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Tax evasion and uncertainty in a dynamic context

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HIGHLIGHTS

- We study optimal dynamic tax evasion in an uncertain setting.
- We find that greater uncertainty affects consumption, not the optimal tax evasion rule.
- We show that institutional uncertainty is not a good instrument to reduce tax evasion.
- We argue that instruments based on controls and sanctions are more effective.

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ABSTRACT

We study optimal dynamic compliance decisions in an uncertain environment. Contrary to the static literature, greater uncertainty affects consumption, not the optimal tax evasion rule. Thus, audit and sanctions rather than fiscal uncertainty should be used to control tax evasion.

1. Introduction

Tax evasion, defined as the deliberate failure to disclose all or part of one's income to the tax authority, is frequently studied because of its pervasive effect on economic growth and income redistribution (Slemrod and Yitzhaki, 2002). Random audits of taxpayers and sanctions on tax evaders are the two most common options available to policymakers. In this vein, Allingham and Sandmo (1972) were among the first authors to justify this policy choice by using a classical portfolio model of tax evasion, where the only source of uncertainty comes from the stochastic audit process. Since then, this mainstream approach has been extended in several ways. For example, Alm (1988), Alm et al. (1992) and Scotchmer and Slemrod (1989) introduce additional forms of fiscal uncertainty and show that under specific assumptions about the degree of risk aversion, greater uncertainty may reduce tax evasion.

However, these results were obtained in a classical static framework where evasion is the only hedging strategy against greater risk. In a dynamic context, by contrast, there may be alternative ways to hedge against an increase in the volatility of the economic environment, including a change in the consumption path. Nevertheless, although tax compliance is typically planned in a dynamic context, the tax evasion literature has only recently recognised this fact. Dzhumashev and Gahramanov (2011), Lin and Yang (2001) and Niepelt (2005), for instance, take account of a dynamic framework, but do not include uncertainty regarding the fiscal parameters.

In this note, we examine various sources of economic and fiscal uncertainty in a dynamic environment by extending the theoretical framework of Levaggi and Menoncin (2012, 2013), showing that uncertainty in the fiscal parameters does not directly affect the tax evasion decision rules in a dynamic setting. Our results are consistent with dynamic portfolio theory and support the standard policy

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rule based on controls and sanctions as the main strategy to reduce tax evasion.

2. The model

We model a risky economic framework in the period $[t_0, \infty[$, described by using a set of stochastic (state) variables $z_t \in \mathbb{R}^s$ that solve the following differential equation:

$$\underset{s\times 1}{dz_t} = \underset{s\times 1}{\mu_t (z_t)}\, dt + \underset{s\times n}{\Omega_t (z_t)'}\, \underset{n\times 1}{dW_t}, \tag{1}$$

where the prime denotes transposition and dW_t the differential representation of n independent Wiener processes (with mean zero and variance dt). Moreover, the value of the state variables at time t_0 is known.

Total income y_t is produced by using a linear production function of accumulated capital k_t:

$$y_t = A_t (z_t)\, k_t, \tag{2}$$

where $A_t (z_t)$ measures total factor productivity, which is stochastic because its value depends on the state variables z_t.

Remark 1. The differential dz_t in (1) can be interpreted as the limit of the difference $z_{t+dt} - z_t$. The value z_t is known at time t, while z_{t+dt} does not belong to the information set at time t. This means that if a representative agent optimises his/her utility at time t, the future path of the stochastic variables is not known at t, only the initial values in t are known. Thus, given z_t and the capital k_t, total income in (2) is known, while income one period (instant) ahead y_{t+dt} is not known and will be stochastic because both z_{t+dt} and k_{t+dt} are not known in t.

Without taxation, the dynamic equation of capital accumulation is described by the following differential equation:

$$dk_t = (y_t - c_t)\, dt + k_t \sigma_t (z_t)'\, dW_t, \tag{3}$$

where the expected increment in capital is given by income y_t net of consumption c_t, while its volatility is assumed to be proportional to capital and to depend on the state variables. Capital diffusion measures intrinsic volatility.[1]

Remark 2. Eqs. (3) and (1) allow us to model a stochastic volatility economy in which not only is capital stochastic by itself, but its volatility may also randomly vary over time (taking into account so-called 'volatility clusters').

