ISSN: 2688-9323

Research on Countermeasures of Rural Talent Return based on Industry Heterogeneity

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Abstract

As the population continues to migrate to the cities, a large number of talents are lost in the rural areas. To accelerate the development of the rural economy, it is necessary to guide talents back to the rural areas. Therefore, it is an important direction to study the influence of the main body of talent absorption on the flow of talents. This article uses a non-competitive input-output model to calculate the capacity and potential of different industries for employment, and the requirements of different industries for the degree level of employees. It is found that different industries have significant differences in employment absorption capacity and potential, as well as the demand for talents at the academic level. Therefore, this paper proposes countermeasures for the return of rural talents by increasing investment in industries with high employability and potential, improving comprehensive rural conditions to attract and retain talents, and guide the employment propensity of practitioners with different educational levels to optimize talent structure and allocation efficiency.

Keywords

Brain drain, Industry associations, Multiplier effect, Input-output model.

1. Introduction

With the successive policies such as zero-threshold settlement, family relocation, rent subsidies and talent apartments, talents continue to be transferred to cities in an orderly manner. While providing social welfare for talents and meeting their own development needs, it has also caused a large drain of rural talents and exacerbated the imbalance in economic development between urban and rural areas. As the saying goes, "people follow the industry", industry is the main body for attracting talents. China's economy is developing at a high speednow, all major industries are accelerating transformation and upgrading with the support of relevant policies. Promoting the expansion and scale of industries with high employment and high economic growth is of great significance in attracting the return of rural talents, accelerating the speed of rural economic development, and narrowing the urban-rural gap.

Scholars at home and abroad have focused on how to accelerate economic development in underdeveloped regions, and have made in-depth research on the complex relationship between industrial development and talent mobility. Based on the duality of the economic structure of developing countries, W. A. Lewis (1954) considers the income gap between urban and rural areas as the only decision-making factor for the transfer of labor from rural to urban areas. As long as the wage level in the urban industrial sector is higher than the average rural wage level, the labor force will flow to the city. So, difference in income levels between different industries will affect labor mobility. It is of practical significance to analyze the motivation of talent mobility from the perspective of industrial heterogeneity, and scholars have made a lot of achievements in this field. Albert Hirschman (1958) believes that

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differences in economic growth are inevitable, and advocates that underdeveloped regions should develop leading industries with large industrial correlation effects and strong driving effects first; taking the software industry as an example, Sun Jian and You Wen (2008) constructed a univariate linear regression model, which qualitatively and quantitatively explained the symbiotic effect and multiplier effect of industrial agglomeration and talent agglomeration, and proved the high correlation between industrial agglomeration and talent agglomeration[1]; Geng Xianhui (2012) used forward and backward correlations and labor input coefficients to measure the ability of different industries to absorb urban employees at different educational levels[2];Liu Chang'e and Xie Wei (2018) emphasized that most of the rural population lost were young people with higher education, which greatly restricted rural construction and development[3];Li Min and Guo Qunqun (2019) proved the significant two-way promoting effect between industrial agglomeration and talent agglomeration by constructing the spatial simultaneous equation model, and pointed out the negative spatial interaction effect between the two[5];Liang Lin, Zhao Yuzheng and Liu Bing (2019) point out that the improvement of the economic environment will promote the shift of talents from outward to inward[4].

Based on the research results of many scholars, this paper selects the 2017 China input-output table as analysis data, merges 149 department input-output tables into 19 department input-output tables, and constructs a non-competitive input-output model to eliminate Impact of the import sector. Based on this, an industry correlation matrix that includes both the demand side and the supply side is introduced. Calculate the employment multiplier, income multiplier of each industry and the ability of different sectors to absorb employees with different educational levels, in order to quantitatively analyze the impact of different industries on the flow of talent.

2. Data and Methods

2.1. Method Introduction

The input-output method was first proposed by Leontief (1941) in the book American Economic Structure and is now widely used in the fields of empirical research, mathematical economics and economic accounting. The input-output method is based on the input-output table. The input-output table categorizes the entire national economy by the production of different products. The column items indicate the inputs and their components in the production process, while the row directions indicate the output and its distribution and use, and then reflect the national economy in the industrial connection. Table 1 is a simplified input-output table, and its relationship in the row direction is $\sum_{j=1}^{n} x_{ij} + y_i = x_i$,the relationship of column upward is: $\sum_{i=1}^{n} x_{ij} + v_j = x_j$[6].

