Measuring Revenue-Maximising Elasticities of Taxable Income: Evidence for the US Income Tax

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Measuring Revenue-Maximising Elasticities of Taxable Income: Evidence for the US Income Tax[*]

John Creedy and Norman Gemmell[†]

Abstract

A recent review of empirical estimates of the elasticity of taxable income (ETI) concluded that 'the US marginal top rate is far from the top of the Laffer curve' (Saez *et al*, 2012, p.42). This paper provides a detailed examination of the analysis underlying this conclusion, and considers whether other tax rates in the US income tax system are on the 'right' side of the Laffer curve. Conceptual expressions for 'Laffer-maximum' or revenue-maximizing ETIs, based on readily observable parameters, are presented for individuals and groups of taxpayers in a multi-rate income tax system. Applying these to the US income tax in 2005, with its complex effective marginal rate structure, demonstrates that a wide range of revenue-maximizing ETI values can be expected for individual taxpayers within and across tax brackets, and in aggregate. For many taxpayers these revenue-maximizing ETIs are well within the range of empirically estimated elasticities.

Keywords: Income Tax Revenue; Elasticity of taxable income; revenue elasticity, Laffer Curve.

JEL Codes: H24; H31; H26

1   Introduction

Discussions of tax revenues and rates are often framed in terms of the well-known Laffer curve, in which total tax revenue is related to the tax rate, within a tax system which is implicitly thought of as having a single constant marginal rate. In this case, revenue changes in proportion to taxable income and an economy is on the 'wrong' side of the Laffer curve if the elasticity of taxable income with respect to the tax rate, τ, is less than minus one.

Expressed in terms of the aggregate 'Feldstein' elasticity of taxable income (ETI) with respect to a proportionate change in the *net-of-tax rate*, $1 - \tau$, this translates into an ETI greater than $(1 - \tau)/\tau$ (Goolsbee, 1999; Hall, 1999). Hence, for a tax rate up to 0.5, an elasticity of taxable income with respect to the net-of-tax rate greater than one is required before a revenue-negative response to a tax rate increase occurs. It is in this context that Saez *et al.* (2012, p.42) conclude, for the top marginal tax rate, that 'the most reliable longer-run estimates range from 0.12 to 0.4, suggesting that the U.S. marginal top rate is far from the top of the Laffer curve'.

In practice income tax structures typically have numerous marginal rates, and there are income ranges which reflect rate progression (an increasing marginal rate) or reductions in effective tax rates where means-tested benefit payments or tax credits, such as the US earned income tax credit, are subject to abatement or taper rates. As a result, there is no single elasticity of taxable income that applies to all individuals at all income levels.[1] This raises the question of whether, or under what circumstances, estimates of the elasticity of taxable income for taxpayers across the full range of incomes and marginal rates can be expected to exceed values which generate revenue-reducing responses to marginal tax rate changes.

The present paper seeks to answer this question by first establishing, in the context of a multi-rate income tax, expressions for the elasticity of taxable income, at any income level, above which an increase in the relevant marginal tax rate produces a decrease in tax revenue. This elasticity, consistent with the maximum point on the Laffer curve, is referred to below as the revenue-maximizing elasticity of taxable income, ETI^L. It is shown that it can take a wide range of values both for individuals and for

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[1]It is also likely to vary as the costs of income shifting, the ability to conceal income and the chances of being detected by the tax authories, the ability to change hours of work in the short and long run, and so on, vary.

groups of taxpayers such as those facing particular marginal tax rates.[2]

Establishing the values of revenue-maximizing ETIs is important because, despite the large number of empirical studies, it has proved difficult to obtain reliable estimates of the elasticity of taxable income, even where the focus of attention has been specific sub-sets of taxpayers such as those at the top of the income distribution.[3] The analysis in this paper suggests that, even if the Saez *et al.* (2012) conclusion above is correct *on average* for taxpayers in the top tax bracket, low ETI^L values appear relevant for many who pay the top marginal tax rate. More generally, low estimated ETIs are quite consistent with revenue-reducing responses by many taxpayers across wide ranges on incomes.

Saez *et al.* (2012) and Giertz (2009b) addressed a different but related question, focusing mainly on the top tax bracket; namely, for alternative assumptions regarding the ETI, how high is the revenue-maximizing tax rate? Saez *et al.* (2012) provide suitable, simple expressions for the revenue-maximizing top tax rate, based on an assumed Pareto distribution of upper tail incomes. Using this approach applied to the 2005 US income tax and IRS taxable income data, Giertz (2009b) estimated the revenue-maximizing top rate between 41% and 78% with assumed ETIs of 1.0 and 0.2 respectively.[4]

Furthermore, Werning (2007), Saez *et al.* (2012) and others have argued that the set of welfare-improving tax reforms is closely related to whether an increase in a particular marginal tax rate is expected to produce an increase in revenue of some minimum amount. Werning (2007), for example, demonstrates that for a tax reform to generate a Pareto superior tax structure, it is required to reduce all tax rates but yield the same or more revenue overall, even though some taxpayers may respond in ways that reduce revenue while others' responses enhance revenues. Hence, Pareto efficiency requires the tax system to be on the revenue-increasing side of the Laffer curve.[5]

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[2]Saez *et al.* (2009, p. 5) provide an expression for the revenue change due to behavioural responses to a change in the top tax rates.

[3]See Goolsbee (1999) for a detailed critique of the elasticity of taxable income concept and empirical estimates, and Giertz (2007, 2009a,b) and Saez *et al.* (2012) for discussions of recent estimates and reviews of related literature.

[4]For lower tax brackets, Giertz (2009b) reports even higher revenue-maximizing tax rates, generally in the range 0.58 to 0.97 for the two lowest federal income tax brackets (10% and 15%) and 0.31 to 0.69 for the other three tax brackets (25%, 28% and 33%). All estimates are obtained from assumed ETIs between 0.2 and 1.0.

[5]Trabandt and Uhlig (2010) attempt to assess empirically how far the existing systems of labour

This paper shows that identifying the revenue-increasing side of the Laffer curve in this context is more complex than simply establishing where the elasticity of taxable income with respect to the tax rate equals minus one. However, the key components of the revenue-maximizing elasticity of taxable income can be calculated using only the details of the effective marginal tax rates and income thresholds describing the complete structure. Furthermore, with information on the complete distribution of taxable income, revenue-maximizing ETI values at aggregate levels or for sub-sets of taxpayers can be obtained.

The next section provides the relevant conceptual expressions for the revenue-maximizing elasticity in a multi-rate system, applicable to individual taxpayers and in aggregate. Section 3 then illustrates values for individual taxpayers based on the US Federal and state income tax systems which, via an array of deductions and tax credits subject to abatement, feature a multitude of effective marginal tax rates across a wide range of taxable income levels. Values for groups of taxpayers in aggregate are analysed in section 4. Section 5 turns briefly to the question explored by Giertz (2009b) and considers the revenue-maximizing marginal tax rate for each tax bracket, for given values of the elasticity of taxable income. Brief conclusions are in section 6.

2   The ETI in Multi-rate Tax Structures

This section demonstrates, at the individual and aggregate levels, how the elasticity of individual or aggregate tax with respect to a bracket's marginal rate depends on characteristics of the tax structure, the relevant elasticity of taxable income, and (for aggregate values) the income distribution. For convenience, the distinction between gross income and taxable income is ignored, though this distinction is likely to be important where there are extensive income tax deductions.[6] Where there are endogenous, income-related deductions, the following analysis must be in terms of income after deductions have been made, as in the case of the illustrations in section 3 below.

and capital income taxation in the US and a sample of European countries are on the 'wrong' side of the Laffer curve. Only the capital income taxes of Sweden and Denmark appear to fall into this category. See Trabandt and Uhlig (2012) for an update.

[6]For discussion of the empirical importance of income-related deductions in personal income tax regimes in OECD countries, see Caminada and Goudswaard (1996) and Wagstaff and van Doorslaer (2001). For the US, Feldstein (1999, p. 675) estimated that total income tax deductions in 1993 amounted to about 60 per cent of estimated taxable income.

In modelling revenue responses the analysis concentrates only on income tax, making no allowance for possible shifting to other lower-taxed income sources such as through incorporation or other tax-favoured entities. An analysis of total tax revenue responses would also need to consider consumption taxes: to the extent that taxable income reductions following income tax increases reflect real rather than shifting responses, consumption will also fall.

2.1 Effective Income Thresholds

The multi-step tax function depends on a set of income threshold, $a_k, ..., a_K$, and a corresponding set of marginal tax rates $\tau_k, ..., \tau_K$. These rates and thresholds can represent the statutory income tax schedule, or the 'effective' schedule of effective marginal rates and thresholds associated with the overall system of income taxes and transfers.[7]

The tax paid by individual i with income of y_i, denoted $T(y_i)$, can be written as:

$$
\begin{aligned}
T(y_i) &= \tau_1(y_i - a_1) & a_1 < y_i \le a_2 \\
&= \tau_1(a_2 - a_1) + \tau_2(y_i - a_2) & a_2 < y_i \le a_3
\end{aligned}
\tag{1}
$$

and so on. If y_i falls into the kth tax bracket, so that $a_k < y_i \le a_{k+1}$, $T(y_i)$ can be expressed for $k \ge 2$ as:

$$
\begin{aligned}
T(y_i) &= \tau_k(y_i - a_k) + \sum_{j=1}^{k-1} \tau_j(a_{j+1} - a_j) \\
&= \tau_k(y_i - a_k^*)
\end{aligned}
\tag{2}
$$

where:

$$
a_k^* = \frac{1}{\tau_k} \sum_{j=1}^{k} a_j(\tau_j - \tau_{j-1})
\tag{3}
$$

and $\tau_0 = 0$. Thus the tax function facing any individual taxpayer in the kth bracket is equivalent to a tax function with a marginal tax rate, τ_k, applied to income measured in excess of an effective threshold, a_k^*. An advantage of this tax function is that the effective threshold in (3) captures the revenue effect of changes in any infra-marginal tax rate, τ_j, or threshold, a_j, $j < k$, changes, as well as any marginal changes, τ_k, or a_k.

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[7]In this latter case, tax revenue, $T(y_i)$, refers to total tax revenue net of any tax credits and transfer payments.

2.2   Changes in Individual Tax Payments

Consider a change in the individual's tax liability resulting from an exogenous increase in one of the marginal tax rates, with other rates and the thresholds unchanged. This gives rise to a behavioral response, so writing $T(y_i) = T_i$, rearranging the total derivative, $dT_i = \frac{\partial T_i}{\partial y_i} dy_i + \frac{\partial T_i}{\partial \tau} d\tau$, in elasticity form, using the general notation, $\eta_{b,a} = \frac{a}{b}\frac{db}{da}$, gives:

$$\eta_{T_i,\tau} = \eta'_{T_i,\tau} + \eta_{T_i,y_i}\eta_{y_i,\tau} \tag{4}$$

Here $\eta'_{b,a} = \frac{a}{b}\frac{\partial b}{\partial a}$ denotes a partial elasticity. In the case where an income change does not lead to a movement across an income threshold, $\eta_{T_i,y_i} = \eta'_{T_i,y_i}$.[8] Equation (4) can be rewritten in terms of the elasticity of taxable income, ETI, using $\eta_{y_i,1-\tau} = -\left(\frac{1-\tau}{\tau}\right)\eta_{y_i,\tau}$, such that:

$$\eta_{T_i,\tau} = \eta'_{T_i,\tau} - \left(\frac{\tau_k}{1-\tau_k}\right)\eta_{T_i,y_i}\eta_{y_i,1-\tau} \tag{5}$$

The first term in (4) may be said to reflect a pure 'tax rate' effect of a rate change, with unchanged incomes, while the term after the minus sign captures the 'tax base' effect, resulting from the incentive effects on taxable income and the revenue consequences of that income change. When discussing the effect on total revenue of a change in the top income tax rate, Saez *et al.* (2012, p. 5) refer to the tax rate effect as 'mechanical' and the second term as the 'behavioral' effect respectively (they do not discuss the separate role of the revenue elasticity in this context).

