National Independent Innovation Demonstration Zone, Industry Agglomeration and Regional Innovation Capability-Research based on high-tech service industry

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Abstract. Under the background of accelerating scientific and technological progress and continuous expansion of technology scale in China, the policy of national independent innovation demonstration zones has been continuously deepened and improved, which promotes the development, transformation and upgrading of innovative economy in China and provides important support for the construction of regional innovation system. Based on the panel data of 285 cities in China from 2003 to 2020, this paper uses the difference in differences (DID) method to explore the impact of the national innovation Demonstration zone policy on regional innovation Capability, and to analyze and test the mechanism of diversified agglomeration and specialized agglomeration of high-tech service industries in the relationship between the two. Further, this paper tests the heterogeneity of policy effect in regions and policy layout; The spatial econometric method is introduced to consider the spatial spillover effect, and the spatial Durbin model is used to further explore the impact of the policy of the national Independent Innovation Demonstration Zone on regional innovation. The empirical results show that the establishment of the national Independent Innovation Demonstration Zone can promote regional innovation capability; The agglomeration of high-tech service industry plays a mediating role in the relationship between the two. The impact of the policy on innovation in the western region is much stronger than that in the eastern and central regions. Through the comparison of policy pattern, the policy effect of the single-city layout is much higher than that of the multi-city layout; There are significant negative externalities in the impact of the national independent innovation demonstration zone policy on regional innovation capability.

Keywords: National independent innovation demonstration zone; Regional innovation capability; Industrial agglomeration; Difference-in-differences model

1 Introduction

National independent innovation demonstration zones are areas approved by the government to promote the development of independent innovation and high-tech indus-

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tries through pioneering, exploring experience and setting an example. In the context of China's accelerating scientific and technological progress and continuous expansion of technology scale, the work of China's independent Innovation Demonstration Zones has been further promoted and implemented: Since the reconstruction of Zhongguancun National Self- Innovation Zone was launched in 2009, China has implemented the national innovation strategy in all aspects and established 21 national self-innovation demonstration zones, including Zhongguancun, Hubei Donghu and Shanghai Zhangjiang, covering 56 cities,62 national high- tech development zones and 128 innovative industrial clusters. The establishment of National independent innovation demonstration zone has become the key support and starting point of national innovation-driven development, giving full play to the guiding function of independent innovation and pilot, establishing a comprehensive innovation value chain and a sound innovation ecosystem, and providing important support for the construction of regional innovation system. Therefore, as the "Experimental field" of science and technology system reform, the role of National independent innovation demonstration zone in improving regional innovation capacity has attracted much attention.

In the opinions of The State Council on "mass entrepreneurship and innovation," it is mentioned that it is necessary to build a world- class source of scientific and technological innovation, give full play to the effect of innovation and entrepreneurship clusters, and promote the integrated development of various bases. At present, the theoretical circle has not reached a consensus on the impact of independent innovation demonstration zone on regional innovation, and its internal mechanism still needs to be deeply explored. It is worth considering whether the national independent innovation demonstration zone can strengthen the communication, cooperation and professional division of labor among enterprises through the agglomeration of high-tech service industry, so as to enhance the regional innovation capacity. Under different regional environments and layout modes, is the impact of the national independent innovation demonstration zone on regional innovation capability different? Does the promotion of regional innovation have spatial spillover? Based on this, this paper discusses the influence mechanism of national innovation demonstration zones on regional innovation capacity, summarizes the operation experience of policy pilot and puts forward relevant suggestions.

The possible contributions of this paper are as follows: firstly, it enriches the theoretical construction and experimental research of national independent innovation demonstration zones and regional innovation and tests the transmission path of high-tech service industry agglomeration in the two. The second is to provide theoretical reference for the government to improve industrial policy and resource allocation, explore more effective methods and models to promote regional innovation ability, and provide strong support and guarantee for the globalization development of China's high-tech service industry.

2 Review of relevant papers

2.1 Evaluation of index system of regional innovation

Cooke [28] took the lead in proposing relevant research on regional innovation, arguing that enterprises in a region interact in the process of innovation, and through learning and reform, they establish an institutional organization network related to regional resources, thus forming a regional innovation system. Through the analysis of regional technology innovation system research, researchers began to pay attention to the evaluation of regional innovation: Wang Xiaoguang and Fang Ya [16] constructed an index system of regional innovation capability evaluation based on industrial clusters. Zhang Yanhong et al. [22] analyzed the innovation capabilities of different provinces from five aspects: knowledge creation, knowledge acquisition, enterprise innovation, innovation environment and innovation performance. Jiao Jingjuan et al. [7], Li Erling and Cui Zhizhen [8] classified regions according to spatial location and economic development, respectively. Sun Kai [13] clustered regions according to relevant indicators.

2.2 Theoretical Research on National Independent Innovation Demonstration Zone

The main purpose of the national independent innovation demonstration zones is to implement the innovation-leading function [15]. Due to the strong socialist characteristics of the pilot policy of the national independent innovation demonstration zones, there are almost no research results on the national independent innovation demonstration zones abroad at present, and only a few scholars have studied the industrial agglomeration caused by the national independent innovation demonstration zones: According to Storper and Venables[34], industrial agglomeration provides convenient face-to-face communication among enterprise clusters and promotes knowledge spillover. Domestic scholars have carried out rich research on the pilot policy of self-created zones, mainly focusing on three aspects: 1. The impact of regional economy and innovation performance [6]. 2.The evaluation of the national independent innovation demonstration zones and related policies: talent policy [9], college students ' entrepreneurship policy [18]and scientific and technological innovation policy [23]. 3.Macro strategic positioning of the national independent innovation demonstration zones [20].

2.3 The impact of national independent innovation demonstration zones on regional innovation

In the current environment of China 's innovation-driven development strategy, the national independent innovation demonstration zone as an important element in the regional innovation system is worthy of further study. Zhang Yongan and Guan Yongjuan [24], Qin Haibo et al. [11], Wei Li and Bu Wei [17], Liu Xiaoyong [10] believed that the promotion of regional innovation capability by national independent innova-

tion zones is mainly reflected in the following four aspects: policy innovation, government preference, resource allocation and technological progress. The existing index systems for the research on national independent innovation demonstration zones are mostly concentrated at the provincial level [17], lacking comprehensive evaluation indicators for prefecture-level cities. In terms of theoretical research and empirical testing, the existing literature pays less attention to the relationship between national independent innovation demonstration zones, high-tech service industry agglomeration, and regional innovation capabilities. Therefore, this paper theoretically analyzes and empirically tests the mechanism of the national independent innovation demonstration zone on regional innovation capability from the aspects of diversified aggregation and specialized aggregation of high-tech service industry, to enrich the relevant research on the influencing factors of regional innovation.

