

Research on the Impact of Technology Transfer on Urban Innovation from the Perspective of Dual Circulation

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Abstract

The purpose of this project is to select the relationship between urban technology transfer and urban innovation in China from 2007 to 2019 as the research object based on the new development pattern of double cycle. From both domestic and international perspectives, data mining technology is used to build the data base of domestic and international technology transfer in Chinese cities, and to investigate the impact of domestic and international technology transfer on urban innovation. The main objectives of this project are as follows: first, to theoretically analyze the relationship between technology transfer and urban innovation; Second, identify the impact of domestic and international technology transfer on urban innovation; Thirdly, from the perspective of industrial agglomeration, resource allocation and innovation accumulation level, we can identify the impact of domestic and international technology transfer on urban innovation; Fourthly, put forward policy suggestions to promote technology transfer and enhance urban innovation.

Keywords

Double Circulation; Technology Transfer; Urban Innovation; Promotion Effect

1. Introduction

Innovation is the inexhaustible driving force of urban development and the surging momentum of high-quality development. Technology transfer is an important link to improve the level of science and technology and promote urban innovation. At present, China is in the key period of transforming the mode of development, optimizing the economic structure and transforming the power of growth, so it is particularly important to empower and increase urban innovation, so it is essential to study the impact of technology transfer on urban innovation.

Based on the new development pattern of double cycle, this project selects China's urban technology transfer and urban innovation from 2007 to 2019 as the research object, carries out a theoretical analysis of the impact of technology transfer on ur-

ban innovation, and constructs an econometrical model to examine the impact of technology transfer on urban innovation and its mechanism, so as to provide theoretical support and practical basis for improving the technology transfer system and accelerating the creation of favorable external conditions for urban innovation.

2.Literature Review, Theoretical Framework and Research Hypothesis

2.1.Literature Review

Looking at the existing literature, there is still room for improvement as follows: first of all, based on the new development pattern of double cycle, it is very important to analyze the different impacts of domestic technology transfer and international technology transfer on urban innovation from both domestic and international perspectives. However, the relevant research is still in the blank, and there are few studies to reveal the economic connotation of technology transfer from the perspective of regional economic growth. Moreover, under different development levels, the impact of technology transfer on urban innovation may be different. How to better play the driving role of technology transfer on urban innovation is a noteworthy issue, and some studies have not yet discussed the regional promotion effect of technology transfer on urban innovation. Therefore, from both domestic and international perspectives, this paper studies the impact of domestic and international technology transfer data on urban innovation from 2007 to 2019 and its mechanism, so as to provide reference for promoting urban innovation.

2.2.Theoretical Framework

According to Schumpeter's theory of innovation economics, the achievements of technological innovation can only be valued if they are spread and applied (Schumpeter, 1934). Cities are places where innovative resources are highly concentrated, and urban innovation has become an important dimension of urban comprehensive ability. Technology transfer is an important way to promote the flow of resources across regions, promote innovation and regional coordination. To this end, it is of positive significance to understand the relationship between technology transfer and urban innovation (Luan Xinchun et al., 2023). In addition, a city's resources for innovation are limited. Therefore, cities are interconnected through technical cooperation, technology transfer and other channels, so that cities can share each other's technological innovation resources, and then improve the quality of their own urban innovation (CAI Hechang, 2021). Therefore, it is very necessary to analyze the different impacts of domestic technology transfer and international technology transfer on urban innovation from the dual perspectives of domestic and international technology transfer, so as to improve the domestic and international technology trading market and build a technology transfer system to support urban innovation.

2.3.Research Hypothesis

Hypothesis 1: domestic technology transfer and international technology transfer have positive effects on urban innovation.

Hypothesis 2: improving industrial agglomeration, optimizing resource allocation and strengthening innovation accumulation can promote the positive effect of technology transfer on urban innovation.

3. Empirical analysis

3.1 Benchmark Regression Results

In order to test the impact of technology transfer on urban innovation, the following benchmark regression model is established from the two dimensions of international technology transfer and domestic technology transfer:

$$\text{indup}_{it} = \alpha_1 \text{zr}_{it} + \alpha_2 \text{zc}_{it} + \alpha_3 X_{it} + \theta_t + \mu_i + \varepsilon_{it} \quad (1)$$

$$\text{indup}_{it} = \alpha_1 \text{fzr}_{it} + \alpha_2 \text{fzc}_{it} + \alpha_3 X_{it} + \theta_t + \mu_i + \varepsilon_{it} \quad (2)$$

Equation (1) represents the impact of domestic technology transfer on urban innovation, and equation (2) represents the impact of international technology transfer on urban innovation. In formula (1), “i” and “t” represent the city and year respectively; Urban innovation as the explanatory variable; “zr_{it}、zc_{it}、fzr_{it}、fzc_{it}” represent the explanatory variables domestic technology transfer in , domestic technology transfer out, international technology transfer in and international technology transfer out respectively; “X_{it}” is set of control variables; “θ_t” is the fixed effect of time; “μ_i” is individual fixation; “ε_{it}” is random interference; “α₁、α₂、α₃” is the corresponding coefficient.

