The Determination of Optimal Fine for
Customs Fraudulent Activities: An Applied Game Theory

Arunee Sangwareetip, Nakorn Indra-Payoong

Faculty of Logistics, Burapha University, Chonburi, Thailand 20131

Tel: 66 38 103100-4 Ext 3214, Fax: 66 38 393231 E-mail: {arunee, nakorn@buu.ac.th}

Abstract

This paper performs a quantitative analysis for the Bangkok Port Customs Bureau to determine the appropriate customs fine rate, which could be used as a tool to prevent and suppress customs fraudulent activities. The Game and Utility theory are employed to predict and explain the fraud behaviors focusing on the utility maximization for both traders and the duty collectors. The study has found that the duty fraudulent game has no dominant strategy and no Nash equilibrium point, suggested that the appropriate game should be dynamic with mixed strategies because opponents can easily learn from the previous game patterns. The results have shown that setting the fine at 30.98 times of payable import duty is considered as optimal.

Keywords: Optimal fine, fraudulent activities, applied game theory

1. Introduction

The extent and persistence of underground economic activities in Thailand suggest some fundamental problems. Shadow or underground economic activities can be divided into illegal activities and unreported legal activities. The generally accepted reason for emergence and sustainability of such underreporting in developing countries is avoiding high taxes. The prohibitively high tax rates are claimed to force companies to hide their activity 'in the shadow'. Johnson (2000) suggested the following causes for unreported activity: predatory behavior of government officials; escaping extortion by criminal gangs, and inadequacy of institutional environment

This study, we integrate economic and psychological concepts (on import tax evasion) in game theory. The game theory is used to analyze behavior of traders and Thai Customs officers that worry about what their confrontation will do. We also study about Thai customs officers and the traders' payoff between the inspection cost (the fixed and variable cost) and the payable duty. When the fraudulent activities begin; traders may acquire the revenue from duty that they don't pay if the Thai customs officers don't take an inspection. In contrast, if the customs officers clarify the fraudulent activities, traders are imposed with a high tax evasion penalty. The profit of the Thai customs officers in the game payoff is the money from the penalty. However, the Thai customs officers waste out the operating cost if the traders aren't hiding the tax. The game model is tested at the Bangkok Port

Customs Bureau which governs the ocean trade activities of the country in which a number of tax evasions are found.

2. Literature Review

The methodology we use in this study is based on the past literature. Becker (1968) proposed that criminals are rational utility maximizing individuals choosing in conditions of risk. Having specified each individual's choice, most models of the optimal enforcement of law focus on maximization of social welfare function as the objective of public policy. In order to optimally deter crime, a fundamental result is derived: a monetary fine should be maximal because it is a costless transfer whereas detection activities are costly.

Sandra (2004) explored the optimal level of the fines imposed on library users. These fines are levied to avert people from keeping books too long or steal them. She set the fines to be high enough to prevent abuses and uses the model based on Polinsky and Shavell (1998) on optimal fines for polluters. It suggests that the optimal fines should depend on the level of harm done, the probability of detection and the variable enforcement cost.

Polinsky and Shavell (1998) presented the theory of the public enforcement of law for the use of public agents (inspectors, tax auditors, police prosecutors) to detect and to sanction violators of legal rules. They examined an array of extensions of the central theory, concerning accidental harms, costs of imposing fines, errors, general enforcement, marginal deterrence, the principal-agent relationship, settlements, self-reporting, repeat offenders, imperfect knowledge about the probability and magnitude of fines, and incapacitation.

Sirisatchawat (1997) explained that fine penalty is a kind of penalty which affects economic status of the criminal. The objective of fine penalty under protection or deterrent theory is not of vengeance. On the other hand, it is to determine the reasonable sum of fine, which could affect the person's discretion to commit crime or to deter him a future crime. Therefore, Day-Fine system should be gradually implemented in Thailand by starting which convicted juristic person since an appropriate income and financial status could be much simpler determined. Also, it should be applied to the offences relating to economic crime in order that the society will be able to judge whether the new system is suitable and shall be corresponded to the considerable value received from the crime committed. Further, the law concerning fine system may be amended as an extreme result.

Sungcawan (1992) described that the purpose of inflicting penalty of property forfeiture of the customs law to the offender is to prevent and suppress the acts of customs duty evasion according to the taxation policy of the state. On the contrary, the criminal law serves as means of the state to keep law and order of the society. This accounts for the major difference between the enforcement of customs law and that of criminal law. The fact that the Supreme Court applies the general principle of property forfeiture under the Penal code to the offense under section 27 bis of the Customs Act of 1926-which does not provide for the penalty of property forfeiture gives rise to many

questions, e.g. arrest, property seizure, prosecution of a customs case, determination of the return of a seized property. It also affects the suppression of acts of customs duty evasion as well as the interpretation of the enforcement of law in other sections with similar contents. In addition, if the customs law is to be correctly enforced in accordance with its real purpose or intention, which is to prevent and suppress acts of customs duty evasion efficiently and effectively, the Customs Act of 1962, Section 27 bis should be changed to contain a clear penalty provisions, and it should be publicly pointed out that the enforcement of the customs law requires adherence to its philosophy as a public law which is basically intended to protect common economic interests.

