

Is tax amnesty good for tax evader?

Abstract

Whether or not tax evaders join tax amnesty programs after evading taxes, an important index is the influence of tax amnesty programson compliance. To study this question, this paper sheds light on a relatively neglected but important area of the tax amnesty literature in the economic analysis of the secondary tax evasion of tax evaders. Considering thatpeople who participate in tax amnesty program after the government approved an amnesty for tax evasionmay not honestly report the whole amounts of evaded tax, thus committing a secondary tax evasion. It is shown that even considering the risk of abstaining from tax amnesty program and incurring possible uncertainty of tax evasion penalties, participating inatax amnesty programprovides a higher level of utility for a tax evader.This result reflects the observation that many tax evaders are willing topay taxes even when expected penalty rate and the probability of being caught evading taxes are extremely low.Also, because secondary tax evasion is accompanied by tax amnesty, we suggest that during the initial assessment period of the tax amnesty plan, tax revenue drastically increased, when the assessment period ends, tax revenue stably declined and ultimately converged on a fixed value.

Keywords: Tax evasion; Tax amnesty; Concealment cost; Secondary tax evasion; Puzzle of compliance

1. Introduction

Tax amnesty program is not a new tax but an administrative scheme to collect past taxes and may be a relatively low-priced means by which these tax liabilities can be collected, and governments of all kinds have increasingly turned to tax amnesties as part of their fiscal revenues in recent years.During the past forty years,it can be observed that tax amnesty programs have been used in many countries in both developed and developing world. For instance, almost all U. S. states have offered tax amnesty programs since 1980, and Spanish Government in 2012 announceda tax amnesty for undeclared assets or those hidden in tax havens, and repatriation would be allowed by paying a 10 percent tax with no criminal penalty to prevent money from flowing out of thatstate. Shortly afterwards, the Liechtenstein Government in 2014 advocated the idea of a one-off, non-punitive voluntary declaration of

38 non-compliance tax amnesty programs, a program currently enforced in Switzerland to avoid
39 an “accumulation” of amnesties. However, it is worthy of note that many amnesty programs
40 which developing countries have been employed, often repeatedly incessantly, including Chile,
41 Colombia, India, and the Mexico.

42 In an important early study, Arindam et al.(1995) provide empirical estimates of the revenue
43 impact of Indian income tax amnesties between 1965 and 1993. This study examines the role
44 of amnesties to allow tax evaders to join these programs and honestly pay the taxes that were
45 evaded by past tax evasion. Their empirical results indicate that only the 1975 amnesty
46 appears to have had a positive impact on tax revenue while other amnesties having negligible
47 or even negative effects. Luitel and Sobel (2007) suggest that, in general, if at first one country
48 declares an amnesty program, it brings the government a temporary revenue augments during
49 the amnesty period but then brings about a reduction in revenue in the long run. Laborda and
50 Rodrigo (2003) find that amnesties had no effect on tax revenue in either the short or the long
51 term. Yet, Luitel and Mahar (2013) suggest that tax amnesties raise higher tax revenues for the
52 US state treasury in the short term. Also, Fisher et al.(1989) suggest that amnesty seems to
53 generate immediate revenue efficiently.

54 Consider tax evaders, how then can existing literature explain why tax evaders may find it
55 worthwhile to take advantage of tax amnesty programs? Leonard and Zeckhauser (1987)
56 discuss that the argument in favor of tax amnesty programs is some people obtain and no
57 one sacrifices if a tax amnesty is provided. Yet, Olivella (1996) suggest that although
58 governments offer tax amnesty programs, tax evaders may not participate in such programs.
59 As Olivella (1996) noted, tax evaders join tax amnesty programs and honestly pay the taxes
60 that were evaded, they risk incurring stringent inspections by tax authorities on their previous
61 annual incomes because of the increase in reported income; this can hamper future intentions
62 to evade paying taxes. Also, Almet al.(1990) argue that the expectation of an amnesty
63 significantly reduced compliance, however, these negative impacts on compliance can be
64 offset by greater post-amnesty enforcement efforts.

65 Other work, Cyert and DeGroot (1987) argue that tax evaders are not well aware of the
66 disutility from tax evasion when they file their tax returns but learn about it well through
67 experience. If they later learn that they would like to be more honest than they have been, an
68 amnesty gives them an opportunity to repay the evaded tax amounts. Besides, Luitel and
69 Tosun’s paper (2013) regard joining tax amnesty programs as a Pareto improvement, because
70 it benefits tax evaders without damaging other parties; however, implementing these programs
71 may decrease tax compliance rates among honest taxpayers, violating horizontal equity.

72 In practice, if tax evaders fail to honestly repay the taxes they evaded after joining tax
73 amnesty programs, when the unreported proportion is subsequently discovered by tax
74 authorities, they must pay penalties equivalent to those paid by the tax evaders who did not join
75 the program when found guilty of tax evasion. Unfortunately, existing theories of tax amnesties

76 have neglected the influence of this condition on expected utility and the income and risk
77 behavior of tax evaders. To fill this gap in the economics literature, this paper considers the
78 influence of tax averters' partial or complete participation in tax amnesty programs (where
79 secondary tax evasion potentially occurs) on their income, expected utility, risk appetite, and
80 choice behaviors. Furthermore, the impact of perceived tax revenue with tax amnesty was also
81 analyzed.

