Tax Rates, Tax Evasion, and Growth in a Multi-period Economy*

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Resumen

Extendemos el modelo básico de evasión fiscal a una economía con varios periodos que exhiba crecimiento sostenido. Cuando los individuos ocultan parte de su verdadera renta a la autoridad fiscal se enfrentan al riesgo de ser inspeccionados y, por consiguiente, de pagar la multa correspondiente. Los impuestos y las multas determinan el ahorro individual y la tasa de acumulación del capital. Demostramos que, si la multa que se impone a los defraudadores es proporcional al importe de los impuestos evadidos, entonces la tasa de crecimiento decrece con el tipo impositivo. Sin embargo, la relación entre crecimiento y el tipo impositivo se convierte en no monótona cuando la multa se impone sobre la cantidad de renta evadida.

Palabras Clave: Evasión fiscal, Crecimiento.

Clasificación JEL: H26, E62, O41.

1. Introduction to the Tax Evasion Problem

In this paper we analyze how the rate of economic growth and the fraction of income declared by taxpayers vary with the tax rate on income. Yitzhaki (1974) in a very influential paper considered a static economy where the penalties were proportional to the amount of evaded taxes and individual preferences exhibited decreasing absolute risk aversion. In this context, Yitzhaki showed that an increase in the tax rate results in a smaller amount of unreported income. However, a positive relation between tax rate levels and evasion has been documented by several empirical studies (see Clotfelter, 1983; Crane and Nourzad, 1987; Poterba, 1987; and Joulfaian and Rider, 1996). In order to reconcile theory with empirical evidence, many papers have tried to generate that positive relationship through

substantial departures from the original Yitzhaki's model. Among these papers, Cowell and Gordon (1988) consider a framework where taxpayers take into account the provision of public goods. Landskroner et al. (1990) add to the basic model the possibility of investing in financial assets and, thus, the tax evasion decision is embedded in a more general portfolio selection problem. Panadés (2001) builds a Ricardian framework where the tax evasion implications of an increase in the tax rate are independent of the crowding out effect. Lee (2001) considers the possibility of self-insurance against possible penalties. Chen (2003) introduces transaction costs associated with tax evasion. Finally, Panadés (2004) departs from the standard model by making taxpayers' utility depend on the relative tax contribution.

We will consider a capital accumulation model where individuals have to choose in each period the amount of wealth they want to consume and the amount of income they report to the tax agency. The tax agency audits taxpayers with some exogenous probability and, if a taxpayer is caught evading, he must pay the corresponding fine. As a by-product, the previous individual choices determine the total amount of productive investment, which in turn determines the stock of capital (or wealth) in the next period.

Obviously, the amount of unreported income decreases with the tax rate in this dynamic scenario when fines are imposed on the amount of evaded taxes and the preferences of all the individuals of the economy are represented by the typical isoelastic Bernoulli utility defined on consumption, $u(c) = \dfrac{c^{1-\sigma}}{1-\sigma}$ with $\sigma > 0$. The intuitive arguments for this result are basically those of the static theory of portfolio selection. Let y be the income of an individual, x is the amount of voluntarily reported income, $\tau \in (0,1)$ is the flat tax rate on income, $p \in (0,1)$ is the probability of being audited by the tax enforcement agency, and $\pi > 1$ is the proportional penalty imposed on the amount of evaded taxes when a taxpayer is caught evading.[1] Therefore, consumption turns out to be a random variable taking the value $y - \tau x - \pi\tau(y - x)$ with probability p and $y - \tau x$ with probability $1 - p$. Let $e = y - x$ be the amount of income concealed from the tax authority. Therefore, the final disposable income is $(1 - \tau)y + e\tau\tilde{h}$, where $\tilde{h}$ is a random variable whose probability function is

$$f(h) = \begin{cases} p & \text{for} \quad h = 1 - \pi, \\ 1 - p & \text{for} \quad h = 1. \end{cases} \tag{1.1}$$

