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A study on labor mobility and human capital spillover

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Abstract

Purpose – The purpose of this paper, starting from a theoretical framework, is to analyze the spillover effects of human capital brought by labor mobility and their influence on the public education investment.

Design/methodology/approach – Based on the endogenous growth theory, the paper establishes a regional human capital spillover model to examine the spillover effects of human capital coming along with the regional labor mobility and the changes of public education investment decision brought by the spillover effects in China.

Findings – It has been found that the regional mobility of labor has made the developed areas gain the spillover benefits of human capital investment from the underdeveloped areas with their superiority of social and economic environment and restrained the incentives for public education investment in the underdeveloped areas, thus the different areas walk on a different growth path, with the expansion of the difference in the economic and education investment growth.

Originality/value – This paper analyzes the possible influences from the spillover of human capital on the economic growth and educational investment and finds a high possibility for the underdeveloped areas to get into a "low development trap" of education investment. The key to solving the problem is to internalize the externalities by the active public policy, in order to realize equal education, rational investment and balanced development.

Keywords China, Government policy, Education, Labor mobility, Human capital

Paper type Research paper

1. Introduction

In general, the spillover of human capital in economics is displayed as the positive externalities for society when people make their private educational investments. Lucas (1988) pointed out:

> [...] human capital investment has spillover benefits, besides the increase in output comes from an additional unit increase of human capital, it also leads to an improvement of social

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average human capital level simultaneously, which determines the average social efficiency, and the improvement of general social efficiency in turn benefits every firm and individuals.

At present, in China, while the externalities of education has made the family education investment be of spillover effects for the society, the regional mobility of labor also creates new human capital spillover, that is, along with the flow of labor the social benefits from the educational investment have also been brought into other regions. As a consequence, of the relaxation of control of population mobility in China, the east and coastal areas have joined the global division of labor with their comparative advantage of labor cost (to attract foreign direct investment); the manufacturing industries, especially the processing industries for export, have been developed and attracted large amount of production factors, especially labor force, forming a "pull" for labor flow. At the same time, the favorable social economic environment there has also attracted a lot of higher quality talents. Therefore, the labor force, with a variety of human capital levels, has been moved from the under-developed areas to the developed regions, which is the most obvious feature of labor mobility in China.

The reason why, the spillover effects of human capital along with labor mobility have attracted so much attention is that human capital has played a more and more important role in the economic growth in China. Besides, the pioneering contributions by Schultz (1960), Mincer (1974) and Becker (1965), the latest researches about the impact on economic growth from education or human capital are mainly originated in the new growth theory. As a main pioneer of the new growth theory, Lucas (1988) put forward a fundamental idea that the growth is mainly impelled by the accumulation of human capital; therefore, the different growth rates between countries can be attributed to the different speed of human capital accumulation of these countries. Another related idea was brought by Benhabib and Spicgel (1994). They pointed out that the difference in growth rates between countries is not from the difference in the speed of human capital accumulation, raised by Lucas, but the difference in the stock of human capital, which in turn influences the abilities of technology innovation and overtaking of the more developed countries. Human capital is one of the important factors to drive the contemporary economic growth. However, education investment is undoubtedly the primary condition to form human capital. Barro and Lee (1993) found that there is a significant correlation between the education level (measured by the average education year) and the consecutive economic growth by studying the cross-countries' data from 1965 to 1985, and public education investment has a notable influence on economic growth.

What kinds of influence have been brought by the spillover effect of human capital on the regional economic growth? Razin and Yuen (1998) found that with knowledge spillover, labor mobility can produce income equalization between regions; whilst on the contrary, prohibiting labor mobility will lead to differentiation of per capita income. Of the domestic researches on the spillover effect of human capital brought by labor mobility, the main focus has been put on the urban-rural and regional spillovers. The empirical study by Hou and Zhang (2007) showed that the rural human capital investment and its overflow are the important sources of the rural-urban disparity in China. Therefore, rural human capital investment must be increased to reduce the disparity between urban and rural in China. Yuan (2007) found that within the cities the spillover effects of human capital are mainly displayed as spillover within the regions. However, in rural areas, they are largely expressed as overflowing from

countryside to cities. Yao and Zou (2003) believed that labor mobility has a definite effect on reducing regional disparity in China. Labor mobility has been controlled in China, but currently there is a great potential to reduce the regional difference by promoting mobility. However, Sun (2004) and Wang *et al.* (2006) found that the free mobility of labor had made the real gross domestic product (GDP) increase in the eastern regions but decrease in the mid-west part of China, therefore, expanding the difference of economic development between regions.