3 Theoretical framework analysis

3.1 The influence of national independent innovation demonstration zone on regional innovation capability

Building the national independent innovation demonstration zone can promote regional innovation. From the perspective of policy environment, the national independent innovation demonstration zone plays a key role in forming technological innovation system. Governments at all levels give preferential policies to enterprises in the national independent innovation demonstration zone to reduce the risk of enterprise innovation [5]. Meanwhile, the complete supporting facilities within the the national independent innovation demonstration zone provide an excellent innovation environment for enterprises, thus promoting the improvement of regional innovation capabilities [24]. Under the background of active market economy, the national independent innovation demonstration zone will respond to the ' call ' to better meet the market demand by developing new products and improving production, thus triggering more fierce market competition and stimulating regional innovation [4]. From the perspective of agglomeration effect, the national independent innovation demonstration zone will establish a series of supporting platforms such as technical and technological services, financial services, intellectual property protection and enterprise incubation within the region to integrate various innovation resources and promote regional innovation capacity. On the one hand, the agglomeration effect can reduce the external cost of enterprises and improve the utilization of resources; on the other hand, it can promote the technology exchange and information sharing of enterprises in the national independent innovation demonstration zone, improve the efficiency of innovation production [33], and enhance the competitiveness of enterprises.

Therefore, the hypothesis is put forward as follows:

H1: The establishment of the national independent innovation demonstration zone can promote regional innovation capability.

3.2 Intermediary role of diversified agglomeration of high-tech service industry

Enterprises in the national independent innovation demonstration zone tend to form a relatively complete industrial chain, establish a sound innovation and entrepreneurship ecology, gather talents with policy dividends, continuously integrate and gather high-quality innovation resources [10], and form diversified high-tech service clusters with their own characteristics. In addition, the establishment of self-created areas considers the expansion of market supply and demand and the proximity of spatial location, which is easy to promote the gradual formation of diversified high-tech service industry clusters with different characteristics and enhance the degree of co-agglomeration.

From the perspective of value creation, as a new form of spatial economic organization, the diversified agglomeration of high-tech service industry can synergize through mechanisms such as collaborative development, detailed division of labor, information sharing and resource integration to form Jacobs externality [19], promote the free flow of innovation elements in the region, contribute to knowledge spillover, to form innovative products and services [30]. From the perspective of value allocation, the diversified aggregation of high-tech service industry can provide production factors and market demand for enterprises, to realize the optimal allocation of resources by sharing supply chain and production resources, so as to reduce transaction costs and gain greater market share in market competition. From the perspective of value capture, the diversified service industry in the national independent innovation demonstration zone can help enterprises form close cooperative relations to reduce the transportation cost and information acquisition cost [1], improve the efficiency of the supply chain of the whole industry, promote the effective operation of the market, and enhance the innovation willingness of innovation subjects.

Therefore, hypotheses are put forward as follows:

H2: The establishment of the national independent innovation demonstration zone promotes regional innovation capacity through the diversified agglomeration of high-tech service industries.

3.3 The intermediary role of specialized agglomeration of high-tech service industry

The national independent innovation demonstration zone has the characteristics of technological innovation activity preference agglomeration, which deepens the specialization agglomeration of high-tech service industry [27]. The high-tech service market demand around the national independent innovation demonstration zone is strong, attracting more similar enterprises to settle in, further improving the degree of specialization and agglomeration in the park [29]. At the same time, enterprises, universities and laboratories in the self-created zone have rich high-end talent reserves, provide rich human capital for regional innovation, deepen the exchange of professional knowledge, and further improve the specialization of high-tech service industry.

According to MAR externality theory, industrial specialization aggregation promotes the exchange and interaction of personnel and information, promotes the transmission, application and development of innovative ideas and new technologies, and drives regional technological innovation [32]. Specialized information sharing can improve the work efficiency of enterprises in the national independent innovation demonstration zone promotes regional innovation capacity through the diversified agglomeration of high-tech service industries., increase the success rate of scientific research, and thus reduce the capital risk [25]. Specialized agglomeration of high-tech service industry can promote the formation of synergy effect among enterprises in the same trade. Through sharing methods such as development costs, it can reduce the recruitment costs, innovation and R&D investment costs, and enterprise learning and communication costs among similar industries [31], and enhance regional innovation capacity.

Therefore, the hypothesis is proposed as follows:

H3: The establishment of national independent innovation demonstration zone enhances regional innovation capacity through the specialized agglomeration of high-tech service industry.

4 Model establishment and indicator description

4.1 model construction

This paper uses the DID method to alleviate the endogeneity problem caused by selection bias. Since the national independent innovation demonstration zone of prefecture-level cities in the sample are established in batches, this paper constructs a multi-time DID model (1) to test the impact of the establishment of national independent innovation demonstration zone on regional innovation.

$$\mathrm{INNit} = \alpha 0 + \beta 0 \mathrm{DIDit} + \gamma 0 \mathrm{Xit} + \theta \mathrm{i} + \theta \mathrm{t} + \varepsilon \mathrm{it} \quad (1)$$

Where, i, t are prefecture-level city, year, X_{it} is control variable, θ_i ,θ_t represents individual fixed effect and time fixed effect respectively; INN_{it}represents the innovation capability of prefecture-level cities in the first year; ε_{it} is the random error term; DID_{it} is the difference-in-differences estimator; β_0 is the regression coefficient focused on in this paper, which measures the average difference between the innovation capability of the national independent innovation demonstration zone group and that of the control group.

To further analyze the mechanism of the pilot policy on regional innovation capacity. The following econometric model is constructed to test the mediating effect of specialized agglomeration and diversified agglomeration of high-tech service industry in the influence of the national independent innovation demonstration zone policy on regional innovation ability. Using the method of stepwise regression, the following econometric model is constructed based on the above formula (1):

$$DIV_{it}/SPE_{it} = \alpha_1 + \beta_1 DID_{it} + \gamma_1 X_{it} + \theta_i + \theta_t + \varepsilon_{it} \quad (2)$$

$$INN_{it} = \alpha_2 + \beta_2 DID_{it} + \delta DIV_{it}/SPE_{it} + \gamma_2 X_{it} + \theta_i + \theta_t + \varepsilon_{it} \quad (3)$$

Where: DIV_{it}, SPE_{it}respectively represents the specialization and diversified agglomeration of high-tech service industry; $\beta_0$represents the total effect of the pilot policy of the national independent innovation demonstration zone; β_2 Represents the direct effect, and$\beta_1 * \delta$ represents the mediating effect.

4.2 Variable setting

4.2.1 Explained variable.

At present, scholars mostly use a single index to evaluate regional innovation (such as the number of patent applications), but do not evaluate the regional capability of prefecture-level cities from a comprehensive perspective. This paper refers to scholars [2][26][12][3] constructed the index of provincial regional innovation capability and weighed the availability and integrity of prefecture-level cities' data, and measured the regional innovation capability of prefecture-level cities from three dimensions of resource capability, environmental capability and technological capability (see Table 1).

