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Discretionary policy, strategic complementarity and tax evasion. A strategic analysis of the Italian audit mechanism

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Discretionary Policy, Strategic Complementarity and Tax Evasion. A Strategic Analysis of the Italian Audit Mechanism[1]

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Abstract

Underlying this work is the idea that there is a problem of strategic complementarity of individuals who choose to evade. Complementarity results from the discretionary policies of governments and the strategic implications of the *Studi di Settore (Sector Studies)*, the mechanism used in Italy to evaluate the income (in reality, the turnover) of professional categories and small firms. In the Italian case, policy discretion and the *Sector Studies* lead to a failure of the coordination mechanism of taxpayers and confer a strong advantage for the coordination mechanism of tax evaders. The outcome is a coordination failure where individuals converge to the least efficient equilibrium from a social perspective.

Keywords: Tax Evasion; Tax Compliance; Audit Selection Mechanism; Complementarity.

JEL Classification: H26; C72.

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1. Introduction

The size of tax evasion in Italy (the non-reported Value Added Tax base is about 250 billion euro per year) shows that individualistic models based on maximizing utility functions, used to investigate this phenomenon, are limited in their effectiveness. Traditional tax compliance models always assume that agents face choices independently. However, the assumption of independency cannot explain the massive tax evasion in Italy. The reason is that the current tax mechanism, *Sector Studies*, becomes a coordination tool for the players to evade taxes.

Sample surveys and other empirical analyses reveal an adaptive behavior of individuals on tax evasion: an individual tends to evade if he/she is convinced that other taxpayers evade. Behaviors that tend to be "self-fulfilling" create dangerous and widespread expectations that are difficult to eradicate. This situation triggers a vicious circle where evasion is perceived as a mass phenomenon which, in turn, leads the individual to commit tax fraud.[3] In this paper we show that widespread tax avoidance is due to the discretion of the government to manage and control the tax system and the mechanism (*Sector Studies - "Studi di Settore"*) in place to estimate the taxable income of small firms, the self-employed and professionals.

In the Italian case, discretion and the audit process lead to a failure of the mechanism of taxpayer coordination and give a major advantage to the mechanism of tax evader coordination. The outcome is a "coordination failure" where individuals converge to the least efficient equilibrium from a social perspective.

The *Sector Studies*, introduced in Italy in 1998, represents an audit selection mechanism to detect firms and the self-employed most likely to evade. Three main characteristics make this fiscal instrument a valid coordinator for the individuals involved (here: small firms, self-employed, professionals), who have been made homogeneous through a process of grouping (cluster analysis). First, an endogenous conducted threshold: firms can be audited when the reported turnover is lower than its presumed level.[4] Second, the presumed turnover, in turn, depends partly on a set of relevant variables as reported by the firm and partly on the features of the economic sector to which the firm belongs. These variables and the turnover threshold are known to individuals who must calculate their turnover by using special software (Gerico). Third, representatives of firms and professions

[3] Hearing of the Deputy Minister Vincenzo Visco in the Tax Policy School of the Finance Police, held in 2006. See Visco (2006).

[4] The parameters of each economic sector to which the firm belongs, are built in the scheme by estimating parameters defining the average (normal) behavior of the firms of the same sector. The economic parameters and hence their distance from the threshold, are compared with average parameters which reflect supposed normal behaviour of these economic subjects.

who are subject to imputed income of the *Sector Studies* are closely involved in the whole process of setting up the optimal turnover level and determining how the fiscal instrument actually works.

This paper proposes a simple model to interpret some strategic issues implicit in tax evasion. This phenomenon often involves a large number of individuals who mis-report a substantial portion of their income and who belong to one or more particular professions or types of firms. We assume that all income except for that of employees falls into these categories.

The simple scheme proposed does not consider the limits of a mechanism for auditing or presumptive income instruments such as the *Sector Studies*, but aims to analyze the strategic behaviour of those individuals involved in this mechanism. [5] Indeed, while there is a substantial literature on auditing mechanisms, their strategic aspects have been less widely investigated.[6] This work aims to identify the various elements that affect the strategic behaviour of the taxpayer-tax dodger as an individual and as a collective body (professional category).

The paper is organized as follows: Section 2 reports some stylized facts concerning the effects of the auditing mechanism in Italy. Section 3 presents the strategic model by referring to some simple concepts and theorems of game theory. Section 4 shows the complementarity effect of the fiscal mechanism which produces an inefficient outcome. Section 5 emphasizes the role of strategic complementarity with incomplete information and Section 6 concludes, making some considerations on the implications of economic policy.