The individual revenue elasticity is:

$$\eta_{T_i,y_i} = \frac{y_i}{y_i - a_k^*} > 1 \tag{6}$$

Hence, within each tax bracket (for which the marginal rate is fixed) the elasticity declines as income increases. As an individual crosses an income threshold, the revenue elasticity takes a discrete upward jump, before gradually declining again.

Hence the elasticity of revenue with respect to the marginal rate faced by an individual in the kth tax bracket is:[9]

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[8]For a proportional tax structure, with constant average and marginal rate, t, and where $\bar{y}$ is arithmetic mean income, $\frac{dT}{dt} = \bar{y} + \frac{td\bar{y}}{dt}$ and in terms of elasticities, $\eta_{T,t} = 1 + \eta_{\bar{y},t}$, giving the result mentioned in the introduction; namely, revenue is maximised where $\eta_{\bar{y},t} = -1$.

[9]Equation (7) demonstrates some similarities with the Saez *et al.* (2009, p. 5) expression for the aggregate revenue response to a change in the top marginal rate. Equation (7) provides a generalisation

$$\eta_{T_i,\tau_k} = \eta'_{T_i,\tau_k} - \left(\frac{y_i}{y_i - a_k^*}\right)\left(\frac{\tau_k}{1 - \tau_k}\right)\eta_{y_i,1-\tau_k} \tag{7}$$

The first term, η'_{T_i,τ_k} is the positive mechanical effect of the rate change, which differentiation of (2), and using (3), shows is:[10]

$$\eta'_{T_i,\tau_k} = \frac{\tau_k(y_i - a_k)}{T(y_i)} = \frac{(y_i - a_k)}{(y_i - a_k^*)} = \frac{T_k(y_i)}{T(y_i)} \tag{8}$$

Individuals' mechanical elasticities therefore differ with their incomes and the tax structure, represented in (8) by differences between the kth threshold, a_k, and the kth effective threshold, a_k^*. Furthermore, since a_k^* is a tax-rate weighted average of all tax thresholds up to and including the individual's marginal tax rate/bracket, this effective threshold parameter enables the full mechanical revenue effect to be captured when a rate or threshold *below* the taxpayer's marginal rate bracket is changed. As can be seen in (7), it also features in the behavioral response component.

The second term in (7) combines the three elements that form the 'behavioral effect'. It can be seen that this comprises, in addition to the ETI, two terms associated with the tax structure and the individual's income level. The behavioral effect is larger the larger is the individual's ETI, the higher is τ_k and the closer is the taxpayer's income to the effective threshold. Each element after the minus sign in (7) is positive, and so the overall behavioral response unambiguously reduces revenue.

In view of the importance of the closeness of y_i to the effective income threshold, a_k^*, the following discussion refers to this as an 'income-threshold' effect though this is often referred to in the fiscal drag literature as a revenue elasticity.[11]

The components of (7) can readily be illustrated by considering the following example in which taxpayers face a marginal tax rate of 20% on income above a threshold,

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of the Saez *et al.* result to all marginal tax rates but applied to individuals. The expressions developed in subsection 2.3 for aggregate responses avoid a specific income distribution assumption, whereas Saez *et al.* (2009, p. 5) assume a Pareto distribution. The latter is less suitable for the whole distribution of taxpayers than for those facing the top marginal rate.

[10] The partial individual elasticity, η'_{T,τ_j}, for $j < k$ (that is, for changes in marginal tax rates below the tax bracket in which the individual falls) is given by $\eta'_{T,\tau_j} = \{\tau_j(a_{j+1} - a_j)\}/T(y)$, which is simply the tax paid at the rate, τ_j, divided by total tax paid by the individual.

[11] See, for example, Creedy and Gemmell (2002). This terminology also reduces the number of references to elasticity measures. As $y_i > a_k$ and $a_1 \geqslant 0$, equation (7) is undefined for $y_i = 0$; hence it cannot account for behavioural responses at the extensive margin such as where taxpayers exit the taxpaying population in response to a tax rate change.

a_k, of \$50,000. And suppose, for any taxpayer, a tax reform which raises their marginal tax rate, τ_k, by 10%, also induces a 4% reduction in their taxable income. Then, for a taxpayer earning \$52,000, raising the 20% tax rate to 22% would induce a \$2,000 reduction in their taxable income, to \$50,000. Hence for this taxpayer all the previous revenue raised at rate τ_k, would be eliminated (in addition to the mechanical revenue increase equal to 2% of \$2,000). That is, 100% of tax revenue previously raised *at the 20% rate* from this taxpayer would be lost when that rate rises to 22%.

By analogy, taxpayers with incomes prior to the tax reform greater than \$50,000 would experience a less than 100% reduction in the tax revenue raised from them at rate τ_k. Hence, given the above parameters and the 4% predicted responsiveness of taxpayers, income equal to \$52,000 turns out to be the income level at which *all* revenue raised at rate τ_k, is lost due to reform. Of interest for present purposes is to assess the degree of responsiveness for each taxpayer which yields a behavioral response to a tax rate rise that exactly matches the induced mechanical tax revenue increase; that is, the revenue-maximising elasticity of taxable income.

Denoting this revenue-maximizing elasticity of taxable income, ETI^L, by $\eta^L_{y_i,1-\tau_k}$, it can readily be obtained by setting the left-hand-side of (7) to zero to yield:[12]

$$\eta^L_{y_i,1-\tau_k} = \eta'_{T_i,\tau_k} \left(\frac{y_i - a^*_k}{y_i} \right) \left(\frac{1 - \tau_k}{\tau_k} \right) \tag{9}$$

An observed or estimated value greater than ETI^L implies that any increase in the taxpayer's marginal tax rate reduces income tax revenue from that taxpayer. From (9), for a given value of individual income, ETI^L is lower when marginal tax rates are higher and income tax thresholds are lower (bearing in mind that a^*_k is a tax-rate-weighted average of the a_ks).

Furthermore, since the terms on the right hand side of (9) are multiplicative, and $0 < \left(\frac{y_i - a^*_k}{y_i} \right) < 1$, but $\left(\frac{1-\tau_k}{\tau_k} \right)$ may be greater than one (for $\tau_k < 0.5$), the behavioral components may act either to magnify or shrink the mechanical effect in determining the maximum ETI consistent with revenue maximization from the individual taxpayer.

Assessing the likely magnitudes of the revenue-maximizing elasticity requires esti-

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[12]Fullerton (2008) gives the familiar revenue maximising tax rate for a proportional tax system, in terms of the ETI, as 1/(1+ETI). Using (4), and setting $\eta'_{T_i,\tau_k} = 1$ and $a^*_k = 0$ for a proportional tax, rearrangement of (4) gives the revenue maximising tax rate, τ^L, as $\tau^L = \left(1 + \eta_{y_i,1-\tau} \right)^{-1}$.

mates of individual taxpayer's mechanical effects, η'_{T_i,τ_k}, which vary considerably across individuals. Alternatively, using (8), the term $\eta'_{T_i,\tau_k}\left(\frac{y_i - a_k^*}{y_i}\right)$ in (9) can be expressed as $\left(\frac{y_i - a_k}{y_i}\right)$, whereby the only computational information required relates to the individual's income, y_i, and the highest tax threshold below y_i, a_k, and:

$$\eta^L_{y_i,1-\tau_k} = \left(\frac{y_i - a_k}{y_i}\right)\left(\frac{1-\tau_k}{\tau_k}\right) \tag{10}$$

Equation (7) can be used more generally to calculate maximum ETIs consistent with *any* particular value of η_{T_i,τ_k}, in addition to the specific revenue-maximizing case of $\eta_{T_i,\tau_k} = 0$. For example, where tax revenue authorities wish to target a particular revenue increase via raising one or more marginal tax rates, it is important to know for which taxpayers or income groups this is likely to involve taxable income and/or revenue reductions. Where $\eta_{T_i,\tau_k} = b > 0$ is targeted, (9) becomes:

$$\eta^b_{y_i,1-\tau_k} = (\eta'_{T_i,\tau_k} - b)\left(\frac{y_i - a_k^*}{y_i}\right)\left(\frac{1-\tau_k}{\tau_k}\right) \tag{11}$$

where $\eta^b_{y_i,1-\tau_k}$ denotes the maximum value consistent with the target $\eta_{T_i,\tau_k} = b$. In practice, if such a revenue target is set, it is likely to apply to aggregate revenue from all taxpayers. Nevertheless, (11) confirms that ETI^b is expected to be less than the revenue-maximizing elasticity (for $b > 0$). As (11) makes clear, as b tends to η'_{T_i,τ_k} (the pure mechanical effect), the maximum elasticity of taxable income consistent with this tends to zero such that the full mechanical effect is realised; see (7).

2.3 Aggregation over Individuals

To aggregate over individuals, first convert (7) into changes, rather than elasticities:

$$\frac{dT_i}{d\tau_k} = \frac{\partial T_i}{\partial \tau_k} - \left(\frac{y_i}{y_i - a_k^*}\right)\frac{dy_i}{d(1-\tau_k)}\left(\frac{T_i}{y_i}\right) \tag{12}$$

Aggregating over $i = 1, ..., N_k$ individuals who are in the kth bracket:

$$\sum_{i=1}^{N_k}\frac{dT_i}{d\tau_k} = \sum_{i=1}^{N_k}\frac{\partial T_i}{\partial \tau_k} - \sum_{i=1}^{N_k}\left(\frac{y_i}{y_i - a_k^*}\right)\frac{dy_i}{d(1-\tau_k)}\left(\frac{T_i}{y_i}\right) \tag{13}$$

Suppose it is required that the total change in revenue from an increase in the rate τ_k is 0. Furthermore, remembering that $T_i = \tau_k(y_i - a_k^*)$:

$$\sum_{i=1}^{N_k}\frac{\partial T_i}{\partial \tau_k} = \tau_k \sum_{i=1}^{N_k}\frac{dy_i}{d(1-\tau_k)} \tag{14}$$

9

Hence:

$$\frac{1}{\tau_k} \sum_{i=1}^{N_k} \frac{\partial T_i}{\partial \tau_k} = \frac{d \sum_{i=1}^{N_k} y_i}{d(1 - \tau_k)} \tag{15}$$

and writing $\sum_{i=1}^{N_k} y_i = Y_k$, where $\eta^L_{Y_k, 1-\tau_k}$ denotes the aggregate elasticity of taxable income for which aggregate revenue is unchanged, it is seen that:

$$\eta^L_{Y_k, 1-\tau_k} = \frac{1}{Y_k} \left(\frac{1 - \tau_k}{\tau_k} \right) \sum_{i=1}^{N_k} \frac{\partial T_i}{\partial \tau_k} \tag{16}$$