In this paper, the KMO value and Bartlett test are carried out: the KMO value is 0.805, and the P value is 0.00, indicating that the original variable has passed the test. In the principal component analysis, the first four eigenvalues are 3.78347, 1.13637, 0.99336 and 0.849286 respectively, and the cumulative explanation percentage is 84.53%, which can explain most of the information. Therefore, this paper constructs the comprehensive index of regional innovation capacity by weighting the first four principal components according to their respective explanation percentage.

4.2.2 Core explanatory variables.

In this paper, cities with the national independent innovation demonstration zone are assigned a value of 1, otherwise 0. The year of establishment and subsequent years are assigned a value of 1, otherwise 0. The policy dummy variable is constructed by multiplying the two.

Table 1. Regional innovation capability index

First index	Second index	Definition
Knowledge capability	Educational level	The proportion of government education and science and technology expenditure to budget expenditure in prefecture-level cities in the year
	Public library book collation	The city 's public library book collection of the year
Environmental capability	Actual foreign investment	The actual amount of foreign investment in the city that year
	Number of Internet	The number of Internet broadband access users in the city that year

	broadband access users	
	Per capital gross regional product	Gross regional product divided by total population at the end of the year
Technological capacity	Total number of patent applications	The total number of patents applied by prefecture-level cities in the year
	Total patent licensing	The total number of authorized patents in prefecture-level cities in the year
	R&D investment	The total R & D investment of the prefecture-level city where the listed company is in that year

Source: Author mapping.

4.2.3 Mediating variables.

High-tech service industry is mainly divided into information technology and communication service industry, information technology service industry and business service industry. According to the classification of national economic industries in the City Statistical Yearbook, this paper classifies transportation, storage, post and telecommunications, information transmission, computer services and software, scientific research and technology services, and geological exploration services into high-tech services.

(1) Specialized agglomeration. Referring to the research of Qing Tao [14], this paper evaluates the agglomeration level of high-tech service industry through regional entropy.

$$SPE = (e_{ir}/\sum_r e_{ir})/(\sum_i e_{ir}/\sum_i \sum_r e_{ir}) \quad (4)$$

Here, e_{ir} denotes the number of people employed in i regional r industries. The larger the index is, the more specialized the region is.

(2) Diversified agglonieration. According to the theory of Zhang Wenxi et al. [21] and Ren Jiao et al. [12], the diversification index is established.

$$DIV = 1/\sum_r s_{irt}^2 \quad (5)$$

In the equation, s_{irt} is the proportion of the number of employees in the i regional r industry in the t first year to the total number of employees in the regional high-tech service industry in the first year. The higher the degree of diversified development of regional high-tech service industry is, the more scattered the employment is, the smaller s_{irt} is, the diversification index is.

4.2.4 Control variables.

Regional innovation capability will be interfered by many factors. In order to reduce the bias of empirical research, this paper refers to the practice of scholars such as Qin Haibo et al. [11] and Liu Xiaoyong et al. [10], and selects the following variables for control. (1) Industrial structure (IND). The percentage of the economic added value of

the secondary industry in the national economic added value of the tertiary industry is used to evaluate the evolution characteristics of regional industrial structure. (2) Population (POP). The population size of a city is measured by the average annual resident population of the area. (3) Government intervention (INT). The ratio of local government fiscal expenditure to GDP is selected to reflect the degree of local government intervention in local innovation capacity. (4) Financial level (FIN). The percentage of financial credit and deposits in GDP at the end of the year represents the degree of financial economic development. (5) Industrial scale (FRA). The proportion of total industrial output value above designated size in GDP is used to reflect the industrial scale. (6) Household saving level (HOU). The ratio of year-end savings balance of urban and rural residents to GDP is used to represent the level of household savings. (7) Infrastructure carrier (NUM). The number of industrial enterprises above the quota is used to represent the infrastructure carrier.

4.3 Data source and data processing

The data sources involved in the empirical research are mainly from the Statistical Yearbook of Science and Technology, China City Statistical Yearbook and CSMAR. The list of the national independent innovation demonstration zone and the time of establishment are from the public list of Torch High-tech Industry Development Center of the Ministry of Science and Technology.

In this paper, most of the city data observations with missing key variables are eliminated, and the missing data are supplemented by linear interpolation method and average value. To reduce the influence of extreme values on parameter estimation, winsorize is used to winsorize the continuous variables at the level of 1%. Since the newly approved self-created zones in 2022 are not within the sample time range, they are excluded from the experimental group of the national independent innovation demonstration zone in this paper. Finally, 285 balanced panel data from 03 to 20 years were obtained.

5 Empirical analysis and results

5.1 Descriptive statistics

It can be seen from Table 2 that about 5.4% of the samples of prefecture-level cities belong to the policy experimental group. There are great differences in regional innovation capabilities in China. The mean value of innovation capabilities of prefecture-level cities with the national independent innovation demonstration zone is much higher than that of prefecture-level cities without the national independent innovation demonstration zone, which initially supports the benchmark hypothesis. The mean values of diversification and specialization of high-tech service industry in the experimental group and the control group were 0.04 and 0.08, respectively; 0.75 and 0.99, indicating that the policy also has a certain impact on the diversification and specialization level of high-tech service industry in prefecture-level cities. The regional het-

erogeneity of control variables such as policy intervention, industrial quantity, population, household savings and infrastructure in each region is obvious.

Table 2. Descriptive statistics

Variable	DID=0						DID=1					
	N	Mean	p50	SD	Min	Max	N	Mean	p50	SD	Min	Max
INN	4851	-0.08	-0.19	0.37	-0.40	2.41	279	1	0.88	0.75	-0.12	2.41
DIV	4851	0.04	0.02	0.05	0	0.33	279	0.08	0.03	0.11	0	0.33
SPE	4851	0.75	0.66	0.36	0.25	2.08	279	0.99	0.88	0.55	0.26	2.08
IN	4851	1.34	1.25	0.62	0.33	4.03	279	0.88	0.89	0.29	0.33	1.79
POP	4851	0.04	0.04	0.02	0	0.13	279	0.06	0.06	0.03	0.01	0.13
INT	4851	0.17	0.15	0.10	0.06	0.59	279	0.14	0.13	0.05	0.07	0.41
FIN	4851	2.16	1.88	1.02	0.87	6.56	279	3.35	3.09	1.30	1.42	6.56
FRA	4851	1.27	1.21	0.63	0.09	3.15	279	1.46	1.42	0.54	0.09	2.72
HOU	4851	0.75	0.71	0.28	0.30	1.76	279	0.72	0.66	0.21	0.43	1.43
NUM	4851	0.10	0.06	0.14	0	0.79	279	0.32	0.25	0.21	0.01	0.79

Data source: calculated by the author.