Table 1. Benchmark Regression Results

Variables	Domestic Technology Transfer	International Technology Transfer	Technology Transfer
	(1)	(2)	(3)
lnzr	0.010** (0.005)		0.008* (0.005)
lnzc	0.010* (0.005)		0.010** (0.005)
lnfzr		0.023*** (0.006)	0.022*** (0.006)
lnfzc		0.012*** (0.004)	0.012** (0.004)
control variable	Yes	Yes	Yes
Fixed effect	Yes	Yes	Yes
Adjusted value of R ²	0.905	0.905	0.905
sample size	3358	3358	3358

Note: *, ** and *** indicate that they are significant at the levels of 10%, 5% and 1%, and the standard errors are in brackets.

Column (1) regression results show that the estimated coefficient of domestic technology transfer in and domestic technology transfer out is significantly positive, indicating that domestic technology transfer in and domestic technology transfer out can effectively drive urban innovation. (2) the regression results show that international technology transfer in and international technology transfer out have a positive correlation with urban innovation. According to column (3), domestic technology transfer and international technology transfer are positively correlated with urban innovation. Technology transfer is a standardized variable after standardization, so through the comparison of regression coefficient, it can be found that international technology transfer has a more significant positive effect on urban innovation than domestic technology transfer. To sum up, hypothesis 1 is valid.

3.2. Robust Test

(1) Replace the explained variable. The explanatory variable urban innovation index in this paper is weighted by principal component analysis, and there may be errors in the setting of weights. Therefore, the entropy method is used to replace the principal component analysis method to redefine the weight to calculate the urban innovation index, and to test the robustness of the benchmark regression results after replacing the explained variables. (2) Replace the model. The System GMM model can take into account the lag of technology transfer affecting urban innovation, so as to make the parameter estimation more effective. The regression results of technology transfer on urban innovation index are basically consistent with the benchmark regression, indicating that the benchmark regression conclusion is robust. (3) Instrumental variable method. Domestic technology transfer in, domestic technology transfer out, international technology transfer in and international technology transfer out were regarded as endogenous variables respectively, and 2SLS was used for regression. The choice of instrumental variables is as follows: first, drawing on the research ideas of Anderson et al. (2007) and Giudice et al. (2017), whether China's "double first-class" universities set up non local institutions and whether China's top 500 enterprises set up branches in non local places during the research period are taken as instrumental variables. KPF (Kleibergen-Paap rk F) tests the original hypothesis of rejecting weak instrumental variables, and there is still a significant positive correlation between technology transfer and urban innovation, indicating that the benchmark regression results are robust.

3.3. Exogenous Shock Test

The multi time point dual difference model is used to study the impact of the national science and technology transfer and transformation demonstration zone policy on urban innovation, and the following model is constructed:

$$\text{indup}_{it} = \lambda_1 \text{did}_{it} + \lambda_2 X_{it} + \vartheta_t + \mu_i + \varepsilon_{it} \quad (3)$$

Among them, "indup_{it}" is the explained variable urban innovation; "did_{it}" is the policy variable, The setting principle of virtual variables in the processing group is that

during the sample period, the cities covered by the national science and technology transfer and transformation demonstration zone are assigned a value of 1, and the cities not covered are assigned a value of 0; The principle of setting up the virtual variable of policy implementation time in the demonstration zone for the transfer and transformation of scientific and technological achievements is that the city is assigned a value of 0 before approval, and then 1; “ X_{it} ” is set of control variables; “ θ_t ” is the fixed effect of time; “ μ_i ” is individual fixation; “ ε_{it} ” is random interference; “ λ_1 、 λ_2 ” is the corresponding coefficient. The results show that the regression coefficient is significantly positive, and the national science and technology achievements transfer and transformation demonstration zone policy is conducive to urban innovation.

3.4. Heterogeneity Test

3.4.1. Urban Location Heterogeneity Test

For the northwest side of Hu Huanyong line, domestic technology transfer out and international technology transfer out have a significant positive impact on urban innovation; Domestic technology transfer and international technology transfer have no significant negative impact on urban innovation. For Hu Huanyong online and southeastern areas, domestic technology transfer and international technology transfer have a significant positive impact on urban innovation, while domestic technology transfer and international technology transfer have no significant positive impact on urban innovation.

3.4.2. Urban Agglomeration Heterogeneity Test

For the five major urban agglomerations, international technology transfer can significantly promote urban innovation, while domestic technology transfer has a significant negative effect on urban innovation. For areas outside the five major urban agglomerations, domestic technology transfer out and international technology transfer out will significantly promote urban innovation.