Using:

$$\frac{\partial T_i}{\partial \tau_k} = \left(\frac{\tau_k}{T_i} \frac{\partial T_i}{\partial \tau_k} \right) \frac{T_i}{\tau_k} = \frac{T_i}{\tau_k} \eta'_{T_i, \tau_k} \tag{17}$$

and substituting for $\eta'_{T_i, \tau_k} = \left(\frac{y_i}{y_i - a_k^*} \right) \left(\frac{\tau_k}{1 - \tau_k} \right) \eta^L_{y_i, 1-\tau_k}$ at maximum revenue, where $\eta^L_{y_i, 1-\tau_k}$ is the elasticity of taxable income for individual i below which an increase in τ_k produces an larger tax payment, it can be seen that:

$$\eta^L_{Y_k, 1-\tau_k} = \sum_{i=1}^{N_k} \left(\frac{y_i}{Y_k} \right) \eta^L_{y_i, 1-\tau_k} \tag{18}$$

Hence the aggregate elasticity of taxable income in the kth tax bracket, such that the revenue from the bracket at the given tax rate is a maximum, is an income-share weighted average of individual elasticities. The above assumes that each individual does not move into a lower tax bracket as a result of the tax rate increase.[13]

As with the elasticity expressions for individuals, the aggregate expression in (18) includes revenue changes associated with infra-marginal taxpayers. This is captured via each individual $\eta^L_{y_i, 1-\tau_k}$, in which terms in a_k^* appear and which, as noted above, includes revnue raised at infra-marginal tax rates. For example, in a three rate tax system, an increase in the middle rate raises revenue from those paying the top marginal rate but without a marginal behavioral response.This is captured by the fact that an increase in the middle tax rate raises the value of the tax-rate-weighted effective theshold, a_k^*, for *all* taxpayers for whom this middle tax rate is applicable either marginally or infra-marginally; see equation (3).

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[13]Under the same assumption, Saez *et al.* (2009, p. 4) show that the actual or estimated ETI for the top tax bracket is an income-weighted average of ETIs for individuals in that bracket.

3 US Individual Revenue-Maximizing ETIs

This section illustrates the revenue-maximizing elasticities of taxable income and their components for individuals, under the US federal and state income tax systems. As equations (9) and (11) reveal, calculating these elasticities requires information on only the tax schedule and income levels, from which the mechanical and behavioral effects can be obtained.

Statutory marginal tax rates and thresholds associated with income tax schedules are readily obtained and generally apply to all or most taxpayers. However, identifying the effective marginal tax rates (EMTRs) and thresholds applicable to specific taxpayers is not straightforward. Taxpayers' personal circumstances, such as marital and tax filing status, numbers of children and dependents are important. When combined with federal payroll taxes, state income taxes, and the eligibility rules around federal social benefit programs, the outcome is typically a complex set of interactions that generate highly individual effective marginal rates. These frequently display the familiar 'Manhattan skyline' pattern of rising and falling marginal rates as income levels rise.

Fortunately for present purposes, the Congressional Budget Office (CBO, 2005) has examined EMTRs for US income taxpayers by filing status across a wide range of taxable income levels in 2005. These include federal, state and payroll taxes (for Social Security and Medicare). CBO (2012) reports on a similar exercise using 2012 data but only for low-to-moderate income level individuals — up to \$50,000 (\$100,000) for single (married) filers — which also covers a range of income-contingent federal transfer payments.

Based on data from CBO (2005), this section reports illustrative revenue-maximizing elasticities of taxable income, ETI^L, for taxable income levels up to \$0.5 million, for three taxpayer types: Single (no children); Married (with 2 children) filing jointly; Head of Household (with one child). Subsection 3.1 first illustrates ETI^Ls for the statutory federal income tax schedule. Subsection 3.2 considers the effect on these ETI^Ls of the various deductions etc associated with different taxpayer types and income levels. Subsection 3.3 shows the impact of adding state and payroll taxes.

3.1 Revenue-Maximizing ETIs: Statutory Tax Schedule

Table 1 shows the statutory marginal tax rates and taxable income thresholds for a single filer in 2005. The final column of the table reports the effective income threshold, a_k^*, for each income bracket, using equation (3).

Table 1: Statutory Federal Income Tax Structure: Single Filer 2005

k	Income threshold a_k	Tax rate τ_k	Effective threshold a_k^*
1	0	0.10	0
2	7,300	0.15	2434
3	29,700	0.25	13340
4	71,950	0.28	19620
5	150,150	0.33	38844
6	326,450	0.35	55800

Using equation (10), together with the data in Table 1, yields a schedule of values for ETI^L at each income level for this taxpayer type, as shown in the top panel of Figure 1. The interpretation of these ETI^L values is as follows. At each taxable income level, an actual or estimated ETI greater than the value shown implies that a *cut* in the applicable marginal tax rate would yield an *increase* in revenue, and vice versa. That is, the behavioral effect outweighs the mechanical effect.

Figure 1 shows that, except at very low incomes, ETI^Ls are generally below two and, importantly, are very low for taxpayers above but close to each threshold. For a taxpayer marginally above a particular threshold, any positive ETI generates an increase in revenue in response to a cut in the marginal rate applicable above that threshold.[14] At very low incomes the ETI^L is 9.0 – obtained from $\frac{y_i - a_1}{y_i} = 1$; $a_1 = 0$; and $\tau_1 = 0.10$, hence $\left(\frac{1-\tau_1}{\tau_1} \right) = 9$. Though such high values imply that it is almost impossible for the behavioral effect to outweigh the mechanical effect, it must be remembered that these results do not apply to the extensive margin. In addition, to the extent that such extensive margin responses are driven by average, rather than marginal, tax rates, the appropriate response elasticity will be different from the (marginal) ETI used here.

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[14]It is assumed here that individuals do not cross thresholds. Hence, for a taxpayer with income just above a_k facing an increase in the marginal rate above a_k, a positive ETI would shift the taxpayer to the tax bracket below, where the relevant ETI^L is much larger.
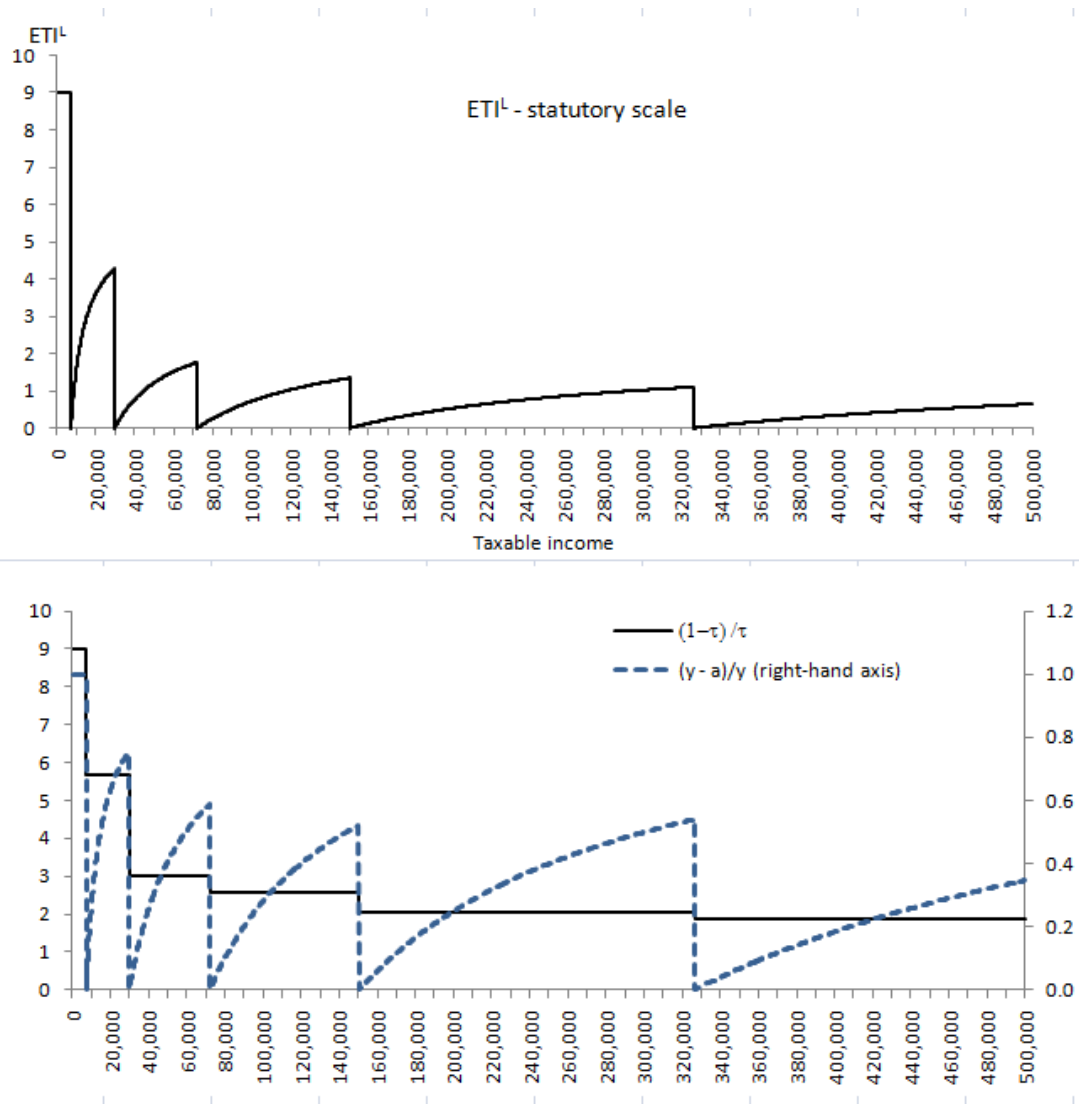
Figure 1: Revenue-Maximizing ETIs: Statutory Income Tax Schedule

The bottom panel of Figure 1 shows values for the two components on the right-hand-side of (10) across income levels. These are $(y_i - a_k)/y_i$ – the combined mechanical effect, $T_k(y_i)/T(y_i)$, and income-threshold effect, $y_i/(y_i - a_k^*)$; and the tax rate effect, $(1 - \tau_k)/\tau_k$. Not surprisingly, the tax rate effect falls with the increasing marginal rate structure of the schedule, from 9 for $k = 1$ to less than 2 ($= 0.65/0.35$) for $k = 6$. With a top marginal rate of 0.35, the tax rate effect is relatively modest for higher income US taxpayers compared with values that might be expected in other countries with higher top tax rates.

An important feature of both panels in Figure 1, is that the introduction of a new top tax bracket (and marginal rate), or a new marginal rate elsewhere in the schedule, creates a new segment of the profile where ETI^L is lower than previously – and zero at the new threshold. For taxpayers paying the initial top tax rate this can be important since the ETI^L profile rises steadily towards an asymptote of $(1 - \tau_k)/\tau_k$ above the top threshold. Hence the introduction of a new threshold at very high income levels (where actual ETIs are often estimated to be higher) could generate much lower ETI^Ls for those taxpayers above the new threshold.

