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Tax Evasion by Firms

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Abstract:

This contribution surveys theoretical analyses of tax evasion by firms. It uses a simple model in which the firm determines economic activity and the under-declaration of the tax base to integrate various approaches into a coherent analytical framework. Initially, the chapter characterises the basic features of the firm's decision. Subsequently, it considers the effects of firm-size heterogeneity, restrictions on evasion behaviour, the co-existence of tax evasion with other illegal activities, output market interactions, non-profit objectives, and corporate governance issues.

JEL-Classification: H 25, H 26, K 34

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Definition

Tax evasion by a firm represents the enterprise's attempt not to comply with tax law and to, thereby, illegally reduce tax payments below the level prescribed by law. Tax avoidance aims to circumvent tax law and to legally reduce tax payments below the level desired by tax authorities.

1. Introduction

In OECD countries, firms remit the overwhelming share of tax revenues (Milanez 2017; Slemrod and Velayudhan 2018; OECD 2020). This is the case because firms either are legally obliged to pay taxes or act as withholding agents. Therefore, firms and businesses have ample scope for tax avoidance and evasion activities, and such behaviour is widespread. Slemrod (2007, p. 28) reports that the average tax gap in the United States – that is, the difference between the amount of taxes due and the amount paid voluntarily and on time – was about 16% in 2001. The average VAT compliance gap in the European Union is about 11% (CASE 2020). Profit shifting constitutes another means of evading or avoiding tax payments. Clausing (2016) indicates that it reduces annual corporate tax revenues in the United States by US $77 to $111 billion, whereas Cobham and Janský (2018) calculate global revenue losses in the range of US $500 billion.

This article outlines the trade-off from a theoretical vantage point, which a firm faces when deciding about the optimal level of tax payments. It provides a positive analysis, while normative issues, such as the optimal design of a tax system and its enforcement in the presence of tax evasion, are beyond its scope. The survey by Wang et al. (2020) and the review by Slemrod (2019) summarise the strongly expanding empirical work on evasion, avoidance and tax planning activities, which is referred to below in so far as it relates to the theoretical findings presented.

2. Basic Model

We consider a single firm that maximises expected profits by determining the level, x, of economic activity and the under-declaration, E, of the tax base. In the basic set-up, there is one tax base. If the firm does not evade or avoid taxes, its (after-tax) profits are given by $\pi(x, t)$, with t denoting the tax rate. The profit maximising level of activity, x*, is defined by $\pi_x(x^*, t) = 0$ and $\pi_{xx}(x^*, t) < 0$, where subscripts denote partial derivatives. Taxes remitted by firms generally reduce profits and economic activity, such that $\pi_t < 0$ and $\pi_{xt} < 0$ apply, although exceptions are feasible, for example in the case of full forward-shifting or a pure profit tax.

If the firm evades or avoids taxes, the resulting monetary gain amounts to Et. We subsequently assume that taxes are under-declared, $E > 0$, and that E is less than the tax base.[1] The expected costs of under-declaring the tax base are given by C(E, t), where C increases in the under-declaration at an increasing rate for $E > 0$ ($C_E(0, t) = 0 < C_E(E > 0, t)$, C_{EE}) and also rises in the tax rate ($C_t > 0$). The expected costs, C, can obviously depend on other components, such as the probability of being detected evading taxes, the magnitude of fines, the nature of court proceedings, or payments to tax advisors.

Expected profits, which incorporate the expected gains from an under-declaration, are given by:

$$\pi^E(x, E) = \pi(x, t) + Et - C(E, t) \tag{1}$$

The maximisation of 'after-evasion profits', π^E, implies two first-order conditions:

$$\pi_x(x^*, t) = 0 \tag{2a}$$

$$t - C_E(E^*, t) = 0 \tag{2b}$$

The optimal activity choice, x*, maximises after-tax profits, π, while the optimal under-declaration of the tax base, E*, balances the marginal gain in terms of lower tax payments with the greater expected costs of reducing the transfer to tax authorities.

The fundamental trade-off described by equation (2b) applies to a firm's tax evasion and to its avoidance choices, as long as a comparison of expected gains, Et, and expected costs, C(E, t), governs both types of behaviour. Therefore, the subsequent exposition focuses on tax evasion.

3. Major Findings

Conditions (2a) and (2b) generate four main insights:

(1) A firm's activity decision is separable from its evasion choice. Hence, a firm always chooses that level of economic activity, x*, which it would have selected in the absence of evasion. Furthermore, the optimal under-declaration, E*, is the same, irrespective of activity choices. Accordingly, a large firm, which chooses a high activity level, under-declares the same amount as an otherwise identical small firm, which exhibits a lower activity, unless the marginal costs of tax evasion, C_E, vary with firm size. While the separability feature is a relatively robust theoretical prediction (Yaniv 1995, 1996), the empirical evidence on the correlation between firm size and tax evasion is mixed and often does not allow to directly test the prediction (Rice

[1] Marrelli (1984), Virmani (1989), and Cremer and Gahvari (1992) provide modelling approaches in which corner solutions can result, i.e., outcomes without tax evasion or tax payments.

