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Study on Influencing Factors and Mechanism of Scientific and Technological Innovation Talents Gathering in Zhejiang Province

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Abstract

This paper systematically studies the influencing factors and mechanism of the agglomeration of scientific and technological innovation talents in Zhejiang Province. The findings are as follows: Firstly, environmental factors such as marketization level, financial development, opening to the outside world, infrastructure construction, medical resources, educational resources, cultural resources and policy support have a positive impact on the agglomeration of scientific and technological talents in Zhejiang Province; Secondly, in the transmission mechanism of the influence of various environmental factors on the concentration of scientific and technological talents in Zhejiang, economic development plays an intermediary role, and the effect is obvious. Various environmental factors indirectly affect the concentration of scientific and technological talents in Zhejiang through economic development. Finally, although both the level and quality of economic development have significant effect on the total concentration of scientific and technological talents in Zhejiang, the mediating effect of economic development level is more significant. These studies are for Zhejiang Province. It provides a theoretical basis for cultivating high-end talents and realizing the agglomeration of scientific and technological innovation talents.

Keywords

Scientific and Technological Innovation Talents, Talent Gathering, Action Mechanism

1. Introduction

At present, the talent demand prediction model driven by big data has become a research hotspot in the field of human resource management at home and

abroad. Many scholars and research institutions are exploring how to use big data analysis methods and technologies to establish talent demand accurate talent demand prediction model, and for the research of scientific and technological innovation talent agglomeration, the relevant literature mainly discusses from the following aspects:

1.1. Current Situation of Scientific and Technological Innovation Talent Gathering

Li Raui, Wu Dianting, Bao Jie *et al.* (2013) [1] found that the domestic origin or birthplace of CAS academicians, the place of obtaining the highest degree (degree) in China, and the place of long-term work in China are mainly distributed in the eastern coastal cities, and the distribution in the eastern, central and western economic regions presents a strong imbalance. Liao Jianqiao, Huang Shuyi and Liu Zhiqiang (2017) [2] found that the regional distribution coefficient of talents in China is much higher than the acceptable national income distribution (Gini) coefficient, but lower than the regional distribution coefficient of the top 500 enterprises in the United States. Li Zhenggang (2018) [3] analyzed the structure of scientific and technological talents in Chongqing from the perspectives of the total amount, structure and industrial distribution of scientific and technological talents. He believed that the total amount of scientific and technological talents in Chongqing was insufficient, regional and industrial development was unbalanced, high-level innovative and entrepreneurial talents were lacking, and the output efficiency of scientific and technological talents was not high. He also put forward suggestions from the aspects of talent policy formulation, talent introduction and training, and talent treatment. It can be seen that the current research on the status quo of science and technology talent agglomeration in China mostly uses the methods of talent quantity, talent quality, talent density and talent location entropy to measure the intensity, quality or equilibrium of regional science and technology talent agglomeration. According to the scientific calculation of statistical data, it is generally believed that the eastern region, especially the eastern coastal region, has a high degree of scientific and technological talent gathering. The rational analysis of the spatial distribution of scientific and technological talents is also based on the idea of the balance between the population number and regional geographical area in the population equilibrium, and it is believed that the regional distribution of scientific and technological talents in China is unbalanced.

1.2. Influencing Factors of Scientific and Technological Innovation Talent Agglomeration

Zhang Chunhai *et al.* (2011) [4] believe that regional economic development level, education environment, investment of scientific research funds, income level and living environment are the main factors affecting the agglomeration of scientific and technological talents in China. Han Weiya (2014) [5], on the basis of summarizing previous studies on factors affecting the agglomeration of scien-