82 The structure of this study is as follows: Chapter 1 presents the introduction; Chapter 2
83 discusses the conditions that must be fulfilled for government tax amnesty plans to succeed;
84 Chapter 3 investigates tax evaders' partial or full participation in tax amnesty plans, tax
85 evaders who participate in the tax amnesty plan but repeat tax evasion, and the effect of
86 participating or not participating in the tax amnesty plan on expected utility and risk-related
87 decisions; Chapter 4 explores the influence of the government's implementation of the tax
88 amnesty plan on tax revenue during the initial and final assessment periods; and Chapter 5
89 offers the conclusion.

90

91 **2. The analytical framework**

92 Based on the general settings used in traditional studies, assume that tax evaders and tax
93 authorities exist in societies. Consider the following simple economy. All the individuals in the
94 economy earn the same income, and are risk neutral, and have the same utility function. In
95 utility models, nonexpected utility theories such as the subjectively weighted utility, the Allais
96 paradox, the prospect theory, and the rank-dependent expected utility theory have been used
97 to explain that people's decision-making behavior is irrational, contrary to the expected utility
98 hypothesis. In addition, using subjective weights or subjectively weighted utilities to analyze
99 the decision-making behavior of people typically causes the sum of the subjective weights of
100 tax evaders to be greater than 1, which contradicts the economic and rational behavior
101 proposed in the expected utility hypothesis.¹ Therefore, this study used the
102 vonNeumann-Morgenstern axioms to analyze the occurrence probability of each type of
103 situation to satisfy the hypothesis that economic activities performed collectively by a society
104 are equalized.

105 Suppose a tax evader makes decisions by envisioning the consequences of his actions and
106 then choosing an action that maximizes his/her expected utility. Regardless of whether tax
107 evasion activities are caught, let a tax evader whose fixed real income, y , is given. Reported
108 income is taxed at the marginal tax rate m . $F(s)$ be the function of the hidden cost of each
109 dollar evaded, and s be the ratio of the hidden cost of each dollar evaded to the evaded one
110 dollar. The hidden cost of each dollar evaded is expressed as $C(s) = s \times \int dF(s)$, where

¹Take, for example, prospect theory replaces the probability of the risky occurrence with a "weighting function" that underweights high probabilities and overweights low ones. Therefore, prospect theory has failed so far to attract the attention of economists as a valuable tool of analyzing tax amnesties, an exception being Alm and Beck (1990).

111 $F'_s(s) = f_s(s)$, $s \in [0,1]$, $C(0) = C'(0) = 0$, $C'(s) > 0$, $C''(s) > 0$, and $y^\sigma > 0$ denotes the
 112 fixed real income of a tax evader while σ is coefficient governing the relationship between
 113 changes in income and changes in tax payments. A tax evader faces two conditions: p , the
 114 probability of being caught evading taxes; and $(1-p)$,² the probability of successful escape,
 115 assume p is independent of reported income. Let v be the proportion of unreported income
 116 to fixed real income. In this case, suppose that τ is the penalty rate that must be paid to the
 117 government for each dollar evaded by a tax evader who does not join a tax amnesty program
 118 and is found guilty of tax evasion,³ where $\tau(m) > m$. Also, in line with Torgler and
 119 Schaltegger(2005), a second or third tax amnesty does not improve tax compliance. Hence,
 120 assume that tax amnesty can only be used once. It is also assumed that, if audited, all of the
 121 unreported income of a tax evader will be discovered. If a tax evader joins a tax amnesty
 122 program after evading taxes, the amnesty penalty rate of each dollar evaded is χ , $\forall \chi < \tau$.

123 For a tax evader, the disutility of evading tax is increasing in the fraction of honest taxpayers,
 124 where $h \in [0,1]$ denotes the fraction of honest taxpayers in society. The coefficient A
 125 measures the degree of disutility that a cheater feels when $100h$ percent of taxpayers report
 126 income honestly, where $A \in [0,1]$. In case of evasion, now let the expected rate of return on a
 127 dollar of evaded tax $E(r) = (1-p-\tau \times p) \times m$ be strictly positive (or, $(1-p)/p > \tau$). Under this
 128 assumption, the government may eliminate evading tax simply by choosing p and τ so that
 129 $E(r) \leq 0$. However, Should the government employ p and τ , if it can influence this
 130 parameter? This paper accords with the world of experience and adopts Andreoni's (1991)
 131 suggestions that it may be rather costly for government to do so. Eq. (1) represents the
 132 premise that a tax amnesty program is not joined following tax evasion:

$$133 \quad (1-p) \times (1-m \times (1-v) + m \times v \times r - A \times h) + p \times (1-m + v \times m - \tau \times m \times v) > 1 + m \times v \times s \times \int dF(s), \forall s, \forall 0 \leq v \leq 1 \quad (1)$$

134 Further, this paper denotes that, when risks are unidentified, tax evaders encounter two
 135 choices after evading taxes: (i) participating in tax amnesty programs and paying penalties, or
 136 (ii) not joining such program, but risking the probability of being caught versus successful
 137 escape.