1992; Nur-tegin 2008; Hanlon et al. 2007; Tedds 2010; Alm and McClellan 2012; Wang 2012; Beck et al. 2014; Gokalp et al. 2017, Dyreng et al. 2020).

(2) If the expected marginal costs of evasion increase by less with the tax rate, t, than the gain from evasion, $C_{Et} < 1$, then the optimal under-declaration of the tax base, E*, rises with t. This theoretical prediction finds some empirical support (Rice 1992; Nur-tegin 2008; Wang 2012; Beck et al. 2014).

(3) Higher marginal expected costs of evasion, C_E, reduce the under-declaration of the tax base. This suggests that a greater probability of being caught evading taxes, a higher penalty, and more pronounced adverse public responses to tax evasion lower the optimal under-declaration, E*.

(4) The aforementioned results are not affected by the type of tax (Yaniv 1995), and apply to settings with multiple tax rates and activity choices, as well (Almunia and Lopez-Rodriguez 2018, online Appendix).

4. Extensions

This section relaxes some assumptions of the simple model. It indicates recent research topics and derives additional predictions, which are susceptible to empirical scrutiny.

4.1 Size-dependent Costs of Evasion

There are various arguments supporting the view that the expected costs of evasion depend on a firm's size and activity level, such that C = C(E, t, x). A large firm with more transactions and more diverse activities can find it easier and, thereby, cheaper to under-declare a given amount of taxes than a smaller enterprise. This suggests that the expected costs of evasion decline with the activity level, $C_x < 0$ (Carillo et al. 2017). This kind of relationship also arises if the probability of being audited shrinks with the magnitude of tax payments, which are larger for firms with higher activity levels, given a constant under-declaration (Marrelli 1984). However, the expected costs of evasion may also rise with the activity level if the probability of being caught evading taxes depends positively on output and, thus, the number of transactions (Marrelli 1984; Virmani 1989; Wang 1990). This is likely in the case of third-party reporting. $C_x > 0$ can also result in a multi-period setting in which the firm invests in cost reductions and thereby enhances the probability of firm survival. Accordingly, the likelihood rises that the firm is punished for current tax evasion activities in later periods (Baumann and Friehe 2010; see also Panteghini 2000). Finally, size-dependent enforcement strategies could result in discontinuous changes in C if the probability of being audited rises for those firms that select a higher activity than some threshold level (Almunia and Lopez-Rodriguez 2018).

Given a dependence of the expected costs of tax evasion on the activity level, the first-order conditions for a profit maximum are $\pi_x(x^*, t) - C_x(E^*, t, x^*) = 0$ and $t - C_E(E^*, t, x^*) = 0$.[2] For $C_x < 0$, tax evasion encourages a firm to expand activity, i.e., big firms evade more than smaller enterprises. Raising the expected marginal costs of evasion, C_E, reduces evasion for a given activity level. Additionally, if the marginal expected costs of tax evasion rise with activity ($C_{Ex} > 0$), then the decrease in the under-declaration provides the firm with incentives to, ceteris paribus, raise activity. However, the direct impact of higher marginal costs of tax evasion on activity is negative. Consequently, the overall activity change tends to be ambiguous. If the activity adjustment cannot be ascertained, the effects on evasion are also indeterminate (Virmani 1989). Consequently, a firm's response to alterations in the incentives to evade taxes depends on the exact specification of the expected costs of tax evasion (Marrelli 1984). Finally, if there is an output effect on the expected costs of evasion, $C_X \neq 0$, tax rate variations affect activity or output choices differently in the presence of tax evasion than in its absence (Lee 1998).

4.2 Restrictions on Evasion Choices

Suppose that the firm cannot choose the level of the under-declaration of the tax base, E, but only select a fraction or multiple, e, of the activity level, x, so that $E = ex$, $e \geq 0$, applies. Moreover, the tax base increases linearly in the activity level. Such a situation may arise if the activity level is easily observable. Think of a tax on the payroll, which consists of the product of the number of employees and their wages. If a head-count is feasible, while wage payments are more arduous to observe for tax authorities, then authorities are likely to know x. Similarly, more elaborate information sharing with the financial sector may restrict evasion choices because this provides banks with extensive knowledge of activity levels (Beck et al. 2014).