Note that $E(\tilde{h}) = 1 - p\pi$. We assume that

$$p\pi < 1, \tag{1.2}$$

which amounts to have $E(\tilde{h}) > 0$, as is customary in the tax evasion literature to guarantee that some evasion takes place. A taxpayer solves thus the following problem:

$$Max_{e} E\left\{\frac{1}{1-\sigma}\left[(1-\tau)y + e\tau\tilde{h}\right]^{1-\sigma}\right\},$$

which, after making an affine transformation, is equivalent to

$$Max_{e} E\left\{\frac{1}{1-\sigma}\left[\left(\frac{1}{\tau}-1\right)y + e\tilde{h}\right]^{1-\sigma}\right\}. \tag{1.3}$$

Note that the previous problem can be viewed as one of selecting the amount invested in a risky asset with random return $\tilde{h}$. Since $E(\tilde{h}) > 0$, we know that the agent will invest some positive amount in the risky asset, that is, $e > 0$ or, equivalently, $x < y$. As τ increases, the argument of the Bernoulli utility function in (1.3) decreases for a given level e of evasion. Since the isoelastic utility displays decreasing absolute risk aversion, an increase in τ makes individuals more risk averse, and this obviously implies that the optimal amount e invested in the risky asset should decrease (see Arrow, 1970; and Pratt, 1964). In fact, Yitzhaki (1974) already proved that the negative relationship between the amount e of income concealed from the tax authority and the tax rate τ holds for all the utilities displaying a decreasing index of absolute risk aversion. Finally, since the value function associated with an isoelastic Bernoulli function is also isoelastic (see Hakansson, 1970), the argument based on the relation between the behavior of the index of absolute risk aversion and individual risk taking should also apply to a dynamic context. In other words, the sign of the relationship between wealth and amount invested in risky asset is preserved in multi-period models of portfolio selection.

In this article we will also discuss the growth implications of changes in taxpayers' behavior due to variations in the tax rate. In particular, we will see that, when penalties are imposed proportionally to the amount of evaded taxes, a higher tax rate results in less income available to purchase new capital. Therefore, the economy ends up growing at a slower rate when the tax rate increases.

We will show however that, if the penalty rate is imposed on the amount of unreported income rather than on the amount of evaded taxes (as in Allingham and Sandmo, 1972), then the amount of income concealed from the tax authority increases with the tax rate. This is so because no income effect is present in this scenario. Therefore, an increase in the tax rate just raises the relative cost of honesty and this could result in a larger amount of income concealed from the tax enforcement agency. Moreover, we will see that in this case it is possible to generate a rate of economic growth that is locally increasing in the tax rate. However, we should note that the penalty structure assumed by Allingham and Sandmo is much less appealing in empirical grounds since it is at odds with the provisions of existing tax codes.

In the next section we develop the basic model with penalties proportional to the amount of evaded taxes. This exercise illustrates the robustness of Yitzhaki's analysis. In Section 3 we consider the case where the proportional penalties are imposed on the amount of unre-

ported income. We will discuss in Section 4 the implications of changes in the tax rate for the rate of economic growth in both cases. The last section concludes the paper.

2.   Fines Proportional to the Amount of Evaded Taxes

Let us consider a dynamic competitive economy in discrete time with a continuum of ex-ante identical individuals lying on the interval $[0,1]$. Each individual $\in [0,1]$ has access to a technology represented by the net production function $y_t(i) = A k_t(i)$ with $A > 0$, where $y_t(i)$ is the net output and $k_t(i)$ is the amount of capital he owns in period t.[2] Output can be devoted to either consumption or investment. After production has taken place, the individual decides both his consumption $c_t(i)$ and the amount $x_t(i)$ of declared income, and then he pays the corresponding income tax at the flat rate $\tau \in (0,1)$. If he is inspected by the tax enforcement agency, the total amount of unreported income is discovered and the taxpayer has to pay a penalty at the flat rate $\pi > 1$, which is imposed on the amount of evaded taxes (as in Yitzhaki, 1974). Inspection of a particular individual is an event that occurs with probability $p \in (0,1)$. The probability of inspection p and the penalty rate π satisfy assumption (1.2) to ensure positive tax evasion. Note that, even if there is no uncertainty about the output produced by an individual (since the initial capital and the audit history of an individual is common knowledge), an audit by the agency is necessary in order to certify indisputably the level of income of a given household.

