Does Evasion Invalidate the Welfare Sufficiency of the ETI?*

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Abstract

In an influential article, Raj Chetty (2009) argues that in the presence of tax evasion the elasticity of taxable income (ETI) is no longer a sufficient statistic for the marginal efficiency cost of funds (MECF). We show that, under Chetty's (2009) risk-neutrality assumption, correctly measuring the standard MECF only requires adding detected evasion inclusive of penalties. In the more general case of risk aversion, it further requires amending the formula to address the private risk-bearing cost of tax evasion.

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1 Introduction

Because it holds the promise of summarizing the welfare cost of all behavioral responses undertaken to reduce tax liability, since Feldstein (1999) the elasticity of taxable income (ETI) has assumed a central role as a sufficient statistic in measuring the marginal excess burden of income taxation. The intuition relies on the simple notion that, at all operative margins, a taxpayer will incur cost equal to one dollar (or sacrifice utility valued at one dollar) to save one dollar in taxes. This implies that the anatomy of behavioral response is irrelevant, because at an optimum the marginal cost of saving a dollar in taxes is equal across all of the margins of behavioral response. Provided the private and social costs of sheltering one dollar of income from taxation are equal, the ETI is a sufficient statistic for welfare analysis.

In an influential paper, Chetty (2009) argues that, contrary to this logic, the anatomy of behavioral response does matter in the presence of some tax-reducing activities, the most prominent being tax evasion, that involve a transfer between private agents (e.g., a fine for detected evasion), because the private costs do differ from social costs. Chetty (2009) then proposes a welfare measure based on a weighted average of taxable income and earned income elasticities, with the weights depending on the marginal social resource cost of sheltering income, implying that the anatomy of response does matter. Getting this right is especially important given that much recent evidence suggests that in many important instances a substantial fraction of the response of taxable income is not accounted for by real responses such as labor supply, but instead by evasion.[1]

In this note we argue that the welfare implications of tax evasion can be handled in a more intuitive fashion by directly adjusting the standard formula for the marginal efficiency cost of funds (MECF), which translates directly into the ETI, in the same way it must be adjusted for any fiscal externality, i.e. whenever a change in tax rates induces taxpayers to shift income to another tax base. As discussed in Slemrod (1998), when fiscal externalities arise the unadjusted ETI overstates efficiency cost because the observed reduction in taxable income is partially offset by socially valued revenue that is not accounted for. Our framework uses the behavioral response of detected evasion to a change in the marginal tax rate to infer the revenue consequences of unobserved evasion. In

[1] See Saez et al. (2012).

contrast, Chetty (2009) uses a (suitably weighted) difference between observed taxable income and observed earnings to infer the revenue consequences of unobserved evasion. While both approaches are correct, we argue that ours is simpler to implement empirically and closer in spirit to the logic of the ETI approach.

Explicitly addressing tax evasion also requires introducing risk into the standard ETI framework, and noting that increasing risk-bearing is one aspect of private cost incurred by evaders when they seek to reduce their expected tax burden.

2 Analysis

2.1 Taxpayer's Problem

Following Chetty (2009), suppose taxpayers simultaneously choose earned income, y, and evaded income, e, given exogenous income A (which cannot be understated) to solve the following Allingham-Sandmo (1972) style expected utility maximization problem:

$$v(A,t,p,F) = \max_{\{y,e\}} (1-p(e))\, u(A+(1-t)y+te-g(e)) + p(e)\, u(A+(1-t)\,y-F(e,t)-g(e)) - \psi(y)\,, \tag{1}$$

where utility, u, is concave in consumption, ψ represents the disutility of earning income, p is the audit probability, t is the marginal tax rate faced by the taxpayer, $F(e,t)$ is the fine for detected and successfully prosecuted tax evasion, and $g(e)$ is a (private and social) resource cost incurred in evading taxes, such as from transacting in cash rather than electronically. The standard Allingham-Sandmo model does not incorporate a resource cost of tax evasion, but we include it here because Chetty (2009) considers situations in which tax evasion has both transfer and resource cost components. To simplify notation, let $c_h = A+(1-t)y+te-g(e)$ and $c_l = A+(1-t)\,y-F(e,t)-g(e)$ denote consumption in the non-audited (high-income) and audited (low-income) states, respectively.[2] The FOCs for the taxpayer are

$$[\partial e] \qquad (1-p(e))(t-g'(e))u'(c_h) - p(e)(F_e + g'(e))u'(c_l) = p'(e)[u(c_h) - u(c_l)], \tag{2}$$

and

$$[\partial y] \qquad (1-p(e))(1-t)u'(c_h) + p(e)(1-t)u'(c_l) = \psi'(y), \tag{3}$$

where $F_e \equiv \partial F(e,t)/\partial e$, and later $F_t \equiv \partial F(e,t)/\partial t$. For simplicity we assume that taxpayers' evasion gamble is the only source of income risk and that p is convex in e. Both assumptions are standard in the tax evasion literature; the latter is intended to capture in a reduced-form representation the assumption that the tax authority has some ability to ascertain the taxpayer's true tax liability and that this is more likely the larger is evasion. We also assume that ψ is convex in y.

