

# Universities and Innovation Potential of the City: A Quasi-Experimental Study of Newly Built Campuses of Colleges and Universities in China

Dongyang Chen, Wei Ha

*Institute of Economics of Education, Peking University, Beijing 100871, China*

---

**Abstract:** *Colleges and universities have been playing an increasingly important role in regional innovation-driven development. Based on panel data (1999-2016) of 287 cities in China, this study conducted an empirical analysis of the influences of the new campuses which were built for the expanded college enrollment on the city's patentable inventions and innovations. The Time-varying DID model was adopted in the analysis. The regression results demonstrate that newly built campuses have boosted inventions and innovations in their cities, benefiting various innovators including individuals and firms; that the impact of newly built campuses increases over time; the newly built campuses of vocational colleges have mainly influenced innovation actors like businesses, while those of regular colleges and universities have impacted both individuals and organizations; that the new campus built in the different city from its headquarter exerts greater promoting effects on the innovation of the city than the campus relocated in the original city and the campus of a newly established university; that the indirect effect of newly built campuses on the invention of all innovation actors is more significant than the impact of their direct collaboration with the latter; that a newly built campus have a more prominent effect on regional innovation when it is situated in an area with a high concentration of universities; and that the existence of the old campus of a university amplifies the promoting effect of its newly built campus on local innovation and the amplifying function strengthens over time.*

*Best Evidence in Chinese Education 2022; 12(2):1635-1642.*

*Doi: 10.15354/bece.22.ab015*

---

**How to Cite:** Chen, D., & Ha, W. (2022). *Universities and innovation potential of the city: A quasi-experimental study of newly built campuses of colleges and universities in China. Best Evidence in Chinese Education, 12(2):1635-1642.*

---

**Keywords:** *Colleges and Universities, Innovation of the City, Newly Built Campuses*

---

**Correspondence to:** Wei Ha, Institute of Economics of Education, Peking University, Beijing 100871, China. E-mail: [waha@pku.edu.cn](mailto:waha@pku.edu.cn)

**Conflict of Interests:** None.

---

© 2022 Insights Publisher. All rights reserved.



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-Non Commercial 4.0 License

(<http://www.creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed by the Insights Publisher.

## **Introduction**

As a result of the intensified reform of market-oriented economy, serving economic development, undertaking scientific research, and training talent have been equally emphasized in China's higher education. The predominance of higher education institutions in the nation's scientific research and innovation has been well acknowledged. Universities' role in social development was further confirmed by a succession of external policies such as the National Revitalization through Science and Education Strategy 1995, the Action Plan for Revitalizing Education in the 21st Century and the National Key Basic Research Development Plan (the "973 Plan") in 1998, and the empowerment of universities in patent applications in 2002.

Over the past twenty years, local governments have committed substantial investment to constructing additional campuses in response to the expansion of college enrollment. At the same time, they have also attempted to utilize this opportunity to open up more zones for innovation such as high-tech development parks and innovation incubation bases to achieve innovation-driven regional development. Their plans for college town construction unexceptionally revealed their policy intention to integrate local higher education resources, promote the collaboration between industry, education, and research sectors, and develop regional high-tech industries to meet the future challenges of knowledge economy. According to the relevant statistics, among more than 300 major cities (excluding those in Qinghai and Tibet) in China, 209 of them are building new college towns. Can so extensive construction of new campuses really drive the development of regional innovation? What are the underlying influential mechanisms?

## **Research Hypotheses**

The newly built college and university campuses in this study refer to those built in the wake of the expansion of college enrollment initiated in 1999. According to the data collected by our research team, by 2021 there were over 1600 new campuses of various types under construction or completed by colleges and universities in 29 provincial administrative regions (except for Qinghai and Tibet) in mainland China. Further classification of these new campuses is made as follows. Regarding school types, there were 925 new campuses for regular colleges and universities and 693 for vocational colleges. The construction of new campuses by regular colleges and universities reached its peak in three to five years following the initiation of expanded colleges' enrollment in 1999, while the number of new campuses of vocational colleges grew steadily. According to their locations, these new campuses can be divided into three categories: there were 377 "newly established campuses", each of which was built as the first campus of its newly set up school; there were 1091 "relocated campuses in the original cities" which refer to those built in the same cities as the old campuses; there were 150 "relocated campuses in new cities" that were built in cities other than the ones where the parent campuses are located. The construction of "relocated campuses in the original cities" and "newly established campuses" was at its peak in three to five years after the introduction of expanded college enrollment. After that, the "relocated campuses in the original cities"

has maintained a high growth rate, while the increase of “newly established campuses” has shown a significant downward trend.