This paper will start from a theoretical framework to analyze the spillover effects of human capital brought by labor mobility and their influence on public education investment. The generalized method of moments (GMM) will be used to analyze the possible influences from the spillover of human capital on the economic growth and educational investment, in order to find a way to eliminate the unfairness in education and society and to realize a harmonizing development of social economy.

2. Fundamental assumptions

Taking human capital theory as a starting point, we integrate total human capital, labor flow, social economic environment, etc. into a simple two-sector endogenous growth model to discuss the relationship between these factors and regional economic growth and education investment. For this the following assumptions have been made:

- *Assumption 1.* All regions are classified into two main categories: developed regions i and under-developed regions j, of which the most important difference lies in the different composite social economic environment. It is the composite social economic environment that induces the labor flow, which affects the economic growth and education investment through human capital accumulation; therefore, the composite social economic environment (q) plays an important role in this model. q is an exogenous variable – the larger q is, the better the environment will be. It can be explained as the level of economic development, social welfare, public policies and institutions, under different composite social economic environments there will be different proportion of labor to flow across the regions.
- *Assumption 2.* The capital is divided into human capital (H) and physical capital (K), the regional production function is taken as:

$$Y_t = A_t K_t^{\alpha}\left[\left(1 + l(q)\right)H_t\right]^{\beta} = A_t K_t^{\alpha}\left[\left(1 + l(q)\right)Nh_t\right]^{\beta} \quad (1)$$

where, A is the technological progress, which is the function of time t; N is the total local labor put into the production in the area; h_t is the average human capital of the laborers; $l(q)$ is the ratio of the human capital brought by labor mobility to the total human capital in the area[1]. At present, China, for the developed area, $0 < l(q) < 1$, indicating a net inflow of human capital and for the underdeveloped area, $-1 < l(q) < 0$, showing a net outflow of the human capital, here, the situations completely relying on the outflow or the inflow of human capital are excluded. For the time being the "apanage principle" is adopted by almost all the regions in China for the national economic accounting, that is, only the local citizens are considered when accounting the value added per capita, the floating population are excluded. $l(q)$ actually plays a role of adding or reducing the average human capital for the local people, namely the positive or negative spillover, both sides of the equation (1) divided by N, the average output can be obtained:

$$y_t = A_t k_t^{\alpha} \left[(1 + l(q)) h_t \right]^{\beta}. \quad (2)$$

- *Assumption 3.* At the present stage, the economic development of China is mainly characterized as driven by investment. In fact, local government not only assumes the public responsibility but also participates in production directly. Suppose that all the local governments imposing a uniform income tax rate θ, of the tax revenue x is used as the educational investment for each laborer next period, the rest is used as production investment, namely:

$$\theta y_t = x_t + i_t. \quad (3)$$

- *Assumption 4.* Corresponding to the household registration system, China carries out "the principle of the person" in education, that is, the local public educational resources can be used only for local citizens, the nonlocal ones are excluded. The average human capital level of the local labor force in the next period is mainly reliant on the public education investment by the local government in the last period. Suppose η is the marginal output of educational investment, the human capital in the period $t + 1$ will be:

$$h_{t+1} = \eta x_t. \quad (4)$$

- *Assumption 5.* Suppose the production capital completely used out at one time, the savings rate after tax of all the regions is s, the increase in capital is mainly from the current savings of local citizens and firms and the investment from the government, therefore, and the average increase of capital for each local laborer will be:

$$k_{t+1} = \theta y_t - x_t + (1 - \theta) s y_t. \quad (5)$$

This model will be used to analyze the spillover effects of labor mobility and their influence on the public educational investment in China.

