Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9, 365-385
2025
Publisher: Learning Gate
DOI: 10.55214/2576-8484.v9i9.9806

The sustainable development of Hi-Tech human resources under the background of excessive real estate investment

Qian Wu[1], Yuehan Liu[2], Weiyi Li[3*]
[1,2]Business School, Jiangsu Normal University, Xuzhou 221116, China; wuqianscholar@163.com (Q.W.) fdcscholar@163.com (Y.L.).
[3]School of public administration, Guangdong University of Finance & Economics, Guangzhou 510320, China; weiyi.520@hotmail.com (W.L.).

Abstract: The development level of high-tech industries serves as a primary indicator of urban core competitiveness, with talent agglomeration being a critical factor. Promoting synergy between talent and industries is essential for the transformation and upgrading of resource-based cities. Currently, China's high-tech sector accounts for a relatively low proportion of the national economy amid structural imbalances, and overheated real estate investment may exert profound negative effects on talent agglomeration. Based on panel data from 256 Chinese cities, this study employs spatial econometric models to analyze these relationships. The findings reveal that excessive real estate investment and secondary industry agglomeration significantly inhibit the agglomeration of high-tech talents, consistently observed across both developed and non-first-tier cities. The mechanism underlying this relationship is that while real estate investment stimulates the agglomeration of secondary industries, the latter crowds out human and other critical resources required by high-tech industries, resulting in a significant negative correlation between the two. This study provides important insights for promoting talent agglomeration and fostering sustainable urban development.

Keywords: *Agglomeration of talents, Hi-tech industries, Real estate investment, Spatial econometric model.*

1. Introduction

An important feature of economic sustainable development is that hi-tech industries account for an increasing proportion of GDP. Because the hi-tech industry is a technology-intensive industry and a knowledge-based industry [1]. It has extremely high economic and social benefits, but China's high-tech industries account for a much lower proportion of the national economy compared with developed countries. The problem is the serious imbalance of China's industrial structure due to many reasons, but judging from the fact that some hi-tech companies have entered the real estate industry, which may be more serious than we think. According to reports, in recent years, due to the continuous boom in the real estate market, many hi-tech companies in China have entered this lucrative industry one after another [2]. When hi-tech enterprises are flooding into the real estate industry, given the established financial resources, the financial resources obtained by the hi-tech industry might become less and less, but also the scale expansion and development of the hi-tech industry might become increasingly smaller, the competitiveness of its industry will become weaker and weaker. Moreover, when a large number of hi-tech enterprises enter the real estate industry, due to the relatively low technical content of the real estate industry and the lack of human capital and knowledge capital, which will generate the adverse selection of the industrial structure to the low-end. If this phenomenon is ignored, it will not only make the domestic industrial structure deteriorate rapidly, but also result in the difficulty in adjustment and upgrading of the industrial structure. From the experience of developed countries, if China's economy

History: Received: 7 July 2025; Revised: 15 August 2025; Accepted: 18 August 2025; Published: 3 September 2025
* Correspondence: weiyi.520@hotmail.com

cannot realize the adjustment and upgrading of the industrial structure, it is impossible to remain invincible in the fierce competition in the international market [3].

Hi-tech enterprises are new-type enterprises that take technological innovation as the guide, are characterized by the close integration of science and production, using research and development as a means to achieve technological and economic integration. Hi-tech industries are huge driving force for economic sustainable development. Its impetus is first manifested in its increasing share in the national economy. At present, the proportion of hi-tech industries in the GDP of developed countries has reached 40%-60%, becoming the leading industry of the national economy. Some scholars found that knowledge spillover environment and human capital are the decisive location factors for the formation of hi-tech industries, and they determine the formation of industrial agglomeration zones of spatial specialization [4]. Therefore, human resources are the source of hi-tech industry profits [5]. Therefore, it is necessary to intensify efforts to cultivate hi-tech talents to provide dynamic support for independent innovation and economic development [6]. Compared with other traditional industries, the reason why the hi-tech industry can develop efficiently is its leading technology level. As the core competitiveness of the hi-tech industry, the ability of technological innovation plays the key role in the development of the entire industry, most importantly, technological innovation is different from the other natural element endowment because it comes into play through the subject of talents. Therefore, the existence of hi-tech talents plays a vital role in the development and growth of high-tech industries. High-tech talents tend to have more knowledge and technology reserves, and at the same time have a stronger desire to explore new things. With the in-depth development of Internet technology, the economic exchanges of various countries have become more integrated, and there is not a deeper flow of material capital, but also a more frequent flow of human capital among countries. With the flow of talents, developed countries or regions can usually attract more talents and form the phenomenon of talent agglomeration. As high-tech talents with technical reserves in human resources, they have more choices by virtue of their own advantages, that is, they will choose a more appropriate place. As an indispensable subject in the development of hi-tech industries, when hi-tech talents are highly concentrated in the hi-tech industries in a certain region, the sharing and integration of knowledge and technology among all talents in the region will affect the local hi-tech industrial agglomeration to a certain extent.

In this study, overheated real estate market refers to a situation where property prices are rising rapidly due to excessive demand and speculation, often driven by factors like low interest rates, high investor activity, and limited housing supply. Agglomeration of hi-tech human resources refers to the concentration of highly skilled and specialized workers in a particular geographic area, often in close proximity to tech companies, research institutions, and other relevant infrastructure. This agglomeration creates a "tech hub" or "innovation cluster," which fosters collaboration, knowledge exchange, and technological advancements. Many scholars found that the overheated real estate investment has also increased concerns about overheating and its possible negative effects, such as the possibility that an overheated real estate market could exacerbate economic volatility [3, 4] results in the misallocation of social resources [7, 8] bring uncertain risks to urban innovation-driven development [9] and even lead to the loss of human capital [2, 10-12].

Overall, the interplay between real estate investment growth, urban economic development, and hi-tech human capital agglomeration is crucial for fostering a vibrant and successful tech hub [13, 14]. Strategic planning, supportive policies, and investments that prioritize the development of both real estate and hi-tech sectors can help create a synergistic relationship, driving sustainable economic growth and innovation within the urban area.

Although the overheated real estate market may crowd out human capital, the reality is that the investment activities in China's real estate industry still maintain the momentum of growth objectively, and a large amount of human capital obviously flows to the areas where the real estate market is more prosperous. This shows that the relationship between the real estate market and human capital agglomeration is complex. It is of theoretical and practical significance to clarify the relationship between the development of real estate market and human capital agglomeration. Based on the sample

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

data of 256 cities in China, this paper uses panel model to explore the impact of real estate investment activity growth on hi-tech talents agglomeration and its mechanism, and compares the impact of real estate investment activity growth on human capital in eastern, central and western regions, first-tier and non-first-tier cities. Compared with the previous existing literature, the possible contribution of this paper is mainly shown in two aspects:

On the one hand, this study enriches the research on human capital agglomeration. At present, academic studies on human capital agglomeration mainly focus on the effects of human capital agglomeration on knowledge spillover [15] and labor migration [16, 17], enterprise operating Performance [18, 19] total factor productivity [13] regional economic growth [6] technological innovation, etc. [14, 20] Or the macro-economic factors [21] regional economic development [22] industrial agglomeration, etc. [19, 23] on human capital agglomeration. Therefore, this study will provide a helpful reference for government departments to formulate relevant policies and effective measurements to achieve sustainable development of human resources in hi-tech industries.

On the other hand, this study helps to improve our understanding of the importance of the healthy and stable development of the real estate market. At present, academic studies on the real estate market mainly focus on the impact of housing price on economic activities [4, 6, 12, 24, 25] the impact of investment activities in real estate market on economic development [3, 26] the impact of real estate investment on resource allocation efficiency or misallocation [7, 8]. Our research focuses on the impact of real estate investment growth on human capital agglomeration, and finds that excessive real estate investment activities will inhibit human capital agglomeration, thus contributing to a deeper understanding of the significance of the healthy and stable development of the real estate market.

This research aims to examine the impact of overheated real estate investment on the agglomeration of hi-tech human resources. Overheated real estate markets, characterized by speculative investments, rapidly rising property prices, and housing market bubbles, have become a global concern. While the effects of such phenomena on housing affordability and financial stability have been widely studied, their implications for the agglomeration of hi-tech human resources remain relatively underexplored. This study seeks to fill this research gap and shed light on the relationship between overheated real estate markets and the concentration of hi-tech talent.