For example, a new top tax rate of 0.40 on taxable incomes above \$400,000 would reduce the ETI^Ls for taxpayers close to but above this threshold, whilst raising it for taxpayers on much higher incomes because the new asymptote of $(1 - \tau_k)/\tau_k$ is now greater. Hence whether revenue reductions are expected from this top tax rate increase depends on the distribution of taxpayers above \$400,000 and, empirical estimates based on samples of taxpayers will depend on *which* specific taxpayers are sampled.

3.2 Revenue-Maximizing ETIs: Federal Income Tax and Filing Status

As CBO (2005, 2012) demonstrate, the itemized deductions, tax credits and phase-out, or abatement, rates of the US Federal income tax system, together with differing statutory thresholds and rates associated with each tax filing status, lead to widely differing effective marginal tax rates across income levels and taxpayers. Figure 2, from CBO (2005, p. 15) for example, shows how these vary for a married taxpayer with two children, under a number of simplifying assumptions.[15]

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[15]For example: all income is from employment; taxpayers have itemized deductions equal to 18 percent of their earnings; 40% of the deductions are state and local taxes (not deductible under the

In addition to substantial differences between the EMTRs and statutory marginal rates at various income levels, EMTRs fall in some cases as income increases. The addition of state and payroll taxes to those shown (see CBO, 2005, pp.16-19) further complicates these schedules of EMTRs, raising them in general but also creating additional income ranges over which EMTRs fall.[16]

The data in Figure 2, and equivalent CBO (2005) data for a single filer (no children) and a head of household filer (one child), allow revenue-maximizing ETIs to be constructed for those illustrative taxpayers. The resulting profiles of ETI^Ls across income levels for single, married (filing jointly), and head of household (HoH) filers are shown in Figures 3, 4 and 5 respectively, where the income ranges $0–100,000$ and $100,000–500,000$ are shown separately. Different scales are used on the vertical axes of the upper and lower panels of each Figure, and in Figure 3, the ETI^Ls for single filers are compared with the statutory case. According to IRS data for 2005, these three taxpayer types made up 98% of total taxable returns (single = 23.7%; married filing jointly = 69.6%; HoH = 4.6%).[17]

In all three figures, ETI^Ls at low income levels (under about $20,000) can take very large negative or positive values.[18] As stressed earlier, these very low income ETI^Ls are of limited relevance here in view of the potential importance of adjustments at the extensive margin to tax rate changes at these lower income levels. Nevertheless, they emphasize that the potential for perverse responses to tax rate changes at these lower income levels - very large positive or negative behavioral responses to tax rate changes could have surprising effects on revenues, given the volatility of ETI^Ls in this region where EMTRs fluctuate around zero.

In the case of a single filer, Figure 3 also shows that, compared to ETI^Ls associated with the statutory tax schedule, the profile of ETI^Ls is generally shifted rightward, at

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Alternative Minimum Tax) and the other 60% are charitable contributions and mortgage interest (deductible under the AMT). CBO includes only some of the most common features of the tax code in the examples.

[16]In the CBO (2005) analysis, and that which follows, payroll tax rates include both employers' and empoyees' contributions. State income taxes are simplified, with a uniform 5 percent rate added to the federal rate, which 'approximates the marginal rate in an average state' (CBO, 2005, p. 16). See CBO (2005) for more details on the specific taxpayer and schedule characteristics assumed.

[17]Remaining return types are married filing separately (2.0%) and surviving spouses (0.05%): See http://www.irs.gov/uac/SOI-Tax-Stats—Individual-Statistical-Tables-by-Filing-Status

[18]The axes have been truncated but there are singularities in the ETI^L profiles when EMTRs equal zero and values can reach as low as -14 in Figure 3.
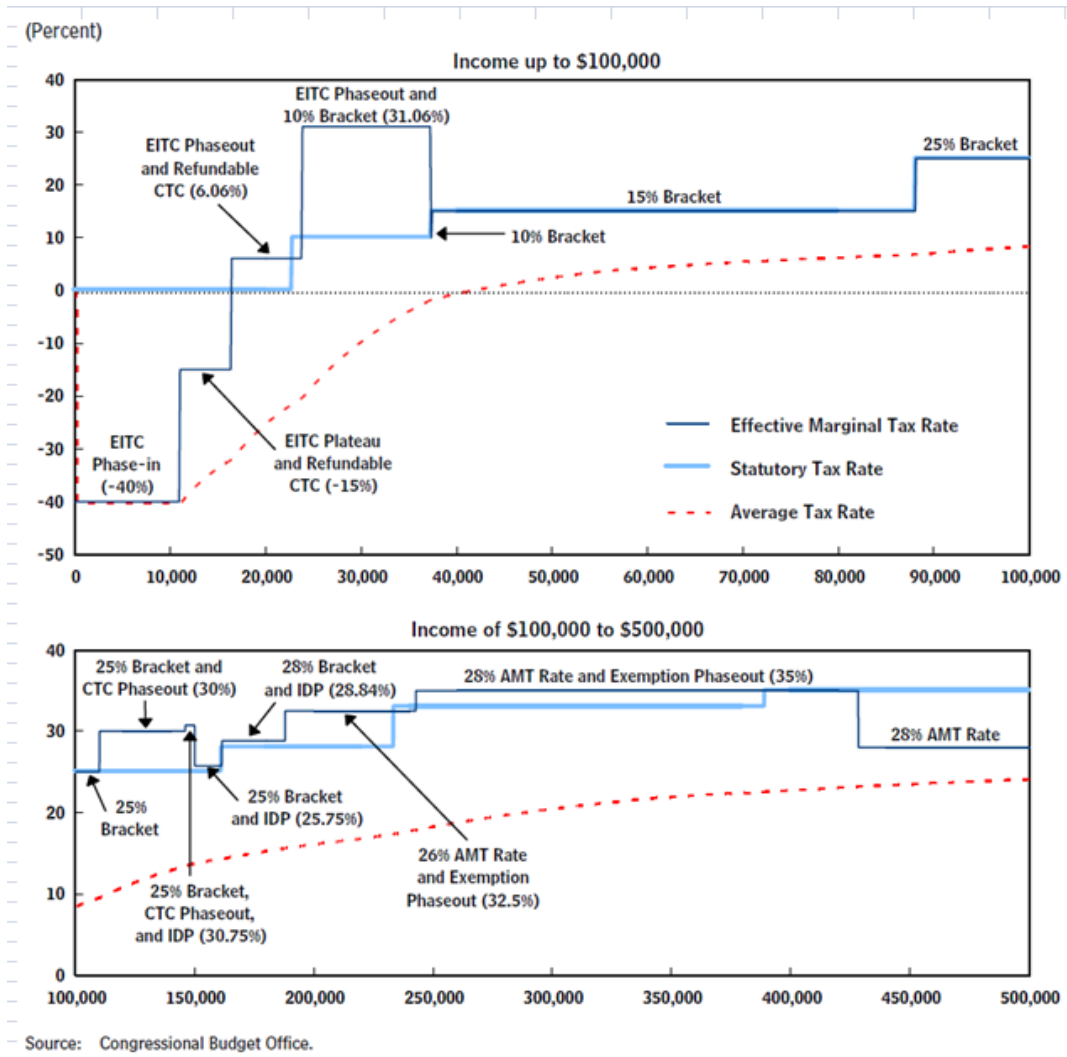
Figure 2: Effective Marginal Federal Income Tax Rates for a Married Couple with Two Children in 2005
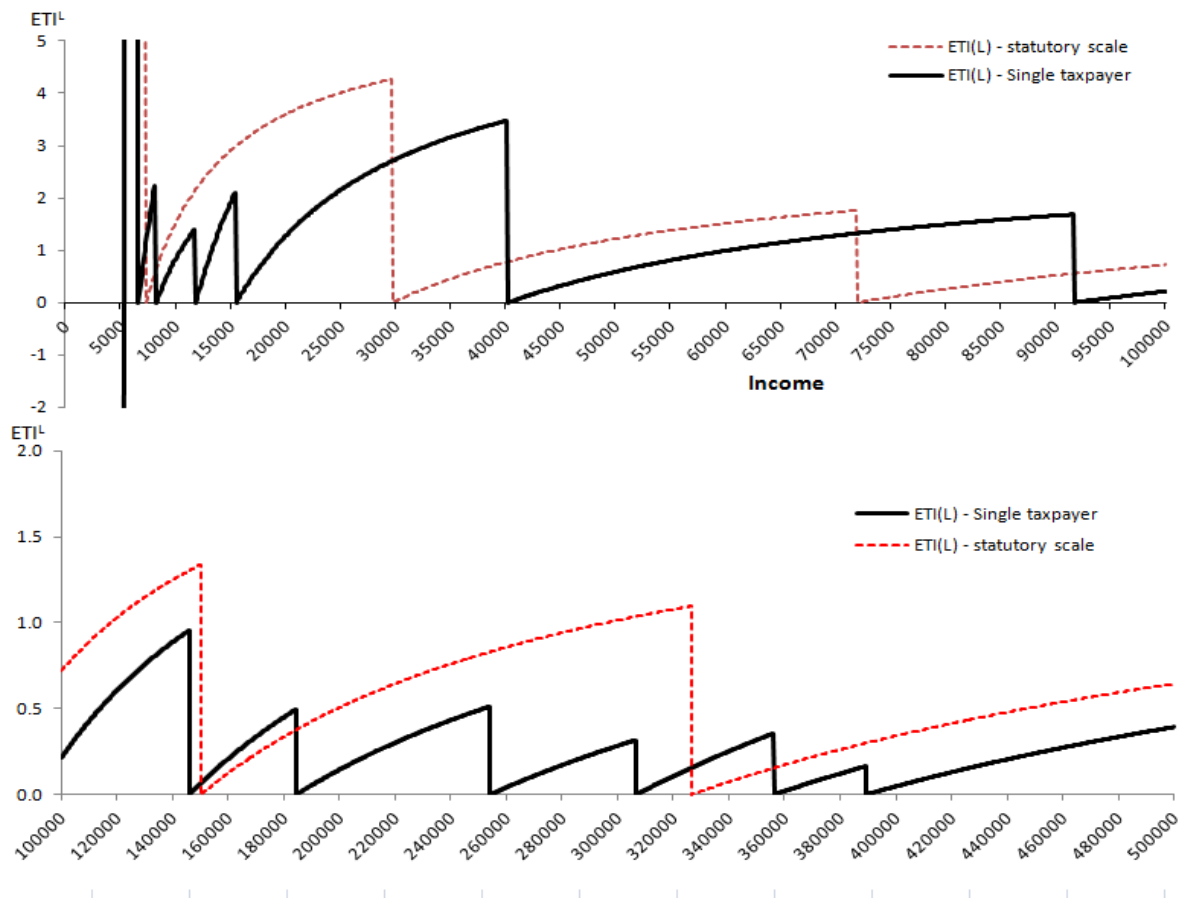
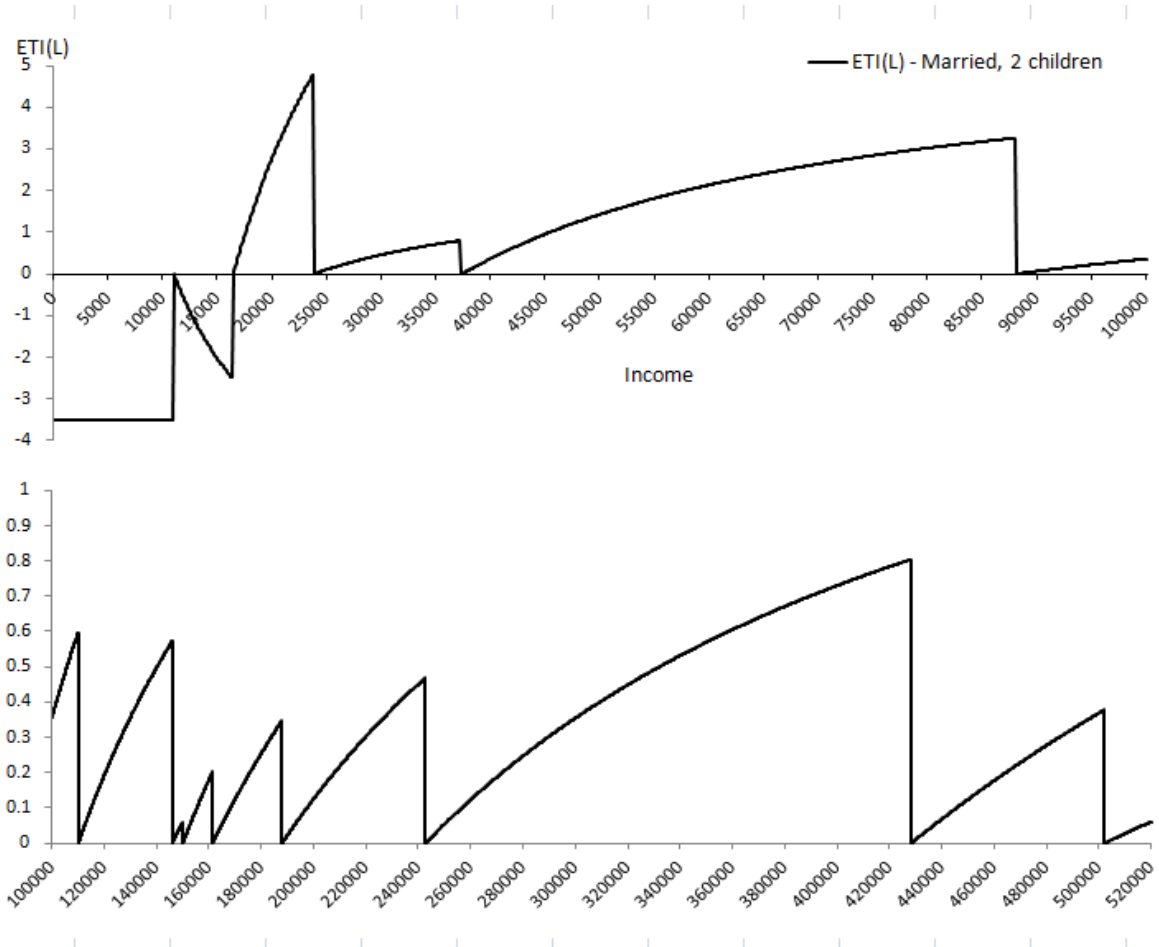Figure 3: Revenue-Maximizing ETIs - Single Filer
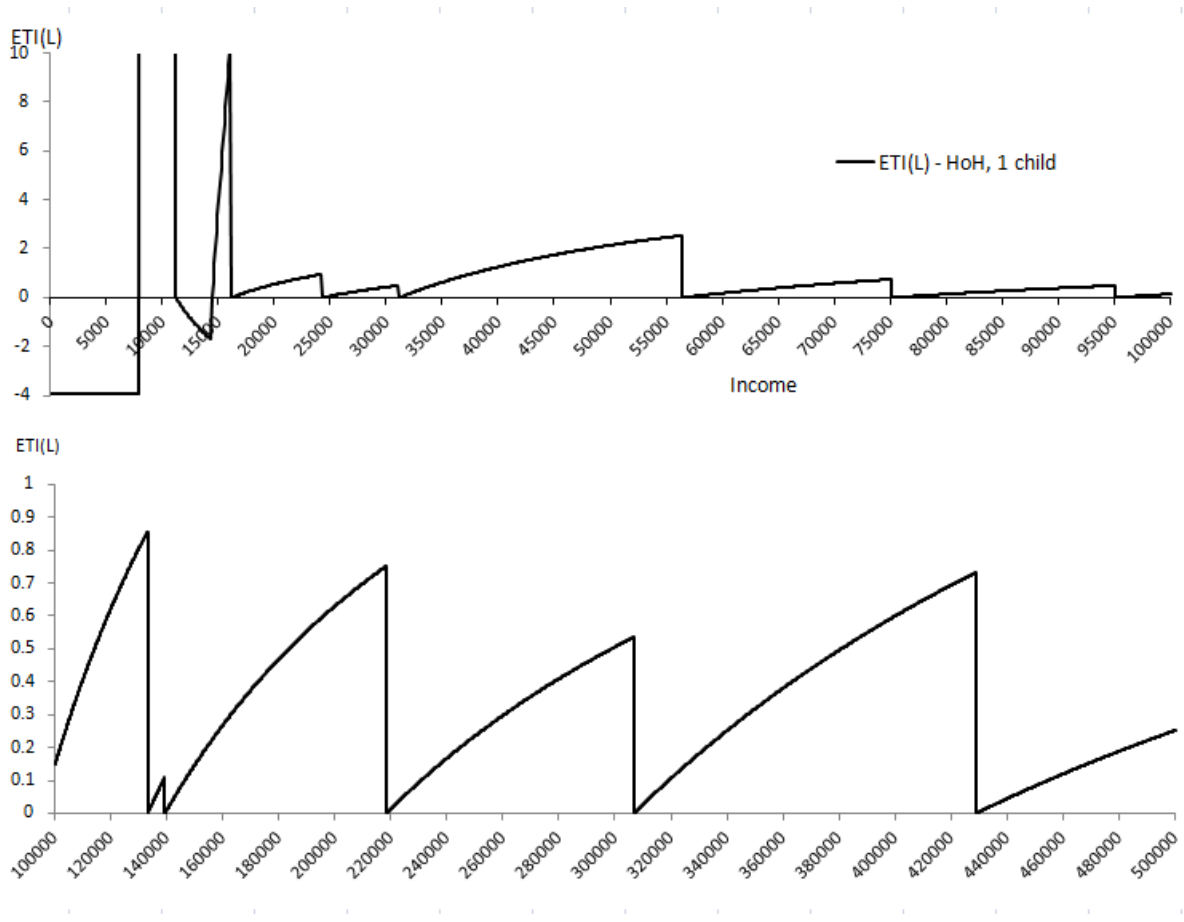
Figure 4: Revenue-Maximizing ETIs - Married Filer

