A Study on the Impact of the Government Behavior of the Intellectual Property Rights Regulation on the Private Enterprises Based on Game Theory

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Abstract   The private enterprises in China, comparing to the state-owned enterprises, have less funds and policy implications to protect their intellectual property. So the government acts in the protection of intellectual property rights have a significant impact on the development of the private enterprises. This paper studies the impact of the government regulations of the intellectual property rights on private enterprises based on the game theory. And the anthors find that it is very important to build an upright, just, honest and clean supervisor team to make sure that the private enterprises' intellectual property rights under good protection. And the anthors suggest to increase the opportunity cost of taking bribes, strengthen the supervision of the supervisor's and take "high salary" mechanism to establish that kind of team.
Key words   Regulation; Game model; Intellectual property rights

1 Introduction

In recent years, China's intellectual property protection has made remarkable achievements, experts and scholars pay attention to various aspects of the intellectual property protection, such as legislation, policies, approach, and so on, and get much more research. However, the Government's protection of intellectual property rights in the conduct of only a small amount of research, For example, Li Zuojuan (2006) pointed out that the Chinese government in protection of intellectual property rights that exist in too much administrative intervention, providing inadequate service ,Xu Qiang (2007) make Zhujiang Road Nanjing city as an example, analysis the capacity of local governments regulation on the intellectual property protection, defined on the power, Zhang Xianfeng (2007) through the effective protection of intellectual property rights when the price of computer software as a standard for comparison and analysis of production of China's protection of intellectual property rights of enterprises and the government's actions and its consequences. Yao Lei (2008) Protection of intellectual property rights from the Government's involvement in the analysis of the causes that promote the protection of intellectual property rights of China's government is due mainly to enhance the international competitiveness from reducing international trade frictions and to promote the need for independent innovation. The protection of intellectual property rights of private enterprises in the study of government behaviour is even more quite scarce.

This article holds that the private enterprises in China has become the backbone of technological innovation, for promoting China's independent innovation plays a decisive role, according to Ministry of Science and Technology statistics, the country's private enterprises to provide about 66% of the patented invention, 74% of technological innovation, 82 % of new product development. However, when talking about innovation, and often overlooked role of small and medium enterprises, large enterprises is generally believed that the main body of innovation. Relative state-owned enterprises, small-scale private enterprise funds, the impact of poor policies, weak awareness of intellectual property protection, intellectual property disputes arising at the same time. Therefore, when the Government acts in the protection of intellectual property rights of private enterprises have a significant impact, this article from the perspective of game theory to the protection of intellectual property rights of private enterprises to study the government's actions.

2 Game Model
2.1 Model assumptions

Model is divided into two phases: $t, t+1$; w_t and w_{t+1} are the regulator of the two phases earners, b_t is the gray income, β Is the discount factor, $a_{t+1}(b_t)$ is the regulator of corruption was found to function after the punishment. For the regulator in real life there are three cases, one clean, and

its effectiveness for $U = w_t + \beta w_{t+1}$; Second, the regulator of corruption, but managed to escape the supervision, not be punished for its effectiveness $U = w_t + b_t + \beta w_{t+1}$; Third, the regulator of corruption, but was discovered and punished, for its effectiveness $U = w_t + b_t - \beta a_{t+1}(b_t)$, as corruption was found, it is no longer in the period $t+1$ of wage earners.

q Is the regulator of its supervision of the higher authorities of the mechanism, we can be understood as the country to monitor the intensity of corruption, θ is the corruption of the regulators in decision-making variables, in reality, the performance of a monitor's professionalism and moral self-cultivation. $q \in [0,1], \theta \in [0,1]$.

The assumption that the average wage of the effectiveness of community level U_e

2.2 Game model analysis

The payment of the matrix game model is as follows:

		Higher-level oversight bodies	
		Supervise (q)	No supervise ($1-q$)
Regulators	Clean(θ)	$w_t + \beta w_{t+1}$	$w_t + \beta w_{t+1}$
	Corruption($1-\theta$)	$w_t + b_t - \beta a_{t+1}(b_t)$	$w_t + b_t + \beta w_{t.}$

Therefore, the regulator is expected to inter-period utility function as follows:

$$E_t U = (1-\theta)\{q[w_t + b_t - \beta a_{t+1}(b_t)] + (1-q)(w_t + b_t + \beta w_{t+1})\} + \theta(w_t + \beta w_{t+1}) \tag{1}$$

