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Tax Evasion and Firms

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Abstract

We review the state of the economics literature on tax compliance by firms and suggest possible directions for future research within this area. The emphasis is on rigorous modelling that can be expected to yield practical policy insights.

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1 Introduction

Why consider the corporations or businesses separately in economic models of tax compliance? Some have adopted an essentially pragmatic approach: it has been argued that to distinguish corporate and personal sectors is an important way to understand the overall distortionary impact of tax evasion (Fullerton and Karayannis 1994). However, this does not address the issue of whether the underlying economic analysis of tax evasion is, or should be, different according to the sector considered.

We will consider here why the issue of tax compliance by firms presents a distinct economic problem. We do this by examining the state of the economics literature on the issue of compliance and tax enforcement as it relates to the behaviour of firms and attempting to unpick the key issues that could characterise a specific theory of compliance by firms. This theoretical approach could then form the basis of appropriate empirical models for the corporate sector and enable policy makers to develop a quantitative model for analysing the effectiveness of tax-compliance regimes.

2 Issues in modelling tax compliance by firms

In principle firms can evade by misreporting or making false declaration about

- profits
- sales or
- input use and other costs.

Some of the key questions to be addressed in the construction of an appropriate model of firms' decisions include:

- Does the assumed market environment of the firm make a difference to its compliance behaviour?
- What assumptions should be made about firms' motivations?
- How should time and uncertainty be modelled?

3 Tax evasion – standard models

We begin with one of the simplest possible models of the firm. And then proceed to a number of standard elaborations of the model that introduce a more interesting economic environment.

3.1 Tax evasion in a competitive market

This is the most commonly used reference case for the formal modelling firm behaviour: the key references are Cremer and Gahvari (1993) and Virmani (1989).

3.1.1 Model

Following the model of Cremer and Gahvari (1993) we assume:

- *Cost structure.* A competitive industry producing with average and marginal cost c.
- *Uniform tax on output*: Firm's output, x, is taxed at rate t.
- *Concealing output is costly*: Only a proportion α of sales are declared to the tax authority – i.e. a proportion $1-\alpha$ of sales are concealed. The unit cost of concealing is given by $G(1-\alpha)$ where $G(\cdot)$ is an increasing convex function.
- *Fixed detection probability.* The probability of discovery and by the tax authority and subsequent conviction is given by β.
- *Fixed proportional penalty.* If evasion is detected then the firm is required to pay the unpaid tax times a factor τ: so the penalty *rate* on evaded tax is $\tau - 1$.

From this we can see that the expected tax rate per unit of output is:

$$t^e := [\alpha + [1-\alpha]\,\beta\tau]\,t$$

Clearly this is under the control of the individual firm as well as the tax authority. Likewise expected profits are:

$$\pi^e := \left[p - c - [1-\alpha]\,G(1-\alpha) - \left[[1-\beta]\underbrace{\alpha t}_{\text{“not caught”}} + \beta\underbrace{[t + [\tau-1]\,[1-\alpha]\,t]}_{\text{“caught”}}\right]\right] x$$

which can be written as

$$\pi^e = [p - c - g(1-\alpha) - t^e]\ x \tag{1}$$

where $g(1-\alpha) :\equiv [1-\alpha]\, G(1-\alpha)$ is the average concealment costs per unit of output. If there were no concealed output (1) would reduce to

$$\pi^e = [p - c - t]x$$

In a competitive industry, the firm maximises expected profits, π^e. For any given output level $x > 0$, (1) implies that the firm chooses α to minimize concealment costs (per total output) plus expected tax rate:

$$g(1-\alpha) + t^e$$

Here is the fundamental *separability property* between the proportion of sales reported (α) and the output decision (x).

From the first-order conditions., a necessary condition to have an interior solution for α is $\beta\tau < 1$. If $\beta\tau > 1$ clearly, no evasion issue will arise and the firm will report honestly. Tis condition can be interpreted by noting that

$$\frac{\frac{t^e}{t} - \alpha}{1-\alpha} = \beta\tau$$

So $\beta\tau < 1$ is equivalent to $t^e < t$ for some α lying between 0 and 1.

The market equilibrium occurs at

$$p = c + g + t^e$$

implying that $\pi^e = 0$ (the profit is positive if the firm is not audited, negative if audited, but in the long run profit are zero).