Based on the three basic assumptions of homogeneity, proportionality and stability, direct consumption coefficient matrix A can be introduced:$a_{ij} = x_{ij}/x_j$, it can be expressed in matrix form as:$AX + y = X$.Leontief model can be obtained by model transformation and derivation: $X = (I - A)^{-1}Y$,X is the column vector of output of each industry, and Y is the column vector of final demand.$(I - A)^{-1}$is Leontief inverse matrix, denoted as L, and l_{ij} of the L matrix represent the total demand for the final product of the production unit of the j department. Leontief model reflecting the relationship between output and final demand, in order to get further relation between output and the initial investment, this paper also introduces the total consumption coefficient matrix:$B = A(I - A)^{-1}$, Ghosh model is obtained, that is: $X = v(I - B)^{-1}$, v is the initially invests in the row vector of each department, B is the output coefficient matrix and $(I - B)^{-1}$is the inverse matrix for Ghosh, denoted as G .g_{ij} of G matrix represents the change in the initial input of sector i by one unit, and the change in output of sector j by one unit[5].

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Table 1. ASimplified Input-Output Table

Input\Output		Intermediate Use				Final Use				Total Output
		Section 1	Section 2	…	Section n	Consume	Gross capital formation	import	Total final use	
Intermediate input	Section1	x11	x12	…	x1n	C1	I1	m1	y1	X1
	Section2	x21	x22	…	x2n	C2	I2	m2	y2	X2
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Sectionn	xn1	xn2	…	xnn	Cn	In	mn	yn	Xn
Initial investment	Remuneration for workers	w1	w2	…	wn					
	Total added value	v1	v2	…	vn					
	Total input	X1	X2	…	Xn					

2.2. Data Source

The data in this paper are selected from the 2017 China labor statistics yearbook and the 2017 149 department input-output table. Since there are only employment data of 19 major industries , considering the matching of data, this paper combined the input-output table of 149 sectors into the input-output table corresponding to 19 sectors on the basis of the input-output table of 149 sectors in 2017.Other variables are calculated from the data in the above two tables.

2.3. Non-competitive Input-output Model

The demand pull model is used to analyze the pull effect of final demand on domestic output, which includes the pull of foreign output. In order to only get the pull of domestic output, imports need to be excluded. Therefore, import coefficient M is introduced in this paper, wherem_i is industry import, $\sum_j x_{ij}$is total use of each industry, $Y_i^C$is the consumption of various industries,$Y_i^I$is the total capital formation of each industry. The direct consumption coefficient of domestic products is further introduced to obtain the non-competitive input-output table, where I is the identity matrix, $\hat{M}$ is the diagonal matrix of diagonal elementsM_j, and Eis the export:

$$M_i = m_i / \sum_j x_{ij} + Y_i^C + Y_i^I, A^{\mathrm{d}} = \mathrm{a}'_{ij} = (I - \hat{M})A$$

Then the non-competitive input-output model is expressed as:

$$Y^d = (I - \hat{M})(Y^C + Y^I) + \mathrm{E}, X^d = (I - A^d)^{-1} Y^d$$

In this paper, the ratio of the number of employees in each industry to the total output of each industry is taken as the labor input coefficient to measure the absorption capacity of the industry to the employees. The employment multiplier $W_j$is introduced to reflect the potential of the industry for the employment of employees [7].Where, $P_j$is the coefficient of labor force, $p_j$is the number of employment in each industry:

$$P_j = \frac{p_j}{x_j}, W_i = \sum_{i=1}^{n} a'_{ij} P_j \quad (1)$$

The income multiplier refers to the increment of labor remuneration in all sectors when the final demand of an industry increases by one unit under the condition that the final use of other industries remains unchanged. It reflects the contribution of the industry to the national

ISSN: 2688-9323

economy, where $W_j$is the coefficient of labor remuneration and W_j is the remuneration of workers in each industry:

$$W_j = \frac{w_j}{x_j}, H_j = \sum_{i=1}^{n} a'_{ij} W_j \tag{2}$$

The degree of forward induction reflects the supply of the industry to other industries, while the degree of backward influence reflects the demand of the industry to other industries. Meanwhile, the degree of backward correlation can be compared to determine the contribution of the industry to the total output of the national economy and the difference:

$$F_i = \frac{\sum_{j=1}^{n} b'_{ij}}{\frac{1}{n}\sum_i^j \sum_i^j a'_{ij}}, \quad E_j = \frac{\sum_{i=1}^{n} a'_{ij}}{\frac{1}{n}\sum_i^j \sum_i^j a'_{ij}} \tag{3}$$

