Advances in Economics, Business and Management Research, volume 159
Fifth International Conference on Economic and Business Management (FEBM 2020)

Research on the Impact of China's National Innovation City Pilot Policy on High-Efficiency Agglomeration ——Estimation and Analysis Based on DID Models

Hongtao Li*, Lili Wang

Department of Humanities and Social Sciences, Dalian University of Technology, Liaoning, 116024
Corresponding author. Email: turkeyjohnlihongtao@gmail.com

ABSTRACT
Can China's national innovative city pilot policy effectively promote urban factor agglomeration? The study used data from 282 prefecture-level cities in China from 2003 to 2017 to establish a DID model and passed batch testing, endogenous testing (PSM-DID, placebo testing), robustness testing and heterogeneity analysis, marginal utility analysis, etc. The method examines the policy effectiveness of the pilot policy for efficient agglomeration. The study found: First, the national innovation city pilot policy can significantly promote the agglomeration of urban forming factors. Second, the national innovative city pilot policy has a more significant role in promoting cities with higher administrative levels. The pilot policy and the location characteristics of the port have consistent characteristics.
Keywords: *National innovative city, efficient agglomeration, DID model, policy Analysis*

1. INTRODUCTION

The national innovation city pilot policy , which began in 2008, has further expanded to 64 cities after 2018.The goal set by the construction of China's national innovation city is to establish a number of regional innovation centers with strong innovation leadership, strengthen the open sharing of various innovation resources among cities, and rely on innovation to promote regional coordinated development.
The analysis of innovation activities from the perspective of neoclassical economics suggests that innovation is endogenous to economic growth, and technological innovation in central cities will lead to further agglomeration of factor resources[1]However, observing historical experience, due to the externalities of scientific and technological innovation activities and knowledge spillovers, there has been no catastrophic concentration of regional development[2]. So, does China's national innovation city pilot policy lead to the Matthew effect of inter-city development, or can it establish a regional innovation system that uses innovation cities as growth poles? Focusing on this issue, this research analyzes the relationship between the pilot policies and the efficient agglomeration from the theoretical and empirical levels.
Based on the analysis of literature and theory, the paper regards the pilot policy as a quasi-natural experiment, the study used data from 282 prefecture-level cities in China from 2003 to 2017 to establish a DID model and passed batch testing, endogenous testing (PSM-DID, placebo testing), robustness testing and heterogeneity analysis, marginal utility analysis, etc. The method examines the policy effectiveness of the pilot policy for efficient agglomeration.
Academia's research on science and technology policy focuses on the impact of government-sponsored science and technology innovation activities on regional development[3]. Further analysis of the relationship between the scientific and technological innovation system and economic development, corporate behavior, but the role of the government system still has theoretical blind spots[4]。In the research of government innovation policy, The regional innovation system proposed by Cooke[5](2018) and the cluster policy theory of Porter[6](2003) and Markusp[7](2018) all believe that technological innovation policies can significantly promote regional economic growth and increase income levels. Scholars such as Bhattacharya[8](2020)and Maddikunta[9](2020)put forward the application analysis

---

Fund project: China National Social Science Fund Key Project “Regional coordinated development strategy leads to the optimization of new urban patterns in Chinese urban agglomerations”(18AJL010)
About the Author：Li Hong-tao(1993-), male, Guangxi, China, PhD student in management, Faculty of Humanities and Social Sciences, Dalian University of Technology, Mainly engaged in the research of regional governance and urbanization. Wang Li-li(1964-), Female, Liaoning, China, Doctor of Management, Professor, Faculty of Humanities and Social Sciences, Dalian University of Technology, PhD Tutor, Mainly engaged in the research of regional governance and urbanization.
Contact address：Department of Humanities and Social Sciences, Dalian University of Technology, No. 2 Linggong Road, Dalian City, Liaoning Province (116024) Li Hong-tao (receive)
contact number: (0)13978350369
e-mail: turkeyjohnlihongtao@gmail.com

of intelligent city and interconnected technology in city.Chinese scholars such as Zhou[10](2016)and Cheng[11](2020) have verified the significant impact of technology and industrial policies on regional development through empirical data based on China.

