The allocation of resources and the matthew effect of regional development

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Abstract. Since the reform and opening up, our country has executed the regional differentiation development strategy. Our economy has maintained sustained and rapid development. But because of factors, history, natural endowment and policy etc., there is large difference between the areas in the economic and social development. The huge difference, presents the "Matthew effect" of the regional development. The paper takes labor and capital as study object and takes Keynes multiplier as the analysis tool. This paper analyses the reasons in the resources allocation perspective, which lead to Matthew effect in regional economic development.

1. Introduction

After the reform and opening up in 1978, China has implemented the differentiated development policy of "letting some people get rich first, forming a rich belt first, and finally realizing common prosperity." Through decades of development, China's economic, scientific and technological strength has been greatly enhanced, and the living standards of the people have continued to improve. However, it is undeniable that while the differentiated development policy promotes economic development, the income gap and growth difference between regions and between urban and rural areas have widened relatively. In order to narrow the differences between regions, urban and rural areas, and promote balanced economic development, the state has also adopted a series of policies and measures, for example, the implementation of the western development, the revitalization of the northeast old industrial base and the rise of the central region and other strategies to promote the economic and social development of the central and western regions. However, the gap in economic and social development has not been fundamentally improved, especially in rural areas. Certainly, there are many reasons for this result, which have been discussed by many scholars in China. This paper focuses on the analysis of the reasons for the "Matthew effect" in economic development from the perspective of factor allocation.

With regard to the analysis of the "Matthew effect" of resource allocation and economic development, Qiyou discussed the Matthew effect in the knowledge economy[1], and Chewei Zhang analyzed the impact of the change in the rate of return on human capital on the income gap. Based on the sample survey data, the rate of return on education is estimated, and it is considered that in order to narrow the income gap, human capital investment should be invested in the poor groups[2]. Chaoyang explored the unfairness and exclusivity embodied in the Matthew effect from the perspective of social capital[3]. Aiping Yang analyzed the origin of Matthew effect of regional development in China from the angle of system; the author thinks that in order to avoid the emergence of Matthew effect in
regional development and the market failure in economic development, it is necessary to innovate the public management system[4]. Xiao Huang measured the intergenerational income mobility of poverty based on the data and analyzed the influence of different channels on intergenerational income mobility and its contribution[5]. It found that the poor groups in China had obvious intergenerational transmission characteristics of poverty.

2. Resource Allocation and Model Analysis of Matthew Effect
In this paper, the Keynesian multiplier principle is extended to the regional economic level, and the Keynesian multiplier of regional economic development is constructed. Using this as a tool, using the neoclassical analysis paradigm, taking labor and capital as an example, this paper analyzes the causes of Matthew effect in regional economic development under the two resource allocation modes of market allocation and government allocation. In order to simplify the analysis, the following assumptions are made:

Hypothesis 1: there are two economic development areas A and B, A is an economically developed area, B is an economically underdeveloped area.

Hypothesis 2: the factor prices of the two places are fixed and the factor supply of the two places is unlimited.

Hypothesis 3: there are only two industrial sectors in both places, one is the basic industry and the other is the non-basic industry.

According to Keynesian multiplier theory, Keynesian income-demand expressions are used in regional situations, as follows:

$$Y_r = C_r + I_r + G_r + X_r - M_r$$  \hspace{1cm} (1)

Among them, $Y_r$ represents regional income, $C_r$ represents regional consumption, $I_r$ represents regional investment, $G_r$ represents regional government expenditure, $X_r$ represents regional exports, and $M_r$ represents regional imports.

Assume that regional consumption is a function of regional disposable income, that is

$$C_r = C_0 + cY_{rd}$$  \hspace{1cm} (2)

Among them, $C_0$ represents regional spontaneous consumption, is an exogenous variable, $Y_{rd}$ represents regional disposable income, $c$ is marginal propensity to consume.

