Title: A Note on Tax Evasion: Environmental Policy in the Presence of Tax Evasion

Author(s): Watanabe, Shigeru

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Abstract

A relationship between tax evasion and environmental policy has already been analyzed by Watanabe (1996). A purpose of this note is to make additional analysis of the same relationship, taking both the tax evasion of profit tax and that of environmental tax into consideration.

The behavior of the firm under imperfectly enforceable pollution tax was examined by Harfold (1978). In this note, the understatement of proceeds for tax evasion is also considered.

In this note, among other results, following results have been derived.

Raising the tax rate of profit increases the amount of reported wastes, but has no effect on the amount of the real wastes. Then the difference between the real wastes and reported wastes will be decreased by raising the tax rate of profit. On the other hand, raising the pollution tax rate decreases not only the reported wastes but also real wastes. But the difference between the real wastes and the reported wastes will not be affected by the increase in the pollution tax rate. Raising the penalty rate of the profit tax evasion will decrease not only the rate of proceeds understatement but also the output level of the firm which emits the wastes. Raising the pollution tax rate will not have effect on the output level but raising the profit tax rate will increase the output level of the firm which emits the wastes.

Raising the penalty rate of underreported wastes will increase the reported wastes but will have no effect on real wastes.
1 Introduction

A relationship between tax evasion and environmental policy has already been analyzed by Watanabe (1996). A purpose of this note is to make additional analysis of the same relationship, taking both the tax evasion of profit tax and that of environmental tax into consideration.

The behavior of the firm under imperfectly enforceable pollution tax was examined by Harfold (1978). In this note, the understatement of proceeds for tax evasion is also considered.

In the next section a simple model will be shown and effects of tax rate or penalty rate, among other effects, will be examined. In the last section, concluding remarks will be given.

2 A Simple Model

Taking the understatement of proceeds into consideration, expected profit is denoted by (1).

\[ E\pi = -(1-t)(ax^2-\beta \log w + t_w \bar{w}) + px(1-t+\varepsilon t) \]
\[ -r_o(w-\bar{w})\{-st_w(w-\bar{w})t + F_w t_o(w-\bar{w})\} - q(\varepsilon)F t_0 px, \]  

where \( t \) is tax rate, cost function is specified such that \( C = ax^2-\beta \log w \), where \( x \) is output level, \( w \) is the real amount of emitted wastes, \( t_w \) is pollution tax rate, \( \bar{w} \) is reported wastes, \( p \) is the price of the output, \( \varepsilon \) is the rate of proceeds understatement, the probability of detecting real wastes is denoted by \( r_o(w-\bar{w}) \), \( (r_o > 0) \), \( s \), \( (0 \leq s \leq 1) \) is the rate at which overpaid profit tax is refunded when the reported wastes are detected to be less than the real wastes, \( F_w(F_w > 1) \) is the penalty rate of the detected underreported wastes, \( q(\varepsilon) \) is the probability of of detecting profit tax evasion, which is specified such that \( q(\varepsilon) = \varepsilon \) in the following, \( F(F > 1) \) is the penalty rate of profit tax evasion.

Maximizing (1) with respect to \( x, w, \bar{w} \) and \( \varepsilon \) yields the following first order conditions.

\[ \frac{\partial E\pi}{\partial x} = -2(1-t)ax + (1-t+\varepsilon t)p - F \varepsilon p \]
\[ = 0, \]  

where \( F \) is the penalty rate of profit tax evasion.
A Note on Tax Evasion

\[
\frac{\partial E\pi}{\partial w} = (1-t)\frac{\beta}{w} + 2r_o(w-\hat{w})(st-F_w)t_w = 0, \quad (3)
\]

\[
\frac{\partial E\pi}{\partial \hat{w}} = -(1-t)t_w - 2r_o(w-\hat{w})(st-F_w)t_w = 0, \quad (4)
\]

\[
\frac{\partial E\pi}{\partial \epsilon} = pxt(1-2F\epsilon) = 0. \quad (5)
\]

Second order conditions are straightforwardly satisfied, since \( st < F_w \).

From the first order conditions following results can be obtained.

\[
w^* = \frac{\beta}{t_w}, \quad (6)
\]

\[
\hat{w}^* = \frac{\beta}{t_w} - \frac{1-t}{2r_o(F_w-st)}, \quad (7)
\]

\[
x^* = \frac{1+\frac{t}{4(1-t)F}}{2\alpha}, \quad (8)
\]

\[
\epsilon^* = \frac{1}{2F}. \quad (9)
\]

Hence, from (6), (7), (8), (9), following results can also be obtained.

\[
\frac{\partial w^*}{\partial \beta} > 0, \quad (10)
\]

\[
\frac{\partial w^*}{\partial t_w} < 0, \quad (11)
\]

\[
\frac{\partial w^*}{\partial F_w} = 0, \quad (12)
\]

\[
\frac{\partial \hat{w}^*}{\partial \beta} > 0, \quad (13)
\]

\[
\frac{\partial \hat{w}^*}{\partial t_w} < 0, \quad (14)
\]

\[
\frac{\partial \hat{w}^*}{\partial F_w} > 0, \quad (15)
\]

\[
\frac{\partial \hat{w}^*}{\partial t} > 0, \quad (16)
\]

\[
\frac{\partial x^*}{\partial t} > 0. \quad (17)
\]
\[
\frac{\partial x^*}{\partial F} < 0, \quad \text{(18)}
\]
\[
\frac{\partial x^*}{\partial F_w} = 0, \quad \text{(19)}
\]
\[
\frac{\partial x^*}{\partial t_w} = 0, \quad \text{(20)}
\]
\[
\frac{\partial \varepsilon^*}{\partial F} < 0, \quad \text{(21)}
\]
\[
\frac{\partial \hat{w}^*}{\partial s} < 0, \quad \text{(22)}
\]
\[
\frac{\partial (w^* - \hat{w}^*)}{\partial t} < 0, \quad \text{(23)}
\]
\[
\frac{\partial (w^* - \hat{w}^*)}{\partial F_w} < 0, \quad \text{(24)}
\]
\[
\frac{\partial (w^* - \hat{w}^*)}{\partial s} > 0, \quad \text{(25)}
\]
\[
\frac{\partial (w^* - \hat{w}^*)}{\partial t_w} = 0. \quad \text{(26)}
\]

3 Concluding Remarks

A relationship between tax evasion and environmental policy has already been analyzed by Watanabe (1996). A purpose of this note is to make additional analysis of the same relationship, taking both the tax evasion of profit tax and that of environmental tax into consideration. The behavior of the firm under imperfectly enforceable pollution tax was examined by Harfold (1978). In this note, the understatement of proceeds for tax evasion is also considered. In this note, among other results, following results have been derived.

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References
