

# The Game Analysis Between Governments in Provinces Border Region Economic Development

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## ABSTRACT

Province border regions play a mediation role in communication between areas during process of regional integration and their economic development is directly subject to cooperation between province governments. Based on the hypothesis of governmental “economic man”, this study derived that inspection enthusiasm of superior government in longitudinal game process depended on awards and implementing impetus of local government depended on earnings from implementation and that local government was inclined to long term game and negative external industries were increased in horizontal game through construction of “bargaining” model in policy formulation of local government and central government, “principal-agent” model in policy implementation and external investment game model of peer governments based on their own benefits. Taking Langfang City of Hebei Province as a demonstration, the proposal of regional integration facilitated province win-win; however, execution time shall be shortened in policy formulation to improve information accessibility. Supervision, inspection and punishment shall be reinforced to realize optimum cooperation between governments of border regions.

**Keywords:** province border region, government, game

## 1. INTRODUCTION

During economic development of China, urban agglomeration has become a new organizational entity of regional development which breaks through regional border between provinces and cities etc and emphasizes on integrated development of big region, becoming the leading space power of global economic agglomeration and development. Different regions play different roles in regional development. Urban agglomeration is not only an economic fusion but also a cultural fusion. During its development, province border regions play an important role as border regions of different areas which are of great significance for coordination of regional development and promotion of regional communication.

However, in process of market-oriented reform, the implementation of reform strategy of decentralization and interest and new financial system of “serving meals to different diners from different pots” stimulates enthusiasm of regional economic development of local governments, but local governments are granted with relatively independent dominant position of economic interest. As the highest local government, province government is the supreme expression of local interest, deciding regional economic policies and leading

orientation of economic development. During development of urban agglomeration, generally local interest and overall interest are not adverse; however, phenomenon of interest conflict is inevitable in short term because of different starting points for interest. Therefore, local governments are confronted with the problem of balancing local short-term interest and long-term gain, regional individual income and overall benefits. This kind of game is more prominent in provinces border in urban agglomeration.

This thesis analyzed the major factors affecting cooperation between regional governments through the game behavior between provincial governments, between central government and provincial government during economic development of provinces border regions, laying foundation for cooperation between regions and providing premise for healthy development of provinces border regions.

## 2. LITERATURE REVIEW

Provincial border region receives relatively less radiation and leading role of -provincial development center due to its marginal location and economic development in the region is lagging behind so it becomes

the shortcoming of provincial economy, which draws general attention of scholars. Domestic research on provincial border region appeared in 1993 at the earliest and achievements come out successively afterwards. To summarize these achievements, studies are mainly made from the following perspectives. Studies such as *A Study on the Economic Development of Provincial Border Regions in China* expound general problems in economic development of provincial border region from the theoretical level. Studies such as *Border-Regional Economics* provide the development of provincial border regions in China with reference through introduction of foreign situations. Currently, studies laying particular emphasis on specific provincial border region taking the majority. Analysis of *Basic Characteristics of Economic Activities of Provincial Border Regions in China* [1], *On Provincial "Administrative Region Border Economy" and Overall Regional Coordinated Development*, and *Analysis of Government Behaviors in Economic Development of Provincial Border Regions – Taking Distribution Characteristics of Poverty-stricken Counties and Self-improvement Counties as Examples* are typical studies. In recent years, some scholars utilize statistical approach to make empirical studies on specific provincial border regions, analyze their development status and materialize these studies, for instance, *Analysis of Economic Development Status of Provincial Border Regions – Taking Border Region of Heibei, Shangdong and Henan Province as an Example*. However, few of all these studies analyze problems in the development of provincial border regions from the perspective of government. The author thinks that administrative power can't be neglected in the process of economic development in China.

Before reform and opening, central government is highly authoritarian while local governments only implement central policies passively; however, independent economic sovereignty makes local governments possess the position as independent interest subjects after reform and opening. In consideration of local benefit differentiation and officers' government performance examination, local governments will make full use of policy instruments to play the game with all powers in the development process.

