

Information asymmetry and incentive contracting with the tax department

Information
asymmetry
and incentive
contracting

385

Horn-chern Lin

Tax Division, Ontario Ministry of Finance, Toronto, Canada, and

Tao Zeng

Wilfrid Laurier University, Waterloo, Canada

Received 23 April 2016
Revised 27 February 2017
Accepted 18 March 2017

Abstract

Purpose – This paper aims to examine the design of optimal incentives for a firm's tax department in the presence of information asymmetry.

Design/methodology/approach – This paper provides a theoretical model to examine the design of optimal incentives. The focus is on a situation in which a risk-averse tax department has private information about its efficiency type or effort to be exerted before the firm sets the incentive schemes.

Findings – This paper shows that a tax department's risk aversion leads to a decline in the fraction of the cost borne by the tax department. It also shows that the optimal contract schemes should be designed to filter out as much uncontrollable risk as possible by using third-party information relevant to a tax department's realized cost.

Social implications – It contributes to a better understanding of the impact of corporate incentive plans on firms' tax practices. This study, by designing a theoretical model, helps explain why there exist differences in tax planning across firms based on the finding that incentives for tax planning activities differ across firms.

Originality/value – This paper is the first study that considers the situation in which tax managers' risk-averse and types, as well as relevant information collected by the firms, can be used to set up incentive schemes and investigates whether and how the incentive schemes will be affected when firms improve their prior information by acquiring relevant information before the tax department acts.

Keywords Contract, Information asymmetry, Moral hazard, Risk averse, Tax department

Paper type Research paper

1. Introduction

In recent years, increasing numbers of researchers have sought to explain tax planning behavior at the firm level (Hanlon & Heitzman, 2010 for a comprehensive review). One of the interesting findings is that tax planning activities differ dramatically across firms (Stickney and McGee, 1982, Zimmerman, 1983, Porcano, 1986, Omer *et al.*, 1993, Gupta and Newberry, 1997, Shackelford and Shevlin, 2001, Phillips, 2003, Olibe and Rezaee, 2008, Dyreng *et al.*, 2010, Hanlon and Heitzman, 2010, Armstrong *et al.*, 2012, Lennox *et al.*, 2013, Badertscher *et al.*, 2013, Higgins *et al.*, 2015).

To date, studies on corporate tax planning have documented that corporate tax-planning activities are associated with several firm characteristics such as firm size, leverage, investments in R&D and intangible assets, intensity of fixed assets, foreign operations, etc. (Stickney and McGee, 1982, Zimmerman, 1983, Porcano, 1986, Omer *et al.*, 1993, Gupta and Newberry, 1997, etc.). Corporate ownership structures including family ownership, institutional shareholding, inside shareholding, ownership concentration and state ownership are also related to firms' tax planning activities (Klassen, 1997, Adhikari *et al.*,



2006, Cao and Dou, 2007, Wu *et al.*, 2007, Wu *et al.*, 2008, Zeng, 2010, Chen *et al.*, 2010, Zeng, 2011, Chan *et al.*, 2013). Meanwhile, existing tax literature finds that auditor quality, firms' political connections, corporate social responsibility, chief executive officer's (CEO's) educational background are all associated with firms' tax planning or tax avoidance activities (Dyreng *et al.*, 2008, Badertscher *et al.*, 2009, Robinson *et al.*, 2010, Armstrong *et al.*, 2012, McGuire *et al.*, 2012, Richardson and Lanis, 2012, Hoi *et al.*, 2013, Kim and Zhang, 2016, among others).

This study, by designing a theoretical model, attempts to explain the differences in tax planning across firms based on the findings that incentives for tax planning activities differ across firms. It indicates that one particular incentive may not be optimal for all firms; rather, certain characteristics such as risk, information and operating environment determine what incentive is best for each firm.

This paper provides a theoretical model to examine the nature of optimal incentives for a firm's tax department in the presence of information asymmetry. Our focus is on a situation in which a risk-averse tax department has private information about its efficiency type or effort to be exerted before the firm sets the incentive schemes. The impact of collecting cost-related information by the firm on the incentive schemes is also studied. It is shown that a tax department's risk aversion leads to a decline in the fraction of cost borne by the tax department. It is also shown that the optimal contract schemes should be designed to filter out as much uncontrollable risk as possible by using third-party information relevant to the tax department's realized cost.

We broadly define tax planning as all activities that can reduce a firm's income tax liability. Tax planning activities are generally delegated to the tax department inside the firm. As argued by Armstrong *et al.* (2012), tax department managers assume three responsibilities: tax compliance, tax advising and tax planning. Tax department managers, as a result of having "expertise" in their domain, often have superior private information concerning the costs and benefits of their tax planning activities, relative to their principals, i.e. the firm's. In addition, the costs of running the tax department may also depend on the level of effort exerted by the tax department. Effort is costly to the department and not freely observed. Because the preferences of the firm and its tax department do not always coincide, the firm is often faced with the compounding problems of adverse selection and moral hazard. If not properly motivated, the tax department managers might have very little incentive to reveal their information or exert their efforts.

Studies of management incentives have become popular in accounting and finance areas following the seminal work of Baker *et al.* (1988) (Baker, 1992, Gibbons and Murphy, 1992, Murphy and Jensen, 1998, Core *et al.*, 1999, Aboody and Kasznik, 2000, Rajgopal and Shevlin, 2002, Shim and Lee, 2003, Eldenburg and Krishnan, 2003, Hartzell and Starks, 2003, Bergstresser and Philippon, 2006, Berrone and Gomez-Mejia, 2009, Fernando and Xu, 2012, Andrews *et al.*, 2017, to name a few). For example, Shim and Lee (2003) examine the relationship between executive compensation and company performance in the service sector. They find a positive relationship between CEOs' compensation (cash compensation and long-term compensation) and firm performance measured as both accounting-based and market-based proxies. Eldenburg and Krishnan (2003) investigate CEOs' compensation on organization performance in hospitals in the USA for 18 years from 1981 to 1998. They find that, compare with private nonprofit hospitals, district hospitals are less profitable and generally underpay CEOs. They also find a positive relation between CEOs' compensation and operating performance. Bergstresser and Philippon (2006) examine the effect of CEOs' compensation on earnings management in 1990s and document that there is a higher level of earnings management, measured as different types of accounting accruals, if CEOs' total

compensation is more closely tied to company share prices. [Fernando and Xu \(2012\)](#) explore the relationship between CEOs' cash and equity compensation and investment in R&D. They find that CEOs are generally rewarded by spending in R&D, especially in the manufacturing sector. They also show that compensation committees can strategically use executive incentive plans to motivate CEOs to undertake R&D activities. Finally, [Andrews et al. \(2017\)](#) examine executive perquisite consumption and find that weak corporate governance leads to higher level of executive perquisite consumption. However, only a few analytical studies on principal-agent incentives focus on corporate tax planning activities.