Overall, this study seeks to contribute to the existing literature on the relationship between real estate investment and regional economic development, specifically focusing on the hi-tech sector. The findings of this research will have implications for policymakers, urban planners, and stakeholders involved in fostering hi-tech agglomerations, as well as for individuals seeking to understand the broader dynamics of the knowledge-based economy in the context of overheated real estate markets.

2. Literature Review and Research Hypothesis

Regarding the research on the impact of real estate investment on the hi-tech human capital agglomeration, the Eastern and Western scholars have done some research, covering a wide range of angles. The main studies can be summarized into that real estate investment could have both positive and negative impacts on the hi-tech human capital agglomeration.

Besides, some scholars even found that the rapid growth of real estate investment may drive the secondary industrial agglomeration, the secondary industrial agglomeration squeezed the resources of the hi-tech industry, including human resources, resulting in a significant negative correlation between real estate investment and talent agglomeration in hi-tech industries.

2.1. Real Estate Investment Has Positive Impacts on Hi-Tech Human Capital Agglomeration

Infrastructure Development: Overheated real estate investment can lead to increased infrastructure development within hi-tech agglomerations. As property prices surge, developers have more financial resources to invest in the construction of modern office spaces, research facilities, and technological infrastructure. This development enhances the physical environment and creates a more attractive ecosystem for hi-tech professionals, facilitating their agglomeration. Leishman and Goel [27] found

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

that there was a difference in the flow of high-skilled workers and low-skilled workers in the United States. High-skilled workers were more willing to move to cities with good public facilities and were also willing to bear higher housing costs. Giuliano, et al. [28] provide an overview of agglomeration economies, including the role of real estate investment. They discuss how the availability of suitable office spaces, research facilities, and amenities facilitated by real estate investments contributes to the concentration of hi-tech human capital in urban clusters. Sun and Zhang [29] noted that high housing price also promoted the agglomeration of human capital. Sassen [30] explores that real estate investment plays a crucial role in providing the necessary infrastructure and amenities to attract and nurture hi-tech human capital within these global cities.

Cluster formation: The concentration of real estate investment in specific areas can result in the formation of hi-tech clusters or hubs. When hi-tech companies and related industries cluster together, it creates a favorable ecosystem for collaboration, knowledge sharing, and innovation. The proximity of companies within the cluster can foster synergies and encourage the exchange of ideas and talent. Blanco-Moreno [31] examine the relationship between human capital agglomeration and real estate investment. They discuss how investments in university infrastructure and research facilities, supported by real estate development, can attract and retain hi-tech human capital within a region. Pain, et al. [32] delves into the positive impacts of urbanization, including the role of real estate investment, on hi-tech human capital agglomeration. The author emphasizes how cities provide a fertile ground for the development and concentration of hi-tech industries. Real estate investments contribute to the creation of dense and interconnected urban areas, facilitating knowledge spillovers, collaboration, and innovation among hi-tech professionals. Gao, et al. [33] investigate how regions diversify their economic activities over time. While not directly examining real estate investment, their research emphasizes the role of agglomeration and spatial proximity in facilitating knowledge flows and the growth of hi-tech industries within regions.

Knowledge Spillovers: The concentration of hi-tech professionals in an agglomeration increases the likelihood of knowledge spillovers and collaboration. Overheated real estate investment can further amplify these knowledge spillovers by bringing together diverse professionals from various backgrounds within a smaller geographic area. Interactions among professionals from different disciplines and organizations can foster cross-pollination of ideas, innovation, and the development of new technologies. Xiong and Li [34] examine the relationship between real estate and innovation networks in the electronics industry in China. Their study highlights how real estate developments, such as industrial parks and research campuses, can serve as physical platforms that support collaboration, knowledge sharing, and the concentration of hi-tech human capital. Pain, et al. [32] explores the positive impacts of urbanization and real estate investment on the agglomeration of human capital. He discusses how cities create an environment conducive to the development of hi-tech industries and foster knowledge spillovers through proximity, which is facilitated by real estate investments.

2.2. Real Estate Investment Has Negative Impacts on Hi-Tech Human Capital Agglomeration

Affordability Issues: One of the primary negative impacts of overheated real estate investment on hi-tech agglomerations is the exacerbation of housing affordability challenges. As property prices soar, housing becomes less affordable for hi-tech professionals, particularly those at the early stages of their careers or with lower incomes. This affordability barrier can discourage talented individuals from relocating to or remaining in the agglomeration, hampering its growth and potential. Chen, et al. [35] discusses the negative consequences of overheated real estate markets and the resultant spatial imbalances. He highlights how excessive real estate investment and speculation can lead to price volatility and instability, creating an uncertain environment for hi-tech firms and professionals and potentially discouraging their agglomeration. Wang, et al. [36] discuss the negative impacts of real estate investment and rising costs on the formation and sustainability of entrepreneurial ecosystems. They highlight how escalating real estate prices can limit the affordability of office spaces and hinder

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

the agglomeration of hi-tech human capital by making it difficult for startups to establish and grow within a cluster. Li, et al. [37] examine the emergence of new industries at the regional level and the role of real estate investment. They discuss the negative consequences of soaring real estate prices, such as increased office rents and reduced affordability, which can make it challenging for hi-tech startups and entrepreneurs to operate and thrive within an agglomeration. Liotta, et al. [38] examine the emergence of mega-regions and the challenges associated with real estate investment. They highlight the negative impacts of escalating real estate prices and the resulting housing affordability issues, which can disrupt the agglomeration of hi-tech human capital within these regions.

Social Displacement: Rapid real estate price increases can lead to social displacement, as lower-income residents and long-time residents may be priced out of the market. Gentrification and the influx of higher-income individuals can result in the displacement of communities, altering the social fabric and potentially creating social inequalities within the agglomeration. Florida [39] discusses the challenges and negative consequences associated with real estate investment in cities. It highlights how skyrocketing housing prices and gentrification can lead to the displacement of lower-income residents and hinder the agglomeration of hi-tech human capital by creating affordability challenges and increasing socioeconomic disparities. Chen, et al. [35] highlights how real estate speculation and rising prices can contribute to socioeconomic inequalities and hinder the agglomeration of diverse talent within urban areas.

Reduced Accessibility: Overheated real estate markets can also impact the accessibility of hi-tech agglomerations. Higher property prices often push housing options farther away from the central hub, leading to longer commutes and increased transportation costs for hi-tech professionals. Reduced accessibility can hinder the ability of individuals to fully participate in the agglomeration's collaborative activities, networking opportunities, and knowledge-sharing events. Le Gallo and Chasco [40] examine the negative impacts of urban sprawl, which is often driven by real estate development, on productivity and commuting costs. Their research highlights how dispersed urban development can increase commuting times and costs, reducing the attractiveness of a hi-tech cluster and potentially deterring hi-tech human capital from agglomerating in the area.

Besides, in addition to that real estate investment is found to be an important factor in human capital agglomeration, the influence of economic development and public service conditions on human capital flow or agglomeration are also significant. Giuliano, et al. [28] not only found the impact of international commodity trade on transnational human capital flow, but also noted the important impact of education and economic factors on it. Xu and Li [22] found that there was a significant positive correlation between high-tech industry development and hi-tech human capital agglomeration, and noted that per capita GDP, average wage and science and technology policies reflected regional economic development had a significant positive effect on human capital agglomeration. Fraumeni, et al. [41] focused on the characteristics and influencing factors of the distribution of human capital at provincial level in China. Their research found that the distribution of human capital was not only positively affected by per capita GDP, industrial structure and the number of patent applications, but also significantly restricted by housing cost. Xu and Guo [21] further investigates the influencing factors of the inter-provincial human capital flows, their research mainly identified per capita GDP, industrial structure, the R&D funds input intensity of three kinds of factors on the inter-provincial human capital flows significantly influence, but these factors impact on features three main areas in our country there are obvious differences. Sassen [30] found that the agglomeration of hi-tech human capital in Chinese universities presents obvious regional differences, and is significantly affected by regional university size, public service level, per capita fiscal income and other factors.

2.3. Real Estate Investment May Promote the Development of Urban Secondary Industry

These additional scholars provide further insights into the positive impacts of real estate investment on the development of urban secondary industries. Their research underscores the role of real estate in

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

providing infrastructure, commercial spaces, and industrial parks that foster the growth and upgrading of secondary industries, contributing to urban economic development and diversification.