138 Let χ be the penalty rate of each dollar evaded by the representative tax evader who joins a
 139 tax amnesty program before being caught evading taxes in previous years, and $m < 1 < \chi < \tau$.
 140 Let K be the proportion of back duty payments to actual unreported taxes of a tax evader
 141 after joining that tax amnesty program, and $K \in [0,1]$. The value of this proportion is only
 142 known to the tax evader who voluntarily repay his/her delinquent taxes. Hence, if a tax evader
 143 joins a tax amnesty program, the total amount of evaded taxes due can be expressed as

² $\tau \times p < 1$, denoting that corner solutions are eliminated, and only interior solutions are considered in this model.

³ Because part of the unreported incomes may be legally exempt incomes, the method of Yitzhaki (1974) was adopted, basing penalties on evaded taxes, rather than basing penalties on evaded incomes as suggested by Allingham-Sandmo (A-S) model (1972).

144 $\kappa \times y \times m \times v \times \chi$. This paper stands in contrast with some existing literature. Assume that a tax
 145 evader in an amnesty program does not honestly repay the evaded taxes. When the
 146 unreported proportion $1 - \kappa$ is subsequently discovered by tax authorities, the additional
 147 amount of penalties due can be expressed as $(1 - \kappa) \times y \times m \times v \times \tau$.

148 Given the definition, an effective tax amnesty strategy provided by the government is given
 149 by :

150 **Proposition 1.** *The premise for establishing an effective tax amnesty program is $\frac{\bar{\omega}^\circ}{q_t} < \theta^*$*

151 **Proof:** See Appendix 1 for details. $\square$

152

153 3. Analysis of the secondary tax evasion under tax amnesty

154 Let $\mathcal{E}$ be the ex ante probability of a tax evader who joins a tax amnesty program after
 155 evading taxes, and $1 - \mathcal{E}$ be the probability of not joining such program, where

156 $\mathcal{E}(y^\sigma \times v) = \int_{\Omega(y^\sigma \times v)} f(\lambda) d\lambda$, $\mathcal{E} \in [0, 1]$. Assume that real income is subject to some

157 stochastic shock, λ , the shock is supposed to be a stochastic variable with probability
 158 distribution function $f(\lambda)$, $\lambda \in (-\infty, \infty)$. To see this, this paper quotes Andreoni (1991)
 159 definition to resolve this exogenous variable, $\mathcal{E}$. Consider a tax evader initially underreports
 160 $y^\sigma \times v$, assume that he/she knows $f(\lambda)$ but not realize λ . After experiencing λ a tax
 161 evader is given an opportunity for the amnesty program. Let

162 $\Phi(y^\sigma \times v; \lambda; s) = U(y^e) - U(y^c) - y^\sigma \times m \times v \times s \times \int dF(s)$ be the ex post net utility gain

163 from participating a tax amnesty. Then a tax evader will take the tax amnesty if and only if
 164 $\Phi \geq 0$. In spite of λ is exogenous, a tax evader has some control over Φ through his/her
 165 picking of $y^\sigma \times v$. Therefore, define the set function $\Omega(y^\sigma \times v) = \{\lambda : \Phi(y^\sigma \times v; \lambda; s) \geq 0\}$.

166 Given $U(\cdot)$ is a von Neumann-Morgenstern cardinal utility function (1944), then if
 167 $\lambda \in \Omega(y^\sigma \times v)$, a tax evader will take the amnesty. In this scenario. According to Proposition

168 1, when $\frac{\bar{\omega}^\circ}{q_t} < \theta^*$, that is, $\theta^A \leq \theta_{t-1} = \theta^*$, $\kappa \notin [-\infty, \theta^A]$, $\forall \mathcal{E}$, $0 < \mathcal{E} \leq 1$, then a tax averter

169 joins a tax amnesty program.

170 Thus, as defined by this paper, a tax evader with a differentiable von
 171 Neumann-Morgenstern cardinal utility function will make a choice after evading taxes: (1)
 172 participating in tax amnesty programs and paying penalties, or (2) not joining such program,
 173 but risking the probability of being caught versus successful escape, then, the expected utility
 174 of a tax evader can be expressed as :

$$175 \quad \hat{Eu}(y^\sigma) \equiv (1 - \mathcal{E}) \times U(y^c) + \mathcal{E} \times U(y^e) - y^\sigma \times m \times v \times s \times \int dF(s), \quad \forall \mathcal{E}. \quad (2)$$

176 Assume that in Eq. (2),

177 $y^c = (1-p) \times (1-m \times (1-v) + v \times m \times r - A \times h) \times y^\sigma + p \times (1-m + v \times m - \tau \times m \times v) \times y^\sigma$, and

