An Empirical Research on the Impact of Population Mobility on the Level of Economic Development in China

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Abstract: This paper selects China as the research object, analyzes the correlation between population mobility and economic development, and then uses the factor analysis method to evaluate the economic development level of each province, and obtains the evaluation results of the economic development level of each province. Then, it uses Multiple Regression Analysis to make an empirical analysis on the impact of China's population mobility on the level of economic development, and comes to the main conclusion that China's floating population has a low educational level, and the reasons for the mobility are affected by the economy. Population mobility not only promotes economic development, but also causes the unbalanced development of economic development in economy, society and industry. This paper puts forward relevant policy suggestions on the impact of China's population mobility on the level of economic growth.

Keywords: Population Flow; Economic Growth; Factor Analysis; Multiple Regression Analysis.

1 Introduction

According to the latest data released by China's National Bureau of statistics, China's floating population reached 376 million at the end of 2020. The large-scale floating population has made great contributions to China's economic take-off and modernization. However, the disadvantages of population mobility are also gradually revealed. The difference of economic development and the imbalance between regions have formed the situation of economic take-off in the eastern coastal areas of China, economic backwardness in the western and northeast regions, and the gap between the rich and the poor is gradually widening. Floating population not only leads to the existing development gap, but also becomes a restrictive factor for the coordinated development of regional economy.

There are three views on the impact of floating population on economic development. First, floating population is a process of re allocation of production factors, which can boost economic development. (Shi & Li 2020) pointed out that the floating population can promote economic

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growth from the aspects of upgrading the industrial structure, driving the increase of consumption, scientific and technological innovation, improving human capital and labor efficiency. [7] (Li & Yin 2005) respectively constructed the labor transfer model under the condition of closed economy, the labor transfer model joining the financial sector and the labor transfer model under the condition of open economy. [5] They found that even without technological progress, continuous labor transfer will trigger economic growth. (Wassink 2020) believed that population inflow can promote the economic growth of the inflow place by improving human capital, promoting technological innovation and expanding market scale. [8] (Yao & Zhang 2020) believed that the population outflow can transfer benefit through income and improve the relative income level of population outflow areas, so as to narrow the regional income gap. Second, floating population will restrict economic development. [4] The large-scale flow of population will produce "urban diseases" such as traffic congestion and environmental pollution. Research by (Jiang, Jia & Cheng 2016) showed that population mobility will hinder economic development through price transmission effect and widening gap effect. [3] (Zhou & Chen 2020) believed that the massive inflow of population makes the supply of labor force exceed the demand, which is easy to cause problems such as resource shortage and traffic congestion, which will have an adverse impact on the economic growth of the inflow place. [10] (Das 2020) believed that population outflow will reduce labor supply and increase the loss of human capital, which will hinder the economic growth of the outflow area. [1] (Zhai, Wang & Shi 2019) pointed out that a large number of labor force poured into cities, the labor supply exceeded the market demand, and the education level of the inflow rural labor force could not meet the needs of modern production, resulting in rising unemployment rate and idle human resources. On the other hand, the influx of population into cities makes the number of urban population far exceed the burden level of urban infrastructure, resulting in an increase in the cost of urban management services and the production of social problems such as left-behind children, left-behind elderly and floating children. The excessive agglomeration of population makes the regional environmental carrying pressure increase or even exceed the regional environmental bearing capacity, resulting in environmental pollution and other problems. Third, the impact of floating population on economic growth is uncertain or has a nonlinear relationship. [9] (Pan & Du 2010) took China's provinces as the research object and used the additive model estimation method to study. They found that the impact of labor outflow in central and Western China on regional economy showed a significant "inverted U" nonlinear relationship. [6] (Gan & Li 2017) conducted an empirical study using the panel smooth transfer model. The results showed that there is an obvious threshold effect in the inflow of population into cities. [2]

Based on the above research background and research results, this paper uses the data of the sixth census, the provincial annual data of the National Bureau of statistics over the years, the national dynamic monitoring survey data of floating population and other data, uses SPSS software to conduct factor analysis on the relevant data, constructs and tests the relevant models, and evaluates the empirical results. Combined with the results of empirical analysis, this paper draws the main conclusions, and puts forward relevant policy suggestions on the impact of China's population mobility on the level of economic development.