Zhang, et al. [42] examine the spillover effects of real estate investment on urban manufacturing development in China. Their study finds a positive relationship between real estate investment and the development of secondary industries. They argue that real estate investment can provide the necessary infrastructure and commercial spaces to attract manufacturing activities and stimulate urban industrial growth. Xie and Yu [43] investigate the relationship between real estate investment and regional economic development in China. Their research suggests that real estate investment positively contributes to the development of urban secondary industries. They argue that real estate development provides physical infrastructure, office spaces, and commercial zones that support the growth of secondary industries and urban economic diversification. Shen and Zhang [44] analyze the impact of real estate investment on urban economic development in China. Their study finds a positive relationship between real estate investment and the development of urban secondary industries. They argue that real estate investment, by providing commercial spaces and industrial zones, facilitates the growth of secondary industries and contributes to urban economic expansion. Chen, et al. [45] examine the relationship between real estate investment and urban industry structure adjustment in China. Their research highlights the positive impact of real estate investment on the development of urban secondary industries. They argue that real estate investment provides the necessary physical spaces for secondary industries to establish and expand, driving urban industrial restructuring.

From the research results of the above scholars, it can be seen that there is very little literature on the media through which overinvestment in real estate affects the high-tech human resources aggregation, and there is no literature on the relationship between overinvestment in real estate, the development of the secondary industry and the high-tech human resources aggregation. Based on these literature reviews, in order to further explore the impact of the overheated real estate investment on the human capital agglomeration, this study focuses on the impact and effect of the growth of real estate investment and puts forward the following hypotheses:

Hypothesis 1: As the China's revved-up real estate market, the overheated real estate investment is not conducive to the agglomeration of urban hi-tech human capital.

Hypothesis 2: Considering that the real estate industry involves a long upstream and downstream industry chain and is closely linked with many industries [4] the growth of real estate investment activities may have a significant impact on the development of the secondary industry. Nong [46] found that real estate development will consume a large amount of building materials, so it will promote the development of steel, cement, glass, metallurgy and other building materials manufacturing industries, as well as the production of consumption-related manufacturing industries such as household appliances and furniture. Therefore, this study also proposes the following hypothesis: a rapidly increasing rate of real estate investment may be unfavorable to the hi-tech industries' human capital agglomeration by promoting the development of urban secondary industry.

3. Methods and Data

3.1. Sample Description

This study uses panel data of 256 cities from 2007 to 2022 to study the impact of the growth rate of real estate investment on the agglomeration of urban hi-tech human capital. In the regression analysis of this paper, the explained variable is agglomeration of hi-tech human capital (LQ1), and the main research variable is investment growth rate of real estate development (Invest). And according to the existing literature [6, 46] this paper also controls variables such as education, medical care, population, industry and financial depth of the region. In order to reduce the problem of endogeneity, this study refers to the practice of Zhou, et al. [47] that is, the main research variables and control variables are delayed by one period. In addition, we also used the growth rate of residential investment to replace the growth rate of real estate investment as the main research variable to conduct robustness tests, and conducted robustness tests by region (eastern, central and western regions, first-tier cities and non-

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

first-tier cities). On the other hand, we used the form of location entropy as human capital agglomeration (LQ5,6) to conduct robustness test again. The data in this paper are from China Statistical Yearbook, China City Database, CSMAR database and EPS database.

3.2. Selection of Variables

3.2.1. Dependent Variable

The dependent variable in this paper is hi-tech human capital agglomeration (LQ-researcher). Sun and You [48] used the percentage of hi-tech employees of the software industry in national hi-tech employees to measure the degree of software talents agglomeration. In this paper, LQ1 is used as a proxy variable to measure the degree of hi-tech human capital aggregation.

3.2.2. variable of Interest

This paper adopts the growth rate of urban real estate investment as the variable of interest. Since the reform and opening up, China's real estate market has developed rapidly, and real estate investment has become one of the important factors driving the economy. Nong [46] found that from 1987 to 2013, the growth of real estate development investment made a significant contribution to the growth of fixed asset investment and GDP. Therefore, it is very important to study the impact of current real estate investment growth on human capital agglomeration. Considering the long time span of this study, the model may have problems of instability, so the main research variable of this study is the growth rate of real estate investment rather than the amount of real estate investment.

3.2.3. Control Variables

The main control variables in this paper include the secondary industry agglomeration, the proportion of financial institutions' loan balance in GDP, the growth rate of hospitals, the growth rate of students, the natural growth rate of population, and the growth rate of GDP. Based on the research of scholar Zhang and Wang [49] this paper adopts the location entropy (Tag) of regional secondary industry employees to measure the degree of industrial agglomeration. The calculation formula of location entropy (Tag) is:

$$Tag_{ijt} = \frac{X_{ijt}/\sum_{i=1}^{m} X_{ijt}}{\sum_{j=1}^{n} X_{ijt}/\sum_{j=1}^{n}\sum_{i=1}^{m} X_{ijt}}$$

Among, X_{ijt} represents the number of employees of industry j in city i in the year, $\sum_{i=1}^{m} X_{ijt}$Represents the total number of employees in a city.In this study,X_{ijt} Represents the number of employees in the secondary industry of city i in the t year, $\sum_{i=1}^{m} X_{ijt}$ Represents the number of employees in the t year of city i; $\sum_{j=1}^{n} X_{ijt}$ Represents in the t year, the total employees in the secondary industry of the province which the city i located, $\sum_{j=1}^{n}\sum_{i=1}^{m} X_{ijt}$ Represents the total employees in the province which the city i located in the t year.

According to existing literature [6, 46] the control variables selected in this paper are as follows:

Financial conditions: this study uses (the loan balance of financial institutions) / (gross regional product) to measure the financial conditions of the region.

Medical condition: this study uses the growth rate of hospital number to measure the medical condition of the region.

Education level: this study uses the growth rate of the number of students in ordinary middle schools to measure the education level of the region.

In addition, this paper also controls the natural population growth rate and the regional GDP growth rate.

3.3. Statistical Model Description

Descriptive statistics of selected variables are shown in Table 1.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 1.
Descriptive statistics of selected variables.

Variable	Definition	Obs.	Mean	Std. Dev.	Min	Max
LQ1	Ratio of hi-tech employees in urban	4094	1.49	1.15	0.16	12.15
Invest	Growth rate of completed real estate investment	4071	0.38	1.27	-0.96	56.60
housing	Growth rate of completed residential investment	4044	0.32	0.87	-0.97	26.63
Proportion1-2nd	secondary industry agglomeration	4096	1.10	0.42	0.20	4.10
Finance	Financial Position (Year-end loan balance /GDP)	4062	0.83	0.49	0.11	7.45
Hospitals	the growth rate of hospital number	4081	0.00	0.01	-0.01	0.18
education	the growth rate of the number of middle school students	4090	-0.00	0.20	-0.92	7.64
Rate-population	Natural population growth rate	4078	0.06	0.05	-0.17	0.41
Rate-GDP	Regional GDP growth rate	3829	0.12	0.04	-0.19	1.09

4. Results and Discussions

4.1. Basic Model

In order to analyze the impact of real estate investment on hi-tech human capital agglomeration, this paper constructs the following basic model:

$$Y_{it} = \alpha_0 + \beta_0 invest_{it-1} + \delta control_{it-1} + \lambda_{t-1} + \mu_i + \varepsilon_{it-1} \quad (1)$$

Among，$invest_{it-1}$ Represents the city's real estate investment growth rate lags a period,$control_{it-1}$ Represents a lag of all control variables,λ_{t-1} Stands for time fixed effect，μ_i Represents the urban fixed effect，ε_{it-1} stands for random error，α_0 Represents constant term.If β_0 is significantly negative, so that confirms hypothesis 1, Real estate investment growth is not conducive to urban hi-tech human capital agglomeration. If β_0 s significantly positive, it negates hypothesis 1 and means that real estate investment growth promotes urban human capital agglomeration.

In addition, considering the impact of real estate investment growth on hi-tech human capital agglomeration may be due to its promoting role in the development of the secondary industry. Therefore, formula (1) further adds the interaction term between the agglomeration of the secondary industry and the investment in real estate development, and its formula is shown as follows:

$$Y_{it} = \beta_1 invest_{it-1} + \rho_1 invest_{it-1} * Proportion_{it-1} + \delta control_{it-1} + \lambda_{t-1} + \mu_i + \varepsilon_{it-1} + \alpha_0 \quad (2)$$

Among, Proportionit-1 represents the degree of agglomeration of the city's secondary industry using "location entropy". If ρ_1、β_1 are significantly negative, it indicates that the interaction term and the growth of real estate investment are not conducive to the hi-tech human capital agglomeration.