178 $y^e = y^\sigma \times [1 - \chi \times m \times v \times \kappa - m \times v \times \tau \times (1-\kappa)]$, where y^c is the expected revenue for a tax

179 evader not joining tax amnesty programs, and y^e the expected revenue for a tax evader

180 joining such programs. Therefore, the joint probability density function can be expressed as

181 $f_{y^e}(y^e) = \frac{d}{dy^e} \int_0^\infty \left\{ \int_0^1 f_{y^e, \varepsilon}(y^e, \varepsilon') d\varepsilon' \right\} dy^e = \int_0^1 f_{y^e, \varepsilon}(y^e, \varepsilon') d\varepsilon'$, and as a taxpayer decides to

182 evade taxes. As mentioned earlier, let v be the proportion of hidden incomes to actual

183 incomes (i.e., the rate of tax erosion). Then, the Hamiltonian first-order optimal control

184 condition of v for the expected utility of tax evasion implies:

$$185 \quad H = [(1-\varepsilon) \times p \times y^\sigma \times m \times (\tau-1) - (1-\varepsilon) \times (1-p) \times m \times (1+r) \times y^\sigma] \times U'(y^c) + \quad (3)$$

$$\quad [\varepsilon \times y^\sigma \times \chi \times m \times \kappa + \varepsilon \times y^\sigma \times m \times \tau \times (1-\kappa)] \times U'(y^e) + y^\sigma \times m \times s \times \int dF(s) = 0,$$

186 The requirement for internal solution is $\tau < \frac{(1-p) \times (1+r) + p}{p}$, $\forall \varepsilon$.

187 Eq. (4) indicates that the secondorder condition of v for the expected utility is $H_v < 0$, or,

188 $\partial^2 H / \partial v^2 < 0$. This reveals that the function of the utility of tax evasion is strictly concave,

189 $U''(\cdot) < 0$, and therefore, the representative tax evader is a risk averter.⁴

$$190 \quad H_v = (1-\varepsilon) \times [p \times y^\sigma \times m \times (\tau-1) - (1-p) \times m \times (1+r) \times y^\sigma]^2 \times U''(y^c) + \varepsilon \times \quad (4)$$

$$\quad [y^\sigma \times \chi \times m \times \kappa + y^\sigma \times m \times \tau \times (1-\kappa)]^2 \times U''(y^e) ,$$

191 As mentioned earlier, κ be the proportion of back duty payments to actual unreported

192 taxes of a tax evader after joining that tax amnesty program. Using Eq. (3) , it is simple to show

193 that the influence of κ on the secondorder condition H_κ for the expected utility of tax

194 evasion is :

$$195 \quad H_\kappa = \varepsilon \times y^\sigma \times m \times (\chi - \tau) \times U'(y^e) + [\varepsilon \times y^\sigma \times \chi \times m \times \kappa + \varepsilon \times y^\sigma \times m \times \tau \times (1-\kappa)] \times m \times v \times y^\sigma \times (\tau - \chi) \times U''(y^e) \quad (5)$$

196 Eq.(5) clearly demonstrates that the function of κ (i.e., the proportion of back duty

197 payments) to the secondorder condition for the expected utility of tax evasion is strictly concave

198 (i.e., $H_\kappa < 0$). A similar result is available for κ from Eq.(5), that even the representative tax

199 evader who participates in a tax amnesty program, may not honestly report the whole amounts

200 of evaded tax, thus committing a secondary tax evasion; nevertheless, the tax evader is strictly

201 risk averse.

202

⁴ The secondorder condition for the expected utility of tax aversion, $H_v < 0$ and $H_\kappa < 0$, indicates that for either the initial or secondary tax evasion after joining a tax amnesty program, large amounts of hidden income increase the risk aversion of a tax evader.

203 **Proposition 2.***In the circumstances of partial or complete participation in an tax*
 204 *amnesty program, when the penalty rate is based on the evaded taxes, the secondorder*
 205 *condition of the hidden-to-actual income proportion, v , for the expected utility of tax*
 206 *evasion is $H_v < 0$, or, $\frac{\partial^2 H}{\partial v \times \partial v} < 0$, and the secondorder condition of the proportion tax*
 207 *duty payments to actual reported taxes for the expected utility of tax evasion is*
 208 *$H_\kappa < 0$, or, $\frac{\partial^2 H}{\partial v \times \partial \kappa} < 0$, confirming the assumption that Hamiltonian is a strictly concave*
 209 *function for both v and κ , and that tax evaders are risk averters.*

210 Moreover, this paper turns to a central question thus presented concerns the choice to be
 211 made between participating in a tax amnesty programs after evading taxes or abstaining from
 212 tax amnesty program and incurring possible uncertainty of tax evasion penalties. To analyze
 213 this question, this section derives the preference implications of the sign of U'' and U''' by
 214 providing a practical theorem for experimental investigations about the influence of tax
 215 amnesty on the risk of decision-making for tax evaders.