2. Stylized facts

To have an idea of the significance of the relationship between tax evasion and *Sector Studies*, we refer to the Revenue Agency data set. Table 1 points out that more than 80% of tax evasion is generated by the service sectors (trade and services to households and firms). These sectors are characterized by small firms which are most likely to evade and are subject to a presumptive taxation mechanism (*Sector Studies*): in Italy about 96% of all firms employ 1-9 employees (4,379,107 of 4,581,545 firms), of which about 16% are individual firms.[7]

[5] See, for instance, Arachi and Santoro (2007), Santoro (2007; 2008), Marchese and Privileggi (2009), Convenevole *et al.* (2007) and the papers of the Revenue Agency's Study Centre.

[6] See, for instance, the work on settlement models of Macho-Stadler and Pérez-Castrillo (2004) and Franzoni (2004). Tax compliance as a coordination game among taxpayers has been investigated by Alm and McKee (2004). Some recent papers on audit rules and strategic interactions among taxpayers are that of Yim (2009) who propose a more cost-effective audit mechanism called "the bounded rule" on the basis of a strategic model between one auditor and multiple taxpayers, and Bayer and Cowell (2009) who examine the impact of a report-dependent audit rule (relative rule) on firms' market decisions and compliance behavior.

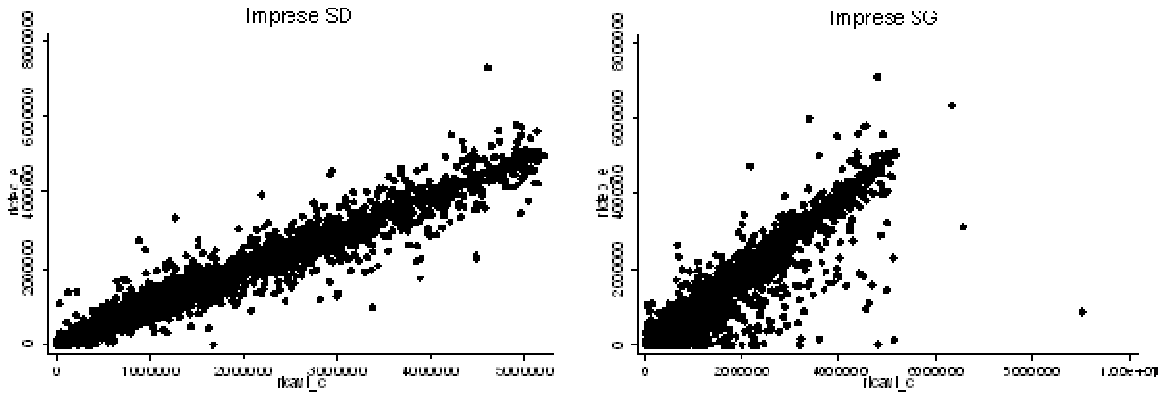
[7] According to some members of the Revenue Agency, the most recent data indicate magnitudes not different from those reported in the table for 2002.

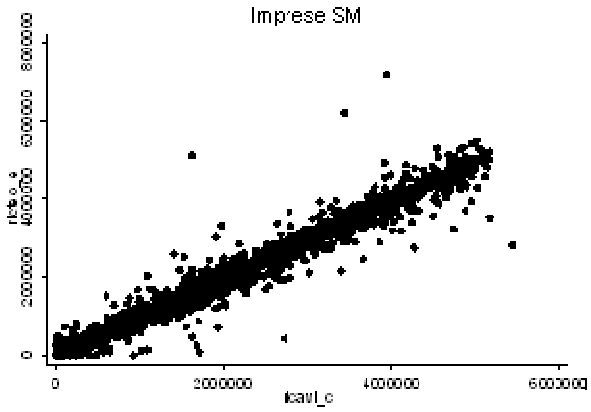
Table 1. Tax evasion by macro-sector - 2002

Sector		
	Euro: million	Percentage composition
Agriculture	9,233	4.56
Industry	21,287	10.51
Construction	8,153	4.03
Commerce, hotels and public utilities	43,006	21.24
Services for firms	74,586	36.84
Services for households	46,219	22.83
Total	202,484	100.00
Source: Pisani and Polito (2006)		

The coordination success of the auditing mechanism is depicted (for 2006) by the plots in Figure 1. The figure reports the presumed (theoretical) turnover levels required by the audit mechanism (vertical axis) and the firms' declared turnover (horizontal axis) for manufacturing (SD), services (SG) and intermediaries and retail stores (SM).

