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AUDITING UNDER STUDI DI SETTORE

ALESSANDRO SANTORO

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Auditing under *Studi di Settore*

Alessandro Santoro[1]

Abstract

Building on Santoro (2008) we study optimal *Sds*-based auditing policies with committment . Under the constraint of inducing truthful input reporting the result is that the Tax Agency should induce only a small change with respect to the audit policy as it is actually perceived by the taxpayers.

1. Introduction

Studi di settore (*Sds)* were introduced in Italy in 1998 with the purpose to reduce tax evasion by small and medium firms. *Sds* are based on a comparison between output reported by the taxpayer (TP) and output presumed by the Tax Agency (TA). The latter, in turn, depends on the value of inputs reported by the TP and on presumed inputs' productivity. The idea is that, on average, presumed output should be higher than output taxpayers would report without *Sds*, so that tax evasion should gradually be reduced.

So far the performance of *Sds* has been quite poor (Agenzia delle Entrate, 2008a). According to many sources (Pisani, 2004; Santoro, 2006; Santoro, 2008) one of the main reasons of this failure is the extensive underreporting of the value of inputs. This, in turn, has reduced presumed output so that no incentive to report higher output levels was actually generated. Consistently with this view, some changes in the process of calculation of *Sds* were introduced by the 2006 Budget Law .

However, these changes have been hotly debated in the public opinion and have raised a number of criticisms. The purpose of this paper is to shift the focus from these procedural changes to the audit policy. More precisely, in this paper we derive an audit policy based on *Sds* which maximizes net tax proceeds under the constraint of inducing truthful input reporting. By doing so, we are able to make a step forward with respect to Santoro (2008). In that paper, there was no clear indication about the optimal auditing policy since there was no constraint on truthful input reporting. In this paper, on the contrary, this constraint is used to obtain a simple and clear-cut description of the optimal audit policy.

The approach we use is the standard Principal-Agent analysis (Andreoni et al. 1998; Sanchez and Sobel, 1993). We assume that TA can (and wants to) credibly commit to an audit policy which is announced to taxpayers before they report output and input values. However, TA's policy is

[1] DSGE, Università degli studi di Milano-Bicocca e Econpubblica (Università Bocconi).

constrained to induce truthful input reporting. After deriving the optimal policy, we compare it with what it seems to be the actual perception by taxpayers.

So far, no committment has ever been taken by the Tax Agency. The taxpayers have adjusted their behaviour to their own private information as well as to the observable data. The available evidence seems to indicate that taxpayers have somehow been overwhelmingly pessimist about the toughness of the TA's policy (Santoro, 2008). Some anedoctical evidence seems to indicate that taxpayers often believe that reporting an output lower than the presumed one would almost automatically generate an audit. In the second part of the paper we shall try to measure the impact of this pessimism on the basis of available aggregate data and to compare existing beliefs about the audit policy with the results of the theoretical analysis.

The paper is organized as follows. In Section 2 we describe the main features of the two types of audits that can be based on *Sds*. In Section 3 we derive the optimal audit policy with commitment under the constraint of truthful input reporting. In Section 4 we compare the optimal audit policy with the policy which taxpayers seemingly perceive on the basis of available data. Section 5 concludes.

2. Audit types

Sds have been fully described in Arachi and Santoro (2007) and Santoro (2008). Here, we briefly summarize their essential features and the two types of audits that *Sds* can generate.

Sds are based on a comparison between output reported by the taxpayer (TP) and output presumed by the Tax Agency (TA). The latter, in turn, depends on the value of inputs reported by the TP and on presumed inputs' productivity. In this paper, we denote reported output with $\hat{R}$, reported inputs value with $\hat{X}$ and presumed inputs' productivity with β . Thus, *Sds* are based on a comparison between $\hat{R}$ and $\beta\hat{X}$.

The audit activity has two main purposes. The first is to generate $\hat{R} \geq \beta\hat{X}$. The second aim is to obtain truthful input reports, i.e to create an incentive for the TP to report $\hat{X} = X$, where X is the true value of inputs. As documented in Santoro (2008), in the first years of implementation of Sds (1998-2004), much more emphasis was placed on output reports, so that truthful reporting of input values was virtually ignored. In recent years, this situation has somehow changed and it seems that the priority has been given to truthful inputs reporting.