216 Let the original properties of a tax averter be B , where $B \geq 0$, and the definitions of y^c
 217 and y^e be identical to those in Eq. (2). Consider people who participated in tax amnesty
 218 programs after the government proposed an amnesty may not honestly report the whole
 219 amounts of evaded tax, thus committing a secondary tax evasion, the expected utility function
 220 is

$$221 \quad (1 - \varepsilon) \times U(B + y^c) + \varepsilon \times U(B + y^e) - y^\sigma \times m \times v \times s \times \int dF(s), \quad (6)$$

222 Clearly, the indifference curve of tax evasion in the bidimensional space of the probability of
 223 $y^c - y^e$; thus, it can be expressed as:

$$224 \quad (1 - \varepsilon) \times U(B + y^c) + \varepsilon \times U(B + y^e) - y^\sigma \times m \times v \times s \times \int dF(s) \equiv U(W), \quad (7)$$

225 Based on the implicit function theorem, define the relationship of y^c and y^e as $y^e(y^c)$,
 226 in which Eq. (7) passes through $(0, 0)$. A total differentiation of both sides of Eq. (7) generates
 227 the following:

$$228 \quad (1 - \varepsilon) \times U'(B + y^c) + \varepsilon \times U'(B + y^e) \times y^{e'}(y^c) = 0, \quad (8)$$

229 Differentiating Eq. (8) generates the following:

$$230 \quad (1 - \varepsilon) \times U''(B + y^c) + \varepsilon \times \left[U''(B + y^e) \times \{y^{e'}(y^c)\}^2 + U'(B + y^e) \times y^{e''}(y^c) \right] = 0, \quad (9)$$

231 Substituting $y^c = y^e = 0$ into Eq. (8) generates $y^{e'}(0) = -(1 - \varepsilon)/\varepsilon$. Substituting $y^c = y^e = 0$
 232 into Eq. (9) generates

$$(1-\varepsilon) \times U''(B) + \varepsilon \times \left\{ U''(B) \times \frac{(1-\varepsilon)^2}{\varepsilon^2} + U'(B) \times y^{e''}(0) \right\} = 0,$$

which can be rearranged to form the following proposition:

$$y^{e''}(0) = \frac{(1-\varepsilon)}{\varepsilon^2} \times \left[\frac{-d \ln U'(B)}{dB} \right], \quad (10)$$

Proposition 3. *If a tax evader's cardinal utility function is $U''(B) < 0$, then $y^{e''}(0) > 0$. The definition of Eq. (10) indicates that a greater Arrow-Pratt index of absolute risk aversion generates a greater curvature of the indifference curve near $(0, 0)$ in the bidimensional space of y^c / y^e . Therefore, let π_w be the risk premium. If "tax amnesty" is normal good, and $\pi_w(y^e) \geq \pi_w(y^c)$, then the corresponding gamble set size of joining tax amnesty programs, $\pi_w(y^e)$, is smaller than that of not joining such programs.*

Under such conditions, joining tax amnesty programs is more profitable than not joining such tax amnesty programs. Fig.1 illustrates the representative tax evader's response to the tax amnesty program, after considering the representative tax evader who participates in a tax amnesty program, may not honestly report the whole amounts of evaded tax, thus committing a secondary tax evasion. Moreover, this is a theoretical result which appears to be relatively robust; participating in tax amnesty programs yields relatively high levels of utility, and is advantageous to tax averters.

In addition, based on Eqs. (7) and (10), define $U'''(B)$ is continuous on $[B, W]$ with $0 \leq B < W$, and π_w , as defined above, denotes the risk premium. Intuitively, it implies that :

$$U'''(W) > U'''(B) \quad \forall W > B \quad (11)$$

As mentioned previously. Let y^e and y^c be two risk prospects on tax amnesty programs, which satisfy the method of moment (MOM), express expected utility and also satisfy $E(y^e)^k = E(y^c)^k$ for all k except $k = 3$. The condition here is

$$\begin{aligned} & EU(B + \pi_w(y^e)) - EU(B + \pi_w(y^c)) \\ &= \frac{1}{6} \times \left\langle E[\pi_w(y^e) - \pi_w((1-\varepsilon) \times y^c - \varepsilon \times y^e)]^3 - E[\pi_w(y^c) - \pi_w((1-\varepsilon) \times y^c - \varepsilon \times y^e)]^3 \right\rangle \times \\ & \quad U'''(B + \pi_w((1-\varepsilon) \times y^c + \varepsilon \times y^e)) \end{aligned} \quad (12)$$

As is clear from Eq. (12), an important implication of Eq. (12) implies that the sign of U''' determines preference between y^e and y^c .⁵

Thus, if an amnesty is offered, the relationship between W and π is given by :

⁵ Suppose the government plans to offer an amnesty, it can be shown from (12) that $U''' > 0$ denotes "tax amnesty" is normal good.

$$\frac{d\pi_w}{dW} = \frac{U'(y^e) - U'(y^c)}{U'(y^e)} < 0 \quad \forall y^e, \quad \forall y^c \quad (13)$$

An insight into the likely effect on the sign of Eq. (13). It is known from Eq. (13) which implies that, under the prevalence of tax amnesty, the greater the income, the lower the tax compliance.