There are more literatures studying government game at both time level and spatial level. Government games in different phases of urban development are studies at time level [2]. Government games at spatial level are divided into two kinds as longitudinal game and transverse game. Longitudinal game refers to the game between local government and central government [3]; Transverse game refers to the game among local governments and it is also named horizontal competition mainly manifesting the fight for circulating production factors. Regional economic development is advanced through rational allocation. It is the primary form of government game. Most of these studies are analysis of game theory and

game model building. Only a few of studies are based on analysis of specific regions. Case Study of *Governments Failure in Coordination Games and its Function Transformation in the Economic Development of Yangze Delta*, *A Game Analysis of the Policy Choice for Local Governments in Regional Economic Cooperation—Taking Shandong Peninsula Urban Agglomerations as an Example* (Shan Chunhong, 2010), *Analysis on the Local Government's Game Competition of the Cross-regional Economic Co-operation—A Case of YUE-GUI Co-operation* [4], and *The Research on Trend of Our Local Government's Game Intention under the Integration of Regional Economies—Taking the Competition of Port Cluster in Yangze Delta as an Example* [5] are typical studies that deserve praise for excellence due to specific analysis of specific issues. But game analyses are not thorough enough. Efficient economic game models are not built for most of analyses. Even if models are built, they are relatively too global or too extensive. Besides, games among government are limited to cities at present; however, studies on provincial border region as the sensitive zone playing the role of a bridge under general background of urban agglomeration and regional integration are very insufficient. This region happens to be the one in which conflicts of interest and game behaviors among governments are most outstanding and competitive [6].

Thus, the author thinks that government game not only includes longitudinal game between local government and superior government but also includes transverse game among government in the cooperation of regional economic integration. Cooperation among local governments with independence of financial rights is the key to regional cooperation and also major route for realizing regional coordination. Provincial border region is important zone for provincial communication. Game behaviors among governments is analyzed to solve problems related with fundamental interests of two parties of the game so as to realize true regional cooperation and provide the development of provincial border region with favorable conditions from the perspective of "economic man".

### **3. CONSTRUCTION OF GOVERNMENT GAME MODEL IN PROVINCIAL BORDER REGION**

Political bodies playing the game in economic activities in provincial border region mainly include central government, provincial government, municipal government and county-level government. In specific game, game behavior can be divided into two major categories. One category is the game between inferior and superior governments. We mainly study the game between central government and provincial government. The other category is interest fight among bordering governments. We mainly analyze game behaviors among provincial governments.

### 3.1 Analysis of the Game between Local Government and Central Government

At administrative level, local government is obedient to central government but has different interest starting point from central government when specific interest is involved and interest fight may occur. "Bargaining" phenomenon appears in the aspects of emphasis, scope and time quantum of specific program in the process of formulating specific program and policy is a game process of balancing interests between local government and central government. However, after program is formulated, if local government has not fully realized the appeal, it will take favorable chance in the process of program delivery to make up interests that have not be fully realized in the process of program formulation by inadequate implementation of the program. Even if local government's appeal can be fully realized, the possibility of inadequate program implementation still exists in front of vested interest because full information symmetry will not be achieved by central government in implementation. Game relationship between local government and central government mainly reflects on "bargaining" game behavior in policy setting and "entrust-agency" game behavior in program delivery.

#### 3.1.1 "Bargaining" game in policy setting

Before making analysis, we shall define a serial of conditions.

(1) At first, local government and central government are personalized organizations and their objectives are to pursue maximum self-interest which conforms to the concept of "economic man" in economics. At the same time, both governments will take part in the game with different game strategies so they can be regarded as players in the game. We can use L (lower level) and S (superior level) to represent them in the analysis.

(2) Moreover, we shall notice that central government won't make institutional innovation initiatively in general case due to "viscosity" of system and high cost of formulating new system so the game will be raised by L (lower level) earlier;

(3) Both parties consume certain time, energy and materials so there will be certain game cost for sure. For the convenience of study, we use P to represent discounted cost in each phase of the game. P is larger than 0 but smaller than 1.

(4) For the convenience of calculation, we will use Q to represent the profit of new system in the game. L and S will fight for the project Q.

(5) At last, S will utilize political compelling force at hand to end the game. Thus, this is a finite game. We take 4 rounds between two parties into calculation at this time.

On basis of the above conditions, we can construct a

game extended figure. See figure 1 below.