[Desai and Dharmapala \(2006\)](#) develop a model on tax sheltering and management high-powered incentive plans. They derive the conditions under which increasing incentives will induce management to undertake higher or lower levels of tax sheltering activities. They indicate that corporate governance characteristics determine how incentives change management's tax sheltering decisions. [Chen and Chu \(2005\)](#) analyze the nature of compensation scheme when the opportunities of evading corporate tax exist. They design a model showing that tax evasion distorts management effort and incurs efficiency loss in the compensation contract. Ultimately, [Crocker and Slemrod \(2005\)](#) specify the optimal incentives for tax managers given the enforcement of tax authority. They examine the nature of compensation contract for tax managers when the tax managers possess private information of reducing tax liability either through legal tax planning activities or through illegal tax evasions. None of these analytical works consider the impact of the degree of the tax manager's risk aversion or information collected by the firm related to the tax manager's realized cost on the optimal incentives.

This paper seeks to fill this gap by developing a theoretical model to examine the design of optimal incentives for a risk-averse tax department in the presence of information asymmetry. The incidence of collecting cost-related information by the firm is also studied. It shows that risk aversion leads to a decrease in the fraction of cost borne by a tax department. An optimal contract should be designed to filter out as much uncontrollable risk as possible by using third-party information relevant to the tax department's realized cost.

Studies in social science posit that risk propensity is a major dimension of an individual's personality and his or her tendencies to take or avoid risks will affect what decision he or she would make in different risky situations ([Slovic 1972](#), [Sitkin and Pablo, 1992](#), [Christensen and Hite, 1997](#)). Tax planning is risky to the extent that there is no clear line between legal tax planning activities and abusive tax avoidance ([Badertscher et al., 2009](#), [Rego and Wilson, 2012](#)). Tax agencies and the courts would interpret tax laws and economic substance in a different way from taxpayers. In addition, it is uncertain whether tax-planning activities will be audited by the tax agency and whether these activities will be challenged by the tax agency as illegal. [Hanlon and Slemrod \(2009\)](#) document that stock market react negatively to the news of tax sheltering. They argue that though aggressive tax activities reduce corporate tax payments, there are associated costs. Risk of being disallowed and facing penalties is one of the costs. Indeed, [Graham et al. \(2014\)](#) report that risk of detection and being challenged by the tax agency is ranked as one of the top three reasons executives forego tax planning strategies. Therefore, risk would be relevant to incentives for a firm's tax-planning activities. Managers' differences in cognitions and perceptions of the risks will affect strategic tax choices.

Given that information is very important in incentive studies, it is not surprising that sizable studies exist on this topic. The vast majority of papers, however, have studied the choice of noisy performance measures to *ex post* evaluate the hidden actions of risk-averse agents ([Banker and Datar, 1989](#), [Datar et al., 2001](#)). In this setting, if the principal can commit to its use of information, then the informativeness principle generally allows one to

determine whether additional *ex post* information is valuable (Holmstrom, 1979). Existing literature has examined the value of different information systems within an agency construct in Christensen (1981). He finds that offering the agent more post-contract, pre-decision information may not necessarily make the principal better off. Madhav and Saouma (2006), however, allow for the possibility that the principal can influence the agent's level of private information and allow the agent to be imperfectly informed. They show that in a full contracting framework with communication, the owner's optimal response is rather to decrease the strength of incentives as the agent becomes more informed.

The basic insight from standard incentive economic theory suggests that to assure that agents input their maximum effort, the principal has to add some incentive elements (Fama, 1980, Baron and Myerson, 1982, Baron, 1989, Laffont and Tirole, 1986, 1993, and Laffont, 1994). It is generally admitted that the extensive form of the game between the principal and the agent, the timing of information gathering and whether information gathering is productive are all crucial. The literature of optimal incentives under asymmetric information has been growing rapidly. Some examples include Boadway *et al.* (1999), Bucovetsky *et al.* (1998), Cornes and Silva (1996), Cremer *et al.* (1996) and Raff and Wilson (1997). However, all these papers ignore the possibility that the principal may also gather information before specifying the incentive plans.

For example, studies in moral hazard literature have considered the issue of incorporating *ex post* observable information in the optimal contracts (Holmstrom, 1979, Shavell, 1979, Cremer and McLean, 1985, Riordan and Sappington, 1988, Demougine and Garvie, 1991, and McAfee and Reny, 1992).

Information is also relevant to the incentives for tax planning activities. Existing studies show that transfer of information and diffusion of knowledge and ideas among networked firms affect their behavior. Firms could have many kinds of social network ties to each other, including memberships in trade organizations, social clubs, university alumni and board interlocks, among others. Brown (2011) and Brown and Drake (2014) argue that information shared by networked firms helps explain why tax planning or tax avoidance varies across firms. Brown (2011) finds that board interlocks affect tax-planning decisions involving firm-owned life insurance tax shelters. More generally, Brown and Drake (2014) find that firms with board ties to low-tax firms have lower three-year cash effective tax rates. Overall, these studies conclude that tax saving strategies, as well as the costs and benefits of adopting these strategies, can spread and are shared among networked firms or partners.

Finally, Hambrick and Mason (1984) posit that managerial types (characteristics), representative of the differences in managers' cognition, knowledge, value, ability and experience, will affect decision making, practices and outcomes, including tax planning. Indeed, Dyreng *et al.* (2010) find that managers' fixed effects play a significant role in firms' tax avoidance. Slemrod (2004) argues that whether firms engage in tax avoidance and evasion activities depends on the nature of the contractual relationship between the firms' shareholders and managers in the tax departments.

In summary, we seek to bring together the tax planning studies and the principal-agent studies. In particular, we incorporate all the three factors discussed above into an incentive model, i.e. risk, information and tax manager's type.

This study contributes to the existing tax contract/incentive literature to the extent that it considers the situation in which tax managers' risk-averse and types, as well as relevant information collected by the firms, can be used to set up incentive schemes, and it investigates whether and how the incentive schemes will be affected when firms improve their prior information by acquiring relevant information before the tax department acts.

The balance of this paper is organized as follows. In Section 2, we specify the assumptions and the basic model. In Section 3, we derive the optimal contracts in the presence of information asymmetry including moral hazard and private information. In Section 4, we address some implications for empirical work. Finally, we summarize, conclude and discuss in Section 5.

2. The models

The model involves a firm and its tax department that contract for a tax planning project. The project has value S for the firm such as tax saving. The tax department's realized cost of the project is:

$$c = \beta - e + \varepsilon \quad (1)$$

where β represents the efficiency parameter of the tax department, e is the tax department's effort and ε is the tax department's forecast error which is normally distributed with mean zero and variance $\sigma_\varepsilon^2 : \varepsilon \sim N(0, \sigma_\varepsilon^2)$. The tax department's effort decreases the cost of the project and incurs a disutility of $\varphi(e)$. The disutility, which is assumed to be common knowledge, has the properties: $\varphi(0) = 0$, $\varphi'(e) > 0$, $\varphi''(e) > 0$ and $\varphi'''(e) > 0$ (which makes stochastic mechanisms not worth considering (Laffont and Tirole, 1993)). The tax department's realized cost C is observable and verifiable. For tax departments, the costs that arise from tax planning activities include increased administrative costs, increased tax examination costs, increased tax authority scrutiny, etc.

Furthermore, we assume that before the firm offers its tax department the incentives, it can acquire verifiable third-party information Z , which is correlated with C (i.e. Z is informative of C). Z is normally distributed with mean zero and variance $\sigma_z^2 : Z \sim N(0, \sigma_z^2)$.

The timing of actions is as follows. First, the firm sets a mechanism or a menu of incentives for its tax department. The tax department then exerts effort in the process of the project. The cost C is then realized. Finally, the firm compensates the tax department according to the incentives.