In this case, the representative tax evader reveals decreasing absolute risk aversion (DARA). Thus, an increase in income leads to a decrease in tax compliance. This expression, seeking to supplement, but not supplant, the Arrow (1970) theory of risk aversion.

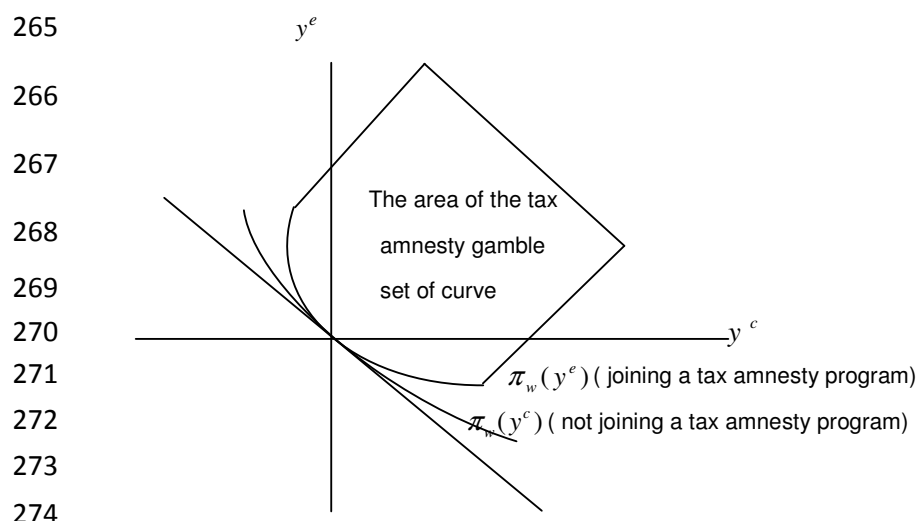


Figure 1. The gamble set of joining or not joining tax amnesty programs

4. Effect of government implementation of tax amnesty on tax revenue

Finally, the analysis could be extended to examine the effect of tax amnesty on tax revenue. Stella (1991) indicated that receipt of additional tax revenue is typically unlikely to occur in the short-run. Because tax amnesty plans may reduce the willingness of taxpayers to voluntarily file taxes, such plans may result in the long-term erosion of a country's tax base. However, contrary to Stella's assertion, this study determined that this statement may not be true in practice. According to actual analyses of the various state-level tax amnesty plans recently implemented in the United States, almost all of the states experienced a short-term increase in fiscal revenue because tax evaders paid overdue taxes or negotiated fines. For example, the state government of Connecticut experienced an increase in tax revenue of approximately US\$175–180 million after the tax amnesty plan was implemented in 2013. Other examples of increases in tax revenue after the implementation of tax amnesty plans are listed as follows by state, year, and amount of tax revenue: New Jersey, 2009, US\$661 million; Louisiana, 2009, US\$439 million; Nebraska, 2013, US\$8.98 million; Florida, 2010, US\$160 million (this tax amnesty plan lasted 90 d); and California, 2005, US\$683 million.⁶ These results differed from

⁶Information obtained from the following website:
<http://www.governing.com/columns/assessments/gov-tax-now-pay-later.html>

the argument proposed by Stella (1991). In other words, based on the tax amnesty plan situations experienced by the various U.S. states, tax amnesty should exhibit a positive effect on tax revenue for governments.

4.1. The expected tax revenue without implementing the tax amnesty

To examine the effect of tax amnesty on tax revenue, Andreoni (1991) argued that tax revenue increase as a result of tax amnesty plans is influenced by the amount of taxes evaded by tax evaders before their participation in the tax amnesty plans. However, Andreoni ignored the effect of assessment period on tax amnesty and tax revenue. Therefore, in this section, the general settings employed by previous literature were used and to examine the influence of tax amnesty plans and assessment period on tax revenue. Suppose that the assessment period in which the government implemented a tax amnesty plan was defined as J ; R^e , which was an exogenous variable, signified the estimated total tax revenue during the assessment period after implementation of a tax amnesty plan; the estimated total tax revenue without implementing the tax amnesty plan was defined as S^e ; $0 < t < T$ marked the period in which the tax amnesty plan was implemented; T was the last day of the assessment period; and λ and μ were the indicator variables of the indicator function that displayed the relationship between time and tax revenue. The expected tax revenue without implementing the tax amnesty plan S^e changed as time t changed. The exponential function to define this relationship is as follows:

$$S^e(t) = e^{-\lambda t + \mu} \quad (14)$$

Eq. (14) shows the changes in the relationship between time and tax revenue for the various assessment periods when no tax amnesty plan was implemented by the government.