For $E = ex$, the first-order conditions for a profit-maximum are $\pi_x(x^*, t) - e^*(t - C_E(e^*x^*, t)) = 0$ and $t - C_E(e^*x^*, t) = 0$. Therefore, activity and evasion decisions are separable if firms can select e optimally. However, institutional restrictions can limit a firm's choice. Suppose a minimum wage has to be paid, giving rise to a lower bound for tax payments. In both cases, there is a threshold for e, which must not be exceeded. Alternatively, if not all costs are tax-deductible and firms cannot overstate costs, they may effectively be constrained in their choice of e. In

[2] See Appendix 7.1 for the calculations that provide formal substance to the subsequent verbal exposition.

consequence, $t - C_E > 0$ results, and the separability feature no longer applies (Marrelli 1984; Wang and Conant 1988; Yaniv 1995; Dyreng et al. 2020).

The empirical evidence that state-owned companies (Tedds 2010; Alm and McClellan 2012; Gokalp et al. 2017) and publicly traded firms (Rice 1992; Hanlon et al. 2007), which are easier to monitor, evade less is consistent with this interpretation. Similarly, a stronger response to tax enforcement by firms, which sell a high share of their output to other firms instead of to consumers, and are, thus simpler to observe via the traceability of transactions between firms (Almunia and Lopez-Rodriguez 2018), can also be viewed in this light.

4.3 Tax Evasion and Other Illegal Behaviour

A firm that evades taxes usually maximises profits with respect to more than just the activity level in addition. Focussing on other modes of illegal behaviour, the firm may avoid labour regulations (Cuff et al. 2020), not pay a minimum wage (Tonin 2011), undertake corruptive activities (Goerke 2008), or violate environmental or workplace safety regulations. Denoting this second illegal activity by A and the gain from evading taxes and the second activity by G(Et, A), where G is increasing in both arguments, the firm's objective may be expressed as:

$$\pi^E(x, E, A) = \pi(x, t) + G(Et, A) - C(E, t, A) \quad (3)$$

If the marginal gains from or the costs of under-declaring the tax base vary with the second illegal activity, the optimal choices of E and A depend on each other. This dependence is likely because reducing the other illegal activity can lessen the likelihood that tax evasion is observed. Alternatively, the payment of bribes may require slush funds, such that the gain from the non-payment of taxes rises. In consequence, a firm's tax evasion behaviour can vary with the enforcement of other regulations, the gains from and fines for violating them, the tax treatment of bribe payments or minimum wage variations. Obviously, tax evasion can also affect other illegal behaviour. From a theoretical perspective, the exact nature of these interdependencies is largely unchartered territory.

A similar evaluation applies if one re-interprets the choices of E and A as evasion decisions for two distinct taxes, such as social security contributions or the VAT, on the one hand, and profit taxation, on the other hand (Almunia and Lopez-Rodriguez 2018; Li et al. 2020). Alternatively, A may describe the extent of bribes paid to tax officials. Abdixhiku et al. (2018), Alm and McClellan (2012), Wang (2012), (Alm et al. 2016) and Gokalp et al. (2017) provide evidence of a positive correlation between corruptibility of a country's tax administration and tax evasion.

The feature that tax evasion affects the gains and costs of other legal tax choices, such as relating to tax avoidance (Huang and Kuo 2014), profit-shifting in case of multinationals companies (Baumann and Friehe 2013), or applications for government subsidies (Ye and Xiang 2020), suggests that the analysis of such interactions deserves further scrutiny.

4.4 Market Interactions

The analysis thus far presumes that the firm's choices do not impact other firms' behaviour and are not affected by the competitors' actions. Suppose, instead, that after-tax profits, π, also depend on the aggregate activity level, X, of all other firms, $\pi = \pi(x, X)$. If activity levels are substitutes, then the gain from expanding production shrinks with X, implying that $\pi_{xX} < 0$ applies.

In such a setting, product market characteristics and tax enforcement activities can have somewhat surprising repercussions. To illustrate, assume that the government makes the product market more competitive by lowering entry barriers, reducing bureaucratic obstacles for setting up a firm, or by opening up the market to foreign competition. All these measures raise the number of competitors and, most likely, the aggregate activity level. Consequently, the firm under consideration chooses a lower activity level and, thus, has a smaller tax base. Since the optimal under-declaration of the tax base is unaffected by activity, while the tax base falls, the fraction of taxes evaded rises. Moreover, if more firms evade the same amount, aggregate tax evasion goes up. Hence, intensifying competition can have an adverse side-effect of aggravating tax evasion activities (Goerke and Runkel 2011). Conversely, more intensive enforcement of tax regulations increases the expected costs of evasion, C. This, in turn, lowers expected after-evasion profits and can make entry into the market less attractive (Goerke and Runkel 2006). In this case, the strictness with which tax authorities collect taxes can be inversely related to the intensity of product market competition (Goerke and Runkel 2011; for further theoretical examinations of the relationship between tax evasion and competition, see Besfamille et al. (2009), Seidel and Thum (2016), Goerke (2017), and Fanti and Buccella (2021), while Cai and Liu (2009), Tedds (2010), Wang (2012), and Gokalp et al. (2017) provide empirical evidence).