tific and technological talents, constructed a measurement index system for the environmental competitiveness of the agglomeration of regional scientific and technological talents, including economic development level, living standard, technology, innovation, cultural and educational factors, and social security factors, and conducted an empirical study using the relevant cross-sectional data of Henan province. Zhang Xixi *et al.* (2014) [6] took the coupling degree and the coupling coordination degree as the evaluation index and constructed the coupling development evaluation model of Marine industry agglomeration and Marine science and technology talent agglomeration, quantitatively assessed the current situation of the collaborative development of Marine industry agglomeration and Marine science and technology talent agglomeration, and put forward countermeasures for the coordinated development of the two systems at the present stage. Wang Quangang and Zhao Yongle (2017) [7] analyzed the key factors affecting the flow and agglomeration of global high-end talents, and argued that talent policy is the original motivation of the flow and agglomeration of high-end talents. The change of economic pattern promotes the flow and agglomeration of high-end talents; The comprehensive social environment ultimately determines the flow and agglomeration of high-end talents. The environment of scientific and technological innovation is the connotation factor of the flow and agglomeration of high-end talents. Tong Yufen *et al.* (2018) [8] found that the spatial agglomeration pattern of the highly educated population in the Beijing-Tianjin-Hebei region, with Beijing and Tianjin as the center and Hebei as the periphery, and the coexistence of the population growth pole and population depression were mainly caused by the centriodynamics of high-end medical facilities, high-quality compulsory education resources, tertiary industry agglomeration level, and knowledge spillover. Zhang Meili *et al.* (2018) [9] believe that economic development level and financial education input have a significant positive impact on the concentration of scientific and technological talents in all regions, wage level and public service level have a significant positive correlation with the concentration of talents at the low score point, and urbanization level has a significant positive impact on the concentration of talents at the high score point. Universities have a significant positive impact on talent concentration at the middle sub-point. Xinxin Guo *et al.* (2018) [10] found that attracting talents is mainly based on economic factors and social public service factors, in which economic level, industrial results and scientific and technological atmosphere can significantly improve talent attraction. The cost of living will significantly reduce talent attraction; The effects of economic factors and social public service factors on the distribution of talents in east, middle and west regions are obviously different; The influence of social public service factors on talent distribution is weaker than that of economic factors. Zeng Xiankui (2018) [11] believes that the factors affecting labor migration mainly include regional economic development strength, public resource gathering power and future development potential. Su Chu *et al.* (2018) [12] found that regional social security level and livable environment have a significant positive correlation

with regional R&D talent agglomeration.

In addition, some domestic scholars studied and analyzed the individual organizational factors of the agglomeration of scientific and technological talents. Zhu Xingzhen (2002) [13] believed that the agglomeration of regional scientific and technological talents was driven by three factors, namely, interest, spirit and environment. Liao Zhongju *et al.* (2013) [14] showed that the income satisfaction of scientific and technological talents was generally low; Population background characteristics have significant differences on their professional and technical titles, job evaluations, and scientific and technological achievements evaluation and reward evaluation; The evaluation of scientific and technological achievements has a significant positive impact on income satisfaction, and the impact is the most powerful. Tang Chaoyong *et al.* (2014) [15], based on the perspective of extension theory, studied the formalized dynamic process of interest conflict of scientific and technological talents in scientific research teams and the influence of the agglomeration of scientific and technological talents, laying a foundation for the governance of interest conflict. Hou Zhenmei *et al.* (2014) [16] found that ethnic identity, education level, job satisfaction and life satisfaction are important factors affecting the concentration of scientific and technological talents. Zhu Puyi *et al.* (2014) [17] found that quantitative and qualitative job insecurity of scientific and technological talents has a significant negative impact on innovation behavior. Li Yanping *et al.* (2018) [18] analyzed seven types of influencing factors of urban talents' residence intention and residence behavior: individual city emotion/fit, survival, relatives and friends, government, city, individual ability and chance. It can be seen that researches on the influencing factors of the agglomeration of scientific and technological talents in China are mostly conducted from the perspectives of individual demand of scientific and technological talents, organization and social environment, and the correlation between each influencing factor and the current situation of the agglomeration of scientific and technological talents in China is measured by quantitative methods. Meanwhile, this article explores the environmental factors that influence talent concentration in Zhejiang Province, and investigates the mediating effects of the level and quality of economic development on the agglomeration of scientific and technological talents in Zhejiang. This provides a theoretical foundation for cultivating high-end talents and achieving the agglomeration of innovative scientific and technological talents in Zhejiang Province.