The clean Regulators utility function as follows:

$$E_\theta U = w_t + \beta w_{t+1} \tag{2}$$

Regulators of the utility function for corruption:

$$E_{1-\theta} U = q[w_t + b_t - \beta a_{t+1}(b_t)] + (1-q)(w_t + b_t + \beta w_{t+1}) \tag{3}$$

In conditions of asymmetric information, the regulator of the higher level of supervisory authority can not directly observe whether or not the regulator clean, and the regulator in accordance with the principle of utility maximization own actions, so only the design of mechanisms to maximize the effectiveness of the regulator to achieve monitoring results.

(IR)Participation constraint: That the regulators will be involved in monitoring the effectiveness of not less than the average level of society brought about by the effectiveness, namely:

$$\text{(IR)} \Delta U = E_t U - U_e > 0 \tag{4}$$

Which means:

$$\Delta U = (1-\theta)\{q[w_t + b_t - \beta a_{t+1}(b_t)] + (1-q)(w_t + b_t + \beta w_{t+1})\} + \theta(w_t + \beta w_{t+1}) - U_e > 0 \tag{5}$$

(IC)Incentive compatibility constraint

Because regulators can not be higher supervision department supervisor observed actions and state θ, regulators want to be clean, must be honest in the choice of the regulator to be greater than the effectiveness of the effectiveness of corruption, namely:

$$E_\theta U > E_{1-\theta} U \tag{6}$$

$$\text{(IC)} \quad w_t + \beta w_{t+1} > q[w_t + b_t - \beta a_{t+1}(b_t)] + (1-q)(w_t + b_t + \beta w_{t+1}) \tag{7}$$

Regulator is expected to inter-period effect of the average wage and social difference between the utility function as follows:

$$\Delta U = E_t U - U_e = (1-\theta)\{q[w_t + b_t - \beta a_{t+1}(b_t)] + (1-q)(w_t + b_t + \beta w_{t+1})\} + \theta(w_t + \beta w_{t+1}) - U_e \quad (8)$$

For regulators, the regulatory authorities when it is in the utility function with the social utility function of the average wage is no difference, that is,

$$\Delta U = 0$$

We can draw the corruption of the critical value function as follows:

$$1-\theta = \frac{U_e - (w_t + \beta w_{t+1})}{q[w_t + b_t - \beta a_{t+1}(b_t)] + (1-q)(w_t + b_t + \beta w_{t+1}) - (w_t + \beta w_{t+1})} \tag{9}$$

We assume that the regulator in the regulatory departments of the utility function when the average wage and the social utility function is no difference, the regulator for the corruption of the decision-making variables θ^*.

$$\because \quad \Delta U = E_t U - U_e > 0$$

We are bound to participate in derivation, may:

$$\frac{\partial \Delta U}{\partial \theta} = -\{q[w_t + b_t - \beta a_{t+1}(b_t)] + (1-q)(w_t + b_t + \beta w_{t+1})\} \tag{10}$$

$$+(w_t + \beta w_{t+1})$$

$$\because w_t + \beta w_{t+1} > q[w_t + b_t - \beta a_{t+1}(b_t)]$$

$$+(1-q)(w_t + b_t + \beta w_{t+1})$$

$$\therefore \frac{\partial \Delta U}{\partial \theta} > 0$$

when $\theta = \theta^*, \Delta U = 0$, $\therefore \ \theta > \theta^*$

We can come to the conclusion: as long as the mechanism to meet the participation constraint (IR) and incentive compatibility constraint (IC), the regulator of the state better than clean $1-\theta$ in a state of critical value. Therefore as a client a higher level of regulatory oversight bodies of the task is to design a reasonable contract (mechanism) so as to meet the participation constraint (IR) and incentive compatibility constraint (IC).