Product market interactions can also affect evasion behaviour if tax authorities compare firms when deciding about enforcement activities. To illustrate this idea, suppose that the expected costs of tax evasion, C, depend on the ratio of the firm's under-declaration of the tax base, E, to the average under-declaration by other firms, denoted by $\overline{E}$. The higher this ratio is, relative to the ratio, $x/\bar{x}$, of the firm's activity level to the average activity level, $\bar{x}$, the higher the expected costs of evasion are. Hence, these costs may be expressed as $C = C(\widetilde{E}, t)$, where $\widetilde{E} = (E/\overline{E})/(x/\overline{x})$. This type of cost function can result if tax authorities employ a relative audit rule. It is based on observable differences in tax payments, which are inversely related to the magnitude of under-declarations, and basically observable differences in activity, as measured by output or input levels (see Bayer and Cowell (2009, 2016), and also Marrelli and Martina (1988)).

If the expected costs of tax evasion are given by $C(\widetilde{E}, t)$, then there are incentives to raise activity to make an under-declaration of the tax base less obvious to authorities. Because $C_{Ex} < 0$ implies that higher marginal costs of evading taxes reduce evasion and the firm's activity level, x, the gains from expanding x fall with tax evasion. Moreover, a greater aggregate activity level, which comes about because the number of competitors rises, such that average activity per firm, $\overline{x}$, declines and evasion is less demanding to hide, induces the firm to raise its under-declaration (see Appendix 7.2). Therefore, if output per firm declines because barriers to entry are reduced, aggregate evasion not only rises because there are more firms evading taxes but also because each of them may evade more (see also Goerke and Runkel 2011).

The approaches sketched above clarify that the interaction between firm behaviour on imperfectly competitive input or output markets and tax evasion deserves greater attention. This is all the more so because market power generally distinguishes firms from individuals, implying that insights from the analysis of personal income tax evasion cannot be applied in a straightforward manner to the behaviour of firms.

4.5 Non-profit Objectives

There has been a long-standing debate on whether firms actually pursue a profit objective (Ward 1958; Baumol 1959, 1962; Williamson 1966). Enterprises may regard firm growth or revenue maximisation as desirable, additional goals. Therefore, firms could maximise a weighted sum of profits and the second objective, or pursue this objective, subject to a profit constraint. To integrate such considerations, assume that there is an additional element, S, in the firm's objective, which affects the gain from activity, such that $S = S(x)$. Furthermore, the expected costs of tax evasion can vary with the additional objective, $C = C(E, t, S(x))$.

Additional arguments can also be present in a firm's objective if the production causes externalities and the firm wants to correct the ensuing welfare losses. Such aspects of corporate social responsibility can affect a firm's objective in various ways (Kitzmueller and Shimshack 2012). If the firm has market power and sells its product at a price above marginal costs, there are additional gains from a higher activity level, implying that $S_x > 0$. If, however, the firm produces an environmentally harmful product, the additional objective may shrink with the activity, $S_x < 0$. Finally, the additional payoff, S, may vary with evasion activities if either the non-payment of taxes undermines the claim of being a socially responsible firm or corporate socially responsible behaviour compensates reputation losses due to tax evasion, $S = S(x, E)$. Hence, we can express the firm's objective as:

$$\pi^E(x, E) = \pi(x, t) + Et - C\big(E, t, S(x, E)\big) + S(x, E) \tag{4}$$

Equation (4) straightforwardly demonstrates that an additional non-profit objective is likely to create a relationship between tax evasion and activity. The direction and strength of this relationship depends crucially on the nature of the additional objective (Goerke 2019). In line with this theoretical insight, empirical analyses suggest that the effect of corporate social responsibility on tax evasion and avoidance behaviour varies with how enterprises interpret such objective and how researchers measure them (Huseynov and Klamm 2012; Lanis and Richardson 2012; Laguir et al. 2015, and Davis et al. 2016). Thus, tax evasion by firms, which do not – only – maximise profits, constitutes a fascinating research topic.

4.6 Separation Between Ownership and Control

This section explores the distinction between owners and managers. The owner is female and maximises π^E. The objective of the male manager is denoted by M.

