Tax avoidance and evasion in a dynamic setting

Duccio Gamannossi degl'Innocenti[1]
Rosella Levaggi[2]
Francesco Menoncin[2]

[1]Università Cattolica del Sacro Cuore, Milano, Italy

[2]Università di Brescia, Brescia, Italy

Table of contents

Intro

Introduction

- Tax avoidance and evasion alter effective tax rates
- Tax systems differentiate between (legal) avoidance and (illegal) evasion but they both reduce revenues collected
- Significant losses of public revenues for evasion: 20% of GDP in Europe, under-reporting is $\approx$ 18% in US with a tax gap of 500 billion
- Avoidance also a sizeable (£4.4 bn. in UK), when accounting for it the US tax gap goes to 1 trillion
- We develop a model to study the optimal evasion and avoidance decision in an inter-temporal setting

Related Literature

- Joint avoidance-evasion decision of crucial importance (Cross and Shaw 1981; 1982).

  Several contributions in a static framework:

  - Alm (1988) and Alm and McCallin (1990) study the case of risk-less and risky avoidance
  - Cowell (1990) investigates distributional impacts
  - Neck (1990) studies interactions with labour supply
  - Gamannossi and Rablen (2016;2017) explore the cases of bounded rationality and optimal enforcement

  Contributions in a dynamic framework:

  - Wen-Zhung and Yang (2001) and Dzhumashev and Gahramanov (2011) first models considering just evasion
  - Levaggi and Menoncin (2012; 2013) identify determinants of Yitzhaki puzzle
  - Bernasconi et al. (2015; 2019) study roles of uncertainty and habit

Research Goals

- Characterize optimal avoidance and evasion
- Analyze how deterrence instruments affect compliance
- Characterize optimal fiscal parameters for the government under various objectives (minimizing evasion, minimizing non-compliance, maximizing revenues and maximizing growth

Model

Consumer's preferences

- The agent's utility increases in the consumption of a privately produced good c_t and a publicly produced good g_t
- The agent utility function is:

$$U(c_t) = \frac{(c_t - c_m)^{1-\delta}}{1-\delta} + v(g_t)$$

  c_t is consumption at time t
  c_m is the minimum consumption
  $v(\bullet)$ is an increasing and concave function
- The utility is HARA with risk-aversion $\frac{\delta}{c_t - c_m}$
  - Lower risk version when c_t is higher (DARA)
  - Higher risk aversion when either δ or c_m is higher

Modelling features and assumptions

- **Evasion is cost-less** and carries a fine η if detected
- **Avoidance is costly** but entails a reduced fine $\eta(1-\beta)$ upon audit
- The fine reduction (β) leads to an avoidance premium
  - Avoidance premium depends on the the tax system and tax administration of the economy
  - Lower with simpler and less-ambiguous tax codes, when legal resources of tax authorities are higher and when courts have higher effectiveness
- Avoidance and evasion are **both correctly detected** upon audit
- The agent assumes no effect of the compliance decision on public good provision (fiscal illusion)

Capital Accumulation

The capital accumulated dk_t is equal to production minus expenses:

$$dk_t = \left[y_t - c_t - \tau y_t (1 - e_t - a_t) - f(a_t) y_t \right] dt - \eta \tau y_t \left[e_t + (1 - \beta) a_t \right] d\Pi_t \tag{1}$$

The capital accumulated dk_t is equal to production minus expenses:

$$dk_t = \left[y_t - c_t - \tau y_t (1 - e_t - a_t) - f(a_t) y_t \right] dt - \eta \tau y_t \left[e_t + (1 - \beta) a_t \right] d\Pi_t \tag{2}$$

The capital accumulated dk_t is equal to production minus expenses:

$$dk_t = \left[y_t - c_t - \tau y_t (1 - e_t - a_t) - f(a_t) y_t \right] dt - \eta \tau y_t \left[e_t + (1 - \beta) a_t \right] d\Pi_t \tag{3}$$

The capital accumulated dk_t is equal to production minus expenses:

$$dk_t = \left[y_t - c_t - \tau y_t (1 - e_t - a_t) - f(a_t) y_t \right] dt - \eta \tau y_t \left[e_t + (1 - \beta) a_t \right] d\Pi_t \tag{4}$$

Conditions for positive avoidance and evasion

Evasion is expedient when:

$$\mathbb{E}_t\left[dk_t\right] > \mathbb{E}_t\left[dk_t\right]_{e_t=0} \Longleftrightarrow \eta\lambda < 1$$