Eq. (15) was the differential equation for the tax revenue collected.

$$\frac{dS^e}{dt} = -\lambda \times S^e \quad (15)$$

4.2. Short-term Effect of Government Implementation of Tax Amnesty on Tax Revenue

Assuming that a certain percentage of tax evaders would participate in the tax amnesty plan during the assessment period, the changes in tax revenue over time would be directly proportional to Eq. (16)

$$\gamma \times J \times \frac{R^e - S^e}{R^e} \quad (16)$$

This study demonstrated that during the initial assessment period of the tax amnesty plan, tax revenue drastically increased. However, as the assessment period gradually approached the final day of the assessment period, tax revenue stably declined and ultimately converged on a fixed value. Proposition 4 was thus formulated:

Proposition 4: During the initial period in which the government implements a tax amnesty plan, tax revenue drastically increases; however, as the assessment period

ends, the probability that tax payers are exempt from fines and successfully evade taxes increases. Therefore, tax revenue received by the government gradually declines as the assessment period reaches the final period, and tax revenue converges on a fixed value.

Proof: See Appendix 2 for details. □

As mentioned above, we show that by breaking horizontal equity, tax amnesties might be perceived as unfair, but governors perceive tax amnesties as another revenue source rather than a tax increase alternative.

5. Conclusions

Theories proposed in previous literature may not have been based on practical economic and social situations. In this study, the possibility that tax evaders engaged in repeat tax evasion after participating in the tax amnesty plan was included as part of the model to avoid oversimplification of the model assumption. This article contributes to the literature on tax amnesties in six ways: First, the influence of erosion rate of tax base due to tax evader's option to tax amnesty plan on the second order condition of the subjective expected utility of tax evaders is characterized by a strictly concave function; Second, the influence of the proportion of back duty payments (recovered from tax evaders who voluntarily paid the negotiated fines and overdue taxes not discovered during previous periods) on the second-order condition of the subjectively expected utility of tax evaders exhibited strictly concave function; Third, by incorporating the amount of money originally possessed by tax evaders, this study demonstrated that compared with tax evaders who did not participate in the tax amnesty plan, those who participated exhibited higher differentiable von Neumann-Morgenstern cardinal utility function. In other words, it shows that, provided there are no changes in penalty rate, and thus the probability of being caught evading taxes, even if tax evaders who participated in tax amnesty programs may not honestly report the whole amounts of evaded tax, thus committing a secondary tax evasion. Nonetheless, this result unambiguously reveals the tax evaders participated in tax amnesty programs yield relatively high levels of von Neumann-Morgenstern cardinal utility, and it is always beneficial to tax evaders. Four, the results of this study support the puzzle of compliance philosophy proposed by Diego and Luca (2011), demonstrating the reason that tax evaders are willing to participate in tax amnesty plans despite the probability of the exogenous variables "penalty rate" and "probability of tax evasion activities being discovered" being low; Five, the willingness of tax evaders to actively participate in tax amnesty plans after tax evasion decreases as the income or wealth of the tax evaders increases, indicating that the tax evaders' utility function features decreased absolute risk aversion (a robust assumption) and that risk assets subject to tax amnesty were normal goods (i.e., the elasticity obtained from the absolute risk aversion function was greater than the robust assumption of zero); and, Six, during the initial assessment period of the tax amnesty plan, tax revenue drastically increased. However, because tax payers are exempt from fines and not required to pay overdue taxes when the assessment period ends, tax revenue stably

declined and ultimately converged on a fixed value. This result may stand in contrast with some existing literature as mentioned previously, but accords well with the world of experience which reflects the observation that many tax evaders are willing to pay taxes even when expected penalties and the probability of being caught evading taxes are extremely low. Note that, this paper, seeking to supplement, but not supplant, the traditional considerations of tax amnesty theories. As a result, while not complete enough to provide insights into the tax amnesty structure, it may thereby lead to an interesting disclosure that there is no tax amnesty compliance to solve.

376

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429

430 **Appendix 1.**

431 In Proposition 1, consider risk-neutral agent and the objective of a tax evader who has not
432 been found guilty of tax evasion prior to the current period is to pursue the minimal individual
433 cost of joining a tax amnesty program. Let q_t be the probability of being caught evading taxes
434 in period t ; the cost of a tax evader can be expressed as

$$435 \Delta C = \underset{\kappa \in [0,1]}{Min} [m \times \chi \times \kappa + q_t \times \theta \times (1 - \kappa) \times m \times \tau] \times y \times v \quad (A.1.1)$$

436 where θ denotes the probability of being caught hiding incomes through any type of
437 government inspection. Adopt κ , the proportion of back duty payments of a tax evader who
438 joins a tax amnesty program, to determine the first-order optimal control condition of the

439 aforementioned equation: $\theta^A = \frac{\chi}{\tau \times q_t}$; the optimal strategy for a tax evader regarding joining

440 a tax amnesty program can be expressed as ⁷

$$\kappa^* = \begin{cases} 0 & \text{if } \theta < \theta^A \\ [0, 1] & \text{if } \theta = \theta^A \\ 1 & \text{if } \theta > \theta^A \end{cases} \quad (\text{A.1.2})$$

442 This deduction proves that only evader who meet the condition of $\theta^A < \theta$ choose to join a tax

443 amnesty program. A tax evader in the condition of $\theta^A > \theta_{t-1} = \theta^*$, $\theta \in [0, \theta^A]$ does not

444 join such program. The number of tax evaders who have not been caught committing tax

445 evasion before the current period (t) can be expressed using the probability density function

446 $(1 - q^*) \times \hat{\theta}$. Thus, $(1 - q^*) \times \hat{\theta} = \min \left\{ \theta^*; \frac{\varpi^\circ}{q_t} \right\}$, where $\varpi^\circ = \frac{\chi}{\tau}$ and ϖ° denotes the

447 ratio of χ (the amnesty penalty rate of each dollar evaded) to τ (the penalty rate, which is

448 greater than the marginal tax rate m) that must be paid by a tax evader who did not join a tax

449 amnesty program and is subsequently discovered by tax authorities. Therefore, the premise

450 for an amnesty program to be effective is $\frac{\varpi^\circ}{q_t} < \theta^*$.