Figure 5: Revenue-Maximizing ETIs - HoH Filer

least below \$100,000. As a result, those taxpayers with relatively high or low ETI^Ls are very different under the two regimes. However, above \$100,000 Figure 3 reveals that most single filers face much lower ETI^Ls than would be inferred from the statutory schedule. This arises primarily from the series of additional thresholds and EMTRs associated with the phase-outs of various deductions and exemptions.[19] Importantly, ETI^Ls for single filers with incomes above around \$100,000 are typically in the 0–0.5 region. These are also plausible values for actual ETIs.

For married, jointly-filing taxpayers with two children, Figure 4 reveals a similar pattern to Figure 3, with values around 0–3 at incomes below \$100,000, but 0–0.5 above \$100,000.[20]. As in the single taxpayer case, these values suggest that taxpayers' precise location along the income scale is critically important for revenue responses to tax rate changes. At the aggregate level (see below) it becomes important to know where most taxpayers are located. Finally, Figure 5, for a head of household filer, displays similar features to the others but two significant differences. Above around \$100,000 the ETI^L profile peaks at higher values of around 0.8–0.9, but below \$100,000 ETI^L values are generally lower than for other taxpayer types. For example an HoH filer reaches an ETI^L local maximum of 0.49 at \$95,000, whereas the equivalent maximum for a single or married taxpayer at around \$90,000 is 1.7 (single), and 3.3 (married).

3.3   Adding State and Payroll Taxes

Adding the impact of state and payroll taxes to EMTRs, CBO (2005) show that, as expected, this raises EMTRs across a range of incomes. Of course, these vary across states; the CBO analysis necessarily makes a number of simplifying assumptions such as that the employee bears the burden of both the employees' and employers' contributions and state taxes are simplified by a uniform 5% rate added to relevant federal Income Tax EMTRs, based on the federal measure of taxable income.[21]

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[19]See CBO (2005, p.12). These higher income phase-outs include the Alternative Minimum Tax (AMT), itemized deduction and personal exemption phase-outs (and the EITC at lower income levels).

[20]Profiles for married taxpayers with more or fewer children would look similar but with the discrete 'cliffs' in the profiles at different income levels.

[21]See CBO (2005, pp. 16-19) for details of the approach and results. Reed et al (2011) provide an alternative revenue-based regression approach to estimate EMTRs for all state-level taxes. Their estimates suggest an average state income tax EMTRs around 2.5% though their personal income measure is broader (hence their EMTRs are lower, other things equal) than the taxable income used by CBO (2005).
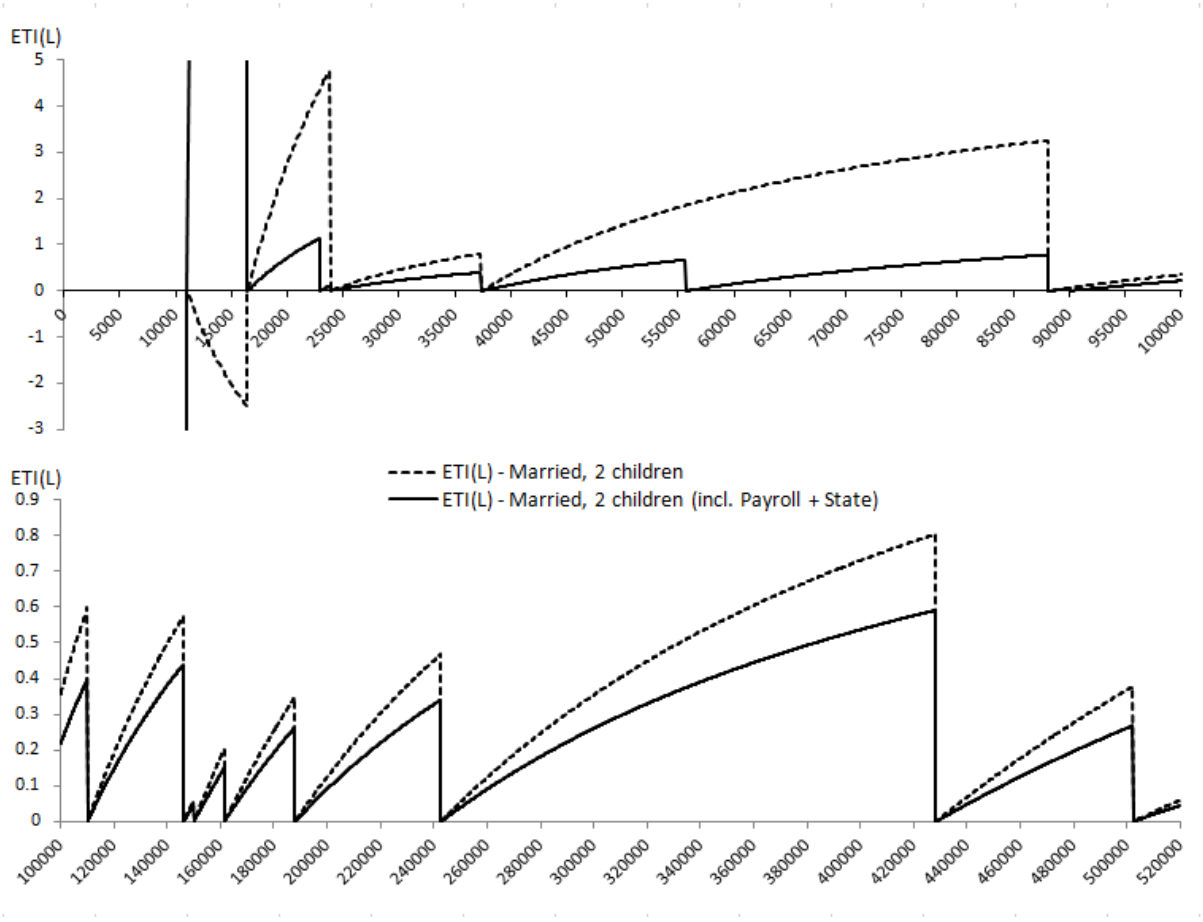
Figure 6: Revenue-Maximizing ETIs Including Payroll & State Taxes - Married Filer

