지역개발연구 제36권 제1호, 2004년 6월, pp.275-306

Increasing Returns, Development Strategy and Regional Economic Segmentation

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This paper has explored the causes of duplicative industries and interregional economic segmentation with increasing returns. In a transitional economy, the better-developed region has comparative advantage in high-tech industries and higher speed of technological progress, and consequently a higher position and a larger share in interregional bargaining on the distribution of the benefits of regional specialization. If the less-developed region does not specialize, it will lose the benefits of regional specialization, but it might gain a higher bargaining position in the future and even catch up the rich region. The higher are the technological level and the speed of technological progress in the better-developed region, the higher is its bargaining power, and the more beneficial is it for the less-developed region to raise its bargaining position by developing "strategic" industries. Though under certain conditions it's self-beneficial for the less-developed region to behave strategically, it's socially inefficient because of loss in total production and allocative efficiency. We also find that fiscal transfer by the central government could induce the less-developed region to specialize, which means that fiscal transfer have both the functions of improving regional income equality and the efficiency of resource allocation.

Key Words: Increasing Returns, Interregional Specialization, Market Segmentation, Fiscal Transfer

JEL Classification: C78, H77, R11, R58

Ⅰ. Introduction

Interregional duplicative industries, market segmentation and local protectionism

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Comments from the participants at the 3rd Young Economists Forum and seminar at CCES, Fudan University, and Financial support from Fudan social science funds are greatly acknowledged.

are in essence phenomena without interregional specialization. Why have these phenomena been persistent in China since the start of the marketization reform? Duplicative industries and the segmentation of regional economy are against the rule that different regions should specialize according to comparative advantage. When we see these phenomena, it would be helpless to attribute it to the local governments' irrational behaviors. If duplicative industries and market segmentation just result from irrational choice, we can hardly understand why they persistently exist during the marketization reform? This paper argues that it's because the marketization reform has changed the distribution of benefits from interregional specialization that the less-developed region's share of the benefits of specialization is reduced. Thus, it might be beneficial for the local governments to independently develop some high-tech industries even without comparative advantages in order to improve their bargaining position (the threat point) to share more in the benefits of future specialization. However, this kind of local governments' rational behavior just results in that each area develop some high-tech industries, leading to duplicative industries time and again. In past duplicative industries were mainly in household electrical appliances and automobile industries, and now in the so-called “third-round duplicative industries” the provinces compete in setting up development zones, especially for photoelectric industries and the biotechnological and medicine industries, but this just embeds potential trouble of next round of regional economic segmentation.[1)]

The independent tendency in developing the local economy will certainly causes the market segmentation or disintegration. Is it a matter of fact? The heated debate on the market integration in China began with Young's paper (2000). He observed that in the last 20 years, the interregional convergence tendency has existed in the composition of GDP, output structure of manufacturing industries

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1) For instance, on March 12th 2002, XinHua Daily Telegraph reported the news of “Zhejiang Valley of Photoelectric Industries” in Fuyang, Zhejiang. And on March 15th, only three days later, the same newspaper reported the plan of “China Valley of Photoelectric Industries” in Changchun, Jilin. As reported by Wenhui Daily on June 20th, 2003, problems of duplicative industries occur in various kinds of high-tech industries. Wei (2001) provided some detailed description of duplicative industries.

and marginal output of capital of significant products. He argued that China's decentralization has caused the serious market segmentation controlled by local governmental officials. However, Naughton (1999) proposed two doubts to this point: Firstly, there is no theoretical yardstick to evaluate structural changes for the moment. Structural change in all Chinese provinces maybe has been driven primarily by ongoing rapid industrialization. Secondly, changes in production structure in china during the reform sometimes reflect the improvement in the inappropriate patterns of regional specialization inherited from the planned economy. Naughton's study showed that inter-provincial trade was growing more rapidly by comparing the inter-provincial trade data in 1992 and 1987. It was also revealed that trade was dominated by inter-industry trade in manufactures (final goods), which is consistent with national integration in the sense of a unified, competitive market. Xinpeng Xu (2002) is against the “trade volume” method adopted by Naughton because: (1) An increase in trade flow among the areas results very probably from increasing returns to scale. In this case, the inter- gional trade barrier is probably not weakened; (2) Integration of the goods market is only one of significant respects. It is necessary to study the labor market and the capital market altogether. He stands for using the business cycle model to examine China's inter-provincial market integration. Using an errorcomponents model, he decomposed the real growth of the industries of each province into macro effect of the whole country, the industry-specific productivity change and the provincial effects. The empirical analysis of the data from 1991 to 1998 indicates that, in the short-term, though provincial effect may explain 35% of the fluctuation of the real inter-provincial outputs. However, in the long run, some industry-specific effects may become the main cause for output fluctuation. This result means that though China's regional market integration is still insuf- ficient, it is on the path of being integrated. The empirical research of Batisse (2002) supports that relatively strong inter-provincial effect exists in the short- term. She also discovered that in China's industries, Jacobs's externality is generally positive. That is to say, diversification is more in favor of the local industries' development; however, the specialization development pattern (Marshall's externality effect) has negative effects on the local industry growth. If this is indeed the case, then it is not odd for local governments to choose duplicative industries and local pro-ction. But the problem is: What is the cause of diversification? Is it efficient for the resource allocation of the whole society? Batisse's research could not give the answer.

In contrast, there are still some researches finding the disintegration trends and regional segmentation in China. Poncet (2001; 2002) employed the data in 1997 further to analyze the evolution of domestic trade barrier in China. Drawing support from the new economic geography theory, She calculated "border effects" in domestic markets. The result indicates that during the period from 1987 to 1997, the inter-provincial border effect in China rose upward. Autarky trend is believed to be the source of domestic market segmentation in China (especially in inland provinces). In addition, the provinces prefer to participate in the international rather than domestic markets.[2] This also strengthens the decreasing tendency of inter-provincial trade intensity. In short, the domestic market of China was in danger of disintegration. She even found that the market integration of Chinese provinces has been poorer than that of the European Union. Zhen and Li (2003) analyzed the technological efficiency of China in aspects of the provincial internal technological efficiency, the inter-industry allocative efficiency and inter-provincial technological efficiency. They discovered that the internal technological efficiency has been improved somewhat since the reform, while the inter-industry allocative efficiency and inter-provincial technological efficiency have deteriorated on the other hand. This research has also provided the evidences for the negative effects of regional segmentation. Bai *et al.* (2002) has studied local protectionism's effect on China's regional specialization. With Ohlin's factor endowments theory, Krugman's increasing returns to scale theory and Marshall's externality theory, they tested relevant hypotheses using the panel data of 29 provinces and 32 industries. Their result indicates that local protectionism obviously exists.[3] Mean-