These objectives may be reached through two types of audits. A firm is liable for a type I audit if and only if it reports $\hat{R} < \beta\hat{X}$. In type II audits, the firm may be audited on the difference between reported and true values of inputs, i.e on $X - \hat{X}$. Type II audits are the logical counterpart of type I

audits. Clearly, if $\beta > 0$, firms can escape type I audits by simply underreporting X, and this explains why $\hat{X}$ should be audited. Although the two types of audits are intertwined, they are intrinsically different. Type I audits are about the difference between *TP*'s presumed and reported output. There can be a number of reasons for this difference, such as a temporary halt in production, a change in the structure of the market, indisposition of the entrepreneur (recall that we are dealing with small and medium sized enterprises - SMEs), and so on. Type II audits are simpler, since they are based exclusively on the difference between the actual and the reported value of X, although if such the audit has a positive outcome the TP's entire tax liability must be recalculated.

There are some legal and institutional constraints on type I audits that are to be taken into account. A feasible functional form of type I audit probability is the following

$$q(\hat{R}/\beta\hat{X}) = \frac{1}{\delta} - \frac{1}{\delta}\frac{\hat{R}}{\beta\hat{X}}, \hat{R} \le \beta\hat{X} \qquad (1)$$
$$q = 0, \hat{R} > \beta\hat{X}$$

Santoro (2008) explains why this functional form satisfies the legal constraints concerning type I audits. Here we note that the choice of $q(.)$ depends entirely on the choice of δ which we define as type I audit policy parameter: the smaller δ, the steeper $q(.)$ is, i.e. the tougher is type I audit policy.

Type II audits may be based on the difference between true and reported levels of inputs[2] Since there are no explicit legal constraints on type II audits, we just assume (for the moment) that there is a nonnegative constant probability p of a type II audit and that the corresponding penalty applies to the weighted difference between the true and the reported level of the relevant variable, i.e to $\beta\left(X - \hat{X}\right)$.

3. The optimal committing strategy

The TA has to announce:

-the value of the presumed input productivity, β;

-the value of the unitary penalties f_I and f_{II};

-the functional form of the audit probability, which is given by (1);

-the value of δ and of p.

[2] We take the relative rather than the absolute difference since we have assumed $\beta > 0$ so that reporting $\hat{X} > X$ is never profitable (it would increase both the expected penalty of a type II audit and the difference $\beta\hat{X} - \hat{R}$).

In this setting, the problem of defining the optimal δ^* is a quite standard Principal-Agent problem where the TA is the Principal and the TP is the Agent. We will consider only one TP, and we shall implicitly assume that our results are valid within the same cluster where the TPs have the same economic features . The TA derives the optimal value of δ and of p by solving

$$\max_{\delta} NTP = \tau\hat{R}(\delta) + q(\delta)(1+f_I)\tau\left(\beta\hat{X} - \hat{R}(\delta)\right) + p(1+f_{II})\tau\beta\left(X - \hat{X}\right) \qquad (2)$$
$$-AC_I - AC_{II}$$

under the constraint of inducing truthful input reporting, where NTP are net (of costs) tax proceeds, τ is the tax rate, $\hat{R}$ is output reported by the TP, $q(\delta)$ is the probability of a type I audit, f's are unitary penalties for the two types of audits . The term $q(\delta)(1+f_I)\tau\left(\beta\hat{X} - \hat{R}_I(\delta)\right)$ denotes expected gross tax proceeds from type I audits, while the term $p(1+f_{II})\tau\beta\left(X - \hat{X}\right)$ denotes gross expected tax proceeds from type II audit activity. Finally, AC denote expected auditing costs.

We follow the literature on tax evasion by firms (see Myles, 1997 for a summary) by assuming proportional taxes. This implies that our model may apply to taxes such as Ires (the Italian tax on corporations) and Irap (the Italian tax on value added) but generally not to Irpef (the Italian tax on individuals, including unincorporated businesses and self-employed people). However, the analysis does apply to Irpef if the change in the tax base holds the TP within the same bracket.