Figure 1. Presumed and declared turnover. Manufacturing (SD), Services (SG), Intermediaries (SM)





The correlation coefficient between theoretical and declared turnover is very high: 98.9 for manufacturing firms, 97 for services firms and, finally, 99.5 for intermediaries and retail stores. This empirical evidence for *Sector Studies* 2006, supports two alternative points of view. First, the effectiveness of the auditing mechanism in inducing tax compliance, since the firms all converge to the presumed turnover. The alternative explanation is that the firms have manipulated the relevant variables in order to reach their presumed turnover levels. This last interpretation is strongly supported by the committee report on *Sector Studies*, funded by the Ministry of Economics (2008), and by several other studies and documents from the Revenue Agency. [8]

3. The Model

3.1 Players

The model is a simple scheme of strategic behaviour and involves two players, government and individuals, which in turn can be expressed as taxpayers (or conformers) (T) or evaders (E). In this work the ability of an individual to declare a lower income than that actually received is defined as avoidance. The government itself must decide whether to adopt a severe behaviour (S) with the planning controls and the imposition of penalties if the taxpayer has been discovered to be an evader, or weak behaviour (W), limiting expensive audits and sanctions.[9] The two types of government are viewed as the government's ability to solve the tax evasion problem and handle the Revenue Agency efficiently. The type structure is described by the following government disutility function which embodies the assumptions on government efficiency and ability to cope with tax evasion.

[8] See, amongst others, Pisani (2004), Convenevole *et al.* (2007), and Santoro (2008).
[9] W=weak; S=strong; T=taxpayer; E=evader.

3.2 Players' payoffs

The government. The government for managing the tax system and for detecting and fining tax evaders undergoes some costs. These depend, of course, on the efficiency of the Revenue Agency. The government's objective is to minimize the following disutility function:

$$(1) \qquad u(C(1+\rho)); \quad C = C^{1-\omega}, \quad \rho = \frac{1-\varepsilon}{1+m}$$

where $\delta u / \delta C > 0$ (disutility increases with *C*) and $C > 1$ reflect the administrative and political costs for planning and managing the tax system and a network of controls. These costs determine the efficiency of the tax system. Since Allingham and Sandmo (1972), one of the crucial assumptions of tax evasion models is that the probability of evasion being detected is fixed and unrelated to any actions of individuals.[10] Here, ρ, the probability of being detected and fined, relies on ε which represents compliance (number of individuals who comply) and *m*, the efficiency of the Revenue Agency. For instance, we can define as an indicator of efficiency the government funding to the Revenue Agency. Often these tax offices have a limited budget to operate with[11].

As regards ρ, we hypothesize an inverse relationship with the number of taxpayers (ε) and efficiency indicator of the Revenue Agency (*m*). Compliance ε ranges from 0 to 1. With $\varepsilon = 1$, $\rho = 0$, that is with full fiscal compliance, the problem of audits and fines disappears. Also the parameter (*m*) ranges from 0 and a positive number *k>1*: 0 indicates full efficiency of the Agency whereas high values of k indicate the greatest inefficiency. In this case the value of ρ is greatly reduced. In 2010, according to the Revenue Agency, the number of fiscal inspections on small firms and self-employed has been 220,000, whereas the number of total small firms and self-employed is about 5 million. These figures provide a rough estimation of the probability of being detected of 0.045.[12]

Small values for (*m*), *ceteris paribus*, increase the probability of being detected but also rise costs (they imply greater financial support from the government). The cost of monitoring, however, may

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[10] Exceptions are the optimal audit models. See, amongst others, Reinangum and Wilde (1985), Sanchez and Sobel (1993) and, more recently, Macho-Stadler and Pérez-Castrillo (1997).

[11] These relationships are exogenously imposed, but they are crucial for strategic decisions. On the endogeneity of enforcement, see Chiarini, Di Domizio and Marzano (2009) .

[12] Busato and Chiarini (2004) calibrate the *probability of being detected* by estimating the unconditional mean of the ratio of number of inspected firms to their total number, $\rho_t = (Inspected \ \ firms)/(Total \ number \ of \ \ firms)$. They first compute the probability of being detected in each year, and then estimate the aggregate probability:

$\rho^* = 1/T \sum_{t=1}^{T} \rho_t = 0.03$.

be partially or fully offset by the revenues generated from fining the tax evaders. In our model this is reflected in a value of ω greater than 1. Depending on whether $\omega > 1$ (low efficiency) or $\omega < 1$ (high efficiency), the cost function is decreasing or increasing in costs.

The cost function is a constant elasticity function: with $\omega < 1$ the function $C = C^{1-\omega}$ is increasing in costs *C* whereas with $\omega > 1$ the function is decreasing. Parameter ω (efficiency of the tax system or reward parameter) should be related to the efficiency of the tax office *m*. For instance, the situation $\varepsilon = 0$ (massive tax evasion) and *m=k* (minimum efficiency) entails $\omega < 1$, an increasing cost function, whereas *m=0* provides a decreasing cost function with $\omega > 1$. These costs reflect the organizational and administrative problems and the costs of monitoring and sanctioning and those of actual collection of penalties, which the government faces in managing the tax system, and it seems natural to link them negatively to the efficiency of the Revenue Agency and the revenues generated from fining the tax evasion.