Avoidance is expedient when:

$$\mathbb{E}_t\left[dk_t\right] > \mathbb{E}_t\left[dk_t\right]_{a_t=0} \Longleftrightarrow \frac{f\left(a_t\right)}{a_t} < \left[1 - \eta\lambda\left(1 - \beta\right)\right]\tau,$$

that is satisfied if $f\left(a_t\right) < a_t\beta\tau$ when evasion is expedient

The optimization problem

$$\max_{\{c_t, e_t, a_t\}_{t \in [t_0, \infty[}} \mathbb{E}_{t_0} \left[\int_{t_0}^{\infty} \frac{(c_t - c_m)^{1-\delta}}{1-\delta} e^{-\rho(t-t_0)} dt \right]$$

under the capital dynamic:

$$dk_t = [y_t - c_t - \tau y_t (1 - e_t - a_t) - f(a_t) y_t] dt - \eta \tau y_t [e_t + (1-\beta) a_t] \, d\Pi_t \tag{9}$$

.

Analysis

Optimal solution

$$a^* = (f')^{-1} \tau\beta,$$

$$e_t^* = \frac{k_t - H}{\tau\eta A k_t}\left[1 - (\lambda\eta)^{\frac{1}{\delta}}\right] - (1-\beta)\, a^*,$$

$$c_t^* = c_m + (k_t - H)\left(\frac{\rho+\lambda}{\delta} + \psi\left\{\frac{1}{\eta} + A\left[(1-\tau) + \tau\beta a^* - f(a^*)\right]\right\} - \frac{1}{\eta}(\lambda\eta)^{\frac{1}{\delta}}\right)$$

$$a^* = (f')^{-1} \tau\beta,$$

$$e_t^* = \frac{k_t - H}{\tau\eta A k_t}\left[1 - (\lambda\eta)^{\frac{1}{\delta}}\right] - (1-\beta)\, a^*,$$

$$c_t^* = c_m + (k_t - H)\left(\frac{\rho+\lambda}{\delta} + \psi\left\{\frac{1}{\eta} + A\left[(1-\tau) + \tau\beta a^* - f(a^*)\right]\right\} - \frac{1}{\eta}(\lambda\eta)^{\frac{1}{\delta}}\right)$$

Optimal solution - No minimum consumption

When $c_m = 0$ the solution to the consumer problem is:

$$a^* = (f')^{-1} \tau\beta,$$

$$e^* = \frac{1}{\tau\eta A}\left(1 - (\lambda\eta)^{\frac{1}{\delta}}\right) - (1-\beta)\, a^*,$$

$$\frac{c_t^*}{k_t} = \left(\frac{\rho+\lambda}{\delta} + \psi\left\{\frac{1}{\eta} + A\left[(1-\tau) + \tau\beta a^* - f(a^*)\right]\right\} - \frac{1}{\eta}(\lambda\eta)^{\frac{1}{\delta}}\right)$$