Figure 6 illustrates the impact of payroll and state income taxes on the ETI^L profile across income levels, based on a married taxpayer with two children, filing jointly. The broken line is the federal income tax case from Figure 4, with the unbroken line showing ETI^{L}s inclusive of payroll and state income taxes. While the downward shift in ETI^L for income over \$100,00 is modest but non-trivial, the downward shift for incomes below \$100,000 is substantial. For incomes between about \$37,000 and \$90,000, for example, the maximum ETI^L becomes 0.77 instead of 3.25 which is obtained when ignoring payroll and state taxes. The average ETI^{L}s over that income range are respectively 0.41 and 2.01 for the with, and without, payroll and state tax cases. Recognizing the impact of these payroll and state income taxes is therefore likely to be important when assessing how close observed elasticities are to those that would maximize revenue from these taxpayers. The further effects of means-tested transfers are examined briefly in the Appendix.

The revenue-maximizing elasticities of taxable income considered in this section are purely illustrative for particular household types. However, they all appear to have ranges of incomes − sometimes several short income ranges and sometimes fewer but wider ranges − over which ETI^{L}s are relatively low. Whether this is likely to generate revenue reductions *in aggregate* in response to EMTR increases depends on the weight of those and other taxpayers in the overall distribution of taxable incomes. This is examined in the following section.

4   Aggregate Values of ETI^L

Calculation of an aggregate ETI^L across the US taxpaying population, or sub-sets of taxpayers such as those within individual statutory rate tax brackets, requires detailed data on the number and personal characteristics of the relevant taxpayers, which is beyond the scope of the present analysis. Nevertheless, this section illustrates likely orders of magnitude by combining ETI^L information on the individual taxpayer types examined above with IRS data on the distribution of US personal incomes.

Using 2005 data on US adjusted gross incomes (AGI) and taxable incomes from taxable returns filed with the IRS, Table 2 shows the share in total taxable income (both within taxpayer types, and across all three types: married filing jointly, head of

household, and single).[22] Summing the rows, the table shows, for example, in column 2 that among married joint-filers, less than 5% of taxable income is earned by M-J taxpayers with AGI below $50,000; around 70% of M-J taxable income is earned by taxpayers with AGI over $100,000 and almost 30% from those with AGI over $500,000 (which also accounts for around 20% of all taxable income; see column 3).[23] Equivalent percentages for single filers are lower, at 59%, 31% and 14%. To explore the impact of these distributions on ETI^L values requires taxable-income-weighted averages of individual ETI^Ls as shown in section 2.3, which in turn requires taxpayer unit record data to identify values of y_i, τ_k, a_k^* and a_k for each taxpayer.

Table 2: Income shares by Taxable Income Band

AGI ($000s)	Married-Joint Income shares		Head of H'hold Income shares		Single Income shares		Total
	% M-J income	% all income	% HoH income	% all income	% S income	% all income	% all income
$20 − 25	0.1	0.1	1.0	0	4.9	1.2	1.3
$25 − 30	0.3	0.2	3.4	0.2	6.0	1.5	1.8
$30 − 40	1.3	0.9	14.4	0.7	12.5	3.0	4.6
$40 − 50	2.5	1.8	15.6	0.7	11.3	2.7	5.3
$50 − 75	11.9	8.4	26.3	1.2	18.8	4.6	14.2
$75 − 100	13.8	9.8	10.7	0.5	8.9	2.2	12.4
$100 − 200	25.4	18.1	11.4	0.5	10.9	2.6	21.2
$200 − 500	15.9	11.3	6.1	0.3	6.8	1.6	13.2
$500 − 1,000	7.5	5.4	3.0	0.1	3.2	0.8	6.3
> $1,000	21.3	15.1	7.7	0.4	10.3	2.5	18.0
	100	71	100	5	100	24	100

In the absence of this level of detail, values of ETI^L within each AGI band are obtained as unweighted averages of ETI^Ls for each taxpayer type, based on the data underlying Figures 3 to 5. These are shown in Table 3 for ETI^Ls based on federal-only and federal plus payroll and state income taxes. With only three taxpayer types

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[22]To save space, this table, and the next one, focus on taxpayers with AGI in excess of $20,000. As noted earlier, the ETI^L estimates probably have limited relevance for taxpayers on lower incomes. In any case, those with incomes below $20,000 represent a small fraction of total AGI or taxable income.

[23]Equivalent percentages for *numbers of married-joint taxpayers* in 2005 are, of course, much smaller, at 23% below taxable income of $50,000; 30% with taxable income above $100,000 and 1.7% above $500,000.

involving specific assumptions regarding numbers of children and so on, these ETI^Ls do not capture the full heterogeneity in individual ETI^Ls. However, the differences within broad filing types lead to different thresholds at which the various EMTRs apply rather than substantially altering EMTR values. The ETI^Ls in Table 3 do capture the major source of differences in ETI^Ls across individuals, namely the impact of different effective thresholds along the income scale.

For example, for AGI over \$20,000 − where ETI^Ls are more readily interpreted − Table 3 shows that unweighted average values within each income band, and across filer types, are often quite low (less than 1 or less than 0.5).This is especially true when payroll and state taxes are included. For top earners − AGI in excess of \$1 million in this case − the values shown in Table 3 are based on the ETI^L applicable to the individual with average income in this income band.[24] As noted earlier, as incomes rise above \$1 million, these ETI^Ls approach $(1 - \tau_K)/\tau_K$, where τ_K is the highest EMTR faced by this taxpayer; that is, for $\tau_K = 0.35$, ETI^L approaches 1.86, though for many high income taxpayers EMTRs exceed 35%. For married joint filers, for example, CBO (2005) estimates a top EMTR (including payroll and state taxes) of 0.43, implying an asymptotic $ETI^L = 1.33$. Using the taxable income shares in Table 2 it is possible to obtain weighted average ETI^Ls across AGI levels for each of the three filer types shown and all three filer groups combined. Table 4 shows these estimates based on all income bands and also for incomes above \$20,000.[25]

Focussing attention on the largest taxpayer groups − married joint filers (M-J) and single (S) filers − Table 4 suggests ETI^Ls around 0.97 for M-J and 2.7 for singles. Ignoring those with incomes below \$20,000 has almost no effect on the M-J group (AGI less than \$20,000 is almost an empty set here; see Table 2) while for Singles, $ETI^L = 1.27$ when low incomes are excluded. These values drop considerably when payroll and state taxes are added, such that the weighted average ETI^Ls become 0.44 (M-J) and 0.48 (S). Over all three taxpayer groups, ETI^L is around 1.03–1.40 (federal tax only) and 0.44 (including payroll and state taxes).

These values can provide illustrative orders of magnitude only, but they are sug-

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[24]From IRS data for 2005 these are around \$2.9 million for a married joint filer and \$3.1 million for a single filer.

[25]As shown above, ETI^Ls for incomes below \$20,000 tend to be highly volatile and arguably are of limited relevance here.

Table 3: ETI^{L}s by Taxable Income Band

AGI ($000s)	Married-Joint (M-J) ETI^L Fed.	Married-Joint (M-J) ETI^L FPS	Head of H'hold (HoH) ETI^L Fed.	Head of H'hold (HoH) ETI^L FPS	Single (S) ETI^L Fed.	Single (S) ETI^L FPS
$20 - 25	2.9	0.5	0.6	0.3	1.8	0.6
$25 - 30	0.3	0.1	0.3	0.1	2.5	0.5
$30 - 40	0.5	0.2	0.7	0.2	3.1	0.4
$40 - 50	0.9	0.3	1.7	0.2	0.3	0.2
$50 - 75	2.2	0.4	0.9	0.3	1.0	0.5
$75 - 100	1.7	0.4	0.2	0.1	1.1	0.5
$100 - 200	0.2	0.2	0.4	0.3	0.4	0.3
$200 - 500	0.4	0.3	0.3	0.2	0.2	0.2
$500 - 1,000	0.1	0.0	0.3	0.2	0.4	0.3
> $1,000	1.5	1.1	1.5	1.2	1.6	1.2

Fed. = Federal income tax only;
FPS = Federal, payroll and state income taxes

Table 4: Weighted Average Revenue Maximising ETIs

Filer Group:		M-J	HoH	S	Total
	Income share:	71%	5%	24%	100%
Weighted ETI^L:					
Fed. only	$(y_i > 0)$	0.97	1.02	2.72	1.40
Fed. only	*$(y_i > \$20k)$*	*0.97*	*0.83*	*1.27*	*1.03*
Fed.+Pay.+State	$(y_i > 0)$	0.44	0.31	0.48	0.44
Fed.+Pay.+State	*$(y_i > \$20k)$*	*0.43*	*0.31*	*0.48*	*0.44*

gestive of an overall federal income tax system that probably involves tax rates that are still on the revenue-increasing side of the Laffer curve. Though some people might argue for ETIs greater than 1.0 or 1.4 for some high income taxpayers, few would claim that these values apply across the taxpaying population.[26] The same argument probably applies, but with less force, for ETI^Ls including payroll and state taxes. Values around 0.44, are within the range of plausible values for actual ETIs estimated from US taxpayer data, but again such estimates are not generally based on representative samples of all taxpayers. Nevertheless, these weighted ETI^L values around 0.4 are sufficiently low as to suggest some caution is warranted before concluding that the US income tax is 'well below' a revenue-maximizing structure, even if this is the case for the highest income taxpayers. More detailed analysis of ETI^Ls based on large samples of individual taxpayers at different income levels would provide more confidence around such estimates.