To meet the participation constraint (IR) and incentive compatibility constraint (IC), the regulatory action is the optimal solution of the following issues:

$$\text{S.t} \ MAXE_t U = (1-\theta)\{q[w_t + b_t - \beta a_{t+1}(b_t)] +$$

$$(1-q)(w_t + b_t + \beta w_{t+1})\} + \theta(w_t + \beta w_{t+1})$$

$$(\text{IR}) \ 0 \prec (1-\theta)\{q[w_t + b_t - \beta a_{t+1}(b_t)] + (1-q)(w_t + b_t + \beta w_{t+1})\}$$

$$+\theta(w_t + \beta w_{t+1}) - U_e$$

$$(\text{IC}) \ w_t + \beta w_{t+1} > q[w_t + b_t - \beta a_{t+1}(b_t)] + (1-q)(w_t + b_t + \beta w_{t+1})$$

First-order conditions: $\dfrac{\partial E_t U}{\partial \theta} = q\beta w_{t+1} - b_t + q\beta a_{t+1}(b_t) = 0$

Deformation of the equation as follows: $q\beta w_{t+1} - [b_t - q\beta a_{t+1}(b_t)] = 0$

The first equation is the regulator of the future expected wage income, the second is the gray income, the third is facing the punishment of corruption.

So we can know whether or not the regulator clean by the impact of three exogenous variables: the higher level supervision department supervision, future expected wages and punitive efforts. For b_t, we believe that it is caused by the regulators need to decide according to their amount of bribery, while the regulator is to decide whether to accept, rather than bargaining. Therefore, the regulator can clean, and its degree of honesty θ marginal utility of the decision with his approach. In the equation $\dfrac{\partial E_t U}{\partial \theta} = q\beta w_{t+1} - b_t + q\beta a_{t+1}(b_t)$ There is any uncertainty. We can see:

if $\quad q\beta w_{t+1} - b_t + q\beta a_{t+1}(b_t) < 0$, so $\quad \dfrac{\partial E_t U}{\partial \theta} < 0$

if $\quad q\beta w_{t+1} - b_t + q\beta a_{t+1}(b_t) > 0$, so $\quad \dfrac{\partial E_t U}{\partial \theta} > 0$

This means that the higher level of supervision of their supervision departments q, it is expected the amount of punishment $a_{t+1}(b_t)$ and the expected wage level w_{t+1} the joint effect of the existence

of a critical value b_t^*, when it is less than b_t^*, $\dfrac{\partial E_t U}{\partial \theta} < 0$, in terms of monitoring and the effect $E_t U$ is the degree of its clean θ function of the reduction, which will lead to $\theta^* \to 0$, means that the regulator will see stolen goods on the corrupt, when the joint effect of higher than b_t^*, $\dfrac{\partial E_t U}{\partial \theta} > 0$, the effect of the regulator $E_t U$ is clean degrees θ an increasing function, which will lead to $\theta^* \to 1$, clean and honest regulators. $\theta^* \to 1$ is exactly what we want to see the results of the $q\beta w_{t+1} - b_t + q\beta a_{t+1}(b_t) > 0$ deformation was: $q\beta w_{t+1} > b_t - q\beta a_{t+1}(b_t)$

Where the left is the regulator's future wages, the right is the imbalance between the accepting bribes and the punishment that was found, that is, income opportunities for bribery.

For a higher level of regulatory supervision q, the inequality in $\beta w_{t+1}, b_t, \beta a_{t+1}(b_t)$ certain circumstances, there is a critical value q^* allow $q^* \beta w_{t+1} = b_t - q^* \beta a_{t+1}(b_t)$, when $q > q^*$, q^* is greater the inequality the more it can to ensure the establishment of regulatory authorities means that the higher level supervision or more stringent monitoring mechanism more robust, $\theta^* \to 1$.

3 Conclusion

The government supervisors' behaves have significant impacts on the market participants who will adjust their actions based on the preceding behaves of the supervisors. If the market participants observed that the supervisors were corrupt, they will do harm to the intellectual property owners to get profits, which will ruin the innovation diffusion and kill the long run economic growth. So, in order to make sure that the innovation diffusion get successful, we should build an upright, just, honest and clean supervisor team to make sure that the private enterprises' intellectual property rights under good protection. And we suggest that increasing the opportunity cost of taking bribes and strengthening the supervision of the supervisor's and taking "high salary" mechanism to establish that kind of team. That means we should severely punish those supervisors who violate the law and discipline to create a warning effect, and we can take the "high-paying Honesty" policy to raise the regulator's income to prevent them from doing corruption. In all those ways, the private enterprise's intellectual property rights will be protected well and the private economy in China will get well developed.

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