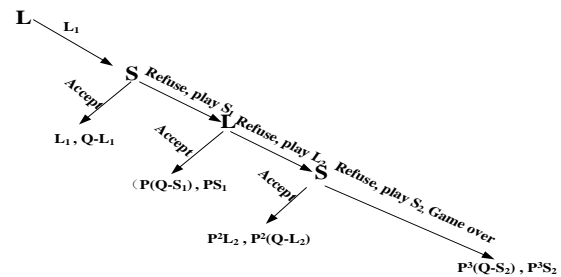


Figure 1 Extended Figure of "Bargaining" Game.

As shown in the figure above, there are 4 phases of this game. At first, lower level (L) put forwards a suggestion to enter the game in first phase. L obtains the benefit of  $L_1$  and superior level (S) obtains the benefit of  $Q-L_1$ . If S accepts the benefit, the game is over. But if S refuses to accept the benefit, the game in the second phase begins. At this time, S will propose to change its earnings to  $S_1$ . If L accepts the proposal, actual benefit of S is  $PS_1$  and that of L is  $P(Q-S_1)$  because additional discount comes into existence in this phase. But the game in third phase begins if L refuses to accept the proposal. At this time, L proposes to change its earnings to  $L_2$ . Actual benefit of L is  $P_2L_2$  and that of S is  $P_2(Q-L_2)$ . If S agrees on the proposal, the game is over but if S disagrees on the proposal, the game in fourth phase begins. At this time, S proposes to change its earnings to  $S_2$  and forces L to agree on the proposal. The game is over in this moment. Eventually, actual benefit of S  $P_3S_2$  and that of L is  $P_3(Q-S_2)$ .

Backward induction is adopted in calculation. Let us suppose that L predicts that S will end the game by its actual benefit in fourth phase. In this way, L can set earnings of S to  $P_3S_2$  in third phase in advance.  $L_2 = Q-S_2$  is obtained through the formula  $P_2(Q-L_2) = P_3S_2$  put forwarded by L for earnings of S. At this time, earnings of L  $P_2L_2 = P_2(Q-S_2)$  is larger than  $P_3(Q-S_2)$ , the earnings in fourth phase.

In a similar way, S can agree on the scheme if S can predict that L will put forward that the earnings  $P_2L_2 = P_2(Q-S_2)$  in second phase. In this way, as long as S makes  $P(Q-S_1)$  equal to  $P_2(Q-S_2)$  for earnings of L in second phase, L can agree on the result of game. At this time,  $S_1 = Q - P(Q-S_2)$  while  $PQ - P_2L_2$  as earnings of S is also larger than  $P_2(Q-L_2)$  in third phase.

In a similar way, if L can predict that S will be satisfied to obtain  $PS_1$  (earnings put forwarded by S in second phase) in first phase, L only need to give S the earnings in first phase and then S will agree on the result of game.  $L_1 = Q - PQ + P_2Q - P_2S_2$  (earnings of L at this time) is obtained through  $Q-L_1 = PS_1 = P[Q - P(Q-S_2)]$ . Because P is larger than 0 but smaller than 1,  $Q-PQ$  is larger than 0. In other words,  $Q-PQ + P_2Q - P_2S_2 > P_2Q - P_2S_2$  (earnings of L in fourth phase); at this time, earnings of L and S are both larger than those in fourth phase.

Finally,  $Q-PQ+P_2Q-P_2S_2$  and  $PQ-P_2Q+P_2S$  as balance of interests between S and L are obtained.

Now that  $S_2$  is known, even if  $S_2$  is Q, in other words, central government does not give any benefit to local government; local government has to accept the scheme under political pressure. Respective earnings of L and S are  $Q-PQ$  and  $PQ$  respectively at this time. When P is equal to 0.5, mutual interest is equal. When P is larger than 0.5, earnings of S are larger than earnings of L. When P is smaller than 0.5, earnings of L are larger than earnings of S.

Conclusion 1: when discount rate in each round of game is larger than 0.5, benefit of superior level will be larger than that of lower level and the superior level will be inclined to short-term game. On the contrary, when discount rate is smaller than 0.5, the lower level is easier to get benefit in the game so local government will be inclined to long-term game. Local government hopes to get more benefit in the game by constant delay.

**3.1.2. "Entrust-agency" game in policy implementation**

A series of conditions are also assumed.