Thus, a weak and accommodating government shows large values for (*m*), which implies inefficient audits and low costs, but with an increasing cost function $\omega < 1$. Efficiency, of course, may be linked to the ability of the tax administration to coordinate and organize the institutional component involved in the tax evasion problem (finance police, tax inspectors, insurance authorities, auditors,...). In the Italian case, and in particular for the *Sector Studies*, (*m*) can also be affected by the degree of involvement of representatives in managing the tax system: *m=k* indicates full involvement (or minimum efficiency for the Agency).[13]

To summarize, we have,

(2) $$\begin{cases} \omega > 1 & decreasing\ cost\ function, \quad if \quad \rho = high \quad m = 0 \\ \omega < 1 & increasing\ cost\ function \quad if \quad \rho = low \quad m = k \end{cases}$$

and $$\begin{cases} m = 0 & if \quad S \\ m = 1 & if \quad W \end{cases}$$

Obviously, we are not specifically considering the budget constraint of the government because, as noted above, it is assumed that other taxpayers (employees) are not subject to choice and that the inefficiencies of the government and the evaders' choice to hide income can be charged on the employees income to balance the budget. [14]

[13] Note that this interpretation of the Revenue Agency contributes to qualify the government's type (W) and (S). In particular, a weak government is one that allows large involvement of the representative in the management and control of the auditing mechanism. In the short run, to be weak for a government means reducing the political and administrative costs.

[14] See Chiarini, Marzano and Schneider (2008) for the tax overburden in the last few decades in Italy. The overburden, which reflects an area of huge tax evasion, has, on average, been more than 11%, and has been maintained for decades. Its persistence implies the involvement of several governments and reflects a major failure and low credibility of the authorities in tackling evasion in Italy.

Individuals. For a given level of public expenditure (for simplicity not considered) and assuming a tax system with two tax rates, $t > \tau$ $(t, \tau < 1)$, the individual's payoff (utility) is determined by the presumed turnover $\hat{s}$, his/her real (true) turnover *s*, and a function of set o relevant variables $f(\Omega)$ (inputs used in the activity, stocks and inventories, allocations, variables associated with sales proceeds, etc.) using the following relations:[15]

$$\hat{s}_{ij} = s_{ij} - f_{ij}(\Omega) \rightarrow \begin{cases} f_{ij}(\Omega) > 0 & \textit{tax evader} \\ f_{ij}(\Omega) = 0 & \textit{honest taxpayer} \end{cases} \tag{3}$$

Whenever individual *i* within professional sector *j* is able to achieve a turnover level $s_i > \hat{s}_{ij}$, he/she may avoid being audited by manipulating Ω and therefore, setting $s_i = \hat{s}_{ij}$. Individuals with a real turnover greater than the theoretical, $s_i > \hat{s}_{ij}$, are prone to be coherent with the presumed turnover because their income *y* will be taxed at a lower rate, and a component of this income *x* will be completely hidden:

$$\begin{cases} y_i(1-\tau) + x_i; & x = \hat{s}_{ij} - s_i + f_{ij}(\Omega) = f_{ij}(\Omega) \quad \textit{tax evader} \\ y_i(1-t) & \textit{honest taxpayer} \end{cases} \tag{4}$$

where y_i is the reported income of individual *i*. Certainly, the *Sector Studies* model is more complex and articulated.[16] Declaring the presumed (normal) turnover level is easy if one can manipulate the variables used to reckon the "reported" level. We assume that tax evaders are manipulating the

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[15] For individual we mean one of the many homogeneous taxpayers.

[16] The Sector Studies is a mechanism of audit selection based on a complex statistical procedure. It signals firms (small firms and independent workers) reporting a low level of turnover with respect a benchmark (the turnover reported by firms with similar characteristics). This mechanism was introduced in 1988 and it is characterized by the following basic elements. The first one is the cluster (a subset of homogeneous firms). Data (number of employees, type of customers, accounting variables, dimensions of the premises, surface area of the offices etc.) are collected from firms with similar activity code and annual turnover under 5,164,569 euro. The second element is the principal component analysis for selecting the most important variables from all those collected. These variables are used to form the clusters. Trough software (GERICO) provided by the Revenue Agency, each taxpayer may calculate his estimated gross turnover, according to the Sector Study pertaining to his activity. The software also provides information on possible incoherence or irregularity in the data imputed by the taxpayer. There may be two kind of audits. A firm may be audited if it reports a turnover lower than a theoretical (imputed) level. The second kind of audit is when the firm reports values of the relevant variables that are too far removed from those reported by the other firms in the cluster.
See Arachi and Santoro (2007) and Marchese and Privileggi (2009).

relevant variables in order to hide a surplus *x* and gain a higher net tax income, since their income will be taxed at τ instead of *t*.[17] These assumptions look sensible as they do not contradict the empirical data reported in Figure 1. To simplify the analysis and emphasizing the strategic aspects we assume the following cases (from now on we neglect the subscript): [18]