We shall first find the optimal reports by the TP as the solution of her own minimization problem and use them back in (2) to find the optimal value of δ.

3.1 TP's behaviour

We now turn to the description of the TP's behaviour. We assume the TP is a risk-neutral firm which aims at minimizing the amount of its expected tax liability (as in Scotchmer, 1987) gross of the concealment cost G generated by tax evasion. The idea (Cowell, 2003) is that tax-evasion is a costly activity since it entails organizational costs (manipulation of current accounts, implementation of a collusion agreement between employers and employees) and possibly also psychological costs. In Cowell (2003) the crucial feature of G is its convexity with respect to the amount of tax evasion. The assumption of increasing marginal concealment cost enables some interesting results even when risk-aversion is not explicitly accounted for.

Finally, we embody the concealment cost in the analysis as $G = G(X - \hat{X})$ where $G' > 0$ since the TP has to modify its current accounts (if X is an accounting variable) or the structure of its firm (if X is a structural variable which we assume can be measured) to provide evidence that $\hat{X} < X$ in the event of a type II audit. We also adopt Cowell's (2003) assumption of convexity, thus $G'' > 0$.

To sum up the TP minimizes her total expected payment (EP) defined as

$$\min EP = \tau\hat{R} + q(\delta)(1+f_I)\tau\left(\beta\hat{X} - \hat{R}\right) + p(1+f_{II})\tau\beta\left(X - \hat{X}\right) + G(X - \hat{X}) \tag{3}$$

with respect to $\hat{R}$ and $\hat{X}$, $q(.)$ is given by (1), f's are unitary penalties for the two types of audits, τ is the proportional tax rate and *G(.)* is the cost function.

Among other features (for the discussion of which we refer the reader to Santoro, 2008) we shall stress here that (3) may be a valid description of the behaviour of rational taxpayers only, and not of honest-by- definition taxpayers. In the real world, many taxpayers do not evade even when it would be rational to do so (Andreoni et al., 1998) and a version of this behaviour happens also in the application of *Sds*, since many taxpayers report $\hat{R} > \beta\hat{X}$. However, this kind of taxpayers clearly do not pose any problem in terms of type I audit policy.

Santoro (2008) shows that truthful reporting, i.e. $\hat{X} = X$ is ensured by

$$p = \Phi(\delta) = \left(1 - \frac{\delta}{4(1+f_I)}\right)\frac{1}{(1+f_{II})} \tag{4}$$

for any given value of δ. The relationship between p and δ needs to be explained. While type II audit policy influences only the choice of $\hat{X}$, type I audit policy influences both the the choice of $\hat{R}$ and of $\hat{X}$. On the one hand, as intuition suggests and as we shall show below, the tougher type I audit policy , the closer $\hat{R}$ is to $\beta\hat{X}$. However, type I audit policy has an opposite impact on input reports: for a given probability of a type II audit, the tougher type I audit policy, the more likely it is that $\hat{X}$ is an underreport. In short, what happens is that the TP chooses how much to underreport inputs by balancing between the riskiness of such a manipulation against its usefulness. The underreporting of inputs is useful when the type I audit policy is tough, since it reduces the gap between a given $\hat{R}$ and $\beta\hat{X}$. On the other hand underreporting inputs is risky, and the degree of this risk depends upon the probability of a type II audit as well as on type II sanctions**.** Equation(4) reflects the fact that as type I audit policy gets tougher (i.e. δ is reduced) p has to be increased to induce truthful input reporting.

Santoro (2008) also shows that the solution of (3) with respect to $\hat{R}$ under (4) is given by

$$\hat{R}(\delta) = \beta X\left[1 - \frac{\delta}{2(1+f_I)}\right] \tag{5}$$

In accordance with the intuition, for a given f_I, the steeper the $q(.)$, i.e. the smaller the δ, and the

closer $\hat{R}$ would be to βX. To have strictly positive output reports, we need to assume $0 < \delta < 2(1+f_I)$.