2. Research Hypothesis and Model Setting

The gathering environment of science and technology talents in Zhejiang is mainly divided into innovation organization environment, economic development environment, social management environment, cultural and educational environment and natural ecological environment. Various gathering environment factors affect the formation and development of the scale of the gathering of science and technology talents. The development of various environment also

affects the urban economic development, which is mainly reflected in that the level of urban economic development mainly relies on the comprehensive development of the city. The innovation organization, economic development degree, social security level, cultural atmosphere creation and natural ecological environment development directly affect the improvement of urban economic development level and economic development quality. The improvement of the level and quality of urban economic development will further promote the development of Zhejiang science and technology talent cluster. The larger the scale of science and technology talent cluster, the more it will in turn affect the development of urban economy.

Therefore, what is the direct effect of the agglomeration environment factors on the agglomeration of scientific and technological talents? How do various factors affect the agglomeration of scientific and technological talents in Zhejiang through economic development? What is the intermediary effect of economic development? In order to aim at the key factors affecting the agglomeration of science and technology talents in Zhejiang, this paper conducts further research on the agglomeration environment of science and technology talents in Zhejiang. Based on the analysis of the gathering environment of scientific and technological talents in Zhejiang, a theoretical model of the influencing mechanism and path of the gathering environment factors and economic development on the gathering of scientific and technological talents is constructed to carry out an empirical analysis, and the following assumptions are made:

1) In the transmission mechanism of the influence of various environmental factors on the agglomeration of scientific and technological talents in Zhejiang, economic development plays an intermediary role, and the effect is obvious. Various environmental factors indirectly affect the concentration of scientific and technological talents in Zhejiang through economic development.

2) Marketization level, financial development, opening to the outside world, infrastructure construction, medical resources, educational resources, cultural resources, policy support and other environmental factors have a relatively stable and positive impact on the concentration of scientific and technological talents in Zhejiang, and the effect is obvious.

3) The interaction between economic development and the concentration of scientific and technological talents in Zhejiang is a cause and effect of each other. The concentration of scientific and technological talents in Zhejiang adversely affects the economic development of Zhejiang and contributes to the economy.

In order to investigate the impact of various environmental factors on the concentration of scientific and technological talents in Zhejiang, the baseline regression model is constructed as follows:

$$y_i = \alpha_0 + \alpha_1 X_i + u_i \tag{1}$$

In the above formula, y_i is the dependent variable (full-time equivalent of scientific and technological talents in Zhejiang/number of scientific and technological talents activities in Zhejiang); X_i is various environmental factors,

including: marketization level (mark), financial development (fin), opening to the outside world (open), infrastructure development (inf), medical resources (med), educational resources (edu), cultural resources (cul), policy support (pol), etc.; u_i Are random perturbation items. In order to further study the direct effects of various environmental factors on the concentration of scientific and technological talents in Zhejiang, as well as the indirect effects of various environmental factors on the concentration of scientific and technological talents in Zhejiang through affecting the level and quality of economic development, this study adopts the intermediary effect model for analysis, as follows:

$$M_i = \beta_0 + \beta_1 X_i + u_i \tag{2}$$

$$y_i = \gamma_0 + \gamma_1 X_i + \gamma_2 M_i + u_i \tag{3}$$

$$y_i = (\gamma_0 + \gamma_2 \beta_0) + (\gamma_1 + \gamma_2 \beta_1) X_i + u_i \tag{4}$$

Substitute formula (2) into formula (3) to get formula (4). Among them, formula (1) α_1 measures the total effect of various environmental factors on the concentration of scientific and technological talents in Zhejiang. Formula (2) β_1 measures the effects of various environmental factors on the intermediary variables M_i, including the level of economic development (gdp) and the quality of economic development (tfp). What is measured in formula (3) γ_1 is the direct effect of various environmental factors on the agglomeration of scientific and technological talents in Zhejiang, and what is measured in formula (4) $\gamma_2\beta_1$ is the indirect effect of various environmental factors on the agglomeration of scientific and technological talents in Zhejiang through intermediary variables.

3. Introduction of Variables

3.1. Dependent Variables

1) Full-time equivalent of scientific and technological talents: The full-time equivalent of research and experimental development personnel (R&D) is selected as the scale index of scientific and technological talents agglomeration, which is the sum of the workload of full-time R&D personnel whose cumulative working hours account for 90% or more of the total working hours in the whole year and the workload converted by the actual working hours of part-time personnel. Therefore, the full-time equivalent of R&D personnel can better reflect the labor input of scientific and technological talents in scientific and technological innovation activities, and reflect the scale of scientific and technological talents gathering. The data are from China Science and Technology Statistical Yearbook.

