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Study on Rare Earth Management Game Between Central and Local Governments in China

LIU Huifang[a],*; LEI Lei[a]; YE Changxie[a]

[a] School of Humanities and Economic Management, China University of Geosciences, Beijing 100083, China.
*Corresponding author.

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Abstract
The interest claim for management of rare earth among central and local governments is not identical. Even in some specific problems they are at variance. So there is a benefit game process. Through establishing a non-cooperative dynamic game theory model, the paper analyzes the strategy selection and game results of Chinese rare earth management among central and local governments, concludes root reasons fort existing problems. And then it offers some specific countermeasures and suggestions.

Key words: Rare earth management; Central government; Local government; Game

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INTRODUCTION
Rare earth is a term that consists of 17 kinds of metal elements and a pretty important strategic resource, which is widely used in high-tech areas concerning national economy and national defense and military. Thus some related countries attach great importance to it.

China is a country that has the most abundant rare earth resource, also the most production, the most export and the most consumption in the world. The rare earth resource is mostly located in Inner Mongolia, Sichuan, Jiangxi, Fujian, Guangdong, Guangxi, Hunan, Shandong and Yunnan. In 1980s at the direction of "abundant water to fast flow", the government did not impose restrictions on mining and exporting the rare earth resource. Since 2003, China had been the monopoly position in the international rare earth market. By the year of 2011, the storage of China's rare earth accounted only for 23% of the whole world, but the production accounted for more than 90% of the world. For several years, the export price of rare earth has been very low, which deviated seriously from the value. Therefore economic income is very low and the consumption of the resource is very vast. The storage percentage of China's rare earth is gradually decreasing year by year and sustainable development is threatened with the destruction of ecological environment. The national rare earth expert indicated that the world largest rare earth – Baotou Bayan obo mine and the southern ionic rare earth ore each will be exhausted in 25 years and 10 years if in accordance with exploitation in 2008. At that time, China would import rare earth from other countries at a very high price.

To promote the rational development of rare earth, Chinese central government has enforced several relevant policies which regulated every level of rare earth industry since 2007, including industrial consolidation, strict conditional on production, regulations of the export quantity, national storage and establishment of supervision organization in the industry. Meanwhile, the government also implement administration on its manufacture, process and export.

However, they are still open questions since very little has been achieved in the implementation of the resource exploitation and export policy of rare earth. Such as damage exploitation and smuggling. As the differences on interest claim among central and local governments and conflicts of interests in several respects, there is an interest game among central and local governments. Since then, the local governments occasionally boycotted, bargained and overtly agreed but covertly opposed on central policies.

Through establishing a non-cooperative dynamic game theory model, the paper analyzes the strategy selection and game results of Chinese rare earth management among central and local governments and looks forward to offering some consulting resource for the rare earth policymaking.

A THEORY MODEL OF GAME

Assuming that the international market is fixed, the paper ignores the foreign countries' reaction on Chinese regulation of the rare earth production and export. That is to say ignoring the variance of other countries' rare earth production and volume of supply on the international market, and China is still the main rare earth supply in the international market. Assuming that the quantity demanded in the international market is invariant or increased somewhat; assuming that the production of enterprises is equal to the trade volume (the trade volume is divided into domestic trade and export); assuming that the domestic rare earth price is same.

i. Participant: participant including two sides, central government 1 and local government 2, considering the participants assembly as N={1,2}.

ii. The order of the participant adopting actions: as the policies maker and manager of rare earth industry central government 1 as foregoer. Local government 2, as executioner and subsidiary of the policies, is the latter one.

iii. The space of the action: central government 1 is S_1, and the action is regulating or not regulating the production and trade of the rare earth,(the main measure of regulation is limitation of the production and enterprise integration, making the admissive production of the government as Q_1 and regarding the quantity of the enterprise as R_1); The space of the action of local government is S_2, according to the acquired information, the local government action is coordinated regulation action and uncoordinated one,(the uncoordinated one mainly expressed at the acquiescent production and the number of enterprises exceed the government limitation, putting the acquiescent production as Q_2 and the number of enterprises as R_2),

Therefore the action space is $S_1=\{Q_1, R_1|Q_1\in[0, \infty), R_1\in[0, \infty)\}$, $S_2=\{Q_2, R_2|Q_2 = Q_2(Q_1), R_2= R_2(R_1)\}$

iv. The information participants understand adopting actions: 1 and 2 understand relevant information, that is to say making the strategy choice in the state of complete information.

v. Payoff functions: Payoff function is the income that participant gained respectively by the end in the various behavior choices. The income should overall consider the economic benefits of production of rare earth, scarcity of rare earth and the effect of rare earth resources sustainable development and ecological environment caused by the production of rare earth.