In order to study how the inter-industry pull effect accumulates into a complete effect, the economic distance matrix is introduced, and the calculation formula is as follows:

$$V = L(L - I) \tag{4}$$

Obviously, the economic distance is greater than or equal to 1, and the economic distance with a large economic distance means that the correlation between two industries is dominated by indirect correlation, while the other way around is dominated by direct influence. In addition to the economic distance matrix, an industrial correlation matrix C should be defined:

$$C = |(L - I) + (G - I)|/2 \tag{5}$$

The matrix includes the Leontief model and the Ghosh model, indicating that the industry correlation degree includes both the demand side and the supply side. The identity matrix I is subtracted from both matrices to eliminate the effect of the initial injection. Another threshold value is introduced, which can exclude the relation of small total correlation effect between industries. On this basis, a matrix S is constructed. To take the integer symbol, rounding can be used to take the integer, a is the threshold[5].

$$S_{ij} = \begin{cases} int(V_{ij}) & f_{ij} \geq a \\ 0 & f_{ij} < a \end{cases} \tag{6}$$

2.4. Results Analysis

Firstly, calculate the labor input coefficient (p) and employment multiplier (W) according to formula (1).Results are shown in table 2, industries with high employment absorption include real estate, education, public management and social organization, construction, health, social security and social services, wholesale and retail, water conservancy, environment and public facilities management industry. Industries with weak employment absorption capacity include residential services and other services, agriculture, forestry, animal husbandry and fishery, power, gas and water production and supply, information transmission, computer services and software industry. Manufacturing, real estate, education, public administration and social organization, transportation, warehousing, post and telecommunications, and information transmission, computer services and software industries have a high potential for hiring employees, while the production and supply of electricity, gas and water, residential services and other service , culture, sports and entertainment, water conservancy, environment and public facilities management, transportation, warehousing and posts and telecommunications industry all have less employment potential.

Secondly, calculate the income multiplier (H) and industry relevance according to formulas (2) and (3).The income multiplier reflects the impact of a change in the industry's final demand on a unit's total revenue. The manufacturing industry, agriculture, forestry, animal husbandry and fishery, transportation, warehousing, post and telecommunications, information transmission industry, computer services and software industry have the top four multipliers, which have a strong driving force for national economic growth. The income multipliers of

ISSN: 2688-9323

industries with high employment absorption capacity or potential are all in the middle and lower positions of the 19 major industries. On the whole, the manufacturing, financial, information transmission, computer services and software, transportation, storage and post and telecommunications, and agriculture, forestry, animal husbandry, and fishery industries are highly correlated, which are 5.41, 2.27, 1.96, 1.47, and 1.39 respectively. These industries have made important contributions to the total output of the national economy, and at the same time their industrial correlations are greater than 1, indicating that these industries have greater demand for other industries than supply to other industries. The industries with high employment absorption or high-potential industries have relatively low industrial associations, among which the information transmission, computer service, and software industries rank third with 1.96, the wholesale and retail industries rank sixth with 0.97, and the other industries have industrial association Degrees are at the end of the 19 major industries.

Table 2. IndustryRelevance, Employment Multiplier, and Income Multiplier of Various Industries in China in 2017

Industry Number	Industrial Relevance	P(1*10-5)	W(1*10-5)	H
1	1.3944	0.0380	0.4071	0.9312
2	0.2551	0.1918	0.3285	0.2528
3	5.4137	0.0862	3.2044	2.6916
4	0.072	0.0525	0.0791	0.1743
5	0.5653	0.3395	0.5445	0.3567
6	0.9733	0.2510	0.4764	0.5598
7	1.4679	0.1491	0.6139	0.6502
8	0.651	0.1077	0.2754	0.3383
9	1.9640	0.0684	0.6135	0.6463
10	2.2662	0.1288	0.5456	0.4772
11	0.1341	1.6664	1.7222	0.1054
12	0.9645	0.1208	0.4790	0.6023
13	0.5017	0.2186	0.3446	0.3547
14	0.1865	0.2392	0.2749	0.3785
15	0.6258	0.0294	0.1583	0.5949
16	0.0282	0.8439	0.8539	0.3335
17	0.2072	0.2941	0.3353	0.5380
18	0.2075	0.2308	0.2658	0.4097
19	0.1429	0.6169	0.6465	0.5300

Note: Industry numbers 1-19 respectively represent agriculture, forestry, animal husbandry and fishery; mining industry; manufacturing industry; production and supply of electricity, gas and water; construction industry; wholesale and retail industry; transportation, storage and post and telecommunications industry; accommodation and catering industry; information transmission, computer service and software industry; finance industry; real estate industry; leasing and business services industry; scientific research, technical services and geological survey industry; water conservancy, environment and public facilities management industry; resident services and other service industries; Education; health, social security and social welfare; culture, sports and entertainment; public administration and social organization.

