

TAX EVASION AND RELATIVE TAX CONTRIBUTION

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This article analyzes the relationship between tax rate levels and tax evasion in a context where the utility of a taxpayer depends on both his or her own consumption and relative position with respect to the average declared income of the economy. In this framework, if the taxpayer declares an amount of his or her income greater (smaller) than the average of the economy, that person's utility will decrease (increase). The author shows that, if the externality from the others' declared income is taken into account, several equilibria arise in the economy. Then, an increase in the tax rate leads to a larger amount of unreported income at the equilibrium displaying the lowest income reports. This comparative statics result agrees with most of the existing empirical evidence.

Keywords: tax evasion; relative tax contribution

1. INTRODUCTION

The sign of the relationship between the tax rate level and the amount of income declared by taxpayers is one of the questions that still is not satisfactorily resolved nowadays. Allingham and Sandmo (1972) introduced the portfolio approach to solve the individual tax evasion problem and showed that, under decreasing absolute risk

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aversion, the sign of the relationship between the amount of voluntarily declared income and the tax rate is ambiguous when the fine imposed on caught evaders is proportional to the amount of income concealed from the tax authority. However, Yitzhaki (1974) found that a rise in the tax rate increases the amount of reported income under decreasing absolute risk aversion when the fine paid by an audited evader is proportional to the amount of evaded taxes. This modification makes the original model more realistic but generates an unambiguous result that has not been supported by the empirical evidence because several studies have documented that higher tax rates tend to stimulate tax evasion.¹ Yitzhaki (1987) modified his previous model by assuming that the probability of being caught evading is an increasing function of the amount of undeclared income. In this context, he showed that a compensate increase in the marginal tax rate results in more tax evasion.² Along this line of research, many authors—such as Gordon (1989); Klepper, Nagin, and Spurr (1991); Lee (2001); and Panadés (2001)—have searched for alternative models aimed at explaining this evident contradiction between the empirical findings and the theoretical ones.³

The objective of this article is to present another natural framework in which it is possible to obtain a negative relationship between declared income and tax rate levels in equilibrium. To this end, I modify the basic portfolio model of tax evasion by assuming that the utility of a taxpayer depends on both his or her consumption and relative position with respect to the average declared income of the economy. I am thus introducing an externality arising from the amount of income reported by the other taxpayers. The question I address in this article is whether the assumption that taxpayers dislike to pay more taxes than others helps us in obtaining a result more consistent with the empirical evidence. Therefore, I will investigate whether the introduction of this externality allows us to generate a positive relationship between the tax rate level and the amount of income concealed from the tax authority.

Several economic models have used the assumption that the relative position of an individual in his or her community affects his or her felicity. The most relevant example can be found in the theory of asset pricing, in which some authors have assumed that one of the arguments of the utility function is the ratio between an individual's

private consumption and the average consumption of the economy (see Galí 1994; Abel 1999). This departure from the traditional formulation of the utility function allows these authors to obtain a possible resolution of the equity premium puzzle posed by Mehra and Prescott (1985).⁴ This kind of “keeping up with the Joneses” feature is also present in our tax evasion problem because individuals will care about their relative tax contribution.

In this context, when a taxpayer declares an amount of his or her income greater (smaller) than the average of the economy, his or her utility will decrease (increase). The introduction of this externality from the others’ declared income generates an additional negative effect on a taxpayer’s willingness to report his or her true income. This new effect could offset the positive income effect associated with an increase in the tax rate. In this case, I will show that when the tax rate increases, taxpayers could end up reporting less income under decreasing absolute risk aversion. In fact, I will show that the model displays at least two equilibria with different associated values of reported income. For the equilibrium with the lowest income report, the disutility obtained by a taxpayer accruing from marginally increasing his or her own amount of reported income turns out to be so large that equilibrium reports end up being decreasing in the tax rate level. Obviously, the opposite occurs at the equilibrium associated with the largest amount of reported income.

The next section presents a model of tax evasion in which the relative tax contribution affects the utility of taxpayers. Section 3 describes the equilibria of this economy. In Section 4, I perform the corresponding comparative statics exercise. In Section 5, I explore the robustness of the main result, considering an alternative penalty structure. The final section offers some concluding remarks.

