Penalty Structure and Individual Tax Evasion: an Approach of Behavioral Public Finance[#]

Chen PINGLU[*] – *Chen YAOGEN*[**]

1 Introduction

China dramatically adjusts the way of collecting individual income tax in 2007. Citizens with annual income over 120 thousand RMB Yuan (about 15000 US$) are required to report directly to tax authorities, while the others still pay tax through employer-withholding system, which means that low income owners need not to file tax returns as before. The deadline is the end of March 2007; however, taxpayers act far from compliance. Till the end of January 2007, for example, only dozens of returns have been reported in Wuhan, a central region city which has a population of more than 8 millions. Tax authorities begin to worry about the evasion problem, but have not got ideas to alleviate it. Unlike developed countries, China lacks experience to deal with individual tax evasion behaviors. Before 2006, tax law only requires that employer is responsible for withholding income tax of its employees, while employees need not to file returns. So the 2007 reform is the first time to put the individual, not the employee under the spotlight.

There are some empirical studies of tax evasion in China, for example, Huang (1996) estimated the scale of evaded tax. It is no wonder that the evaded individual income tax could almost be omitted, since the turnover taxes are the mainstream of public revenues. So far, systematic

---

The article is supported by HUST-SRF No. 2006M022B and National Natural Science Foundation of China No. 70173003.

* Pinglu, Chen, Ph.D. – Associate Professor; Department of Public Finance, School of Management, Huazhong University of Science and Technology, Luoyu Road 1037#, Wuhan, Hubei, 430074, People Republic of China; <chen.pinglu@hust.edu.cn>.

** Yaogen, Chen, Doctoral Candidate in Finance – Research Fellow, Institute of Finance and Trade Economics, The Chinese Academy of Social Sciences (CASS), No. 2 Yuetan Beixiaojie, Xicheng District, Beijing, 100836, People Republic of China; <chenyaogen352038@163.com>.

normative explanation in this field still remains naïve in China. While the literature about tax evasion makes remarkable progress in western countries, 30 years ago, in their pioneering work, Allingham and Sandmo (1972) applied the theory of uncertainty to analyze the individual taxpayer's decision on whether and to what extent to evade the income tax by deliberate underreporting. The Allingham-Sandmo (hereinafter, referred as A-S) model measures the effects of tax rates, detection probabilities, and penalty level on the utility gained by under-reporting taxable income. In general, the model predicts that tax evasion is decreasing when detection risk, penalty levels and the stigma rate increasing, but the effect of increasing the tax rate on evasion is ambiguity. The reason is that there is a substitution effect and an income effect. Assuming that the individual is decreasing absolute risk aversion, when the tax rate rises, it makes tax evasion more attractive, which is a substitution effect .On the other hand, there is an income effect. Higher tax rate lowers net income, so that the lower income makes the taxpayer less willing to take risks and hence evade income.

Assuming that the probability of detection is independent of the amount evaded and that there is no stigma and non-increasing absolute risk aversion, Yitzhaki (1974) shows that an increase in the tax rate causes a reduction in tax evaded. In Yitzhaki (hereinafter, referred as Y) model, fine is paid on the evaded tax, rather than on the evaded income in A-S model. It can be given by imagining evasion and reporting as two distinct activities. With penalty rate (per dollar of evaded tax), evasion becomes more benefit, relative to non-evasion, as tax rate increases. However, an increase in tax rate, which also increasing the marginal cost in the form of higher expected fines, reduces the income of the taxpayer. So, there is no substitution effect in *Y* model. With constant, or declining absolute risk aversion, only the income effect operates in the *Y* model and a higher marginal tax rate leads taxpayers to evade less, which is very different from the A-S model.

The main difference between A-S and *Y* model is the penalty structure; there are some works focused on this issue (Koskela, 1983; Balassone and Jones, 1998; Borck, 2004). The A–S or *Y* model has been extended into a number of directions including endogenous income, dynamic effects, social norms, tax avoidance and certainty in the outcome of audits, and so on. Most works are typically based on the expected utility theory (EUT) framework, but empirical evidence shows many paradoxes (Skinner and Slemrod, 1985; Alm et al, 1992; Pudney et al, 2000).

We notice that behavioral science is a possible way to offer new explanation, the integration of behavioral economics and tax evasion would just fall into the field of the emerging behavioral public finance. Behavioral public finance concerns bounded rationality, which are a non-EUT framework and a better approximation to realities. Realistic assumptions will make better predictions, for instance, prospect theory achieved some exciting explanations in tax analysis, which is a good alternative or complement of the EUT model. Till now, there is little work on the penalty structure on tax evasion issue under the new behavioral public finance framework. This paper would make a try on it.

The paper is organized as follows. The next section presents the conceptions of behavioral public finance and prospect theory. In Section 3, we outline the model of relating tax evasion and penalty structure applying the prospect theory. Section 4 studies the effect of penalty structure on tax revenue, and presents the penalty structure equilibrium under public voting. The last section concludes the paper.