3.2. TA's choice

Using (4) we rewrite (2) as

$$\max_{\delta} NTP = \tau\hat{R}(\delta) + q(\delta)(1+f_I)\tau\left(\beta X - \hat{R}(\delta)\right) - c_I q(\delta) - c_{II}\Phi(\delta) \tag{6}$$

where c_I is unitary type I audit cost and c_{II} is unitary type II audit cost. The main difference between (6) and (2) is that (6) includes truthful input reporting, so that there cannot be any tax proceeds from type II audit activity. Also, in (6) both expected audit costs are written as a product of unitary costs by the probability to run the audit.

Using (5) in (1)yields

$$q(\delta) = \frac{1}{2(1+f_1)} \tag{7}$$

Using (5) and (7) we can write

$$q(\delta)(1+f_I)\tau\left(\beta\hat{X} - \hat{R}(\delta)\right) = \frac{\tau}{2}\beta X\frac{\delta}{2(1+f_I)} = \frac{1}{4}\tau\beta X\frac{\delta}{(1+f_I)} \tag{8}$$

Type I expected audit costs will be simply equal to

$$AC_I = \frac{c_I}{2(1+f_1)} \tag{9}$$

where c_I denotes type I unitary audit cost. Finally, type II expected audit costs when truthful reporting of input values has to be ensured, i.e. when (4) holds, are equal to

$$AC_{II} = c_{II}\left(1 - \frac{\delta}{4(1+f_I)}\right)\frac{1}{(1+f_{II})} \tag{10}$$

Using (5), (7), (8), (9) and (10) in (6), we rewrite the TA's objective function as

$$NTP = \tau\beta X\left[1 - \frac{\delta}{4(1+f_I)}\right] - \frac{c_I}{2(1+f_1)} - c_{II}\left(1 - \frac{\delta}{4(1+f_I)}\right)\frac{1}{(1+f_{II})} \tag{11}$$

We note that

$$\frac{dNTP}{d\delta} = \frac{1}{4(1+f_I)}\left\{-\tau\beta X + \frac{c_{II}}{(1+f_{II})}\right\} \tag{12}$$

so that there is no internal solution: the optimal δ is either equal to the maximum value of δ, $2(1+f_I)-\varepsilon$, or to its minimum value, $\delta\min$, which is strictly positive but whose exact magnitude cannot be established a priori since it depends on the audit technology as well as on other financial and technical constraints. The non existence of an internal solution is mainly due to the linearity of the model.

Let us note that if

$$(1+f_{II})\tau\beta X \geq c_{II} \tag{13}$$

holds, then the TA should set

$$\delta = \delta\min \tag{14}$$

since the sign of the derivative in (12) is negative when (13) is verified. This is an intuitive result: if type II audit costs are low relatively to the value of presumed output, the best the TA can do is to take the toughest possible attitude in type I audit policy (minimum possible value of δ) since such an attitude increases $\hat{R}$, while truth reporting of inputs can be obtained by means of a high probability of a type II audit at a relatively low cost.

To see why inequality (13) seems a plausible assumption, consider that the cost c_{II} is of approximately 12 hours per tax officer (Agenzia delle Entrate, 2008b, p.65), which is approximately 340 euros (considering a monthly labour cost of 4000 euros and 140 hours of work per month). For legal reasons f_{II} ranges in the interval (0;2] so that it is strictly positive. Even if there are some taxpayers who reports zero output, on average output reported by TPs is around 200.000 of euros (see next Section). Therefore (13) is a very plausible assumption.

4. A comparison with taxpayers' perceptions

We can use the analytical framework developed in Santoro (2008) and in the previous Section to calculate what are taxpayers beliefs about the audit policy which is actually conducted by the Tax Agency, where no commitment is taken.

Let us denote with $\tilde{\delta}$ the level of type I audit policy parameter which is embodied in actual taxpayers' beliefs. If (5) provides a guidance, then this value can be obtained by taxpayers' reports and taxpayers beliefs about type I sanctions as follows

$$\tilde{\delta} = 2(1+f_I)\left[1-\frac{\hat{R}}{\beta X}\right] \tag{15}$$

Taxpayers'beliefs about type I sanctions f_I are important since, rather than being fixed by the law, this sanction depends on the outcome of a sort of bargaining process between the Tax Agency and

the taxpayer. In Santoro (2008) f_I was assumed to vary in the interval [-0,1; 1,5]. A negative value of f_I is due to additional 'discounts' that are offered by the Tax Agency to the taxpayer who pays immediately. Real data suggests that these discounts may be more important than what previously considered. Table 1 below reports data about (*maggiore imposta accertata*, MIA) and (*maggiore imposta definita*, MID) for subsets of type I audits conducted on reports concerning years 2001 and 2002.