2) Similarly, Berkowitz and DeJong (2001a) investigated the economy transition of Russia, they found negative correlation between the expansion of international trade and integration of domestic market. And in another paper, they figured, unreasonable decentralization is the main cause of market segmentation (Berkowitz and DeJong, 2001b).

while, though there are sufficient evidences to show harm of local protectionism, in the long run, yet with temporary reverse, regional specialization has made quite great progress in recent years. In other words, the power of market economy has gradually exceeded the effect of local protection and becomes leading factor of regional development. When we consider further that infrastructure construction has also greatly reduced costs of interregional trade, regional market integration will become irreversible. But now the local protectionism policy has been proved to be one of elements leading to China's market segmentation, so we need to study the causes of local protectionism.

A direct interpretation of local protectionism is that the local government wants to maintain fiscal revenue and protect local labor force from unemployment, but this cannot explain the original causes of local protectionism. There are two reasons at point. First, this interpretation is merely applicable to explain why the government protects the firms that are creating fiscal revenue and employment. If they could not sustainably develop, costs of such protection will become larger and larger, thereby the local government would not protect them persistently.[4] Second, in reality, local protectionism and duplicative industries are not necessarily seen as protection for those existing firms, but often for the growing industries, which might need lots of investment from the government in their initial stage and couldn't generate fiscal revenue or even employment for the region. Therefore,

3) They define objectives of local protectionism as helping industries with high marginal tax of profits, and sectors with relatively more state-owned employment. This is still debatable. Furthermore, in their empirical study, besides factor endowment theory, the assumption of increasing returns of regional specialization theory and externality theory are both supported.

4) For example, on July 24th 2001, CCTV reported a case in Shucheng county of Anhui province. In order to protect local fiscal revenue and stability, the local government set up a special office to guarantee sales of local products. The office set sales requirements for each township, especially for local products of wine, beer and cement. To protect local cement, the local government had forbidden cement from other regions from entering the local market, though the local cement production was very costly. And the governments also required the local teachers who got paid from the local fiscal revenue to by 3 bottles of local wine. Fortunately, at the end of the of the report, it said that the authorities had closed that special office.

we need further explanation of why the government always strategically invests in the "promising" industries.

Another direct interpretation is that the local government takes protectionist measures for the sake of political achievements. Nevertheless, the problem is why the protectionism may bring forth political achievements. Empirical studies have shown that local economic growth will suffer from deviating from local comparative advantage (Lin and Liu, 2003). Then, why are local governments still so interested in taking supporting policy to certain industries? If there is no benefit of protectionism, it cannot become persistent phenomenon, especially under democratic political system, in which protectionist policy without any benefit will surely meet with opposition from local residents. Thus, behind local protectionism and regional economic segmentation, there must exist some deeper reasons.

The third interpretation is based on a global viewpoint. Since China is involved in the global economy deeper and deeper, if all the regions in China have the same or similar comparative advantages, duplicative industrial structure in every region seems reasonable. Yet, what needs to be paid attention to is, though there is some relationship between duplicative industries and regional segmentation, they are not the same thing. Although the globalization can explain duplicative industries (Poncet, 2001, 2002), it can not explain why local government will take the protectionist policies. Moreover, it seems very hard to believe that in such a country like China with a vast territory and tremendous divergences in respects of technology, resources, developing level and so on, comparative advantages are the same or similar in different areas in the global respect. Even in the whole world, though regions in China may have the same comparative advantages in labor-intensive industries such as household appliances, we can hardly believe that they all possess the same comparative advantage to produce motor vehicle and the photoelectric products.

This paper explores the causes of duplicative industries and regional economic segmentation with increasing returns. We argue that fiscal decentralization and the development strategy of local governments are the reasons leading to duplicative industries and local protectionism since the start of the reform. During the transition, the allocation of benefits of specialization has turned from the completely equal distribution under the planned economy to a bargaining mechanism in a transitional economy. As the better-developed region has comparative advantage in high-tech industries and higher speed of technological progress, it has consequently a higher position in interregional bargaining and a larger share of the benefits of regional specialization. If the less-developed region does not specialize, it will lose the benefits of regional specialization, but it might also gain a higher bargaining position in the future and even catch up the better-developed regions. The higher are the technological level of better-developed region and its speed of technological progress, the higher is its bargaining power, and the more beneficial is it for the less-developed region to raise its bargaining position by developing "strategic" industries. Though under certain conditions it's self-beneficial for the less-developed region to behave strategically, it's socially inefficient because of loss in total production and efficiency of resource allocation. Since the local development strategy may deteriorate the efficiency of specialization of the whole society, can we do something to rectify this misallocation of resource? In China, the proportion of local government financial expenditures is rising. In other words, the local government is more and more dependent on internal fiscal expenditure, and less dependent on fiscal transfer by the central government. Relatively decrease in central government finance and the increase in local public finance may provide economic incentive for the local government to interfere with local economy and take protectionist policies. We have verified that, since the less-developed regions do not specialize only for a larger share of specialization benefits in the future, the fiscal transfer by the central government could induce the less-developed regions to specialize and to abandon the development strategy inconsistent with their comparative advantage.

This paper is structured as follows: The second section is the main part, where we will employ a two-period model to study local governments' decision on specialization. By that model, we need to consider the effect of increasing returns to scale on governments' decision during the industrial development in order to reveal the low efficiency of regional specialization under local governments' strategic decision. In section three, we discuss how fiscal transfer by the central government can improve the efficiency of regional specialization. The basic idea is that, since the local government doesn't specialize just for a larger share of specialization benefits in the future, then, the fiscal transfer by the central government can act as a commitment to transfer more specialization benefits to less-developed regions to induce them to specialize. The last section concludes and discusses the implications for federalism theory and international trade theory.