4. Mechanism Analysis

Explore the impact of technology transfer on urban innovation from different levels of industrial agglomeration, resource allocation and innovation accumulation, and construct models (4) and (5) to test:

$$\text{indup}_{it} = \beta_1 \text{zr}_{it} + \beta_2 \text{zc}_{it} + \theta_1 M_{it} \times \text{zr}_{it} + \theta_2 M_{it} \times \text{zc}_{it} + \theta_3 M_{it} + \beta_3 X_{it} + \theta_t + \mu_i + \varepsilon_{it} \quad (4)$$

$$\text{indup}_{it} = \beta_1 \text{fzr}_{it} + \beta_2 \text{fzc}_{it} + \theta_1 M_{it} \times \text{fzr}_{it} + \theta_2 M_{it} \times \text{fzc}_{it} + \theta_3 M_{it} + \beta_3 X_{it} + \theta_t + \mu_i + \varepsilon_{it} \quad (5)$$

Among them, M represents industrial agglomeration, resource allocation and innovation accumulation, “ β_1 、 β_2 、 β_3 、 θ_1 、 θ_2 、 θ_3 ” are the corresponding coefficient; Other variables were consistent. Among them, the coefficient of interaction term is the focus of attention, that is, for regions with different industrial agglomeration, resource allocation and innovation accumulation level, the impact of technology transfer on urban innovation.

4.1. Promoting Effect of Industrial Agglomeration

The results show that the interaction between international technology transfer and industrial agglomeration is significantly positive, and the interaction between international technology transfer and industrial agglomeration is not significant, indicating that the improvement of industrial agglomeration level helps to promote the positive impact of international technology transfer on urban innovation. It can be seen that with the improvement of industrial agglomeration level, the positive effect of domestic technology transfer and international technology transfer on urban innovation has gradually emerged and the coefficient has increased.

4.2. Promoting Effect of Resource Allocation

The results show that the interaction between domestic technology transfer and resource allocation is not significantly negative, the interaction between domestic technology transfer and resource allocation is not significantly positive, and the interaction between international technology transfer and resource allocation is significantly negative, indicating that with the continuous optimization of resource allocation, it is helpful to strengthen the positive effect of international technology transfer on urban innovation.

4.3. Innovation Accumulation Promotion Effect

The interaction between domestic technology transfer and innovation accumulation is significantly positive, indicating that with the improvement of innovation accumulation level, the driving effect of domestic technology transfer on urban innovation has been promoted, and the interaction between international technology transfer and innovation accumulation has a significant role in promoting urban innovation, that is, with the improvement of innovation accumulation level, the positive effect of international technology transfer on urban innovation has been increasing.

To sum up, from the perspective of domestic technology transfer, industrial agglomeration and innovation accumulation can promote the positive impact of domestic technology transfer on urban innovation. From the perspective of international technology transfer, industrial agglomeration and innovation accumulation can promote the positive impact of international technology transfer on urban innovation, and resource allocation can promote the positive effect of international technology transfer on urban innovation. So hypothesis 2 holds.

5. Conclusions and Policy Recommendations

This paper uses data mining technology to obtain the detailed data of invention patent and utility model patent transfer at the urban level in China, and takes 283 prefecture level and above cities in China from 2007 to 2019 as research samples to empirically study the role of technology transfer on urban innovation from domestic and international perspectives. The results show that: first, technology transfer has

a positive effect on urban innovation in China, and international technology transfer has a greater positive effect on urban innovation, indicating that although the scale and quantity of domestic technology transfer occupy the dominant position, the technological advancement needs to be improved, and some key core technologies still rely on international technology. Second, a series of robustness tests are carried out on the benchmark regression results by replacing the explained variables, replacing the model with the System GMM model, instrumental variables, and the impact of policy exogenous shocks in the national demonstration zone for the transfer and transformation of scientific and technological achievements, which proves that the conclusion of this paper has strong robustness. Third, the analysis of heterogeneity shows that technology transfer can better drive urban innovation in cities with more advantages in geographical location and urban agglomerations. Fourthly, the analysis of regional promotion effect shows that with the improvement of industrial agglomeration, resource allocation and innovation accumulation level, the positive impact of technology transfer on urban innovation is increasing. Based on the results of this study, the following policy suggestions are put forward.

First, we should improve the domestic and international technology transfer network and enhance the efficiency of the technology transfer system.

Second, improve the level of industrial agglomeration and give better play to the positive externalities of industrial agglomeration.

Third, we should accelerate the construction of a unified national market and promote more optimal allocation of resources.

Fourth, we should enhance the level of innovation accumulation and strengthen the supply of high-quality scientific and technological achievements.

Fifth, promote the advanced, digital, green and low-carbon development of urban industry.

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