It can be seen that there is no unified and perfect theoretical system regarding the trend of innovation activities on regional economic development, especially whether the government's science and technology policies can effectively promote urban and regional development has been debated in recent years. In terms of the policy effectiveness of national innovative cities, Scholars such as LI, YANG[12](2019), ZENG, ZHOU[13](2019) conducted a double differential policy evaluation and analysis of innovative city pilot policies and urban innovation capabilities.

However, the analysis of the impact of China's national innovative city pilot policy on efficient urban agglomeration is extremely rare, and there is a lack of research results that link the pilot policy with regional agglomeration-diffusion effects and regional coordinated development.

Therefore, the research takes China's national innovative city pilot policy as the research object. At the empirical level, the pilot policy is regarded as a quasi-natural experiment, this research uses DID models to examine the effect of pilot policies on efficient agglomeration and spatial spillover effects. According to the literature and fact analysis, the research proposes the following research hypotheses:

H1： The national innovative city pilot policy has a significant positive impact on the efficient agglomeration of cities.

H2：The national innovative city pilot policy has a spatial spillover effect on the efficient agglomeration of surrounding areas.

The main contributions of the study are:

First, from the perspective of research, the study focuses on the impact of government innovation activities on urban and regional development patterns, whether enhancing innovation activities in large and medium-sized cities will lead to the Matthew effect of regional development, or can form a regional innovation system. The research further chooses the national innovative city pilot policy as the research object, regards it as a quasi-natural experiment way to analyze the influence of the pilot policy on the urban efficiency.

Secondly, from the empirical level, we pay attention to the effect of the national innovative city pilot policy on efficient agglomeration, and use the PSM-DID to estimate and analyze the policy effect of the pilot policy.

2. EMPIRICAL MODEL SETTING AND VARIABLE DESCRIPTION

2.1 Model Settings

Between 2008 and 2013, China has successively established 47 innovative cities, and the pilot policy was studied as a quasi-natural experiment：The pilot city is the experimental object, and the non-pilot city is the control group. Research set dummy variables for the implementation time of urban pilot policies $Test_{it}$. Pilot policies and subsequent years in cities will be set to 1, and the rest will be 0, to achieve dynamic multi-period DID model estimation. Establish the model as follows：

$$LnDensity_{it} = \alpha + \chi_1 Test_{it} + \chi_i contorl + year_t + city_i + \varepsilon_{it} \quad (1)$$

Among them, $Density$ is the efficient agglomeration of cities, $Test$ is a pilot policy, $year$ is a series of virtual variables of time effect, $city$ means that the city's individual effects are controlled.

2.2 Variable Description

The explained variables are efficiently aggregated $Density$, the study measures economic density by the ratio of the city ’s GDP to the built-up area[14]. The Research adopted as the control variables the year-end road area ($Road$), urban rail passenger transport volume ($Pass$), urban rail freight transport volume (Fre), and urban post and telecommunications business volume ($Post$) that would significantly affect the flow of urban factors.

The study analyzed the high-efficiency agglomeration effect of the national innovative city pilot policy in the period of 2003-2017. In order to ensure the accuracy of the study, the study selected 282 prefecture-level and above cities with stable administrative levels from 2003 to 2017 Research object[2]。The data of the cities at the prefecture level and above used by the Institute come from the "China City Statistical Yearbook (2004-2018)", and some of the data come from the city macro data in the statistical yearbooks of the provinces and the statistical bulletins of national cities' economic and social development. The relevant price data used by the research institute is deflated

[2]Considering the particularities of the Hong Kong Special Administrative Region, Macau Special Administrative Region, and Taiwan, the study did not include this area in the study, and there are many data vacancies in Lhasa.

using the GDP index of China Statistical Yearbook (2000-2018) with 2000 as the base period. Since the statistical caliber of the yearbook is provincial data, the study uses the provinces where the GDP index of each city is located. The data is converted.

3. EMPIRICAL MODEL ANALYSIS

3.1. Basic Regression Model Estimation

The study uses data from 282 prefecture-level cities in China as a full sample to analyze the efficient agglomeration of national innovative city pilot policies. The regression results are shown in Table 1.

The study first uses models (1) to estimate the impact of the national innovative city pilot policy on efficient agglomeration without the inclusion of control variables. The results show that the pilot policy is significantly positive at 1%, indicating the pilot policy Can significantly promote the agglomeration effect of cities. Models (2) and (3)further incorporate control variables and estimate them through fixed effects and high-dimensional fixed effects, respectively. The results again verify the significant positive effects of the pilot policies. In terms of control variables, the city's total passenger traffic, road area, freight volume, post and telecommunications services all have a significant positive relationship with the flow of factors, which also verifies the rationality of the model control variables.