2 Some Notes on Behavioral Public Finance and Prospect Theory

2.1 Behavioral Public Finance

Empirically-driven behavioral economics uses evidence from psychology and other disciplines to construct models of limits on rationality, willpower and self-interest to explain anomalies and make new predictions (Rabin, 1998). This approach deliberately rejects the “F-twist” premise that theories should not be judged by their assumptions, on the grounds that models based on more realistic assumptions will make better predictions. Although behavioral economics is fledging, the methodology makes some successful applications in organization theory, marketing, macro policies, saving, labor, financial market and so on. Public finance is among such filed as well. When imperfection in human rationality functions in public sectors, a new discipline of behavioral public finance comes into being, although it is not wide spread known as behavioral finance.

Behavioral public finance asks how limits on consumer and voter rationality influence taxation and public spending. The seminal work is by McCaffrey (1994) on cognitive psychology and taxation. The central principle is that some taxes are more visible than others. Politicians exploit these differences in searching for ways to increase tax receipts. A full theory of taxation and spending therefore depends on a good account of which types of taxes are easy and hard to impose (well-organized interest group competition will matter too, of course), and how astute revenue-seeking politicians are at understanding investor tax psychology (Camerer, 2005). McCaffrey and Slemrod（2004）sketch out three clusters of questions raised by behavioral public finance: Form matters, time matters and compliance matters. The first cluster of questions looked at inconsistencies and confusions in the popular perception of public finance system design; the second raised questions about how to even think about, let alone implement welfare improving fiscal policies in the light of behavioral inconsistencies. The final cluster of questions concerns a more practical, but still central, subject matter for public finance: why do citizens pay taxes, and how can a government keep them doing so, and prevent them from not complying? It is clear that the theme of this paper just match the third cluster.

Prospect theory is a powerful tool for normative behavioral public finance, unlike experiment and field research methods; it enables theoretical description of irrational behaviors. Prospect theory deals with bounded rational decision under risky. The traditional theory for this goes back to Von Neumann and Morgenstern (1944), if preferences satisfy a number of plausible axioms – completeness, transitivity, continuity, and independence – then they can be represented by the expectation of a utility (EU) function. Since then, the vast majority of models dealing with risk follow the way of expected utility framework. Unfortunately, experimental work in the late decades has shown that people systematically violate EU theory when choosing among risky gambles. In response to this, there has been an explosion of work on so-called non-EU theories, all of them trying to do better job of matching the experimental evidence. Some of the known models include weighted-utility theory (Chew and MacCrimmon 1979; Chew, 1983), implicit EU (Chew, 1989; Dekel, 1986), disappointment aversion (Gul, 1991), regret theory (Bell, 1982; Loomes and Sugden, 1982), rank-dependent utility theories (Quiggin, 1982; Segal, 1987, 1989; Yaari, 1987), and prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992). Of all the non-EU theories, prospect theory may be the most promising for tax evasion applications, since it is most successful at capturing the experimental results._There have been some works on tax compliance problem using prospect theory, for instance, Yaniv (1999), Elffers and Hessing (1997), Bernasconi and Zanardi (2004), Dhami and al-Nowaihi (2006).

2.2 Prospect Theory

Kahneman and Tversky (1979) laid out the original version of prospect theory. Prospect theory distinguishes two phases of choice process: one is phase of editing, and the other is subsequent phase of evaluation. Editing is preliminary analysis of the offered prospects, which often yields a simpler representation of prospects. Editing includes several operations:

- *Coding.* People perceive outcomes as gains or losses which are defined to some neutral point of reference. The location of the reference point and the consequent coding as gains or losses can be affected by the formulation of the offered prospects (framing effect).

- *Combination.* Prospects with identical outcomes are reduced to one prospect.

- *Segregation.* The reckless component is segregated from the risky component.

- *Cancellation.* Components common to the options are dropped.

- *Simplification.* Prospects may be simplified to assess their value more easily.

- *Detection of Dominance.* Dominated alternatives are rejected without further evaluation.

The final edited prospect could depend on the sequence of editing operations, which is likely to vary with the structure of the offered set and with the format of the display. The preference order between prospects need not be invariant across contexts, because the same offered prospect could be edited in different ways, depending on the context in which it appears.

The second phase, evaluation, is the assessment of the edited prospects to find the one with the highest value. The utility of an outcome is defined by two components, its value function $v(x, p)$ which measures the subjective, relative value of an outcome regarding the reference point. The second component is the probability weighting (p). Prospect theory is designed for gambles with at most two non-zero outcomes. It proposes that when offered a gamble $(x, p; y, q)$, to be read as "get outcome x with probability p, outcome y with probability q", where $x \leq 0 \leq y$ or $y \leq 0 \leq x$, people assign it a value of $V(x, y) = \pi(p) \cdot v(x) + \pi(q) \cdot v(y)$, v and π are shown in Fig. 1 and Fig. 2.