From the solution to the maximization problem gives some comparative statics

3.1.2 Comparative statics

1. Changes in tax rate (t_k) and audit probability β_k in an industry k can affect equilibrium quantities in other industries but have no impact on the equilibrium prices in other markets (t_l^e and p_l) and share of concealed output decisions (α_l), with $k \neq l$.

2. Reported sales: Decrease as tax rate increases.

$$\frac{\partial \alpha}{\partial t} < 0$$

3. Expected tax rate: Indeterminacy of tax rate on expected tax rate (an increase in t raises the expected tax t^e directly but causes an indirect decrease in t^e as evasion rises)

$$\frac{\partial t^e}{\partial t} \lesseqgtr 0$$

4. Effects upon prices: Post-tax price rises but by less than the amount of the tax since some of the tax increase is absorbed in increased evasion.

$$0 < \frac{\partial p}{\partial t} < 1$$

5. Effects of changes in the probability of detection: Increased probability of detection raises the proportion of sales declared, expected tax and the market price.

$$\frac{\partial \alpha}{\partial \beta} > 0, \frac{\partial t^e}{\partial \beta} > 0, \frac{\partial p}{\partial \beta} > 0$$

6. Unambiguous effect on welfare since it raises the price level

3.2 Tax evasion in monopolistic and oligopolistic markets

The market-structure assumption adopted in section 3.1 is obviously over-simplified. A straightforward step would be to relax the assumption of a given selling press and replace it to the more general where we just assume that there is a determinate demand curve. The main references for this modified approach are as follows:

- Marelli (1984) and Marrelli and Martina (1988). In both cases firms are assumed risk averse.
- Myles (1995) assumes risk neutrality.

3.2.1 Model

A monopolist facing a demand function $x(p)$ chooses the price and level of evasion to maximise the following expression for profit:

$$\pi^e := \left[p - c - [1-\alpha]\, G(1-\alpha) - \left[[1-\beta] \underbrace{\alpha t}_{\text{“not caught”}} + \beta \underbrace{[t + [\tau - 1]\,[1-\alpha]\, t]}_{\text{“caught”}} \right] \right] x(p)$$

which can again be written as

$$\pi^e = [p - c - g(1-\alpha) - t^e]\ x(p) \tag{2}$$

3.2.2 Results

Given that (2) is essentially that of (1) with x replaced by $x(p)$ it is not surprising to find that basically same conclusions apply to the monopolistic case as those for the case of perfect competition.

The only really interesting novelty is the phenomenon of overshifting (where the price rises more than the increase in tax) and undershifting. Tax evasion reduces possibility of overshifting whenever $\rho\tau < 1$ and increases it if $\rho\tau > 1$. Hence, overshifting of taxation is more likely if the rate of punishment is higher.

4 Other theoretical issues

As a final point on theory consider the ways in which the basic paradigms of section 3 have been developed to draw some policy-relevant conclusions.

4.1 Optimal taxation rules

On the basis of the kind of structure outlined in section 3.1 optimal taxation rules are then derived in Cremer and Gahvari (1993) and in Etro (1998).

4.2 Separability of output and tax evasion decisions

The separability issue is potential more problematic once one drops the assumption of risk neutrality. A number articles on this issue have appeared in Public Finance Quarterly and National Tax Journal in past two decades.

Wang and Conant (1988) study the expected utility function when a monopolist overstates production costs (δ) in order to reduce taxable profits. They reach the conclusion that uncertain monopolist's optimal rate of output is not affected by either the profit tax or the penalty rate. In Wang and Conant, the probability of detection and penalty rate are exogenously fixed and monopolist decides on the *proportion* of cost overstatement ($\delta C(x)$).

$$EU = (1-\beta)U[R(x) - C(x)] + \beta\{U[R(x) - C(x)] - (\tau - 1)t\delta C(x)$$

Yaniv (1995) has developed a model of tax evasion for different type of taxes that can be evaded by the firm (profit, sales, payroll, withholding, etc.) showing that the different types of taxes do not alter the separability conclusion. The separability property holds both in competitive and monopolistic markets when probability of detection and penalty rate are exogenously fixed.

Yaniv (1996), considering the *amount* of cost overstatement extends the separability results to cases in which both the probability of detection and the penalty rate vary with the amount of cost overstatement, i.e. $\beta = \beta[\delta C(x)]$ and $(\tau - 1) = \tau[\delta C(x)] - 1$, where $\tau' > 0$ and $\beta' > 0$.