In general, expressed as U= PQ—C(Q)—M(R)—F(Q)—G(Q).

Game tree is shown in Figure 1.

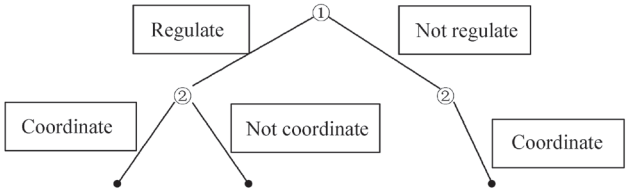

Figure 1
Game Model of Central Government 1 and Local Government 2

Pay vector is $U=(U_1, U_2)$, U_1 is the comprehensive income of the central government 1 in the end of the game, U_2 is the comprehensive income of the local government 2 in the end of the game.

The comprehensive income of the central government 1:

$U_1=PQ_1—C_1(Q_1)—M_1(R_1)—F_1(Q_1)—G_1(Q_1)$

The comprehensive income of the local government 2:

$U_2=PQ_2—C_2(Q_2)—M_2(R_2)—F_2(Q_2)—G_2(Q_2)$

P is market price of rare earth, P is the function of Q_1 and Q_2; $C_1(Q_1)$ and $C_2(Q_2)$ respectively express the cost of Q_1 and Q_2 , $M_1(R_1)$ and $M_2(R_2)$ express the management total cost of the central government and the local government when rare earth enterprise number is R_1 and R_2 ; $F_1(Q_1)$ express the resource consumption value that central government bears when production of rare earth is Q_1 ;$F_2(Q_2)$ express the resource consumption value that the local government bears when production of rare earth is Q_2 ; $G_1(Q_1)$ express the impact of ecological environment caused by Q_1 , $G_2(Q_2)$ express the impact of ecological environment caused by Q_2 and impact is shown on value compensation amount of recovery of ecological environment.

The Chinese government representing the whole country needs to consider the overall interests and maximize the whole value; the local government mainly stands in the local point of view and pursuits the local profit maximization.

Namely solving

$\max U_1= PQ_1—C_1(Q_1)—M_1(R_1)—F_1(Q_1)—G_1(Q_1)$ (1)

$\max U_2= PQ_2—C_2(Q_2)—M_2(R_2)—F_2(Q_2)—G_2(Q_2)$ (2)

In theory, the central government's payoff function form and local government's should be completely consistent,but the actual content has the obvious difference.

THE PROCESS OF GAME ANALYSIS

The Central Government's Strategy Selection

After taking unregulated strategy by central government, it would have formed a condition as mentioned in the introduction. The consolidated income of rare earth

development U would be very little. Because of the lower rare earth price (P), more manufacturing enterprises(R), larger resources depletion F(Q)and ecological environment disruption G(Q), the central government would practice manage rare earth.

The central government carries out a series of policies and measures for management by a number of departments: the Ministry of Land and Resources administrates the mining rights of rare earth, the Ministry of Industry and Information Technology issues a mandatory production plan for smelting separation enterprises, rare earth export quotas and export tariffs shall be determined by the Ministry of Commerce and the State Administration of Taxation and the Ministry of Environmental Protection decides pollutant emission standards of rare earth enterprises. The main strategies are as follows:

i. Controlled rare earth production is Q_1, which helps to improve the market price P and reduce resource consumption F_1 (Q_1) and environmental damage G_1 (Q_1) .The effect of rare earth export quota control and collection of rare earth export tariff are same as the effect of controlling production.

ii. Delineation of national planning areas of rare earth resource is designed to take back parts of mining rights and supervision rights; integrate rare earth industries, greatly reducing enterprises number, and expect to integrate the industrial flow path, such as exploitation, production, sales, research and development, and transfer it to much powerful central enterprises. Obviously, such measures make for greatly reduce the cost of management M_1 (R_1).

iii. Waste water, waste gas, waste slag, tailings produced by rare earth during the production of the acquisition and separation cause the destruction of vegetation, soil and water loss and other problems, not only the destruction of the ecological environment, but also a threat to public safety. The Chinese counterpart ministries on the one hand require local governments and enterprises to adopt various ways of ecological environment protection, on the other hand specialize dedicating funds for management, namely that The Chinese counterpart ministries partially bear the compensation cost of the ecological environment.