Ⅱ. Increasing Returns, Development Strategy and Duplicative Industries: An Intertemporal Decision Model of Specialization

In this section, we consider the local government's intertemporal decision of specialization. Because of increasing returns in the production process, we have to resort to a dynamic game framework to compare the welfare in different states of specialization. To simplify the analysis, we study a three-period game. In the 0th period, the key parameters in the model are decided. In this paper, key parameters are the relative speed of technological progress (Φ) and the initial technological level of high-tech industries (A) of the better-developed region. In the 1st and the 2nd periods of the game, the two players may choose to specialize or not. (See the timing of the game in Figure 1.) They will surely specialize in the 2nd period, because it's just a one-period static decision in the 2nd period. Therefore, whether the players choose to specialize or not depends on their comparison between utility levels of different choices. As non-specialization in the 2nd period can not be a rational choice, in the following analysis, we will compare their utility levels when participators choose to specialize in the 1st period or not, but both specialize in the 2nd period subsequently.

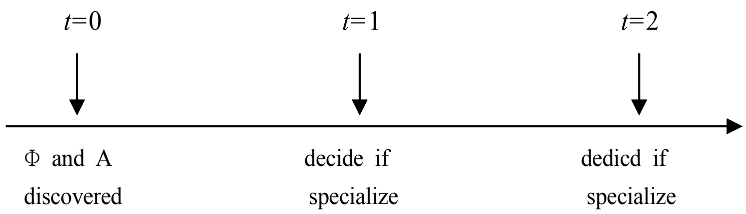

Figure 1. Timing of the game of regional specialization

In the following analysis, we assume there are two regions. The less-developed region has comparative advantage in the production with lower technology, while the better-developed one has comparative advantage in the production with high technology. In what follows, we denote the variables of the better-developed region with superscript "*". For the convenience to solve the model, we assume that the spot utilities of two regions can be written as $U=C^l \cdot C^h$,[5] where C^i (i=l, h) denotes consumption of products with lower technology, C^h consumption of products with higher technology. We generalize the total labor force in each region as 2.

1. An autarky economy

We consider the intertemporal decision of one region in the 1st and the 2nd period. The corresponding variables are denoted respectively with subscripts 1 and 2. The programming for each region to maximize its intertemporal utility (U) is:

$$\underset{L_1,L_2}{Max} \quad U=C_1^l \cdot C_1^h + C_2^l \cdot C_2^h$$

where, the control variables are the labor force allocated in high-tech industries in the two periods denoted as L_1 and L_2, respectively. With total labor force assumed to be 2, $(2\text{-}L_i)$ (i=1,2) is the labor force allocated in the low-tech production. The constraints of this programming are the production functions of the two products in two periods. For the sake of simplicity, production functions are assumed to be linear with labor force as the only input, where the labor can be generalized as any kind of input. We denote the relevant variables of the low-tech (high-tech) products by lower-case (upper-case) letters, then the 4 production functions of the two products in two periods can be written as:

$$y_1 = a_1(2-L_1)$$

$$Y_1 = A_1 L_1$$

$$y_2 = a_2(2-L_2) = a_1(2-L_2)$$

5) This utility function is a simplified version of Cobb-Douglas type.

$$Y_2 = A_2 L_2 = 2\phi L_1 A_1 L_2$$

where, we denote Y (or y) as yield which are totally transferred to consumption, A (or a) as technical level, and L_i (i=1,2) as labor input in the high-tech industries. In the equations above, we actually assume there is no technological progress in production of low-tech product, thus the technological levels in two periods are the same (a_2=a_1), while there exists human capital accumulation and increasing returns in production of high-tech product, and the corresponding form of technological progress is:

$$A_2 = 2\phi L_1 A_1$$

In other words, the technological level in the 2^{nd} period is linear and positively correlated with the quantity of labor force in the 1^{st} period. Φ is an exogenous parameter denoting the speed of technological progress, determined by exogenous factors such as economic institution, the education level and so on. From the four production functions above and the optimal programming, we get the solution of the model as:

$$L_1 = 1 + \Phi \quad \text{and} \quad L_2 = 1$$

We may see that the faster is the technological progress is, the more labor force would be put into high-tech industries in the 1^{st} period, for this could better obtain the technological progress in the high-tech industries, along with more output in the future. This may be summarized as proposition 1:

Proposition 1. In the dynamic decision, as there exits technological progress from increasing returns in one industry, then, in this industry, the faster is its technological progress, the more is its labor input. The initial technogical level is irrelevant to labor allocation.

When allocation of labor force in both periods have been determined, we may further figure out a region's intertemporal gross utility in autarky condition:

$$U = a_1(2-1-\phi)\cdot A_1(1+\phi) + a_1 \cdot 2\phi(1+\phi)\cdot A_1 = a_1 A_1 (1+\phi)^2$$

In order to simplify the analysis, we assume that in the less-developed region the initial technological level in both industries and the speed of technological progress are all 1, and $a^*_1=1$, $A^*_1=A$, $\Phi^*=\Phi$ for the better-developed region without loss of generality, then utilities of the local and better-developed region in completely autarky condition (no specialization) are respectively:

$$U_0=4$$

$$U^*_0=A(1+\Phi)^2$$

2. Specialization according to static comparative advantage

As there exits static comparative advantages in the two regions, it's not hard to calculate their yields under the condition of specialization according to their static comparative advantages, at the same time we may denote α_i and β_i (i=1,2) as shares of the low and the high-tech product in the 1st and the 2nd period, respectively, of the less-developed region. (See Table 1.) Then, we study two mechanisms to share the two products. First, we study a scheme that the central planner maximizes the welfare of the whole society. Another scheme is that the two regions share the products by a Nash bargaining solution in a transitional economy.

Table 1. Outputs and shares under complete specialization

		1st period		2nd period	
		Low-tech	High-tech	Low-tech	High-tech
Outputs	Less-developed	2	0	2	0
	Better-developed	0	$2A$	0	$2\Phi\cdot 2\cdot A\cdot 2=8\Phi A$
Share	Less-developed	α_1	β_1	α_2	β_2
	Better-developed	$1-\alpha_1$	$1-\beta_1$	$1-\alpha_2$	$1-\beta_2$

1) Allocation in the planned economy

Here, neither do we consider any distortion in production caused by asymmetric information or incentive problem in the planned economy, nor do we study the possible rationing schemes under disequilibrium in planned economy. We assume that the central planner maximizes a social welfare function, $V=U \cdot U^*$, where U and U^* denote intertemporal gross utility of the less-developed and better-developed region, respectively. This function implies that the central planner is concerned with regional equality, and that the utility levels of the two regions cannot be completely substituted.

$$\underset{\alpha_1,\beta_1,\alpha_2,\beta_2,}{Max} \quad V=U \cdot U^* = [2\alpha_1 \cdot \beta_1 \cdot A + 2\alpha_2 \cdot \beta_2 \cdot 8\Phi A] \cdot [2(1-\alpha_1) \cdot 2(1-\beta_1) \cdot A + 2(1-\alpha_2) \cdot (1-\beta_2) \cdot 8\Phi A]$$

According to the first-order condition we can get:

$$\alpha_1 = \beta_1 = \alpha_2 = \beta_2 = \frac{1}{2}$$

The above result may be summarized as:

Proposition 2. In a planned economy, the products are equally distributed.