Lee (1998) shows that the separability property and the neutrality of profit taxes rely heavily on how the audit probability and penalty rate are formulated. Lee shows that if the audit probability or the penalty rate are neither constant nor only function of over-reported costs, and instead they are also function of the reported value of a variable other than profit (such as costs, or revenues), then profit taxes are not neutral in presence of tax evasion. Lee develops his arguments in a monopolistic setting with profit taxes but given the assumption of profit maximization, the same results should apply to different taxes and competitive market as in Yaniv (1995) – see also Wang (1990).

5 Empirical analysis

The empirical analysis of corporate tax evasion is extremely limited. In the main it consists of either a compilation of rather obvious results (e.g. tax evasion depends on the preferences of the person who has the power over declaration), or of procedures that could be considered as methodological very weak (e.g. see the comments on Rice 1992). The main reasons, pointed out by Rice (1992) are:

1. lack of theoretical models, since theory mainly focused on personal income tax evasion;

2. lack of corporate income tax compliance microdata;

3. lack of confidence in microdata on tax compliance and relevance of measurement error.

Rice presents and analyses the IRS's Tax Compliance Measurement Program (TCMP) dataset, which was built at the end of the 1980s from an examination of the tax and financial records of a stratified random sample of about 30,000 US corporations out of a population of 1.5 million corporation with assets less than $10 million.

There are two main results of Rice's paper that do not have counterparts in the literature on personal income tax compliance:

1. firm's compliance is positively associated with being publicly traded and with belonging to a highly regulated industry;

2. having low profits relative to the industry median is correlated with higher corporate tax evasion.

It should be noted that there are a number of problems concerning the data and also the econometric modelling. In particular measurement error seems to jeopardise the robustness of Rice's conclusions.

An interesting example of more recent work on compliance is Joulfaian (2000) who finds a positive and significative correlation between managers' preferences and firm compliance using US data.

6 Direction of future research

From the brief survey of models and empirical implementation above it is clear that this a promising field where innovative theoretical and applied research remains to be done. Here we briefly review the theoretical and empirical possibilities as they appear in the light of the current state of the literature.

6.1 Theoretical analysis

Further development of the theoretical modelling is important not just for its own intrinsic interest but as a prerequisite for intelligent policy analysis of the corporate sector.

Compare the situation of the personal and the corporate sector as they are commonly conceived within microeconomic analysis. It is reasonable to argue that individuals – and perhaps even families and households – exist as exogenously given entities; the set of potential tax-payers could be imagined as exogenously given. This is not the case with firms: firms are born and dissolved; they merge and change their shape; they do all this in response to economic incentives. The tax system and its enforcement mechanism are essential components of those economic incentives and so we have to have a reasonable model of firm behaviour before we can say anything intelligible about the impact of tax and enforcement policy. Of course the contrast is with the household sector is somewhat overstated, but we believe that this contrast contains an important component of the problem.

We do not pretend to make progress with this modelling task here. However it is useful to list a number of key issues that remain to be addressed in the modelling of corporate behaviour.

- An assumption that turns out to be crucial is that of single-period profit-maximisation as a paradigm of firm behaviour. It is important to introduce an explicit time dimension into the model, not only to take into account the issue of multiperiod activity by the firm but also to clarify the sequence of decisions by firms (in reporting) and by the tax authority (in announcing and enforcing policy).

- What is the relevance of reputation for corporate tax evasion?

- Depending on form of the audit probability, the penalty rate, and the utility function, the monopolist may produce either more or less than it would in absence of a tax. This raises the question of what the "appropriate form" for inclusion in a model. Appropriateness here may be just in terms of the way tax authorities appear to behave: or it may be possible to base this on some kind of optimising behaviour by tax-enforcement agencies.

- The risk-neutrality assumption is clearly convenient analytically and leads to some sharp conclusions about behaviour. But is it appropriate?

Recent events (for example the Enron bankruptcy) have shown that if the potential loss – in our case the penalty – is very high, risk-neutrality seems questionable even for firms – see section 4.2 above.

- Once the point about risk aversion is conceded it may be appropriate to consider the introduction of "orders of risk aversion" as a useful for concept for modelling corporate tax evasion. (Bernasconi 1998)

Not all of these generalisations could reasonably be expected to be included in a simple theoretical model; but they could serve as the basis for constructing a coherent research agenda.

