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A Study on the Impact of Agglomeration Economy on the Employment of University Graduates: An Empirical Analysis Based on the Synergistic Effect of the Chang-Zhu-Tan Urban Agglomeration

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Abstract:
This paper investigates the impact of economic agglomeration on university graduates' employment, using the "Chang-Zhu-Tan" urban agglomeration in Hunan Province as a case study. Drawing on data from 2000 to 2022 across the three cities, the study employs 69 valid sample points, incorporating variables such as employment, industrial agglomeration, urbanization, fiscal expenditure, financial development, and economic growth. Empirical analysis based on the model data and underlying mechanisms reveals that the level of economic agglomeration has a significant positive effect on regional employment rates. As agglomeration increases, employment opportunities in the region also rise, offering valuable insights for policymakers aiming to enhance employment outcomes for local university graduates.

Keywords:
graduate employment; economic agglomeration; urban agglomeration

1. Introduction

Against the backdrop of China's ongoing economic transformation and the massification of higher education, the employment of university graduates has become a critical social issue—marked simultaneously by labor shortages and difficulties in graduate employment. As China's urbanization continues to accelerate, the Chang-Zhu-Tan urban agglomeration—comprising Changsha, Zhuzhou, and Xiangtan—has emerged as a pilot zone for comprehensive reform within the framework of the national "Two-Oriented Society" initiative. Driven by favorable policies, this region has experienced rapid economic growth and notable industrial agglomeration, making it the most economically advanced and resource-rich area in Hunan Province [1].

At the same time, the Chang-Zhu-Tan region boasts abundant higher education resources, producing a large number of university graduates each year whose employment patterns are closely tied to regional economic development. This paper aims to empirically explore the relationship between economic agglomeration and graduate employment, offering insights that can assist governments in optimizing resource allocation, foster-

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ing agglomeration-driven economic growth, and encouraging local employment among university graduates.

2. Literature Review

The concept of economic agglomeration was first introduced by German economist Alfred Weber in 1909, who posited that the spatial concentration of industries facilitates labor specialization and reduces transaction costs by linking supply and demand more directly. Firms decide whether to cluster based on a cost-benefit analysis of agglomeration effects [2]. In China, research on economic agglomeration began relatively late and has largely drawn on foreign methodologies and theoretical frameworks [3]. In recent years, however, the rapid growth of the Chinese economy has brought increased academic attention to agglomeration effects. Most domestic studies have focused on the impact of industrial, manufacturing, and population agglomeration on regional economic performance [3], while the relationship between agglomeration economies and university graduate employment remains underexplored.

Local governments in China have become active participants in market-driven economic activities and have introduced a series of policies to attract investment, playing a key role in shaping patterns of industrial agglomeration [4]. As the first nationally recognized urban agglomeration in central China, the Chang-Zhu-Tan region shoulders the dual responsibility of enhancing the provincial capital's role and promoting balanced regional development. Data show that in 2022, the economic output of Chang-Zhu-Tan surpassed 2.02 trillion RMB, accounting for over 40% of Hunan's total GDP. The region was home to more than 6,000 large-scale industrial enterprises, highlighting its significant industrial concentration.

As Chang-Zhu-Tan's integration process advances, the urban cluster is evolving into a dual-structured economic zone: a service industry hub centered in Changsha and manufacturing belts radiating outward through cities like Yueyang, Zhuzhou, and Xiangtan. However, this economic advantage has not fully translated into talent retention. According to the 2022 Employment Quality Brief Report for General Higher Education Graduates in Hunan Province, only 57.92% of graduates who signed employment agreements or contracts remained in Hunan. Specifically, 54.14% remained in Changsha, 4.7% in Zhuzhou, and 3.4% in Xiangtan—while nearly one-third of graduates migrated to more economically developed areas such as the Yangtze River Delta and Pearl River Delta.