(1) Superior level or central government S and lower level or local government L as two game agents still exist. In reality, central government is not able to fully grasp policy implementation condition of local government. The game is unfolded in the state of incomplete information.

(2) Suppose that there are only two absolute options for lower local government. One option is to strictly execute the decision of superior level. Suppose that earnings of local government are  $r_1$  and implementation cost is  $c$  at this time. Earnings of central government are  $R$  because of strict implementation of the decision. The other option goes to non-implementation of superior decision. At this time, lower government will still obtain some vested earnings  $r_2$  and there is no cost at this time. In the meantime, superior central government does not obtain any earning from this policy so the value is equal to 0.

(3) There are two absolute options for superior central government as well. One option is to inspect the executive condition of local government. Suppose that inspection cost of central government is  $C$  at this time. The other option is to get rid of inspection and there will be no cost.

**Table 1** Game Matrix of Local and Central Governments in Policy Implementation (I)

L S	Inspection	No inspection
	Implementation	$r_1-c$ $R_1-C$

No implementation	$r_2$ $-C$	$r_2$ $0$
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According to the hypothesis, we can get chart 1, game matrix. We can analyze from the game matrix that no matter local government executes or not, the state with no inspection is better than the state with inspection for superior central government; however, lower local government L only cares  $r_1-c$  (actual earning in implementation) and  $r_2$  (vested earnings brought by rejecting policy implementation no matter superior government makes inspection or not. If actual earnings are larger than vested earnings without implementation, policy will be implemented no matter superior level makes inspection or not. If actual earnings are smaller than vested earnings without implementation, policy implementation won't be made no matter superior level makes inspection or not.

Conclusion 2: Under the conditions of incomplete information and non-punishment, superior central government won't make inspection in terms of interest and that whether local government execute superior decision or not depends on that whether actual earnings by implementing the policy is higher than vested earnings without implementation.

If we add another condition, in other words, if superior central government will punish P if it finds that lower local government has not made policy implementation in inspection process and the penalty goes to superior central government, new game matrix in chart 2 will be obtained.

**Table 2.** Game Matrix of Local and Central Government in Policy Implementation (II)

L S	Inspection	No inspection
	Implementation	$r_1-c$ $R_1-C$
No implementation	$r_2-P$ $-C+P$	$r_2$ $0$

After this condition is added, central government will not make inspection under the premise of implementation made by local government. Under the condition of non-implementation made by local government, inspection will be made if penalty is higher than inspection cost and it will not be made if penalty is lower than inspection cost according to the relationship of penalty and inspection cost. Lower government will compare  $r_1-c$  with  $r_2-P$  (the balance between vested earnings without implementation and inspected penalty) and decide to make implementation or not when central government is making inspection. Similarly, lower local government will compare  $r_1-c$  (actual earnings with implementation) and  $r_2$  (vested earnings without any implementation) and

decide to make implementation or not if central government does not make inspection.

Conclusion 3: Material reward can be given to verification department under the condition of incomplete information to improve the enthusiasm in verification and improve the feasibility of policy so as to make actual benefit through carrying out a resolution by local government greater than possible benefit for non-implementation to realize positive, conscientious and initiative implementation of local government.

**3.2 Analysis of the game among local governments**

As previously mentioned, provincial border region has relatively low radiating capacity and spillover effect within the scope of this province due to its marginal location, which may create benefit to the bordering province. Thus, when making investment into this region, provincial government shall not only consider cost benefit but also the externality of investment project. In other words, it shall be considered that whether investment into positive exterior project or negative exterior project is more profitable.

Let us suppose that there is a provincial border region between A and B province and two types of industries, M and N can be developed in the provincial border region. Among these two industries, M is positive exterior industry that the investment of one party will create earnings for the other party and earnings ratio of the other party is  $\gamma$ . N is negative exterior industry that the investment of one party will harm earnings of the other party and impairment ratio is  $\zeta$ . Total investment of two provinces is represented by I.