The level of investment in a region is partly exogenous, that is, partly spontaneous and partly dependent on the local income level, which is expressed as follows:

$$I_r = I_0 + iY_{rd}$$  \hspace{1cm} (3)

Among them, $I_0$ represents spontaneous investment and is an exogenous variable, $i$ regional marginal propensity to invest.

In Keynesian multiplier theory, government expenditure is exogenous and depends on the political system, but for regional government expenditure is somewhat different, regional government expenditure can be divided into two items, one is government purchase and the other is government investment. For government purchases are basically negatively related to regional income, while government investment expenditure is positively related to regional income regional government expenditure can be expressed as follows:

$$G_r = G_0 + (g_1 - g_2)Y_{rd}$$  \hspace{1cm} (4)

Among them, $G_0$ represents spontaneous government expenditure, $g_1$ represents marginal propensity of the government in the maintenance and investment of public infrastructure, and $g_2$ represents the marginal propensity of the government to withdraw from the local economy when the government is growing in the regional economy.

$t$ represents the average tax rate level, regional disposable income can be expressed as:

$$Y_{rd} = (1-t)Y_r$$  \hspace{1cm} (5)
For regional imports, part of the external regional income is a function of the regional income, expressed as:

$$M_r = M_0 + mY_{rd}$$  \hspace{1cm} (6)

Among them, $M_0$ represents exogenous regional import and $m$ represents regional marginal propensity to import.

For exports, $X_r$ is an exogenous variable, depending on the economic development of other regions, the formulas (2) to (6) are substituted into (1):

$$Y_r = C_0 + c(1-t)Y_r + I_0 + i(1-t)Y_r + G_0 + (g_1 - g_2)(1-t)Y_r + X_r - [M_0 + m(1-t)Y_r]$$  \hspace{1cm} (7)

Finished up:

$$Y_r = \frac{C_0 + I_0 + G_0 + X_r - M_0}{1 - [(c - m) + (i + g_1 - g_2)](1-t)}$$  \hspace{1cm} (8)

$$Y_r = k_r(C_0 + I_0 + G_0 + X_r - M_0)$$  \hspace{1cm} (9)

Among them: 

$$k_r = \frac{1}{1 - [(c - m) + (i + g_1 - g_2)](1-t)}$$  \hspace{1cm} (10)

$k_r$ is the regional multiplier. We call $c - m$ the marginal propensity to consume in local production products, and $i + g_1 - g_2$ is called the marginal propensity of regional investment. It can be seen from equation (10) that the regional multiplier is positively correlated with the marginal propensity $k_r$ of the local production product and the marginal propensity $i + g_1 - g_2$ of the regional investment, and negatively correlated with the average tax rate $t$.

2.1. *Analysis of Matthew effect under the Condition of Market Allocation Resources*

2.1.1. *Analysis of Matthew effect formed by factor allocation under the difference of industrial structure.* Under the assumption that the regional economic sector is divided into basic industries and non-basic industries, the regional industrial structure is more closely related to economic growth. For the developed regions A, due to the strong concentration of the regional economy, the industry support is relatively complete, and the basic industry is dominant. For economically underdeveloped regions B, the regional economy is weaker and cannot form a leading industry, or the leading industry has a relatively short industrial chain, and the economic relations within the region are relatively weak. The economy is characterized by non-basic industries. For the A and B regions, an export-oriented enterprise was also introduced to examine the changes in economic growth caused by the differences in regional industrial structures in the A and B regions.

Rewrite equation (9) as follows:

$$Y_r = k_rX_r + k_r(C_0 + I_0 + G_0 - M_0)$$  \hspace{1cm} (11)

The first part of the (11) formula indicates the relationship between income and the export industry, and the second part indicates the relationship between income and specific economic activities. If the regional exit change is $\Delta X_r$, the change in regional income $Y_r$ can be expressed as:

$$\Delta Y_r = k_r\Delta X_r$$  \hspace{1cm} (12)