Fig. 1: Value function

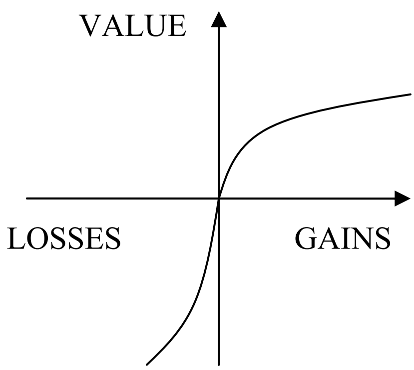
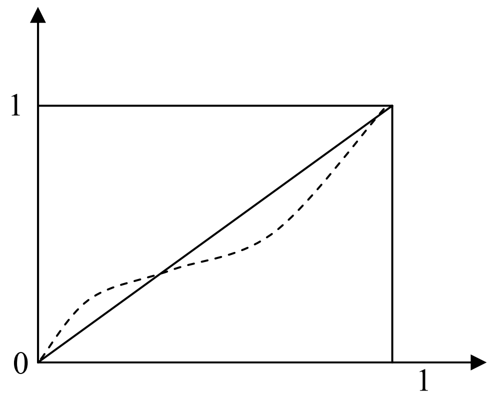


Fig. 2: Probability weighting function



This formulation has a number of important features. First, utility is defined over gains and losses rather than over final wealth positions. So, there is a reference point. The current state is considered the status-quo. Actions are considered as deviations from the status-quo. Deviations are losses and gains from that staring point. The second important feature is the shape of the value function v in Figure 1, namely its concavity in the domain of gains and convexity in the domain of losses. Both of gain and loss are diminishing sensitivity, but losses are steeper. The perceived difference between a gain of 200$ and 100$ appears bigger than the difference between a gain of 1100$ and 1200$. And a loss of 100$ show bigger than a gain of 100$. Equivalently, the same differences in losses weigh heavier for small outcomes than for higher ones. Put it simple, people are risk averse over gains, and risk-seeking over losses. The last feature of prospect theory is the nonlinear probability transformation. Small probability are overweighed, so that $\pi(p) > p$. High probability are underweighted, so that $\pi(p) < p$. As is shown in Fig. 2, probability counts mostly at the two extremes (Barberis and Thaler, 2003).

Based on additional evidence, Tversky and Kahneman (1992) draw out a generalization of prospect theory which can be applied to gambles and tax evasion with more than two outcomes. Specifically, if a gamble promises outcome x_i with probability p_i, they proposed that people assign the gamble the value function as following

$$v(x) = \begin{cases} x^{\beta}, x \geq 0 \\ -\theta(-x)^{\beta}, x \leq 0 \end{cases}, \beta \in [0,1], \theta > 1. \qquad (1)$$

Where the income x is relative to the reference point, and the probability weighting function is as follows

$$W^{+}(p) = W^{-}(p) = W(p) = \frac{p^{\varepsilon}}{\left[p^{\varepsilon} + (1-p)^{\varepsilon}\right]^{1/\varepsilon}}, \varepsilon \in [0,1]. \qquad (2)$$

We take a probability weighting function to be a strictly increasing function, $W(p)$, from [0, 1] onto [0, 1]. Hence $W(p)$ is continuous with $W(0) = 0$, $W(1) = 1$. We assume that $W(p)$ is differentiable on (0, 1). At a general level, the probability weighting function for gains, $W^{+}(p)$, need not be the same as that for losses, $W^{-}(p)$. But, in order to discuss simply, we set $W^{+}(p)$ as the same as $W^{-}(p)$. (Camerer and Ho, 1991, 1994).

3 The Model

The basic structure follows Borck's work (2004). The model distinguishes from Borck's model by using the prospect theory, while Borck analyzes penalty structure on the income tax evasion issue under the framework of the classical EUT.

In our model, taxpayer has exogenous taxable income $Y > 0$ and can choose to evade some amount $E \in [0, Y]$. The government levies a tax on declared income at the constant marginal rate t, $0 < t < 1$. If the taxpayer evades ($0 \leq E \leq Y$), then he is caught with probability $p(E)$, $p \in [0, 1]$. We assume that $p(E)$ is continuously differentiable and $p'(E) \geq 0$, which means the taxpayer is more likely to be caught if he evades more. That the probability of detection may depend on the amount evaded is quite similar with the EUT tax evasion literature. If he was caught, he has to pay a penalty fine. The penalty schedule is

$$S = (1 - a + a \cdot t) \cdot s \cdot e, \quad a \in [0,1]. \tag{3}$$

The deliberate designed equation (3) by Borck mixes the two extreme penalty structures. With $a = 0$, the penalty is levied on the amount evaded, which corresponds to the A-S model; with $a = 1$ on the other hand, fines are levied on evaded tax, which corresponds to the Y mode. In order to simplify calculation, the model neglects stigma rates and other elements. Denoting by I^+ and I^-, respectively, the income of the taxpayer when he is "caught" and when he is "not caught" is as follows