5   The Revenue-Maximizing Tax Rate

As mentioned in section 2, Fullerton (2008) discusses the derivation of the revenue maximizing tax rate for a proportional income tax. Saez *et al.* (2012, p. 6) derive an analogous expression for the top tax rate which maximizes revenue from taxpayers in the top income tax bracket, which Giertz (2009b) applies to US IRS data. Equivalent expressions are also easily obtained for the multi-rate system by setting the change in revenue in (7) to zero and rearranging to give the revenue-maximizing tax rate, τ_k^L, in terms of a given elasticity of taxable income (instead of the revenue-maximizing ETI corresponding to a given value of τ_k). Hence:

$$\tau_k^L = \left[\left(\frac{y_i}{(y_i - a_k^*)} \right) \left(\frac{\eta_{y_i, 1-\tau_k}}{\eta'_{T_i, \tau_k}} \right) + 1 \right]^{-1} \tag{19}$$

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[26]See, for example, Weber (2011, 2012). Saez et al (2012) argue that a plausible range of ETI values is between 0.1 and 0.4. However, Weber (2011) obtains ETI estimates around 1.0 from examining US tax reform, mainly TRA86, over 1979-90 using a sample from the Michigan IRS Tax Panel which, she claims, does not over-sample high income individuals; see Weber, 2011, p.11). Nevertheless, as Weber acknowledges, higher income individuals were most affected by the TRA86 reforms.
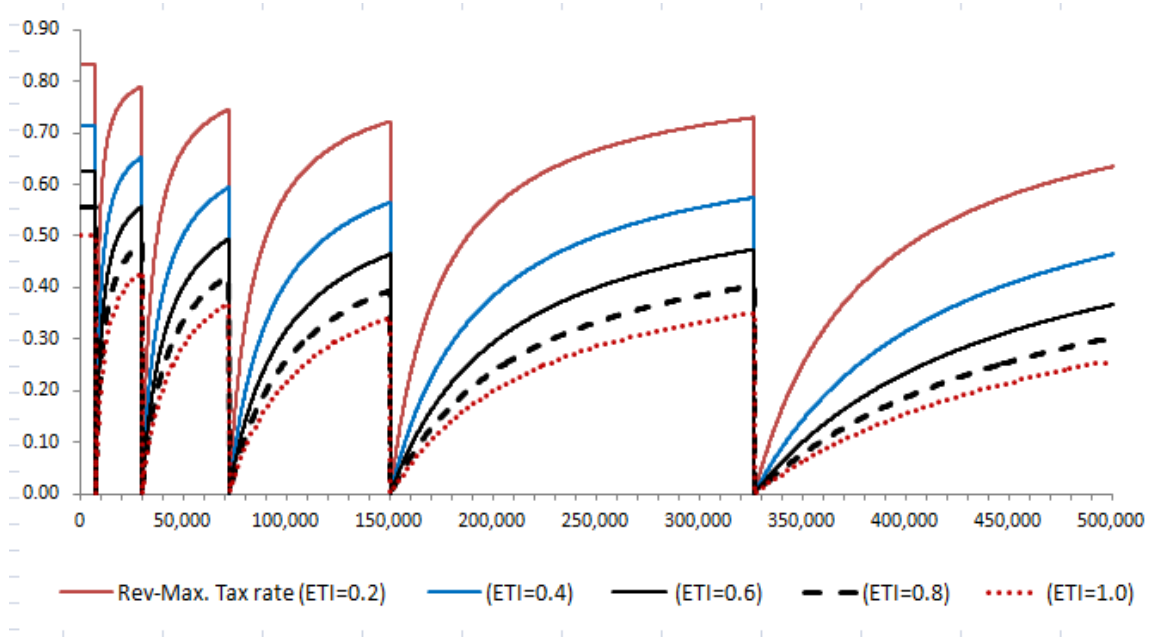
Figure 7: Revenue-Maximizing Tax Rates

Substituting for the mechanical elasticity in (19) using $\eta'_{T_i,\tau_k} = \frac{(y_i - a_k)}{(y_i - a_k^*)}$ from (8), further rearrangement shows that:

$$\tau_k^L = \frac{(y_i - a_k)}{y_i(1 + \eta_{y_i, 1-\tau_k}) - a_k} \tag{20}$$

For a proportional income tax, where $a_k = a_k^* = 0$, equation (20) yields the Fullerton special case of $\tau_k^L = 1/(1 + \eta_{y_i, 1-\tau_k})$.[27]

Figure 7 shows values of τ_k^L using (20) for the statutory federal income tax based on five ETI values in the range 0.2–1.0. In addition to τ_k^L rising as incomes increase above each tax threshold, these profiles also tend to shift downwards in successively higher tax brackets.

Similar profiles can be created using the effective marginal rate structure and tax-payer types analysed above. Figure 8 shows the equivalent case for a single filer (with no children) based on the EMTRs and thresholds of the federal plus payroll and state

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[27]The Saez *et al.* expression for the revenue-maximising *top* tax rate is given by $\tau_K^L = (1 + \alpha\eta_{y_i, 1-\tau_K})^{-1}$, where α is a measure of average income in the top bracket relative to the top threshold income. It can be shown that this is equivalent to equation (20), where, in the present case, $\alpha = y_i/(y_i - a_K)$, for $y_i > a_K$.
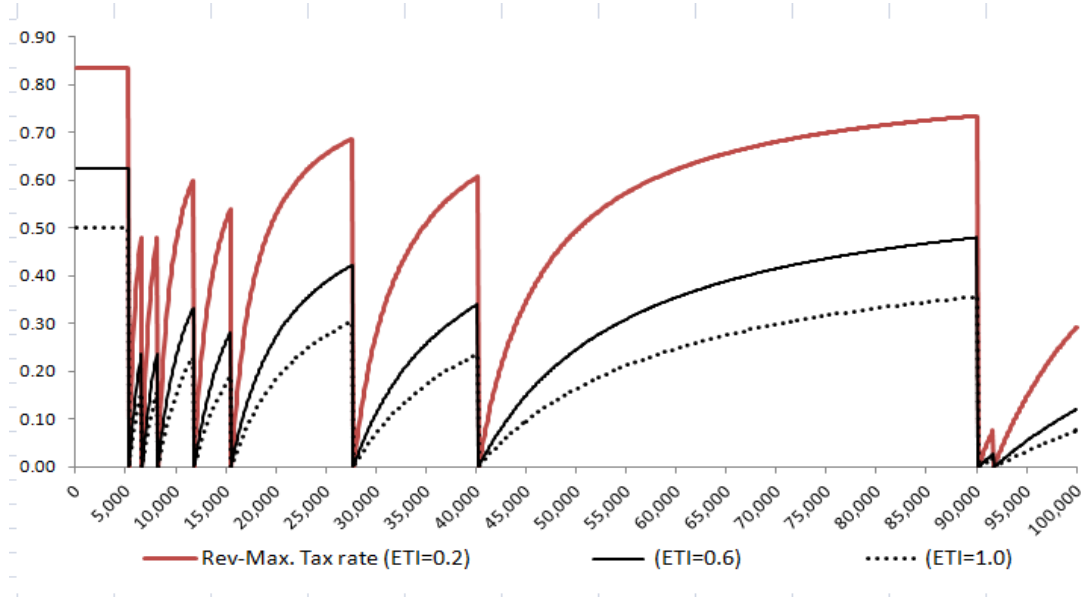
Figure 8: Revenue-Maximizing Tax Rate for Single Filer (No Children)

tax regime described above. Income values up to $100,000 are shown for clarity, but the profiles follow a similar pattern as incomes increase further. It can be seen that the revenue-maximizing tax rate for any individual varies considerably across taxpayer incomes but is also highly variable depending on the assumed value of the ETI. According to IRS data, average taxable income for single-filing taxpayers (with positive taxable income) in 2005 was around $28,000. It can be seen that τ_k^L around this income level is in a very unstable range.

Given volatilities around specific taxable income levels, Table 5 shows revenue-maximizing tax rates for single filing taxpayers associated with the average reported taxable income within each of the AGI bands examined above. These are shown for assumed ETIs of 0.2 and 1.0, with the relevant 2005 statutory federal MTRs, and combined federal-payroll-state EMTRs for a single filer (no children) in the two right-hand columns. It can be seen that, although the statutory rate is well below the revenue-maximizing rate when ETI = 0.2 is assumed, this is not always the case when comparing with the EMTRs, especially at higher income levels. Also, based on a much higher ETI = 1.0, there are some cases where the revenue-maximizing rate appears to be below the observed statutory MTR and/or the EMTR.

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These numbers should be treated cautiously. Revenue-maximizing tax rates are not a linear function of average taxable income, as Figure 8 makes clear. In addition, it is unclear how far taxpayers respond to these estimated effective marginal rates (including payroll and state taxes) or the statutory rates shown. However the results in Table 5 highlight two important properties. Firstly, that the issue of how revenue-maximizing tax rates compare to observed rates needs to be considered carefully across the complete tax schedule, not merely at the top end, and for specific taxpayer types. Secondly, for the highest incomes (in excess of $1 million), revenue-maximizing tax rates appear to be relatively high (at around 47-81% using the ETI range shown), and possibly well above generally observed top tax rates.[28] However, it is much less clear that the outcome for top rate taxpayers earning below $1 million puts them 'well below' the Laffer maximum rate.

Table 5: Revenue Maximising Tax Rates by AGI Bands: Single Filer

AGI	Average TI[†]	Rev-Maximizing Tax Rate (%)		Statutory	Single-filer
($000s)	($)	(ETI = 0.2)	(ETI = 1.0)	MTR	EMTR[*]
< $5	1,025	83	50	0	7
$5 − 10	1,902	83	50	0	7
$10 − 15	4,445	83	50	0	7
$15 − 20	8,771	25	6	10	35
$20 − 25	13,356	37	10	10	28
$25 − 30	17,983	41	12	15	33
$30 − 40	24,200	64	26	15	33
$40 − 50	32,722	43	13	15	32
$50 − 75	45,249	36	10	25	41
$75 − 100	66,236	66	28	25	41
$100 − 200	105,313	39	11	28	34
$200 − 500	245,182	55	20	33	40
$500 − 1,000	595,114	63	26	35	42
> $1,000	3,122,202	81	47	35	42

[†] TI = taxable income; [*] EMTR at average TI within each AGI band.

The estimates in Table 5 may be compared with similar values estimated for τ_k^L by Giertz (2009b). Based on the 2005 income tax, including federal, payroll and state

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[28]Recall also that the EMTRs shown relate to labor income. To the extent that higher income taxpayers earn greater amounts of capital income, which generally face lower tax rates, the EMTRs shown will exaggerate the relevant EMTRs.

taxes, Giertz estimated τ_k^L for five assumed values of the elasticity of taxable income between 0.2 and 1.0. These are shown, for the top tax bracket (for which comparisons are most readily made) in Table 6 along with the equivalent values from the analysis in this paper. Giertz (2009b) estimates would appear to include all single filers in the top tax bracket in 2005; that is, those with incomes above $326,450$. The most relevant comparison is based on the two highest income brackets in the IRS data in Table 5; that is, income in excess of $500,000$.[29]

Table 6: Revenue Maximising Tax Rates: Comparisons with Giertz (2009b)

Top Tax Bracket Revenue-Maximizing Tax Rate, τ_K^L (%)						
		ETI:				
Income above:	*Source:*	0.2	0.4	0.6	0.8	1.0
$326,450$	*Giertz (2009b)*	78	63	53	46	41
$500,000$	*this paper*	79	65	56	48	43

As the table demonstrates, the Giertz revenue-maximizing top tax rate estimates are very close to those obtained here for each ETI assumed value. The Giertz (2009b) values are slightly smaller, as would be expected since ETIs for taxpayers between $326,450$ and $500,000$ have been shown earlier to be among the lowest within the top tax bracket and serve to reduce the Giertz estimates relative to those calculated for taxpayer incomes over $500,000$. As Giertz (2009b) argues, with an actual top tax bracket EMTR of approximately 41%, ETIs around 1.0 or greater imply that it is above the revenue-maximizing rate.