3. Theoretical analyses

3.1 Spillover effect of human capital from labor mobility

Suppose the average output level is y_0 or y_t with or without labor flow, for the developed areas the spillover effect of human capital of labor mobility should be equal to the added value on the average output for the local laborers that is actually created by the inflow laborers, in other words:

$$l(q) h_t \frac{\partial y_t^i}{\partial h_t} = l(q) h_t A_t k_t^{\alpha} \beta \left[(1 + l^i(q)) h_t \right]^{\beta - 1} (1 + l^i(q)) = \beta l^i(q) y_t^i > 0. \quad (6)$$

Equation (6) indicates that the spillover effect of human capital brought by the labor inflow will make the added value produced by each local worker larger than that with no labor inflow, namely:

$$y_t^i > y_0^i. \quad (7)$$

For the under-developed areas, equation (6) can be used to illustrate the negative spillover effect of human capital brought about by labor outflow and accounted as the output reduced by the local laborers, for the same reason, $\beta l^j(q) y_t^j < 0$, then:

$$y_t^j < y_0^j. \tag{8}$$

Therefore, we can obtain the following inference.

Inference 1. The labor mobility has made the developed areas obtain a positive spillover effect while the underdeveloped areas suffer a negative spillover effect.

3.2 Influence on the public education investment by the spillover effect

The objective of the public education investment by the government is to maximize the final output next period, in other words:

$$\text{Max } y_{t+1} = A_{t+1}k_{t+1}^{\alpha}\left[\left(1 + l(q)\right)h_{t+1}\right]^{\beta}. \tag{9}$$

It has been constrained by the government budget:

$$\theta y_t = x_t + i_t.$$

Taking derivative of equation (9) with respect to x_t, we get:

$$\frac{\partial y_{t+1}}{\partial x_t} = -\alpha\left[\theta y_t - x_T + (1-\theta)sy_t\right]^{\alpha-1}\left[\left(1 + h(q)\right)(\eta x)\right]^{\beta *}A_t$$

$$+\left[\theta y_t - x_T + (1-\theta)sy_t\right]^{\alpha}\beta\left[\left(1 + h(q)(\eta x)\right)\right]^{\beta-1*}\left(1 + h(q)\right)\eta^* A_t = 0.$$

After transforming we get:

$$\frac{\alpha}{\theta y_t - x_T + (1-\theta)sy_t} = \frac{\beta(1 + h(q))\eta}{(1 + h(q))\eta x_t}.$$

Therefore, the optimal education outlay from the government will be:

$$x^* = \frac{\beta(\theta + s - s\theta)y_t}{\alpha + \beta}.$$

Let $\theta + s - s\theta = \wedge$. Then:

$$x^* = \frac{\beta \wedge y_t}{\alpha + \beta}. \tag{10}$$

It can be noticed from equation (10) that with the fixed savings rate and tax rate, no matter for the developed or the underdeveloped regions the amount of the educational expenditure is not only associated to its output level but also correlated to the local output elasticity of human and physical capital. When output elasticity of human capital is larger than that of physical capital ($\beta > \alpha$), the government will arrange for more from its fiscal budget to develop education, in order to increase human capital accumulation; otherwise ($\beta < \alpha$), the government will spend more from its fiscal budget on production directly, in order to get higher output growth. Thus, the following inference can be obtained:

Inference 2. Under the current accounting system in China, the output elasticity of human capital is an important factor affecting the government education investment; in the regions with low-output elasticity of human capital the government is more likely to invest in physical capital to directly promote the economic growth.

In order to know more about how the spillover effect of human capital affects the public education investment at the equilibrium situation, we take the log of both sides of the equation (10) and get:

$$\ln x_t = \ln \frac{\beta\wedge}{\alpha+\beta} + \ln A_t + \alpha \ln k_t + \beta \ln\left[\left(1 + l(q)\right)h_t\right]. \tag{11}$$

Transforming equation (4) into $h_t = \eta x_{t-1}$ and substituting it into equation (11), we obtain:

$$\ln x_t = \ln \frac{\beta\wedge}{\alpha+\beta} + \ln A_t + \alpha \ln k_t + \beta \ln \eta + \beta \ln(1 + l(q)) + \beta \ln x_{t-1}. \tag{12}$$

When there exists a barrier that prevents labor from flowing across the regions, $l(q) = 0$, there will be no regional spillover of human capital, thus:

$$\ln x_0 = \ln \frac{\beta\wedge}{\alpha+\beta} + \ln A_t + \alpha \ln k_t + \beta \ln \eta + \beta \ln x_{t-1}. \tag{13}$$

Therefore, with no spillover effect of human capital, the educational expenditure from the government depends completely on current output level and the comparison of the output elasticity between human capital and physical capital.