To motivate the tax department to participate in the project, the firm compensates its tax department with a monetary incentive t in addition to the reimbursement of cost. We assume the incentive t to be linear in the realized cost C , i.e. $t(C, Z) = a - b_1C + b_2Z$, where a is a fixed payment, b_1C is the share of cost that the tax agency will bear and b_2Z is a compensation based on the relative performance. A fixed-price contract corresponds to the case in which $b_1 = 1$ and the tax department is the residual claimant for its cost saving. A cost-plus contract corresponds to the case in which $b_1 = 0$. In the model, the firm will choose the incentive parameters to maximize its utility.

In the model, we assume the tax department is risk averse and has mean-variance preferences:

$$U = Et - \frac{r}{2}var(t) - \varphi(e) \quad (2)$$

where $var(t)$ is the variance of the incentive and r is the coefficient of risk aversion. Note that:

$$Et = a - b_1(\beta - e); \quad var(t) = b_1^2\sigma_s^2 + b_2^2\sigma_z^2 - 2b_1b_2\rho\sigma_s\sigma_z$$

where ρ is the correlation coefficient between C and Z . Therefore, $\frac{r}{2}var(t)$ can be interpreted as the risk premium. To engage with the tax-planning project, the tax department will face risks such as the change of tax laws and being audited by the government. We normalize the

tax department's outside opportunity level of utility or "reservation utility" to 0. For an incentive to be enforceable, it must respect individual rationality (*IR*) constraints:

$$U(\beta) \geq 0 \quad \forall \beta$$

which guarantees willing participation.

For simplicity, we assume the firm is risk neutral. The firm's utility and net expected gains for the firm is:

$$V = S - E[t + C] \tag{3}$$

From equation (2):

$$Et = \frac{r}{2} var(t) + \varphi(e) + U$$

It follows:

$$V = S - [(\beta - e) + \varphi(e)] - \frac{r}{2} var(t) - U \tag{4}$$

In the next section, we derive the optimal incentive: $t(C, Z) = a - b_1C + b_2Z$, under information asymmetry, including moral hazard and private information.

As we discussed before, the following three factors are relevant to the designing of an optimal incentive plan, i.e. risk, information gathering and tax manager's type. In the pure moral hazard problem, we assume the tax department's type is known and show that the risk-averse status of the tax department and the third-party information collected by the firm, which is informative of the realized cost incurred by the tax department engaging in tax planning activities that affect the incentive plans and hence the tax planning activities.

In the pure adverse-selection situation, we assume the tax department's effort is known and show whether a risk-averse situation and type of tax department affect the incentive plans and hence the tax planning activities. Finally, for the second-best mechanism design, we indicate that a tax manager's type, risk aversion and collecting cost-related information, all influence the firm's optimal incentive schemes and hence the tax planning activities.

3. Optimal incentives

3.1 Pure moral hazard problem

We first examine a pure moral hazard problem, where the firm knows the tax department's type β , but does not observe the effort e exerted by the tax department. The firm realizes that in the face of an incentive function $t(C, Z)$, the tax department will choose the effort e that is in its best interest. That is:

$$e \equiv \arg \max_e U(\beta, \bar{e}) \tag{5}$$

The first-order condition for this problem is:

$$b_1(\beta) = \varphi'(e) \tag{6}$$

Total differentiation shows that the tax department's effort is a positive function of the power of the incentive, $b_1(\beta)$:

$$\frac{de}{db_1} = \frac{1}{\varphi''(e)} > 0$$

The objective function of the firm becomes:

$$\begin{aligned} \max_{\{b_1, b_2, U\}} V &= S - [(\beta - e) + \varphi(e)] - \frac{r}{2} (b_1^2 \sigma_s^2 + b_2^2 \sigma_z^2 - 2b_1 b_2 \rho \sigma_s \sigma_z) - U \\ \text{s.t. (5) and } U &\geq 0 \end{aligned} \quad (7)$$

The solution to this problem:

$$b_1(\beta) = \frac{1}{1 + (1 - \rho^2) r \sigma_\varepsilon^2 \varphi''(e(b_1(\beta)))} > 0 \quad (8)$$

$$b_2(\beta) = \frac{b_1(\beta) \rho \sigma_\varepsilon}{\sigma_z} \begin{cases} \geq 0 \\ < 0 \end{cases} \quad \text{iff} \quad \rho \begin{cases} \geq 0 \\ < 0 \end{cases} \quad (9)$$

$$U(\beta) = 0 \quad (10)$$

Note: [equation \(9\)](#) indicates that the optimal incentive scheme exhibits relative performance evaluation. The tax department is compensated based not only on its realized cost C but also on the relevant information provided by third-party Z . [Equation \(10\)](#) implies that the tax department should receive only reservation utility:

PI. If C and Z are independent ($\rho = 0$), then $b_2(\beta)$ is equal to zero; if C and Z are perfectly correlated ($\rho^2 = 1$), then $b_1(\beta) = 1$ and $b_2(\beta) = \pm \frac{\sigma_\varepsilon}{\sigma_z}$; if C and Z are positively correlated ($\rho > 0$), then $b_2(\beta) > 0$; finally, if C and Z are negatively correlated ($\rho < 0$), then $b_2(\beta) < 0$.

Proof: Using [equations \(8\)](#) and [\(9\)](#). Done.

PI indicates the impact of the third-party information on optimal incentive schemes. If the third-party information is not informative, i.e. C and Z are independent ($\rho = 0$), then $b_2(\beta)$ is optimally set to be equal to zero. This reflects the fact that with C and Z independent and knowing Z tells the firm nothing about the tax department's cost C and so gives no better estimate of e . Including Z in the incentive scheme will simply add noise to the performance measure; because the tax department is assumed to be risk averse ($r > 0$), this in turn will tighten the IR constraint and reduce the firm's gains.

On the other hand, if C and Z happen to be perfectly correlated, all risk can be filtered out and first-best can be achieved as if there is no information asymmetry. In this case, the firm gets the highest gains from the tax department's tax-planning activities.

If C and Z are positively correlated ($1 > \rho > 0$), then $b_2(\beta)$ should be positive. A low Z signals that a given level of the observed low $C = \beta - e + \varepsilon$ is likely to reflect good luck (low ε) rather than more effort (high e). Similarly, if Z is high, C is likely to be high, and a given, observed level of low C signals higher level of effort e . A positive value for $b_2(\beta)$ takes account of these possibilities by increasing the pay when general conditions are bad (when Z is high) and decreasing it when they are good (when Z is low).

Meanwhile, if C and Z are negatively correlated ($-1 < \rho < 0$), then $b_2(\beta)$ is optimally set to be negative. A low Z then signals that the given level of the observed low $C = \beta - e + \varepsilon$ is evidence suggesting a high level of e , which is compensated through a negative value for $b_2(\beta)$. This is consistent with the general result that an optimal mechanism should filter out as much uncontrollable risk as possible. Using Z as a filter reduces uncontrollable risk by the factor $1 - \rho^2$.

P2. The absolute value of the correlation between C and Z is higher (lower), i.e. the third-party information is more informative about the tax department's realized cost; thus, the fraction of cost borne by the tax department (i.e. $b_1(\beta)$) will be higher (lower).