$$I^+ = (1 - t) \cdot Y + t \cdot E, \tag{4}$$

$$I^- = (1 - t) \cdot Y - (1 - a + a \cdot t) \cdot s \cdot E. \tag{5}$$

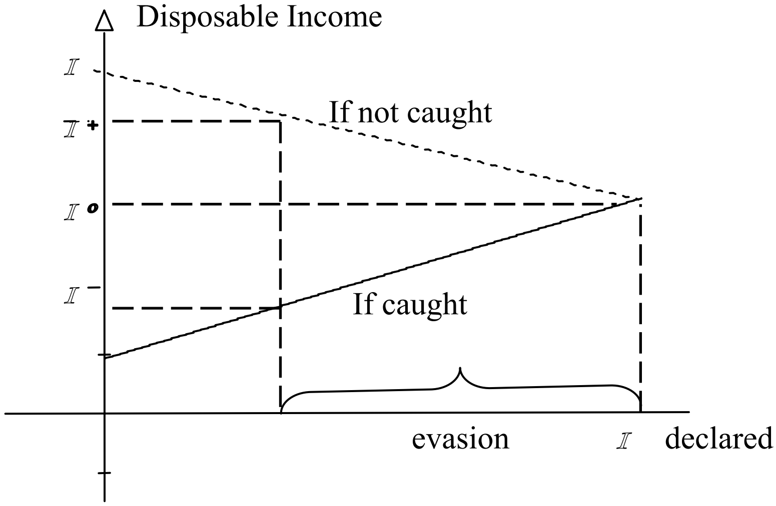
Although prospect theory does not provide sufficient guidance to determine the reference point in each possible situation, in several cases there can be a plausible candidate for a reference point. Indeed, specifying a suitable reference point is often essential for a successful application of prospect theory.

Taking the legal after-tax income as the reference point, we find

$$I^0 = (1 - T) \cdot Y. \tag{6}$$

Taxpayer has to decide whether to attempt to evade paying tax and, if so, how much to evade. Once the decision to evade has been taken, one of two possible states of the world must obtain: Either the taxpayer escapes detection and enjoys a after-tax level I^+, or he is caught, convicted and punished, in which case his after-tax level is I^-. If he chooses to be perfectly honest, then it is I^0 as shown in Figure3.

Fig. 3: Payoff to Tax Evasion



Since we set the legal after-tax income (equation 6) as our reference income, hence

$$\Delta I^{+} = I^{+} - I^{0} = I^{+} - (1-t)\cdot Y = t\cdot E \geq 0\,, \tag{7}$$

$$\Delta I^{-} = I^{-} - I^{0} = I^{-} - (1-t)\cdot Y = -\left(1-a+a\cdot t\right)\cdot s\cdot E \leq 0\,. \tag{8}$$

Then using equation (1), we get

$$v(x) = \begin{cases} (\Delta I^{+})^{\beta} = \left[t\cdot E\right]^{\beta}, x \geq 0 \\ -\theta(-\Delta I^{-})^{\beta} = -\theta\cdot\left[\left(1-a+a\cdot t\right)\cdot s\cdot E\right]^{\beta}, x \leq 0 \end{cases}. \tag{9}$$

It is easy to see that the taxpayer is in the domain of losses if caught but in the domain of gains if not caught. Let *v* be the taxpayer's value function and W^{+}, W^{-} be the probability weighting function for the domains of gains and losses, respectively. Then, according to cumulative prospect theory, the taxpayer maximizes the following value function

$$\begin{aligned} V\left(E,t,a,\theta\right) = {} & W^{+}\left[1-p\left(E\right)\right]\left(t\cdot E\right)^{\beta} \\ & - W^{-}\left[p\left(E\right)\right]\cdot\theta\cdot\left[\left(1-a+a\cdot t\right)\cdot s\cdot E\right]^{\beta}, \end{aligned} \tag{10}$$

Apply the first and second order condition, we find

$$\frac{\partial V}{\partial E}=E^{\beta-1}\begin{Bmatrix}-\theta\cdot[(1-a+a\cdot t)\cdot s]^{\beta}\left[\beta\cdot W^{-}+E\left(W^{-}\right)'p'\right]+\\ +t^{\beta}\left[\beta\cdot W^{+}-E\left(W^{+}\right)'p'\right]\end{Bmatrix}, \tag{11}$$

$$\frac{\partial^2 V}{\partial E^2}=(\beta-1)\cdot E^{\beta-2}\cdot\begin{Bmatrix}-\theta\cdot[(1-a+a\cdot t)\cdot s]^{\beta}\cdot\left[\beta\cdot W^{-}+E\left(W^{-}\right)'p'\right]+\\ +t^{\beta}\cdot\left[\beta\cdot W^{+}-E\left(W^{+}\right)'\cdot p'\right]\end{Bmatrix}$$