When $0 < l(q) < 1$, equation (12) indicates the function of educational expenditure for the developed area, since $\gamma = \beta \ln(1 + l(q)) > 0$, at this time:

$$x_t > x_o. \tag{14}$$

When $-1 < l(q) < 0$, equation (12) represents the function of educational expenditure for the under developed area, since $\gamma = \beta \ln(1 + l(q)) < 0$, at this time:

$$x_t < x_o. \tag{15}$$

Therefore, we get the third inference.

Inference 3. Because the spillover effect of human capital has been brought by the labor mobility, for those areas having received the positive spillover effect from the labor flow, the government will be more willing to invest in education, but in those areas which received the negative spillover effect, the government will be less willing to spend on education.

From the last term at the right side of equation (12), it can be noted that the public education investment in the current period is also a function of that in the last period. Also, from the previous analysis it also can be found that education investment is an endogenous product of social economic development; different levels of economic development inevitably result in different levels of public education investment. Furthermore, the spillover effect of human capital will cause a different investment desire on education between the developed and the underdeveloped areas. All these factors affect the following education investment. Thus, the difference of economic development between regions could be expanded to include their different investment desires; therefore, a stable path of low-development trap could be formed; that is, as a result of the previous inadequate investment on education a disadvantage for obtaining technology next period has been created and further retards the development. The following is clear.

Inference 4. Education investment has a feature of intergeneration transmission; the spillover effect of human capital has strengthened the differentiation of education investment, in the underdeveloped areas with more labor flowed out; the public education investment could be situated on the path of low-development trap.

4. Econometric model and method

4.1 Model estimation method and sample

In order to estimate, the dynamic effect from the spillover of human capital along with the labor mobility on the public education investment in different areas in China, we extend equation (12) into panel data models as equations (16) and (17), in which we take the mobility of human capital as explanatory variable, the public education investment as dependent variable and μ_{it}, μ_{jt}, as random disturbance terms:

$$\ln x_{it} = \ln \frac{\beta_i \wedge}{\alpha_i + \beta_i} + \ln A_{it} + \alpha_i \ln k_{it} + \beta_i \ln \eta + \beta_i \ln\left(1 + l(q_i)\right) + \underline{\beta_i \ln x_{it-1}} + \mu_{it}, \tag{16}$$

$$\ln x_{jt} = \ln \frac{\beta_j \wedge}{\alpha_j + \beta_j} + \ln A_{jt} + \alpha_j \ln k_{jt} + \beta_j \ln \eta + \beta_j \ln\left(1 + l(q_j)\right) + \underline{\beta_j \ln x_{jt-1}} + \mu_{jt}. \tag{17}$$

It is revealed from the existing literature that the most difficulty in applying dynamic panel data model lies in the estimation technique; using lagged dependent term (underlined term) as explanatory variable could result in correlation between explanatory variable and random disturbance, and there is a cross-section interdependence upon each other, therefore, estimating by using standard random effect or fixed effect will certainly result in inconsistence of parameter estimation, thereby distorting the economic meaning based on the estimation results. Hsiao (1986) systematically studied the dynamic panel model setting and estimation method, taking different starting values within eight different situations. As a result, for the larger and smaller panels, with different starting values, the likelihood functions are different; inaccurately choosing the initial condition will lead to wrong parameter estimation and therefore inconsistency. Furthermore, if there is little information for determining the initial value, the difficulty in using GLS estimation and MLE estimation will be increased. Hsiao pointed out, in particular, that the consistency of MLE, GLS estimators of random dynamic model is determined by the assumption of the starting value and the way of approaching infinity. Comparatively, Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1988) put forward the GMM estimation, in which the consistent estimation can be obtained by the method of instrumental variable. The key of GMM is the moment conditions equation on the basis of instrumental variable. For this, we take first-order difference on equations (16) and (17) and get the following equations:

$$\Delta \ln x_{it} = \Delta \ln A_{it} + \alpha \Delta \ln k_{it} + \beta \Delta \ln\left(1 + l(q_i)\right) + \beta\gamma \Delta \ln x_{it-1} + \Delta\mu_{it}, \tag{18}$$

$$\Delta \ln x_{jt} = \Delta \ln A_{jt} + \alpha \Delta \ln k_{jt} + \beta \Delta \ln\left(1 + l(q_j)\right) + \beta\gamma \Delta \ln x_{jt-1} + \Delta\mu_{it}. \tag{19}$$

The main objectives of taking the first-order difference are to select appropriate instrumental variable and generate corresponding moment conditions equation. Since the explanatory variables $\Delta\log x_{it}$, $\Delta\log x_{jt}$ in the equations (18) and (19) are correlated to the random terms $\Delta\mu_{it}$, $\Delta\mu_{jt}$, respectively, we take x_{it-2}, x_{jt-2} as instrumental variables for x_{it-1}, x_{jt-1} to deal with this correlation and use GMM to carry out the estimation.

4.2 Data and processing method

The panel data, we selected for study are from 29 provinces and cities during the period of 1999-2006 in China. According to the situation of labor mobility, the 29 provinces have been divided into two large regions: labor inflow and labor outflow regions. The former includes Beijing, Tianjin, Shanghai, Shandong, Zhejiang, Fujian, Guangdong, and Liaoning and Jiangsu; the latter includes Anhui, Jiangxi, Henan, Hunan, Hubei, Sichuan, Chongqing, and Shanxi and Guangxi. All the data are from *China Statistical Yearbook*, *Comprehensive Statistical Data and Materials on 55 Years of New China*, *China Population Yearbook*, etc. All the variables in the paper have been adjusted according to the fixed price of 1999, in order to eliminate the price influences:

- *Per capita output* (y). Under the current accounting system of China, the value added created by the flowing labor is reflected by the output increase produced by the registered household population. Therefore, per capita output here is set as per capita GDP based on the household registered population.
- *Capital input* (k). One of the important tasks for analyzing the factors of economic growth is to measure the capital input. Whether, the stock of capital can be estimated accurately or not is related to whether the role of capital input can be correctly reflected in the economic growth or not. Because of the complexity and lack of complete and systematic statistical data, it is very difficult to accurately calculate the capital stock. Since no large-scale capital survey has been carried out before in China, the capital stock of provinces and cities we adopted here is obtained by using the perpetual inventory method based on 1990 as a benchmark.
- *The data of labor mobility*. Here, the mobility is an extended notion, which includes migration with the household registration and without the household registration. The research based on the data of 1 percent population sample survey by the National Bureau of Statistics reported that, of the migrated population crossing provinces in China, more than 90 percent are working age population over 16; the non-working age population under 16 only accounted for 8.8 percent. In other words, the young and middle aged with strong ability dominate the migrating population crossing the provinces. Therefore, we use migrating population here to represent the labor mobility. The data of labor mobility equals the resident population, including out-comers minus the average registered local household population provided by the Household Registration Office of the Ministry of Public Security. All the materials of migrating population are from the *Yearbook of China Population*.
- *Public education expenditure*. The public education budget can be classified as from two sources in China: Central Government and Local Government.

The spillover of human capital studied in this paper is mainly concerned with local government; therefore, the public education expenditure we examined is the education outlays from the local government budget.