2. THE MODEL

Let us consider the standard Allingham and Sandmo (1972) model of tax evasion. There is a continuum of taxpayers who are identical *ex ante*. All taxpayers have the same exogenous income y , which is subjected to a flat tax rate $\tau \in (0, 1)$. Let x be the amount of income declared by a taxpayer. The tax authority audits the tax reports with

an exogenous probability $p \in (0, 1)$, and if such an investigation takes place, the true income y is always discovered. In this case, the taxpayer has to pay a proportional fine $\pi > 1$ on the amount of evaded taxes. This specification of the tax evasion problem is thus the same as that of Yitzhaki (1974).

I assume that the taxpayer's utility depends on both his or her contingent consumption and relative position with respect to the average declared income in the economy. In particular, I assume that the utility of a taxpayer diminishes when he or she is declaring an amount greater than the average of the other taxpayers. This kind of externality accruing from the others' reported income captures the idea that taxpayers care about their relative position in the economy. Note that because tax rates are flat, we could replace the assumption that individuals care about their relative report with the equivalent assumption that they care about their relative position in terms of voluntary tax contributions. Therefore, let us assume that each taxpayer maximizes the following expected utility:

$$(1 - p)u(C^N) + pu(C^Y) - \gamma v\left(\frac{x}{\bar{x}}\right), \quad \text{with } \gamma > 0, \quad (1)$$

where $C^N \equiv y - \tau x$ is the individual consumption when the taxpayer is not audited, $C^Y \equiv y - \tau x - \pi \tau (y - x)$ is the consumption when the taxpayer is audited, and \bar{x} is the average declared income of the economy. I assume that the utility u satisfies $u' > 0$ and $u'' < 0$. The function v depends on the relative tax contribution x/\bar{x} of the taxpayer under consideration. Moreover, I will also assume that $v'' > 0$ and $v'(0) = 0$. This means that $v'(x/\bar{x}) > 0$ whenever $x/\bar{x} > 0$. The parameter $\gamma > 0$ measures the importance of the relative tax contribution. Under the previous assumptions, it is clear that each individual derives disutility from declaring more income than the average taxpayer. Therefore, taking as given the average report \bar{x} , each individual chooses the amount x of declared income to maximize (1). The first-order condition for this maximization problem when $\bar{x} > 0$ is

$$-\tau(1 - p)u'(C^N) + \tau(\pi - 1)pu'(C^Y) - \gamma v'\left(\frac{x}{\bar{x}}\right) \frac{1}{\bar{x}} = 0. \quad (2)$$

The second-order condition,

$$D \equiv (-\tau)^2(1 - p)u''(C^N) + \tau^2(\pi - 1)^2 pu''(C^Y) - \gamma v''\left(\frac{x}{\bar{x}}\right) \left(\frac{1}{\bar{x}}\right)^2 < 0,$$

is clearly satisfied because $u'' < 0$ and $v'' > 0$.

To obtain the restrictions on the parameter values of the optimization problem yielding interior income reports when $\bar{x} > 0$, I evaluate the first-order condition at $x = 0$ and $x = y$. Because (1) is a concave function of x , and $v'(0) = 0$, the following two conditions are sufficient to obtain an optimal report such that $x \in (0, y)$:

$$\tau(\pi - 1)pu'[y(1 - \tau\pi)] > \tau(1 - p)u'(y) \quad (3)$$

and

$$p\pi < 1. \quad (4)$$

I thus restrict my analysis to a parameter configuration in which the previous two inequalities are satisfied.

3. EQUILIBRIUM

As a first step toward examining the sign of the relation between reported income and tax rates, we need to find the equilibrium of this economy. As all taxpayers are identical before the potential inspection occurs, it holds that $\bar{x} = x$ in equilibrium. As a consequence, the first-order condition (2) becomes in equilibrium

$$-\tau(1 - p)u'(C^N) + \tau(\pi - 1)pu'(C^Y) - \gamma v'(1) \left(\frac{1}{x}\right) = 0. \quad (5)$$

The next proposition refers to the multiplicity of equilibria exhibited by this economy:

Proposition 1. There exists a $\gamma^* > 0$ such that, for every $\gamma \in (0, \gamma^*)$, the economy has at least two different equilibrium values for the amount x of reported income.