The Government levies a proportional tax $0 \le \tau_t (z_t) \le 1$ on income, which may be uncertain since it depends on the state variables z_t. In this case, taxation would be contingent on the prevailing economic framework. Without evasion, the net change in capital becomes

$$dk_t = ((1 - \tau_t)\, y_t - c_t)\, dt + k_t \sigma_t (z_t)'\, dW_t. \tag{4}$$

The agent may hide a proportion $e_t \in [0, 1]$ of his or her income y_t. If evasion is detected, a fine must be paid. If this amount is $\eta_t (\tau_t, z_t)$ (defined as a non-decreasing function of τ_t), the evasion fine is

$$\eta_t (\tau_t, z_t)\, e_t y_t. \tag{5}$$

Fiscal uncertainty is introduced by assuming, as in Alm (1988), that the tax rate, penalty, and tax base are uncertain. The specification of $\eta_t (\tau_t, z_t)$, which is stochastic, allows us to consider several fine regimes:

- $\eta_t (\tau_t, z_t) = \alpha (z_t)$: the fine is on evaded income as in Allingham and Sandmo (1972);
- $\eta_t (\tau_t, z_t) = \beta (z_t)\, \tau_t$: the fine is on evaded tax as in Yitzhaki (1974);
- $\eta_t (\tau_t, z_t) = \alpha (z_t) + \beta (z_t)\, \tau_t$: the fine is a combination of these two previous cases.

Evasion introduces further risk in Eq. (4) since the fine may or may not be paid. If the proportion e_t of income is evaded, the amount of tax $\tau_t e_t y_t$ remains unpaid and the expected change in capital becomes

$$\mathbb{E}_t [dk_t] = ((1 - \tau_t + \tau_t e_t)\, y_t - c_t)\, dt, \tag{6}$$

where $\mathbb{E}_t [\cdot]$ is the expected value operator conditional on the information set at time t.

As in Levaggi and Menoncin (2012, 2013), we model auditing as a Poisson jump process $d\Pi_t$ with expected value and variance given by[2]

$$\mathbb{E}_t [d\Pi_t] = \lambda_t (z_t)\, dt, \tag{7}$$

$$\mathbb{V}_t [d\Pi_t] = \lambda_t (z_t)\, dt, \tag{8}$$

where $\mathbb{V}_t [\cdot]$ is the variance operator and the function $\lambda_t (z_t) \in [0, \infty[$ (the "intensity" of the process) determines the frequency of audits within a time interval. When $\lambda_t (z_t) = 0$, the probability of being caught is zero and when $\lambda_t (z_t)$ tends towards infinity, the probability of being caught tends towards 1. Here, we assume that the intensity of auditing is stochastic and depends on the state variables z_t.

Finally, the stochastic process of capital accumulation can be written as

$$\begin{aligned} dk_t = {} & ((1 - \tau_t + \tau_t e_t)\, y_t - c_t)\, dt + k_t \sigma_t (z_t)'\, dW_t \\ & - \eta_t (\tau_t, z_t)\, e_t y_t d\Pi_t, \end{aligned} \tag{9}$$

from which,

$$\begin{aligned} \mathbb{E}_t [dk_t] = {} & ((1 - \tau_t + (\tau_t - \eta_t (\tau_t, z_t) \\ & \times \lambda_t (z_t))\, e_t)\, y_t - c_t)\, dt, \end{aligned} \tag{10}$$

$$\mathbb{V}_t [dk_t] = k_t^2 \sigma_t (z_t)' \sigma_t (z_t)\, dt + \eta_t (\tau_t, z_t)^2\, e_t^2 y_t^2 \lambda_t (z_t)\, dt. \tag{11}$$

We assume that the Wiener process dW_t and Poisson process $d\Pi_t$ are (instantaneously) independent. This assumption means that no shock on the state variables z_t directly affects the jumps in the auditing process (the effect is only indirect through the value of the variables z_t).

Remark 3. The two main fiscal variables τ_t and η_t are known at time t and, accordingly, any agent who wants to optimise his/her intertemporal consumption will take them as given. However, at time t, the future values of both τ_s and η_s for $s \in [t, \infty[$ are subject to stochastic fluctuations which affect the optimal consumption path as it will be shown in the next section.

The vector of the s covariances between the changes in capital (dk_t) and those in the state variables (dz_t) is

$$\mathbb{C}_t [dk_t, dz_t] = k_t \sigma_t' \Omega_t dt, \tag{12}$$

where the elements of the vector $\sigma_t' \Omega_t$ may be positive or negative depending on the effect of z_t shocks on capital accumulation.

[1] In Dzhumashev and Gahramanov (2011) and Lin and Yang (2001), capital is not stochastic by itself, but it becomes stochastic because of the uncertainty of the auditing process.

[2] This process can be thought of as the limit of a binomial model whose value is 1 with probability λdt and 0 otherwise.