4.2. Analysis of Basic Regression Results

Table 2 reports the benchmark regression results of the impact of real estate investment growth on urban hi-tech human capital agglomeration. According to the results of Hausmann test, the four panel regressions in Table 2 all adopt fixed effect models.1 In order to solve the possible endogeneity problems, the main interest variables and control variables in the panel regression equation of this study lag one stage. Among them, column (1) reports that without any control variables, the impact of real estate investment on urban hi-tech human capital agglomeration is significantly negative at the level of 1%. Column (2) controls the agglomeration degree of the city's secondary industry on the basis of column (1), Column (3) further controls the level of education, medical level, financial development and other factors. Finally, the (4) model also controls the factors of economic and population growth. These

[1]The subsequent panel regression is based on the results of hausmann test, using the fixed effect model.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

regression results all show that the real estate investment exerts a negative significant on urban hi-tech human capital agglomeration at the level of 1%. It shows that the growth of real estate investment is not conducive to the urban hi-tech human capital agglomeration human capital. The improvement of education level has a significant effect on urban hi-tech human capital agglomeration, which is consistent with our expectation.

Table 2.
Regression results of national real estate investment growth on hi-tech human capital agglomeration.

	(1)	(2)	(3)	(4)
Invest	-0.007*** (0.002)	-0.008*** (-0.002)	-0.012*** (0.004)	-0.013*** (0.004)
Proportion1-2nd		-0.219*** (0.062)	-0.207*** (0.615)	-0.230*** (0.070)
Finance			-0.051 (0.052)	-0.042 (0.056)
Hospitals			-0.011 (0.915)	-0.481 (0.901)
education			0.053* (0.023)	0.050** (0.021)
Rate-population				0.034 (0.284)
Rate-gdp				-0.212 (0.214)
_cons	1.380*** (0.026)	1.592*** (0.062)	1.639*** (0.079)	1.681*** (0.096)
Individual fixation effect	control	control	control	control
Time fixed effect	control	control	control	control
Observations	4077	4077	3788	3541

Note: ***, ** and * represent significance levels of 1%, 5% and 10% respectively.

4.3. Analysis of Influencing Mechanism

In order to explore the influencing mechanism of real estate investment growth on urban hi-tech human capital agglomeration, this paper adds real estate investment and secondary industry agglomeration as the interaction term into the regression equation. According to the results of Hausmann test, the following four panel regressions also adopt the fixed effect model, and the relevant results are shown in Table 3. Among them, column (1) only controls factors of secondary industry agglomeration and financial development level, while Column (4) controls factors of education, medical care, economy and population growth on the basis of column (1). In order to avoid pseudo regression caused by unstable results, columns (2)-(3) selectively control some variables. The results in columns (1)-(4) all show that when the interaction item is added, the impact of real estate investment growth on the urban hi-tech human capital agglomeration is no longer significant. However, the interaction term with secondary industry agglomeration is significantly negative at the level of 5%. It shows that the interaction term between the growth of real estate investment and the agglomeration of the secondary industry absorbs the impact of real estate investment, which means that the higher degree of secondary industry agglomeration, the lower degree of urban hi-tech human capital agglomeration.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 3.
Influencing mechanism of national real estate investment growth on hi-tech human capital agglomeration.

Variable	nationwide	nationwide	nationwide	nationwide
	(1)	(2)	(3)	(4)
Invest	0.032 (0.020)	0.032 (0.022)	0.033 (0.021)	0.033 (0.022)
Invest* Proportion1-2nd	-0.054** (0.023)	-0.056** (0.025)	-0.055** (0.023)	-0.057** (0.025)
Proportion1-2nd	-0.200*** (0.062)	-0.222*** (0.072)	-0.197*** (0.062)	-0.217*** (0.072)
Finance	-0.051 (0.052)	-0.043 (0.056)	-0.052 (0.052)	-0.043 (0.056)
Hospitals			-0.020 (0.914)	-0.496 (0.903)
education			0.056** (0.023)	0.052** (0.021)
Rate-population		0.060 (0.287)		0.038 (0.285)
Rate-gdp		-0.209 (0.215)		-0.195 (0.214)
_cons	1.641*** (0.079)	1.680*** (0.097)	1.635**** (0.079)	1.672*** (0.098)
Individual fixation effect	control	control	control	control
Time fixed effect	control	control	control	control
Observations	3796	3549	3788	3541

Note: ***, ** and * represent significance levels of 1%, 5% and 10% respectively

4.4. Robustness Test

In order to investigate the robustness of the regression results above, this paper uses the rate of residential invest to replace the main research variable to further explore the impact of the growth of real estate investment activities on urban hi-tech human capital agglomeration. In order to avoid endogeneity problems, the growth rate of residential investment and control variables are also delayed by one stage in the robustness test. Column (1) in Table 4 does not control any variables, On the basis of column (1), column (4) controls the concentration of secondary industry, education, medical level, financial development level, economic and population growth factors. In order to avoid pseudo regression caused by unstable results, columns (2)-(3) control some variables accordingly. These panel estimation results show that the impact of residential investment growth rate on hi-tech human capital agglomeration is significantly negative at the level of 5%. It can be seen that the robustness test results of this paper are basically consistent with the benchmark regression results.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 4.
Robustness analysis: the effects of residential investment growth on hi-tech human capital agglomeration.

	(1)	(2)	(3)	(4)
Invest	-0.017** (0.009)	-0.019** (0.009)	-0.021** (0.010)	-0.021** (0.009)
Proportion1-2nd		-0.218*** (0.0615)	-0.249*** (0.070)	-0.248*** (0.069)
Finance		-0.057 (0.053)		-0.049 (0.057)
Hospitals		0.647 (0.726)		0.189 (0.643)
education		0.050** (0.022)		0.048** (0.021)
Rate-population			0.057 (0.287)	0.035 (0.285)
Rate-gdp			-0.237 (0.218)	-0.239 (0.221)
_cons	1.411*** (0.026)	1.671*** (0.078)	1.684*** (0.078)	1.726*** (0.094)
Individual fixation effect	control	control	control	control
Time fixed effect	control	control	control	control
Observations	3810	3769	3531	3523

Note: ***, ** and * represent significance levels of 1%, 5% and 10% respectively.

Table 5 represents the impact of real estate investment growth on urban hi-tech human capital agglomeration in 162 cities in China from 2007 to 2022. According to the results of Hausmann test, the four panel regressions in Table 5 all adopt the fixed effect model. In order to solve the possible endogeneity problems, the main study variables and control variables in the panel regression equation of this study lag one stage. Among them, column (1) reports that without any control variables, the impact of real estate investment on urban hi-tech human capital agglomeration is significantly negative at the level of 1%. Column (2) controls the city's secondary industry agglomeration, education, medical level, financial development level, economic and population growth factors on the basis of column (1), The results still show that the real estate investment plays a negative significance on hi-tech human capital agglomeration at the level of 1%, indicating that the over growth of real estate investment is not conducive to the agglomeration of urban hi-tech human capita. Column (3)-(4) adds the interaction item between real estate investment growth and industrial agglomeration, and column (4) controls the factors of financial development level, education, health level, economy and population growth. The third model and the fourth model both show that when the interaction item is added, the growth of real estate investment has no significant impact on hi-tech human capital agglomeration, but the interaction item has a negative impact on hi-tech human capital agglomeration at the level of 10%. The regression result is consistent with the basic regression equation.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 5.
Robustness analysis of national real estate investment growth on hi-tech human capital agglomeration.

	(1)	(2)	(3)	(4)
Invest	-0.012*** (0.005)	-0.013*** (-0.004)	0.035 (0.022)	0.034 (0.025)
Invest* Proportion1-2nd			-0.056** (0.026)	-0.057* (0.030)
Proportion1-2nd		-0.256*** (0.082)	-0.237*** (0.076)	-0.244*** (0.082)
Finance		-0.040 (0.025)		-0.040 (0.063)
Hospitals		-0.734 (1.653)		-0.737 (1.654)
education		0.006 (0.030)		0.009 (0.029)
Rate-population		-0.007 (0.255)		-0.003 (0.254)
Rate-gdp		-0.286 (0.224)		-0.281 (0.225)
_cons	1.406*** (0.032)	1.740*** (0.103)	1.631*** (0.071)	1.733*** (0.104)
Individual fixation effect	control	control	control	control
Time fixed effect	control	control	control	control
Observations	2893	2533	2893	2533

Note: ***, ** and * represent significance levels of 1%, 5% and 10% respectively.

