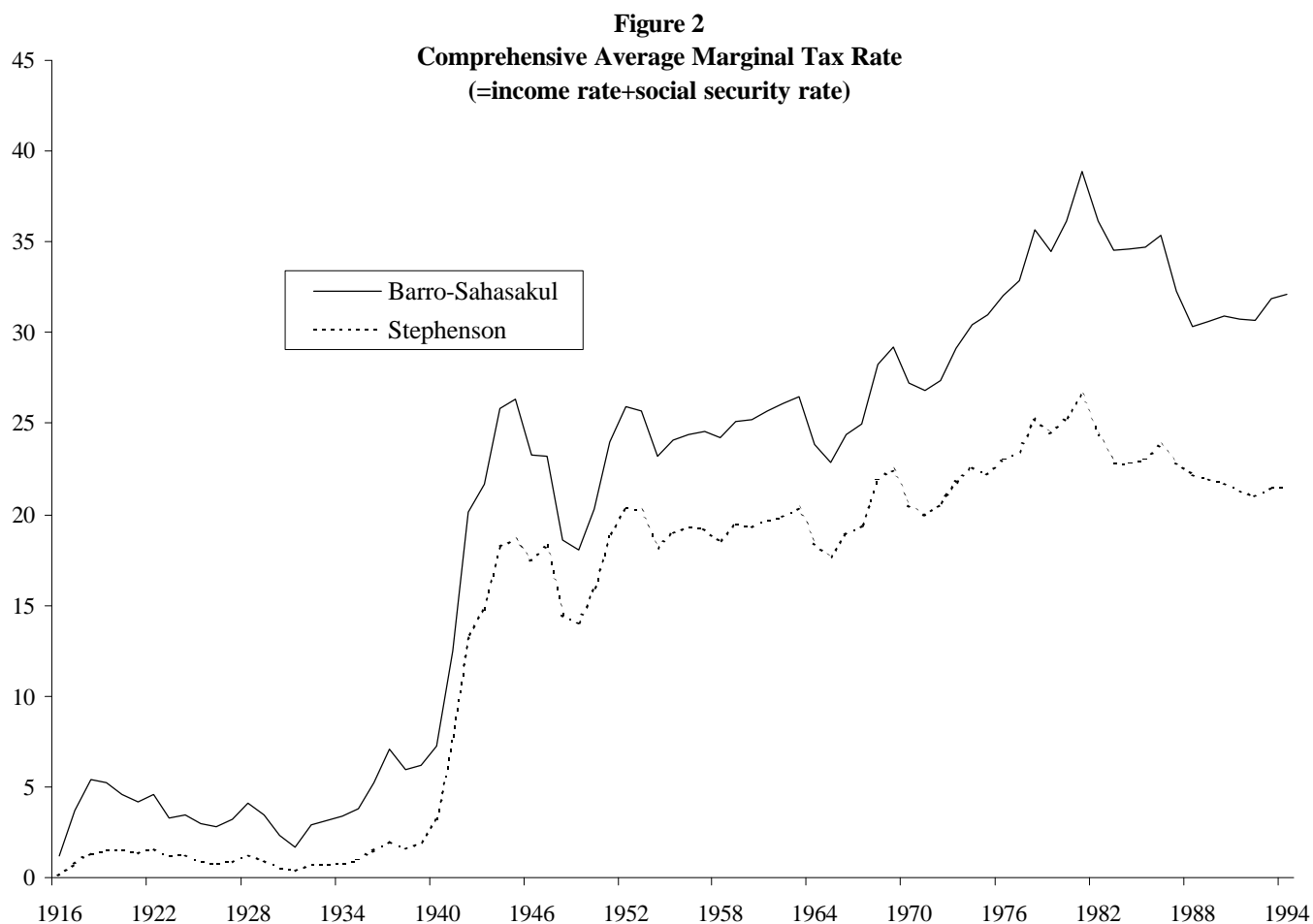
#### 4. Conclusion

We have shown how the Barro-Sahasakul and Stephenson approaches to measuring the comprehensive average statutory marginal tax rate are consistent with different models of substitution of taxable for nontaxable income. Contrary to the suggestions of Stephenson (1998, pp. 390, 393), both approaches are consistent with taxable income's being less than total personal income, and with a positive correlation (over time, or across households) between tax deductions and personal income.