5. Empirical study

5.1 Labor mobility

We begin with the study of regional labor mobility, which includes both migration population with household registration, and floating population without household registration. Working age population is the dominant part of the migration and floating population. Table I shows the ratios of net migration population and net

Region	Province	Net migration rate	Net floating rate	Spillover effect
Eastern 1				
	Beijing	1.39	30.79	4,307.06
	Tianjin	0.18	10.87	987.97
	Hebei	−0.83	0.11	−20.29
	Liaoning	0.08	0.21	14.43
	Shanghai	0.7	31.09	5,186.88
	Jiangsu	0.1	13.41	784.87
	Shanxi	−0.11	0.25	3.99
	Inner Mongolia	−0.23	0.29	1.99
	Jilin	−0.11	0.25	4.73
	Heilongjiang	−0.22	0.25	1.17
Middle				
	Anhui	−0.1	−5.67	−99.06
	Jiangxi	0	−14.3	−257.59
	Henan	−0.03	−15.72	−311.96
	Hubei	−0.05	−14.72	−104.04
	Hunan	−0.04	−14.99	−98.23
Eastern 2				
	Zhejiang	0.13	16.72	1,131.30
	Fujian	0	4.71	239.98
	Shandong	0	0.95	42.52
	Guangdong	0.25	27.09	1,873.24
	Guangxi	0	−4.68	−79.69
	Hainan	0.16	1.91	65.12
	Chongqing	0.07	−11.36	−262.11
	Sichuan	−0.24	−14.72	−103.47
	Guizhou	−0.07	−3.1	−32.70
	Yunnan	0.01	0.47	10.58
Western				
	Shanxi	−0.41	−0.83	−23.69
	Gansu	−0.31	−0.11	−6.28
	Qinghai	−0.22	0.38	4.15
	Ningxia	0	0.11	2.79
	Xinjiang	0.37	0.34	24.17

Table I.
Labor mobility in provinces of China

Note: Unit: percent, Yuan
Sources: *China Statistical Yearbook, China Population Yearbook and Comprehensive Statistical Data and Materials on 55 Years of New China*; all the values in the table are the average value of 1996-2006

floating population to the total local population of every province during the period of 1996-2000. The data illustrate that the mobility was characterized by:

- *Flowing from the western to the eastern*. Eastern areas are the main destinations of labor mobility. Except for Hebei nearby Beijing and Guangxi nearby Guangdong, almost all the provinces of eastern areas are the destinations of migration population crossing provinces in China. In 2006, the migration and floating population trans-provinces amounted to nearly 50 million. Of all the migrants into the eastern areas, 18.1 percent are flowing between the provinces within the eastern part of China; 81.9 percent are from the western part of China; that is to say, the main direction of the mobility of the working-aged population is from the mid-west to the east areas in China.
- *Flowing from the underdeveloped large agricultural provinces, with relatively larger population, to the developed large industrial provinces.* Those provinces such as Henan, Sichuan, Hubei, Hunan, Chongqing, etc. with relatively backward industries and larger population are the main outflow areas; while those eastern coastal regions such as the Pearl River, Yangtze River Delta Regions with high-developed manufacturing industries, and Beijing, Shanghai with high-developed service industries, are the main inflow areas. The former, with their comparative advantages of low-labor cost (to absorb foreign investment) participate in the world labor division to develop manufacturing industry, especially the export-oriented processing industry, and attract factors, especially labor, from the region and beyond to concentrate into the area. Meanwhile, the latter, with their composite advantages of geographic and social economy, form a "high land" for the flowing talents. It is illustrated by Table I that, among the migration and floating populations, the amount absorbed by Beijing and Shanghai accounted for more than 30 percent of the local household registered population. Within the latest decade, the population which flowed into the developed areas from Henan, Sichuan, Hubei, Hunan, Chongqing, etc. accounted for about 15 percent of the local population.

5.2 Spillover of human capital

Based on equation (17), labor mobility has been divided into two sections, as the net inflow region and the net outflow region, to form two dynamic panel data sets. Using relative software for econometric analysis we get Table II. Sargan test has been used to verify the validity of the instrumental variables. It is shown by the Sargan p-value in Table II that all the variables used in GMM estimation are valid, therefore, the moment estimator is reliable. Since the β-value from Table II satisfies the t-test, the spillover effect of human capital in different regions can be calculated by equation (6); that is, the value created by the inflowing human capital brought by labor mobility has been calculated as an increase on the average output by the local labor force or the value-added reduced by the outflowing human capital has still been calculated on the average output by the all household registered local population. As the size of labor mobility gradually expands in China, the well-educated labor force such as college graduates and the ordinary laborers with general education, flow in large quantities from the mid-west to the east developed regions for employment or work. These cheap but certain-skilled workers have played An increasingly important role in the economic development of the labor inflow regions. As well as improving the allocation of