The Local Government's Strategy Selection

Over the years, the rise of the rare earth mining and smelting separating enterprises has led to the development of the local economy, and greatly increase the local fiscal revenue, and improve the local people's employment rates and income levels. Therefore, local government naturally takes strategy which works in with the central government when the central government takes unregulated strategy of rare earth, resulting the small composite income of rare earth exploitation .

In the event that the central government take measures to control the rare earth production, if the choice of strategy taken by the local government is fully compatible with the central government, then the interests of the local is completely obey national interests, comprehensive income $U_2 = U_1$; If it is not fit, then the local interests is fully protected, comprehensive income is U_2; However, this situation is not realistic in China. The reality is that the local government will not completely mismatch, also not be fully fit, the main strategies are as follows:

i. For rare earth resource-rich regions, the control of rare earth production and export volume will directly affect the local economic benefits, such as GDP, local finance income, employment and revenue of general public, but PQ2 is the guarantee of economic benefits. For some local rare earth enterprise, limited production quota far cannot satisfy the production capacity and stage production halts will bring a lot of loss; thus, the implementation of production control of local government and monitoring would be greatly weakened. For instance, without enough active management and regulation to illegally mining and secretly and excessively exploring, there will be making Q_2 larger than Q_1.

ii. Some local companies have built stable foundation, whose contributions to the local economy are rather prominent. National incorporation of rare earth. In particular, if the central enterprises stand on the point of their own interests to make management decision independently, the configuration of the various resources is not necessarily preceded locally. The tax contribution to local is very few and the coordination with local government is more difficult. Therefore, the local government is not willing to hand over the dominance of the resources in the central enterprises. In that context, the local government didn't implement actively the central government's policy for the consolidation. So bargaining, delay and perfunctory, passive resistance is easy to understand.

Taking rare earth of Ganzhou in Jiangxi province for example. Ganzhou Rare Earth Mining Limited Company is found by municipal government of Ganzhou which in charge of unified mining, manufacturing and selling in 2004. In recent years, some central enterprises have began to enter Jiangxi province hoping to be able to integrate and purchase the rare earth resources of South China, such as China Minerals and Aluminum Corporation of China and so on. But they received the local government and enterprise's heavy resistance in the distribution of the mining rights, smelting and separation of enterprise ore blending. The integration of work descended into deadlock.

iii. According to the lack of spatial distribution of rare earth industry, the rare earth resources area will do everything to enlarge the scale of rare earth resources in order to occupy an advantaged role in the future industrial distribution of country.

iv. The resources tax imposing on rare earth and all kinds of taxes of production cycles and export tariffs are low for years. However, the society has always undertaken the high cost of environment and resources together. Taking their economic interests into account, the local government often indulges in the damage of the ecological environment caused by rare earth and the waste of resources. That is because the local government and enterprises only assume a small part of the ecological environmental impact, the ministries and commissions assume a small part of the other and the local people and their generations bear the most of the rest. It is the posterity that bears the consequence of the resources waste rather than governments at all levels and enterprises.

v. Attract foreign capital. Foreign countries have a great demand for rare earth. Some enterprises of developed countries have started to massively invest in factories in rare earth resources area of China for the past few years, because they are not subjected to quota restriction when they purchase rare earth minerals in China. These foreign enterprises can evade China's export quota restriction by purchasing large number of local rare earth materials and metal and transport to abroad for further processing or reserving after the simple process. And the local government completes achievement of attracting foreign investment.