2 Model introduction and variable selection

2.1 Introduction to multiple linear regression model

Let the dependent variable be y and k independent variables be x_1, x_2, …, x_k respectively. The equation describing how the dependent variable y depends on independent variables x_1, x_2, …, x_k and error term ε is called multiple linear regression model. Its general form can be expressed as:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon \quad (1)$$

In the equation, β_0, β_1, β_2, …, β_k is the parameter of the model; ε is the error term.

Equation (1) shows that y is a linear function of x_1, x_2, …, x_k (Part of $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k$) plus the error term ε. The error term reflects the influence of random factors on y except the linear relationship between x_1, x_2, …, x_k and y. It is the variation of y that cannot be explained by the linear relationship between x_1, x_2, …, x_k and y.

In the multiple linear regression model, there are three basic assumptions about the error term ε, which are normality, equal variance and independence. According to the assumptions of the regression model, there is:

$$E(y) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k \quad (2)$$

Equation (2) is called multiple linear regression equation, which describes the relationship between the expected value of dependent variable y and independent variables x_1, x_2, …, x_k.

In the regression model, β_0, β_1, β_2, …,β_k are unknown and need to be estimated using sample data. When the sample statistics are used to estimate the unknown parameters in the regression equation, the estimated multiple linear regression equation is obtained. When the sample statistics $\hat{\beta}_0$, $\hat{\beta}_1$, $\hat{\beta}_2$, …, $\hat{\beta}_k$ are used to estimate the unknown parameters β_0, β_1, β_2, …,β_k in the regression equation, the estimated multiple linear regression equation is obtained. Its general form can be expressed as:

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \cdots + \hat{\beta}_k x_k \quad (3)$$

In the equation, $\hat{\beta}_0, \widehat{\beta}_1$, $\hat{\beta}_2$, …, $\hat{\beta}_k$ are the estimated value of parameter β_0, β_1, β_2, …, β_k; $\hat{y}$ is the estimated value of the dependent variable y. $\hat{\beta}_0$, $\hat{\beta}_1$, $\hat{\beta}_2$, …, $\hat{\beta}_k$ are called partial regression coefficient. $\hat{\beta}_1$ represents the average variation of x_1 when x_1 changes every unit dependent variable y when x_2, x_3, …, x_k are constant. Other partial regression coefficients have similar meanings.

Random sampling of n groups of sample observations of explained variables and explanatory variables.

$$(y_i,\ x_{ji}), i = 1,2,\dots,n, j = 0,1,2,\dots,k \tag{4}$$

Parameters in multivariate linear regression model $\hat{\beta}_0$, $\hat{\beta}_1$, $\hat{\beta}_2$, …, $\hat{\beta}_k$ can be obtained according to the least square method. That is, to minimize the sum of squares of residuals, the estimated value of parameters should be the solution of the following equations.

$$\begin{cases} \frac{\partial}{\partial \hat{\beta}_0} Q = 0 \\ \frac{\partial}{\partial \hat{\beta}_1} Q = 0 \\ \frac{\partial}{\partial \hat{\beta}_2} Q = 0 \\ \cdots \\ \frac{\partial}{\partial \hat{\beta}_k} Q = 0 \end{cases} \tag{5}$$

Among them:

$$\begin{aligned} Q &= \sum_{i=1}^{n} e_i^2 = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2 \\ &= \sum_{i=1}^{n} (y_i - (\hat{\beta}_0 + \hat{\beta}_1 x_{1i} + \hat{\beta}_2 x_{2i} + \cdots + \hat{\beta}_k x_{ki}))^2 \end{aligned} \tag{6}$$

Then we get a set of linear algebraic equations about the estimated values of the parameters to be estimated.