Proof: Totally differentiating equation (8) and using $r > 0$, $\varphi''(e) > 0$ and $\varphi'''(e) > 0$, we have $\frac{\partial b_1(\beta)}{\partial \rho^2} > 0$ iff $\rho^2 \neq 1$. Done.

P2 indicates the impact of the correlation between C and Z on the optimal incentive scheme offered by the firm. In general, a higher correlation leads to a higher fraction of the cost borne by tax department.

P3. If the tax department's risk aversion is higher, the fraction of cost borne by tax department (i.e. $b_1(\beta)$) will be lower. In particular, if the tax department is risk neutral (i.e. $r = 0$), then $b_1(\beta) = 1$ and $b_2(\beta) = \frac{\rho \sigma_c}{\sigma_z}$. If the tax department is extremely risk averse (i.e. $r \rightarrow +\infty$), then $b_1(\beta) \rightarrow 0$ and $b_2(\beta) \rightarrow 0$.

Proof: Totally differentiating equation (8) and using $\varphi''(e) > 0$ and $\varphi'''(e) > 0$, we obtain $\frac{\partial b_1(\beta)}{\partial r^2} < 0$ iff $\rho^2 \neq 1$. Done.

P3 states the impact of the tax department's risk aversion on the optimal incentive scheme offered by the firm. In general, risk aversion leads to a decrease in the fraction of the cost borne by the tax department. Finally, if the tax department is extremely risk averse while the firm is risk neutral, efficient risk sharing requires that the firm provide full assurance to the tax department.

P4. The higher (lower) the correlation between third-party information Z and realized cost C , the more (less) the firm will gain; the more (less) risk-averse tax department is, the less (more) the firm will gain.

Proof: Differentiating V with respect to ρ and using envelope theorem, we have $\frac{\partial V}{\partial \rho} > 0$ if $\rho > 0$ and $\frac{\partial V}{\partial \rho} < 0$ if $\rho < 0$. Differentiating V with respect to r and using envelope theorem, we have $\frac{\partial V}{\partial r} < 0$. Done.

P4 indicates that the gains from tax-planning activities are different across firms dependent on the risk-averse status of their tax departments. The gains also depend on the third-party information collected by the firms if it is informative of the realized cost incurred by the tax department engaging in tax planning activities.

In summary, in the pure moral hazard situation, it is shown that given the tax department's type, risk and information gathering are relevant to designing the best incentive schemes.

3.2 Pure adverse-selection problem

For the pure adverse-selection problem, the firm can observe the tax department's effort e and verify the realized cost C but does not know the true value of β . The firm's prior information about β is represented by an absolutely continuously differentiable distribution function $F(\beta)$, with density $f(\beta)$ which is assumed to be positive on $[\underline{\beta}, \bar{\beta}]$. From the revelation principle, we know that any mechanism is equivalent to a direct revelation mechanism that induces the tax department to truthfully announce its cost parameter β .

Let $\{\alpha(\hat{\beta}), b_1(\hat{\beta}), b_2(\hat{\beta}), e(\hat{\beta})\}_{\hat{\beta} \in [\underline{\beta}, \bar{\beta}]}$ be such a revelation mechanism, where $\hat{\beta}$ is the announcement by the tax department. That is, if the tax department announces a cost

parameter $\hat{\beta}$, it will receive a fixed payment $a(\hat{\beta})$, bear the cost share $b_1(\hat{\beta})C$, receive a compensation based on relative performance $b_2(\hat{\beta})Z$ and be required to exert effort level $e(\hat{\beta})$. The tax department's utility as a function of its true parameter β and the announced one $\hat{\beta}$ is:

$$u(\hat{\beta}, \beta) \equiv a(\hat{\beta}) - b_1(\hat{\beta})(\beta - e(\hat{\beta})) - \varphi(e(\hat{\beta})) - \frac{r}{2} [b_1(\hat{\beta})^2 \sigma_s^2 + b_2(\hat{\beta})^2 \sigma_z^2 - 2b_1(\hat{\beta})b_2(\hat{\beta}) \rho \sigma_s \sigma_z] \quad (11)$$

Therefore, the optimal effort is a positive function of the power of the incentives $b_1(\hat{\beta})$. In the second stage, the tax agency announces its type. The revelation mechanism induces truthful revelation if and only if:

$$\beta \in \arg \max_{\hat{\beta}} u(\hat{\beta}, \beta) \quad (12)$$

The first-order and second-order conditions associated with the above program are:

$$u_{11}|_{\hat{\beta}=\beta} = 0 \quad \text{almost everywhere} \quad (13)$$

$$u_{11}|_{\hat{\beta}=\beta} = -u_{12}|_{\hat{\beta}=\beta} = \frac{db_1(\beta)}{d\beta} \leq 0 \quad \text{almost everywhere} \quad (14)$$

The above two conditions are called incentive compatibility (IC) constraints which are equivalent to equation (12). Let $U(\beta) \equiv u(\beta, \beta)$ denote type β tax department's utility when it is truthful. Application of envelope theorem to equation (11) yields:

$$\dot{U}(\beta) \equiv \frac{dU}{d\beta} = -b_1(\beta) \quad (15)$$

Integrating equation (15), we get:

$$U(\beta) = \int_{\beta}^{\bar{\beta}} b_1(\tilde{\beta}) d\tilde{\beta} + U(\bar{\beta}) \quad (16)$$

Any optimal mechanism has to respect not only IC constraints (13) and (14) but also IR constraints:

$$U(\beta) \geq 0, \quad \forall \beta \quad (17)$$

where the reservation utility of tax department is normalized to zero. The firm then solves:

$$\begin{aligned} & \max_{\{b_1(\cdot), b_2(\cdot), e, U(\cdot)\}} \int_{\beta}^{\bar{\beta}} \{S - [\beta - e + \varphi(e)] \\ & - \frac{r}{2} [b_1(\beta)^2 \sigma_s^2 + b_2(\beta)^2 \sigma_z^2 - 2b_1(\beta)b_2(\beta) \rho \sigma_s \sigma_z] - U(\beta)\} \\ & \text{s.t. (13), (14) and (17)} \end{aligned} \quad (18)$$

First, integrating by parts, the expected utility to be enjoyed by the tax department is:

$$\int_{\underline{\beta}}^{\bar{\beta}} U(\beta) dF(\beta) = \int_{\underline{\beta}}^{\bar{\beta}} \frac{F(\beta)}{f(\beta)} b_1(\beta) dF(\beta) + U(\bar{\beta}) \quad (19)$$

Next, substituting equation (19) into equation (18), we transform the firm's optimization problem to:

$$\begin{aligned} \max_{\{b_1(\cdot), b_2(\cdot), e, U(\cdot)\}} \int_{\underline{\beta}}^{\bar{\beta}} \left\{ S - [\beta - e + \varphi(e)] - \frac{r}{2} [b_1(\beta)^2 \sigma_s^2 + b_2(\beta)^2 \sigma_z^2 - 2b_1(\beta)b_2(\beta)\rho\sigma_s\sigma_z] \right. \\ \left. - \frac{F(\beta)}{f(\beta)} b_1(\beta) \right\} dF(\beta) - U(\bar{\beta}) \\ \text{s.t. (14)} \end{aligned} \quad (20)$$