Accordingly, simple calculating results in the utility levels of the two regions:

$$U = U^* = A + 4\Phi A$$

The above result is in line with China's history in the planned economy. At that time, the output level of the better-developed regions in eastern China such as Shanghai was much higher than that of inland regions, yet, they also accounted for a large part in central government's fiscal revenue. Therefore, the living standard in Shanghai was not so high as its development level.

2) Bargaining solution in the transitional economy

Anther mechanism is Nash bargaining solution by which we model the allocation of products between regions in a transitional economy. In this solution, the threat points of the two regions are the utilities that they get in their autarky condition.[6] Then this programming may be written as:

6) Here, we define their threat points as the utilities of autarky, when no cooperative results could be gained in bargaining. Usually, Nash bargaining model defines the threat point

$$\underset{\alpha_1,\beta_1,\alpha_2,\beta_2,}{Max} \quad H = [U - U_0]\cdot[U^* - U_0^*] = [2\alpha_1 \cdot 2\beta_1 \cdot A + 2\alpha_2 \cdot \beta_2 \cdot 8\Phi A]$$
$$[2(1-\alpha_1)\cdot 2(1-\beta_1)\cdot A + 2(1-\alpha_2)\cdot(1-\beta_2)\cdot 8\Phi A - A(1+\Phi)^{2}]$$

According to the first-order condition, the proportions of the two products that the two regions get in two periods are the same, that is:

$$\alpha_1 = \beta_1 = \alpha_2 = \beta_2 = s$$

Substitute it into the first-order condition, and we get:

$$(1-2s)(4+16\phi)A - \frac{A(1+\phi)^2}{(1-s)} + \frac{4}{s} = 0$$

It's obvious that allocation proportion is determined by two key parameters in the model, initial technological level (A) and the speed of technological progress (Φ) in the high-tech industry in the better-developed region. It's obvious that when Φ $=A=1$ the two parties have no difference in technological level and speed of technological progress, so they have the same threat points and consequently $s=\frac{1}{2}$. Thus the two parties share equally the products. What we are interested in

is how do regions share products when $A>1$ and $\Phi>1$, which means the better-developed region has comparative advantage in the high-tech industries, and faster speed of technological progress. In order to obtain this comparative static solution, we assume:

$$\psi = (1-2s)(4+16\phi)A - \frac{A(1+\phi)^2}{(1-s)} + \frac{4}{s}$$

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in the bargaining process, not related to external market. It could be verified that Nash bargaining model is consistent with strategic bargaining model that describes the bargaining process more concretely, where the initial utilities equal the threat points in Nash bargaining model. Certainly, some researches regard the threat point as a result from external market. A brief discussion concerning the definition of the threat point can be found in Cahuc *et al.* (1996) and Lu (2003). Our model excludes the situation that regions join international trade because of the definition of threat point. Besides, within a range of costs of international trade, if no interregional trade, both regions just produce under autarky, so that the domestic market in our study is of bilateral monopoly type.

By this, we get:

$$\frac{\partial \psi}{\partial s} = -(8+32\phi)A - \frac{A(1+\phi)^2}{(1-s)^2} - \frac{4}{s^2} < 0$$

$$\frac{\partial \psi}{\partial A} = (1-2s)(4+16\phi) - \frac{(1+\phi)^2}{(1-s)}$$

$$\frac{\partial \psi}{\partial \phi} = (1-2s)16A - \frac{2A(1+\phi)}{(1-s)}$$

With the implicit function theorem, we can easily find out:

;

$$\left.\frac{ds}{dA}\right|_{\phi=A=1;s=\frac{1}{2}} < 0 \qquad \left.\frac{ds}{d\phi}\right|_{\phi=A=1;s=\frac{1}{2}} < 0$$

That is to say, within the neighborhood of equal allocation solution, the higher are the initial technological level and the speed of technological progress in high-tech industries in the better-developed region, the less does the less-developed region gain in the bargaining solution. In order to know changes of share of products that the less-developed region gains in the bargaining solution with respect to the initial technological level and the speed of technological progress in high-tech industries in the better-developed region, we use Matlab to numerically simulate the bargaining solution. The result shows that the share of products gained by the less-developed region in the bargaining solution is negatively correlated with the initial technological level and the speed of technological progress in high-tech industries in the better-developed region. (See Figure 2 where the horizontal axis is the speed of technological progress in high-tech industries in the better-developed region and the vertical axis is the share that the less-developed region gets.) This yields Proposition 3.

Proposition 3. Under bargaining solution, the product allocation is no more equal. The region with initial comparative advantage in high-tech industries could obtain larger share of products, and its share of products is positively correlated with its initial technological level and speed of technological progress in high-tech industries.

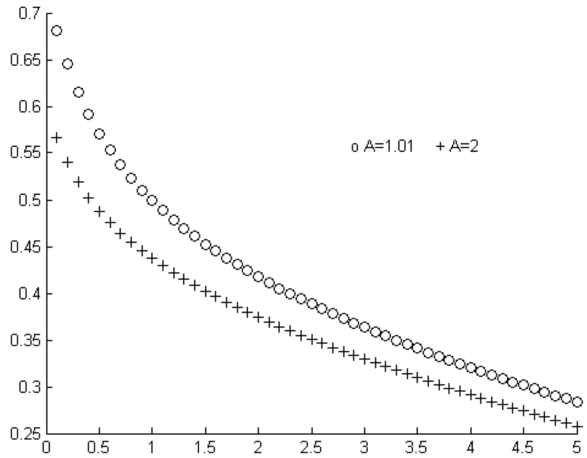


Figure 2. The distribution of products in the bargaining solution

Based on propositions 2 and 3, we may obtain the following inference:

Inference 1. The transition from a planned economy to a market economy may lead to interregional inequality.