These differences between the resulting calculations are more than academic. Figure 2 plots the comprehensive average marginal tax rate series of Barro and Sahasakul given in table 1 versus the comprehensive marginal tax rate series that Stephenson introduces. The two differ significantly in both levels and, in recent years, changes. Stephenson's series indicates that the average marginal tax rate in the U.S. has fallen from 22.2% in 1988 to 21.5% in 1994 while according to the Barro and Sahasakul series, marginal tax rates have actually risen during that time period from 30.3% to 32.1%. As we show in the appendix, similar trends are also present for the comprehensive tax rate series where social security taxes are included. Since both the

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<sup>10</sup>As a computational note, notice that this results in Stephenson's multiplying the average marginal tax rate by  $AGI/PI$  twice for the period 1916-1946, once to account for the presence of non-filers and once to account for the fraction of income that is taxable.



Barro-Sahasakul and the Stephenson series measure the amount of taxes paid in the same manner, the difference lies in the tax base. This indicates that during this time, the difference between adjusted gross income as used by Barro and Sahasakul and personal income as used by Stephenson is growing more important.

While the two series are significantly different, and motivated by different models of tax evasion and avoidance, it is not clear that one is “better” than the other for analyzing behavior responses to taxes. And, especially if the analysis focuses on tax years prior to the 1940's, perhaps a third

series is needed that more adequately captures tax avoidance behavior of those without taxable income.

## Appendix

Here we present the basic equations of sections 2 and 3 when social security taxation is added to the model. The firm faces a flat rate social security tax of  $\sigma_f$  on salary payments to employees below the social security earnings ceiling, and its problem becomes

$$\max p = (1 - g)[F(L) - wL - \min\{K\sigma_f, wL\sigma_f\}]$$

where  $K$  represents the earnings ceiling. The first-order condition of this problem can be represented by

$$w = \begin{cases} \frac{F'(L)}{1 + \sigma_f} & \text{if } x_i < K \\ F'(L) & \text{if } x_i > K \end{cases}.$$

The household faces a flat rate social security tax of  $\sigma_{ei}$ , and, under the Barro-Sahasakul assumption of substitutibility, its budget constraint is now<sup>11</sup>

$$c_i = w_i L_i + k_i - T(w_i L_i + k_i - n_i) - \min\{K\sigma_e, (w_i L_i + k_i - n_i)\sigma_e\} - N_i(n_i).$$

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<sup>11</sup>Whether or not there are deductions from the payroll tax, and whether these are the same as those for the personal income tax, is not relevant for our analysis of Barro and Sahasakul's tax rate series. However, as we show, there must be such payroll tax deductions to justify Stephenson's procedure, although the quantitative importance of this assumption is fairly small as marginal payroll tax rates are relatively small.

The Stephenson assumption of non-substitutibility leads to a budget constraint of

$$c_i = w_i L_i + k_i - T(\alpha_i(w_i L_i + k_i)) - \alpha_i \min\{K\sigma_e, (w_i L_i + k_i)\sigma_e\}.$$

The wedge between the marginal product of labor and the marginal rate of substitution between consumption and leisure is:

$$-\frac{U_{L_i}}{U_{C_i}} \frac{1}{F'(L_i)} = \begin{cases} \frac{1 - T'(x_i) - s_e}{1 + s_f} & \text{if } x_i < K \\ 1 - T'(x_i) & \text{if } x_i > K \end{cases}.$$

The tax rate is once again defined as one minus the tax wedge and can be approximated by

$$t_i \approx \begin{cases} a_i \left[ T'(x_i) + \frac{s_f / a_i + s_e}{1 + s_f} - s_f T'(x_i) \right] & \text{if } x_i < K \\ a_i T'(x_i) & \text{if } x_i > K \end{cases}.$$