4.6.1 Expected Costs of Tax Evasion

If firm owners can diversify income risks by holding small stakes in many firms, then the uncertainty associated with tax evasion does not require special attention. In the case of a manager, however, such diversification may be impossible or costly. This is especially true if the expected costs of tax evasion include the monetary equivalent of imprisonment or other personalised sanctions, such as ostracism by colleagues or neighbours. Therefore, the certainty equivalent of the expected cost of tax evasion, C, may be higher for a manager than a firm owner, such that $\alpha > 1$ holds true in equation (5).

$$M(x, E) = \pi(x, t) + Et - \alpha C(E, t) \tag{5}$$

We can then predict that managers evade fewer taxes than if the owner decides about the under-declaration of the tax base. More generally, the above argument suggests a systematic relationship between a manager's risk-aversion and tax evasion behaviour (Joulfaian 2000; Goerke 2007).

A common theme in the debate about excessive manager remuneration is the claim that profit-related pay induces managers to primarily pursue short-term profit objectives. Given that many instances of tax evasion are detected with a substantial delay, and the final determination of the tax burden and possible fine payments are subject to lengthy bargaining procedures and trials, a manager may already have left the company when the entire costs of tax evasion materialise. From this vantage point, the expected costs of tax evasion are, therefore, lower than those relevant for the company ($\alpha < 1$ in equation (5)). Hence, hired managers can be predicted to evade more than owners.

Deviations of the parameter α from a value of unity due to differential time horizons can also be interpreted in terms of the firm's ownership structure. If ownership is concentrated, as it is often true for family firms or more likely to be the case for privately owned enterprises than those firms that are publicly traded, such enterprises may not maximise profits in the short-run but have a long term objective. These firms can, hence, have smaller incentives to evade taxes.

Differences in the expected cost of tax evasion may further be interpreted with a regard to legal regulations. Assume that the law imposes vicarious liability and the firm is at least partly liable for the manager's actions. This is tantamount to a reduction of the expected costs of evasion from the manager's perspective. Employment contracts that compel the employer to stand in for a fine that tax authorities have imposed on the manager have similar effects. In both cases, a hired manager has, ceteris paribus, greater incentives to evade taxes than the owner.

Finally, variations in the parameter α can capture differences between managers. The higher a manager's abilities are to evade taxes, the lower are the parameter α and his expected costs, and the higher is the under-declaration of the tax base. This suggests that better qualified managers evade more taxes (Koester et al. 2017). Alternatively, suppose a manager's evaluation of the expected costs is affected by previous experience with tax evasion activities or other illegal behaviour. This is likely to be the case because many determinants of expected costs are based on subjective evaluations, such as the probability of being audited, the extent to which an audit reveals evasion activities or the probability of winning an ensuing lawsuit. If prior experience with personal income tax evasion reduces the subjectively perceived expected cost of corporate evasion, there is a positive impact on tax evasion by firms (Joulfaian 2000; Chyz 2013).

4.6.2 Corporate Governance

A manager's decisions may not be confined to the activity level, x, and the under-declaration, E. If his actions cannot be controlled perfectly, he may also shift income to himself. We label such managerial diversion of a firm's assets as theft, denoted by W (cf. Desai et al. 2007). Theft increases the manager's payoff by the full amount and reduces after tax-profits by (1 – t)W if the respective expenditure lowers the tax base. When trying to appropriate W, the manager has to expend effort, which reduces utility because he is not fully compensated for his effort. For simplicity, the costs of effort, g, increase in the sum of x, E, and W at an increasing rate, implying that g = g(x + E + W) and g', g'' > 0 hold true. This could be the case if every hour the manager spends for increasing the amount of taxes evaded or theft is no longer available for expanding the activity level because he has a limited time budget.

Given the opportunity to directly improve his payoff, the manager's objective can be expressed as:

$$M(x, E, W) = \beta \underbrace{[\pi(x, t) - W(1 - t) + tE - C(E, t)]}_{= \pi^E} + \gamma W - g(x + E + W) \tag{6}$$

If there is perfect control of the manager, γ = 0 applies, and he chooses W = 0. If the parameter γ is positive, then an agency problem exists, and an increase in γ can be interpreted as a reduction in corporate governance quality. Finally, the parameter β indicates the strength of incentive compensation.

The first-order conditions for a maximum of the manager's payoff, M, are:[3]

$$M_x = \beta \pi_x(x, t) - g'(x + E + W) = 0 \tag{7a}$$

$$M_E = \beta(t - C_E(E, t)) - g'(x + E + W) = 0 \tag{7b}$$

$$M_W = -\beta(1 - t) + \gamma - g'(x + E + W) = 0 \tag{7c}$$

Assuming an interior solution for theft (W = W*), an increase in the parameter γ and, hence, more severe agency problems reduce the optimal under-declaration of the tax base, E*. This is the case because the manager obtains a greater payoff from theft, such that W* increases, and spends less effort on the illegal activity from which he benefits to a lesser extent. Equations (7a) and (7b) clarify that the fall in E* is accompanied by a decline in economic activity, x*. The inverse relationship between theft and tax evasion is strengthened if the marginal expected costs of evasion depend positively on theft (C = C(e, t, W) and $C_{EW} > 0$), while declining marginal costs ($C_{EW} < 0$) may also give rise to a positive correlation (Desai and Dharmapala 2006, 2009).