2) Number of talents in science and technology activities: The number of personnel in science and technology activities is selected as the robustness test index for the analysis of the influencing factors of scientific and technological talent agglomeration. The term "personnel engaged in scientific and technological activities" refers to those who are directly engaged in scientific and technological activities, as well as those who are engaged in the management of scientific and

technological activities and those who provide direct services for scientific and technological activities. Personnel directly engaged in scientific and technological activities include: personnel engaged in scientific and technological activities in research rooms, laboratories, technology development centers, pilot workshops (bases) and other institutions run by units; Although they do not work in the above institutions, they are included in the scientific and technological activities project (subject) group. Personnel engaged in the management of scientific and technological activities and providing direct services for scientific and technological activities include: administrative personnel related to scientific and technological activities, and personnel who directly provide services for scientific and technological activities such as documentation, material supply, equipment maintenance, etc. The data were obtained from "Zhejiang Statistical Yearbook".

3.2. Core Explanatory Variables

1) Marketization level (mark): The marketization level of a region reflects the extent to which the market plays a role in the allocation of resources for regional development. The higher the marketization level of a region, the fewer obstacles to the flow of scientific and technological personnel. Sun Jian, Ding Xuemeng (2019) used the relative index of regional marketization process to measure the marketization level of a region. Based on the availability of time series data, this study uses the proportion of private employment in Zhejiang (the number of employment in private enterprises/the number of employees) to measure the marketization level of Zhejiang, which is derived from "Zhejiang Statistical Yearbook".

2) Financial Development (fin): The development of the monetary market plays an important role in the study and absorption of advanced technologies by scientific and technological talents, which affects the phenomenon of the agglomeration of scientific and technological talents and the agglomeration effect. Using the method of Lu Feng and Yao Yang for reference, this study uses the proportion of RMB domestic loans (RMB domestic loans/GDP) as the main index to reflect the level of financial development in Zhejiang, and the data comes from "Zhejiang Statistical Yearbook".

3) Degree of Openness to the outside world: He Zhang and Qin Donghai (2003) *et al.* use the proportion of total imports and exports to GDP to measure the level of economic openness to the outside world of each region, while this paper uses Ji Danjun (2016) to measure the level of openness to the outside world by the proportion of foreign direct investment to GDP (foreign direct investment/GDP). The data comes from "Zhejiang Statistical Yearbook".

4) Infrastructure Construction (inf): Infrastructure construction directly reflects the development level of urban construction, and areas with better infrastructure construction are more conducive to the flow and exchange of scientific and technological talents. At the same time, Aschauer's (1989) research shows that infrastructure plays a positive role in promoting economic growth. Yao

Xianguo, Zhang Haifeng *et al.* (2008) used the mileage of highways per 10,000 square kilometers. In this paper, considering the current status and future trend of urban development in Zhejiang, the number of operating kilometers of public transportation was used to measure the infrastructure construction in Zhejiang. The data were derived from "Zhejiang Statistical Yearbook".

5) Medical resources (med): Tong Yufen and Liu Hui (2018) [8] believe that medical facilities are the core element of regional public service level, and the measurement indicators include per capita medical and drug cost of discharged patients, number of health workers per 10,000, number of beds in medical institutions per 10,000, number of three hospitals, etc. This study draws on the practice of Han Weiya (2014) [5] and uses the number of hospital beds per thousand registered population to measure the development degree of medical resources in Zhejiang, with data from "Zhejiang Statistical Yearbook".

6) Education Resources (edu): Cities with a higher level of higher education development have greater advantages in training, attracting and retaining talents. Considering that scientific and technological talents pay more attention to the environment and level of their children's education, this study uses the number of students in various schools to measure the level of urban educational resources.

7) Cultural resources (cul): Han Weiya 164 *et al.* chose the number of books owned by 100 people as the main measurement index. Based on the availability of time series data, this study uses the total volume of library books to measure the development of cultural resources in Zhejiang, and the data comes from "Zhejiang Statistical Yearbook".