$$+E^{\beta-1}\begin{Bmatrix}-\theta\cdot[(1-a+a\cdot t)\cdot s]^{\beta}\left[\beta\left(W^{-}\right)'\cdot p'+\left(W^{-}\right)'p'+E\left(W^{-}\right)''\cdot(p')^2\right]+\\ +E\left(W^{-}\right)'\cdot p''\end{Bmatrix}$$

$$+E^{\beta-1}\left\{t^{\beta}\cdot\begin{bmatrix}\beta\left(W^{+}\right)'\cdot p'-\left(W^{+}\right)'p'-E\left(W^{+}\right)''\cdot(p)^2-\\ -E\left(W^{-}\right)'p''\end{bmatrix}\right\} \tag{12}$$

$$\frac{\partial^2 V}{\partial E\partial\theta}=-\beta\cdot E^{\beta-1}\cdot[(1-a+a\cdot t)\cdot s]^{\beta-1}\cdot\left[\beta\cdot W^{-}+E\left(W^{-}\right)'\cdot p'\right]<0, \tag{13}$$

$$\frac{\partial^2 V}{\partial E\partial\alpha}=E^{\beta-1}\begin{Bmatrix}-\theta\cdot\beta\cdot[(1-a+a\cdot t)\cdot s]^{\beta-1}\cdot(t-1)\cdot\\ \cdot\left[\beta\cdot W^{-}+E\left(W^{-}\right)'p'\right]\end{Bmatrix}>0, \tag{14}$$

$$\frac{\partial^2 V}{\partial E\partial t}=E^{\beta-1}\begin{Bmatrix}-\theta\cdot\beta\cdot a\cdot s\cdot[(1-a+a\cdot t)\cdot s]^{\beta-1}\left[\beta\cdot W^{-}+E\left(W^{-}\right)'p'\right]+\\ +\beta t^{\beta-1}\left[\beta\cdot W^{+}-E\left(W^{+}\right)'p'\right]\end{Bmatrix}. \tag{15}$$

Note that the sign of terms in equation (12) are ambiguous, so the sign of $\frac{\partial^2 V}{\partial E^2}$ is ambiguous. Let E^* be the maximization point in equation (11), given the values of the parameters *a*, *t*, *θ*, at point of $E = E^*$, set $\frac{\partial V}{\partial E}=0$ in equation (12) to get

$$t^{\beta} \cdot \left[\beta \cdot W^{+} - E\left(W^{+}\right)' \cdot p' \right] = \theta \cdot [[1 - a + a \cdot t] \cdot s]^{\beta} \cdot \left[\beta \cdot W^{-} + \left(W^{-}\right)' \cdot p' \right] \cdot \quad (16)$$

From equation (15) and equation (16), we get

$$\begin{aligned} \frac{\partial^2 V}{\partial E \partial t} &= E^{\beta-1} \cdot \theta \cdot \beta \cdot [(1 - a + a \cdot t) \cdot s]^{\beta-1} \cdot \\ &\cdot \left[\beta \cdot W^{-} + E\left(W^{-}\right)' p' \right] \cdot t^{-1} \cdot (1 - a) \geq 0 \end{aligned}, \quad (17)$$

Since $\beta > 0, W^{-} > 0, \left(W^{-}\right)' > 0, p' \geq 0, \theta > 0, 0 \leq a \leq 1$, from equation (17), it is clear that $\frac{\partial^2 V}{\partial E \partial t} \geq 0$. If $\frac{\partial^2 V}{\partial E^2}$=0, then E^* is critical point of $\frac{\partial V}{\partial E}$; If $\frac{\partial^2 V}{\partial E^2} \neq 0$, then E^* is regular point of $\frac{\partial V}{\partial E}$. Assume E^* is a regular point, then $\frac{\partial^2 V}{\partial E^2} < 0$, at $E = E^*$. Hence, from equation (13), (14), (17) and applying the implicit function theorem, we can find

$$\frac{\partial E^*}{\partial t} = -\frac{\partial^2 V}{\partial E \partial t} / \frac{\partial^2 V}{\partial E^2} \geq 0, \frac{\partial E^*}{\partial \alpha} = -\frac{\partial^2 V}{\partial E \partial \alpha} / \frac{\partial^2 V}{\partial E^2} > 0, \frac{\partial E^*}{\partial \theta} < 0. \quad (18)$$

This establishes an important relationship:

Proposition. *At a regular interior optimum, tax evasion is strictly increasing in the penalty structure parameter a, non-decreasing in the tax rate, t and strictly decreasing in the coefficient of loss aversion, θ.*

The effect of the tax rate on evasion depends on the penalty structure, as shown by Yitzhaki (1974). In *Y* model, *a*=1, fines are paid on the evaded tax, so the result is that an increase in the tax rate *t* causes a reduction in tax evaded. However, according to the proposition, we can see that tax evasion is non-decreasing in the tax rate *t* and there is no relation between the effect of the tax rate on evasion and the penalty structure parameter *a*. Under prospect theory, the result is very different from that analysis under the expected utility theory. That is not surprising that higher tax rate would induce taxpayer losing more. According to prospect theory, facing larger loss, people prefer to risk and are risk-seeking. So, people often underestimate high Probability case. As a result, tax evasion happens.