Lots of researches show that, in China's marketization reform, interregional income disparity tends to enlarge. Inference 1 might be an interpretation to this phenomenon, that is, the marketization reform changes the equal distribution mechanism under the planned economy system, thus leading to regional inequality.[7]

3. Non-specialization in the 1^{st} period

If the regions do not specialize in the 1^{st} period, an alternative choice is autarky in the 1^{st} period and specialization in the 2^{nd} period. Since the high-tech industries are characterized by increasing returns, if the less-developed region develops independently in the 1^{st} period, it will obtain more benefits in the 2^{nd} period for

7) There are a number of literatures about the source and tendencies of china regional income disparity. Some of them hold similar argument that the transfer payment of central government was biased to better-developed regions, thus, not helpful to narrow the interregional income disparity (Raiser, 1998; Ma and Yu, 2003).

two reasons: (1) The less-developed region could take advantage of non-specialization in the first period to make technological progress in the high-tech industry, so that in the 2^{nd} period, with a higher threat point under autarky in the bargaining to divide the benefits of specialization, the less-developed region could share more benefits from specialization. (2) Also because of increasing returns in high-tech industries, after the independent development in the 1^{st} period, it is even possible to reverse the comparative advantage, and this actually resembles to the concept of dynamic comparative advantage in the theory of international trade (Redding, 1999). However, the above two positive effects are at the expense of the benefits of regional specialization in the 1^{st} period. To decide if specialize or not, the local governments need to compare the local utilities when specializing or not specializing in the 1^{st} period, but specializing in the second period.

If both regions are independent in the 1^{st} period, the two industries may equally have 1 unit labor force input, and they may get utilities of 1 or A, respectively. (See table 2.) And if they continue autarky in the 2^{nd} period, the same input may yield the utilities of 2 and 2ΦA, respectively (see table 3), which are their threat points of Nash bargaining in the 2^{nd} period.

When autarky is chosen in the 1^{st} period, it is theoretically possible that comparative advantage reverses in the 2^{nd} period, in case that the exogenous speed of technological progress of the less-developed region is adequately fast. Accordingly,

Table 2. Outputs and utilities under autarky in the 1st period

	Output		Utility
	Low-tech	High-tech	
Less-developed	1	1	1
Better-developed	1	A	A

Table 3: Outputs and utilities under autarky in the 2nd period

	Output		Utility
	Low-tech	High-tech	
Less-developed	1	2	2
Better-developed	1	$2\Phi A$	$2\Phi A$

when we discuss the specialization state in the 2^{nd} period, it is necessary to discuss whether the comparative advantage is maintained or reversed.

1) The comparative advantage is maintained in the 2nd period ($2\Phi A>2$)

Since the specialization decision in the 2^{nd} period is static, both parties will surely specialize according to their comparative advantage in the 2^{nd} period. The outputs under complete specialization and the shares the two regions gain are given in table 4.

Table 4. Outputs and shares when comparative advantage is maintained in the 2nd period

		Low-tech	High-tech
Outputs	Less-developed	2	0
	Better-developed	0	$4\Phi A$
Share	Less-developed	α	β
	Better-developed	1-α	1-β

The shares of outputs would be determined by the Nash bargaining solution as follows, where the threat points of both players are the utilities obtained under autarkic in the 2^{nd} period.

$$\underset{\alpha,\beta}{Max} \quad H=[U-U_0]\cdot[U^*-U_0^*]=[2\alpha\cdot\beta\cdot 4\phi A-2]\cdot[2(1-\alpha)\cdot(1-\beta)\cdot 4\phi A-2\phi A]$$

The first order conditions yield:

$$\alpha=\beta=s$$

Insert this into the first order condition, then we get:

$$(4-8s)\phi A-\frac{\phi A}{(1-s)}+\frac{1}{s}=0$$

It is easy to observe that, when $\Phi=A=1$, there are no comparative advantages between both parties, and $s=\frac{1}{2}$. But we need to know the products are shared in the case with comparative advantages. Let

$$\psi=(4-8s)\phi A-\frac{\phi A}{(1-s)}+\frac{1}{s},$$ then we get:

$$\frac{\partial\psi}{\partial s} = -8\phi A - \frac{\phi A}{(1-s)^2} - \frac{1}{s^2} < 0$$

$$\frac{\partial\psi}{\partial A} = (4-8s)\phi - \frac{\phi}{(1-s)}$$

$$\frac{\partial\psi}{\partial \phi} = (4-8s)A - \frac{A}{(1-s)}$$

By implicit function theorem, we get:

$$\left.\frac{ds}{dA}\right|_{\phi=A=1;s=\frac{1}{2}} < 0\ ;\ \left.\frac{ds}{d\phi}\right|_{\phi=A=1;s=\frac{1}{2}} < 0$$

That is to say, within the neighborhood of equal distribution, the higher are the initial technological level and the speed of technological progress, the less is gained by the less-developed region under the bargaining solution.

2) The comparative advantage is reversed in the 2nd period ($2\Phi A<2$)

Analogously, when comparative advantage is reversed, Table 5 lists the outputs and the shares that the regions get under complete specialization in the 2nd period:

Table 5. Outputs and shares when comparative advantage is reversed in the 2nd period

		Low-tech	High-tech
Outputs	Less-developed	0	4
	Better-developed	2	0
Share	Less-developed	α	β
	Better-developed	1-α	1-β

The share of outputs result from the Nash bargaining solution as follows:

$$\underset{\alpha,\beta}{Max}\quad H= [U-U_0]\cdot[U^*-U_0^*] = [2\alpha\cdot 4\beta - 2]\cdot[2(1-\alpha)\cdot 4(1-\beta) - 2\phi A]$$

Still from the first order conditions, we get:

$$\alpha = \beta = s$$

Thus, the first order condition can be rewritten as:

$$(4-8s)-\frac{\phi A}{(1-s)}+\frac{1}{s}=0$$

Similar analysis shows that, when, Φ=A=1 there are no comparative advantages between both regions, and $s=\frac{1}{2}$. In order to study the influence of the initial technological level and the speed of technological progress of the better-developed region on output distribution, let $\psi=(4-8s)+\frac{1-\phi A}{(1-s)}$. Then:

$$\frac{\partial\psi}{\partial s}=-8-\frac{\phi A}{(1-s)^2}-\frac{1}{s^2}<0$$

$$\frac{\partial\psi}{\partial A}=-\frac{\phi}{(1-s)}<0$$

$$\frac{\partial\psi}{\partial\phi}=-\frac{A}{(1-s)}<0$$

Obviously:

$$\frac{ds}{dA}<0 \quad \frac{ds}{d\phi}<0$$

Again, within the neighborhood of equal allocation, the higher are the initial technological level and the speed of technological progress, the less does the less-developed region gain in the bargaining solution.