ISSN: 2688-9323

Thirdly, look from the circumstance that industry absorbs employment personnel of different educational level. Generally speaking, the education industry mainly absorbs highly educated employees, accounting for 80.4%. The industries that also mainly absorb high-education-level labor force are scientific research, technical services, geological exploration, and finance. Agriculture, forestry, animal husbandry and fishery have a strong ability to absorb low-education labor force, and only 1.7% of high-education laborers are engaged in agriculture, forestry, animal husbandry and fishery. Among industries with high employment capacity or potential, 0.6% of employees in the real estate industry have no education, 52.2% of primary education and 47.2% of higher education; the public management and social organization industry and the health, social security and social service industries mainly accept highly educated employees, accounting for 69.9% and 76.4% of their total employment respectively; the construction industry mainly receives primary education labor, accounting for industrial employment 87.3% of the staff. The specific results are shown in Table 3.Through the above analysis, we can obtain several industries with high employment absorption capacity and potential, as well as different industries' level of employment requirements for employees. However, any industry is not developed in a single way, so it is particularly important to obtain more detailed industry information and industry association networks for high employment absorption industries. Therefore, this article introduces economic distance to judge the dependence relationship between industries. According to the economic distance matrix calculated according to formulas (4), (5) and (6) (the results are not shown in the text), among industries with high employment absorption capacity or potential, the economic distance between the real estate industry and other industries is greater than 2, indicating that they Other industries are complex relationships that include direct and indirect effects. The construction industry is only directly related to the production and supply of electricity, gas and water, and is indirectly related to other industries; education and residential services and other services, health, social security and social welfare, culture, sports and entertainment public management and social organizations are directly related; information transmission, computer services and software are closely related to the financial industry, and indirectly related to real estate, leasing and business services. Taking the real estate industry as an example, this article uses economic distance to draw a simplified industrial chain of the real estate industry, as shown in Figure 1.

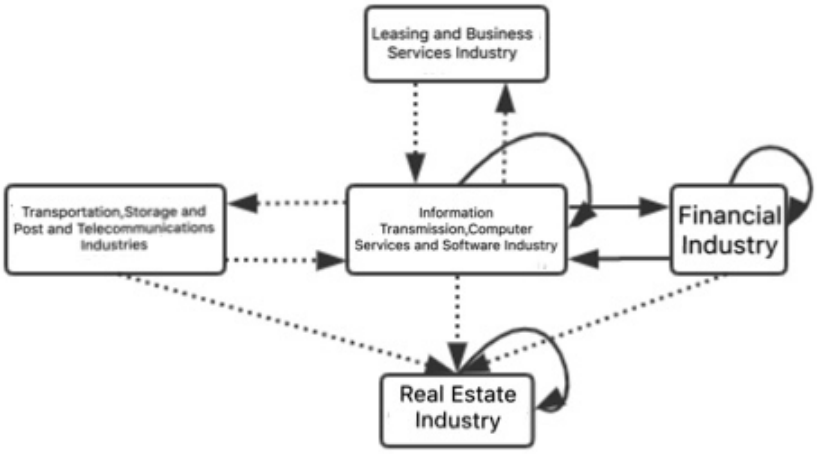

Figure 1. Simplified Real Estate Industry Chain

ISSN: 2688-9323

Table 3. Proportion of Employed Persons With Different Education Levels in Different Industries in China in 2017

Industry Number	Uneducated	Ranking	Primary Education	Ranking	Higher Education	Ranking
1	7.1%	1%	91.2%	1%	1.7%	19%
2	0.5%	9%	67.4%	8%	32%	12%
3	0.8%%	6%	74.8%	6%	24.4%	14%
4	0.4%	11%	48.3%	12%	51.4%	8%
5	1.1%	4%	87.3%	2%	11.6%	18%
6	0.7%	7%	71.9%	7%	27.6%	13%
7	0.5%	10%	75.4%	5%	24.2%	15%
8	1.1%	5%	83.5%	3%	20.6%	16%
9	0.2%	16%	23.8%	15%	75.9%	5%
10	0.1%	19%	23.6%	16%	76.6%	3%
11	0.6%	8%	52.2%	10%	47.2%	10%
12	0.4%	12%	49.6%	11%	50.1%	9%
13	0.2%	17%	22.5%	18%	77.5%	2%
14	2.7%	2%	64.2%	9%	33%	11%
15	2.3%	3%	79.3%	4%	18.4%	17%
16	0.2%	18%	19.4%	19%	80.4%	1%
17	0.3%	14%	23.4%	17%	76.4%	4%
18	0.4%	13%	45.8%	13%	53.7%	7%
19	0.3%	15%	29.7%	14%	69.9%	6%