Furthermore, a higher tax rate, t, raises the amount of theft, W*, if t does not increase the activity level and does not lower the marginal expected costs of tax evasion (see also Desai et al. 2007). Higher marginal costs of tax evasion, C_E, obviously reduce the under-declaration of the tax base, E*, do not affect activity, x*, and raise theft, W*, by the same amount by which E* declines.

[3] See Appendix 7.3 for the second-order conditions and formal details of the subsequent comparative static analysis.

Finally, giving the manager a greater share of profits, i.e., raising β, induces him to lower the under-declaration, E^*, and raise theft, W^*, and the activity level, x^* (see Desai and Dharmapala 2006).

The above analytical setting can be re-interpreted to illustrate the effects of tax evasion on work incentives in principal-agent settings. Suppose, for this purpose, that x defines the manager's effort level and W the fixed wage. While the disutility from effort, g, which depends on x and E only, $g = g(x + E)$, and the wage payment, W, are certain, the gain, $Z = \beta[\pi(x, t) - W(1 - t) + tE - C(E, t)]$, from the economic activity and tax evasion is uncertain. If the manager is risk-averse, his payoff can be expressed as $M = \mu Z + \gamma W - g(x + E)$. The parameter μ, $0 < \mu \leq 1$, indirectly measures the effect of uncertainty or risk-aversion. While the manager chooses effort, x, and the under-declaration, E, to maximise M, the principal selects the fixed wage, W, and incentive compensation, β, to maximise her income $(1 - \beta)Z$, where x and E depend on β and W due to the manager's optimising behaviour and his participation constraint.

Chen and Chu (2005) show within this kind of framework that tax evasion reduces the manager's effort unless he exhibits constant absolute risk-aversion. This is the case because the manager has to be compensated by a higher fixed wage for the additional uncertainty in his returns from tax evasion. Crocker and Slemrod (2005) consider a setting with superior information of the manager about tax evasion opportunities. While this assumption suggests lower costs of evasion for the manager and, hence, higher tax evasion than the principal would choose in a full-information framework, adjustments in the manager's compensation may counteract this effect. Besides, Crocker and Slemrod (2005) establish that a manager reacts more strongly to variations in penalties than the principal.

5. Summary

The theoretical analysis of income tax evasion by individuals is well developed in public economics. Corresponding investigations of tax evasion and tax avoidance by firms have lagged behind and are dispersed over various fields. This chapter provides a consistent analytical framework to highlight aspects of tax evasion choices specific to firms. It indicates potentially interesting topics for future research and formulates empirical predictions, which can be derived from the theoretical analyses.

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7. Appendix

7.1 Size-dependent Costs of Evasion

Maximisation of the firm's objective $\pi^E(x, E) = \pi(x, t) + Et - C(E, t, x)$ yields:

$$\pi_x(x, t) - C_x(E, t, x) = 0 \quad \text{(A.1a)}$$

$$t - C_E(E, t, x) = 0 \quad \text{(A.1b)}$$

The second-order conditions are $C_{EE} > 0$, $\pi_{xx} - C_{xx} < 0$, and

$$-(\pi_{xx} - C_{xx})C_{EE} - (C_{Ex})^2 > 0. \quad \text{(A.2)}$$

The effects of a higher tax rate, t, on optimal choices are given by:

$$\frac{dE^*}{dt} = \frac{-(\pi_{xx} - C_{xx})(1 - C_{Et}) - C_{Ex}(\pi_{xt} - C_{xt})}{(C_{xx} - \pi_{xx})C_{EE} - (C_{Ex})^2} \quad \text{(A.3a)}$$

$$\frac{dx^*}{dt} = \frac{C_{EE}(\pi_{xt} - C_{xt}) - (1 - C_{Et})C_{Ex}}{(C_{xx} - \pi_{xx})C_{EE} - (C_{Ex})^2} \quad \text{(A.3b)}$$

If the expected costs of evasion do not vary with activity, that is, if $C_{xx} = C_{Ex} = C_{xt} = 0$, the output variation is given by $dx/dt = -\pi_{xt}/\pi_{xx}$, which clearly differs from the expression in (A.3b).