8) Policy Support (pol): Talent policy, science and technology innovation policy and other policies are important guarantees for the concentration of science and technology talents. This study uses the method of Lu Lixiang and Niu Xiaoyan for reference, and adopts the proportion of government fiscal expenditure (government fiscal expenditure/GDP), with data from "Zhejiang Statistical Yearbook".

3.3. Mediating Variables

1) Economic development speed (gdp): The GDP can directly reflect the economic development level of the region, and the data is easy to obtain and more accurate. According to the corresponding data of "Zhejiang Statistical Yearbook", the gdp deflator is obtained with 1978 as the base period; and the data to do the correct processing.

2) Economic Development Quality (TFPi). The DEA-Malmquist index method was used to measure the growth rate of total factor production in Zhejiang. The Malmquist index method of total factor productivity based on DEA method can avoid the strong assumption condition when calculating Solow residual. Using Zhang Jun *et al.*'s estimation method for reference, the capital stock is calculated by using the total fixed capital formation over the years through the

perpetual inventory method. Labor input adopts the number of employees at the end of the year. Finally, DEAP2.1 was used to calculate Malmquist index.

3.4. Statistical Description of Data

Descriptive results of specific variables in this study are shown in Table 1 below.

4. Analysis of Empirical Results

4.1. Path Analysis of Scientific and Technological Talent Agglomeration with Economic Development Speed as the Intermediary Variable

GDP is taken as the intermediary variable, and the full-time equivalent of scientific and technological talents in Zhejiang is taken as the dependent variable. The

Table 1. Descriptive statistics of each variable.

Variable names	Code	Definition and assignment	Observed quantities	Mean
Full-time equivalent of science and technology talent	*y*1	Scientific and technological personnel The sum of the workload of full-time personnel (personnel engaged in scientific and technological activities during the year whose cumulative working time accounts for 90% or more of the total working time) and the workload of part-time personnel converted according to the actual working time. The data should be processed correctly	21	166175.8
Number of talents in science and technology activities	*y*2	Scientific and technological activities personnel refer to those who are directly engaged in scientific and technological activities, as well as those who are engaged in the management of scientific and technological activities and those who provide direct services for scientific and technological activities. Do the right processing of data	26	404102.9
Marketization level	*mark*	Share of private employment (employment in the private sector/number of people employed); And correct data processing	26	22.66
Financial development	*fin*	The proportion of RMB domestic loans (RMB domestic loans/GDP); And correct the data	26	182.85
Open to the public	*open*	Share of foreign direct investment (FDI/GDP); And get the data right	26	4.83
Infrastructure construction	*inf*	Kilometres operated by public transport; And correct data processing	26	14580.65
Medical Resources	*med*	Number of hospital beds per 1000 registered population; And correct data processing	26	6.29
Educational Resources	*edu*	Number of students enrolled in schools by type; And matching the data	26	2,778,923
Cultural Resources	*cul*	Total number of collections of library books; Data matching process	26	3763.96
Policy Support	*pol*	Share of government expenditure (government expenditure/GDP); And get the data right	26	17.7
Level of economic development	*gdp*	The *gdp* deflator is obtained using 1978 as the base period; And the data are treated correctly	26	436.06
Quality of economic development	*tfp*	The *tfp* was estimated according to Zhang Jun *et al.*, and the Malmquist total factor productivity index was estimated based on DEA method; And the data are processed correctly	26	1.02

influence of various environmental factors on the agglomeration of scientific and technological talents in Zhejiang was obtained through path regression analysis and two-step method, and the results are shown in Table 2. In terms of

Table 2. Analysis results of the path influencing the concentration of scientific and technological talents (GDP as the intermediary variable).