$$\begin{cases} \sum y_i - \sum(\hat{\beta}_0 + \hat{\beta}_1 x_{1i} + \hat{\beta}_2 x_{2i} + \cdots + \hat{\beta}_k x_{ki}) = 0 \\ \sum y_i\, x_{1i} - \sum(\hat{\beta}_0 + \hat{\beta}_1 x_{1i} + \hat{\beta}_2 x_{2i} + \cdots + \hat{\beta}_k x_{ki}) x_{1i} = 0 \\ \sum y_i\, x_{2i} - \sum(\hat{\beta}_0 + \hat{\beta}_1 x_{1i} + \hat{\beta}_2 x_{2i} + \cdots + \hat{\beta}_k x_{ki}) x_{2i} = 0 \\ \cdots \\ \sum y_i\, x_{ki} - \sum(\hat{\beta}_0 + \hat{\beta}_1 x_{1i} + \hat{\beta}_2 x_{2i} + \cdots + \hat{\beta}_k x_{ki}) x_{ki} = 0 \end{cases} \tag{7}$$

By solving the linear algebraic equations composed of $(k + 1)$ equations, the estimated value $\hat{\beta}_j$, j=0, 1, 2, …, k of $(k + 1)$ parameters to be estimated can be obtained.

2.2 Variable selection and data description

Floating population: The floating population studied in this paper refers to the population who live in other townships, towns and streets, have left the place of household registration for more than half a year, and have not moved or changed their registered residence to other townships, towns and streets. This paper selects the number of inter provincial inflow population in various provinces and urban areas in China's "six Census" data as an index to measure. In the gender ratio data of floating population, the proportion of men and women of inter provincial floating

population (female = 1) is selected, which can simplify the data and do not affect the results of empirical analysis. As for the data on the flow time of the inter provincial floating population, the proportion of the inter provincial population with a flow time of less than four years is selected. The length of the flow time can also perceive the attraction of the economic construction of a region to the inflow population. As for the education level data of the inter provincial floating population, the proportion of the inter provincial population without higher education is selected. The education level can reflect the infrastructure and economic development level of the country. These processed data can more intuitively reflect the characteristics of China's floating population.

Level of economic development: The level of economic development is mainly considered from three aspects: economic aggregate and added value of major industries, employment and social fixed asset investment. Eleven indicators are selected to construct the index system. In terms of economic aggregate and added value of major industries, seven indicators are selected, including regional GDP, industrial added value, construction added value, wholesale and retail added value, accommodation and catering added value, financial added value and real estate added value. Regional GDP can reflect the overall level of regional economic growth and the economic status of the region in China. The added value of different industries can reflect the current situation of industrial structure and the focus of economic development in a region. At the same time, it can also better comprehend people's consumption demand and provide reference for the government to formulate economic development plan. In terms of employment, the employment of urban units is selected as an indicator. The employment shows the employment situation and scale of the region from the side, and the employment scale is closely related to the industrial scale and economic development level of the region. In terms of social fixed asset investment, three indicators are selected: fixed asset investment in education, health, social security, fixed asset investment in social welfare, and fixed asset investment in culture, sports and entertainment. The selected relevant industries are industries aimed at ensuring people's living standards and improving the quality of life, which can reflect the level of urban infrastructure construction and people's living standards. The data are mainly from the annual data of China's National Bureau of statistics and the data of China's statistical yearbook over the years.

3 Empirical analysis

3.1 Correlation analysis between population mobility and economic development

Use SPSS software to standardize the number of inter provincial floating population, urban employment and relevant economic indicators, and then analyze the correlation. The results showed that the correlation coefficients between the number of inter provincial floating population and regional GDP, industrial added value, construction added value, wholesale and retail added value, accommodation and catering added value, financial added value, real estate added value, urban unit employment, fixed asset investment in education, health, social security, fixed asset investment in social welfare and fixed asset investment in culture, sports and entertainment are greater than 0.5, It proves that there is correlation between indicators.

3.2 Evaluation of economic development level

By means of factor analysis test, factor extraction and other analysis methods, the regional GDP, industrial added value, wholesale and retail added value, accommodation and catering added value, financial added value, real estate added value and urban unit employment are mainly explained by the first common factor; The added value of construction industry, fixed asset investment in education, health, social security, social welfare, culture, sports and entertainment are mainly explained by the second common factor; the first common factor is called economic factor, the second common factor is called quality of life factor.