In the next section we will assume instead that the penalty rate $\hat{\pi}$ is imposed on the amount of unreported income (as in Allingham and Sandmo, 1972) and, thus, is independent of the tax rate. Note however that in both scenarios the audit probability is assumed to be independent of both the current amount of reported income and the history of reports and audits of each taxpayer. This simplifying assumption allows us to focus on the growth implications of imposing penalty rates either on the amount of evaded taxes or on the amount of evaded income. Note that a variation in the tax rate only affects the cost of honesty in the latter case, whereas an increase in the tax rate τ raises the cost of both honesty and cheating in the former case. Moreover, audit strategies that depend on the past audit history and on the taxpayers' reports are characterized under an explicit objective of the tax enforcement agency, like the maximization of either the amount of government revenues or of taxpayers' welfare. However, we do not make explicit the maximization problem of the agency and we take instead as given the values of the instruments chosen by the agency so as to keep the setup as close as possible to Yitzhaki (1974) and Allingham and Sandmo (1972). Then, we proceed to evaluate the growth implications of their alternative penalty structures.

The amount of output remaining after consumption has taken place and taxes and (potential) penalties have been paid by a consumer i constitutes his net investment, which is added to the capital stock $k_t(i)$ that he owned at the beginning of period t. The resulting stock $k_{t+1}(i)$ is used for next period production. Therefore, the budget constraint of an audited individual is

$$Ak_t(i) - \tau x_t(i) - \pi\tau[Ak_t(i) - x_t(i)] = c_t(i) + [k_{t+1}(i) - k_t(i)], \qquad (2.1)$$

whereas the budget constraint of a non-audited individual is

$$Ak_t(i) - \tau x_t(i) = c_t(i) + [k_{t+1}(i) - k_t(i)]. \qquad (2.2)$$

We assume that the amount of taxes collected by the tax agency is devoted to finance a government spending g_t that takes the form of non-excludable public good. According to the law of large numbers, the budget constraint of the government in per capita terms is the following:

$$g_t = \tau\bar{x}_t + \pi\tau(A\bar{k}_t - \bar{x}_t),$$

where $\bar{k}_t = \int_{[0,1]} k_t(i)di$ and $\bar{x}_t = \int_{[0,1]} x_t(i)di$ are the aggregate amounts of capital and reported income, respectively, in period t. We assume that g_t enters into the instantaneous utility of individuals in an additive way. Therefore, the marginal rate of substitution of private consumption between two arbitrary periods is not affected by the level of government spending. Moreover, under this additive specification, government spending does not affect the marginal rate of substitution of consumption in the two states of the nature within the same period, namely, when the individual is audited and when he is not. Individuals are thus assumed to maximize the following discounted sum of instantaneous utilities taking as given the path $\{g_t\}_{t=0}^{\infty}$ of government spending per capita:

$$\sum_{t=0}^{\infty} \beta^t[u(c_t(i)) + v(g_t)], \qquad (2.3)$$

where $\beta \in (0,1)$ is the discount factor. Following most of the growth literature and in order to obtain simple equilibrium equations, we use the logarithmic functional form for the instantaneous utility accruing from private consumption, $u(c_t(i)) = \ln c_t(i)$. However, the model can be generalized to an isoelastic utility function with non-unitary index of relative risk aversion as follows from the discussion in Section 1. Moreover, recall that logarithmic preferences yield a saving rate that is independent of the interest rate, which agrees with the empirical evidence. Finally, note that the additive utility accruing from government spending can be suppressed from the consumers' objective function since consumers take as given the path of g_t.[3]

The amount of unreported income of individual in period is

$$e_t(i) = Ak_t(i) - x_t(i).$$

Hence, we can use the previous budget constraints (2.1) and (2.2) to write the law of motion of capital per capita as

$$k_{t+1}(i) = \begin{cases} \left[1 + (1 - \tau)A\right]k_t(i) - c_t(i) + \tau(1 - \pi)e_t(i), & \text{with probability } p, \\[2ex] \left[1 + (1 - \tau)A\right]k_t(i) - c_t(i) + \tau e_t(i), & \text{with probability } (1 - p), \end{cases}$$

or, equivalently,

$$k_{t+1}(i) = \left[1 + (1 - \tau)A\right]k_t(i) - c_t(i) + \tau\tilde{h}(i)e_t(i), \tag{2.4}$$

where $\tilde{h}(i)$ is an idiosyncratic i.i.d. random variable having the probability function

$$f(h(i)) = \begin{cases} p & \text{for} \quad h(i) = 1 - \pi, \\[2ex] 1 - p & \text{for} \quad h(i) = 1, \end{cases} \tag{2.5}$$

and, hence, $E(\tilde{h}(i)) = 1 - p\pi$ for all $i \in [0,1]$.