4. The numerical simulation of utilities in different specialization states

In the model stated above, whether the less-developed region chooses to specialize or not depends on the utility level of two choices. We need to compare regional utilities in various states of specialization in the model that depends on the solution of shares of specialization benefits, s. Without explicit solutions of s, we resort to numerical simulation to compare utilities in various states of specialization.

In the process of numerical simulation, we set certain values for the two key exogenous variables, A and Φ. Then we use Matlab to calculate utilities in various states of specialization of two regions. We subtract the total utilities under complete specialization from that of autarky in the 1st period. The positive result means non-specialization is better; otherwise specialization is preferred. First, we fix A to see how utilities change with Φ. Then we change the value of A, and investigate how the curve of utility differences moves. Through this numerical simulation displayed in Figure 3, we accomplish comparative static analysis of model.

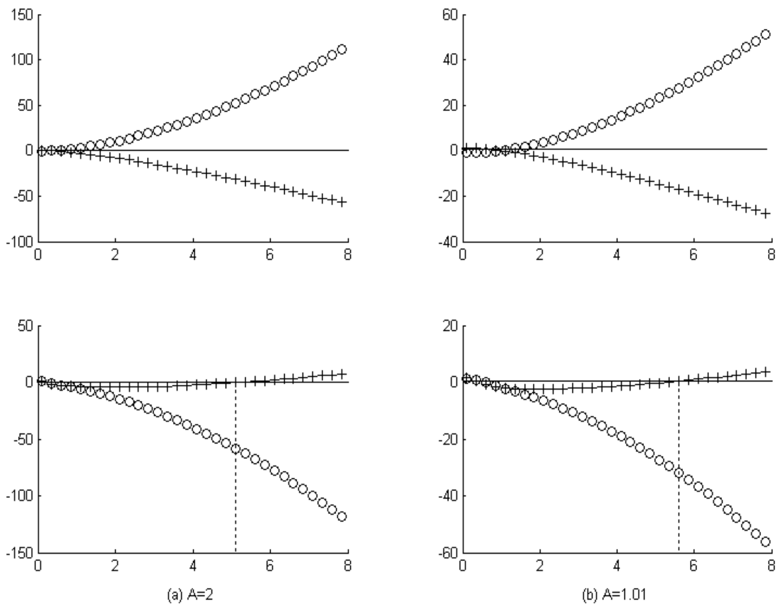
From Figure 3, the upper two charts simulate the utility difference between the solutions in market bargaining and in planned economy, which is the total utility in market bargaining minus the utility in the planned equal distribution. In the figure, the vertical axis denotes the utility, and the horizontal axis denotes Φ, the speed of technological progress of the better-developed region. We could draw the same conclusion from the figure as Inference 1. That is to say, during the transition from planned allocation to market bargaining, the region with comparative advantage in high-tech industries achieves higher utilities while the less-developed region suffers the loss of utilities. Moreover, we would conclude Inference 2 by changing the value of parameters Φ and A:

Inference 2. The higher is the interregional gap of the initial technological level and the faster is the speed of technological progress in the better- developed region, the more does the less-developed region lose during the transition from equal allocation under a planned system to the market bargaining solution.

The lower two charts simulate the utility differences between non-specialization and complete specialization in the solution of market bargaining that is equal to the sum of utilities of non-specialization in the 1^{st} period and specialization in the 2^{nd} period minus that of specialization in both periods, depicted on the vertical axis. The horizontal axis still represents Φ, the speed of technological progress in the better-developed region. We find that the curve of the utility difference of the less-developed region that is represented by “+” is of U-shape, whose turning point is where the comparative advantage is reversed in the 2^{nd} period, i.e., $2\Phi A=2$. Firstly, let us look at the right part of the curve where the comparative advantage is maintained. We find that there is always utility loss in the better-developed region if no specialization in the 1^{st} period. Given the value of A, the utility loss of the better-developed region increases with Φ. And for the less-developed region, given the value of A, the utility difference rises with Φ from negative to positive, which means that with the value of Φ high enough, the sum of utilities under autarky in the 1^{st} period might exceed that under specialization in the 1^{st} period. Why would this happen? Given the value of A, a higher Φ strengthens the comparative advantages of the better-developed region in high-tech industries, and raises its bargaining threat point in the 2^{nd} period, thereby makes it win more products. Hence, if the less-developed region does not specialize in the 1^{st} period, it will lose the benefits of regional specialization on one hand, but on the other hand it might also gain technological progress in high-tech industries and a higher threat point in the 2^{nd} period. Meanwhile, without specialization, the better-developed region has to produce the low-tech products as well, thus losing technological progress in the high-tech industry and its threat point utility in the 2^{nd} period. What deserves notice is that this effect is different from the dynamic comparative advantage. Even without reverse of comparative advantage, the less-developed region still has incentives not to specialize in the 1^{st} period under some conditions so as to share more benefits of specialization in the 2^{nd} period. By changing the value of A, we would observe the effect of A on regions' choice. The figure of numerical simulation shows, with a higher value of A, the critical value of Φ where non-specialization utility exceeds the utility of specialization is lower (see where the dashed line locates). Though it might be rational for the less-developed region to choose non-specialization, the whole society will absolutely lose because what the better-developed region loses exceeds what the less-developed region wins. So, non-specialization is not socially optimal. This provides an explanation to the phenomenon that the low efficiency of regional specialization is hard to be improved. From the above analysis of numerical simulation, we can conclude:

Proposition 4. To gain the technological progress in the high-tech industry, the less-developed region may have incentives not to specialize in the 1st period to raise its threat point in the bargaining in the 2nd point. The higher are the initial technological level and the speed of technological progress in the better-

developed region, the more could the less-developed region gain by temporarily not specializing. Under certain conditions, it's rational for the less-developed region not to specialize, but this is not socially optimal.