Using SPSS software, the factor score coefficient of each index is estimated by regression analysis method. According to the comprehensive reflection ability of each common factor, calculate and summarize the proportion of the variance contribution rate of each index in the total variance contribution rate of the two common factors, and obtain the comprehensive factor score of each region.

The five regions with the highest scores in economic factors are Guangdong, "Jiangsu, Zhejiang and Shanghai" and Beijing, all of which score more than 1, indicating that these regions have higher regional economic development level, faster industrial renewal and optimization speed, and higher people's consumption level. However, the economic development of Guizhou, Hainan, Ningxia, Qinghai and Tibet is slow, the living and consumption level has not been well developed. The five regions with the highest scores in the quality of life factor are Shandong, Henan, Sichuan, Anhui and Hebei, indicating that although the economic development of these regions is not top-notch, the development and construction of these regions pay more attention to the cultivation and investment of education and culture, the development of entertainment industry is better, and the regions pay more attention to the investment of basic security and social welfare, so people's life happiness is higher, but the quality of life factor scores of Ningxia, Qinghai, Beijing, Tibet and Shanghai are low, with scores below - 1, indicating that the quality of life of people in these areas is poor. Among the top five cities with comprehensive factor scores, Guangdong, Jiangsu and Zhejiang are areas with good economic development level and pay attention to infrastructure construction and the development of Humanities and entertainment industries. Shandong and Henan have a general level of economic development, but they are areas with better urban infrastructure and cultural industry development. Generally speaking, the provinces, autonomous regions and cities in the eastern or central region rank the top in the comprehensive score. However, the areas with low scores in all factors are the western region of China, which shows that although China's western development strategy has achieved certain results, the poverty problem in Western China has not been fundamentally solved. Economic construction in Western China still needs to be strengthened.

3.3 An empirical analysis of the impact of population mobility on the level of economic development

Because the multiple linear regression model should include not only the independent variables concerned by the research, but also the control variables. According to previous studies, fixed asset investment and total import and export will affect the level of economic development. Therefore, these two variables are included in the multiple linear regression model.

Model estimation and test: According to the selected data, the model can be preliminarily set as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \quad (8)$$

Among them, the explanatory variable Y is the comprehensive score of economic development level, X_1 is the proportion of men and women in the inter provincial floating population (female = 1), X_2 is the proportion of the inter provincial floating population with a floating time of less than four years, X_3 is the proportion of the inter provincial floating population without higher education, X_4 is the fixed asset investment of each province and city, and X_5 is the total export-import volume of each province and city.

(1) Goodness of fit test of model

Using SPSS software to conduct multiple linear regression analysis on the data, table 1 is obtained. It can be seen from table 1 that the correlation coefficient R = 0.678, the goodness of fit R^2 =0.459, the adjusted R^2 = 0.399, and the standard error is 1.096, indicating that the regression interpretation percentage of this regression model is relatively high, and the fitting result of the model is reasonable. Then, the value of Durbin-Watson test is 1.808, close to 2, indicating that there is no correlation between residual terms.

Table 1: Goodness of fit results

Model	R	R^2	Adjusted R^2	Error in standard estimation	Durbin-Watson
1	0.678	0.459	0.399	1.096	1.808

(2) Significance test of regression equation

It can be seen from table 2 that at the significance level of 5%, F = 7.648, and the corresponding significance is 0.001, which is far less than 0.05. The original hypothesis is rejected, so the established regression equation is effective.

Table 2: Analysis of variance table

Model		Sum of squares	Degrees of freedom	Mean square	F	Statistical significance
1	Regression	27.563	3	9.188	7.648	0.001[b]
	Residual	32.437	27	1.201		
	Total	60.000	30			

(3) Significance test of regression coefficient

Because the regression results of fixed asset investment (X_4) and the total export-import volume (X_5) are not significant, the regression results of these two variables are not shown in Table 3.