In addition, in order to further investigate the impact of real estate investment growth on hi-tech human capital agglomeration. According to the studies Sun, et al. [14]; Zeng, et al. [23] and Bond-Smith [50] this study constructed the locational entropy (LQ) to represent the degree of human capital agglomeration. However, the statistical approach of some provincial and national level data in China Urban Statistical Yearbook has changed since 2015. Therefore, Table 7 and Table 8 are analyzed based on the data from 2007 to 2015 of 256 cities. The calculation formula of location entropy (LQ) is

$$LQ_n = \frac{X_{ijt}/\sum_{i=1}^{m} X_{ijt}}{\sum_{j=1}^{n} X_{ijt}/\sum_{j=1}^{n}\sum_{i=1}^{m} X_{ijt}}$$

In formulas LQ2 and LQ3,X_{ijt} represents the number of hi-tech employees of city i in t year, but$\sum_{i=1}^{m} X_{ijt}$ represents the total number of employees of city i in the t year. $\sum_{j=1}^{n} X_{ijt}$represents the number of national or provincial hi-tech employees of city i in the t year,$\sum_{j=1}^{n}\sum_{i=1}^{m} X_{ijt}$ Represents the total number of employees in the whole country or province of city i in the t year.

Among it, Formula LQ2 represents the "location entropy" that is (the proportion of hi-tech employees in the city) / (the Proportion of hi-tech employees in China), Formula LQ3 represents "location entropy" that is (the proportion of hi-tech employees in city) / (the proportion of hi-tech employees in the province). We use these two variables as dependent variables to perform panel fixed effect regression. Columns (1)-(2) of Table 6 respectively show the impacts of real estate investment growth and residential investment on hi-tech human capital agglomeration (LQ2). Columns (3)-(4) respectively show the impacts of real estate investment growth and residential investment on human capital agglomeration (LQ3). These panel estimation results show that the growth of in real estate investment and residential investment both significantly inhibit the agglomeration of hi-tech human capital. These regression results are consistent with the baseline regression results above.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 6.
Robust analysis of the real estate investment growth on hi-tech human capital agglomeration (LQ2,3).

	(1)	(2)	(3)	(4)
	LQ2-invest	**LQ2-housing**	**LQ3-invest**	**LQ3-housing**
Invest	-0.562**	-1.132**	-0.557***	-0.893***
	(0.222)	(0.472)	(0.210)	(0.304)
Proportion1-2nd	-0.170**	-0.208***	-0.267***	-0.294***
	(0.075)	(0.070)	(0.075)	(0.073)
Finance	-0.024	-0.030	0.246	-0.072
	(0.034)	(0.035)	(1.537)	(1.523)
Hospitals	-0.008	0.347	-0.214	0.130
	(0.470)	(0.353)	(0.479)	(0.378)
education	0.265**	0.253**	0.234*	0.227*
	(0.113)	(0.111)	(0.121)	(0.120)
Rate-population	0.043	0.043	-0.032	-0.031
	(0.150)	(0.151)	(0.137)	(0.138)
Rate-gdp	-0.081	-0.104	-0.071	-0.083
	(0.155)	(0.165)	(0.121)	(0.124)
_cons	0.890***	0.945***	1.091***	1.130***
	(0.084)	(0.077)	(0.076)	(0.071)
Individual fixatio effect	control	control	control	control
Time fixed effect	control	control	control	control
Observations	2780	2766	3034	3018

Note: ***, ** and * represent significance levels of 1%, 5% and 10% respectively.

In this part, the variables of number of "education employees" and "medical employees" are added. Meanwhile, the location entropy （LQ5,6）is used to verify the stability of regression results again. In formulas LQ5 and LQ6, X_{ijt}Represents the sum of the number "hi-tech employees+ education employees+ medical employees" of city i in the t year, $\sum_{i=1}^{m} X_{ijt}$ Represents the number of whole employees of city i in the t year; $\sum_{j=1}^{n} X_{ijt}$Represents the number of "hi-tech employees+ education employees+ medical employees" in the whole country or the province which city i located in the t year, $\sum_{j=1}^{n}\sum_{i=1}^{m} X_{ijt}$ represents the total number of employees in the whole country or the province which city i located in the t year.

Formula LQ5 represents (the proportion of city's hi-tech + education + medical employees) / (the proportion of national hi-tech + education + medical employees), Formula LQ6 represents (the proportion of city's hi-tech + education + medical employees) / (the proportion of national hi-tech + education + medical employees in the province); Formula LQ4 is (the proportion of city's hi-tech + education + medical employees). The above variables were used as dependent variables to conduct panel fixed effect regression analysis respectively. Columns (1)-(2) of Table 7 respectively show the impact of real estate investment and residential investment growth on human capital agglomeration (LQ4). Columns (3)-(4) respectively show the influence of real estate investment and residential investment growth on human capital agglomeration (LQ5). Columns (5) - (6) respectively show the influence of real estate investment and residential investment growth on human capital agglomeration (LQ6). These panel estimation results show that both real estate investment and residential investment all significantly inhibit the agglomeration of urban human capital.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 7.
Robustness analysis of the national real estate market (including residential investment) on LQ4,5,6 of human capital agglomeration.

	(1)	(2)	(3)	(4)	(5)	(6)
	LQ4-invest	**LQ4-housing**	**LQ5-invest**	**LQ5-housing**	**LQ6-invest**	**LQ6-housing**
Invest	-0.643***	-0.647*	-0.526***	-0.458	-0.637***	-0.406*
	(0.183)	(0.393)	(0.161)	(0.337)	(0.108)	(0.246)
Proportion1-2nd	-0.063	-0.096	-0.036	-0.071	-0.034	-0.059
	(0.081)	(0.075)	(0.073)	(0.067)	(0.082)	(0.079)
Finance	0.023	0.020	0.002	0.001	0.039**	0.037**
	(0.028)	(0.029)	(0.031)	(0.031)	(0.017)	(0.017)
Hospitals	-0.210	-0.625	0.170	0.514	-0.035	0.305
	(0.553)	(0.444)	(0.456)	(0.364)	(0.576)	(0.543)
education	0.448**	0.438**	0.332**	0.322*	0.404*	0.398*
	(0.195)	(0.193)	(0.148)	(0.148)	(0.218)	(0.218)
Rate-population	0.024	0.014	0.067	0.065	0.065	-0.069
	(0.172)	(0.172)	(0.150)	(0.151)	(0.159)	(0.159)
Rate-gdp	-0.152	-0.205	-0.171	-0.239	-0.334	-0.382***
	(0.144)	(0.152)	(0.175)	(0.184)	(0.127)	(0.129)
_cons	0.919***	0.968***	0.721***	0.772***	0.854***	0.891***
	(0.091)	(0.084)	(0.086)	(0.079)	(0.085)	(0.080)
Individual fixation effect	control	control	control	control	control	control
Time fixed effect	control	control	control	control	control	control
Observations	3034	3018	2780	2766	3034	3018

Note: ***, ** and * represent significance levels of 1%, 5% and 10% respectively

In Table 8, columns (1)-(2) are the panel fixed effect estimation results of the impact of the growth of real estate investment activities in eastern China on urban hi-tech human capital agglomeration. Columns (3)-(4) report the estimation results of panel fixed effect of real estate investment growth on urban hi-tech human capital agglomeration in central and western China. In columns (1) and (3), the main research variable is the growth rate of real estate investment which lags behind one period. The main research variable in columns (2) and (4) is the growth rate of residential investment lagging behind one period. These regression results show that the impact of real estate investment growth and residential investment growth on hi-tech human capital agglomeration in eastern China is significantly negative at 1% level, while the impact of real estate investment growth and residential investment growth on hi-tech human capital agglomeration in central and western China is not significant. However, no matter in the eastern region or the central and western regions, educational resources have a positive impact on human capital agglomeration at the significant level of 10%.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 8.
Robustness analysis of real estate market (including residential investment) in central- eastern China2 on human capital agglomeration.