Proof. See the appendix.

This proposition ensures that, for a sufficiently small positive value of γ , the economy displays several equilibria associated with different levels of reported income. Let x_1 be the lowest equilibrium level of declared income, whereas x_2 is the largest equilibrium level of declared income. Note that in both equilibria, the level of evasion is larger than that obtained in the original model without externalities (i.e., when $\gamma = 0$). This is so because the introduction of the negative

externality associated with relative tax contribution generates an additional effect that penalizes truthful income reporting.

To understand the emergence of the several equilibria displayed by this model, we should bear in mind that taxpayers could coordinate their reporting strategies to an equilibrium with low reports. In this case, as the average report \bar{x} is small, the marginal disutility of declaring more income is large because the denominator of the relative tax contribution x/\bar{x} is small. This makes taxpayers declare optimally a small amount of income, which in turn confirms the assumption that the average reported income \bar{x} is small. The opposite argument applies to an equilibrium with a large level of reported income.

We will show in the next section that the effects of changes in the tax rates on reported income depend on the specific equilibrium value of the reported income at which we perform the comparative statics exercise.

4. EFFECTS ON TAX EVASION OF CHANGES IN THE TAX RATE

Let us rewrite condition (5) as

$$-\tau(1-p)xu'(C^N) + \tau(\pi-1)xpu'(C^Y) - \gamma v'(1) = 0. \quad (6)$$

Therefore, when the externality on average declared income is present, the effect of an increase in the tax rate on reported income is given by the following expression, which is obtained from implicitly differentiating (6):

$$\frac{\partial x}{\partial \tau} = \frac{(1-p)xu'(C^N) - \tau(1-p)x^2u''(C^N) - (\pi-1)pxu'(C^Y) + \tau(\pi-1)px(x+\pi(y-x))u''(C^Y)}{((-\tau)^2(1-p)u''(C^N) + \tau^2(\pi-1)^2pu''(C^Y))x - \tau(1-p)u'(C^N) + \tau(\pi-1)pu'(C^Y)}. \quad (7)$$

The following proposition gives us the sign of the previous derivative:

Proposition 2. Let $\gamma \in (0, \gamma^*)$. Assume that the utility function u exhibits decreasing absolute risk aversion (DARA). Then,

$$\left. \frac{\partial x}{\partial \tau} \right|_{x=x_1} < 0 \quad \text{and} \quad \left. \frac{\partial x}{\partial \tau} \right|_{x=x_2} > 0.$$

Proof. See the appendix.

The previous result tells us that an increase in the tax rate can lead to either less or more reported income depending on the equilibrium at which we evaluate the policy change. The intuition behind Proposition 2 lies in the combination of two opposite effects. First, we have the effect associated with an increase in the tax rate. When the fine is imposed on the amount of evaded taxes, the penalty rate increases proportionally with τ , and therefore, there is no incentive to substitute evasion for honesty. Thus, we are left with a pure income effect, and the sign of this effect depends on the behavior of the taxpayer's index of absolute risk aversion. In particular, this income effect on the amount of reported income is positive under DARA because, when the wealth diminishes as a consequence of an increase in the tax rate, the absolute risk aversion rises, and thus the taxpayer tends to evade less to reduce his or her risk exposure.

Second, we have the effect associated with the change in the relative declared income. An increase in the amount of an individual's declared income places a taxpayer in a worse relative position with respect to the other taxpayers, and thus his or her utility decreases. Therefore, the externality from the others' reports makes taxpayers reduce the amount of their reported income.

The sign of expression (7) depends on the importance of the two effects discussed above. In particular, Proposition 2 tells us that the externality effect will offset the income effect depending on the equilibrium that we are considering. When we evaluate the derivative (7) at the lowest-income report equilibrium x_1 , the externality effect is greater than the income effect, and therefore, an increase in the tax rate will result in more tax evasion. The intuition of this result lies in the fact that the equilibrium value x_1 is associated with a low value of the average report \bar{x} ; hence, to declare one additional unit of own income results in a large marginal disutility. Obviously, when we evaluate the derivative (7) at the largest-income report equilibrium x_2 , the average reported income of the economy is also large, and thus the marginal disutility of an increase of reported income is small. As a consequence, the income effect compensates the externality effect, and we recover the original result of Yitzhaki (1974) at x_2 .