Since the introduction of an export enterprise, assuming regional income growth is $\Delta Y_r$, the additional expenditure of the new enterprise in the local economy can be expressed as $\Delta Y_r(c_f - m_f)(1-t_f)$, $c_f$ represents the marginal propensity to consume, $m_f$ represents the
marginal import propensity of the enterprise, and \( t_f \) indicates the corporate tax rate. Due to the multiplier effect, the new revenue increment in the economy is:

\[
\Delta Y_r = \Delta Y_f + k_r \Delta Y_f (c_f - m_f)(1-t_f)
\]

(13)

Even if the new entry into the enterprise has the same marginal propensity to consume, due to the different industrial agglomerations in A and B regions, the new enterprises in B region behaved as more production resources needed to import enterprises from other places, that is, the marginal propensity to import of enterprises in B region is greater than A’s. Then the economic growth of the A region is greater than B’s.

2.1.2. Analysis of labor area flow. According to neoclassical view, the demand for labor is a kind of demand, which depends on the marginal product of labor. According to the principle of profit maximization with marginal benefit equal to marginal cost, when the real wage rate is equal to the marginal product of labor, the enterprise determines the demand for its labor force. According to the law of diminishing marginal returns on capital and other factors of production in the same circumstances, with the constant input of labor, the marginal product is shrinking, so the demand of labor is a function of the reduction of the real wage rate, while the labor supply is an increasing function of the real wage rate, and the labor market can be cleared. Combine the labor supply and demand then get a simple labor market model, as shown in Figure 1.

Figure 1. Simple model of the labor market

In Figure 1, \( L^* \) represents the full employment level at the current market wage level, and the equilibrium wage is \( W^* \). If the initial real wage level of the market is \( W_1 \), the market has \((L_1, L_{w1})\) involuntary unemployment. Neoclassicism believed that unemployment could be reduced by a decrease in the real rate of wages. But there are always factors that prevent real wage rates from falling to market-clearing levels, such as minimum wage laws and union monopolies.

In the case where the labor force can flow freely, the laborer always makes the best choice when facing the difference in labor compensation in different regions. The human capital theory, the Todaro model, and the labor dynamic migration model all explain the labor migration. In this paper, the imbalance model of regional labor migration is used to illustrate the economic impact of labor migration on different regions. For economically developed regions A and economically underdeveloped regions B, when the cost of labor is not free to flow or the cost of flow is very high, the two labor markets are balanced, and the equilibrium real wage \( W^*_{ai} \) in economically developed regions is greater than the equilibrium realities \( W^*_{bi} \) in underdeveloped regions, as shown in Figure 2.
Figure 2. Regional labor free flow imbalance model

In Figure 2, (a) shows the supply and demand of labor in economically developed regions, and (b) shows the supply and demand of labor in economically underdeveloped regions. In the case that the labor force cannot flow freely, the labor supply curve in region A is \( S_{A1} \), the labor demand curve is \( D_{La} \), the two intersect in \( H_1 \), the equilibrium real wage level is \( w_{a1}^* \), the employment level is \( L_{a1} \), and the labor supply curve in region B is \( S_{B1} \), the labor demand curve is \( D_{Lb} \), the two intersect at \( N_2 \), the equilibrium real wage level is \( w_{b1}^* \), and the employment level is \( L_{b1} \).

When the labor force is homogeneous, because the equilibrium real wage levels in the two regions A and B are different, and the real wage level in the A region is greater than the B’s, when the labor force can flow freely, the labor flows from the B region to the A region, the equilibrium wage levels in the two places will eventually become consistent, that is \( w_a^* = w_b^* \). The labor supply curve in region A moved from \( S_{A1} \) to \( S_{A2} \), and the equilibrium real wage level dropped from \( w_{a1}^* \) to \( w_{a2}^* \), and the equilibrium employment level increased from \( L_{a1} \) to \( L_{a2} \). On the contrary, the labor supply curve in region B moved from \( S_{B1} \) to \( S_{B2} \), the equilibrium real wage level rose from \( w_{b1}^* \) to \( w_{b2}^* \), and the equilibrium employment level decreased from \( L_{b1} \) to \( L_{b2} \). The increase in labor demand \( L_{a1}L_{a2} \) in developed regions is entirely supplemented by labor outflows \( L_{b2}L_{b1} \) in economically underdeveloped regions. Under the new equilibrium conditions, labor flow between the two regions is in a state of balance, but from the perspective of economic scale, the economies of developed regions have increased in size, while the economies in underdeveloped regions have scaled down.