Paths	Coefficient	Standard Error	*t*
mark → *y*1	0.2336***	0.0157	14.9
mark → *gdp*	0.1529***	0.0179	8.52
mark, *gdp* → *y*1	0.1186***	0.0180	6.59
	0.7516**	0.1048	7.17
fin → *y*1	1.2446*	0.5983	2.08
fin → *gdp*	1.0232**	0.4048	2.53
fin, *gdp* → *y*1	0.2053	0.2022	1.02
	1.4170***	0.0992	14.29
open → *y*1	−0.8586***	0.1345	6.38
open → *gdp*	−0.6817***	0.0623	10.95
open, *gdp* → *y*1	0.5333***	0.1212	4.38
	2.041***	0.1658	12.31
inf → *y*1	1.3559***	0.2682	5.05
inf → *gdp*	0.9440***	0.1927	4.9
inf, *gdp* → *y*1	0.149	0.1639	0.91
	1.2784***	0.1297	9.85
med → *y*1	3.3143***	0.3978	8.33
med → *gdp*	2.2948***	0.2994	7.66
med, *gdp* → *y*1	0.73	0.4384	1.66
	1.1263***	0.1661	6.78
edu → *y*1	1.7629***	0.2069	8.52
edu → *gdp*	1.1858***	0.1697	6.99
edu, *gdp* → *y*1	0.5084*	0.1997	2.55
	1.0579***	0.1429	7.4
cul → *y*1	1.4402***	0.1168	12.33
cul → *gdp*	1.0106***	0.0862	11.72
cul, *gdp* → *y*1	0.4880*	0.2474	1.97
	0.9423***	0.2295	4.11
pol → *y*1	1.2543***	0.2578	4.87
pol → *gdp*	0.8456***	0.1916	4.41
pol, *gdp* → *y*1	0.2001	0.1415	1.41
	1.2468***	0.1191	10.47

Note: *, ** and *** are significant at the 10%, 5% and 1% levels respectively.

the total effect on the concentration of scientific and technological talents in Zhejiang, the environmental factors such as marketization level, opening to the outside world, infrastructure construction, medical resources, educational resources, cultural resources and policy support all have significant effect at the statistical level of 0.001 ($P < 0.001$). The financial development was significant at the statistical level of 0.05 ($P < 0.05$). Specifically, for each unit increase of marketization level, financial development, infrastructure construction, medical resources, educational resources, cultural resources, policy support and other environmental factors, the total effect of Zhejiang's scientific and technological talent agglomeration will be significantly increased by 0.23, 1.24, 1.36, 3.31, 1.76, 1.44, 1.25 units, respectively. And for every unit increased in opening to the outside world, the total effect was significantly reduced by 0.86 units.

From the point of view of the direct effect on the concentration of scientific and technological talents in Zhejiang, the environmental factors such as marketization level and opening to the outside world have a significant effect at the statistical level of 0.001 ($P < 0.001$); While educational resources, cultural resources and other environmental factors were significant at the statistical level of 0.05 ($P < 0.05$). Specifically, for every unit increase in marketization level, opening to the outside world, cultural resources and other environmental factors, the direct effect of the concentration of scientific and technological talents in Zhejiang will be significantly increased by 0.12, 0.53, 0.51 and 0.49 units, respectively. Among the effects of various environmental factors on the concentration of scientific and technological talents in Zhejiang, what role does GDP play as an intermediary variable? How do these factors affect the concentration of scientific and technological talents in Zhejiang through GDP? What are the indirect effects? These questions require deeper analysis. Therefore, further results are obtained by using Sobel test and Structuralequation modeling (SEM), as shown in Table 4. In terms of the indirect effects on the concentration of scientific and technological talents in Zhejiang, the environmental factors such as marketization level, opening to the outside world, infrastructure construction, medical resources, educational resources, cultural resources and policy support all have significant effects at the statistical level of 0.001 ($P < 0.001$), while the intermediary effect of GDP is significant ($P < 0.001$). The financial development was significant at the statistical level of 0.05 ($P < 0.05$), and the intermediary effect was significant at the statistical level of 0.01 ($P < 0.05$). Specifically, for each unit increase in marketization level, financial development, infrastructure construction, medical resources, educational resources, cultural resources, policy support and other environmental factors, the indirect effect of the concentration of scientific and technological talents in Zhejiang will be significantly increased by 0.11, 1.45, 1.21, 2.58, 1.25, 0.95, 1.05 units respectively; And the indirect effect was significantly reduced by 1.39 units for every unit increase in opening to the outside world. The contribution of each environmental factor to the indirect effect of the concentration of scientific and technological talents in Zhejiang is 49.20%, 116.50%, 162.11%, 89.01%, 77.98%, 71.16%, 66.12% and 84.05%, respec-

tively. It can be seen that the intermediary effect is very obvious and the contribution degree is very high. In addition to the marketization level, the indirect effect of other environmental factors on the concentration of scientific and technological talents in Zhejiang is more than the direct effect.