The Bellman equation for the stochastic dynamic problem faced by individual i is

$$V(k_t(i)) = \underset{c_t(i),\, e_t(i)}{Max} \left\{ \ln c_t(i) + \beta E_t\left[V(k_{t+1}(i))\right] \right\}, \tag{2.6}$$

where $k_{t+1}(i)$ satisfies (2.4) and the operator E_t is the conditional expectation given the information available at the beginning of period t. It is well known that the value function for this problem is an affine transformation of the logarithmic function, $V(k_t(i)) = D\ln k_t(i) + G$ with $D > 0$ (see Hakansson, 1970). Therefore, using (2.4) and computing the conditional expectation $E_t\left[V(k_{t+1}(i))\right]$, the optimization problem faced by the taxpayer i who has an amount of capital $k_t(i)$ at the beginning of period t, becomes

$$\underset{c_t(i),\, e_t(i)}{Max} \left\{ \ln c_t(i) + \beta(D\left[p\ln(n_t(i) - c_t(i) + \tau(1 - \pi)e_t(i)) + \right. \right.$$
$$\left. \left. + (1 - p)\ln(n_t(i) - c_t(i) + \tau e_t(i))\right] + G) \right\},$$

where the variable $n_t(i)$ is the after-tax wealth of an honest taxpayer, which is given by

$$n_t(i) = \left[1 + (1 - \tau)A\right]k_t(i). \tag{2.7}$$

Differentiating with respect to $c_t(i)$ and $e_t(i)$ we obtain the following first order conditions for the previous problem:

$$\frac{1}{c_t(i)} = \beta D\left[\frac{p}{n_t(i) - c_t(i) + \tau(1 - \pi)e_t(i)} + \frac{1 - p}{n_t(i) - c_t(i) + \tau e_t(i)}\right],$$

and

$$\frac{p(\pi - 1)}{n_t(i) - c_t(i) + \tau(1 - \pi)e_t(i)} = \frac{1 - p}{n_t(i) - c_t(i) + \tau e_t(i)}.$$

Solving for $c_t(i)$ and $e_t(i)$ in the previous two equations, we obtain

$$c_t(i) = \frac{1}{1 + \beta D} n_t(i) \tag{2.8}$$

and

$$e_t(i) = \left(\frac{\beta D}{1 + \beta D}\right)\left(\frac{1 - p\pi}{\tau(\pi - 1)}\right)n_t(i). \tag{2.9}$$

Using the expressions for $c_t(i)$ and $e_t(i)$ we have just obtained, the Bellman equation (2.6) becomes

$$D\ln k_t(i) + G = \ln\left(\frac{1}{1 + \beta D}n_t(i)\right) +$$

$$+\beta Dp\ln\left(n_t(i) - \frac{1}{1 + \beta D}n_t(i) + \tau(1 - \pi)\left(\frac{\beta D}{1 + \beta D}\right)\left(\frac{1 - p\pi}{\tau(\pi - 1)}\right)n_t(i)\right) +$$

$$+\beta D(1 - p)\ln\left(n_t(i) - \frac{1}{1 + \beta D}n_t(i) + \tau\left(\frac{\beta D}{1 + \beta D}\right)\left(\frac{1 - p\pi}{\tau(\pi - 1)}\right)n_t(i)\right) + \beta G.$$

Collecting the coefficients of $\ln k_t(i)$ appearing in the previous expression, we obtain

$$D = 1 + \beta Dp + \beta D(1 - p),$$

so that

$$D = \frac{1}{1 - \beta}. \tag{2.10}$$

Substituting (2.10) and (2.7) into (2.8) and (2.9), we get the following consumption and evasion policies:

$$c_t(i) = (1 - \beta)\left[1 + (1 - \tau)A\right]k_t(i), \tag{2.11}$$

and

$$e_t(i) = \frac{\beta(1 - p\pi)}{\tau(\pi - 1)}\left[1 + (1 - \tau)A\right]k_t(i). \tag{2.12}$$