From the perspective of welfare, the free flow of labor has different effects on different stakeholders. For developed regions, due to the decline in wage rate, the supply of labor has been reduced from \( L_{a1} \) to \( L_{a1}' \), and the surplus of the overall laborer has decreased by \( a \), while in the developed regions, the surplus has increased by \( (a+b) \) because of the decline in the real wage rate; For underdeveloped regions, due to the outflow of labor, the local wage rate rises, and the surplus of labor left in the local area increases by \( c \); while the enterprises in underdeveloped regions decrease their producer surplus by \( (c+d) \) because of the increase in real wage rate; for the outflowing labor, the remainder is increased by \( (d+e) \). For economically developed regions, the overall welfare change is \( b \), and for the underdeveloped regions, the overall welfare change is \( e \). Therefore, both the labor inflow region and the labor outflow region benefit from the labor flow, that is, the labor flow is a Pareto improvements in resource allocation. At the level of the whole country, the inter-regional labor migration has increased the welfare level of the whole country by \( (b+e) \), which also shows that labor flow between regions is effective.
The above analysis is based on the assumption that the labor force is homogeneous, but in the case of relaxation of this assumption, according to the view of human capital, the human capital owned by the laborer is positively correlated with the level of retained wages. At the same time, the individual labor mobility of workers with higher human capital is stronger than that of workers with lower human capital, and they are more sensitive to the difference of wage rate. And laborers with higher human capital also have certain advantages in obtaining employment information than workers with lower human capital. Therefore, the transfer of labor is not carried out simultaneously, but is carried out according to the quality of the labor force from high to low. With the continuous flow of labor, the stock of human capital in the place of flow and inflows is constantly changing, the capital stock in the inflow place is rising, the marginal product of labor is rising, while the capital stock of the outflow place is decreasing, and the marginal product of labor is decreasing. The marginal product of labor is changing, which in turn affects changes in labor demand, as shown in Figure 3.

![Figure 3. Cumulative effects of interregional labor flow](image)

In Figure 3 (a) (b), similar to the assumption in Figure 2, there is a difference in the real wage level \( w_{A1}^* - w_{B1}^* \) between the initial developed region and the underdeveloped region, which will encourage the migration of the labor force from the economically underdeveloped region B to the economically developed region A. As a result, the labor supply curve in region A moves from \( S_{A1} \) to \( S_{A2} \), while the labor force curve in area B moves from \( S_{B1} \) to \( S_{B2} \). However, from the perspective of human capital, laborers with higher quality are sensitive to labor price differences and have higher migration ability, which makes high-quality laborers transfer faster, while low-quality laborers transfer more slowly or even cannot transfer. For region A, the labor supply curve moves from \( S_{A1} \) to \( S_{A2} \) means that the stock of human capital in region A is rising, resulting in an increase in the average output of capital and marginal output. Then the labor demand curve of area A moves from \( D_{A1} \) to \( D_{A2} \), the new equilibrium real wage level decreases less than that in figure 2 (a), and the increase in employment is larger than that in figure 2 (a). On the contrary, for economically underdeveloped region B, due to the outflow of labor force, the decline in the stock of human capital, and the decline in marginal output of capital, the labor demand curve moves further to the left, and the level of balanced wages does not rise much, or even remains unchanged or decreases. Due to the persistence of labor price differences, the process of labor migration will continue, and there will be no wage-employment balance. The final result is that the total economic volume of region A is getting larger and larger, while that of region B is getting smaller and smaller, and the income gap between the two places will become larger and larger, resulting in the "Matthew effect" of independent allocation of the labor market.
2.1.3. Analysis of capital area flow

The fundamental reason for the cross-regional flow of capital is nothing more than chasing profits and risk aversion. The focus of investment entities in cross-regional investment lies in risks and benefits, and their behavior patterns must be manifested as maximizing benefits under established risks or minimizing risks under established expected benefits. Therefore, the motivation of cross-regional capital flow can be attributed to the relative substitution of risk and income by investment entities in different regions.