Note that the negative relation between x and τ obtained in the low-income report equilibrium agrees with the aforementioned empirical findings. Notice that in Yitzhaki (1974), the sign of the

derivative (7) was unambiguously positive under DARA, whereas I have shown that the opposite result can be obtained under the same assumption.

5. THE CASE OF PENALTIES ON EVADED INCOME

To see whether the effect of an increase in the tax rate on tax evasion is sensitive to the penalty structure, let us consider the case in which the penalty rate $\hat{\pi}$ is imposed on the amount of unreported income, as in Allingham and Sandmo (1972). Needless to say, most of the tax codes around the world impose fines on the amount of evaded taxes rather than on the amount of income concealed from the tax authority. In this section, I will carry out under the new penalty structure the same analysis that I made in the previous section under the (much more realistic) penalty specification of Yitzhaki (1974). Note that the two penalty structures are directly related because $\hat{\pi} = \pi \tau$.

The consumption when the taxpayer is not audited is again $C^N \equiv y - \tau x$, but the consumption if the inspection takes place will be $C^Y \equiv y - \tau x - \hat{\pi}(y - x)$, where $\hat{\pi} > \tau$.⁵ The first-order condition of the taxpayer's problem when $\bar{x} > 0$ becomes now

$$-\tau(1-p)u'(C^N) + (\hat{\pi} - \tau)pu'(C^Y) - \gamma v' \left(\frac{x}{\bar{x}} \right) \frac{1}{\bar{x}} = 0. \quad (8)$$

The second-order condition,

$$\hat{D} \equiv (-\tau)^2(1-p)u''(C^N) + (\hat{\pi} - \tau)^2 pu''(C^Y) - \gamma v'' \left(\frac{x}{\bar{x}} \right) \left(\frac{1}{\bar{x}} \right)^2 < 0,$$

is also satisfied as $u'' < 0$ and $v'' > 0$.

In this case, the following conditions on parameter values ensure that the solutions of the taxpayer's problem when $\bar{x} > 0$ are interior, that is, $x \in (0, y)$:

$$(\hat{\pi} - \tau)pu'[y(1 - \hat{\pi})] > \tau(1-p)u'(y)$$

and

$$p\hat{\pi} < \tau.$$

I restrict again my analysis to a parameter configuration in which the previous two inequalities hold.

Applying the equilibrium condition $x = \bar{x}$ on (8), we get

$$-\tau(1-p)u'(C^N) + (\hat{\pi} - \tau)pu'(C^Y) - \gamma v'(1) \left(\frac{1}{x} \right) = 0. \quad (9)$$

The next proposition refers also to the existence of multiple equilibria in this economy:

Proposition 3. There exists a $\gamma^{**} > 0$ such that, for every $\gamma \in (0, \gamma^{**})$, the economy has at least two different equilibrium values for the amount x of reported income.

Proof. See the appendix.

In this case, we also have at least two values of reported income x that satisfy equation (9). The intuition for this result is the same as in Proposition 1. Let \hat{x}_1 and \hat{x}_2 be the lowest and largest equilibrium value of reported income, respectively. The impact of a tax increase on declared income is given by the sign of the following derivative obtained from implicitly differentiating (9):

$$\frac{\partial x}{\partial \tau} = \frac{(1-p)u'(C^N) - \tau(1-p)xu''(C^N) + pu'(C^Y) + (\hat{\pi} - \tau)pxu''(C^Y)}{(-\tau)^2(1-p)u''(C^N) + (\hat{\pi} - \tau)^2 pu''(C^Y) - \tau(1-p)u'(C^N) + (\hat{\pi} - \tau)pu'(C^Y)}. \quad (10)$$

The following proposition provides the sign of expression (10) when the utility function u displays constant relative risk aversion and under an empirically reasonable restriction on the parameter values of the model:

Proposition 4. Assume that the utility function u exhibits constant relative risk aversion (CRRA), $\hat{\pi} \leq 1$ and $r \leq 1/\hat{\pi}$, where $r \equiv \frac{-Cu''(C)}{u'(C)}$ is the index of relative risk aversion. Then, there exists a $\hat{\gamma} \in (0, \gamma^{**})$ such that, for all $\gamma \in (0, \hat{\gamma})$,

$$\left. \frac{\partial x}{\partial \tau} \right|_{x=\hat{x}_1} > 0 \quad \text{and} \quad \left. \frac{\partial x}{\partial \tau} \right|_{x=\hat{x}_2} < 0.$$

Proof. See the appendix.