It is then clear that the individual amount $e_t(i)$ of unreported income is decreasing in the tax rate τ for a given value of $k_t(i)$ which is consistent with the original result obtained by Yitzhaki (1974). Moreover, the amount of evaded taxes is

$$\tau e_t(i) = \frac{\beta(1 - p\pi)}{(\pi - 1)}\big[1 + (1 - \tau)A\big]k_t(i),$$

which is also decreasing in the tax rate. Note that the consumption policy (2.11) is exactly the same as the policy obtained when the tax evasion phenomenon is disregarded. The latter case is easily derived by making $p\pi = 1$ so that $e_t(i) = 0$ (see (2.12)). In fact, the parameters p and π characterizing the tax enforcement policy do not have any effect on the amount of consumption in period t for given values of both the tax rate τ and the capital stock $k_t(i)$ (see (2.11)). Therefore, the impact of a variation in the tax enforcement policy is totally absorbed by the amount of unreported income.

3.   Fines Proportional to the Amount of Unreported Income

In their seminal paper, Allingham and Sandmo (1972) introduced the portfolio approach to solve the static tax evasion problem, and they assumed that the penalties imposed on caught evaders were independent of the tax rate. Therefore, in their paper the flat penalty rate was imposed on the amount of unreported income rather than on the amount of evaded taxes. It should be mentioned that this specification of the penalty structure is much less realistic than the one assumed by Yitzhaki (1974) since to our knowledge all the tax codes around the world impose penalties that depend on the amount of evaded taxes rather than on the amount of concealed income. The optimal amount of unreported income obtained in the previous section can be easily transformed to cope with this alternative assumption. Letting $\hat{\pi}$ be the penalty rate on unreported income, we have that $\hat{\pi} = \pi\tau$. Therefore, after replacing π by $\hat{\pi}/\tau$, the policy function (2.12) becomes

$$e_t(i) = \frac{\beta(1 - p\hat{\pi})}{\tau(\hat{\pi} - 1)}\big[1 + (1 - \tau)A\big]k_t(i). \tag{3.1}$$

Note that the consumption policy (2.11) is not affected by this alternative assumption on the penalty structure.

Even if Allingham and Sandmo found that the effect of changes in the tax rate on unreported income was ambiguous for general concave utility functions, the derivative of $e_t(i)$ with respect to τ can be unambiguously signed in the present context under some parametric restrictions. The assumption (1.2) becomes $p\hat{\pi} < \tau$ in the present context. Moreover, in order to account for effective punishment to evaders, we assumed that $\pi > 1$ which now becomes $\hat{\pi} > \tau$. Finally, we make the empirically reasonable assumption that the total fine to be paid by evaders does not exceed the amount of concealed income, that is, $\hat{\pi} < 1$.[4] Performing the derivative of e_t with respect to the tax rate τ, we immediately get

$$\frac{de_t(i)}{d\tau} = \underbrace{\left[\frac{\beta k_t(i)}{\tau(\hat{\pi} - \tau)}\right]}_{S}\underbrace{\left[\frac{\tau^2 + p\hat{\pi}^2 - 2p\hat{\pi}\tau}{\tau(\hat{\pi} - \tau)}\big[1 + (1 - \tau)A\big] - A(\tau - p\hat{\pi})\right]}_{Q}.$$

Clearly, the term S is strictly positive as $\hat{\pi} > \tau$, whereas the term Q can be rewritten as

$$\frac{\tau^2 + p\hat{\pi}^2 - 2p\hat{\pi}\tau}{\tau(\hat{\pi} - \tau)} + \frac{A\left[p(\hat{\pi} - \tau)^2 + \tau^2(1 - p)(1 - \hat{\pi})\right]}{\tau(\hat{\pi} - \tau)}. \tag{3.2}$$