Table 1: values of f_I, *MIA* and *MID* in .000 € (source: Italian Tax Agency,data provided to the author)

Year	% of type I audits	$\tau(\beta X - \hat{R})$=MIA	$(1+f_I)\tau(\beta X - \hat{R})$=MID	f_I
2001	83,89%	93.224	36.483	-0,6
2002	77,81%	76.814	47.868	-0,38

The subsets considered in Table 1 are type I audits that have reached a final settlement (*definizione*); remaining type I audits have not reached such a stage since the taxpayer and the Tax Agency have not agreed upon a value of f_I and the matter was presumably settled by a Court (*Commissioni tributarie*). According to recent data, and contrarily to what it used to happen previously, the Tax Agency succeeds in approximately the 50% of cases settled by a Commissione tributaria. When this happens, no discount is granted and f_I lies in the interval [1;2]. On the contrary, when the Court's decision is favourable (partially or totally) to the taxpayer, f_I lies in the interval [-0,5; -1]. On the basis of these data, we assume that a reasonable taxpayer's forecast of f_I is -0,3.

Table 2 reports aggregate data about and for fiscal years 2004 and 2005 for taxpayers whose behavior is compatible with our model, i.e. who report $\hat{R} < \beta\hat{X}$.

Table 2: values of $\beta\hat{X}$ and $\hat{R}_i$, when $\beta\hat{X} > \hat{R}$, in .000 € (source: Agenzia delle Entrate, 2008a)

Year	$\beta\hat{X}_i$	$\hat{R}_i$	$\hat{R}_i / \beta\hat{X}_i$
2004	201.574.622	179.826.122	89,21%
2005	186.781.432	167.388.907	89,61%

The ratio $\hat{R} < \beta\hat{X}$ in both years has been around 90%, which, together with f_I =-0,3, implies an

estimate of $\tilde{\delta}$ around 0.14%. This estimate is compatible with our model and consistently small. More precisely, using this value in (1), we have $q(\tilde{\delta}) = 71\%$, i.e. a perceived probability, by the TP, of around 71% to be audited under type I audit. This is a very high value which seems in line with some stylized facts observed in the period 1998-2004 and could be explained by the role played by organizations of SMEs involved in the elaboration of *Sds*(Santoro, 2008) as long as with the usual tendency by the taxpayers to overestimate audit probabilities (Andreoni et al. 1998).

5. Concluding remarks

Tax Agencies are reluctant to commit to given auditing policies (Andreoni et al., 1998). In the case of *Sds*, such a commitment is even more complex because of the need to take into account the impact of type I audit policies on input reports. Since *Sds* are based on a comparison between $\hat{R}$ and $\beta\hat{X}$, a tougher audit policy almost surely generates more intensive input underreporting (Santoro, 2008). Moreover, the spontaneous (and ex-post unrational) pessimism of taxpayers about the toughness of type I audit policy may have reinforced the idea that committment was unnecessary from the TA's viewpoint.

However, this situation cannot last forever. As Santoro (2008) noted, since misperception is a market failure, the first, obvious, policy prescription would be to give TPs a 'correct perception' of the risk by means of an appropriate auditing policy. However, Santoro (2008) could not reach a clear-cut characterization of the optimal type I audit policy since input reporting was not constrained to be truthful in that paper. Once this constraint is considered, the technical derivation of the optimal type I audit policy is greatly simplified and the solution is, due to the linearity of the model, a clear-cut one.

In particular, we show here that, under plausible assumptions type I audit probability should be increased (by increasing the number of audits) up to its maximum feasible level. However because of the existing taxpayers' missperception, the switch to this optimal audit policy should not be perceived as too dramatic by the taxpayers.

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