Ignoring equation (14) for the moment, we obtain the following first-order conditions for the firm's maximization problem:

$$e(\beta): \quad \varphi'(e(\beta)) = 1 \quad \text{or} \quad e(\beta) = e^f \quad \forall \beta \quad (21)$$

$$b_1(\cdot): \quad -r [b_1(\beta)\sigma_s^2 - b_2(\beta)\rho\sigma_s\sigma_z] - \frac{F(\beta)}{f(\beta)} < 0 \quad (22)$$

$$b_2(\cdot): \quad b_2(\beta)\sigma_z^2 - b_1(\beta)\rho\sigma_s\sigma_z = 0 \quad (23)$$

$$U(\bar{\beta}): \quad -1 < 0 \quad (24)$$

From equations (22) and (23), we find that the firm should set:

$$b_1(\beta) = b_2(\beta) = 0 \quad (25)$$

From equation (24), the firm should set $U(\bar{\beta}) = 0$, which together with equations (16) and (25), implies $U(\beta) = 0$ and $a(\beta) = \varphi(e^f)$, $\forall \beta$. The tax department should exert the same level of effort e^f as if no information asymmetry exists and receive only reservation utility.

In summary, in the pure adverse-selection situation, it is shown that given the tax department's effort, the optimal incentive scheme does not depend on the type.

3.3 Second-best mechanism design

In the real world, the firm may verify the realized cost C but does not know the tax department's true type β and cannot observe the effort e exerted by the tax department.

Let $\{a(\hat{\beta}), b_1(\hat{\beta}), b_2(\hat{\beta})\}_{\hat{\beta} \in [\underline{\beta}, \bar{\beta}]}$ be such a revelation mechanism, where $\hat{\beta}$ is the type announced by the tax department. That is, if the tax department announces a cost parameter $\hat{\beta}$, it will receive a fixed payment $a(\hat{\beta})$, bear the cost share $b_1(\hat{\beta})C$ and receive a

compensation based on relative performance $b_2(\hat{\beta})Z$. The tax department's utility as a function of its effort level e , its true parameter β and the announced one $\hat{\beta}$ is:

$$u(\hat{\beta}, e, \beta) \equiv a(\hat{\beta}) - b_1(\hat{\beta})(\beta - e) - \varphi(e) - \frac{r}{2} [b_1(\hat{\beta})^2 \sigma_s^2 + b_2(\hat{\beta})^2 \sigma_z^2 - 2b_1(\hat{\beta})b_2(\hat{\beta}) \rho \sigma_\varepsilon \sigma_z] \quad (26)$$

To solve for the optimal mechanism, we use backward induction. First, the tax department finds its optimal effort given the special mechanism. That is:

$$\Phi(\hat{\beta}, \beta) \equiv \max_e u(\hat{\beta}, e, \beta) \quad (27)$$

The first-order condition for this problem is:

$$b_1(\hat{\beta}) = \varphi'(e) \quad (28)$$

Therefore, the optimal effort is a positive function of the power of the incentives $b_1(\hat{\beta})$. In the last second stage, the tax department announces its type. The revelation mechanism induces truthful revelation if and only if:

$$\beta \in \arg \max_{\hat{\beta}} \Phi(\hat{\beta}, \beta) \quad (29)$$

The first-order and second-order conditions associated with the above program are:

$$\Phi_1|_{\hat{\beta}=\beta} = 0 \text{ almost everywhere} \quad (30)$$

$$\Phi_{11}|_{\hat{\beta}=\beta} = -\Phi_{12}|_{\hat{\beta}=\beta} = \frac{db_1(\beta)}{d\beta} \leq 0 \text{ almost everywhere} \quad (31)$$

The above two conditions are also called *IC* constraints. Let $U(\beta) \equiv \Phi(\beta, \beta)$ denoting type β department's utility when it is truthful. Application of envelope theorem yields:

$$\dot{U}(\beta) = -b_1(\beta) \leq 0 \quad (32)$$

Integrating equation (32), we get:

$$U(\beta) = \int_{\beta}^{\beta} b_1(\tilde{\beta}) d\tilde{\beta} + U(\bar{\beta}) \quad (33)$$

Any optimal mechanism has to respect not only *IC* constraints (30) and (31) but also *IR* constraints:

$$U(\beta) \geq 0 \quad \forall \beta \quad (34)$$

where the reservation utility of the tax agency is normalized to zero. However, because $U(\beta)$ is non-increasing from equation (32), inequality [equation (34)] can be replaced by:

$$U(\bar{\beta}) \geq 0 \tag{35}$$

Because of the problem of asymmetric information, the tax department type $\beta < \bar{\beta}$ will enjoy positive indirect utility. When both moral hazard and self-selection problems are present, the objective of the firm is to maximize expected utility under the *IC* and *IR* constraints:

396

$$\begin{aligned} \max_{\{b_1(\cdot), b_2(\cdot), U(\cdot)\}} \int_{\underline{\beta}}^{\bar{\beta}} & \left\{ S - [\beta - e + \varphi(e)] - \frac{r}{2} [b_1(\beta)^2 \sigma_s^2 + b_2(\beta)^2 \sigma_z^2 - 2b_1(\beta)b_2(\beta)\rho\sigma_s\sigma_z] \right. \\ & \left. - U(\beta) \right\} dF(\beta) \\ \text{s.t.} & (31), (33), \text{ and } (35) \end{aligned} \tag{36}$$

Substituting [equation \(33\)](#) into [equation \(27\)](#) and differentiating, we obtain the following first-order conditions for the firm's maximization problem:

$$b_1(\cdot): \left[(1 - \varphi'(e)) \frac{de}{db_1} - r [b_1(\beta)\sigma_\varepsilon^2 - b_2(\beta)\rho\sigma_\varepsilon\sigma_z] \right] - \frac{F(\beta)}{f(\beta)} = 0 \tag{37}$$

$$b_2(\cdot): b_2(\beta)\sigma_z^2 - b_1(\beta)\rho\sigma_s\sigma_z = 0 \tag{38}$$

$$U(\bar{\beta}): -1 < 0 \tag{39}$$

Intuitively, because the firm's gain is decreasing in the utility of the tax department from [equation \(4\)](#) regardless of the efficiency type of the tax department, the firm sets $U(\bar{\beta}) = 0$. Note that [equation \(28\)](#) implies that $\frac{de}{db_1} = \frac{1}{\varphi''(e)} > 0$. Using this together with [equations \(37\)](#) and [\(38\)](#), we find that the firm should set:

$$b_1(\beta) = \frac{1 - \frac{F(\beta)}{f(\beta)} \varphi''(e)}{1 + (1 - \rho^2)r\sigma_\varepsilon^2 \varphi(e)} \tag{40}$$

$$b_2(\beta) = \frac{b_1(\beta)\rho\sigma_\varepsilon}{\sigma_z} \tag{41}$$

Because tax department's equilibrium effort level e is a function of $b_1(\beta)$, we can solve for $b_1^*(\beta)$ from [equation \(40\)](#) and $b_2^*(\beta)$ from [equation \(41\)](#). The utility the tax department obtains is:

$$U^*(\beta) = \int_{\beta}^{\bar{\beta}} b_1^*(\tilde{\beta}) d\tilde{\beta} \tag{42}$$