I also obtain in this case that an increase in the tax rate results in either more or less reported income, depending on the equilibrium we are considering. It should be noticed that under this penalty

specification, there exists a substitution effect because fines no longer depend on the tax rate, and hence an increase in the tax rate penalizes honest behavior. Therefore, under the conditions of Proposition 4, the amount of evaded income is already increasing in the tax rate when the externality associated with the relative tax contribution is absent. Note, however, that at the high-income report equilibrium \hat{x}_2 , the externality effect accruing from modifying one's own income report is small because the denominator of the relative tax contribution x/\bar{x} is large. Therefore, externalities are not strong enough to reverse the comparative statics result obtained when $\gamma = 0$. On the contrary, at the low-income report equilibrium \hat{x}_1 , the denominator of x/\bar{x} is so small, and thus externalities are so strong that the sign of the corresponding derivative is reversed. Finally, note that in this context, the comparative statics result that agrees with the empirical evidence corresponds to the equilibrium exhibiting a large amount of declared income, which is in stark contrast to Proposition 2. Nevertheless, recall that the previous result is obtained under a quite unrealistic penalty structure.

6. CONCLUDING REMARKS

In this article, I have made a new attempt to explain the apparent contradiction between the results obtained by the traditional models of tax evasion and the empirical evidence about the reaction of taxpayers to changes in tax rate levels. Although most of the theoretical models predict that reported income increases with the tax rate, the empirical evidence runs in the opposite direction. An obvious strategy to resolve this contradiction is to endow the basic model with new elements aimed at better capturing some features of taxpayer behavior. Along this line of research, in this study, I have considered an equilibrium model in which the utility function of a taxpayer depends both on the amount of his or her own consumption and relative tax contribution. My analysis shows that an increase in the tax rate could induce taxpayers to raise the amount of unreported income when penalties are imposed on the amount of evaded taxes. This is so because there exists an equilibrium in which individuals coordinate in such a way that reports are so low that to declare more income than the rest of

taxpayers is heavily penalized. At this low-income report equilibrium, a tax rate increase results in more income concealed from the tax authority.

APPENDIX A

Proof Proposition 1. Condition (5) can be rewritten as

$$\underbrace{-\tau(1-p)u'(C^N) + \tau(\pi-1)pu'(C^Y)}_{F(x)} = \underbrace{\gamma v'(1)}_{H(x)} \left(\frac{1}{x}\right). \quad (\text{A.1})$$

Note that the concavity of u ensures that

$$F'(x) = (-\tau)^2(1-p)u''(C^N) + \tau^2(\pi-1)^2pu''(C^Y) < 0.$$

Moreover, $F(0)$ is finite and strictly positive, and $F(y)$ is strictly negative because conditions (3) and (4) hold by assumption. The function $H(x)$ is an hyperbole satisfying $H'(x) < 0$, $\lim_{x \rightarrow 0} H(x) = \infty$, and $\lim_{x \rightarrow \infty} H(x) = 0$. In consequence, it is immediate to see that $F(x)$ and $H(x)$ intersect at least two times for a sufficiently low positive value of γ . Therefore, there exists a γ^* such that, for all $\gamma \in (0, \gamma^*)$, equation (A.1) has at least two solutions for x belonging to the open interval $(0, y)$. ■