1) Assuming *y=1*, an honest taxpayer (T) is coherent ("*congruo*") with the *Sector Studies* mechanism when $s_i = \hat{s}_{ij}$. In this case, he/she receives with both government types (severe S and weak W) the payoff $(1-t)$.
2) An evader (E) is characterized by $s_i > \hat{s}_{ij}$ but reports a turnover equal to the presumed one. The payoff when a government is severe (S) is $x(1-\rho \cdot t \cdot s)$ where *x* is the turnover gap $(s_i - \hat{s}_{ij})$ and $\rho \cdot t \cdot s > 1$ stands for the penalty to be paid if discovered or audited. [19] In that case the government takes back the entire surplus and also affects the income of the tax evader. If the government is weak (W), the payoff is $x + (1-\tau)$ and the evader behaves as a taxpayer, paying a lower tax rate on a lower real income $y(1-\tau)$ and pocketing the entire surplus *x*.

The various possibilities are reported in the following payoff matrix:

Figure 2

Individual \ Government	***S***	***W***
T	$(1-t)$; $C(1+\frac{1-\varepsilon}{1+0})$	$(1-t)$; $C(1+\frac{1-\varepsilon}{1+k})$
E	$x(1-\rho \cdot t \cdot s)$; $C(1+\frac{1}{1+0})$	$x+(1-\tau)$; $C(1+\frac{1}{1+k})$

The government's payoffs are determined with *m=k>1* for type W and *m=0* for type S. We set $\varepsilon = 0$ for the case in which the individual is an evader.[20] With regard to the cost function $C = C^{1-\omega}$,

[17] We rule out statistical errors which can provide $s_i \neq \hat{s}_{ij}$. Moreover, we are assuming that the only problem with the *Sector Studies* mechanism is that it leaves individuals to manipulate the relevant variables.

[18] See also Santoro (2008). Pisani (2004) shows how firms manipulate the relevant variables in order to become coherent with the presumed revenue level.

[19] Obviously, the penalty should avoid solutions that lead to bankruptcy.

[20] Note, however, that we also may set $\varepsilon \cong 0$ (i.e. it is negligible) when a government faces a single individual as taxpayer without affecting the strategic result.

we may assume that a single individual decision does not affect the government cost function, for which the government's costs of planning and controlling the fiscal system can be approximated in all cases with $\omega = 0$.

The result of this interaction, with complete information, is trivial. The optimal choice of the individual is to act as a taxpayer when a government is of type S, and to evade with a government W. For the government, the choice W is a dominant strategy. This discretionary policy under full information leads to a unique Nash equilibrium (*E, W*). The government's strategy S is not a credible threat as the strategy is strictly dominated by W. The simplicity of this strategic behaviour may conceal an important element: the government of type W, acting against the individual, assumes that losses are of a second order, and as such, are not important, even if it is right that the revenue lost should be recovered in another game with other types of taxpayers. [21]

Thus, the government has a dominant strategy since it is not worth the money to strengthen audit in order to catch one specific cheater. However, if there are many homogenous cheaters in the society, the choice of being a severe government may not necessarily be dominated. This is the object of the next two sections.

4. *Many individuals (a category game)*

In Italy, the audit mechanism of the *Sector Studies* defines a situation with many similar private individuals in their work, entrepreneurship, opportunities and preferences. One of its main elements is the cluster to make sets of firms and individuals economically homogeneous. Thus we may assume that in each cluster all individuals are identical in their preference and feasible actions, and play in a setting characterized by symmetric equilibria (all individuals choose the same action): all evaders $\hat{E}$ or honest taxpayers $\hat{T}$.

-Individuals' coordination mechanism

The game is characterized by many similar agents and a government, and attention is restricted to symmetric equilibria ($E = \hat{E}; T = \hat{T}$)**.** The origin of strategic coordination of individuals is Schelling's (1960) concept of a focal equilibrium, in which players in a game will have the highest payoffs if they can coordinate on a strategy. This can easily occur if these individuals have information that leads them to focus on a particular strategy that will improve the likelihood of reaching the coordinated outcome.

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[21] Since the seminal work of Akerlof and Yellen (1985) the literature on near-rational behaviour has shown how one can generate much greater first-order effects.