To illustrate the statements relating to the impact of the marginal costs of tax evasion in the main text, suppose that C(E, t, x) is given by $(c + c_1E + c_2E^2)f(t, x)$, where $c, c_2 \geq 0$, $c_1 > 0$ and $f(t, x) > 0$. Because the expected marginal costs of evasion equal $C_E = f(t, x)(c_1 + 2c_2E)$, they rise with c_1. The impact on the first-order conditions (A.1) is:

$$\frac{\partial^2 \pi^E}{\partial x\, \partial c_1} = -f_x(x, t) \quad \text{(A.4a)}$$

$$\frac{\partial^2 \pi^E}{\partial E\, \partial c_1} = -f(x, t) < 0 \quad \text{(A.4b)}$$

Therefore, the variations in the optimal under-declaration of the tax base, E*, and the activity level, x*, due to higher marginal expected cost of tax evasion, c_1, are:

$$\frac{dE^*}{dc_1} = \frac{(\pi_{xx} - C_{xx})f + C_{Ex}f_xE}{(C_{xx} - \pi_{xx})C_{EE} - (C_{xE})^2} \tag{A.5a}$$

$$\frac{dx^*}{dc_1} = \frac{-C_{EE}f_xE + fC_{Ex}}{(C_{xx} - \pi_{xx})C_{EE} - (C_{xE})^2} \tag{A.5b}$$

Suppose, that the expected marginal costs of tax evasion rise with the activity level, implying that $C_x = f_x(c + c_1E + c_2E^2) > 0$ and $C_{xc_1} = f_xE > 0$ apply. In this case, the direct negative effect of a rise in c_1 on the under-declaration of the tax base, E*, is mitigated or even reversed by a decrease in activity, such that the overall variation in E* is uncertain. The same ambiguity arises with regard to the change in the activity level, x*.

7.2 Relative Costs of Tax Evasion

If the expected costs of tax evasion are given by $C = C(\widetilde{E}, t)$, where $\widetilde{E} = (E/\overline{E})/(x/\overline{x})$ and $C_E = \partial C/\partial\widetilde{E} > 0$ apply, the first-order conditions for profit maximum are:

$$\pi_x(x,t) + C_E(\widetilde{E},t)\frac{\widetilde{E}}{x} = 0 \tag{A.6a}$$

$$t - C_E(\widetilde{E},t)\frac{\overline{x}}{\overline{E}x} = 0 \tag{A.6b}$$

Second-order conditions are:

$$\pi_{xx} - C_{EE}\left(\frac{E\overline{x}}{\overline{E}x^2}\right)^2 - 2C_E\frac{\widetilde{E}}{x^2} < 0, \tag{A.7a}$$

$$C_{EE}\left(\frac{\overline{x}}{\overline{E}x}\right)^2 > 0 \tag{A.7b}$$

and

$$D = -C_{EE}\left(\frac{\overline{x}}{\overline{E}x}\right)^2\left(\pi_{xx} - C_{EE}\left(\frac{\widetilde{E}}{x}\right)^2 - 2C_E\frac{\widetilde{E}}{x^2}\right) - \left(C_E\frac{\overline{x}}{\overline{E}x^2} + C_{EE}\frac{\overline{x}}{\overline{E}x}\frac{\widetilde{E}}{x}\right)^2$$

$$= -\left(\frac{\overline{x}}{\overline{E}x}\right)^2\left(\pi_{xx}C_{EE} + \frac{C_E}{x^2}\right) > 0 \tag{A.7c}$$

(A.6a) describes the firm's incentives to raise activity, in order to reduce the costs of tax evasion. The impact of a higher average activity level, $\overline{x}$, on the firm's optimal activity, x*, and under-declaration of the tax base, E*, are determined by

$$C_E \frac{E}{\overline{E}x^2} + C_{EE} \frac{E^2 \overline{x}}{\overline{E}^2 x^3} \quad (A.8a)$$

and

$$-C_E \frac{1}{\overline{E}x} - C_{EE} \frac{\widetilde{E}}{\overline{E}x}, \quad (A.8b)$$

and are given by:

$$\frac{dx^*}{d\overline{x}} = -\frac{\left(C_E + C_{EE}\widetilde{E}\right)C_E \overline{x}}{D\overline{E}^2 x^3} < 0 \quad (A.9a)$$

$$\frac{dE^*}{d\overline{x}} = \frac{\left(C_E + C_{EE}\widetilde{E}\right)\left(\pi_{xx} - C_E \frac{\widetilde{E}}{x^2}\right)}{D\overline{E}x} < 0 \quad (A.9b)$$

If entry into the market is made easier, more firms will compete and the average activity level per firm, $\overline{x}$, is likely to fall. Hence, the under-declaration of the tax base rises, for a given average amount, $\overline{E}$, not declared by other firms.