6   Conclusions

Recent empirical literature on the elasticity of taxable income (ETI) has been concerned with whether an estimated ETI is likely to exceed a threshold value consistent with the revenue-maximizing point on the Laffer curve. This has been explored in the context of a single marginal rate system or with respect to the top marginal rate only. For multi-rate income tax systems commonly used in practice, this paper has developed expressions for the revenue-maximizing elasticity, ETI^L. It has shown both that values

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[29]Since the next highest income group reported in the IRS data is $200,00 - $500,000, a reliable split of the class data into above/below the top tax threshold is not possible here.

of ETI^L can be expected to vary widely within and across income tax brackets, and that approximations based on a proportional income tax, or top marginal rate, are likely to be highly inaccurate. Expressions for the ETI^L in a multi-rate income tax are composed of three elements: a mechanical effect, an income threshold effect and a tax rate effect. Each element varies across taxpayers within a given tax structure and across tax structures. They are highly sensitive to the number and frequency of tax rates and thresholds. The approach was also used to derive the associated revenue-maximizing tax rate, t_k^L, for individual taxpayers within each income bracket and in aggregate.

Illustrating values for the revenue-maximizing ETIs, for individuals and groups of taxpayers, based on the US income tax system in 2005 suggests that revenue-maximizing ETIs for individual taxpayers take very different values depending on their personal tax filing and family characteristics, the structure of effective tax rates and thresholds, and their income levels. As a result, it can be expected that, for a given actual elasticity of taxable income, the prospect that this exceeds the revenue-maximizing value is very different across taxpayers, with ETI^{L}s being especially low for those taxpayers above but close to EMTR thresholds. ETI^{L}s for groups of taxpayers are also therefore likely to be highly dependent on which taxpayers are included in a sample, their income and other characteristics.

Whether revenue-maximization occurs in aggregate clearly depends on the balance of these individual revenue-reducing and revenue-enhancing responses by different taxpayers. Examining ETI^{L}s for illustrative groups of taxpayers using IRS data on the distribution of taxable income across AGI bands suggests that they can also be very different across different income groups, and again depend on taxpayers' filing status, family characteristics and so on. Though many of the aggregate estimates obtained here can be relatively high − consistent with an income tax system having rates generally below revenue-maximising levels − this may not be the case for significant sub-sets of taxpayers across a range of income levels.

Appendix: The Effects of Means-Tested Transfers

Data from CBO (2012) allow examination of the effect of adding the phasing-in or out of means-tested transfers to the previous analysis. However, this is for the 2012 tax regimes rather than 2005, and only for lower income levels (up to $100,000 for married joint filers and $50,000 for single filers). CBO (2012) examined EMTRs for the hypothetical case of a single parent with one child, eligible for a number of family, housing and health insurance transfers; see CBO (2012a, p. iv).[30] Such taxpayers are more likely to be in receipt of means-tested transfers. Equivalent EMTRs for married couples with two children and single taxpayers with no children are considered in CBO (2012b), which provides more details of simplifying assumptions.

Figure 9 shows the cases of a single taxpayer with no children and a married couple with two children, both of whom receive eligible transfers. The higher EMTRs, caused by transfer phase-out, produce ETI^Ls that display very low values over a range of incomes. For the single individual with no children, this range is approximately from $6000 to $23,000, while for a married couple with two children it is from about $13,000 to $50,000 or more. In these cases ETI^L values generally lie below 0.2, and often *well* below. To the extent that the EMTRs associated with withdrawal of transfers, as well as the effects of payroll taxes are salient to those taxpayers, the relatively lower ETI^Ls suggest the possibility that actual elasticities may not need to be high for reactions by such taxpayers to be revenue-reducing, or at least involve large behavioral effects relative to mechanical effects.

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[30]CBO examined disposable income of a hypothetical single parent with one child, assuming that, when eligible, it would receive Temporary Assistance for Needy Families, the Housing Choice Voucher Program, SNAP, and either Medicaid or the Children's Health Insurance Program (CHIP). Only income from employment was considered.
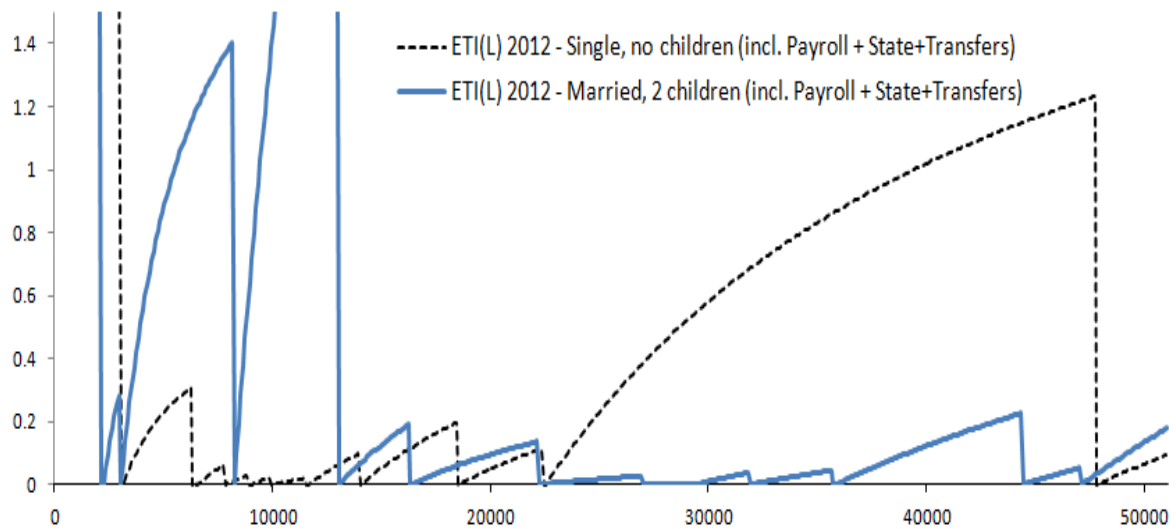
Figure 9: Revenue-Maximizing ETIs Including Transfers: 2012

References

[1] Auten, G. and Carroll, R. (1995) Behavior of the affluent and the 1986 Tax Reform Act. In *Proceedings of the 87th Annual Conference on Taxation of the National Tax Association*, Columbus, Ohio, pp. 70-76.

[2] Auten, G. and Carroll, R. (1999) The effect of income taxes on household behavior. *Review of Economics and Statistics*, 81, pp. 681-693.

[3] Auten, G., Carroll, R. and Gee, G. (2008) The 2001 and 2003 tax rate reductions: An overview and estimate of the taxable income response. *National Tax Journal*, 61, pp. 345-364.

[4] Caminada, K. and Goudswaard, K. (1996) Progression and revenue effects of income tax reform. *International Tax and Public Finance*, 3, 57-66.

[5] Congressional Budget Office (2005) . *Effective Marginal Tax Rates on Labor Income*. Washington DC: CBO (November).

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[6] Congressional Budget Office (2012a) *Effective Marginal Tax Rates for Low- and Moderate-Income Workers.* Washington DC: CBO (November).

[7] Congressional Budget Office (2012b) *Illustrative Examples of Effective Marginal Tax Rates Faced by Married and Single Taxpayers: Supplemental Material.* Washington DC: CBO (November).

[8] Cournot, A.A. (1838) *Researches into the Mathematical Principles of the Theory of Wealth* (English edition, 1927, translated by N.T. Bacon and edited by I. Fisher). London: Stechert-Hafner.

[9] Creedy, J. and Gemmell, N. (2002) The built-in flexibility of income and consumption taxes. *Journal of Economic Surveys*, 14, pp. 509-532.

[10] Feldstein, M. (1995) The effect of marginal tax rates on taxable income: a panel study of the 1986 Tax Reform Act. *Journal of Political Economy*, 103, pp. 551-572.

[11] Fullerton, D. (1982) On the possibility of an inverse relationship between tax rates and government revenues. *Journal of Public Economics*, 19, pp. 3-22.

[12] Fullerton, D. (2008) Laffer curve. In *The New Palgrave Dictionary of Economics* (edited by S.N. Durlauf and L.E. Blume). London: Palgrave-Mamillan.

[13] Giertz, S.H. (2007) The elasticity of taxable income over the 1980s and 1990s. *National Tax Journal*, LX, pp. 743-768.

[14] Giertz, S.H. (2009a) The elasticity of taxable income during the 1990s: new estimates and sensitivity analyses. *Southern Economic Journal*, 77, pp. 406-433.

[15] Giertz, S.H. (2009b) The elasticity of taxable income: influences on economic efficiency and tax revenues, and implications for tax policy. In *Tax Policy Lessons from the 2000s* (ed. by A.D. Viard), pp. 101-136. Washington, DC: AEI Press.

[16] Goolsbee, A. (1999) Evidence on the high-income Laffer curve for six decades of tax reform. *Brookings Papers on Economic Activity*, 1999, pp. 1-47.

[17] Hall, R.E. (1999) Comments and Discussion. *Brookings Papers on Economic Activity*, 1999, pp. 48-51.

[18] Reed, W.R., Rogers, C.L. and Skidmore, M. (2011) On estimating marginal tax rates for US states. *National Tax Journal*, 64, 59-84.

[19] Saez, E. (2004) Reported incomes and marginal tax rates, 1960-2000: evidence and policy implications. In *Tax Policy and the Economy* (ed. by J. Poterba), pp. 117-173. Cambridge, MA: MIT Press.

[20] Saez, E., Slemrod, J.B. and Giertz, S.H. (2012) The elasticity of taxable income with respect to marginal tax rates: a critical review. *Journal of Economic Literature*, 50, pp. 3-50.

[21] Trebandt, M. and Uhlig, H. (2010) How far are we from the slippery slope? the Laffer curve revisited. *National Bureau of Economic Research Working Paper* no. 15343.

[22] Trebandt, M. and Uhlig, H. (2012) How do Laffer curves differ across countries? *Board of Governors of the Federal Reserve System, International finance Discussion Paper* no. 1048.

[23] Wagstaff, A. and van Doorslaer, E. (2001) What makes the personal income tax progressive? A comparative analysis for fifteen OECD countries. *International Tax and Public Finance*, 3, pp. 299-316.

[24] Weber (2011) *Obtaining a consistent estimate of the elasticity of taxable income.* Mimeo, University of Oregon.

[25] Weber (2012) *The fixed-bracket average treatment effect: a constructive alternative to LATE analysis of tax policy.* Mimeo. Paper presented to the American Economics Association Annual Meetings, San Diego, California, January 2013.

[26] Werning, I. (2007) *Pareto efficient income taxation.* MIT Working Paper. Available at http://econ-www.mit.edu/faculty/iwerning/papers.

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