To envisage the simultaneous game that each agent plays with the others, we follow Van Huych, Battialo and Beil (1991), denoting $a_1.....a_n$ as the actions taken by *n* individuals (odd) and *M* the median of these actions. The payoff function for each individual is defined as:

(5) $$u(a_i, M) = \alpha M - \beta(M - a_i)^2 \qquad \alpha, \beta > 0$$

In our case we restrict the strategy space of each agent to be an honest taxpayer or a tax evader $a_i \in \{T, E\}$. The individual's payoff is increasing in the median *M* and decreasing in the gap between the single action a_i and the median. This coordination problem, with complete information (payoffs and actions) and common knowledge, is trivial: if in the tax evasion game efficiency leads individuals to choose the action with the largest return, the efficient outcome is $E_1.....E_n$. Each element or pre-negotiated agreement which brings individuals to choose $E_1.....E_n$ would be self-enforcing.[22] If pregame information is not possible, to solve a non-trivial coordination problem, we may expect individuals to use the Nash equilibrium to inform their strategic behavior:

(6) $$u(a_i, M^*) \leq u(a_i^*, M^*) \text{ that is, } u(T_i, \hat{E}^*) \leq u(E_i^*, \hat{E}^*)$$

Consider, now, a setting in which each individual chooses to evade or pay taxes, taking as given the choice of all others belonging his/her category or professional class. This mechanism develops an incentive for the individual to align on one of the equilibria of the game.
The utility for the evader becomes:

(7) $$u(x, t, \tau, \lambda E) \qquad \partial u / \partial \lambda > 0, \quad \partial u / \partial \tau < 0, \quad \partial u / \partial t < 0, \quad \partial u / \partial x > 0$$

where *E* indicates the choice by the rational individual to evade. When the individual is an evader, his/her value increases by a factor λ due to the fact that other individuals belonging to the same class are evading. In other words, λ is the proportion of taxpayers in the same cluster who decide to evade. If these individuals act in a complementary way they increase the utility because one

[22] To prevent any misunderstandings, we leave out the strategic interactions among taxpayers. In this game we do not model how an individual has to form beliefs about others actions, and how he compares the expected payoff between comply and evade. In this case there might be multiple equilibria conditional on beliefs and the parameters of the game. We may use social norm as a substitute for others' likelihood to evade and argue that it is the best interest for a taxpayer to evade if he thinks that the others are going to evade. We emphasize in this paper that with the Italian audit mechanism the possibility for the individual to converge to an equilibrium (comply or evade) is made easier, since the *Studi di Settore* provides him the information about the choice of all the others belonging to the same category or professional class.

cannot judge (auditing, monitoring and sanctioning) a whole professional category, a whole class of job or a particular type of enterprise; there are positive spillovers due to the fact that the utility of an evader increases with the decisions of other evaders. This is the crucial aspect, strategic complementarity, which is the basis of the tax evasion phenomenon and it is related to the government's discretionary policy.

The advantage also emerges from the aggregation of taxpayers who comply:

(7.1) $u(t,\psi T) \qquad \partial u/\partial \psi > 0, \quad \partial u/\partial t < 0.$

For honest taxpayers the benefit is directly linked to the reduction in tax burden that is obtained if most (or all) taxpayers were to act as such, and can be thought of as tax deductions and/or tax allowances or, further, as a reduction in the tax rate for the category involved. Thus, ψ ($\lambda + \psi = 1$) is the proportion of taxpayers in the same cluster who decide to be honest. [23] These parameters should reflect the determinants that lead to aggregate solutions that the literature indicates specifically as *strategic substitutability* and *strategic complementarity*. [24]

Now, the choice of the individual is simply to evade (*E*) if the aggregate of individuals belonging to his/her category choose to evade ($\hat{E}$), or be an honest taxpayer if this is the choice of the category ($\hat{T}$).[25] Actions of individuals are strategic complements: being an honest taxpayer creates an incentive for the remaining agents to act honestly. This strategic complementarity is central to the tax evasion and tax compliance of the coordination game, and provides positive spillovers in that the payoff of an individual increases as the action chosen by the others increases.

-The government cost function

The coordination game among individuals has important effects on the government's decision. When a single individual aligns his/her decision with those of fellow colleagues it makes a significant change in costs, since the probability of control and punishment changes due to the fact that a large component of individuals (possibly the whole category) evade or meet compliance.

The behaviour (and costs) of the government, which is not affected by the decision of a single individual, is strongly influenced by the aggregate of evaders and taxpayers. In particular, for the cost function $C = C^{1-\omega}$ we have to keep in mind the assumptions described in (2): $\omega > 1$, if ρ is high and *m=0*; and $\omega < 1$ for low values of ρ and *m=k>1*.

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[23] Obviously the tax rates τ, t provide disutility whereas ψ, λ entail utility to the individuals.

[24] See, for instance, Fehr and Tyran (2005) and the works quoted within the paper.

[25] $\hat{E}$ and $\hat{T}$ denote the decision taken by all other individuals.

In a setting with full compliance $\hat{T}$ ($\varepsilon = 1$) the costs are reduced (recall equation 1) whereas in the case of tax evasion $\hat{E}$ the costs are increased. The various effects of these possibilities are shown in Figure 3.