It can be seen from table 3 that the coefficient of the constant term is -9.029, the coefficient of the proportion of men and women is -4.701, the coefficient of the proportion of the population with a floating time of less than four years is 11.411, and the coefficient of the proportion of the population without higher education is 9.169. This result is consistent with China's social situation, indicating that the establishment of the model is in line with economic significance. And the corresponding significance of the regression coefficients of X_1, X_2 and X_3 are less than 0.05, indicating that there is an obvious linear relationship between the above three independent variables and dependent variables and has strong explanatory ability.

(5) Residual normality test

In the multiple regression model, the error term is assumed to be normal, that is, the error term is a random variable that obeys the normal distribution, and the expected value is 0. The normality assumption of residuals can be tested by drawing a normal probability diagram. The drawing results of this study are shown in Figure 1. It can be seen from Figure 1 that the normal P-P diagram of the regression standard residual of the model is roughly a straight line, and all points are close to the diagonal. The standard error of the residual statistics given by SPSS is 0.949, less than 2. Therefore, it can be considered that the assumption about the residuals obey the normal distribution is basically valid and and will not affect the accuracy of the model prediction.

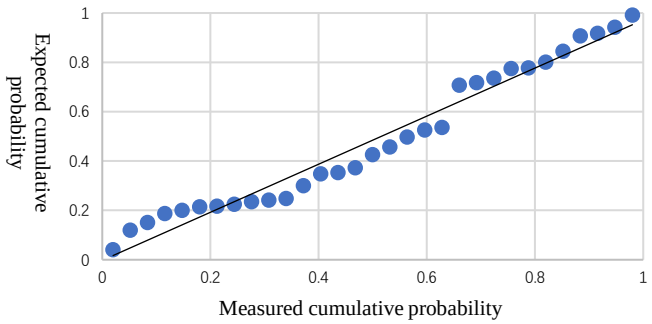

Figure 1 Normal P-P diagram of regression standard residual

(4) Multicollinearity test

It can be seen from table 3 that the tolerance of the three independent variables is greater than 0.5, and the expansion factor VIF is relatively small, which is relatively close to 1, indicating that the collinearity between these variables is relatively weak. At the same time, it can be seen from table 4 that the eigen value in the table are greater than 0, indicating that there is no obvious collinearity between variables, and most of the values of variance ratio are far less than 1, indicating that there is no obvious collinearity.

Table 3 Regression coefficient table

Model		Unstandardized Coefficient		Standardized Coefficient	t	Statistical significance	Collinearity statistics	
		B	Standard error	Beta			Tolerance	VIF
1	constant	-9.029	4.253		-2.123	0.043		
	X_1	-4.701	1.092	-0.674	-4.306	0.000	0.817	1.225
	X_2	11.411	3.818	0.511	2.988	0.006	0.685	1.461
	X_3	9.169	2.997	0.564	3.060	0.005	0.589	1.699

Combined with the results in table 3 and table 4, it shows that there is no obvious multicollinearity in the regression model, so it is not necessary to modify the regression model.

Table 4 Collinearity diagnosis table

Model		Eigen value	Condition index	Variance ratio			
				(constant)	X_1	X_2	X_3
1	1	3.971	1.000	0.00	0.00	0.00	0.00
	2	0.017	15.446	0.01	0.32	0.16	0.05
	3	0.011	19.379	0.01	0.65	0.03	0.27
	4	0.001	53.493	0.88	0.03	0.81	0.68

Empirical results: According to the above process of model construction and test, the final multiple regression model can be obtained as follows:

$$Y = -9.029 + -4.701X_1 + 11.411X_2 + 9.169X_3 \quad (9)$$

It can be seen that the comprehensive score of economic development level is positively correlated with the proportion of people who have been floating for less than four years and the proportion of people who have not received higher education among the inter provincial floating population, and negatively correlated with the proportion of men and women (female = 1) of the inter provincial floating population. When other factors remain unchanged, the comprehensive score of economic development level will increase by an average of 4.701 for every unit of reduction in the proportion of men and women of inter provincial floating population. Among the inter provincial floating population, the comprehensive score of economic development level will increase by an average of 11.411 for each additional unit of the proportion of the population with a floating time of less than four years. The comprehensive score of economic development level will increase by an average of 9.169 for each additional unit of the proportion of people without higher education among the inter provincial floating population.