Results of the Game

i. The central government requires cooperation from local governments for rare earth management, but local governments would make many ill-matched strategy choices considering the local interests. The central government management is a multiple management and divided policies from various sources which eventually led to poor coordination and unity of policies and measures, that make local governments use flaws to get local interests without much conflict with central policy.

ii. The situation of stealing and excessive digging rare earth has not been effectively controlled. The situation of covert smuggling export is rather serious. The waste of the resource and a large reduction of the reserve don't get controlled. The industrial consolidation of rare earth still has many difficulties.

iii. Now local government has small responsibility for the negative impact of the rare resource development on sustainable development and ecological environment. That is F_2 (Q_2) and G_2 (Q_2) that local governments undertake are much smaller than the actual negative influence. Since the damaged area is too big and governance cost is pretty high, the government inputs to recover the ecological environment have little effect. For example, preliminary estimation indicates that the cost of restorative treatment of rare earth development is as high as 38 billion Yuan in Ganzhou. However, rare earth industry profit of Jiangxi province is only 6.4 billion Yuan in 2011. In the point of comprehensive benefits, it would be not worth the candle.

ANALYSIS OF REASONS FOR EXISTING PROBLEMS

i. The distribution of rare earth resource in a region is relatively decentralized and the mountain forests regions that peasants possess in some places have rare earth. These reasons cause that its easy mining, low access threshold of fund and technology, which results in difficult control to the local rare earth development and production either state-owned key enterprises and enterprises. Without the cooperation of local governments, the state-owned key enterprises is hard to form a long-term effective control to rare earth.

ii. The number of inconsistencies in interests of all related parties are the direct cause of the problems. If a rare earth controlling policy is produced, all interested parties are hard to come to an agreement. Then it causes a problem that central government wants to control but the policy always drags on, which eventually leads to the problem more and more difficult to be solved. People and officials, state-owned key enterprises and local governments, even state-owned capital and private capital have interest conflicts. It would be still an undemanding control scheme, even if central government forces to formulate control scheme regardless of local governments and enterprise's benefit.

iii. Local governments and the central government fail to make an agreement on interests. The current management policies and measures are more focus on national strategic interests and ignore the local interests to an extent without relevant compensation measures, which interferes and rejects production restrictions and rare earth industrial consolidation.

iv. Evaluation criterion on local governments is main determinant to the direction of local governments efforts. Currently, local economic growth, fiscal revenue, employment rate, income level, export sales and investment attraction are important to the country. And rare earth resource areas are always dependent on rare earth resource development. Therefore, local government would like to keep its tight grip on rare earth resource development for their work performance. And they don't examine the local ecological environment and sustainable development of the resource. As a result, local governments do not have full power to control ecological environmental protection and resource conservation problems.

COUNTERMEASURES

i. The central government should adjust the criteria of assessment of local governments. The accounts of GDP and fiscal revenue should be moderately reduced. The governments should pay more attention to the quality, not quantity for export and investment evaluation and add environmental protection and sustainable development of mineral resources to the criteria of assessment.

Also they should properly consider whether to set up the comparative diversified way for the assessment of employment rate and resident income level.

ii. The central government should consider both national interests and local interests when they introduce policies in order to make proportion of the nation and local interests more accordance and less conflict so that local governments can actively cooperate to carry out the relevant management measures of the central government.

iii. The central government should surrender part of the profits. And the government should give appropriate compensation for damaged resource areas caused by the rare earth resource management, properly settle the damaged local enterprises, solve the livelihood compensation fund shortage problem around mining areas so that local governments can actively and conscientiously supervise and control the rare earth resource exploitation and local enterprises can close and reorganize smoothly.

iv. The government should improve the income distribution system of rare earth resource tax. And it is better to incline the resource tax distribution to local governments. Meanwhile the government should boost the resource tax to local transfer payment to guarantee local governments' financial income and make the resource ownership smooth transition.

v. Governments should encourage all kinds of rare earth enterprises to go out, carry out overseas rare earth resource exploring strategy and take part in the international rare earth industry competition. As Chinese rare earth companies have advanced mining and separating technology and a great progress in capital strength, if governments take the Go Out policy, not only it would relieve the excessive decrease of domestic rare earth reserves and the intense competition among rare earth enterprises, but also can make a safeguard on the superiority of rare earth resource products as well as the rare earth applicability industry development in the future.

REFERENCES

Wu Z.J.(2012) . The reflection and discussion of rare earth industrial policy in China. *Contemporary Finance & Economics*, 90-100.

Lai Dan, & Wu Y.D.(2012) . The problems and reform ideas of rare earth resource tax in China. *China Finance*, 46-48.

Wu Y.D, & Mao K.Z. (2011). " Rare earth problem" and rare earth industry policy orientation. *Reform of Economic System*, 170-173.