When moving from this individual approximation to aggregate averages, the average marginal income tax is calculated the same as in section 3, while the social security portion of the average marginal tax rate is calculated as an income weighted average between the self-employed and employees, who face a different social security tax rate, and between those above and below the social security earnings ceiling:

$$\bar{t}^{SS} = a \left[ \Omega_2 \frac{s_f + s_e}{1 + s_f} + \Omega_3 s_s - \Omega_2 s_f \bar{T}'' \right].$$

$\Omega_2$  and  $\Omega_3$  are the ratio of wage and salary income below the social security ceiling to aggregate adjusted gross income of employees and the self-employed, respectively.  $\bar{T}''$  is the

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average marginal tax rate on income below the social security contribution ceiling.<sup>12</sup>  $\sigma_f$ ,  $\sigma_e$ , and  $\sigma_s$  are the statutory social security tax rates faced by firms, employees, and the self-employed, respectively.  $\alpha$  is set to 1 by Barro and Sahasakul, while Stephenson sets it equal to  $AGI/PI$ . The comprehensive average marginal tax rate is then given by the sum of the marginal personal income tax rate and the marginal social security tax rate:

$$\bar{\eta}^c = \bar{\tau}^I + \bar{\tau}^{SS}$$

where  $\eta^c$  represents the comprehensive average marginal tax rate. Table 1, in addition to showing the Stephenson average marginal income tax rate, shows each component of the comprehensive average marginal tax rate using the Barro-Sahasakul concept.

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<sup>12</sup>One other difference between Barro and Sahasakul and Stephenson is in the calculation of the final term in (9). Stephenson incorrectly uses the average marginal tax rate for all income, while Barro and Sahasakul correctly use the average marginal tax rate for income below the social security ceiling. The difference is quantitatively insignificant however.

Table 1*							
	$\bar{t}_{B-S}^I$	$\Omega_1 \left( \frac{s_f + s_e}{1 + s_f} \right)$	$\Omega_2 s_s$	$\Omega_1 s_f \bar{T}'$	$\bar{h}_{B-S}^c$	$\frac{AGI}{PI}$	$\bar{t}_{STEPH}^I$
	(1)	(2)	(3)	(4)	(5) =(1)+(2)+(3)-(4)	(6)	(7) =(1)*(6)
1916	1.2				1.2	0.16	0.2
1917	3.7				3.7	0.23	0.8
1918	5.4				5.4	0.25	1.4
1919	5.2				5.2	0.29	1.5
1920	4.6				4.6	0.32	1.5
1921	4.2				4.2	0.34	1.4
1922	4.6				4.6	0.35	1.6
1923	3.3				3.3	0.35	1.2
1924	3.5				3.5	0.37	1.3
1925	3				3	0.29	0.9
1926	2.8				2.8	0.28	0.8
1927	3.2				3.2	0.29	0.9
1928	4.1				4.1	0.32	1.3
1929	3.5				3.5	0.29	1
1930	2.3				2.3	0.24	0.6
1931	1.7				1.7	0.22	0.4
1932	2.9				2.9	0.24	0.7
1933	3.1				3.1	0.24	0.7
1934	3.4				3.4	0.24	0.8
1935	3.8				3.8	0.25	1
1936	5.2				5.2	0.28	1.5
1937	4.6	0.9	0	0	5.5	0.29	1.3
1938	3.4	0.9	0	0	4.3	0.27	0.9
1939	3.8	0.9	0	0	4.7	0.31	1.2
1940	5.6	1	0	0	6.5	0.45	2.5
1941	11.3	1	0	0	12.3	0.63	7.1
1942	19.2	0.9	0	-0.1	20	0.67	12.8
1943	20.9	0.7	0	-0.1	21.6	0.68	14.3
1944	25.2	0.7	0	-0.1	25.8	0.71	17.8
1945	25.7	0.6	0	-0.1	26.2	0.7	18.1
1946	22.6	0.7	0	0	23.3	0.75	17
1947	22.6	0.6	0	0	23.2	0.79	17.8
1948	18	0.6	0	0	18.5	0.78	14.1
1949	17.5	0.6	0	0	18	0.78	13.6
1950	19.6	0.8	0	0	20.2	0.79	15.4
1951	23.1	1	0	-0.1	24	0.79	18.2
1952	25.1	0.9	0	-0.1	25.9	0.79	19.8
1953	24.9	0.8	0	-0.1	25.7	0.79	19.6
1954	22.2	1	0.1	-0.1	23.1	0.78	17.4
1955	22.8	1.2	0.1	-0.1	24	0.79	18
1956	23.2	1.2	0.1	-0.1	24.3	0.79	18.4
1957	23.2	1.3	0.1	-0.1	24.5	0.79	18.2
1958	22.9	1.3	0.1	-0.1	24.2	0.77	17.5
1959	23.6	1.6	0.1	-0.1	25.2	0.78	18.3
1960	23.4	1.8	0.1	-0.2	25.3	0.77	17.9
1961	24	1.7	0.1	-0.2	25.7	0.77	18.5
1962	24.4	1.7	0.1	-0.2	26	0.76	18.7