resources, the regional mobility of labor has also made the vulnerable regions generate the spillover effects of their human capital. At the same time, as creating social wealth for the local regions, the large amount of flowing labor also provides huge tax revenue, and therefore offers an abundant financial resource for social construction and development. It has been illustrated, in accordance with inference 1, (Table I), that the developed areas gained the spillover benefits from the labor mobility, e.g. Beijing and Shanghai got the value-added of ¥4,307.06 and 5,186.88, respectively, on the per capita GDP calculated according to the household registered population; while Jiangxi and Henan reduced by −¥257.59 and −311.96, respectively, on the per capita GDP. However, the education expenditure of the outflowing labor generally has been paid by the under-developed regions. Therefore, the developed areas have obtained the spillover effect of education investment from under-developed areas.

5.3 Low development trap of public education investment

The spillover effect of human capital from public education directly reduces the incentive for investment in underdeveloped areas. It can be seen from Table II that in both the developed and underdeveloped areas, the output elasticity of human capital is smaller than that of physical capital; it is probably related to the current stage of economic development of China, which is characterized obviously by investment pulling. Almost no local government is taking education investment as the priority choice to pull the economy in the short run. Public choice theory has emphasized the nature of "economic man" as public officer. Under the current appraising system, which overemphasizes GDP in China, for the government officers to invest a large amount of resources in education whose return is not clear in the short run, is not a "rational" choice. However, because of the different industrial structures and the level of economic development in the different regions, the difference of the output elasticity between the human capital and physical capital in the developed area is smaller than that in the underdeveloped area, which certainly will result in less willingness to invest on education in the underdeveloped area than in the developed area. Even worse is that the labor outflowing areas are normally the mid-west economically backward areas, whose financial strength is rather limited. For the governments in the underdeveloped areas, making education investment with the spillover effect of human capital has a clear suspicion of "Making the bridal clothes for other people." From the results of the model estimation it can be noted that for a 1 percent increase in the net emigration rate, the public education investment will be reduced by 0.356 percent with other variable constant. For the government in the labor inflow area it is conducive to have a higher

	Labor inflow region	Labor outflow region
α	0.513	0.565
T-test	(4.773)	(5.846)
β	0.445	0.356
T-test	(2.458)	(8.795)
Constant	0.134	0.127
T-test	(3.167)	(5.779)
Sargan p-value	0.978	0.996

Source: Obtained by the estimation

Table II.
GMM estimation for the public education investment

quality labor force to promote their labor productivity and obtain more productive return and therefore increase tax revenue and consumption. However, according to the rule of "who profits who to pay expenses," it is questioned whether the government in the labor outflowing areas should be willing, or not, to assume this part of the education cost with the government in the labor inflow area. Actually, with no institutional constraint this situation could not appear, thus, spillover effect of human capital is bound to deteriorate further, along with the regional difference of education investment (Figure 1).

The indirect influence from the spillover effect of human capital on public education investment is the decline in the investment ability of the under-developed regions. The spillover effect of human capital has expanded the economic difference between developed and under-developed regions, and the education investment is, in turn, determined by the level of social economic development in the regions. Calculated at the fixed price of 1990, the regional difference of per capita GDP between labor outflow and labor inflow areas has expanded from ¥1,602.50 in 1996 to ¥10,785.24 in 2006. Figure 1 shows that the difference in public education investment presents a trend of expansion; per capita difference in 2006 is about five times that of 1996. Education development is decided by the investment in education, which is determined by the economic development and the economic development in turn is decided by the accumulation of human capital, which is determined by the education development. The estimated result in Table II shows that the investment in education of the last period will exert an important impact on the education investment next period. For the underdeveloped regions with mainly labor outflow the impact will be even larger. Wei and Yang (1997) pointed out that unbalanced regional economic development results in serious unbalanced education investment between regions. This unbalance, in turn, is bound to bring about unequal regional economic development. The study by Yang (2000) indicated that the economic backwardness will lead to an insufficient supply of education, and at the same time the unbalanced development in economy and culture will result in huge regional differences, urban-rural differences, rich and poor differentiation, etc. Azariads and Drazen (1990) verified that there exists a "low development trap" in human capital accumulation and education investment. On the one hand, the current difference in education investment still exists; on the other hand the decline in incentive levels from the government, as the main investment