5.2 Parallel trend test

To verify the premise of the parallel trend hypothesis, this paper constructs the following model:

$$INN_{it} = a_3 + \sum_{k=-4}^{3} a_k I_{it}^k + \gamma_3 X_{it} + \theta_i + \theta_t + \varepsilon_{it} \quad (6)$$

Where I_{it}^k represents the dummy variable set up in the self-created area. Let $k = t - yi,$, when $k = -4, \ldots, 3$, corresponding $I_{it}^k = 1$, otherwise 0, this paper sets the year before the establishment of the national independent innovation demonstration zone as the base year. Figure 1 shows the estimated coefficient of the national independent innovation demonstration zone variable and its 95% confidence interval. It can be seen from Figure 1 that the estimated coefficients of period -4 to -2 are all significantly 0. However, the coefficients of 0-3 stages all reject 0 significantly. This shows that before the implementation of the policy, the innovation capabilities of the two areas have basically the same trend, and after the implementation of the policy, the innovation capabilities of the two areas have a large difference, and the hypothesis of parallel trend is established.

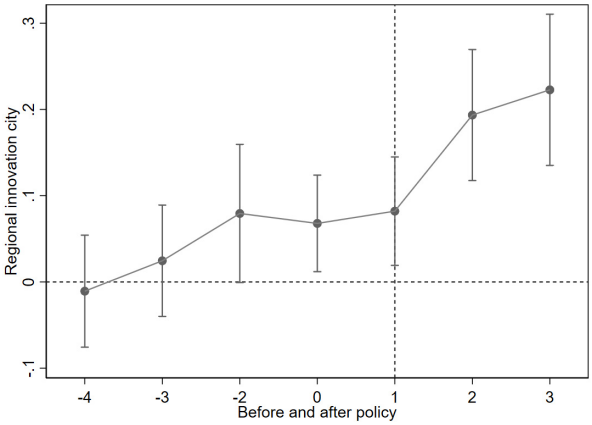

Fig. 1. Parallel trend test

Data source: calculated by the author.

5.3 Benchmark regression results

Regression results (1) in Table 3 show that the DID coefficient is significantly positive at the level of 1%. This shows that compared with other regions, the innovation capacity of the national innovation demonstration zone is stronger. Its economic significance is also significant: on average, the innovation capacity of prefecty-level cities with the national innovation demonstration zone increases by about 27.34% compared with those without the national innovation demonstration zone. This is because under the premise of pursuing effective improvement of regional innovation capacity, compared with prefect-level cities without the national innovation demonstration zone, the establishment of the national innovation demonstration zone is conducive to creating a superior innovation environment and providing policy support, to carry out innovation activities more effectively and improve innovation achievements and contributions better. This is consistent with Hypothesis H1.

Columns (2) and (4) show that the diversification agglomeration coefficient and specialization agglomeration coefficient of high-tech service industry are both significantly positive at the level of 5%. The results in columns (3) and (5) show that the diversification and professional agglomeration of high-tech service industry significantly improve regional innovation capacity, and the coefficients of the national independent innovation demonstration zone are all smaller than the benchmark regression results, which also means that the agglomeration of high-tech service industry is an important intermediary path for the policy of the self-created zone to affect regional innovation. The establishment of the national independent innovation demonstration zone promotes the diversified agglomeration of high-tech service industry by improving the integration of industrial chain and optimizing the allocation of innovation resources. The diversified agglomeration strengthens the cooperation and communication between upstream and downstream companies and lays a solid material founda-

tion for enhancing regional innovation. The establishment of the national independent innovation demonstration zone can provide favorable policy environment and resource support for the region, attract the same type of enterprises and talents with similar professional skills to participate in the design, development and application of products, technologies and business models of the high-tech service industry, promote the cooperation and innovation among the high-tech service industry enterprises in the region, and improve the regional innovation ability. This is consistent with Hypotheses H2 and H3.

Table 3. Benchmark regression results

Variable	(1) INN	(2) DIV	(3) INN	(4) SPE	(5) INN
DID	0.2734***	0.0164**	0.2674***	0.0747**	0.2695***
	(7.98)	(2.37)	(7.87)	(2.16)	(7.84)
DIV			0.3649**		
			(1.97)		
SPE					0.0522**
					(2.24)
Control	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes
Individual	Yes	Yes	Yes	Yes	Yes
N	5127	5127	5127	5127	5127
F	43.1863	3.8796	39.4637	3.3953	39.0497
R^2	0.8799	0.7800	0.8803	0.8174	0.8802

Note: The numbers in brackets are clustered standard errors at the prefecture-level where the samples are located; * represents p<0.10, ** represents p<0.05, and ** represents p<0.01; The same hereinafter.

Data source: calculated by the author.

5.4 Robustness test

5.4.1 Placebo test.

In this paper, the placebo test was conducted to exclude the influence of other unknown factors on the selection of pilot areas and confirm the robustness of the benchmark regression results. The prediction results in Figure 2 show that the regression coefficient is 0.273376, which is concentrated around 0, indicating that the policy of the national independent innovation demonstration zone can promote the development of the innovation capacity of prefecty-level cities.

5.4.2 Propensity Score matching (PSM-DID).

In this paper, the control variables were regarded as matching variables, and the caliper matching was completed at 1:1. The balance test was carried out to confirm the validity of the matching results, and then the above equations (3), (4) and (5) were

repeated 500 times. As shown in Figure 3, the deviation of the variables after matching is significantly reduced, which indicates that using PSM for data preprocessing is more effective. Table 4 shows that the PSM-DID regression results are generally consistent with the benchmark 19 regression results. This shows that after considering the endogeneity problem caused by selection bias, the national independent innovation demonstration zone still plays an important role in promoting regional innovation, and high-tech service industry agglomeration is still an important influencing mechanism between the two.

5.4.3 Eliminate the influence of municipalities.

To further verify the reliability of the research results, this paper excludes the sample data of the municipalities directly under the Central Government to exclude the impact of the large differences between the municipalities and other prefecture-level cities due to economic strength, policy preference and other factors on the regression results. Table 5 shows that the regression results are still significant.