The denominator of the first term of the previous sum is positive since $\hat{\pi} > \tau$ and the numerator satisfies

$$\tau^2 + p\hat{\pi}^2 - 2p\hat{\pi}\tau > \tau^2 + p\hat{\pi}\tau - 2p\hat{\pi}\tau = \tau(\tau - p\hat{\pi}) > 0,$$

where the first inequality comes again from the fact that $\hat{\pi} > \tau$, while the last inequality arises since $p\hat{\pi} < \tau$. Finally, the second term of the sum (3.2) is positive since $\hat{\pi} < 1$ and $\hat{\pi} > \tau$. Therefore, under our plausible parametric restrictions, an increase in the tax rate results in a larger amount of income concealed from the tax authority. This is so because, when the fine imposed on evaders is independent of the tax rate, an increase in τ makes honesty more expensive, while the cost of evasion remains unchanged. Obviously, the amount $\tau e_t(i)$ of evaded taxes is now increasing in the tax rate τ for a given value of the current stock of capital $k_t(i)$.

The comparative statics result we have just obtained is empirically more plausible than that of Section 2. However, as we have already acknowledged, the result of this section is obtained under a less realistic assumption on the penalty structure.

Finally, let us point out that the sign of comparative statics exercise performed in this section agrees with that obtained by Yaniv (1994) in a static setup. This author showed that the amount of income concealed from the tax authority is increasing in the tax rate when the utility function is isoelastic with an index σ of relative risk aversion satisfying $\sigma \leq 1/\hat{\pi}$. This assumption is clearly met in our model since our logarithmic utility function involves a unitary index of relative risk aversion, i.e., $\sigma = 1$.

4.   Growth Implications of Changes in the Tax Rate

In order to analyze the effect of tax rate changes on the rate of economic growth when fines are proportional to the amount of evaded taxes, we should first compute the aggregate amount of capital in period $t + 1$, which is given from (2.4) by

$$\begin{aligned}
\bar{k}_{t+1} &= \left[1 + (1 - \tau)A\right]\int_{[0,1]}k_t(i)di - \int_{[0,1]}c_t(i)di + \tau\int_{[0,1]}\tilde{h}(i)e_t(i)di \\
&= \left[1 + (1 - \tau)A\right]\int_{[0,1]}k_t(i)di - \int_{[0,1]}c_t(i)di + \tau\left[\int_{[0,1]}\tilde{h}(i)di\right]\left[\int_{[0,1]}e_t(i)di\right] \\
&= \left[1 + (1 - \tau)A\right]\bar{k}_t - \bar{c}_t + \tau(1 - p\pi)\bar{e}_t,
\end{aligned}$$

where the second equality follows from the independence between the variables $\tilde{h}(i)$ and $e_t(i)$ at the beginning of period t whereas the last equality comes from the law of large numbers for a continuum of i.i.d. random variables, according to which $\int_{[0,1]}\tilde{h}(i)di = E(\tilde{h}(i)) = 1 - p\pi$ and from the definition of aggregate consumption, $\bar{c}_t = \int_{[0,1]}c(i)di$.

Therefore, the rate of growth γ of aggregate capital satisfies

$$\gamma = \frac{\overline{k}_{t+1}}{\overline{k}_t} - 1 = \left[1 + (1 - \tau)A\right] - \frac{\overline{c}_t}{\overline{k}_t} + \tau(1 - p\pi)\left(\frac{\overline{e}_t}{\overline{k}_t}\right) - 1. \tag{4.1}$$

From the linear policy functions of consumption and evaded income, (2.11) and (2.12) we get

$$\frac{\overline{c}_t}{\overline{k}_t} = (1 - \beta)\left[1 + (1 - \tau)A\right],$$

and

$$\frac{\overline{e}_t}{\overline{k}_t} = \frac{\beta(1 - p\pi)}{\tau(\pi - 1)}\left[1 + (1 - \tau)A\right].$$

Therefore, the rate of growth (4.1) becomes

$$\gamma = \left[1 + (1 - \tau)A\right] - (1 - \beta)\left[1 + (1 - \tau)A\right] + (1 - p\pi)\tau\frac{\beta(1 - p\pi)}{\tau(\pi - 1)}\left[1 + (1 - \tau)A\right] - 1,$$

which simplifies to

$$\gamma = \left[1 + (1 - \tau)A\right]\beta\left[1 + \frac{(1 - p\pi)^2}{\pi - 1}\right] - 1, \tag{4.2}$$

and, thus,

$$\frac{d\gamma}{d\tau} < 0.$$

We have already showed that higher tax rates are associated with lower evasion levels. Thus, fewer resources are available for capital accumulation, which implies in turn that the economy ends up growing at a lower rate when fines are proportional to the amount of evaded taxes.