Using equation (2), the tax department's expected incentive is:

$$Et^*(\beta) = U^*(\beta) \varphi(e(b_1^*(\beta))) + \frac{r}{2} \cdot [b_1^*(\beta)^2 \sigma_e^2 + b_2^*(\beta)^2 \sigma_z^2 - 2b_1^*(\beta)b_2^*(\beta)\rho\sigma_e\sigma_z] \quad (43)$$

Using the prior assumption of linear incentive $t(C,Z) = a - b_1C + b_2Z$, we have the fixed payment:

$$a^*(\beta) = Et^*(\beta) + b_1^*(\beta) [\beta - e(b_1^*(\beta))] \quad (44)$$

Similar to the pure moral hazard problem, the optimal incentive scheme exhibits relative performance evaluation. This is consistent with the general result that an optimal mechanism should filter out as much uncontrollable risk as possible. Using Z as a filter reduces uncontrollable risk by the factor $(1 - \rho^2)$. If C and Z are perfectly correlated, all risk can be filtered out and the optimal mechanism for the risk-averse tax department will be the same as the one for the risk-neutral tax department. Once again, risk aversion leads to a decrease in the fraction of cost borne by the tax agency. Similar to the pure moral hazard problem, the slope $b_1(\beta)$ for type β decreases with the coefficient of risk aversion r . Furthermore, the higher (lower) the correlation between third-party information Z and realized cost C , the more (less) the firm will gain, and the more (less) risk-averse the tax department is, the less (more) the firm will gain.

- P5.* Under optimal incentive schemes, the gains for the firm are higher for the pure adverse selection situation than for the second-best situation; the gains for the firm are higher for the pure moral hazard situation than for the second-best situation.

Proof: The second-best situation imposes additional constraints on the optimal problems. The additional constraints strictly bind, so the optimal problem's feasible set is a subset of the less constrained problem's optimal solution such as moral hazard or adverse selection problems. Hence, the maximum value achieved in the more second-best problem is less than that in the moral hazard or adverse selection problem. Done.

P5 indicates that the firm will gain more if it can observe the effort exerted by the tax department. If we assume that strong corporate governance helps the firm to better observe the effort exerted by tax managers, *P5* implies that the better governed firms will gain more from tax-planning activities. Hence *P5* implies that benefits from tax planning activities are different across firms dependent on corporate governance.

P5 also indicates that the firm will gain more from tax-planning activities if it knows its tax department's type.

Overall, our theoretical models in this section indicate that a tax manager's type, risk aversion and informative third-party information influence the firm's optimal incentive schemes and gains.

4. Empirical implications

This paper provides a theoretical model to examine the design of optimal incentives for a firm's tax department in the presence of information asymmetry and risk aversion. It shows that if the firm acquires informative information about the tax department's efficiency type or effort, it will be able to better design its incentive schemes. It has some implications for empirical work. For example, if collection of information related

to the tax department's type depends on whether to the tax department is viewed as a cost center and a profit center, we may expect that incentive for and, hence, the tax planning activities may differ under different regimes (Robinson *et al.*, 2010).

Another example of the empirical implications is that if content of information acquired depends upon organizational structures, centralized versus decentralized (Hlaing, 2012), we can also expect that the incentive designed for the tax department and hence the tax planning activities will differ under different organizational structures.

5. Summary, conclusion and implication

This paper provides a theoretical model to examine the design of optimal incentives for a firm's tax department in the presence of information asymmetry. Our focus is on a situation in which a risk-averse tax department has private information about its efficiency type or effort to be exerted before the firm sets the incentive schemes. The impact of collecting cost-related information by the firm on the incentive schemes is also studied. It is shown that the tax department's risk aversion leads to a decline in the fraction of cost borne by the tax department. It is also shown that the optimal contract schemes should be designed to filter out as much uncontrollable risk as possible by using third-party information relevant to the tax department's realized cost. Ultimately, knowing the tax department's type helps the firm gains more by designing the optimal incentive schemes.

Our models support the finding in Holmstrom (1979), Baiman and Demski (1980) and Demski and Sappington (1984) to the extent that there may be gains for the firm in basing the incentive schemes on the third-party information relevant to the tax department's cost C . By collecting highly correlated information about the tax department's cost and using the information in specifying incentive schemes, the firm can focus on those factors that affect the tax department's performance over which it has some controls. Our models also show that the optimal incentive schemes should consider the tax department's risk aversion and let it bear lower fraction of the cost when more factors in the operating environment are outside its control.

This study has important implications for policy makers, corporate managements and academics. It contributes to a better understanding of the impact of corporate incentive plans on firms' tax practices. If the firm acquires third-party information about the tax department's efficiency type or effort, it will be able to better design its incentive schemes. This study, by designing a theoretical model, helps explain why there are differences in tax planning across firms based on the finding that incentives for tax planning activities differ across firms. It indicates that one particular incentive may not be optimal for all firms; rather, certain characteristics such as risk, information and operating environment determine what incentive is best for each firm.

This study may lead to two extensions. First, future studies could consider the situation in which the firms do not know their tax department's type but can use a relevant signal to tag the tax departments before setting up incentives and investigate whether and how the incentive plans will differ when the firms can improve their prior information by acquiring a signal before the tax department managers act. Second, in this study, we assume that the firm can, at no cost, collect information relevant to the tax department's realized cost. In a more realistic situation, information would be collected with cost, and future studies may examine how the cost incurred from collecting information will affect the firm's optimal incentives and gains.