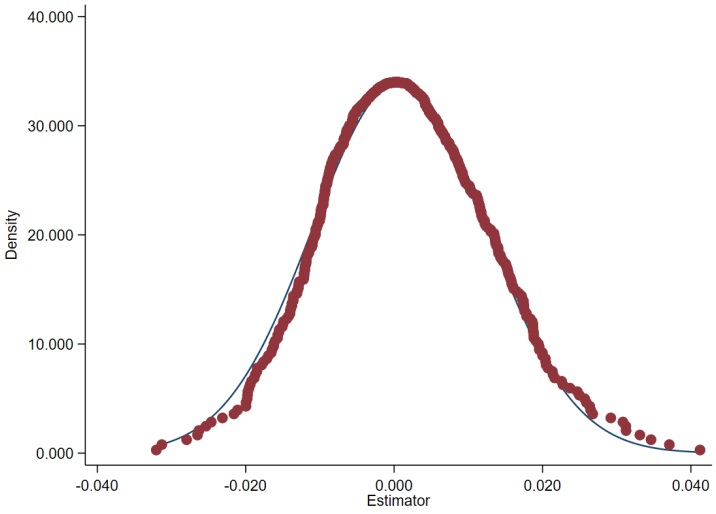

Fig. 2. Placebo test matching

Data source: calculated by the author.

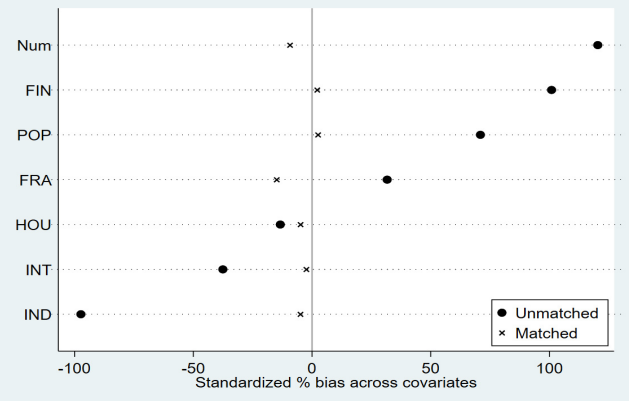

Fig. 3. Results of propensity score

Data source: calculated by the author.

Table 4. Robustness test- Propensity score matching

Variable	(1) INN	(2) DIV	(3) INN	(4) SPE	(5) INN
DID	0.2602***	0.0164**	0.2539***	0.0744**	0.2561***
	(7.85)	(2.40)	(7.73)	(2.11)	(7.71)
DIV			0.3836**		
			(2.11)		
SPE					0.0542**
					(2.30)
Control	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes
Individual	Yes	Yes	Yes	Yes	Yes
N	5095	5095	5095	5095	5095
F	42.3444	3.9015	38.4711	3.3555	38.2308
R^2	0.8702	0.7763	0.8706	0.8139	0.8705

Data source: calculated by the author.

Table 5. Excludes the impact of municipalities directly under the Central Government

Variable	(1) INN	(2) DIV	(3) INN	(4) SPE	(5) INN
DID	0.2671***	0.0171**	0.2601***	0.0747**	0.2631***
	(7.79)	(2.34)	(7.69)	(2.04)	(7.66)
DIV			0.4134**		
			(2.20)		
SPE					0.0537**
					(2.28)
Control	Yes	Yes	Yes	Yes	Yes

Time effect	Yes	Yes	Yes	Yes	Yes
Individual	Yes	Yes	Yes	Yes	Yes
N	5055	5055	5055	5055	5055
F	40.3916	3.2423	36.9451	3.0168	36.4882
R^2	0.8582	0.7585	0.8588	0.8039	0.8586

Data source: calculated by the author.

6 Further research

6.1 Heterogeneity analysis

The geographical location and the positioning of different types of national innovation demonstration zones may make the impact of the policy implementation effect of the national independent innovation demonstration zone on regional innovation significantly different.

6.1.1 Regional heterogeneity.

Regional heterogeneity will reflect the national innovation-driven development strategy and the rational allocation effect of local innovative talents. This paper conducts sub-sample regression according to geographical location. The regression results in Table 6 show that the driving effect of the national independent innovation demonstration zone on innovation capability is very significant in the western region, but relatively small in the eastern and central regions. The reason for this phenomenon may be that the improvement of regional innovation capacity has a marginal decreasing trend. Compared with the rapidly developing eastern and central regions, the overall innovation capacity of the western region is lower, and the establishment of the the national independent demonstration zone has a more obvious effect on the industrial structure adjustment and resource allocation efficiency of the prefecture-level cities. However, the eastern and central regions themselves have perfect innovation environment and resources, and the innovation ability has a relatively high level. Therefore, the promotion effect of the national independent demonstration zone policy on the development of the eastern region is relatively limited.

6.1.2 Heterogeneity of policy layout.

Among the 23 national innovation demonstration zones, they include the single-city layout including a single national high-tech zone, and the joint multi-city layout mode of multiple national high-tech zones. Different policy layouts may cause great differences in policy effects. Therefore, this paper divides the treatment group into two sub-samples: single-city layout and multi-city layout. It can be seen from Table 6 that the two layout modes have significantly improved the regional innovation capacity, and the policy effect of the single-city layout is much higher than that of the multi-city layout. This may be due to the fact that the policy of multi-city layout involves more cooperation between government departments, which leads to a long time and

lower efficiency of policy implementation, thus reducing the influence relationship between the two.

Table 6. Regional heterogeneity analysis and heterogeneity analysis of policy layout

Variable	(1) East	(2) Mid	(3) West	(1) Single	(2) Multiple
DID	0.2335***	0.1946***	0.4011***	0.5028***	0.2355***
	(5.37)	(3.62)	(3.40)	(6.24)	(6.53)
Control variable	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes
N	2068	1944	1043	756	4371
F	33.5736	10.4257	12.1228	318.0870	37.4604
R^2	0.9163	0.7546	0.8441	0.9758	0.8452

Data source: calculated by the author.

6.2 Spatial effect

Technological innovation spillover effect will have a significant impact on regional economic and social development and scientific and technological development. Therefore, it is of great significance to explore the influence of the establishment of independent innovation demonstration zones on regional innovation from a spatial perspective for the selection and construction of the national innovation demonstration zone.

6.2.1 Selection of spatial weight matrix.

The first law of geography holds that things are related to each other, and the correlation of economic development between regions will greatly affect the spatial interaction between regions. To comprehensively explore the influence of the establishment of independent innovation demonstration zones on regional innovation, this paper chooses geographical adjacency matrix $W1$ and economic nesting matrix $W2$ as spatial weights respectively.

6.2.2 Spatial autocorrelation test.

Based on the above geographical adjacency matrix and economic nesting matrix, the global Moran 's index statistics are used for spatial autocorrelation analysis to measure the spatial correlation intensity between cities. The results of Table 7 show that there is spatial correlation between the innovation ability of prefecture-level cities. Meanwhile, to identify the internal correlation and specific distribution of innovation capabilities more intuitively among different prefecture-level cities, this paper selects the local Moran 's index to test the local correlation.

As shown in Figs.4 and 5. It can be seen that the INN is positive and passed the 1 % significance test. The scatter plot shows that INN is mainly concentrated in the first and third quadrants, which indicates that there is a strong positive correlation and similar agglomeration characteristics of regional innovation capability in space, which proves the rationality of the spatial regression model.