Thus, a pressing challenge for the Chang-Zhu-Tan urban agglomeration is how to transform its "physical aggregation" of economic resources into a "chemical reaction" that generates synergistic effects. Breaking down administrative barriers and establishing a collaborative governance mechanism among the three cities is key to overcoming the region's talent retention dilemma.

3. Research Methodology and Analysis

This study investigates the impact of economic agglomeration on university graduate employment, using a static panel regression model. The analysis focuses on three cities—Zhuzhou, Xiangtan, and Changsha—over the period from 2000 to 2022. A total of 69 valid data samples were collected across the three cities. The data used in this study were sourced from the China Urban Statistical Yearbook and the EPS database.

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3.1 Variable Description

To measure economic agglomeration, this study uses the level of industrial agglomeration as a proxy. Specifically, industrial agglomeration is represented by the number of employed persons (in ten thousand) divided by the administrative area (in square kilometers), as suggested by prior research [5]. Due to the unavailability of region-specific graduate employment rate data, the overall employment rate of each city is used as a substitute indicator.

In addition to the core explanatory variable, several control variables were included to improve the robustness of the model. These are: per capita GDP (logged), government expenditure, financial development, and urbanization rate.

The specific variables and their definitions are summarized in Table 3-1 below:

Table 3-1

Type	Definition	Code	Description
Dependent Variable	Employment Rate	job	Number of employed persons / Total population
Independent Variable	Industrial Agglomeration	IC	Number of employed persons / Administrative area
Control Variable	Urbanization Rate	Urb	Urban population / Total population
	Government Expenditure	Gov	Fiscal expenditure / GDP
	Financial Development	loan	Total loans / GDP
	Economic Development	lnGDP	Natural logarithm of per capita GDP

3.2 Model Specification

To examine the relationship between economic agglomeration and employment, this study constructs the following static panel regression model:

$$job_{it} = \alpha_0 + \alpha_1 IC_{it} + \alpha_i X_{it} + \varepsilon_{it} \quad \text{(Equation 3-1)}$$

Where α_0 is the intercept term; ε_{it} represents the random error term. If $\alpha_1 > 0$, it suggests that a higher degree of economic agglomeration is associated with an increase in the regional employment rate. Conversely, if $\alpha_1 < 0$, it indicates that economic agglomeration has a negative impact on regional employment. X_{it} represents the set of control variables.

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3.3 Descriptive Statistics

Table3-2

Variable	N	Mean	Standard Deviation	Minimum	Maximum
job	69	0.120	0.0364	0.0762	0.203
IC	69	0.00648	0.00480	0.00252	0.0309
lngdp	69	10.56	0.889	8.965	11.85
Urb	69	0.313	0.0523	0.259	0.415
gov	69	0.109	0.0297	0.0441	0.177
loan	69	0.943	0.488	0.384	2.120

Descriptive statistics show that the mean employment rate across the sample is 0.12, with a minimum value of 0.0762 and a maximum value of 0.203. The average level of industrial agglomeration is 0.00648.

3.4 Correlation Analysis

To ensure the reliability of the regression results and to avoid empirical bias caused by multicollinearity, this study conducts a correlation analysis of the main variables prior to model estimation. The results of this analysis are presented in Table 3-3.

Table 3-3

	job	IC	lngdp	Urb	gov	loan
job	1					
IC	0.769***	1				
lngdp	0.699***	0.479***	1			
Urb	0.800***	0.695***	0.545***	1		
gov	0.182	0.0740	0.690***	-0.111	1	
loan	0.621***	0.615***	0.399***	0.889***	-0.145	1

The results show that the correlation coefficient between the economic agglomeration variable (IC) and the dependent variable (job) is 0.769, which is significantly positive at the 1% level. This suggests that a higher level of economic agglomeration is associated with increased regional employment rates.

3.5 Regression Analysis

A multiple regression model was employed to estimate the effect of economic agglomeration on employment. The regression results are shown in Table 3-4.