As shown above, an increase in a increases tax evasion. The intuition for this result is that there are two effects of increasing a from the individual's point of view Borck (2004). The first is the substitution effect, increasing a reduces the marginal penalty per evaded dollar, for positive tax rates (from equation (3), $\frac{\partial S}{\partial a} = t - 1 < 0$). So evading taxes becomes more profitable at the margin. The second is an income effect, since the taxpayer's net-of-penalty income when caught increases. Given that the taxpayer is risk averse, the marginal benefit of evasion increases. Both effects lead to higher evasion. In the Y model, a=1, and in the A-S model, a=0, according to the proposition, tax evasion is higher with penalties of the Y kind than with AS penalties.

4 Optimal Penalty Structure

4.1 Penalty Structure and Tax Revenue

Based on the above hypothesis, tax authority can successfully detect the tax evasion; under the probability p, vice versa, $1 - p$, which is the same probability distribution confronting the above taxpayer. Because tax authority has no subjective probability, it has no probability weighting function. Hence, the tax authority' expected tax revenue is

$$ET = t \cdot Y + \left[p \cdot (1 - a + a \cdot t) \cdot s\right] \cdot E - (1 - p) \cdot E \,. \tag{19}$$

Where $[p \cdot (1 - a + a \cdot t)] \cdot E$ is the revenue of detecting the tax evasion. $(1 - p) \cdot E$ is the loss of tax authority, when individual successfully evades the tax. The first order condition of equation (19) is

$$\frac{\partial ET}{\partial a} = p \cdot s \cdot (t - 1) < 0 \,. \tag{20}$$

We can see that the tax revenue of tax authority is strictly decreasing in penalty structure a. In the A-S model of tax evasion, fines are paid on evaded income (a=0), whereas in the Y model, fines are paid on evaded tax (a=1). So, in the A-S model, the penalty structure a is zero and in the Y model, the penalty structure a is one. As shown in equation (16), if tax authority choose A-S model, its tax revenue will be higher than *Y* model. Under prospect theory we show that, in the (*Y*) model, evasion is higher and tax evasion lower than in the AS model. If government seeks to maximize expected tax evasion, it would prefer penalties of the AS model type. But in the realty, most countries choose the penalty structure that *a* is close to one. So why would government want to choose the *Y* style penalty structure? The answer depends on the way that government trades off citizen welfare and tax revenue.

4.2 Equilibrium

Borck (2004) outlined the trade-off process. Supposes that individuals are identical, and the population is normalized to one. Consider the following sequence of events: government first sets the penalty rate structure, and individuals then decide on how much income to declare. In order to study rational government behavior, one must specify its objective function. Several assumptions are possible. For instance, government could be benevolent or a self interested Leviathan. Without studying the details of government behavior, we assume that government maximizes a weighted sum of expected tax revenue and expected voter welfare. This assumption implies that while the government cares about a large budget, it also has to take account of voter backlash in case of excessive taxation. The government's problem is described as following

$$\psi(t,a,s,E,\theta,p)=\phi V(E,t,a,s,\theta)+(1-\phi)\cdot E\cdot T(t,p,a,s,E). \tag{21}$$

Where Φ is the weight attributed by the government to voter welfare versus tax revenue. When Φ is large, it shows that voter' welfare more is the object of government. Then from equation (21), using envelope theorem, the first order condition is

$$\phi\frac{\partial V}{\partial\alpha}+(1-\phi)\cdot\frac{\partial(E\cdot T)}{\partial\alpha}=0\,. \tag{22}$$

Where

$$\frac{\partial V}{\partial\alpha}=-W^{-}[p(E)]\cdot\theta\cdot\beta\cdot(t-1)\cdot[(1-a+a\cdot t)\cdot s]^{\beta-1}>0\,, \tag{23}$$

$$\frac{\partial E \cdot T}{\partial a} = p \cdot s \cdot (t-1) < 0 . \tag{24}$$

While tax revenue decreases with a larger a, voter welfare increases, creating a tradeoff for government. At the optimum, the welfare gain of voters from increased penalty structure (weighted by Φ) just equals the expected loss of tax revenue (weighted by $1-\Phi$).

Obviously, the higher the weight on voter welfare in the government objective function, the larger is a at the optimum. If one interprets Φ as a measure of object of government, the result would imply that if the government considering citizen' welfare, (Φ=1) should have Y style penalty functions whereas autocratic governments (Φ=0) should have A-S style penalty schedules. More generally, more autocratic countries should have penalties which are more tightly tied to evaded income than evaded tax. Taken at face value, this would be consistent with the model. It would also be good news in the sense that one could infer that the penalty structure is that preferred by voters, not bureaucrats (Borck, 2004).