7.3 Corporate Governance

The second derivatives of equations (7) with respect to the endogenous variables, allowing for a dependence of the expected costs of evasion on theft, W, C = C(E, t, W), are given by:

$$M_{xW} = M_{xE} = -g'' < 0 \quad (A.10a)$$

$$M_{xx} = \beta\pi_{xx} + M_{xE} < 0 \quad (A.10b)$$

$$M_{EE} = -\beta C_{EE} + M_{xE} \quad (A.10c)$$

$$M_{EW} = -\beta C_{EW} + M_{xE} \quad (A.10d)$$

$$M_{WW} = -\beta C_{WW} + M_{xE} \quad (A.10e)$$

The derivatives with respect to the parameters γ, t, β, and c_1, assuming that C(E, t, W) can be expressed as $C(t, E, W) = f(t, W)(c + c_1E + c_2E^2)$, $f(t, W) > 0$ (see Appendix 7.1), are $M_{x\gamma} = M_{E\gamma} = M_{xc_1} = M_{Wc_1} = 0$, $M_{w\gamma} = 1$, $M_{wt} = \beta$, $M_{w\beta} = t - 1$ and:

$$M_{xt} = \beta\pi_{xt} \quad (A.11a)$$

$$M_{Et} = \beta(1 - C_{Et}) \quad (A.11b)$$

$$M_{Ec_1} = -\beta f(t, w) \quad (A.11c)$$

$$M_{x\beta} = M_{E\beta} = \pi_x > 0 \quad (A.11d)$$

The determinant of the system of equations (7) is:

$$D = M_{xx}(M_{EE}M_{WW} - (M_{WE})^2) - (M_{xE})^2(M_{WW} - 2M_{EW}) - (M_{xE})^2M_{EE}$$

$$= \beta^2[M_{xx}(C_{EE}C_{WW} - (C_{WE})^2) - M_{xE}\pi_{xx}(C_{WW} + C_{EE} - 2C_{WE})] \qquad (A.12)$$

D is surely negative if C does not depend on W and will also have this sign for C = C(E, t, W) if, as sufficiency conditions, $C_{EE}C_{WW} - (C_{WE})^2 \geq 0$ and $C_{WW} + C_{EE} - 2C_{WE} \geq 0$ hold, where one inequality has to be strict. We subsequently assume $D < 0$.

An increase in γ raises theft

$$\frac{dW^*}{d\gamma} = \frac{(M_{xE})^2 - M_{EE}M_{xx}}{D} = \beta\frac{C_{EE}M_{xx} - M_{xE}\pi_{xx}}{D} > 0, \qquad (A.13)$$

and unambiguously lowers the under-declaration and the activity level if $C_{EW} = 0$ applies.

$$\frac{dE^*}{d\gamma} = \beta\frac{M_{xE}\pi_{xx} - C_{WE}M_{xx}}{D} \qquad (A.14a)$$

$$\frac{dx^*}{d\gamma} = \frac{-\beta M_{xE}}{D}(C_{WW} - C_{WE}) \qquad (A.14b)$$

Since the sign of dW*/dγ is unaffected by the impact of W on the marginal expected costs of evasion, whereas the numerator of dE*/dγ becomes smaller if C_{WE} is negative, the inverse relationship between theft and tax evasion may no longer exist if $C_{WE} < 0$.

Theft, W*, will rise with the tax rate t if $M_{xt} \leq 0$ and $C_{Et} \geq 0$.

$$\frac{dW^*}{dt} = \beta\frac{C_{EE}[\beta M_{xx} - M_{xt}M_{xE}] - \beta M_{xE}C_{Et}\pi_{xx}}{D} \qquad (A.15)$$

The impact of higher marginal expected costs of tax evasion, that is, an increase in the parameter c_1, is given by $dx^*/dc_1 = 0$ and:

$$\frac{dW^*}{dc_1} = -\frac{\beta^2 f(t,W)M_{xE}\pi_{xx}}{D} = -\frac{dE^*}{dc_1} > 0 \qquad (A.16)$$

Finally, a rise in the share of profits, β, the manager obtains, raises tax evasion and activity, and reduces theft. Assuming C = C(E, t), we have:

$$\frac{dE^*}{d\beta} = -\frac{(\pi_x + 1 - t)M_{xE}\beta\pi_{xx}}{D} > 0 \qquad (A.17a)$$

$$\frac{dx^*}{d\beta} = \frac{(\pi_x + 1 - t)M_{xE}\beta C_{EE}}{D} > 0 \qquad (A.17b)$$

$$\frac{dW^*}{d\beta} = \frac{(1-t)[M_{EE}M_{xx} - (M_{xE})^2] + \pi_x M_{xE}(M_{EE} + M_{xx})}{D} < 0 \qquad (A.17c)$$

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