4.2. Analysis of the Path of Scientific and Technological Talent Agglomeration with Economic Development Speed as the Intermediary Variable

The TFP growth rate is taken as the intermediary variable, and the full-time equivalent of scientific and technological talents in Zhejiang is taken as the dependent variable. The influence of various environmental factors on the concentration of scientific and technological talents in Zhejiang was obtained through path regression analysis and two-step method, and the results are shown in Table 3. The total effect of various environmental factors on the agglomeration of scientific and technological talents in Zhejiang is the same as the results in Table 2.

From the point of view of the direct effect on the concentration of scientific and technological talents in Zhejiang, the level of marketization, opening to the outside world, medical resources, educational resources, cultural resources and other environmental factors have a significant effect at the statistical level of 0.001 ($P < 0.001$). The environmental factors such as infrastructure construction and policy support were significant at the statistical level of 0.05 ($P < 0.05$). Specifically, for every unit increase in marketization level, infrastructure construction, medical resources, educational resources, cultural resources, policy support and other environmental factors, the direct effect of the concentration of scientific and technological talents in Zhejiang will be significantly increased by 0.21, 1.04, 3.42, 1.53, 1.64, 0.95 units, respectively. And the direct effect of opening to the outside world will be reduced by 0.71 units for every unit increase.

Among the effects of various environmental factors on the agglomeration of scientific and technological talents in Zhejiang, what role does TFP play as an intermediary variable? How do these factors affect the concentration of scientific and technological talents in Zhejiang through TFP, and what are the indirect effects? These problems need more in-depth analysis. Sobel test and Structural equation modeling (SEM) were used to obtain further results, as shown in Table 4. From the indirect effect on the concentration of scientific and technological talents in Zhejiang, only the environmental factors such as marketization level and financial development have a significant effect at the statistical level of 0.05 ($P < 0.05$), and the intermediary effect is significant ($P < 0.05$). Specifically, for every 1 unit increase in marketization level, financial development and other environmental factors, the indirect effect of Zhejiang science and technology talent agglomeration will be significantly increased by 0.02 and 0.90 units respectively. The contribution of each environmental factor to the indirect effect of the concentration of scientific and technological talents in Zhejiang is 8.93%, 72.50%, 16.89%, 23.18%, −3.33%, 13.46%, −14.15% and 24.66%, respectively. It can be seen that the intermediary effect is very poor and the contribution degree is very

low. In addition to the marketization level and financial development, the indirect effects of other environmental factors on the accumulation of scientific and technological talents in Zhejiang are not obvious, and far lower than the direct effects.

Table 3. Analysis results of the path affecting the concentration of scientific and technological talents (with TFP growth rate as the intermediary variable).

Paths	Coefficient	Standard Error	*t*
mark → *y*1	0.2336***	0.0157	14.9
mark → *tfp*	−0.0075**	0.0025	2.99
mark, *tfp* → *y*1	0.2127***	0.0175	12.16
	−2.7788**	1.32	2.11
fin → *y*1	1.2446*	0.5983	2.08
fin → *tfp*	−0.0844*	0.0305	2.77
fin, *tfp* → *y*1	0.3422	0.6105	0.56
	−10.6968*	3.8785	2.76
open → *y*1	−0.8586***	0.1345	6.38
open → *tfp*	0.0343**	0.0103	3.32
open, *tfp* → *y*1	−0.7135***	0.1642	4.34
	4.2276	2.9006	1.46
inf → *y*1	1.3559***	0.2682	5.05
inf → *tfp*	−.0621**	0.0173	3.6
inf, *tfp* → *y*1	1.0415**	0.3379	3.08
	5.0633	3.4647	1.46
med → *y*1	3.3143***	0.3978	8.33
med → *tfp*	−0.1525***	0.031	4.92
med, *tfp* → *y*1	3.4246***	0.6156	5.56
	0.7231	3.0215	0.24
edu → *y*1	1.7629***	0.2069	8.52
edu → *tfp*	−0.0606**	0.0205	2.96
edu, *tfp* → *y*1	1.5256***	0.2369	6.44
	−3.9165*	2.1963	1.78
cul → *y*1	1.4402***	0.1168	12.33
cul → *tfp*	−0.0635***	0.0123	5.14
cul, *tfp* → *y*1	1.6440***	0.1746	9.42
	3.2102	2.0982	1.53
pol → *y*1	1.2543***	0.2578	4.87
pol → *tfp*	−0.0587**	0.0162	3.63
pol, *tfp* → *y*1	0.9450**	0.325	2.91
	5.2745	3.5436	1.49

Note: *, ** and *** are significant at the 10%, 5% and 1% levels respectively.