References

- Aboody, D. and Kasznik, R. (2000), "CEO stock awards and the timing of corporate voluntary disclosure", *Journal of Accounting and Economics*, Vol. 29 No. 1, pp. 73-100.
- Adhikari, A., Derashid, C. and Zhang, H. (2006), "Political policy, political connections, and effective tax rates: longitudinal evidence from Malaysia", *Journal of Accounting and Public Policy*, Vol. 25 No. 4, pp. 574-595.
- Andrews, A., Linn, S. and Yi, H. (2017), "Corporate governance and executive perquisites", *Review of Accounting and Finance*, Vol. 16 No. 1, pp. 21-45.
- Armstrong, C.S., Blouin, J.L. and Larcker, D.F. (2012), "The incentive for tax planning", *Journal of Accounting and Economics*, Vol. 53, No. 3, pp. 391-411.
- Badertscher, B., Katz, S.P. and Rego, S.O. (2009), "Does private equity ownership affect tax reporting aggressiveness?", Working paper, Harvard Business School Accounting and Management Unit.
- Badertscher, B., Katz, S.P. and Rego, S.O. (2013), "The separation of ownership and control and tax avoidance", *Journal of Accounting and Economics*, Vol. 56 No. 2, pp. 228-250.
- Baiman, S. and Demski, J. (1980), "Economically optimal performance evaluation and control systems", *Journal of Accounting Research*, Vol. 18 No. 1, pp. 184-220.
- Baker, G.P. (1992), "Incentive contracts and performance measurement", *Journal of Political Economy*, Vol. 100 No. 3, pp. 598-614.
- Baker, G.P., Jensen, M.C. and Murphy, K.J. (1988), "Compensation and incentives: practice vs theory", *The Journal of Finance*, Vol. 43 No. 3, pp. 593-613.
- Banker, R. and Datar, S. (1989), "Sensitivity, precision, and linear aggregation of signals for performance evaluation", *Journal of Accounting Research*, Vol. 27 No. 1, pp. 21-39.
- Baron, D.P. (1989), "Design of regulatory mechanisms and institutions", in Schmalensee, R. and Willig, R. (Ed), *Handbook of Industrial Organization*, Elsevier, Amsterdam, Vol. 2, pp. 1347-1447.
- Baron, D.P. and Myerson, R. (1982), "Regulating a monopoly with unknown cost", *Econometrica*, Vol. 50 No. 4, pp. 911-930.
- Bergstresser, D. and Philippon, T. (2006), "CEO incentives and earnings management", *Journal of Financial Economics*, Vol. 80 No. 3, pp. 511-529.
- Berrone, P. and Gomez-Mejia, L.R. (2009), "Environmental performance and executive compensation: an integrated agency-institutional perspective", *Academy of Management Journal*, Vol. 52 No. 1, pp. 103-126.
- Boadway, R., Horiba, H.I. and Jha, R. (1999), "The provision of public services by government funded decentralized agencies", *Public Choice*, Vol. 100, pp. 157-184.
- Brown, J.L. (2011), "The spread of aggressive corporate tax reporting: a detailed examination of the corporate-owned life insurance shelter", *The Accounting Review*, Vol. 86 No. 1, pp. 23-57.
- Brown, J.L. and Drake, K.D. (2014), "Network ties among low-tax firms", *The Accounting Review*, Vol. 89 No. 2, pp. 483-510.
- Bucovetsky, S., Marchand, M. and Pestieau, P. (1998), "Tax competition and revelation of preferences for public expenditure", *Journal of Urban Economics*, Vol. 44 No. 3, pp. 367-390.
- Cao, S.J. and Dou, K. (2007), "Determinants of the variability of corporate effective tax rates: evidence of listed company in China", Working paper, Chong Qing University, Chong Qing.
- Chan, K.H., Mo, P.L. and Zhou, A.Y. (2013), "Government ownership, corporate governance and tax aggressiveness: evidence from china", *Accounting and Finance*, Vol. 53 No. 4, pp. 1029-1051.
- Chen, K.-P. and Chu, C.Y. (2005), "Internal control vs. external manipulation: a model of corporate income tax evasion", *RAND Journal of Economics*, Vol. 36 No. 1, pp. 151-164.

- Chen, S., Chen, X., Cheng, Q. and Shevlin, T. (2010), "Are family firms more tax aggressive than non-family firms?", *Journal of Financial Economics*, Vol. 95 No. 1, pp. 41-61.
- Christensen, J. (1981), "Communication in agencies", *Bell Journal of Economics*, Vol. 12 No. 2, pp. 661-674.
- Christensen, A.L. and Hite, P.A. (1997), "A study of the effect of taxpayer risk perceptions on ambiguous compliance decisions", *Journal of the American Taxation Association*, Vol. 19 No. 1, pp. 1-18.
- Core, J.E., Holthausen, R.W. and Larcker, D.F. (1999), "Corporate governance, chief executive officer compensation, and firm performance", *Journal of Financial Economics*, Vol. 51 No. 2, pp. 371-406.
- Cornes, R. and Silva, E. (1996), "Transfer between jurisdictions with private information: the equity/efficiency trade-off", Working paper 96/12, Keele University, Staffordshire.
- Cremer, H., Marchand, M. and Pestieau, P. (1996), "Interregional redistribution through tax surcharge", *International Tax and Public Finance*, Vol. 3 No. 1, pp. 157-173.
- Cremer, J. and McLean, R. (1985), "Optimal selling strategies under uncertainty for a discriminating monopolist when demands are interdependent", *Econometrica*, Vol. 53 No. 2, pp. 345-361.
- Crocker, K.J. and Slemrod, J. (2005), "Corporate tax evasion with agency cost", *Journal of Public Economics*, Vol. 89 No. 6, pp. 1593-1610.
- Datar, S., Kulp, S. and Lambert, R. (2001), "Balancing performance measures", *Journal of Accounting Research*, Vol. 39 No. 1, pp. 75-92.
- Demougins, D. and Garvie, D. (1991), "Contractual design with correlated information under limited liability", *Rand Journal of Economics*, Vol. 22 No. 4, pp. 477-489.
- Demski, J. and Sappington, D. (1984), "Optimal incentive contracts with multiple agents", *Journal of Economic Theory*, Vol. 33 No. 1, pp. 152-171.
- Desai, M.A. and Dharmapala, D. (2006), "Corporate tax avoidance and high-powered incentives", *Journal of Financial Economics*, Vol. 79, No. 1, pp. 145-179.
- Dyreng, S.D., Hanlon, M. and Maydew, E.L. (2008), "Long-run corporate tax avoidance", *The Accounting Review*, Vol. 83 No. 1, pp. 61-82.
- Dyreng, S.D., Hanlon, M. and Maydew, E.L. (2010), "The effect of executive on corporate tax avoidance", *The Accounting Review*, Vol. 85 No. 4, pp. 1163-1189.
- Eldenburg, L. and Krishnan, R. (2003), "Public versus private governance: a study of incentives and operational performance", *Journal of Accounting and Economics*, Vol. 35 No. 3, pp. 377-404.
- Fama, E.F. (1980), "Agency problems and the theory of the firm", *Journal of Political Economy*, Vol. 88 No. 2, pp. 288-307.
- Fernando, G.D. and Xu, Q. (2012), "CEO compensation and strategic expenses: penalizing, shielding or rewarding?", *Review of Accounting and Finance*, Vol. 11 No. 3, pp. 279-297.
- Gibbons, R. and Murphy, K.J. (1992), "Optimal incentive contracts in the presence of career concern: theory and evidence", *Journal of Political Economics*, Vol. 100 No. 3, pp. 468-505.
- Graham, J.R., Hanlon, M., Shevlin, T. and Shroff, N. (2014), "Incentives for tax planning and avoidance: evidence from the field", *The Accounting Review*, Vol. 89 No. 3, pp. 991-1023.
- Gupta, S. and Newberry, K. (1997), "Determinants of the variability in corporate effective tax rate: evidence from longitudinal data", *Journal of Accounting and Public Policy*, Vol. 16 No. 1, pp. 1-39.
- Hambrick, D.C. and Mason, P.A. (1984), "Upper echelons: the organization as a reflection of its top managers", *Academy of Management Review*, Vol. 9 No. 2, pp. 193-206.
- Hanlon, M. and Heitzman, S. (2010), "A review of tax research", *Journal of Accounting and Economics*, Vol. 50 No. 1, pp. 127-178.
- Hanlon, M. and Slemrod, J. (2009), "What does tax aggressiveness signal? Evidence from stock price reactions to news about tax shelter involvement", *Journal of Public Economics*, Vol. 93 No. 1, pp. 126-141.