5 Conclusion

In this paper, we analyze the individual income tax evasion and penalty structure. What is different from neoclassical tax evasion theory is that we apply prospect theory other than the EUT framework. A-S style and Y style are the two typical penalty structures: in the A-S style, fines are paid on evaded income, whereas in the Y style, fines are levied on evaded tax. The finding shows that: 1) In the Y model, evaded tax is higher and tax revenue is lower than in the AS model. 2) In the Y model, the effect of tax rate on tax evasion depend on penalty structure, however, there is little relationship between the effect and penalty structure. An increasing tax rate t causes a non-decreasing tax evasion. 3) If government seeks to maximize expected tax evasion, it would prefer penalties of the AS type. If expected voter welfare is the object of government, it would choose Y style penalties.

This paper is a tentative exploration to unite the behavioral economics and practical public finance issues, and some constructive conclusions are obtained. Further researches could examine the efficiency and equity of tax evasion issues following the prospect theory track, the results could be promising. To the extent that behavioral economics rests on empirically verifiable (and verified) understanding about how real people think, choose, decide, and act in life setting, public finance models that aim for real-world relevance ought to take behavioral insights into account.

Acknowledgements

We would like to acknowledge the helpful comments of Wang Tao, Liu Hua, Liu Fang and seminar participants Yao Ling, Chen Botao at HUST on earlier versions of this paper. We would also like to thank the Project 70173003 supported by National Natural Science Foundation of China and HUST-SRF No. 2006M022B for their financial assistance.

References

[1] Allingham, M. G. – Sandmo, A (1972): *Income tax evasion: A theoretical analysis*. Journal of Public Economics, 1972, vol. 1, no. 3-4, pp. 323-338.

[2] Alm, J. – McClelland, G. H. – Schulze, W. D. (1992): *Why do people pay taxes?* Journal of Public Economics, 1992, vol. 48, no. 1, pp. 21-38.

[3] Andreoni, J. – Erard, B – Feinstein, J. (1998): *Tax Compliance*. Journal of Economic Literature, 1998, vol. 36, no. 2, pp. 818-860.

[4] Arias, R. J. (2005): *A Note on Indirect Tax Evasion*. [on-line], Buenos Aires, Asociación Argentína de Economía Política, c2005, [cit. 30. 9. 2007], <http://www.aaep.org.ar/anales/works/works2005/arias.pdf>.

[5] Balassone, F. – Jones, P. (1998): *Tax evasion and tax rates: Properties of a penalty structure*. Public Finance Review, 1998, vol. 26, no. 3, pp. 270-285.

[6] Barberis, N. – Thaler, R. (2003): *A Survey of Behavioral Finance*. In: Constantinides, G. M. – Harris, M. – Stulz, R. (eds.): *Handbook of the Economics of Finance*. Amsterdam, North Holland, 2003, pp. 1053-1124.

[7] Bell, D. E. (1982): *Regret in decision making under uncertainty*. Operations Research, 1982, vol. 30, no. 5, pp. 961−981.

[8] Bernasconi, M. – Zanardi, A. (2004): *Tax evasion, tax rates and reference dependence*. FinanzArchiv, 2004, vol. 60, no. 3, pp. 422-445.

[9] Borck, R. (2004): *Income Tax Evasion and the Penalty Structure*. Economics Bulletin, 2004, vol. 8, no. 5, pp. 1-9.

[10] Camerer, C. F. (2005): *Behavioral Economics*. (working paper). In: *World Congress of the Econometric Society*. London, Econometric Society, 2005.

[11] Camerer, C. F – Ho, T-H. (1991): *Nonlinear weighting of probabilities and violations of the betweenness axiom*. (Unpublished manuscript). Philadelphia, University of Pennsylvania, 1991.

[12] Camerer, C. F – Ho, T.-H. (1994): *Violation of the betweenness axiom and nonlinearity in probability*. Journal of Risk and Uncertainty, 1994, vol. 8, no. 2, pp. 167–196.

[13] Chew, S. (1983): *A generalization of the quasi-linear mean with applications to the measurement of income inequality and decision theory resolving the Allais paradox*. Econometrica, 1983, vol. 51, no. 4, pp. 1065-1092.

[14] Chew, S. – MacCrimmon, K. (1979): *Alpha-nu choice theory: an axiomatization of expected utility* (working paper). Vancouver, University of British Columbia, 1979.

[15] Cowell, F. A. (1990): *Cheating the Government*. Cambridge, MIT Press, 1990.

[16] Dekel, E. (1986): *An axiomatic characterization of preferences under uncertainty: weakening the independence axiom*. Journal of Economic Theory, 1986, vol. 40, no. 2, pp. 304-318.

[17] Elffers, H. – Hessing, D. J. (1997): *Influencing the prospects of tax evasion*. Journal of Economic Psychology, 1997, vol. 18, no. 2, pp. 289-304.