Table 3-4

job	Coefficient	Std. err.	t	P>t
IC	2.7318	0.5759	4.7400	0.0000
lngdp	0.0148	0.0063	2.3500	0.0220
Urb	0.4232	0.1284	3.3000	0.0020
gov	-0.0856	0.1572	-0.5400	0.5880
loan	-0.0221	0.0092	-2.4100	0.0190
_cons	-0.1566	0.0333	-4.7000	0.0000
N=69,F=57.55,R2= 0.8204				

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As shown in Table 3-4, the P-value for the independent variable IC is 0.000, which is below the 0.01 threshold. This indicates that the coefficient is statistically significant at the 1% level and positively signed. In other words, a higher level of regional economic agglomeration is associated with an increase in regional employment rates. The coefficient for IC is 2.7318, suggesting that for each unit increase in economic agglomeration, the regional employment rate rises by approximately 2.7318 units. Among the control variables, lngdp is also positively signed and significant at the 5% level, indicating that higher levels of economic development are conducive to improving regional employment outcomes.

4. Conclusion and Recommendations

4.1 Conclusion

Based on the collaborative development framework of the Chang-Zhu-Tan urban agglomeration, this study employs a static panel regression model to analyze the relationship between industrial agglomeration and regional employment rates from 2000 to 2022. The empirical results reveal a significant positive effect of increased economic agglomeration within the Chang-Zhu-Tan region on local employment rates.

4.2 Recommendations

Since the first Chang-Zhu-Tan Regional Integration Cooperation Joint Conference held in May 2018, the region has achieved notable progress in high-quality development. However, compared with more developed regions such as the Pearl River Delta, it still lacks competitiveness in terms of policies, economic development level, and supporting infrastructure. This has led to limited attractiveness for new graduates, with declining employment retention rates from vocational college graduates to undergraduates and postgraduates, and a general shortage of high-end talent.

To enhance employment outcomes across the Chang-Zhu-Tan urban agglomeration, efforts should focus on leveraging the scale effects of economic agglomeration and the structural advantages of coordinated urban development. The following policy recommendations are proposed:

1. Enhance Scale Effects and Strengthen Coordination Mechanisms

Through integrated strategic planning, the Chang-Zhu-Tan region should dismantle administrative barriers to factor mobility and further optimize industrial distribution. It should maximize the scale effects of economic agglomeration by jointly developing national-level industrial clusters. Vertical integration and horizontal collaboration along the industry chain should be encouraged to build a tiered and networked industrial ecosystem, thereby improving the region's capacity to absorb employment. Internal synergy within the urban cluster can help mitigate siphoning effects. The region should enhance infrastructure connectivity to promote transport integration and co-develop digital infrastructure. At the policy level, a unified labor market standard and an interconnected social security system should be established to facilitate the reasonable distribution of talent, capital, and technology across the region, reducing the spatial and temporal costs of cross-city employment.

2. Strengthen Human Capital and Equalize Public Services

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Uneven distribution of human capital among the three cities in the Chang-Zhu-Tan region has hindered coordinated regional development, and public service availability plays a crucial role in promoting rational allocation of talent. The government should adopt talent-oriented policies, anchored in high-quality public services to ensure efficient labor mobility. Innovations in public service provision—such as shared education and healthcare resources, cross-city allocation of affordable housing, and the establishment of ecological compensation funds—can help reduce the pressure of talent outflow from secondary cities. Additionally, improving intercity transportation networks and integrated information platforms can enhance access to employment opportunities and vocational training resources for job seekers in peripheral areas, forming a region-wide, inclusive employment support system.

3. Develop Digital Platforms and Expand Employment Opportunities

The region may pilot comprehensive reform zones for factor markets, aiming to overcome administrative fragmentation in areas such as household registration, land quotas, and data ownership. A cross-city credit recognition system based on blockchain technology should be established. Especially in the digital economy, the region could co-develop data markets and joint incubation platforms to drive the intelligent transformation of traditional industries and foster emerging business models, thereby attracting more innovative talent. Furthermore, the promotion of remote work and flexible employment models—enabled by digital technologies—can transcend geographic constraints and broaden the scope of employment opportunities.

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