451 **Appendix 2.**

452 Based on (15) and (16), the differential equation was expressed as (A.2.1):

$$\frac{dS^e}{dt} = -\lambda \times S^e + \gamma \times J \times \frac{R^e - S^e}{R^e} \quad (\text{A.2.1})$$

454 Further computations produced an nonhomogeneous equation:

$$\frac{dS^e}{dt} = - \left(\lambda + \gamma \times \frac{J}{R^e} \right) \times S^e + J \times \gamma \quad (\text{A.2.2})$$

456 The homogeneous equation corresponding to the nonhomogeneous equation, (A.2.2), is as

457 follows:

$$\frac{dS^e}{dt} = - \left(\lambda + \gamma \times \frac{J}{R^e} \right) \times S^e \quad (\text{A.2.3})$$

459 Using the separation of variables method, the following equation was obtained:

⁷ If tax penalties are based on the evaded incomes of a tax averter, then

$$\Delta C = \min_{\lambda \in [0,1]} [\beta \times \sigma + q_t \times \theta \times (1 - \sigma) \times \tau] \times y \times v, \quad \theta^A = \frac{\chi}{\tau \times q_t}$$

$$\int \frac{dS^e}{S^e} = -\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times \int dt \quad (\text{A.2.4})$$

By using the integrals from both sides of the equation, the following equation was formulated:

$$\ln |S^e| = -\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times t + C$$

$$\text{Solving this equation produced the result } S^e = \pm e^{-\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times t + C}$$

By setting the constant $C = \pm e^C$ and substituting this constant into the aforementioned

equation, the general solution for the homogeneous equation (A.2.3) was obtained:

$$S^e = c \times e^{-\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times t} \quad (\text{A.2.5})$$

The general solution (A.2.5.) of the homogeneous equation was modified and the constant C

was changed to the constant for time $c(t)$ to satisfy the nonhomogeneous equation (A.2.2.)

and obtain the hypothetical solution for the nonhomogeneous equation:

$$S^e(t) = c(t) \times e^{-\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times t} \quad (\text{A.2.6})$$

Because the solution of (A.2.6) must satisfy the differential equation (A.2.2), the

aforementioned equation was substituted into the equation and the derivative was calculated

to produce the following equation:

$$\begin{aligned} \frac{dc(t)}{dt} \times e^{-\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times t} + c(t) \times \left[-\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times e^{-\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times t} \right] \\ = -\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times c(t) \times e^{-\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times t} + \gamma \times J \end{aligned} \quad (\text{A.2.7})$$

The following equation was derived by rearranging the equations:

$$\frac{dc(t)}{dt} = \gamma \times J \times e^{-\left(\lambda + \gamma \times \frac{J}{R^e}\right) \times t}$$

By setting $\beta = \lambda + \gamma \times \frac{J}{R^e}$ and calculating the integral, the following equation was obtained:

$$c(t) = \gamma \times J \times \int e^{\beta t} dt = \gamma \times J \times \frac{e^{\beta t}}{\beta} + c' \quad (\text{A.2.8})$$

Therefore, the general solution for the nonhomogeneous equation was expressed as follows:

$$S^e(t) = \left(\gamma \times J \times \frac{e^{\beta t}}{\beta} + c' \right) \times e^{-\beta t} = \frac{\gamma \times J}{\beta} + c' \times e^{-\beta t} \quad (\text{A.2.9})$$

481 The initial value of the actual tax revenue was set as $S(0) = S_0$ and substituted into (A.2.9)
 482 to produce the following result:

$$483 \quad S(0) = S_0 = \frac{\gamma \times J}{\beta} + c' \times e^{-\beta \times 0}$$

$$484 \quad \therefore c' = S_0 - \frac{\gamma \times J}{\beta}$$

485 Therefore, the expected cumulative tax revenue for assessment period $0 < t < T$ was as
 486 follows:

$$487 \quad S^e(t) = \frac{\gamma \times J}{\beta} + \left(S_0 - \frac{\gamma \times J}{\beta} \right) \times e^{-\beta t} \quad (\text{A.2.10})$$

488 (A.2.10) indicates that during the initial assessment period of the tax amnesty plan, tax
 489 revenue drastically increases. However, as the final day of the assessment period approaches,
 490 tax revenue will stably decline and ultimately converge on a fixed value.

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