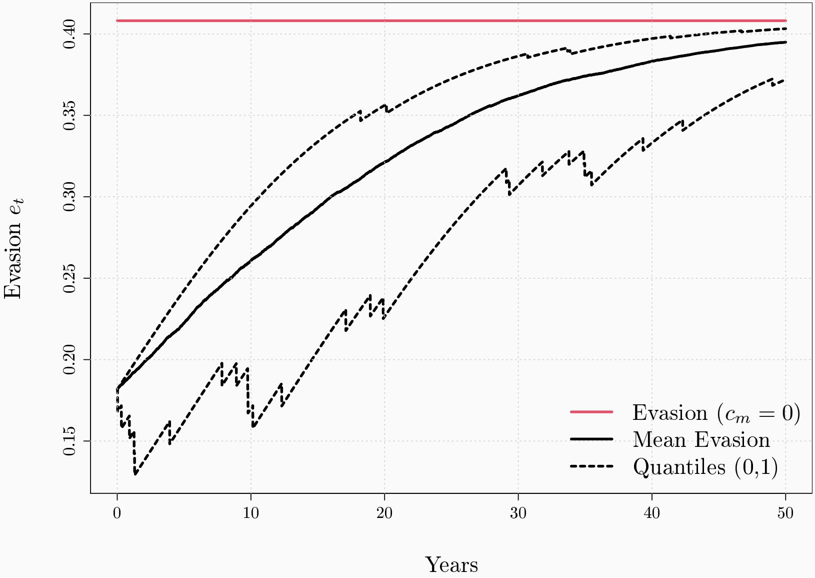
Remarks about tax avoidance

Tax avoidance depends on its cost f, the avoidance premium β and the tax τ

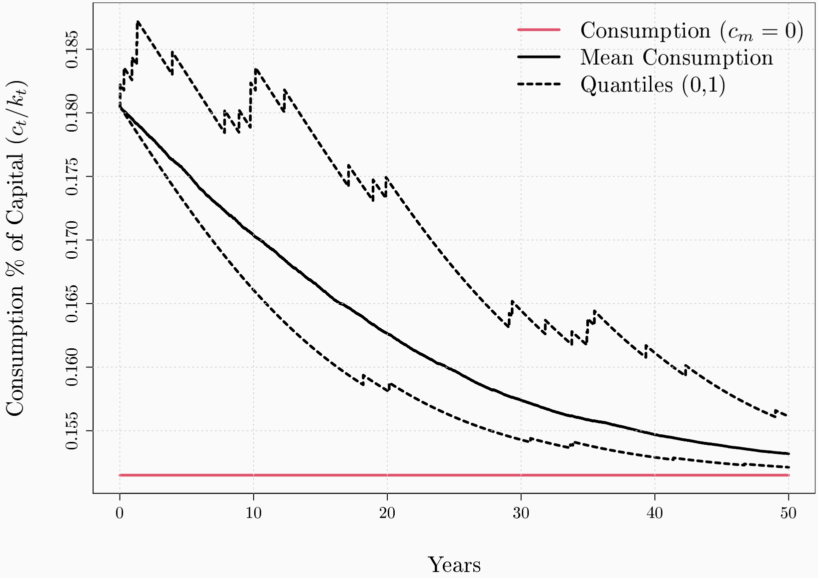
Is a constant share of income and does not depend on c_m

Does not depend on risk-aversion nor on deterrence parameters η and λ

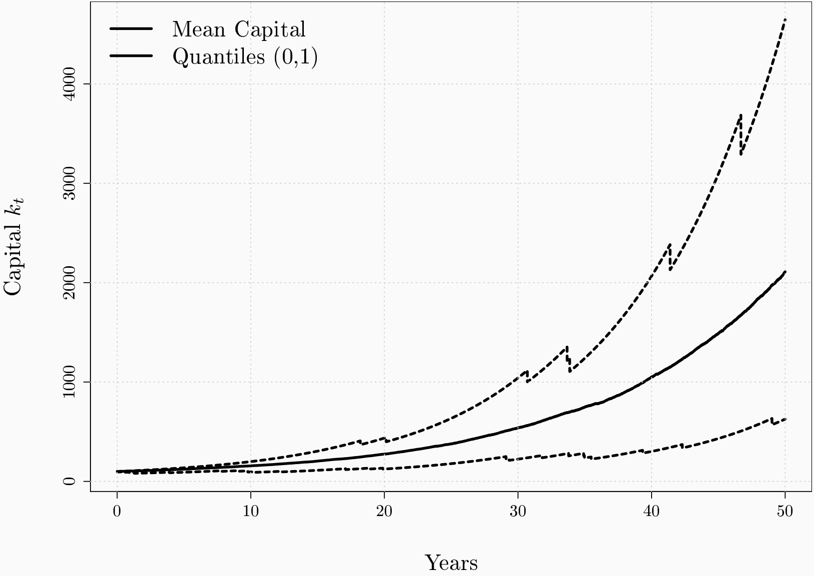
Evasion dynamics



Consumption dynamics



Capital dynamics



Comparative Statics

	a^*	e_t^*		$E_t^* = a^* + e_t^*$	
λ	0	$-$		$-$	
η	0	$-$		$-$	
β	$+$	$+/-$	$+/-$	$+$	
τ	$+$	$-$		$+/-$	$+/$

Table 1: Comparative statics for interior a^*, e_t^*

Where:

$$\mathbb{E}\left[dT_t\right] = \tau y_t \left(1 - e_t^* - a_t^*\right) dt + \eta y_t \tau \left[e_t^* + \left(1 - \beta\right) a_t^*\right] d\Pi_t$$

are expected revenues collected:

Comparative Statics - Remarks on β

When $c_m > 0$ the sign of $\frac{\partial e_t^*}{\partial \beta}$ is ambiguous, but if $c_m = 0$

$$\frac{\partial e_t^*}{\partial \beta} \gtreqless 0 \iff \frac{\partial a^*}{\partial \beta}\frac{1}{a^*} \lesseqgtr \frac{1}{1-\beta}.$$