If we consider instead the framework proposed by Allingham and Sandmo (1972) with penalties independent of the tax rate, the growth rate (4.2) will become

$$\gamma = \left[1 + (1 - \tau)A\right]\beta\left[1 + \frac{(1 - p\hat{\pi})^2}{\tau(\hat{\pi} - 1)}\right] - 1.$$

Note that when τ gets close to zero, the rate of growth approaches infinity, and the same occurs when τ tends to its upper bound $\hat{\pi}$. This means that γ is a non-monotonic function of the tax rate, and, in particular, it is decreasing for small values of τ, whereas it is increasing for large values of τ. Since tax evasion is encouraged by higher tax rates in the Allingham and Sandmo's model under our parametric restrictions, an increase in τ

could result in more resources available for acquisition of capital and, hence, in higher growth rates. Therefore, the reduction in reported income could outweigh the typical negative effect of flat rate taxes on capital accumulation (see, among many others, Rebelo, 1991).

Our last results tell us that, if the penalty rate is independent of the tax rate then an increase in the tax rate might be growth enhancing. Note that this result is just positive and no normative conclusions can be inferred from it. Since more taxes are evaded, the potential provision of public goods becomes smaller so that total individual welfare is affected in a way that depends on the relative weight attached to government spending in the agents' preferences.

5. Conclusion

In this paper, we have shown that the negative theoretical relationship between unreported income and tax rates is preserved in a multi-period economy when fines are imposed on the amount of evaded taxes. However, under the assumption that the fine paid by caught evaders is proportional to the amount of evaded income, the sign of the previous relation is reversed.

Concerning the rate of economic growth when fines are proportional to the amount of evaded taxes, we have shown that the rate of capital accumulation cannot increase with the tax rate, since the amount of disposable income always decreases in this case. However, if fines are imposed on the amount of unreported income, then the larger evasion triggered by higher tax rates could increase the amount of disposable income and, thus, capital could be purchased at a faster pace.

We have considered a capital accumulation model with very simple features aimed at highlighting the main point of the paper. Among the simplifying assumptions that could be relaxed we could mention the fact that all the individuals exhibit the same preferences and, thus, the same attitude towards risk; the fact that audit probabilities are independent of the income voluntarily reported by taxpayers (see Reinganum and Wilde, 1985, 1986; and Caballé and Panadés, 2005; for different approaches that relax this assumption); the lack of strategic interaction between taxpayers and the tax enforcement agency so that phenomena like reputation and learning are absent; and finally that government spending is assumed to be totally unproductive. Concerning the last aspect, we should mention that the case where government spending is used as a productive input (as in Barro, 1990) has been analyzed in a related paper (Caballé and Panadés, 1997). We should point out however that the comparative statics results concerning the relation between tax evasion and tax rates obtained in the present paper also hold under this alternative assumption on the role of government spending.

Notes

1. If the penalty rate π were smaller than one, evading taxpayers would never be punished.

2. See Rebelo (1991) for a model where the Ak production function arises endogenously when physical and human capitals are perfect substitutes. In this case the capital stock k embodies both kinds of capital.

3. Our assumptions on the role of public spending is standard in the growth models when this spending is non-productive. For alternative assumptions appearing in the theory of public goods provision, see Cowell and Gordon (1988).

4. Note that any reasonable calibration of the model of Allingham and Sandmo (1972) will yield $p < \tau$. Therefore, $\hat{\pi} < 1$ implies that $p\hat{\pi} < \tau$.

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Abstract

We extend the basic tax evasion model to a multi-period economy exhibiting sustained growth. When individuals conceal part of their true income from the tax authority, they face the risk of being audited and hence of paying the corresponding fine. Both taxes and fines determine individual saving and the rate of capital accumulation. We show that, if the penalty imposed on tax evaders is proportional to the amount of evaded taxes, then the growth rate is decreasing in the tax rate. However, the relationship between growth and tax rate becomes non-monotonic when the penalty rate is imposed on the amount of evaded income.

Key words: Tax evasion, Growth.

JEL classification: H26, E62, O41