- Hartzell, J.C. and Starks, L.T. (2003), "Institutional investors and executive compensation", *Journal of Finance*, Vol. 58 No. 6, pp. 2351-2374.
- Higgins, D., Omer, T.C. and Phillips, J.D. (2015), "The influence of a firm's business strategy on its tax aggressiveness", *Contemporary Accounting Research*, Vol. 32 No. 2, pp. 674-702.
- Hlaing, K.P. (2012), "Organizational architecture of multinationals and tax aggressiveness", Working paper, University of Waterloo, Waterloo.
- Hoi, C.K., Wu, Q. and Zhang, H. (2013), "Is corporate social responsibility (CSR) associated with tax avoidance? Evidence from irresponsible CSR activities", *The Accounting Review*, Vol. 88 No. 6, pp. 2025-2059.
- Holmstrom, B. (1979), "Moral hazard in teams", *Bell Journal of Economics*, Vol. 10 No. 1, pp. 74-91.
- Kim, F. and Zhang, L. (2016), "Corporate political connections and tax aggressiveness", *Contemporary Accounting Research*, Vol. 33 No. 1, pp. 78-114.
- Klassen, K. (1997), "The impact of inside ownership concentration on the trade-off between financial and tax reporting", *The Accounting Review*, Vol. 72 No. 3, pp. 455-474.
- Laffont, J.J. (1994), "The new economics of regulation ten years after", *Econometrica*, Vol. 62 No. 3, pp. 507-537.
- Laffont, J.J. and Tirole, J. (1986), "Using cost observation to regulate firms", *Journal of Political Economy*, Vol. 94 No. 3, pp. 614-641.
- Laffont, J.J. and Tirole, J. (1993), *A Theory of Incentives in Procurement and Regulation*, MIT Press, Cambridge, MA.
- Lennox, C., Lisowsky, P. and Pittman, J. (2013), "Tax aggressiveness and accounting fraud", *Journal of Accounting Research*, Vol. 51 No. 4, pp. 739-779.
- McAfee, R.P. and Reny, P. (1992), "Correlated information and mechanism design", *Econometrica*, Vol. 60 No. 2, pp. 395-421.
- McGuire, S.T., Omer, T.C. and Wang, D. (2012), "Tax avoidance: do industry experts make a difference?", *The Accounting Review*, Vol. 87 No. 3, pp. 975-1001.
- Madhav, A.R. and Saouma, R.E. (2006), "Optimal information asymmetry", *The Accounting Review*, Vol. 81 No. 3, pp. 677-712.
- Murphy, K.J. and Jensen, M.C. (1998), "Performance pay and top management incentives", available at: <http://ssrn.com/abstract=94009> or <http://dx.doi.org/10.2139/ssrn.94009> (accessed December 2016).
- Olibe, K.O. and Rezaee, Z. (2008), "Income shifting and corporate taxation: the role of cross-border intrafirm transfers", *Review of Accounting and Finance*, Vol. 7 No. 1, pp. 83-101.
- Omer, T.C., Molloy, K.H. and Ziebart, D.A. (1993), "An investigation of the firm size-effective tax rate relation in the 1980s", *Journal of Accounting, Auditing and Finance*, Vol. 8 No. 2, pp. 167-182.
- Phillips, J. (2003), "Corporate tax-planning effectiveness: the role of compensation-based incentives", *The Accounting Review*, Vol. 78 No. 4, pp. 847-874.
- Porcano, T.M. (1986), "Corporate tax rates: progressive, proportional or regressive", *Journal of the American Taxation Association*, Vol. 7 No. 1, pp. 17-31.
- Raff, H. and Wilson, J. (1997), "Income redistribution with well-informed local governments", *International Tax and Public Finance*, Vol. 4 No. 4, pp. 407-427.
- Rajgopal, S. and Shevlin, T. (2002), "Empirical evidence on the relation between stock option compensation and risk taking", *Journal of Accounting and Economics*, Vol. 33 No. 2, pp. 145-171.
- Rego, S. and Wilson, R. (2012), "Executive compensation, equity risk incentives, and corporate tax aggressiveness", *Journal of Accounting Research*, Vol. 50 No. 3, pp. 775-809.

- Richardson, G. and Lanis, R. (2012), "Corporate social responsibility and tax aggressiveness: an empirical analysis", *Journal of Accounting and Public Policy*, Vol. 31 No. 1, pp. 86-108.
- Riordan, M. and Sappington, D.E.M. (1988), "Optimal contracts with public ex post information", *Journal of Economic Theory*, Vol. 45 No. 1, pp. 189-199.
- Robinson, J.R., Sikes, S.A. and Weaver, C.D. (2010), "Performance measurement of corporate tax departments", *The Accounting Review*, Vol. 85 No. 3, pp. 1035-1065.
- Shackelford, A.D. and Shevlin, T. (2001), "Empirical tax research in accounting", *Journal of Accounting and Economics*, Vol. 31 No. 2, pp. 321-387.
- Shavell, S. (1979), "Risk sharing and incentives in the principal and agent relationship", *Bell Journal of Economics*, Vol. 10 No. 1, pp. 55-73.
- Shim, E.D. and Lee, J. (2003), "A canonical correlation analysis of CEO compensation and corporate performance in the service industry", *Review of Accounting and Finance*, Vol. 2 No. 3, pp. 72-90.
- Sitkin, S.B. and Pablo, A.L. (1992), "Reconceptualizing the determinants of risk behaviour", *Academy of Management Review*, Vol. 17 No. 1, pp. 9-38.
- Slemrod, J. (2004), "The economics of corporate tax selfishness", *National Tax Journal*, Vol. 57 No. 4, pp. 877-899.
- Slovic, P. (1972), "Information processing, situation specificity, and generality of risk taking behaviour", *Journal of Personality and Social Psychology*, Vol. 22 No. 1, pp. 128-134.
- Stickney, C.P. and McGee, V.E. (1982), "Effective corporate tax rates, the effect of size, capital intensity, leverage, and other factors", *Journal of Accounting and Public Policy*, Vol. 1 No. 1, pp. 125-152.
- Wu, L., Wang, B., Lin, C. and Li, S.K. (2007), "Local tax rebates, corporate tax burdens, and firm migration: evidence from china", *Journal of Accounting and Public Policy*, Vol. 26 No. 5, pp. 555-583.
- Wu, L., Wang, Y., Gillis, P. and Wei, L. (2008), "State ownership, tax status, and size effect of effective tax rate in China", Working paper, Beking University, Beijing.
- Zeng, T. (2010), "Ownership concentration, state ownership and effective tax rates: evidence from China's listed firms", *Accounting Perspective*, Vol. 9 No. 4, pp. 271-289.
- Zeng, T. (2011), "Institutional environment, inside ownership and effective tax rate", *NanKai Business Review International*, Vol. 2 No. 4, pp. 348-357.
- Zimmerman, J. (1983), "Taxes and firm size", *Journal of Accounting and Economics*, Vol. 5 No. 1, pp. 119-149.

About the authors

Dr Horn-Chern Lin is an Economist of Ontario Ministry of Finance. He has many publications in academic journals including *Journal of Chinese Economic and Foreign Trade Studies*, *Review of Accounting and Finance*, *Chinese Management Studies*, *Taiwan Economic Review*, etc.

Dr Tao Zeng is an Associate Professor with supervision status for Master and PhD students at Lazaridis School of Business and Economics, Wilfrid Laurier University. She has many publications in academic journals including *Canadian Journal of Administrative Sciences*, *Review of Accounting and Finance*, *Journal of Financial Economic Policy*, *Canadian Tax Journal*, *Asian Review of Accounting*, etc. Tao Zeng is the corresponding author and can be contacted at: tzeng@wlu.ca

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgroupublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.