3. Game theory model

This section presents a strategic game model between traders and the Thai customs officers. The game begins when traders have the import shipments and they do not want to pay the right duty. The Thai customs officers have to make a decision whether to inspect those shipments or not. The Game and Utility theory are employed to predict and describe the fraud behaviors focusing on the utility maximization for both traders and duty collectors. Although this game is somewhat similar to the past literature in tax inspection, the structure of game payoffs is different, stipulating different Nash equilibria in our game model. The behavior of the tax evasion game is:

Table 1:   Behavior of the tax evasion game

Event	Actions	
	Traders	Thai customs officers
1	Evade	Inspect
2	Evade	Not inspect
3	Comply	Inspect
4	Comply	Not inspect

The utility functions represent the satisfaction of traders and Thai customs officers. The utility function for traders, U_M can be written as:

$$U_M = qT + \varepsilon \tag{1}$$

where:

q is probability of the customs officers for not inspecting the import shipment

T is payable tax or import duty for traders; ε is stochastic term

The utility function for the Thai customs officers, U_O can be written as:

$$U_O = pT + \varepsilon \tag{2}$$

where:

p is probability of the traders for complying the rules (i.e. not evading the tax)

Assume that ε = 0, i.e. there are no other factors influencing the payoffs for both traders and the customs officers. c_0 and c_1 are the cost of inspection and not inspection for the customs officers.

Traders are considered for tax evasion only when the customs officers inspect the import shipments. If so, they have to pay a tax penalty, T. The customs officers collect an amount of the penalty, xT for their benefit. Therefore, x can be taken as a decision variable to determine the optimal fine R, and the game payoff is given by:

Table 2: game payoffs for optimal fine

		Thai customs officers		Probability
		Inspect	Not inspect	
Traders	Evade	$(-xT),(-c_0+xT)$	$(+T,-T-c_1)$	$(1-p)$
	Comply	$(0,-c_0)$	$(0,-c_1)$	p
Probability		q	$(1-q)$	

In a strategic game model, the utilities of traders and the Thai customs officers are maximized, i.e. $U_M = U_O$.

$$-xTq + xT - Tq = -c_0 + 2xT - xTp - T + Tp - c_1 - c_0 p \tag{3}$$

Then, the optimal fine, R is obtained by:

$$R = xT \tag{4}$$

Based on the inspection costs from the customs officers exercised, and the historical tax evasion activities, we apply c_0 = 3,412, c_1 =1,884, p = 0.10, and q =0.02. The payable import duty or tax, T is assumed to 100 Baht in this study

$-(100 \times 0.02)\ x +100-(100 \times 0.02)$ = -3,412+(2×100) x -10 x -100+10-1,884-341.20

$2x$ +98 = -5,727.20+190 x

x = 30.98

From (4), the optimal fine for tax invasion, R is 3,098 Baht

4. Conclusions

In this paper, we develop a simple game model between traders and the Thai customs officers. We have found that there is no dominant strategy for both traders and the customs officers, and no Nash equilibrium point. The game begins when the shipments are imported by traders, suggested that the appropriate game should be dynamic with mixed strategies. The results have shown that the optimal penalty rate for tax evasion is 30.98 times of a payable duty. Further research may focus on trader payoffs and the revenue gained for the Thai customs officers in connection with a bribe action in order to determine how much the optimal fine would be.

References:

[1] Gary J.Becker.,1968, Crime and Punishment : An Economic Approach, Journal of Political Economic, 76, 169-217.

[2] Johnson, S, D. Kaufmann ,J McMillan, C. Woodruff, 2000, Why Do Firms Hide? Bribes and Unofficial Activity after Communism, Journal of Public Economic, 46, 495-520.

[3] Nuno, G., 2001, Optimal law enforcement when victims are rational players, Economic of Governance, 12(5), 231-242.

[4] Polinsky, A.M., & Shavell, S., 1992, Enforcement cost and the optimal magnitude and probability of fine, Journal of Law & Economic, 35(1), 133-148

[5] Polinsky, A.M., & Shavell, S., 1998, Public Enforcement of law: The New Palgrave Dictionary of Economics and the Law, Volume 3 (P-Z), New York, 178-188

[6] Roger, A., & McCain, G., 2004, Game theory, United States: Thomson Learning.

[7] Sandra, R., & Carole, B., 2004, How to determine the optimal fine in court? Game theoretical and empirical analysis, Belgium: Center of Economic Studies.

[8] Sandra, R., & Ronald, R., 1999, Optimal fines in libraries and documentation centers, Scientometrics and Information, 2(14), 431-440.

[9] Sorat Sungcawan,1992,The effect of the precedent of supreme court in forfeiture by customs act B.E. 2469 article 27 BIS, Graduate School, Chulalongkorn University, Bangkok.

[10] Waraporn Sirisatchawat, 1997, Punishment of fine: A study of dayfine system., Graduate School, Chulalongkorn University, Bangkok.