Table 1 Basic regression results

Explained variable	*LnDensity*		
Eariable	（1）	（2）	（3）
	FE	FE	hdFE
Test	0.096***	0.073**	0.073***
	(0.031)	(0.035)	(0.016)

Note: The coefficients of ***, **, and * in the table indicate passing the inspection level of 1%, 5%, and 10% respectively. Control variables, time and fixed effects of individuals were studied. Other variables and R parameters were omitted due to space

3.2 Endogenous Test

Since the development of the national innovation city pilot policy is to explore the path of urban innovation development, to create a number of regional innovation demonstration leading highlands, the government has a purpose in the choice of pilot policy cities. As a result, the pilot policy is not a random choice in the course of natural experimentation. Cities with higher development levels, stronger innovation capabilities, and better basic conditions are more likely to be selected as national innovative cities. The purposeful choice in this pilot policy process will lead to the bias of double difference estimation（selection bias）。Therefore, the study further screens the samples by means of propensity matching score (PSM), and then attempts to avoid endogenous problems caused by non-random selection in policy evaluation. The study selected the number of college students in the city, urban innovation ability, government jurisdiction, and government scale as matching variables[3]，3375 urban samples were screened by neighbor matching。After propensity matching, the model estimates that ATT is significant at the 1% level, and the standardized deviation of each variable is less than 10%. The t-test structure of each variable accepts the original hypothesis that there is no systematic difference between the experiment and the control group. In the study, the double differential estimation (DID) is carried out on the matched data samples, and the results are shown in Table 2 model (4). The results still indicate that the pilot policy is significantly positive at the 1% level, indicating that the national innovative city pilot policy can significantly promote the efficient clustering of cities, and the conclusion remains stable.

In order to further test the effectiveness of the pilot policy, the study establishes a random test of the pilot policy through counterfactual estimation. In model (5), the effectiveness of the policy is verified by advancing the policy establishment time (researching to advance the policy by 3 years). In model (6), the control group is randomly selected as the experimental object to determine whether the policy is effective for the control group. The specific results are shown in Table 2.

The regression results in Table 2 show that the random premise of the pilot in model (4) does not affect the policy effectiveness, and the pilot policy is still significant at the 1% level. In model (6), when the control group is regarded as the experimental group for estimation, the pilot policy fails to pass the 5% significance level, indicating that the pilot policy will not affect the non-experimental group. A series of counterfactual estimates basically verified that the pilot policy only estimates the utility of the experimental group (The following tables are the same).

3.3 Robustness Test and Heterogeneity Analysis

Model (7) replaces the urban economic density of the explanatory variable with GDP per capita for robustness test. Models (8) and (9) respectively carry out the

[3]The urban innovation capability refers to the "China Urban and Industrial Innovation Report 2017" with the urban innovation index from 2003 to 2016 as the matching variable; the government's jurisdiction is the number of city-level units within the jurisdiction of the city; the government's scale is the ratio of fiscal revenue to GDP.

multiplication of the pilot policy with the city administrative level dummy variable[4] and the port city dummy variable [5] to investigate and analyze the heterogeneity of the city in terms of rank and location during the pilot policy process, and the specific results See Table 3.

The regression results in Table 3 show that after model (7) replaces the explanatory variables of the model, the pilot policy is still significant at the 5% level, and the estimated results remain stable. In model (8), the pilot policy remains at 1%, and the interaction between the pilot policy and the city's administrative level is significantly positive, indicating that cities with higher administrative levels benefit more from the pilot policy. The pilot policy in Model (9) is basically not significant, but the interaction between the pilot policy and the location characteristics of the port is significant at 1%, indicating that the pilot policy is consistent with the agglomeration effect of China 's ports, and the location characteristics are still Explain the core elements of China's regional efficient agglomeration.