The model shows that among the inter provincial floating population, women's contribution to economic development is higher than men's, which means the improvement of Chinese women's economic strength and comprehensive ability. From the perspective of flow time, short-term population flow can better reflect people's quality of life and promote the improvement of economic development level. It also shows that China's inter provincial floating population is mainly short-term floating population. From the perspective of education level, the population without higher education mainly affects the level of economic development, which is in line with the current situation of China's economic development. The education level of China's inter provincial floating population is low, but it is undeniable that it is these people without higher education who build cities day and night and contribute to the economic development of cities. This also reflects the imbalance between China's economic development and education development.

The action mechanism of the floating time of floating population on the level of economic development: This paper will qualitatively analyze the specific mechanism of the impact of the floating time of the floating population on the level of economic development from the perspective of the causes of population mobility. From the nine causes of population mobility in the "The Sixth National Census" data, it can be seen that the largest number of people are floating due to work and business, accounting for 45.12% of the total floating population. The floating population due to accompanying family members accounts for 14.17% of the total floating population. In addition, the floating population due to learning and training, demolition and relocation accounts for about 10% of the total floating population. The floating population due to other reasons accounts for a relatively low proportion. It shows that nearly half of the population flows for economic reasons. The main purpose of their mobility is to obtain more income in order to improve their own or family's economic situation and have richer living conditions after returning home. If they move for too long, they will be wandering for a long time and unable to reunite with their families. They will be separated from the original purpose of moving and lose the driving force for local economic development. Therefore, the floating time of the floating population will ultimately affect the level of economic development through the channel of population mobility reasons.

4 Conclusions and policy recommendations

The gap between the rich and the poor regions is gradually widening. It is urgent to alleviate the impact of population mobility on the level of economic development. This paper investigates the impact of population mobility on the level of economic development by using the method of regression analysis. The results show that the proportion of men and women in the inter provincial floating population, the proportion of the population with a floating time of less than four years in the inter provincial floating population, and the proportion of the population without higher education in the inter provincial floating population have a significant impact on the level of economic development. Therefore, in view of the above research conclusions, the following policy suggestions are put forward:

First, improve the education level of floating population. The level of education will directly affect the scope of people's employment, economic income and their contribution to social and economic development. China's floating population is mainly composed of people with low

educational background, and the population with higher education accounts for a relatively small proportion. The education level of the employed population not only increases the hidden danger of social security in the inflow area, but also limits the speed of industrial development to a certain extent. In order to accelerate regional economic growth, upgrade industrial structure and promote the strategy of developing the country through science and education, we should increase investment in education, improve people's education level and cultivate high-quality, professional and scientific and technological talents.

Second, improve the social security system and public service system. With the development of economy, people's cost of living is also increasing. The inflow of floating population has not only made great contributions to the economic, social and cultural development of the inflow areas, but also increased the needs of the inflow areas. However, the demand of the floating population has not been well solved, such as the housing and medical problems of the floating population, the education of the children of the floating population, the old-age security of parents and so on. In addition to the issue of people's livelihood security, due to the increase of residential population, people's demand for social services in the inflow areas also increases, which also increases the difficulty of regional public management and public security. For the above problems caused by population inflow, the government should strengthen regional infrastructure, improve the public service system, issue relevant policies for the livelihood security of the floating population itself and their families, improve the social security system, solve the worries of the floating population and promote the harmonious development of society.

Third, tap and develop regional advantageous industries and optimize the industrial structure. Although China's western and northeast regions are economically underdeveloped, these regions are rich in natural resources and inhabited by a large number of ethnic minorities, and their regional cultures have their own characteristics. Therefore, these regions can fully tap the potential of their own resources and develop and strengthen industries with local characteristics according to local conditions. The advantage of local characteristic industry lies in its own uniqueness and not easy to replace, which is conducive to the long-term development of the industry. It is suggested to cultivate and introduce professional talents, introduce modern agricultural and industrial technology, develop supply chain in combination with the development of online economy, integrate and allocate resources, and upgrade local characteristic industries to local advantageous industries.

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