The neoclassical regional economics factor allocation and migration theory is based on the law of variable factor ratio, that is, the marginal production attribute of the factor depends on the relative use of the factor. According to the law of diminishing marginal returns, if the quantity of one element in production remains unchanged, as the amount of use of another factor increases, its marginal production will continue to decline. Under the same other conditions, the more the amount of capital used, the lower the marginal output for a fixed number of labors. In the case where the two production factors of capital and labor are complementary, the higher the relative value of capital and labor, the lower the marginal production of capital, and the lower the marginal production of capital. Determining the price of a factor of production is the marginal production of the factor, so the flow of capital must flow from a region with low marginal capital production to a region with high marginal capital production. As the flow of capital makes the marginal production of inflowing capital decline, and the marginal production of outflowing capital rises, according to the law of diminishing marginal returns, the marginal production of capital between the two places is equal, and the balance of capital allocation among regions is achieved.

For economically developed regions A and underdeveloped regions B, the capital used by the two regions is $K_a$ and $K_b$, respectively, and the labor amount is $L_a$ and $L_b$, then the capital labor ratio of the two places is $rac{K_a}{L_a}$ and $rac{K_b}{L_b}$, respectively, if the capital labor ratio in region A is higher than that of region B, that is,

$$\frac{K_a}{L_a} > \frac{K_b}{L_b}$$  \hspace{1cm} (14)

Under the premise of free flow of capital, capital flows from regions A to B, and labor flows from regions B to A. As long as there is a difference in capital labor ratio, this reverse capital flow will exist until the two places capital labor ratio is equal, that is,

$$\frac{K_a}{L_a} = \frac{K_b}{L_b}$$  \hspace{1cm} (15)

Through the flow of capital and labor, the two production factors are optimized in space, and the marginal products of each factor are increased, so that the efficiency of the two elements is maximized, that is, the spatial flow of capital and labor is a kind of Pareto improvement of resource allocation.

2.1.4. Comprehensive analysis of labor and capital flows

According to neoclassical economics, in the absence of obstacles to the flow of factors, capital flows from areas with low marginal production to areas with high marginal production. According to the law of diminishing marginal returns, the capital allocation of the final region is balanced. But the reality is far from this. It is more common that capital flows from less developed regions to relatively economically developed regions. This paper combines labor flows with capital flows to reveal the “Matthew effect” that appears in economic development under the conditions of market allocation of resources.
For economically developed regions A and economically underdeveloped regions B, the capital rent rates of the initial two regions are $r_a^1$ and $r_b^1$, respectively, and the two are equal, as shown in Figure 4. Due to a favorable impact on region A, this causes the marginal production of capital in region A to rise, which in turn causes the capital demand curve to shift to the right. The capital demand curve moves from $D_{ka1}$ to $D_{ka2}$. The capital rent rate in the capital market rises from $r_a^1$ to $r_a^2$, and the amount of capital in the A region rises from $K_a^1$ to $K_a^2$. Due to the free flow of capital, there is a difference in the capital rent rate between the two regions. The capital flow in region B moves to region A, so that the capital supply curve of region A moves from $S_{ka1}$ right to $S_{ka2}$, and conversely, the capital supply curve of region B moves from $S_{kb1}$ left to $S_{kb2}$. For region A, the new capital supply curve $S_{kb2}$ intersects the capital demand curve $D_{ka2}$ to reach the new equilibrium, but the equilibrium capital rent rate is uncertain relative to the initial capital rent rate, which depends on the relative range of the movement of the capital demand and supply curve. For region B, the outflow of capital makes the ratio of capital to labor decrease, the high-quality labor force flows from region B to region A, and the decline of human capital makes the marginal output of capital decrease. As a result, the capital demand curve of region B moves from $D_{kb1}$ to $D_{kb2}$, and the change of equilibrium capital rent ratio is uncertain relative to the initial capital rent rate of region B, which also depends on the relative movement of capital demand and supply curve. However, this does not mean that the capital flows of the two regions have ended or reached a dynamic balance. The continuous flow of labor forces further increases the marginal output of capital in region A, and the capital demand curve further moves to the right, thus the capital flows start again. In addition to labor flow, the capital stock in region A keeps rising, the economy in region A will have agglomeration effect, the marginal output of capital and labor will further increase, and the capital and labor will gather in region A. Through the allocation of resources by the market, the economically developed regions have a continuous siphon effect on the underdeveloped regions, and the gap between the two regions is getting larger and larger, which is also the "Matthew effect" in the economic development.