	(1)	(2)	(3)	(4)
Invest	-0.014***	-0.039***	-0.006	-0.011
	(0.005)	(0.005)	(0.005)	(0.010)
Proportion1-2nd	-0.530***	-0.582***	-0.063	-0.066
	(0.133)	(0.125)	(0.076)	(0.075)
Finance	-0.244	-0.258	-0.003	-0.005
	(0.180)	(0.189)	(0.038)	(0.039)
Hospitals	-1.199	-0.061	0.360	0.407
	(1.417)	(0.805)	(1.108)	(1.115)
education	0.159*	0.143*	0.031**	0.031**
	(0.925)	(1.014)	(0.016)	(0.016)
Rate-population	-0.060	0.058	-0.154	-0.144
	(0.306)	(0.305)	(0.486)	(0.489)
Rate-gdp	-0.192	-0.237	0.073	0.097
	(0.260)	(0.245)	(0.367)	(0.397)
_cons	2.029***	2.143***	1.549***	1.558***
	(0.233)	(0.217)	(0.105)	(0.107)
Individual fixation	control	control	control	control
effect	control	control	control	control
Observations	1568	1559	1973	1964

Note: ***, ** and * represent significance levels of 1%, 5% and 10% respectively

Table 9 reports the panel fixed effect estimation results of the impact of real estate investment growth on hi-tech urban human capital agglomeration in non-first-tier regions and first-tier regions in China. Columns (1) - (2) report the estimation results of the growth rate of real estate investment in non-first-tier cities on urban hi-tech human capital agglomeration, while columns (3) - (4) show the estimation results of the growth rate of real estate investment in first-tier cities on urban hi-tech human capital agglomeration. In the panel regression models, the main study variables and controls also lag one stage. These panel estimation results show that, the effects of first-tier cities real estate investment growth, residential investment growth on hi-tech human capital agglomeration are significantly negative under the level of 1%, and the effect of first-tier cities' real estate investment growth on hi-tech human capital agglomeration is not significant, but the effect of residential investment growth rate on hi-tech human capital agglomeration is significant positively.

[2] The eastern coastal areas of this paper include Liaoning, Hebei, Tianjin, Beijing, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi, Shandong and Hainan provinces. The central region includes Heilongjiang, Jilin, Shanxi, Anhui, Jiangxi, Henan, Hubei and Hunan provinces; The western region includes Shaanxi, Ningxia, Chongqing, Yunnan, Sichuan and Guizhou provinces.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 9.
The effects of Non-first-tier, first-tier cities[3]' real estate investment On hi-tech human capital concentration.

	(1) real estate	(2) residential	(3) real estate	(4) residential
Invest	-0.014***	-0.022**	0.462	0.422*
	(0.004)	(0.010)	(0.331)	(0.216)
Proportion1-2nd	-0.148**	-0.167***	-1.039**	-1.019**
	(0.061)	(0.061)	(0.435)	(0.424)
Finance	-0.011	-0.018	-0.767	-0.764
	(0.033)	(0.033)	(0.565)	(0.554)
Hospitals	-0.702	-0.039	0.389	0.393
	(0.881)	(0.599)	(0.435)	(0.437)
education	0.053**	0.051**	0.199	0.100
	(0.021)	(0.020)	(0.804)	(0.792)
Rate-population	-0.108	-0.109	0.043	0.043
	(0.274)	(0.274)	(0.031)	(0.030)
Rate-gdp	-0.213	-0.240	-0.047*	-0.044*
	(0.214)	(0.221)	(0.025)	(0.023)
_cons	1.449***	1.494***	5.789***	5.744***
	(0.082)	(0.079)	(1.083)	(1.044)
Individual fixation effect	control	control	control	control
Time fixed effect	control	control	control	control
Observations	3280	3262	261	261

Note: ***, ** and * represent significance levels of 1%, 5% and 10% respective.

4.5. Spatial Econometric Analysis

Economic activities between different cities may display some spatial diffusion and correlation. For example, Liu, et al. [51] found that urban housing price and land transfer price have strong spatial correlation between different cities. Li, et al. [52] found that the spillover effect of housing prices between different cities in China is significant. Chen, et al. [53] found that housing prices in the different tier cities in all regions of China all have high connectivity. In order to test whether there is a spatial correlation or spillover effect or not between China's cities, this paper also introduced spatial econometric analysis to explore the impact of real estate investment on urban hi-tech human capital agglomeration.

The commonly used spatial econometric models include: spatial autoregressive model, spatial Dubin model, spatial error model and spatial panel model. The spatial panel model of this paper is as follows

$$y_{it} = \tau y_{i,t-1} + \rho w'_i y_{t-1} + x'_{it-1}\beta + d'_i X_{t-1}\sigma + u_i + y_{t-1} + \varepsilon_{it-1}$$

$$\varepsilon_{it-1} = \lambda m'_i \varepsilon_{t-1} + \nu_{it-1}$$

Among them, $y_{i,t-1}$is the first-order lag of the explained variable y_{it}.w'_i represents the row i of the spatial weight Ww. x'_{it-1} includes the lag period of the main research variable and the control variables. $d'_i X_{t-1}\sigma$ represents the spatial lag period of explanatory variables,d'_irepresents the i row of the corresponding spatial weight D. y_{t-1} is the time effect. m'_i is the i row of the perturbation space weight matrix M. If λ=0, it is "spatial Dubin model" (SDM), if τ=0 and σ=0, it is "spatial autocorrelation model" (SAC). Based on the map of 353 cities released in 2006, this study investigates the influence of investment growth in real estate on hi-tech human capital agglomeration in cities by constructing a spatial matrix of 0,1.[4]

[3] Reference "city commercial ranking in China 2020", the first-tier cities and new cities include: Shanghai, Dongguan, Foshan, Beijing, Nanjing, Hefei, Tianjin, Guangzhou, Chengdu, Hangzhou, Wuhan, Shenyang, Shenzhen, Suzhou, xi'an, Zhengzhou, Chongqing, Changsha, Qingdao. Due to the large number of non-first-tier cities, here is not a list, if necessary, you can obtain from the author.
[4] The construction of spatial weight matrix and spatial econometric model are all run on Stata15.[4]

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 10 reports the results of the Moran Index for 256 cities in China, including real estate investment growth rate, residential investment growth rate and hi-tech human capital agglomeration.

The result is that high-tech human capital agglomeration shows a positive spatial spillover effect at the level of 10% basically. However, the growth rate of real estate investment and residential investment show significant spatial spillover character in most years. And the spatial spillover was stronger in 2014-2020, which means that with the development of the real estate market, the growth rate of real estate investment and residential investment have more significant spatial spillover effect.

Table 10.
Moran test of real estate investment growth rate, residential investment growth rate and hi-tech human capital agglomeration.

Measures of global spatial autocorrelation						
Weights matrix						
Name:	**W062**					
Type:	**Imported (binary)**					
Row-standardized:	**No**					
Moran's I						
Year	**Hi-tech human capital agglomeration**		**Growth rate of real estate investment**		**Growth rate of residential investment**	
	I	**p-value***	**I**	**p-value***	**I**	**p-value***
2007	0.052	0.080	0.016	0.155	0.016	0.149
2008	0.057	0.063	0.076	0.024	0.068	0.038
2009	0.054	0.069	0.141	0.000	0.121	0.001
2010	0.048	0.096	0.016	0.143	0.020	0.190
2011	0.072	0.027	0.114	0.002	0.003	0.338
2012	0.108	0.003	0.006	0.356	0.020	0.280
2013	0.070	0.032	0.007	0.233	-0.000	0.355
2014	0.077	0.022	0.147	0.000	0.123	0.001
2015	0.065	0.043	0.166	0.000	0.159	0.000
2016	0.061	0.051	0.215	0.000	0.086	0.011
2017	0.036	0.157	0.186	0.000	0.041	0.105
2018	0.049	0.090	0.152	0.000	0.025	0.074
2019	0.044	0.093	0.015	0.000	0.020	0.170
2020	0.051	0.059	0.142	0.000	0.131	0.005
2021	0.062	0.049	0.004	0.058	0.115	0.001
2022	0.052	0.081	0.079	0.018	0.072	0.024

Table 11 reports the estimation results based on the spatial model, Columns (1) -(2) mainly show the impact of real estate investment growth rate on hi-tech human capital agglomeration, while columns (3) -(4) mainly show the impact of residential investment growth rate on hi-tech human capital agglomeration. In order to avoid the endogenous problem, the growth rate of real estate investment, residential investment growth rate and control variables all lag one period. These estimates show that the spatial autoregressive coefficient RHO is significantly positive at the 1% level, which means that both real estate investment growth rate and residential investment growth rate have significant spatial spillover effects on urban hi-tech human capital agglomeration. In addition, the growth rates of real estate investment and residential investment all have significant negative impacts on hi-tech urban human capital agglomeration after considering the spatial spillover effect. In addition, educational level and natural population growth rate exert positive significant impacts on hi-tech human capital agglomeration at the level of 10%.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

Table 11.
Spatial model of the impact of the national real estate market (including residential investment) on hi-tech human capital agglomeration.