1963	24.7	1.9	0.1	-0.2	26.5	0.77	19
1964	22.1	1.8	0.1	-0.1	23.8	0.77	17.1
1965	21.2	1.7	0.1	-0.1	22.9	0.77	16.4
1966	21.7	2.8	0.1	-0.2	24.5	0.77	16.8
1967	22.3	2.8	0.1	-0.2	25	0.78	17.3
1968	25.2	3.2	0.1	-0.3	28.3	0.78	19.6
1969	26.1	3.2	0.1	-0.3	29.2	0.78	20.2
1970	24.3	3.1	0.1	-0.3	27.2	0.76	18.4
1971	23.9	3.1	0.1	-0.3	26.8	0.75	17.9
1972	24.2	3.4	0.1	-0.3	27.4	0.76	18.3
1973	25	4.4	0.2	-0.4	29.1	0.75	18.7
1974	25.7	5	0.2	-0.4	30.5	0.75	19.2
1975	26.3	5	0.2	-0.5	31	0.72	18.9
1976	27.3	5	0.2	-0.5	31.9	0.72	19.8
1977	28.1	5	0.2	-0.5	32.8	0.72	20.2
1978	31	5.2	0.2	-0.6	35.7	0.72	22.2
1979	28.9	6.1	0.3	-0.7	34.6	0.71	20.7
1980	30.4	6.2	0.2	-0.8	36.2	0.71	21.5
1981	32.5	6.9	0.3	-0.8	38.9	0.69	22.5
1982	29.5	7.2	0.3	-0.8	36.1	0.68	20.1
1983	27.6	7.3	0.3	-0.7	34.5	0.67	18.5
1984	27.2	7.7	0.4	-0.7	34.6	0.67	18.2
1985	27.4	7.6	0.4	-0.8	34.7	0.67	18.4
1986	28	7.7	0.4	-0.8	35.4	0.68	19.1
1987	25.2	7.3	0.4	-0.7	32.3	0.72	18.0
1988	23.3	7.3	0.4	-0.7	30.3	0.74	17.2
1989	23.4	7.4	0.4	-0.7	30.6	0.73	17.0
1990	23.3	7.9	0.4	-0.7	30.9	0.71	16.6
1991	23.2	7.8	0.4	-0.7	30.8	0.70	16.2
1992	23.2	7.7	0.4	-0.7	30.7	0.69	16.0
1993	24.2	7.9	0.4	-0.7	31.8	0.68	16.4
1994	24.3	8.1	0.4	-0.7	32.1	0.68	16.5

\*Data for 1916-1980 in columns (1)-(6) is taken from Barro and Sahasakul (1986) Table 2. Columns (1)-(6) for the years 1981-1994, and column (7) for all years, are either replications of, or direct calculations using, data provided by Stephenson (1998).

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