[18] Huang, W. (1996): *Hidden Economy in China* (in Chinese). Beijing, China Commercial Press, 1996.

[19] Kahneman, D. – Tversky, A. (1979): *Prospect Theory: Analysis of Decision under Risk*. Econometric, 1979, vol. 47, no. 2, pp. 263-291.

[20] Koskela, E. (1983): *On the shape of tax schedule, the probability of detection and the penalty schemes as deterrents to tax evasion*. Public Finance, 1983, vol. 38, no. 1, pp. 70-80.

[21] Loomes, G. – Sugden, R. (1982): *Regret theory: an alternative theory of rational choice under uncertainty*. The Economic Journal vol. 92, no. 368, pp. 805−824.

[22] McCaffery, E. J. (1994): *Cognitive Theory and Tax*. UCLA Law Review, 1994, vol. 41, no. 7, pp. 1861-1947.

[23] McCaffery, E. J. – Baron, J. (2003): *The Humpty Dumpty Blues: Diasaggregation Bias in the Evaluation of Tax Systems.* Organizational Behavior and Human Decision Processes, 2003, vol. 91, no. 2, pp. 230-242.

[24] McCaffery, E. J. – Baron, J. (2004): *Heuristics and Biases in Thinking about Tax*. In: *Proceedings of the 96th Annual Conference on Taxation 2003*. Washington, D.C., National Tax Association, 2003, pp. 434-443.

[25] Pudney, S. E. – Pyle D. J. – Saruc, T. (2000): *Income tax evasion: An experimental approach*. In: MacDonald A. – Pyle D. J. (eds.): *Illicit activity: The economics of crime and tax fraud*. Dartmouth, Aldershot, 2000, pp. 267-289.

[26] Quiggin, J. (1982): *A theory of anticipated utility*. Journal of Economic Behavior and Organization, 1982, vol. 3, no. 4, pp. 323-343.

[27] Rabin, M. (1998): *Psychology and Economics*. Journal of Economic Literature, 1998, vol. 36, no. 1, pp. 11-46.

[28] Sandmo, A. (2005): *The Theory of Tax Evasion: A Retrospective View*. National Tax Journal, 2005, vol. 58, no. 4, pp. 643-663.

[29] Segal, U. (1987): *Some remarks on Quiggin's anticipated utility*. Journal of Economic Behavior and Organization, 1987, vol. 8, no. 1, pp. 145−154.

[30] Skinner, J. – Slemrod, J. (1985): *An economic perspective on tax evasion*. National Tax Journal, 1985, vol. 38, no. 3, pp. 345-353.

[31] Slemrod, J. – Yitzhaki, S. (2002): *Tax avoidance, evasion and administration*. In: Auerbach A. J. – Feldstein, M. (eds.) *Handbook of Public Economics*. vol. 3. Amsterdam, Elsevier Science, 2002, pp. 1423-1470.

[32] Tversky, A. – Kahneman, D. (1992): *Advances in prospect theory: cumulative representation of uncertainty*. Journal of Risk and Uncertainty, 1992, vol. 5, no. 4, pp. 297-323.

[33] Von Neumann, J. – Morgenstern, O. (1944): *Theory of Games and Economic Behavioral*. Princeton, Princeton University Press, 1944.

[34] Yaniv, G. (1999): *Tax compliance and advance tax payments: A prospect theory analysis*. National Tax Journal, 1999, vol. 52, no. 4, pp. 753-764.

[35] Yaari, M. (1987): *The dual theory of choice under risk*. Econometrica, 1987, vol. 55, no. 1, pp. 95-115.

European Financial and Accounting Journal, 2007, vol. 2, no. 2, pp. 25-43.

Penalty Structure and Individual Tax Evasion: an Approach of Behavioral Public Finance

Chen Pinglu – Chen Yaogen

ABSTRACT

China is encountering grave individual tax evasion problem since the new filing system taking effect in 2007. The traditional Allingham and Sandmo (A-S) model illustrates tenuous credibility in explaining the puzzle. In this paper, we link individual tax evasion behaviors and varied penalty structure schemas within the behavioral public finance framework instead, by using the cumulative prospect theory. We differentiate penalty structures between A-S style and Yitzhaki style, that is, fines are levied on unreported income in A-S style while on evaded tax in the latter. The paper compares the classical model based on expected utility theory with the new model based on prospect theory. The analysis shows that: firstly, evasion is higher in the Yitzhaki style penalty structure and tax revenue remains lower than A-S style. Secondly, in the case of Yitzhaki style penalty structure, the effect of tax rate on tax evasion depends on penalty structure, however, there is little relationship between the effect and penalty structure. As a result, the new model could serve as a better explanation of the individual tax evasion behaviors.

Key words: Tax Evasion; Individual Income Tax; Prospect Theory; Penalty Structure; Behavioral Public Finance.

JEL classification: H26, D81.