6.2 Empirical analysis

Clearly the empirical analysis which that can be undertaken to implement a compliance model will depend on which particular developments are pursued from the list in Section 6.1. Clearly, also, it will also depend on the statistical information that is available. Here one has to make a distinction between "Alice in Wonderland" data that simply could never be extracted and data that, although not yet in existence, could become come available albeit under some restriction as to their openness to non-governmental researchers. The "Alice in Wonderland" problem relates to obvious difficulties with confidentiality or misrepresentation that rule out the possibility of making independent observations at the level of individual the agent. However, some types of data are not available simply because it has not been clearly stated what should be produced for the purposes of effective tax modelling or what should be the priorities for producing appropriate data given limitation of resources within tax authorities.

To make some advancement in this area let us draw up a brief list of "non-Alice" suggestions that could lead to more effective economic modelling of tax compliance.

- Perhaps the most glaring lack is that of a European counterpart to the TCMP described in Rice (1992); this is something that should be given serious thought by data providers in each of the participating countries. At this stage we have not defined what kind of information such a dataset should present and we will deal with this later in the project.

- The TCMP also has its limitations: it has little to say on "non-filers" or "ghosts." However, in both the British and the Italian context this kind of data is capable of being generated either from tax authorities or from related government agencies. It would permit a an empirical implementation of the type of model in Cowell and Gordon (1989) and (1995).

- Sometimes practical economic enquiry has to proceed by stealth. A valuable example of this in the personal sector is the approach by Pissarides and Weber (1989) to the under-reporting of personal income tax, by analysing consumption data for households. An interesting task for academic researchers and official data-providers jointly is to identify observables that are likely to be correlated with profit (as consumption is with income) and that firms have an incentive to reveal more truthfully.

References

Bernasconi, M. (1998, January). Tax evasion and orders of risk aversion. *Journal of Public Economics 67*(1), 123–134.

Cowell, F. A. and J. P. F. Gordon (1989). On becoming a ghost: Indirect tax evasion and government audit policy.

Cowell, F. A. and J. P. F. Gordon (1995). Auditing with ghosts. In G. Fiorentini and S. Peltzman (Eds.), *The economics of organised crime*, pp. 185–196. Cambridge, London: Cambridge University Press and CEPR.

Cremer, H. and F. Gahvari (1993). Tax evasion and optimal commodity taxation. *Journal of Public Economics 50*, 261–275.

Etro, F. G. (1998, July). Incidenza fiscale e regole di ramsey con potere di mercato ed evasione. *Rivista di Politica Economica 88*, 27–59.

Fullerton, D. and M. Karayannis (1994). Tax evasion and the allocation of capital. *Journal of Public Economics 55*, 257–278.

Joulfaian, D. (2000, November). Corporate income tax evasion and managerial preferences. *Review of Economics and Statistics 82*, 698–701.

Lee, K. (1998). Tax evasion, monopoly, and nonneutral profit taxes. *National Tax Journal 51*, 333–338.

Marelli, M. (1984). On indirect tax evasion. *Journal of Public Economics 25*, 181–196.

Marrelli, M. and R. Martina (1988). Tax evasion and strategic behaviour of the firms. *Journal of Public Economics 37*, 55–69.

Myles, G. D. (1995). *Public Economics*. Cambridge: Cambridge University Press.

Pissarides, C. and G. Weber (1989). An expenditure-based estimate of Britain's black economy. *Journal of Public Economics 39*, 17–32.

Rice, E. M. (1992). *The Corporate Tax Gap: Evidence on Tax Compliance by Small Corporations*, pp. 125–161. The University of Michigan Press.

Virmani, A. (1989). Indirect tax evasion and production inefficiency. *Journal of Public Economics 39*, 223–237.

Wang, L. F. S. (1990, December). Tax evasion and monopoly output decisions with endogenous probability of detection. *Public Finance Quarterly 18*, 480–487.

Wang, L. F. S. and J. L. Conant (1988, December). Corporate tax evasion and output decisions of the uncertain monopolist. *National Tax journal 41*, 579–81.

Yaniv, G. (1995). A note on the tax-evading firm. *National Tax Journal 68*, 113–20.

Yaniv, G. (1996, October). Tax evasion and monopoly output decisions: Note. *Public Finance Quarterly 24*, 501–5.