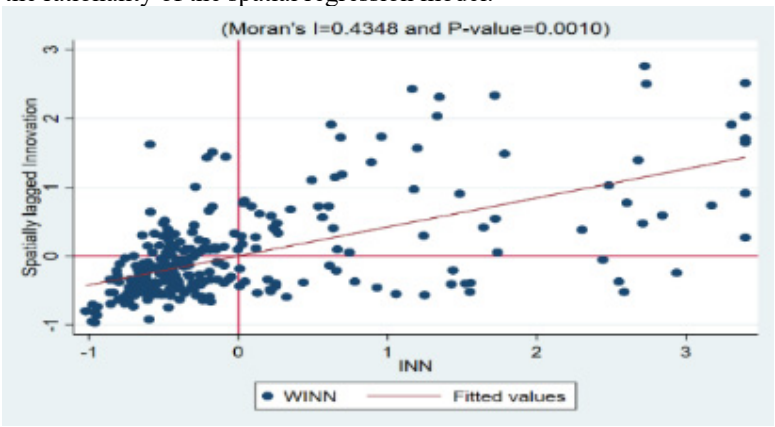

Fig. 4. Matrix-year=2

Data source: calculated by the author.

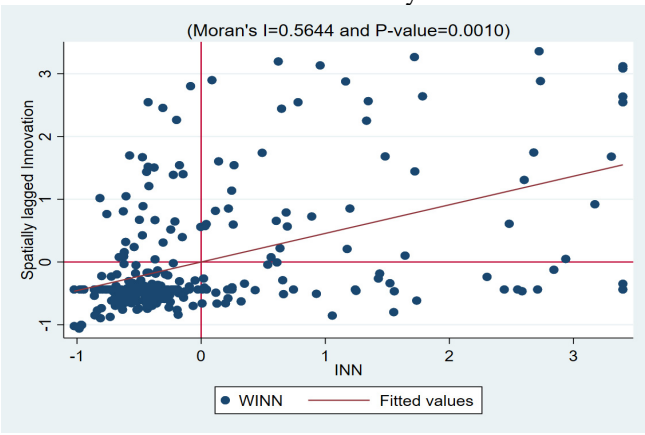

Fig. 5. Economic nested matrix -year=2020

Data source: calculated by the author.

Table 7. Test results of global Moran's index

Matrix	W1		W2	
Year	I	P-value	I	P-value
2003	0.189	0.000	0.343	0.000
2004	0.224	0.000	0.354	0.000

2005	0.184	0.000	0.319	0.000
2006	0.231	0.000	0.406	0.000
2007	0.291	0.000	0.477	0.000
2008	0.244	0.000	0.375	0.000
2009	0.259	0.000	0.398	0.000
2010	0.277	0.000	0.438	0.000
2011	0.271	0.000	0.439	0.000
2012	0.360	0.000	0.546	0.000
2013	0.379	0.000	0.587	0.000
2014	0.321	0.000	0.468	0.000
2015	0.341	0.000	0.501	0.000
2016	0.323	0.000	0.487	0.000
2017	0.370	0.000	0.535	0.000
2018	0.407	0.000	0.574	0.000
2019	0.376	0.000	0.525	0.000
2020	0.435	0.000	0.564	0.000

6.2.3 Construction of spatial Durbin model.

In this chapter, based on the results of LM test, SAR, SEM, SDM model comparison, LR test and Wald test (see Table 8 and Table 9), the spatial Durbin model is established to explore the impact of independent innovation demonstration zone policies on regional innovation:

$$INN = \mathrm{a}_4 + \beta_3 DID_{it} + \gamma_4 X_{it} + \rho W_k INN + \varphi W_k DID_{it} + \omega W_k X_{it} + \theta_i + \theta_t + \varepsilon_{it} \quad (7)$$

In the formula, $\beta_3$represents the correlation coefficient of the policy effect, ρ represents the spatial autoregressive coefficient, W_k is the spatial weight matrix with ×different weights of n×n order (n is the number of cities), and φ, ω represents the estimated coefficients of the policy effect of the spatial independent innovation demonstration zone and the influence of spatial control variables on regional innovation.

Table 8. LM test

Matrix	W1		W2	
test	LM-value	P-value	LM-value	P-value
LM-Lag test	527.189	0.000	152.475	0.000
Robust LM-Lag test	167.700	0.000	29.383	0.000
LM-Error test	403.121	0.000	155.532	0.000
Robust LM-Error test	43.632	0.000	32.441	0.000

Data source: calculated by the author.

6.3 Analysis of regression results of spatial Durbin model

Table 9 reports the spatial regression results of the establishment of independent innovation demonstration zone on regional innovation. The results show that ρ is significantly positive at the level of 1%, that is, the improvement of regional innovation capacity will drive the innovation of neighboring regions. The estimated coefficient Wk is significantly negative, and the possible reason is that the policy of the independent innovation demonstration zone will bring a "siphon effect" on the innovation capacity of the neighboring areas: the establishment of the self-innovation zone will make the innovation factors of the neighboring cities converge to the independent innovation demonstration zone, which will impact the innovation factors of the surrounding areas, thus inhibiting the innovation capacity of the surrounding areas.

Table 9. Test results of spatial effect

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	W1			W2		
	SAR	SEM	SDM	SAR	SEM	SDM
DID	0.2544***	0.2729***	0.2647***	0.2656***	0.2808***	0.2771***
	(7.68)	(7.78)	(18.82)	(7.75)	(7.90)	(19.77)
$\rho/\lambda/\rho$	0.2543***	0.2786***	0.2585***	0.1191***	0.1172***	0.1363***
	(6.28)	(8.17)	(14.74)	(4.38)	(5.43)	(10.36)
σ^2	0.0232***	0.0233***	0.0231***	0.0242***	0.0242***	0.0240***
	(6.37)	(6.40)	(50.34)	(6.55)	(6.51)	(50.63)
WDID			-			-
			(-3.10)			(-3.28)
LR test	37.33***	62.46***		22.97***	19.92**	
Wald test	37.38***	63.63***		27.47***	20.32***	
Control	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes
Individual	Yes	Yes	Yes	Yes	Yes	Yes
N	5130	5130	5130	5130	5130	5130
R^2	0.5302	0.5336	0.5263	0.5473	0.5427	0.5448

Data source: calculated by the author.