2.2 Marginal Efficiency Cost of Funds

A. General Form

We begin by establishing the marginal efficiency cost of funds (MECF) in this setting, and then show its relationship to the elasticity of taxable income. Following Mayshar (1991) and Slemrod and Yitzhaki (1996), we define the MECF for a marginal change in the tax rate t to be the marginal welfare cost to the taxpayer per marginal dollar of net revenue raised:

$$MECF(t) \equiv -\frac{(1/\alpha)(\partial v/\partial t)}{R_t}, \tag{4}$$

where α is the taxpayer's marginal utility of exogenous income, $v = v(A,t,p,F)$ is the taxpayer's indirect utility function, and R_t is the net revenue raised from a marginal increase in the tax rate, t. The effect of a marginal increase in the tax rate t on revenue raised consists of a marginal

[2] The separability of consumption and disutility of work is made for analytical convenience, but does not constrain the distortionary effects of taxation on labor supply and evasion to be independent (Yitzhaki, 1987).

mechanical burden, T_t, and a behavioral response component, $-B_t$, allowing us to re-express Equation (4), as follows:

$$MECF(t) = -\frac{(1/\alpha)(\partial v/\partial t)}{T_t - B_t}, \tag{5}$$

with positive values of B_t indicating that a marginal increase in the tax rate induces behavioral response that reduces revenue raised.

Each of these terms needs further interpretation in the presence of tax evasion. Net tax revenue, R, is equal to tax receipts remitted on reported income plus the present value of the revenue eventually collected from detected evasion and fines:

$$R(t) = t(y-e) + p(e)[te + F(e,t)], \tag{6}$$

so that the marginal change in net revenue from an increase in the income tax rate, t, is equal to

$$\begin{aligned} R_t = & \underbrace{[(y-e) + p(e)(e + F_t(e,t))]}_{T_t} \\ & + \underbrace{\left[t\frac{d[y-e]}{dt} + t\frac{de}{dt}[p'(e)e + p(e)] + \frac{de}{dt}(p'(e)F(e,t) + p(e)F_e(e,t))\right]}_{-B_t}. \end{aligned} \tag{7}$$

Recognizing that p and F are functions of e, which depends on t, the behavioral response term, B_t, can be simplified, as follows:

$$B_t = -t\frac{d[y-e]}{dt} - t\frac{d[ep]}{dt} - \frac{de}{dt}\frac{\partial[pF]}{\partial e}. \tag{8}$$

The first term is the tax revenue consequence of the response of *initially* reported taxable income to a change in the marginal tax rate, which numerous empirical studies have attempted to estimate (see Saez et al. 2012 for a review). The second term is the tax revenue consequence of the response of detected evasion to a change in the tax rate; to empirically estimate this term one would need data on the tax responsiveness of discovered evasion to a marginal change in the tax rate, even though the enforcement-induced revenue may be collected years after the tax rate change. The third term is the present value of the response of penalties collected on detected evasion to a change in the tax rate.

Focusing now on the welfare implications for the taxpayer of a marginal increase in the tax rate, and making use of the envelope theorem, we have:

$$\begin{aligned}
-\frac{\partial v}{\partial t} &= (1-p(e))(y-e)\,u'(c_h) + p(e)(y+F_t)\,u'(c_l) \\
&= y\left[(1-p(e))\,u'(c_h) + p(e)\,u'(c_l)\right] - e(1-p(e))\,u'(c_h) + p(e)\,F_t u'(c_l) \\
&= \mathbf{E}u'(c)\left(y - \frac{e(1-p(e))\,u'(c_h) - p(e)\,F_t u'(c_l)}{\mathbf{E}u'(c)}\right) \\
&= \mathbf{E}u'(c)\left(T_t - p(e)(1-p(e))(e+F_t)\left(\frac{u'(c_h)-u'(c_l)}{\mathbf{E}u'(c)}\right)\right),
\end{aligned} \tag{9}$$