Table 4. Effects of each influencing factor, GDP and TFP growth rate on the concentration of scientific and technological talents.

Paths	Direct action effect	Indirect acting effect	Total acting effect	Intermediate variable	Mediating effect in total effect (%)	Ratio of indirect effect to direct effect
mark → *y*1	0.1186***	0.1149***	0.2336***	*gdp*	49.20***	0.9686
fin → *y*1	0.2053	1.4499**	1.2446**		116.50**	7.0622
open → *y*1	0.5333***	−1.3918***	−0.8586***		162.11***	2.61
inf → *y*1	0.149	1.2068***	1.3559***		89.01***	8.0968
med → *y*1	0.7300*	2.5845***	3.3143***		77.98***	3.5416
edu → *y*1	0.5084***	1.2545***	1.7629***		71.16***	2.4672
cul → *y*1	0.4880*	0.9523***	1.4402***		66.12***	1.9514
pol → *y*1	0.2001	1.0542***	1.2543***		84.05***	5.2683
mark → *y*1	0.2127***	0.0208*	0.2336***	*tfp*	8.93*	0.098
fin → *y*1	0.3422	0.9024*	1.2446*		72.50*	2.6368
open → *y*1	−0.7135***	0.145	−0.8586***		16.89	0.2033
inf → *y*1	1.0415***	0.3143	1.3559***		23.18	0.3018
med → *y*1	3.4246***	0.1103	3.3143***		3.33	0.0322
edu → *y*1	1.5256***	0.2373	1.7629***		13.46	0.1555
cul → *y*1	1.6440***	0.2038	1.4402***		14.15	0.1239
pol → *y*1	0.9450**	0.3094	1.2543***		24.66	0.3274

Note: *, ** and *** are significant at the 10%, 5% and 1% levels respectively.

5. Conclusions and Policy Recommendations

According to the research conducted in this paper, the influencing factors and mechanisms of science and technology talent aggregation in Zhejiang Province were systematically studied, and the following conclusions were drawn: 1) Environmental factors such as marketization level, financial development, opening up, infrastructure construction, medical resources, educational resources, cultural resources, and policy support have a positive impact on the aggregation of science and technology talents in Zhejiang Province, and their effects are significant. 2) Among the various environmental factors that influence the aggregation of science and technology talents in Zhejiang Province, economic development plays an intermediary role, and its effect is significant. The various environmental factors indirectly affect the aggregation of science and technology talents in Zhejiang Province through the channel of economic development. 3) Although both the level and quality of economic development significantly contribute to the overall utility of aggregating science and technology talents in Zhejiang Province, the intermediary role of the level of economic development on the aggregation of science and technology talents in Zhejiang Province is more pronounced.

Based on the research findings mentioned above, the following are the policy recommendations: 1) Enhancing Marketization: Promote market-oriented reforms and create a favorable business environment to attract scientific and technological talents. This can be achieved by reducing bureaucratic red tape, streamlining regulations, and encouraging entrepreneurship; 2) Strengthening Financial Development: Improve access to funding and investment opportunities for research and development activities. This can be done by establishing venture capital funds, providing tax incentives for innovation, and supporting the development of financial institutions that cater to the specific needs of technology-driven industries; 3) Promoting Openness and Global Integration: Foster international collaborations and attract foreign talents and investments. This can be achieved through policies that encourage knowledge exchange, facilitate technology transfer, and create platforms for global cooperation.

Fund Project

Zhejiang Soft Science Research Project: Mechanism analysis and realization path research of Flexible agglomeration of international Top innovative talents in Zhejiang Province under the background of big Data (Project No.: 2022C35077).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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