3. Research Conclusions and Policy Recommendations

3.1. Research Conclusions

Through the above analysis, we find that there are differences in the employment absorption capacity and potential of different industries and the demand for employees at different educational levels. Most industries with high employment capacity are service industries, and these industries often have high employment absorption potential. After further calculating the income multipliers and industry correlations of the 19 major industries, it was found that the industries with high employment absorption capacity or high potential industries had smaller income multipliers and industry correlations, and their contribution to total output was less than other industries. This contradicts the requirement of rapid economic development in less developed areas, but information transmission, computer services, software, and wholesale and retail industries have a strong role in driving economic growth, which can meet the dual needs of high employment absorption and high economic pulling capacity. Finally, we quantitatively analyzed the needs of different industries for employment at different educational levels, and found that the education, financial industry, and scientific research, technical services and other industries mainly attract high-educated labor. Agriculture, forestry, animal husbandry and fishery, and the construction industry have a high absorption capacity for those with primary education. At the same time, high employment absorption and high economic stimulus industries have high requirements on capital, technology and resources. It is difficult for underdeveloped regions to build mature industrial chains in a short period of time. Therefore, by introducing an economic distance matrix, we have obtained highly dependent industries, on the one hand, underdeveloped regions can carry out industrial chain construction according to this, on the other hand, they can choose individual or combined industries to invest according to local conditions.

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3.2. Policy Recommendations

The transfer of talents to developed regions is an objective law of economic development under the market economy system, and artificially preventing the flow of talents to developed regions is a cure for the symptoms and not the root cause. Improving the level of economic development and the comprehensive social environment of the less developed regions,can naturally break down the barriers to talent movement and attract talent to the less developed regions. So we make the following suggestions:

The first is to prioritize the development of industries with high employment absorption capacity or potential. We must prioritize the development of industries with high employment absorption capacity and high employment absorption potential in rural areas, such as manufacturing, transportation, storage and post and telecommunications, real estate, education, wholesale and retail, construction and so on. At the same time, it is also necessary to promote the development of manufacturing, public management and social organization, construction, health, social security and social service industries, which have a strong driving force for economic growth. In addition, we must also take into account the coordinated development of upstream and downstream industries directly related to the above industries. These industries can provide more jobs and higher income levels, and can naturally attract talents to move to rural areas.

The second is to raise the average income level and the comprehensive social environment. On the one hand, we should prevent the brain drain, on the other hand, we should retain the imported talents. The attraction of a region to talents depends on the degree to which it meets the needs of talents themselves.

The sencond is it can attract talents from rural areas by increasing the average wage income level in rural areas, increasing the investment in transportation, health care and education resources, and improving the service capacity of public facilities. In addition, industries with high absorption capacity or strong potential are more likely to attract employees with high education level. However, employees with high education level need to be in an environment that can meet their needs of value realization, which requires appropriately increasing the material and spiritual rewards for rural employees with high education level to ensure that they can enjoy practical benefits and realize their own value.

The third is to guide the employment tendency of labor forces with different educational levels. It is necessary to improve the efficiency of personnel allocation, and guide the employment tendency of workers with different education levels according to the absorption capacity of employees with different education levels in different industries; hierarchical employment training is required for talents with different education levels, so as to ensure that the quantity and quality of talents are in harmony with the current and future development needs of rural development employment absorption capacity or potential industries; the distribution of different educated employment personnel must also be adjusted, highly educated employees often have stronger learning abilities, and have a moderate tilt in the distribution of talents towards industries that are highly driven by the regional economy.

The fourth is to accelerate the process of urbanization and adhere to the reform of the household registration system. The status quo of economic development in rural areas may not be able to carry too many people, and at the same time, returnees will also face the psychological gap and inconvenience caused by the huge urban-rural differences. Under such a realistic situation, accelerating the construction of small towns and promoting land intensification development has become a key measure to attract talents, which requires accelerating the process of urbanization and promoting the reform of the household registration system. It is necessary to appropriately improve the settlement conditions for

ISSN: 2688-9323

rural and small town populations to move to large and mega cities, while reducing the settlement costs of small towns and ensuring the same social benefits and guarantees as the original population.

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