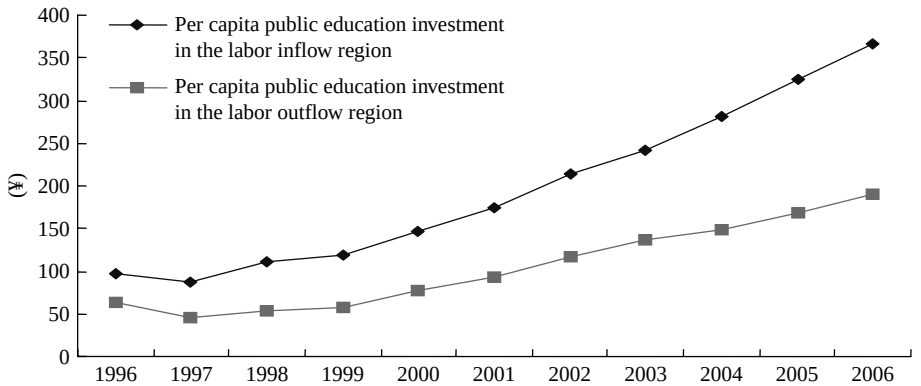

Figure 1.
Regional difference in public education investment

source, further deteriorates the unbalanced education investment. Therefore, "low development trap" in education investment becomes true.

6. Conclusion and suggestion

Labor mobility has generated the spillover effect of human capital; on the one hand affecting the education investment incentive of the government in the underdeveloped areas where the labor is mainly outflowing; on the other hand, reducing the ability of education investment from the government in the outflowing area by influencing economic growth. The current difference in education investment and economic development still exists and continually deteriorates. A vulnerable region risks falling into the "low development trap" in public education investment. In economics the way to eliminate the externalities is internalize. Practically, in China, that is to setup a regional compensation mechanism for vulnerable areas. There are two aspects which could be considered.

First, strengthen the function of transfer payment for education from the central government. The spillover effect of human capital has made education break through the scale of local public goods, and become the nationwide public goods. The labor inflow area enjoys the social benefits of education from the outflow area but needs not pay for it, which is obviously disobeying the rule of "who profits who to pay expenses." From now on, the central budget should consider labor mobility, taking part of the fiscal revenue from the developed area that is using more out-coming laborers to compensate for the education in labor outflow areas, and at the same time setup a special education poverty zone to carry out a special transfer payment. For the time being the regions inhabited by minorities, mountain, pasturing, and the remote areas in the west of China, have been listed as the key areas of "national compulsory education engineering for the poverty areas" and are specially supported by the central budget. However, this range should be extended to those labor-exporting provinces, and a special fund should be set aside by the central government to specially support the education in those areas, in order to solve the problems of lack of incentives for education investment and fundamentally deficient education service in these areas.

Second, improve the composite social economic environment of the underdeveloped areas. It is the difference of social economic development level that attracts the large-scale labor mobility in China. The oversized disparity of development will cause, inevitably, welfare loss for the whole society and affect sustainable development. The government of China should change the current inadequate GDP appraising mechanism and education investment system through institutional reform and innovation and more importantly, increase the composite investment for the underdeveloped areas in order to reduce the regional disparity. At present, in China, besides the policy of "Western Great Opening," it is necessary to increase investment in the middle provinces with huge populations and large-scale labor outflow to realize the objective of equal development of economy and education, and eliminate the social economic root of human capital spillover.

Note

1. Here, we suppose that the average human capital of the new comers is largely the same as that of the local worker, normally the laborers can mobile are with higher human capital among the locals, only those with at least the same human capital as the locals can have the competitive strength.

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Further reading

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