Figure 3

Category		Government: ***S***	Government: ***W***
	$\hat{T}$	$(1-t)+\psi;\quad C^{-}(1+\left(\frac{1-1}{1+0}\right))$	$(1-t)+\psi;\quad C(1+\left(\frac{1-1}{1+k}\right))$
	$\hat{E}$	$x(1-\rho\cdot t\cdot s)+\lambda;\ C^{-}(1+\left(\frac{1-0}{1+0}\right))$	$x+(1-\tau)+\lambda;\ C^{+}(1+\left(\frac{1-0}{1+k}\right))$

where C^{+} stands for an increasing cost function $C = C^{1-\omega}$ with $\omega < 1$, and C^{-} a decreasing cost function. The strategic form of Figure 3 reduces to the simplest Figure 4:

Figure 4

Category		Government: ***S***	Government: ***W***
	$\hat{T}$	$(1-t)+\psi;\quad C^{-}$	$(1-t)+\psi;\quad C$
	$\hat{E}$	$x(1-\rho\cdot t\cdot s)+\lambda;\ C^{-}(2)$	$x+(1-\tau)+\lambda;\quad C^{+}(1.03)$

Figures 3 and 4 are defined by the following government characteristics:[26]

1) For a strong and efficient (*m=0*) government, the full compliance costs decrease ($\omega > 1$) whereas the probability of auditing and fining tends to zero along with the rise in taxpayers: $u(C) = C^{1-\omega}(1+0) \Rightarrow C^{-}$.

[26] Notice that caught evaders in Figure 3 still keep the utility λ. This is to testify that a whole professional category, a whole class of job or a particular type of enterprise are on trial.

2) When the government S (*m=0*) is faced by extensive tax evasion, the probability of being detected (and its costs) tend to increase, although the cost function is decreasing ($\omega > 1$): $u(C) = C^{1-\omega}(1+1) \Rightarrow \quad C^{-}(2)$.

3) In the case of a weak and inefficient (*m=k>1*) government with full compliance ($\varepsilon = 1$), the probability of being sanctioned ρ tends to zero but the inefficiency of the tax office does not allow a decreasing cost function, $u(C) = C$.

4) When the government W (*m=k>1*) faces extensive tax evasion, C increases along with the cost of auditing and sanctioning . Here we assume that the parameter k is such as to generate the most reliable estimate for Italy (see footnote 12):
$u(C) = C^{1-\omega}(1+0.03) \Rightarrow \quad C^{+}(1.03)$

Figures 3 and 4 show the solutions of the strategic interaction between the aggregate of individuals and the government with two Nash equilibria ($\hat{T}$, *S*) and ($\hat{E}$, *W*). The first, ($\hat{T}$, *S*), is unambiguously Pareto-optimal from the welfare point of view, but the empirical evidence clearly shows that the equilibrium which characterizes the economy is ($\hat{E}$, *W*)**:** a problem of "coordination failure" leads individuals to converge on the suboptimal equilibrium ($\hat{E}$, *W*).[27] Indeed, convergence to this equilibrium is determined by the strictly dominant strategy $\hat{E}$ whenever the condition $\psi < x + \lambda$ holds.[28]

5. ***A game with incomplete information***

To stress the importance of the complementarity effect (and the coordination mechanism) and the discretionary policy to reach the suboptimal equilibrium ($\hat{E}$, *W*), we may reformulate the game in strategic form with uncertainty, highlighting the role of category coordination. Suppose that individuals have private information: they may have two types which fully describe any information available which is not common knowledge. For our current purpose we will consider the game played after Nature's type assignments as one in strategic form.[29] The individual has private information about the choice of all the others belonging to his/her category or professional class ($\hat{T}$

[27] On the importance of strategic complementarities as a basis for macroeconomic coordination failure, see, amongst others, Cooper and John (1988) and King and Wolman (2004).

[28] If we relax the assumption on symmetric equilibria $\varepsilon = 0$ and $\varepsilon = 1$, and replace it with a fraction of individuals who act as taxpayers and a fraction who act as tax evaders, the analysis may be slightly altered but it still relies upon parameters ψ and λ.

[29] We are considering a static game of incomplete information.

or $\hat{E}$). In other words, the individual knows λ (and hence ψ) and we hypothesize that his/her type space has two elements, denoted λ^1 ($\lambda = 1$ and $\psi = 0$) and λ^0 ($\lambda = 0$ and $\psi = 1$). A strategy for the government is, as before, just a single action (S, W). The payoffs are shown in Figure 5.