o better-developed region + less-developed region

Figure 3. Utility comparison in different states of specialization and output allocation

The other question we are concerned about is whether there exists the effect of reverse of comparative advantage under local development strategy? In the lower two charts, the comparative advantage is reversed when A times Φ equals 1. With a lower Φ, the less-developed region will have a stronger comparative advantage in the 2^{nd} period. Finally, the effects of reverse in comparative advantage will also lead the less developed region to choose non-specialization in the 1^{st} period.[8)]

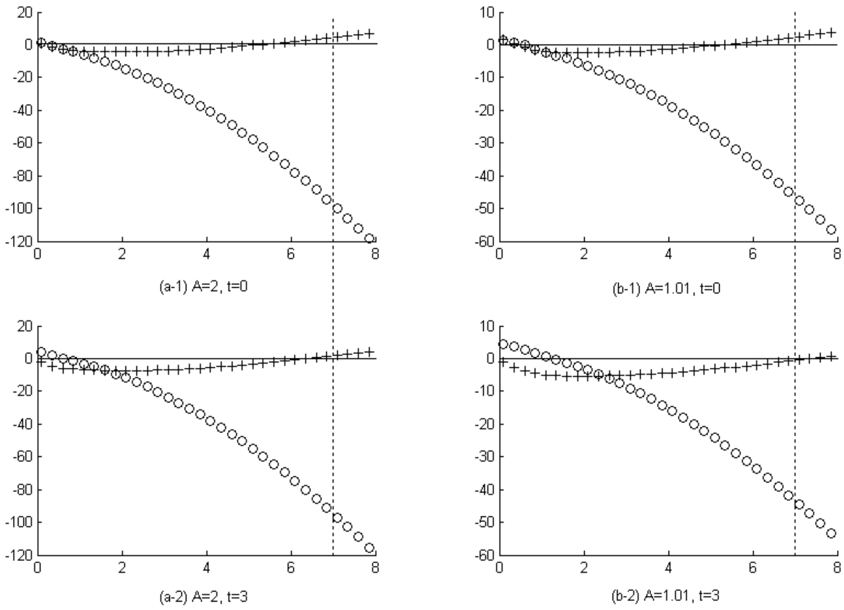
8) This is actually the effect of dynamic comparative advantage. If the speed of technological progress is too low, it will also choose not to specialize in the 1st period. Because ϕ is too low, relative technological retrogress occurs in the high-tech industry in the better-developed region. Though it's beneficial to specialize in the first period, the better-developed region will lose in its threat point in the 2nd period. Of course, this

It deserves attention that, in above model, even if A is an observable parameter as the initial technological level of high-tech industries in the better-developed region in the 1^{st} period, Φ is a parameter describing the future, which is only defined by the players' subjective judgment. In recent years, the behavioral economics finds that people tend to exaggerate positive aspects of themselves but underestimate their negative aspects, thus being over-confident. If over-confidence emerges in local governments' development strategy, they will overrate their abilities and speed of technological progress, which may strengthen the less-developed region's tendency of non-specialization in the 1^{st} period.

Ⅲ. Fiscal Transfer as a Mechanism to Induce Regional Specialization

From the analysis of the model and numerical simulation in the preceding section, it is the bargaining mechanism that shares the benefits of specialization between regions in a transitional economy, thus, the less-developed regions endowed with lower threat points are likely to choose not to specialize in order to raise future threat points for more benefits. Then, could central government induce the less-developed regions to specialize in the 1^{st} period by fiscal transfer that allocates more benefits of specialization to less-developed regions, and to improve the social welfare? With this question, we introduce the fiscal transfer into our former analysis framework, to investigate the effects of this mechanism on specialization. First, let the regions choose if to specialize, and the market bargaining process determines the state of interregional specialization and benefits shares, and then, the central government transfer a part of benefits of specialization from better-developed regions to less-developed ones. We denote this transfer by variable t, and let t=3, then we could compare the utilities of the two regions in different specialization states by Figure 4.

will hardly happen in reality.



o better-developed region + less-developed region

Figure 4. The effects of central fiscal transfer on specialization

In Figure 4, the vertical axis still denotes differences in intertemporal utility which we can get by subtracting utility of specialization in both periods from that of non-specialization in the 1st period but specialization in the 2nd period. And the horizontal axis still represents the speed of technological progress in better-developed regions, Φ. In Figure 4, (a-1) and (b-1) are just copies of the lower two charts of Figure 3, indicating the utility differences when A=2 or A=1.01, respectively, while (a-2) and (b-2) show the utility differences with t=3 when A=2 or A=1.01. By comparing the charts, we find that with the fiscal transfer, given Φ, non-specialization in the 1st period would meet greater loss. In certain interval of Φ, the introduction of fiscal transfer could induce less-developed regions to specialize in the 1st period, when the utility difference becomes from positive to negative. When Φ=7 where the dashed line locates, if A=1.01, t=3 is enough to incentivise the less-developed region to specialize. While A=2, t=3 is not enough. Similarly, given A=1.01, if Φ=6, t=3 is enough for the less-developed region to choose to specialize in the 1^{st} period, but when Φ=8, t=3 is not enough. In other words, the higher are the initial technological level and the speed of technological progress, the more fiscal transfer is needed to induce the less-developed regions to specialize in the 1^{st} period.

Obviously, the introduction of central fiscal transfer that increases the gains of less-developed region from specialization, makes it preferable for the less-developed region to join specialization in the 1^{st} period. For the better-developed region, despite the loss in the share of potential benefits of regional specialization, it still gains for the less-developed region is induced to participate into the interregional specialization as the better-developed region expects. Therefore, central fiscal transfer can not only act as a mechanism of improving interregional equality, but also betters the efficiency of resource allocation in interregional specialization.

With above analysis we can establish:

Proposition 5: If the central government could commit to allocate more benefits of specialization to less-developed regions by fiscal transfer, it is possible to realize regional specialization, and to increase the production and welfare of the whole society. And the higher are the initial technological level and the speed of technological progress in high-tech industry in better-developed regions, the more fiscal transfer is needed to induce less-developed regions to specialize in the 1st period. The fiscal transfer functions as a mechanism both to improve interregional income disparity and allocative efficiency.