7 Conclusions and suggestions

7.1 Research conclusions and prospects

Based on the panel data of 285 prefecture-level cities in China during 2003-20, this paper uses the principal component analysis method to establish the regional innovation composite index, discusses and tests the effect of the independent innovation demonstration zone policies on regional innovation through DID, and introduces the intermediary variables of specialized aggregation and diversified aggregation of high-

tech service industry, and discusses the mechanism of the independent innovation demonstration zone policies on regional innovation in detail. In addition, the heterogeneity analysis of geographical location and policy layout and the test of spatial spillover effect are carried out. The main conclusions are as follows: (1) The establishment of self-created areas can significantly improve regional innovation capacity. (2) The policy of the independent innovation demonstration zone can promote the agglomeration effect of high-tech service industry in the region and promote regional innovation capacity. (3) The promotion effect of the independent innovation demonstration zone policy on the development of the western region is significantly greater than that of the eastern and central regions. (4) Through comparative analysis of policy layout, this paper finds that the effect of policy implementation in single city layout on improving innovation capacity is significantly better than that in multi-city layout. (5) The policy of the independent innovation demonstration zone has a significant siphon effect on regional innovation capacity.

7.2 Policies and suggestions

Based on the above research conclusions, this paper puts forward the following suggestions to maximize the policy implementation effect and enhance the innovation capacity.

Firstly, more attention should be paid to scientific and technological innovation, and the integration and opening of scientific and technological innovation resources should be strengthened when establishing and improving the policy measures of the independent innovation demonstration zone. The government can start from the following four aspects: (1) promote the construction of industrial agglomeration service platform, establish a sound human resources, financial services and other policy innovation system, reduce the cost of innovation and entrepreneurship; (2) Give full play to the guiding role of policy tools for scientific and technological innovation activities, and provide targeted support for specific types of scientific and technological activities; (3) Pay attention to the coordinated development among regions, encourage the upstream and downstream industries of the independent innovation demonstration zone and surrounding areas to coordinate; (4) Accelerate the cultivation of R&D institutions and other innovative organizations, and promote the exchange and cooperation among innovative organizations.

Secondly, the government should strengthen the cultivation and support of high-tech industries in the independent innovation demonstration zone and promote the professional aggregation of high-tech service industries. At the same time, the government should guide enterprises to strengthen collaborative innovation and cultivate high-quality talents, improve their position and competitiveness in the industrial chain, and promote the sustainable development of high-tech service industry in the independent innovation demonstration zone.

Thirdly, the independent innovation demonstration zone should pay attention to avoid the phenomenon of industrial isomorphism and low-end homogenization competition, and encourage the diversified development of the service industry in the independent innovation demonstration zone. The current market competition mode

has been upgraded to innovation ecosystem competition, and the government should promote cross-field and cross-industry innovation collaboration in the national independent innovation demonstration zone to improve the efficiency of resource allocation.

Fourthly, the government should make clear the development orientation, rationally plan the layout of the national independent innovation demonstration zone, and strengthen the differentiated formulation of policies. Since the innovation environment of the eastern and central regions has been relatively perfect, the government should increase the support and help to the backward western region, and effectively promote the enhancement of the innovation ability of the western region by means of policy guidance and financial support in the national independent innovation demonstration zone.

Fifthly, we should consider the coverage and spatial layout of the implementation of the policy when making the policy of the national independent innovation demonstration zone. The policy layout should focus on the single city. By improving the innovation ability of the single city, the development of surrounding cities should be boosted, and a benign interaction mode should be formed. At the same time, policy implementation should also pay attention to the synergistic interaction between cities, improve the efficiency of administrative cooperation between prefecture-level city governments, encourage the complementary advantages and sharing of innovation resources among regions, establish regional innovation alliance or innovation ecosystem, and promote the coordinated development and collaborative innovation of regions.

Sixth, the construction of national independent innovation demonstration zone should fully consider the impact of the construction of the national independent innovation demonstration zone on neighboring areas. It is necessary to balance the positive effects such as technology spillover and the siphon effect caused by excessive resource tilt, give full play to the existing industrial advantages, achieve regional complementary advantages and resource sharing through policy regulation and regional cooperation, and promote regional coordination and innovation.

References

1. Bao J. (2018) The economic growth effect of high-tech industry agglomeration. Zhejiang Gongshang University. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C475KOm_zrgu4lQARvep2SAk-6BvX81hrs37AaEFpExs0EfQ8PzP6CltgI6Id8E-amfe7GcBKmN28RAarrkgV-tR&uniplatform=NZKPT&src=copy
2. Chen J., Chen Y.F., Yu F.Z. (2007) The impact of FDI on promoting China's regional innovation capability. Sci. Res. Manage., 2007(01): 7-13. DOI: 10.19571/j.cnki.1000-2995.2007.01.002.
3. Chen T.Y., Xie X.F. (2023) Does cultural industry agglomeration enhance regional innovation capability? An empirical test based on spatial econometric model. Explor. Econ. Probl., 2023(03): 111-125. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7ioT0BO4yQ4m_mOgeS2ml3UHZuH5HHRZsGCL3-nQYigYf1EmLS4wPc3YJHKayLRMpA&uniplatform=NZKPT&src=copy

4. Fang L., Xu W.X. (2015) The impact of innovation-driven on regional economic growth: A case study of high-tech zones. Chongqing Soc. Sci., 2015(11): 58-65. DOI: 10.19631/j.cnki.css.2015.11.007.
5. Gu J.Q., Peng J.J. (2020) Research on the institutional innovation issues of national innovation demonstration zones under the background of high-quality development. Zhongzhou Acad. J., 2020, No.286(10):26-31. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7i8oRR1PAr7RxjuAJk4dHXoqYNkjD9UxiECZYAsorsZYewZj_QOPGM4o91mJ4mmVii&uniplatform=NZKPT&src=copy
6. Guo J.H., Guo M.N., Guo S.F., Zhang S.S. (2021) Can China's innovation policy pilot effectively drive enterprise innovation? Empirical evidence based on the construction of national innovation demonstration zones. Ind. Econ. Res., 2021(02): 56-70. DOI: 10.13269/j.cnki.ier.2021.02.005.
7. Jiao J.J., Wang J.E., Cheng K. (2017) Spatial evolution of China's regional innovation capability and its spatial spillover effects. Econ. Geogr., 37(09): 11-18. DOI: 10.15957/j.cnki.jjdl.2017.09.002.
8. Li E.L., Cui Z.Z. (2018) Coupling and coordination analysis between China's regional innovation capability and economic development level. Geogr. Sci., 38(09): 1412-1421. DOI: 10.13249/j.cnki.sgs.2018.09.003.
9. Li Y.P., Zheng A.Q., Shen C., Luo J.Z. (2016) Evaluation of talent policies in national innovation demonstration zones: A case study of Zhongguancun and East Lake High-tech Zones (2009-2013). J. Wuhan Univ. (Philos. Soc. Sci.), 69(02): 85-89. DOI: 10.14086/j.cnki.wujss.2016.02.011.
10. Liu X.Y., Chen X.X., Ding H.F., Liang J.Y. (2022) National innovation demonstration zones and the high-quality development of national high-tech zones. Econ. Probl., 2022(10): 98-107. DOI: 10.16011/j.cnki.jjwt.2022.10.008.
11. Qin H.B., Xiao H.B., Wu J., Zhang X.F. (2021) National innovation demonstration zones, government innovation preference, and regional innovation capability. East China Econ. Manage., 35(12): 52-62. DOI: 10.19629/j.cnki.34-1014/f.210728009.
12. Ren J., Zhao R.R., Ren J.H. (2023) Digital finance, high-tech industry agglomeration, and regional innovation performance. Stat. Decis., 39(05): 86-91. DOI: 10.13546/j.cnki.tjyjc.2023.05.016.
13. Sun K. (2021) Sensitivity analysis of influencing factors on China's regional innovation capability. Math. Stat. Manage., 40(03): 417-428. DOI: 10.13860/j.cnki.sltj.20210415-001.
14. Qing T. (2023) Intellectual property protection, agglomeration differences, and firm innovation. Econ. Res., 10(01): 15-46. DOI: 10.16513/j.cnki.cje.20230215.002.
15. Wang L.Y., Li D.X., Chen X.Y. (2019) Evaluation of the effect of "national innovation demonstration zone" policy: Evidence from quasi-natural experiments. J. Quant. Econ. Res., 10(04): 22-39. DOI: 10.16699/b.cnki.jqe.2019.04.003.
16. Wang X.G., Fang Y. (2010) Evaluation of the regional innovation capability of Harbin-Daqing-Qiqihar industrial corridor based on industrial clusters. Sci. Technol. Prog. Policy, 27(10): 100-103. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKgchrJ08w1e7_IFawAif0mwy7TgQsjAd8jE8x-5RKOna0nmOCSRvCSZoj0wV2d5Ijt4vm3fEfsBB&uniplatform=NZKPT&src=copy
17. Wei L., Bu W. (2018) Study on the promotion effect of national innovation demonstration zones on economic growth. Sci. Technol. Prog. Policy, 35(18): 48-56. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7i0-kJR0HYBJ80QN9L51zrPz0d_hXdda6BoreKThd_CLyrgQvpteE9Ya0gSMnYPHOr&uniplatform=NZKPT&src=copy