2.2. Analysis of Matthew effect under the condition of government allocating resources

The root of the government's allocation of resources lies in the failure of the market. In essence, it is the administrative allocation and adjustment of the areas where the market cannot allocate resources effectively. The effective regulation and control of resource allocation by the state or the government is a necessary condition for the market to play a fundamental role in the allocation of resources. In different historical periods, the objectives of the government are different, and then the government
also shows different characteristics in the allocation of resources. For example, in the early stage of reform and opening up, the state pursued the principle of giving priority to efficiency and giving consideration to fairness. In the new century, the central government, in order to curb excessive disparities in regional development, implemented development strategies such as the large-scale development of the western region, the revitalization of the old industrial base in northeast China and the rise of the central region to promote balanced development of regional economy. The fiscal policy has begun to tilt to the central and western regions, and more government-led funds have gone to the central and western regions.

However, there are two ways for local governments to invest in infrastructure, one is that local governments are responsible for investment, and the other is that central and local governments jointly invest. For the public expenditure that is responsible by the local government, since the government's expenditure funds mainly come from local taxes, the tax scale of regions with different levels of economic development is necessarily different, so from the perspective of investment scale, economically underdeveloped regions are necessarily smaller than economically developed regions. Even in the case of the same amount of investment in the two regions, due to the difference in government investment multiplier between the two regions, the economic growth of the economically developed regions is greater than that of the economically underdeveloped regions at the same level of investment. Under the mode of joint investment by the central government and local governments, local governments are generally required to undertake a certain proportion of project investment funds, which is also the "matching system" of government projects.

In the case of the matching system of project funds, the choice of investment projects depends on the supporting capacity of local governments. When the financial capacity can meet the matching requirements of projects, the central government and local governments will jointly invest and build a number of important projects. On the contrary, when the local financial capacity fails to meet the supporting requirements, the central government cannot regard the region as an investment destination. Assuming that the investment of a project is $G$, and the proportion assumed by local government and central government is $\alpha$ and $\beta$ respectively, when the local government finance can reach matching $\alpha G$, the net increase of local government investment is $\beta G$, according to the multiplier principle, the income growth that meets the matching area is:

$$\Delta Y = \beta G \left(1 - \frac{1}{1 - ((c - m) + (i + g_1 - g_2))(1 - t)}\right) = k_\beta \beta G$$

(16)

For the economically underdeveloped regions that cannot meet the fund matching, the net investment increment of local governments is zero, and the corresponding income increment is also zero. If the growth of regional public capital stock is taken into account, the marginal benefit of private capital will increase; causing the flow of capital, labor and other factors, and the gap between local economies will be larger.

3. The conclusion

From the above analysis, it can be seen that no matter the market or the government allocates resources, it will inevitably lead to the imbalance of economic development level between regions, and the gap between regions is increasing. It can be seen from formula (10) that in the case of the same consumption, investment or government purchase, the regional income will be increased differently due to the difference in the regional multiplier. Therefore, in order to change the economic situation of economically backward regions, it is necessary to improve the regional multiplier of economically underdeveloped regions, increase the number and quality of production factors in backward regions, improve the marginal output of factors, and curb the trend of one-way flow of factors under the condition of market allocation of resources.

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