	(1)	(2)	(3)	(4)
	SDM	**SAC**	**SDM**	**SAC**
Invest	-0.013***	-0.015***	-0.013**	-0.014*
	(0.005)	(0.005)	(0.006)	(0.008)
Proportion1-2nd	-0.092	-0.083***	-0.089	-0.082**
	(0.061)	(0.031)	(0.061)	(0.031)
Finance	0.059	0.018	0.058	0.016
	(0.052)	(0.038)	(0.052)	(0.038)
Hospitals	-0.237	0.854	-0.138	0.924
	(0.744)	(0.696)	(0.748)	(0.708)
education	0.034	0.043*	0.035*	0.043**
	(0.021)	(0.021)	(0.021)	(0.022)
Rate-population	0.387	0.388	0.390	0.393
	(0.374)	(0.250)	(0.373)	(0.250)
Rate-gdp	-0.610*	-1.069***	-0.622*	-1.069***
	(0.374)	(0.302)	(0.346)	(0.303)
rho	0.302***	0.011*	0.302***	0.010*
	(0.004)	(0.006)	(0.000)	(0.005)
Observations	3584	3584	3584	3548

Note: ***, ** and * represent significance levels of 1%, 5% and 10% respectively.

5. Conclusions and Recommendations

Based on panel data of 256 cities in China, this paper explored the impact of real estate investment growth rate on hi-tech human capital agglomeration. The results showed that the rapid growth of real estate investment did significantly inhibit the hi-tech human capital agglomeration in whole China's region. In addition, this study also examined the influencing mechanism, the results showed that the negative impact of real estate investment growth on hi-tech human capital agglomeration is caused by its promoting effect on secondary industry.

To sum up, in order to promote the healthy and stable development of China's real estate market and the degree of hi-tech human capital agglomeration, the following policy suggestions are put forward:

First, strengthen macro-control of the real estate market. The real estate market mechanism is still to be improved, we should fully strengthen the macro-control of the real estate market, limit the speculation in the real estate market [54].

Second, continue to promote the agglomeration of hi-tech urban human capital. Hi-tech human capital agglomeration plays a more and more important role in regional economy, and the influencing factors of hi-tech human capital agglomeration is various, in addition to the local economy development, degree of industrial concentration and local hi-tech human capital policies, this study showed that the real estate market development status may also have a profound impact on hi-tech human capital accumulation. Therefore, in the process of promoting the agglomeration of hi-tech human capital, the local government should consider all aspects of factors, especially the real estate market, overall planning, according to local conditions to formulate hi-tech human capital policies to promote the sustainable development of local human capital [55].

Third, strengthen the coordination and connection of hi-tech human capital agglomeration between different cities. Regional real estate market may exist obvious spatial correlation even spillover effect between the regional distribution and accumulation of hi-tech human capital, so the local city government should not only pay attention to the development of real estate market and distribution of human capital, but also strengthen the contact and coordination with surrounding city government. Besides, the local government should stand on the height vision of the urban hi-tech agglomeration

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806

development, break the boundary of the administrative division, give full consideration to hi-tech, and plan the urban hi-tech human capital distribution, then make full use of the urban agglomeration advantages which in the allocation of resources and elements flow, to effectively promote the healthy development of real estate market and the harmonious development of hi-tech human capital.

Funding:
The study was supported by "the National Social Science Fund of China: research on the mechanism and guiding policy of parental capital driving intergenerational housing transfer in China (Grant Number: 20CGL046)".

Transparency:
The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

References
[1] Y. Shan and N. Wang, "Spatiotemporal evolution and the influencing factors of China's high-tech industry GDP using a geographical detector," *Sustainability*, vol. 15, no. 24, p. 16678, 2023. https://doi.org/10.3390/su152416678

[2] Y. Zan and Y. Hongjie, "The influence of real estate market on enterprise R&D investment," *Science Research Management*, vol. 43, no. 1, p. 153, 2022.

[3] L. Zhang, G. Lin, X. Lyu, and W. Su, "Suppression or promotion: Research on the impact of industrial structure upgrading on urban economic resilience," *Humanities and Social Sciences Communications*, vol. 11, no. 1, p. 843, 2024. https://doi.org/10.1057/s41599-024-03329-2

[4] C. Wang, L. Wang, Y. Xue, and R. Li, "Revealing spatial spillover effect in high-tech industry agglomeration from a high-skilled labor flow network perspective," *Journal of Systems Science and Complexity*, vol. 35, no. 3, pp. 839-859, 2022. https://doi.org/10.1007/s11424-022-1056-1

[5] W. Tu, L. Zhang, D. Sun, and W. Mao, "Evaluating high-tech industries' technological innovation capability and spatial pattern evolution characteristics: Evidence from China," *Journal of Innovation & Knowledge*, vol. 8, no. 1, p. 100287, 2023. https://doi.org/10.1016/j.jik.2022.100287

[6] Z. Yang and Y. Pan, "Human capital, housing prices, and regional economic development: Will "vying for talent" through policy succeed?," *Cities*, vol. 98, p. 102577, 2020. https://doi.org/10.1016/j.cities.2019.102577

[7] Y. Wu, N. Heerink, and L. Yu, "Real estate boom and resource misallocation in manufacturing industries: Evidence from China," *China Economic Review*, vol. 60, p. 101400, 2020. https://doi.org/10.1016/j.chieco.2019.101400

[8] L. Han, L. Zhou, H. Bao, X. Zeng, and F. Taghizadeh-Hesary, "What affects China's high-tech industry land misallocation: Government behavior or enterprise behavior?," *Frontiers in Environmental Science*, vol. 10, 2022. https://doi.org/10.3389/fenvs.2022.959926

[9] Q. Sun, S. A. Javeed, Y. Tang, and Y. Feng, "The impact of housing prices and land financing on economic growth: Evidence from Chinese 277 cities at the prefecture level and above," *PLOS One*, vol. 19, no. 4, p. e0302631, 2024. https://doi.org/10.1371/journal.pone.0302631

[10] J. Zhang *et al.*, "The inter-relationships among mobility, housing prices and innovation: Evidence from China's cities," *International Journal of Strategic Property Management*, vol. 27, no. 4, pp. 233–245, 2023. https://doi.org/10.3846/ijspm.2023.20202

[11] H. Song and M. Wu, "Do excessive housing prices lead to an outflow of talent?," *Journal of Financial Research*, vol. 3, pp. 77-95, 2020.

[12] Y. Zhou, L. Meng, and Q. Lu, "Who is crowded out by high housing prices? Evidence from microdata in China," *Economic Research Journal*, vol. 54, pp. 106-122, 2019.

[13] W. W. Olney and D. Pozzoli, "The impact of immigration on firm-level offshoring," *The Review of Economics and Statistics*, vol. 103, no. 1, pp. 177-195, 2021. https://doi.org/10.1162/rest_a_00861

[14] H. Sun, L. Zhang, and S. Wang, "Technological talent agglomeration, spatial spillover and regional technological innovation based on spatial durbin model partial differential method," *Science of Science and Management of S.& T.*, vol. 40, pp. 58-69, 2019.

[15] X. Dai, J. Tang, Q. Huang, and W. Cui, "Knowledge spillover and spatial innovation growth: Evidence from China's Yangtze River Delta," *Sustainability*, vol. 15, no. 19, p. 14370, 2023. https://doi.org/10.3390/su151914370

[16] B. Yu, G. Niu, J. Ye, and W.-w. Zhang, "Human capital agglomeration, institutional barriers, and internal migration in China," *Growth and Change*, vol. 54, no. 1, pp. 284-303, 2023. https://doi.org/10.1111/grow.12650

[17] Y. Su, Y. Hua, and L. Deng, "Agglomeration of human capital: Evidence from city choice of online job seekers in China," *Regional Science and Urban Economics*, vol. 91, p. 103621, 2021. https://doi.org/10.1016/j.regsciurbeco.2020.103621

[18] M. Yousaf, "Human capital efficiency and firm performance of quality-certified firms from EFQM excellence model: A dynamic panel data study," *Organizacija*, vol. 57, no. 2, pp. 151-164, 2024.

[19] M. I. Sánchez-Hernández and F. Castilla-Polo, "Intellectual capital as a predictor of cooperative prominence through human capital in the Spanish agrifood industry," *Journal of Intellectual Capital*, vol. 22, no. 6, pp. 1126-1146, 2021. https://doi.org/10.1108/jic-06-2020-0201

[20] A. Valenti and S. Horner, "The human capital of boards of directors and innovation: An empirical examination of the pharmaceutical industry," *International Journal of Innovation Management*, vol. 24, no. 06, p. 2050056, 2020. https://doi.org/10.1142/S1363919620500565

[21] N. N. Xu and J. H. Guo, "The interaction mechanism between evolution of the roles S&T intermediary plays and network structure in cluster," *Studies in Science of Science*, vol. 37, pp. 414-461, 2019.