18. Xiao X., Wang T. (2015) Evaluation of policies on university students' entrepreneurship in national innovation demonstration zones. Stud. Sci., 33(10): 1511-1519. DOI: 10.16192/j.cnki.1003-2053.2015.10.010.
19. Yang H.C., Li L.S., Liu J. (2016) The impact of high-tech industry agglomeration on technological innovation and regional comparison. Stud. Sci., 34(02): 212-219. DOI: 10.16192/j.cnki.1003-2053.2016.02.008.
20. Zhang W.Y. (2016) Orientation of positioning, construction strategies, and the direction of national innovation demonstration zones. Reform, 2016(11): 53-64. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7iAEhECQAQ9aTiC5BjCgn0Rp8Xz9NWW4auKk71PT_otbHNxlrMDqbwyW0Zv1WrV-_i&uniplatform=NZKPT&src=copy
21. Zhang W.X., Wu Q., Wang B., Huang J. (2019) Multidimensional study on the impact of industrial specialization and diversification agglomeration on urban land use efficiency. China Popul. Resour. Environ., 29(11): 100-110. https://kns.cnki.net/kcms2/article/ abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7iLik5jEcCI09uHa3oBxtWoDQbQcYX6biHEhOaFkmwgM0CfId_I8W3MFMaOBYhitkk&uniplatform=NZKPT&src=copy
22. Zhang Y.H., Fan Y., Tian X.Q. (2013) Comparative analysis and countermeasures of regional innovation capability in Guizhou Province from 2008 to 2011. Sci. Technol. Prog. Policy, 30(03): 47-50. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44 YLTlOAiTRKgchrJ08w1e7xAZywCwkEEIyvxYLRB41cVHH2S1yf4AOKikn8mlaTcoIq5xSg9PYMUdXMlfb3g8_&uniplatform=NZKPT&src=copy
23. Zhang Y.A., Geng Z. (2015) Quantitative evaluation of China's regional science and technology innovation policies based on the PMC index model. Sci. Technol. Manage. Res., 35(14): 26-31. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7ir5D84hng_y4D11vwp0rrtQVNziU93JssXw3G2indsfhA4PucdD4hEa9M-GvPp5cZ&uniplatform=NZKPT&src=copy
24. Zhang Y.A., Guan Y.J. (2021) Study on the impact of national innovation demonstration zone policy on regional economy. Soft Sci., 35(01): 101-107. DOI: 10.13956/j.ss.1001-8409.2021.01.16.
25. Zhu X.A., Zhang X. (2020) The spatial spillover effect of high-tech industry agglomeration on the quality of regional economic growth: A study based on panel spatial Durbin model. Econ. Geogr., 2020, No. 452(03): 169-184.https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7i8oRR1PAr7RxjuAJk4dHXolRJKeYjvqtw7Hg8_WovcVaDBnmXBavK4kfBeHh3o0J9&uniplatform=NZKPT&src=copy
26. Zou H., Xu B.B., Yang S. (2013) Evaluation of China's regional innovation capability based on entropy method. Sci. Technol. Manage. Res., 33(23): 56-61. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKjw8pKedNdX5_mkCYmAjR9zor2pB3zzh63uc5DhXr5v6hskh-vfAWIw029AlKLhh1MIyBkAoYoIn&uniplatform=NZKPT&src=copy
27. Audretsch, D. B., & Feldman, M. P. (1996). R&D Spillovers and the Geography of Innovation and Production. The American Economic Review, 86(3), 630–640. http://www.jstor.org/stable/2118216
28. Cooke, P. (1992). Regional innovation systems: Competitive regulation in the new Europe. Geoforum, 23(3), 365–382. doi:10.1016/0016-7185(92)90048-9
29. Díez-Vial, I., & Montoro-Sánchez, Á. (2016). How knowledge links with universities may foster innovation: The case of a science park. Technovation,50-51, 41–52. doi:10.1016/j.technovation. 2015.09.00110.1016/j.technovation.2015.09.001
30. Jacobs, J.M. (1969). The Economy of Cities.doi:10.4324/9780203023525-28

31. Lee, B. K., & Sohn, S. Y. (2018). Disparities in exploitative and exploratory patenting performance across regions: Focusing on the roles of agglomeration externalities. Papers in Regional Science. doi:10.1111/pirs.12359
32. Marshall, A. (1920) Principles of Economics. Macmillan, London. https://oll.libertyfund.org/title/marshall-principles-of-economics-8th-ed
33. Storper, M., & Venables, A. J. (2004). Buzz: face-to-face contact and the urban economy. Journal of Economic Geography, 4(4), 351–370. http://www.jstor.org/stable/26160910
34. Schumpeter J A. The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Piscataway, NJ: Transaction Publishers, 1934. https://ssrn.com/abstract=1496199