Figure 5

		Government			
		S		***W***	
Category	$\hat{T}(\lambda^0)$	$(1-t)+\psi$	C^-	$(1-t)+\psi$	C
	$\hat{E}(\lambda^0)$	$x(1-\rho \cdot t \cdot s)$	$C^-(2)$	$x+(1-\tau)$	$C^+(1.03)$
	$\hat{T}(\lambda^1)$	$(1-t)$;	C^-	$(1-t)$;	C
	$\hat{E}(\lambda^1)$	$x(1-\rho \cdot t \cdot s)+\lambda$;	$C^-(2)$	$x+(1-\tau)+\lambda$;	$C^+(1.03)$

While the individual knows his/her type, the government places, say, equal probabilities on the two types. Obviously, this is only an assumption of convenience that will be removed below changing Nature's type distribution: the government has strong prior that there will be many tax evader ex-ante.

The left uppermost cell states that if the government plays S and the individual has type λ^0 and plays E, they get $C^-(2)$ and $x(1-\rho \cdot t \cdot s)$, respectively. The government's payoff depends only on the chosen actions and not on who the individual is. We can easily find the Bayesian-Nash equilibria of this game. Regardless of what the government does, λ^0 chooses $\hat{T}$ and λ^1 chooses $\hat{E}$**.** The government faces an opponent who may play $\hat{T}$ and $\hat{E}$ with equal probability, because λ^1 and λ^0 are equally likely. Clearly, in this case, the government's best response is S.[30] Thus, for this game the strategy set $\{(\hat{T}, \hat{E}), S, p = 1/2\}$ is a Bayesian equilibrium**.** Interestingly, when Nature's type assignment favors λ^1**,** with a probability $p \to 0$ that the individual is type λ^0 (that is when $\psi = 0$), the equilibrium will be ($\hat{E}W$). On the contrary, when there is full probability of the individual being type λ^0**,** (that is $\psi = 1$), the outcome is ($\hat{T}S$).

Notice that we do not want to emphasize that these equilibria are tied to the assumptions regarding the structure of beliefs. The game with uncertainty stresses that the individual has private

[30] To be an optimal response for the government to play W, the following condition provided by the comparison of the expected disutility should hold: $(C - C^-) \leq (C^-(2) - C^+(1.03))$.

information about his type, but Nature may well coordinate this information. The only possibility for the individual to converge to an equilibrium is that he/she should have private information about the choice ($\hat{T}$ or $\hat{E}$) of all the others belonging to the same category or professional class. Nature's assignments are common knowledge. Individuals typically do not find it difficult to coordinate on the tax evasion equilibrium and the authority is unable to prevent such coordination among individuals: the mechanism is based on turnover (not income) which may be easily manipulated, the turnover threshold ($\hat{s}_j$) and the set of relevant variables (Ω) are common knowledge and playing with Gerico (the software provided by the Revenue Agency to apply the *Sector Studies*) is straightforward. Thus the pre-game setting with the involvement of the representative in the game provides the elements for a mechanism that allows such coordination.

The taxpayers' lack of coordination

The important issue is the lack of coordination of taxpayers. The advantage of complementarity parameter λ, which permits the coordination of tax evaders, is clearer and easier to appreciate with respect to the complementarity parameter of taxpayers ψ. This difference also arises in other important aspects that concern the government: first of all, the lack of a clear and credible tax system project. Given the size of the Italian public finance disequilibria (debt and deficits), outcomes due to a high parameter ψ (essentially a reduction in tax rates on income) may not prove credible to individuals. Moreover, fiscal credibility is irrelevant if the coordination power of the *Sector Studies* mechanism is not restricted (e.g., to limiting or hindering the representation of categories involved in the construction and management of procedures; to including parameters to avoid manipulating procedures on the relevant variables etc.) or completely redefined.

Also note that strategic complementarity inhibits a process of strategic substitutes for the individual: to go back on his/her decision and act honestly (as an individual taxpayer or enterprise), for instance declaring $s_i > \hat{s}_{ij}$ and a higher income, could be costly (unfair competition).

6. *Conclusions*

Several implications of this simple model are worth mentioning. First, tax evasion may have considerable second-order effects in terms of costs, especially if there is some coordination mechanism of individuals. Second, when a government is not able to commit to the action S (a discretionary government), this necessarily leads to strategic complementarity of tax evaders. The discretionary approach on tax evasion should be reduced as much as possible: it creates the failure

of honest taxpayers to meet compliance and increases the number of those who act as tax evaders. Third, strategic complementarity entails a coordination failure, where individuals converge to the least efficient equilibrium from a social perspective. Finally, in Italy, the audit mechanism is envisaged to coordinate individuals to be tax evaders. Only in this way can a multitude of individuals analyze parameters ψ, λ. If we reflect upon the *Sector Studies*, the philosophy of the mechanism (the audit threshold, average parameters and the Gerico software used to manipulate the relevant variables) and the coordination institution, represented by category representatives along with tax advisers, [31] contribute to enhance λ and hence lead to tax evasion on a massive scale.

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[31] There are about 266,000 tax advisers in Italy against 137,000 operating in France.

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