Table 2 Endogenous test regression results

Explained variable	*LnDensity*		
Variable	(4)	(5)	(6)
	PSM-DID	Placebo test 1	Placebo test 2
Test	0.065***	0.143***	0.195
	(0.022)	(0.046)	(0.363)

Table 3 Robustness test and heterogeneity analysis

Explained variable	*LnGDP*	*LnDensity*	*LnDensity*
Variable	(7)	(8)	(9)
Test	0.193***	0.326***	0.016
	(0.034)	(0.066)	(0.050)
*Test*Level*		0.059**	
		(0.025)	
Test Port*			0.270***
			(0.056)

4. CONCLUSION

Through the analysis of the national innovative city pilot policy for efficient agglomeration, the study found the following conclusions:

First, the national innovation city pilot policy can significantly promote urban factor agglomeration.

Second, the national innovative city pilot policy has a more significant role in promoting cities with higher administrative levels. The pilot policy and the location characteristics of the port have consistent characteristics.

Next, further discussions and policy recommendations will be launched based on the above research findings.

First of all, the research demonstrates that the national innovative city pilot policy has a significant positive effect on the efficient agglomeration of cities. The government should further enrich and expand the coverage of innovative cities, combine innovative city pilot policies with urban agglomeration development plans, and form a boost to the innovative development and innovative vitality of central cities and urban agglomerations.

Second, the study found that the pilot policies of cities with higher administrative levels have a more significant role in promoting the flow of factors, and the role of pilot policies is consistent with the characteristics of port distribution. This phenomenon shows that such cities with higher administrative levels have significant advantages in the process of economic development, forming the development characteristics of agglomeration of elements. The consistency of the role of the pilot policy and the distribution of ports indicates that the selection process of the list of innovative cities focuses on promoting the innovative development of regions with advantageous locations.

REFERENCES

[1]SCHILIRÒ, Daniele, et al. The growth conundrum: paul romer's endogenous growth, International Business Research, 12(10) (2019) 75-85.

[2]Commendatore P , Kubin I , Petraglia C , et al. Regional integration, international liberalisation and the dynamics of industrial agglomeration, Journal of Economic Dynamics and Control, 48(2014) 265-287.

[3]Gertler, Meric S . Rules of the game: the place of institutions in regional economic change, Regional Studies, 44(1) (2010) 1-15.

[4]Sotarauta M , Pulkkinen R . Institutional entrepreneurship for knowledge regions: in search of a fresh set of questions for regional innovation studies[J]. Environment and Planning C: Government and Policy, 29(1) (2011) 96-112.

[4]Assign virtual variables to the city administrative level, the municipality is assigned a value of 4, the sub-provincial city is assigned a value of 3, the quasi-sub-provincial city is assigned a value of 2, the general prefecture-level city is assigned a value of 1.

5 China's coastal ports and inland ports will be assigned a value of 1, otherwise 0.

[5]Cooke P. Evolutionary Complexity Geography and the Future of Regional Innovation and Growth Policies[J]. Resilience and Regional Dynamics, (1) (2018) 11-30.

[6]Porter, Michael. The Economic Performance of Regions[J]. Regional Studies, 37(6-7) (2003) 545-546.

[7]Markus G , Bjørn A . Place-based innovation policy for industrial diversification in regions[J]. European Planning Studies, 26(8) (2018) 1638-1662.

[8]Bhattacharya S , Siva R K S , Gadekallu T R , et al. A Review on Deep Learning for Future Smart Cities[J]. Internet Technology Letters (2020).

[9]Maddikunta P K R , Srivastava G , Gadekallu T R , et al. Predictive model for battery life in IoT networks[J]. IET Intelligent Transport Systems, 2020(8).

[10]Zhou F L , Wang X , Li Y , et al. Influence research of multi-dimensional tech-innovation behavior on tech-innovation performance[J]. International Journal of Innovation ence, 8(2) (2016) 148-160.

[11]Cheng C , Liu Y , Liu Y , et al. Cropland use sustainability in Cheng - Yu Urban Agglomeration, China: Evaluation framework, driving factors and development paths[J]. Journal of Cleaner Production, (2020) 256.

[12]LI Zheng , YANG Siying. Has the Project of Innovative Cites Increased the Level of Innovation ? [J]. Economics Dynamics,2019(8) 70-85.

[13]ZENG Jingjing, ZHOU Danping. Regional Characteristics , Industrial Structure, and the Performance of Urban Innovation-Based on a Quasi-natural Experiment on Innovative City Pilots [J]. Public Management Review, 1(3) (2019) 66-97.

[14]World Bank.World Development Report 2009: Reshaping Economic Geography.World Bank Publications (2008).