Inspired by studies, we still use Cobb-Douglas function to calculate earnings of A and B.

$$R_A = (M_A + \gamma M_B)^\delta (N_A - \zeta N_B)^\beta \tag{1}$$

$$R_B = (M_B + \gamma M_A)^\delta (N_B - \zeta N_A)^\beta \tag{2}$$

At the same time,  $M + N \leq I$

The following circumstances shall be satisfied when Lagrange formula is utilized to realize maximum benefit.

$$M_A = M_B = \frac{\delta - \delta \zeta}{\beta + \beta \gamma + \delta - \delta \zeta} I \tag{3}$$

$$N_A = N_B = \frac{\beta + \beta \gamma}{\beta + \beta \gamma + \delta - \delta \zeta} I \tag{4}$$

Substitute (3) and (4) into (1) and (2) to obtain earnings of A and B:

$$R_A = \left[ \frac{(\delta - \delta \zeta)(1 + \gamma)}{\beta + \beta \gamma + \delta - \delta \zeta} \right]^\delta \left[ \frac{(\beta + \beta \gamma)(1 - \zeta)}{\beta + \beta \gamma + \delta - \delta \zeta} \right]^\beta = R_B \tag{5}$$

If A and B are regarded as a whole, to realize maximum overall benefit and distinguish from the above result, investments of A and B at this time are represented by MA', NA', MB' and NB while earnings are represented

by RA' and RB'.

$$\text{MaxR} = (M_A + \gamma M_B)^\delta (N_A - \zeta N_B)^\beta + (M_B + \gamma M_A)^\delta (N_B - \zeta N_A)^\beta \tag{6}$$

$$\text{Simultaneously, } M_A + N_A = M_B + N_B \leq I \tag{7}$$

Satisfaction can be re-obtained by using the above method:

$$M_A' = M_B' = \frac{\delta}{\beta + \delta} I \tag{8}$$

$$N_A' = N_B' = \frac{\beta}{\beta + \delta} I \tag{9}$$

Substitute (8) and (9) into (1) and (2) to obtain earnings of A and B at the moment:

$$R_A' = \left[ \frac{\delta}{\beta + \delta} (1 + \gamma) I \right]^\delta \left[ \frac{\beta}{\beta + \delta} (1 - \zeta) I \right]^\beta = R_B' \tag{10}$$

The following formulas can be deduced through comparing (8), (9) and (3), (4).

$$M_A (= M_B) < M_A' (= M_B')$$

$$N_A (= N_B) > N_A' (= N_B')$$

The following formula can be deduced through comparing (10) and (5).

$$R_A (= R_B) < R_A' (= R_B')$$

It is easy to see from the above calculations that due to interest motive, positive exterior investment in disperse policy decision is less than that in centralized policy decision and negative exterior investment is more than that in centralized policy decision but total income is less than that in centralized policy decision.

Conclusion 4: Negative exterior industries but not positive exterior industries are increased during the game among local government. Thus, provincial border region is in need of unified regulation and control of superior government to optimize industries. Benefit of each party will be improved after optimization of industries to realize true win-win result.

**4. CONCLUSION**

Special location of provincial border region can not only become the lagging region of provincial development as marginal area of the province, but also get access to development opportunities in regional development by virtue of the convenient location as provincial border region, which totally depends on cooperative consciousness among governments. Only favorable cooperation is realized among provincial governments can provincial border regions be able to realize good development. Otherwise, its special location makes it become the marginal area of development in all sides and fall into the gulf of lagging development due to

the obstruction of administrative division and consideration of provincial governments' own interest.

At the same time, cooperation between governments at two sides will further optimize the industry and promote the development of economy in two places to benefit both sides.

However, the following condition shall be satisfied to realize cooperation among governments. At first, accessibility of information shall be improved in policy setting. Realistic feasibility of policy and actual earning shall be improved but local cost shall be reduced. The chance of obtaining earning without implementation shall be reduced for local government. In the second place, inspection on the implementing condition of local government shall be enhanced in the process of policy implementation and severe punishment shall be made for non-execution or inadequate execution. Moreover, the key is to guarantee that cooperation could promote balance and improvement of interests for all parties, which is the premise for realizing real cooperation and start point as well as impetus for collaboration of all parties. Under the condition of mutual benefit, all parties will make active promotion and perform the agreement even though the superior unit does not make inspection.

#### **ACKNOWLEDGMENTS**

This study was sponsored by "Green Channel" Program of Beijing (grant no. Z161100001116016)

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