where $\mathbf{E}u'(c) = (1-p(e))\,u'(c_h) + p(e)\,u'(c_l)$ is the marginal expected utility of exogenous income, α, using $\mathbf{E}$ to represent an expectation taken over utility in the audited and non-audited states. Combining Equations (5) and (9) yields the following expression:

$$MECF = \frac{1 - \frac{1}{T_t}\left[p(e)(1-p(e))(e+F_t)\left(\frac{u'(c_h)-u'(c_l)}{\mathbf{E}u'(c)}\right)\right]}{1-\frac{B_t}{T_t}}, \tag{10}$$

where T_t and B_t are as in Equations (7) and (8). Equation (10) is our most general form of the MECF with tax evasion. The term in the numerator captures the marginal increase in the risk-bearing cost of tax evasion, first discussed in Yitzhaki (1987), which is the loss in expected utility compared to a revenue-equivalent tax system in which taxpayers agree not to evade taxes. A marginal increase in the tax rate increases the amount of risk the taxpayer bears because the size of the evasion gamble mechanically increases with the tax rate.

B. Standard Penalty Function

In the United States, and many other countries, the penalty for detected evasion is proportional to the tax understatement, so in our case with a linear tax schedule we can express the penalty function as follows: $F(e,t) = f(e)\,te$, where te is the amount of tax understatement and $f(e)$ is the penalty rate assessed per dollar of understatement. The IRS imposes a standard 20 percent penalty on underpayment that "lacks economic substance"—meaning underpayment that does not, apart from federal tax effects, meaningfully change a taxpayer's material circumstances (IRS, 2012); in this case $f(e) = 0.2$. When the penalty function for detected evasion is linear in the tax rate, and evasion has no resource cost ($g(e) = 0$), then a change in the tax rate has no substitution effect (Yitzhaki, 1974); in the special case of risk-neutrality this implies that the amount of evasion does not depend on the tax rate (see Equation 2). However, when evasion is not a pure transfer and has a resource cost component ($g'(e) > 0$), then an increase in the tax rate makes evasion relatively more desirable.

Assumption 1: *(Penalty for detected evasion is proportional to the tax rate)* $F(e,t) = f(e)\,te$.

Under Assumption 1, the term B_t/T_t in the denominator of Equation (10) can be simplified to give an intuitive elasticity-based representation. First, substitution of $F(e,t) = f(e)\,te$ into Equation (8), and some rearrangement, gives

$$B_t = -t\frac{d[y-e]}{dt} - t\frac{d[ep]}{dt} - t\frac{de}{dt}\frac{\partial[pfe]}{\partial e} \tag{11}$$

$$= -t\frac{d[(y-e)+pe(1+f)]}{dt}, \tag{12}$$

recognizing that p and f are a function of e. Similarly, substitution of $F(e,t) = f(e)\,te$ into the expression T_t in Equation (7) gives

$$T_t = (y-e) + pe(1+f). \tag{13}$$

The term $(y-e)$ is initially reported taxable income, used in numerous empirical studies; the additional term $pe(1+f)$ is detected evasion grossed up by the average penalty rate, so that it reflects the penalty-inclusive remittance if caught evading. Hence, under Assumption 1, the term B_t/T_t in the denominator of the MECF (Equation 10) is equal to $t/(1-t)\,\varepsilon$, where

$$\varepsilon \equiv \frac{1-t}{(y-e)+pe(1+f)}\frac{d[(y-e)+pe(1+f)]}{d(1-t)} \tag{14}$$

is the elasticity of taxable income, adjusted to include detected evasion grossed up by the average penalty rate, with respect to the net-of-tax rate. Thus, under Assumption 1, only two modifications are required to restore the welfare sufficiency of the ETI in the presence of tax evasion: (i) adjust initially reported taxable income to include detected evasion grossed up by the average penalty rate; and (ii) adjust the numerator of the MECF to reflect the marginal change in the risk-bearing cost of tax evasion.

C. Risk-Neutrality

Chetty (2009) focuses on the special case of risk neutrality. When utility is quasi-linear in consumption, $u(c, y) = c - \psi(y)$, the numerator of Equation (10) is equal to unity, because there is no risk-bearing cost of tax evasion: $u'(c_h) = u'(c_l)$. The elasticity of taxable income, inclusive of detected evasion grossed up by the penalty rate, is a sufficient statistic for the MECF:

$$MECF = \frac{1}{1 - \left(\frac{t}{1-t}\right)\varepsilon}, \tag{15}$$

where ε is given by Equation (14). This conclusion contrasts with Chetty (2009), with which we provide a reconciliation in the next section.