According to our analysis, more benefits of interregional specialization by central government should be allocated to less-developed region, the immediate effect of this mechanism is to narrow the regional economic disparity. More importantly, it could induce less-developed region to participate in the countrywide specialization, improving the efficiency of resource allocation. Nowadays, China's transfer payment is distributed to every region without distinction. Nevertheless, a larger share is given to the better-developed regions, so that it hasn't narrowed but enlarged interregional income disparity (Ma and Yu, 2003). Wong and Bhattasali (2003) also reported that, in China, the province with higher per capita GDP also obtains higher per capita fiscal transfer. Therefore, the effect of fiscal transfer equalization is extremely limited. Although China's experimental pattern of fiscal transfer in 1995-1996 had made efforts to equalizing transfer payments, the country still has a long way to go.

Illustrated by the analysis above, during the transition from a planned economy to a market economy, complete fiscal decentralization may lead to local protectionism. On the other hand, moderate reservation of central government's power, and fiscal transfer to less-developed regions would do good to interregional specialization and improve the efficiency of resource allocation. Blanchard and Shleifer (2000) hold the similar point of view. They argued that federalism would run efficiently under some degree of centralization, otherwise there would come local protectionism policies to segment the economy. They explain with this argument why Russia and China have different performances during the reform.

Ⅳ. Conclusion

This paper has explored the causes of regional economic segmentation with increasing returns. In a planned economy, the central government allocated the benefits of regional specialization fairly for interregional equality. Since the start of the reform, the benefits are allocated under the market bargaining. The better-developed region has comparative advantage in high-tech industries and higher speed of technological progress, and consequently a higher position in interregional bargaining and a larger share of the benefits of regional specialization. As for less-developed regions, specialization brings benefits in the first period. If not to specialize, it will lose the benefits of regional specialization, but gains the development of hi-tech industries, raising its bargaining position and sharing more benefits of specialization in the future. Under certain conditions, it might be more advantageous for the less-developed region not to specialize. In addition, the higher are the initial technological level and the speed of technological progress in better-developed region, the more beneficial is it for the less-developed region to raise its bargaining power by developing "strategic" industries. Though under certain conditions it's self-beneficial for the less-developed region to behave strategically, it's socially inefficient because of loss in total production and efficiency of resource allocation. We also verified that since the less-developed region does not specialize only for a larger share of benefits of future specialization, the fiscal transfer by the central government could induce the less-developed region to specialize and to abandon the development strategy apart from comparative advantage.

Based on the analysis in this paper, there're two policy implications. Firstly, the central government should transfer more benefits of interregional specialization to less-developed regions, which could not only narrow interregional income disparity but also induce them to participate in the nationwide specialization system. Secondly, the regional development strategy results from China's investment system that ensures the local governmental investment plan made by the local Planning Commission. Hence, it is urgently suggested that the central government reform the investment mechanism, transform the local productive investment to public finance, and abolish the local Planning Commission that plans the local development strategy. Moreover, it is worthwhile discussing where the transfer of central finance and the local fiscal expenditures go. As a great deal of empirical analysis reveals, the infrastructure investment and development of education are preferable to narrow development gap between regions of China (Demurger, 2001; D'emurger, *et al*., 2002). According to the reasons stated above, not only the central government's fiscal transfer (including the funds for the West Development Strategy) but the local governmental expenditure should go to infrastructure and education, yet not directly be used as productive investment.

For successful transition, moderate centralization is essential, because over-decentralization conduces protectionist policies of local governments and deteriorates the efficiency of regional specialization. This argument has developed the existing theory of decentralization and federalism which have already discerned the benefits of decentralization. Hayek (1945) argued that, because local governments and consumers have better information than the central government about local conditions and preferences, they will make better decisions. Tiebout (1956) said that competition among jurisdictions allows residents to sort themselves and match their preferences with a particular menu of local public goods. Qian and Weingast (1997) proposed the second generation of federalism theory. Similar to the viewpoint that managers might not act as shareholders hope, their argument is that governmental officials might also deviate from the interests of people. However, under an appropriate government structure and with market incentives and punishments, local officials will take risks and make efforts to pursue social interests. Moreover, with the decentralization of government, fiscal competition may work as a constraint and serve as a commitment device to avoid inefficient governmental expenditure (Qian and Roland, 1998). If decentralization only has such benefits, should the central government only act as a protector of the country? Theoretical implication of this paper suggests that complete decentralization might result in interregional competition and non-specialization under strategic behavior and regional protectionist policies.[9] Fortunately, the fiscal transfer by the central government may be taken as a commitment to help less-developed region participate in the specialization. Thus, the moderate degree of centralization may improve efficiency of specialization. This idea is just consistent with Blanchard & Shleifer (2000). Then, is China's fiscal system of proper decentralization or centralization? The ratio of local governments' expenditure to the total expenditure reveals that China has been well decentralized (Jin, Qian, and Weingast, 2001), while the corresponding indices are 34% and 22% for industrialized countries and developing countries, respectively (World Bank, 1996). However, in our opinion, the ratio of local fiscal expenditure to the total finance is not the only index to measure the degree of decentralization. The key issue is the effects of fiscal decentralization. There have been many empirical studies on this topic, but having got somewhat different conclusions (see the review article by Yan and Lu, 2003). According to Zhang and Zou (1998) fiscal decentralization has negative effects on China's economic growth. Though we argue in this paper that fiscal decentralization might lead to regional economic segmentation, we don't

9) Qian and Roland (1998) holds the similar viewpoint.

advocate raising the proportion of central finance. Since the fiscal system reform in 1994, fiscal centralization has changed the behavior of local government from ‘helping hand’ to ‘grabbing hand’, which has checked regional development (Chen *et al*., 2002). Hereby, the so-called “optimal” structure of decentralization involves a series of disciplines for local governments, and more central fiscal transfer to the less-developed regions.

Since regional economic specialization is the foundation of interregional trade, our model might be extended to explain international trade policies, in particular, trade protectionism, trade barrier and strategic trade policies, which is for our future research. Finally, let's put forward some theoretical implications for theories of economic growth. Although specialization is the basic force behind technological progress, how to deepen specialization has not been intensively studied. The fiscal transfer to less-developed regions neither cuts down the transaction costs emphasized by Yang and Borland (1991), nor lowers coordination costs that are at the center of the analysis of Becker and Murphy (1992), but it could deepen specialization. We hope that this idea might help people understand how specialization is determined.

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