Proof Proposition 2. Combining (A.1) with (7) and rearranging, we have that

$$\frac{\partial x}{\partial \tau} = \frac{-\gamma v'(1)\left[\frac{1}{x} + (x + \pi(y-x))R_A(C^Y)\right] - \tau(1-p)xu'(C^N)\left[(x + \pi(y-x))R_A(C^Y) - xR_A(C^N)\right]}{xF'(x) + \gamma v'(1)\left(\frac{1}{x}\right)}, \quad (\text{A.2})$$

where $R_A(C) \equiv \frac{-u''(C)}{u'(C)}$ is the Arrow-Pratt index of absolute risk aversion. The numerator of (A.2) is unambiguously negative under DARA because $x + \pi(y-x) > x$ and $C^Y < C^N$. The denominator of (A.2) will be positive if

$$\gamma v'(1) > -x^2 F'(x). \quad (\text{A.3})$$

Obviously, for the lowest-income report equilibrium x_1 , it holds that $F'(x_1) > H'(x_1)$, where

$$H'(x) = -\gamma v'(1) \left(\frac{1}{x^2}\right).$$

Then, condition (A.3) holds at x_1 ; consequently, $\frac{\partial x}{\partial \tau} \Big|_{x=x_1} < 0$. For x_2 , it holds that $F'(x_2) < H'(x_2)$. We thus get in this case that $\frac{\partial x}{\partial \tau} \Big|_{x=x_2} > 0$. ■

Proof Proposition 3. From condition (9), we know that the equilibrium value of declared income has to satisfy

$$\hat{F}(x) = H(x),$$

where $\hat{F}(x) = -\tau(1-p)u'(C^N) + (\hat{\pi} - \tau)pu(C^Y)$ and $H(x) = \gamma v'(1)(\frac{1}{x})$. Following the same arguments as in the proof of Proposition 1, it is immediate to see that $\hat{F}(x)$ and $H(x)$ have at least two intersection points on $(0, y)$ for a sufficiently low positive value of γ . ■

Proof of Proposition 4. Combining (9) with (10) and rearranging terms, we get

$$\frac{\partial x}{\partial \tau} = \frac{\gamma v'(1)[\frac{1}{x(\hat{\pi}-\tau)} - R_A(C^Y)] + (1-p)u'(C^N)[\frac{\hat{\pi}}{(\hat{\pi}-\tau)} - \tau x[R_A(C^Y) - R_A(C^N)]]}{x\hat{F}'(x) + \gamma v'(1)(\frac{1}{x})}. \quad (\text{A.4})$$

Note that only the first term of the numerator depends on γ , and this term can be made negligible for a sufficiently small positive value of γ . Then, following the same arguments as those appearing in Yaniv (1994), we obtain that, if the utility function exhibits CRRA, $\hat{\pi} < 1$, and $r \leq 1/\hat{\pi}$, then the second term in the numerator of (A.4) will be positive. The denominator of (A.4) will be positive if

$$\gamma v'(1) > -x^2 \hat{F}'(x). \quad (\text{A.5})$$

It is easy to see that $\hat{F}'(\hat{x}_1) > H'(\hat{x}_1)$. Then, condition (A.5) holds at \hat{x}_1 ; consequently, $\frac{\partial x}{\partial \tau}|_{x=\hat{x}_1} > 0$ for a sufficiently small positive value of γ . Similarly, $\hat{F}'(\hat{x}_2) < H'(\hat{x}_2)$. In this case, we have $\frac{\partial x}{\partial \tau}|_{x=\hat{x}_2} < 0$ for a sufficiently small positive value of γ . ■

NOTES

1. Clotfelter (1983) and Poterba (1987) report a positive relation between tax rate and undeclared income using a real income database.
2. A compensate increase in the marginal tax rate occurs when the net income of a taxpayer does not vary as a consequence of the change in the marginal tax rate.
3. Slemrod (1985) and Feinstein (1991) cast some doubts on the results obtained by some of these authors because they argue that it is not possible to distinguish between the effect of the tax rate on evaded income and the overall effect of other variables that are also relevant for the problem under consideration.
4. Several recent papers in macroeconomics have analyzed the dynamic effects of introducing relative consumption as an argument in the utility function (see Ljungqvist and Uhlig 2000; Carroll, Overland, and Weil 1997; de la Croix 1998).
5. This penalty formulation requires that $\hat{\pi} > \tau$ because otherwise, tax evasion would not be punished.

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