2.3 Relationship with Chetty (2009)

Chetty (2009) assumes risk neutrality and uses the behavioral response term $-B_t$ to measure the deadweight cost of taxation:

$$\frac{dW}{dt} \equiv -B_t. \tag{16}$$

This differs from the MECF representation under risk neutrality only in that the deadweight cost of taxation is expressed in dollars, rather than per dollar of net revenue raised. Next, following the notation in Chetty (2009), define $z(e, t)$ to be revenue collected from detected evasion and penalties:

$$z(e, t) \equiv p(e)\left[te + F(e, t)\right]. \tag{17}$$

Using the notation introduced in Equations (16) and (17), the deadweight cost of taxation (Equation 8) can be re-expressed as follows:

$$\frac{dW}{dt} = t\frac{dy}{dt} + \frac{de}{dt}\left(\frac{\partial z}{\partial e} - t\right). \tag{18}$$

This is the condition derived by Chetty (2009, Equation 14) for the deadweight cost of taxation in the presence of evasion with resource and transfer costs; it is a weighted average of two behavioral response terms. Next, note that under risk neutrality the taxpayer's FOC for evasion (Equation 2) simplifies to:

$$\frac{\partial z\left(e,t\right)}{\partial e} - t = -g'\left(e\right), \tag{19}$$

where $z\left(e,t\right)$ is as defined in Equation (17). Substituting Equation (19) into Equation (18), and some re-arrangement, gives Chetty's (2009, Equation 17) preferred weighted average representation for the deadweight cost of taxation:

$$\frac{dW}{dt} = t\left\{\mu\frac{dTI}{dt} + \left(1-\mu\right)\frac{dLI}{dt}\right\}, \tag{20}$$

where $TI \equiv y - e$ is initially reported taxable income, $LI \equiv y$ is earned income, and $\mu \equiv g'\left(e\right)/t$ is the marginal social cost of sheltering income divided by the tax rate. If the private and social marginal costs of sheltering income are the same, then $\mu = 1$, and the response of taxable income to a change in the tax rate is a sufficient statistic for the deadweight cost of taxation. But in the presence of evasion $\mu \neq 1$, and the deadweight cost of taxation depends on a weighted average of the responses of taxable and earned income.[3]

Now, compare Equation (20) with our expression for the deadweight cost of taxation:

$$\frac{dW}{dt} = t\frac{d\left[\left(y-e\right) + pe\left(1+f\right)\right]}{dt}, \tag{21}$$

[3] When considering risk-averse taxpayers (in Appendix A), Chetty (2009) defines μ to include the risk-bearing cost of tax evasion, preserving the same weighted-average representation.

which can be derived by substituting the form of the penalty function under Assumption 1 into Equation (8). Unlike Chetty's (2009) expression, our representation is *not* a weighted average of sub-components of behavioral response, and so does not require the estimation of an additional quantity μ.[4] The anatomy of behavioral response is of relevance only because when there is evasion one must account for the "hidden" revenue implications of detected evasion and fines. But this is true whenever there are fiscal spillovers, even without evasion.

3 Conclusion

Taking account of the welfare effects of tax evasion requires two changes from the standard analysis of the marginal efficiency cost of funds and the elasticity of taxable income. The first is to incorporate the changes in detected evasion and accompanying fines, as shown in Equation (7). This is simply one example of fiscal spillovers, a well-known adjustment to the ETI in order for it to be a sufficient statistic of marginal welfare cost. The second change requires incorporating the change in the private risk-bearing cost of tax evasion to the numerator of the marginal efficiency cost of funds expression. This is crucial because in the Allingham-Sandmo (1972) model of tax evasion it is the private cost of increased risk-bearing that constrains optimal evasion. In sum, Chetty's (2009) representation of the social marginal cost of taxation with evasion (Equation 20) is correct, but should not be interpreted as undermining the logic behind the welfare sufficiency of the ETI when accounting for fiscal spillovers, in this case from revenues initially collected to those collected ultimately from fines and penalties on detected evasion. Unlike Chetty's more general approach, we make no attempt to account for optimization errors due to misperceived prices or costs; while this analysis is important, the implications of allowing for optimization errors extend well beyond the ETI literature.

[4] Chetty (2009) shows that for the special case where tax evasion is a pure transfer ($g'(e) = 0$) then the labour income elasticity is a sufficient statistic for the ETI. To see this, note that $\mu = 0$ in Equation (20) when $g'(e) = 0$. Our expression for the deadweight cost of taxation (Equation 21) remains valid. Both representations are correct because changes in the tax rate have no effect on evasion under risk-neutrality when the penalty for evasion is proportional to the amount of evasion (Yitzhaki, 1974).

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