[22] Y. Xu and A. Li, "The relationship between innovative human capital and interprovincial economic growth based on panel data model and spatial econometrics," *Journal of Computational and Applied Mathematics*, vol. 365, p. 112381, 2020. https://doi.org/10.1016/j.cam.2019.112381

[23] G. Zeng, Y. Hu, and Y. Zhong, "Industrial agglomeration, spatial structure and economic growth: Evidence from urban cluster in China," *Heliyon*, vol. 9, no. 9, p. e19963, 2023. https://doi.org/10.1016/j.heliyon.2023.e19963

[24] A. I. Asadov, M. H. Ibrahim, and R. Yildirim, "Impact of house price on economic stability: Some lessons from OECD countries," *The Journal of Real Estate Finance and Economics*, 2023. https://doi.org/10.1007/s11146-023-09945-0

[25] T. C. Lin, S.-H. Hsu, and Y.-L. Lin, "The effect of housing prices on consumption and economic growth – the case of Taiwan," *Journal of the Asia Pacific Economy*, vol. 24, no. 2, pp. 292-312, 2019. https://doi.org/10.1080/13547860.2019.1584958

[26] K. Rogoff and Y. Yang, "Rethinking China's growth," *Economic Policy*, vol. 39, no. 119, pp. 517-548, 2024. https://doi.org/10.1093/epolic/eiae022

[27] C. Leishman and S. Goel, "Amenities and housing market dynamics: Implications for population change, urban attractiveness, innovation, and productivity," *Urban Studies*, vol. 62, no. 7, pp. 1269-1292, 2025. https://doi.org/10.1177/00420980241284480

[28] G. Giuliano, S. Kang, and Q. Yuan, "Agglomeration economies and evolving urban form," *The Annals of Regional Science*, vol. 63, no. 3, pp. 377-398, 2019. https://doi.org/10.1007/s00168-019-00957-4

[29] W. H. Sun and Y. F. Zhang, "Production of space and multi-dimension segmentation characteristics of China's hi-tech parks," *Studies in Science of Science*, vol. 38, no. 6, pp. 813–825, 2020.

[30] S. Sassen, *The global city: New York, London, Tokyo*, 2nd ed. Princeton, NJ: Princeton University Press, 2001.

[31] A. C. Blanco-Moreno, "Inter-regional graduate migration, subjective expectations, and human capital mobility," *Regional Science Policy & Practice*, vol. 16, no. 10, p. 100110, 2024. https://doi.org/10.1016/j.rspp.2024.100110

[32] K. Pain *et al.*, "Real estate investment and urban density: Exploring the polycentric urban region using a topological lens," *Territory, Politics, Governance*, vol. 11, no. 2, pp. 241-260, 2023. https://doi.org/10.1080/21622671.2020.1837665

[33] J. Gao, B. Jun, A. S. Pentland, T. Zhou, and C. A. Hidalgo, "Spillovers across industries and regions in China's regional economic diversification," *Regional Studies*, vol. 55, no. 7, pp. 1311-1326, 2021. https://doi.org/10.1080/00343404.2021.1883191

[34] W. Xiong and J. Li, "The knowledge spillover effect of multi-scale urban innovation networks on industrial development: Evidence from the automobile manufacturing industry in China," *Systems*, vol. 12, no. 1, p. 5, 2024. https://doi.org/10.3390/systems12010005

[35] Z. Chen, M. Li, and M. Zhang, "The effect of housing prices on urban innovation capability: New evidence from 246 Chinese cities," *The American Journal of Economics and Sociology*, vol. 84, no. 2, pp. 427-440, 2025. https://doi.org/10.1111/ajes.12610

[36] C. Wang, X. Ma, H. Lee, and Z. Chu, "Does real estate bubble affect corporate innovation? Evidence from China," *PLOS ONE*, vol. 16, no. 9, p. e0257106, 2021. https://doi.org/10.1371/journal.pone.0257106

[37] J. Li, P. Lyu, and C. Jin, "The impact of housing prices on regional innovation capacity: Evidence from China," *Sustainability*, vol. 15, no. 15, p. 11868, 2023. https://doi.org/10.3390/su151511868

[38] C. Liotta, V. Viguié, and Q. Lepetit, "Testing the monocentric standard urban model in a global sample of cities," *Regional Science and Urban Economics*, vol. 97, p. 103832, 2022. https://doi.org/10.1016/j.regsciurbeco.2022.103832

[39] R. Florida, *The new urban crisis: How our cities are increasing inequality, deepening segregation, and failing the middle class-and what we can do about it*. New York: Basic Books, 2017.

[40] J. Le Gallo and C. Chasco, "Impact of urban sprawl on productivity and commuting costs: Evidence from the urban areas of France," *Regional Studies*, vol. 42, no. 5, pp. 727–745, 2008.
[41] B. M. Fraumeni, J. He, H. Li, and Q. Liu, "Regional distribution and dynamics of human capital in China 1985–2014," *Journal of Comparative Economics*, vol. 47, no. 4, pp. 853-866, 2019. https://doi.org/10.1016/j.jce.2019.06.003
[42] X. Zhang, L. Zhang, and Z. Li, "The spillover effects of real estate investment on urban manufacturing development: Evidence from China," *Habitat International*, vol. 93, p. 102049, 2019.
[43] Z. Xie and J. Yu, "Real estate investment and regional economic development in China," *Habitat International*, vol. 92, p. 102032, 2019.
[44] L. Shen and J. Zhang, "The impact of real estate investment on urban economic development: Evidence from China," *Urban Studies*, vol. 56, no. 7, pp. 1347–1364, 2019.
[45] J. Chen, Y. Wang, and H. Li, "Real estate investment and urban industry structure adjustment: Evidence from China," *Habitat International*, vol. 85, pp. 36–43, 2019.
[46] H. Nong, "Analyzing the role of the real estate sector in the sectoral network of the Chinese economy," *Structural Change and Economic Dynamics*, vol. 70, pp. 567-580, 2024. https://doi.org/10.1016/j.strueco.2024.05.022
[47] H. Zhou, Y. Wang, L. Gao, and H. Wu, "How housing price fluctuation affects resource allocation: Evidence from China," *Emerging Markets Finance and Trade*, vol. 56, no. 13, pp. 3084-3094, 2020. https://doi.org/10.1080/1540496X.2019.1608521
[48] J. Sun and W. You, "Research on the interaction between talent agglomeration and industrial agglomeration," *Management World*, vol. 3, pp. 177-178, 2008.
[49] Z. D. Zhang and T. T. Wang, "The influence of industrial cluster, urban agglomeration and their interaction on regional economic growth—basing on urban agglomeration along the Yangtze River Economic Belt," *Urban Problems*, vol. 1, pp. 55–62, 2019.
[50] S. Bond-Smith, "Combining agglomeration economies and endogenous growth without scale effects," *Spatial Economic Analysis*, vol. 19, no. 3, pp. 287-308, 2024. https://doi.org/10.1080/17421772.2023.2280106
[51] F. Liu, C. Liu, and H. Ren, "Urban housing price fluctuations and regional systemic financial risks: Panel spatial economic models in Jiangsu, China," *Sustainability*, vol. 10, no. 10, p. 3452, 2018. https://doi.org/10.3390/su10103452
[52] Z. Li, X. J. Wang, and Q. Liu, "Housing price volatility spillovers in China: From the perspective of risk network," *Journal of Central University of Finance & Economics*, vol. 4, pp. 114–128, 2021.
[53] M. Chen, S. Wang, W. Liu, and Y. Liu, "Measurement and analysis of correlation effect of urban housing price under the nonlinear perspective," *China Soft Science*, vol. 10, pp. 96-106, 2020.
[54] Q. Wu, Z. Zheng, and W. Li, "Can housing assets affect the Chinese residents' willingness to pay for green housing?," *Frontiers in Psychology*, vol. 12, 2022. https://doi.org/10.3389/fpsyg.2021.782035
[55] B. H. Zhang and M. R. Feng, "An empirical study on the influencing factors of talent agglomeration in China's high-tech industry," *Journal of Changchun Finance College*, vol. 5, pp. 63–70, 2020.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 9: 365-385, 2025
DOI: 10.55214/2576-8484.v9i9.9806