- If $\frac{\partial a^*}{\partial \beta}$ is higher than a threshold, e is decreasing in β
- When β is big $\frac{\partial a^*}{\partial \beta}$ is higher so avoidance deterrence may increase evasion
- Relative to $c_m = 0$, when $c_m > 0$ the threshold is lower
    - More likely to have worsening of evasion

Comparative Statics - Remarks on τ

The sign of $\frac{\partial E_t^*}{\partial \tau}$ is ambiguous when either $c_m > 0$ or $c_m = 0$ but in the latter case it is:

$$\frac{\partial E_t^*}{\partial \tau} = \underbrace{-\frac{1}{\tau^2 \eta A}\left(1 - (\lambda\eta)^{\frac{1}{\delta}}\right)}_{<0} + \underbrace{\beta \frac{\partial \left(f'\right)^{-1} \tau\beta}{\partial \tau}}_{>0}$$

- When τ decreases, there are two effects:
    - The negative term (from evasion) becomes bigger in abs terms
    - The positive term (from avoidance) shrinks
- A rise in τ reduces E_t in economies with sufficiently high taxation

Comparative Statics - Remarks on τ

Also the sign of $\frac{1}{dt}\frac{\partial \mathbb{E}_t[dT_t]}{\partial \tau}$ is ambiguous when either $c_m > 0$ or $c_m = 0$ but the latter case provides some insights:

$$\frac{1}{dt}\frac{\partial \mathbb{E}_t\left[dT_t\right]}{\partial \tau} \gtreqless 0 \iff \tau \lesseqgtr \frac{1-\beta a_t^*}{\beta \frac{\partial a_t^*}{\partial \tau}}.$$

- The sign of the derivative is positive for low levels of τ and the sign switches (at least once) when τ increases
  - If $f(a)$ is super-linear but not super-quadratic $\Rightarrow$ one sign switch
  - If $f(a)$ is super-quadratic $\Rightarrow$ two sign switches
- In a real-world setting the model predicts a Laffer curve
- The sign-switching threshold is inversely related to β
  - The higher the β, the lower the tax rate from which increasing taxes reduces revenues

Optimal capital dynamics and growth

The expected growth rate of the modified capital is

$$\gamma^* := \frac{1}{\delta}\left((1-\tau)A-(\rho+\lambda)+\frac{1}{\eta}+(\tau\beta a_t^*-f(a_t^*))A\right)-\left(1-(\lambda\eta)^{\frac{1}{\delta}}\right)\lambda$$

and

$$\frac{\partial\gamma^*}{\partial\beta}=\frac{1}{\delta}\frac{\tau}{\eta}a_t^*A>0$$

- A growth-maximizing government would chose $\beta^*=1$
  - Somewhat implied by assuming a public good not increasing productivity

Tax avoidance deterrence

Fines and audits are ineffective against tax avoidance

Avoidance deterrence might increase evasion:

1. Avoidance premium:
   - Decreasing a high β reduces both avoidance and evasion
   - Decreasing a low β entails an increase of evasion
   - Evasion increase is more likely when $c_m > 0$
2. Tax rate:
   Decreasing τ reduces avoidance but the increasing effect on evasion eventually lowers compliance and revenues

Negative effects can be sterilized using audit probability or fines

$$a^* = (f')^{-1} \tau \beta,$$

$$e^* = \frac{1}{\tau \eta A} \left(1 - (\lambda \eta)^{\frac{1}{\delta}}\right) - (1 - \beta)\, a^*.$$

Fiscal Reforms

Model insights about avoidance cost not practically relevant

- Increasing both f and f' would lower avoidance and evasion
- Avoidance cost cannot be told apart from legal costs of ”intended” economic activity

A reduction of β could be attained through

- Simplifying the tax system
  - Reducing the extent of variation of tax treatments (deductions, exemptions and preferential treatments)
- Specific anti-avoidance reforms at national and multi-national level

Concluding Remarks

- We develop the first dynamic model entailing both avoidance and evasion
- Avoidance deterrence calls for the implementation of specific policies
- Avoidance deterrence might worsen evasion but this effect can be sterilized with audits and fines
- The interactions between avoidance and evasion
  - Leads to the emergence of a Laffer curve
  - Provides a possible interpretation for the Yitzhaki puzzle

Thank you!

Questions?