First of all, according to the existing experience, the operation of the newly built campus can not only promote the invention of the university itself, but also enhance the innovation ability of other actors such as businesses and individuals, through face-to-face communication between the school and firms, scientific and technological service, application of research results, popularization of cutting-edge expertise, and creation of innovative atmosphere. Thus, we propose the first hypothesis (H1): the operation of new campuses of colleges and universities can effectively promote the innovation of the city where they are built, and the influence can spill over into other innovation agents such as enterprises and individuals.

Second, newly built campuses of different types and location characteristics yield different knowledge spillovers and research transfer results to innovation actors in the local city due to their varying backgrounds and educational orientations. Therefore, we put forward hypothesis two (H2): the impact on the city’s innovation from newly built campuses of regular universities and vocational colleges may differ; also, there may be differences in the impact between “newly established campuses”, “relocated campuses in the original cities”, and “relocated campuses in new cities.”

Third, there are time gaps between innovation input and output in the process of adjusting and transforming production factors by innovation actors. In the operation of new campuses, innovative elements spill over in the material or immaterial forms. In this process, learning, digestion, absorption, and diffusion of innovative elements by innovation actors are significantly dynamic. Most importantly, the construction and opening of new campuses are long-term processes in real-world contexts. As a result, we bring up the third hypothesis (H3): The positive effect of the new campuses of colleges on the city’s innovation is cumulative, which gradually increases over time.

Last, newly built college campuses can influence external innovation actors such as firms and individuals through collaborative invention or through promoting the latter’s innovation practices by providing knowledge service. The second influencing path plays a more salient role in boosting patentable inventions in the city. Hence, the fourth hypothesis is suggested: the newly built college campuses are more likely to impact external actors’ innovation through indirect involvement than through direct cooperation with them.

## **Research Models**

Based on the existing panel data, this study constructed a difference-in-differences (DID) model to investigate the impact of the newly built college campuses on the city’s innovation capacity. The traditional DID method is generally valid to cases in which the policy intervention occurs in a single period of time and the sample intervention status remains unchanged, otherwise the setting of interactions will severely contradict the parallel trend assumption, which may lead to biased estimation coefficients. As a result, we used a more flexible Time-varying DID model instead of the conventional DID model in this study, since there are differences in the opening time among those new campuses and in the number of new campuses built in sampled cities.

A requirement for using DID method is that the experimental group meets the criterion of random distribution. In other words, there are no other potential time-varying characteristics of cities that may affect the estimation results in the model. This study managed to control for the key indicators that may affect the city's construction of new campuses such as economic foundation, population size, the number of existing campuses and the interactions of time trend, etc. and add fixed effects of the city and fixed effects of the year. It also attempted to avoid the interference from other imperceptible omitted variables in the estimation results.

The other requirement for using DID method is that the innovation activities of the experimental group and the control group be aligned with the parallel trend assumption. This study further combined the preliminary Time-varying DID model with the event study method. A parallel trend test was conducted by observing the difference in the impact of the two groups of samples before the intervention; the research hypotheses were verified by inferring the trend from the dynamic changes of the policy effects.

## **Research Findings**

### ***Preliminary Regression Results***

Preliminary regression results from equation one of the model demonstrated that the operation of newly built campuses of universities has significantly promoted innovation in the cities where they are located. The regression coefficient of the effect was 0.020, that is, on average, each new campus brought about 2.0% increase in patented inventions for the city. The regression results showed that the regression coefficients of the effects of newly built university campuses on individuals, enterprises, colleges, research institutions and other actors were all positive, and the first three coefficients are statistically significant. This indicates that the knowledge spillover of the new campuses is not limited to the higher education sector but can also affect the innovation activities of external factors, such as businesses and individuals. Thus, H1 is validated.

To check the interference caused by the non-random distribution of newly built college campuses in various cities, this study proceeded to perform a robustness test by focusing on cities with newly built university campuses and incorporating fixed effects of provinces and years and found that the regression results of the test were consistent with the preliminary regression results. This shows that the impact of newly built university campuses on the city's innovation is robust.

To evaluate the potential impact of the possibly, randomly omitted variables on the empirical research conclusions, this study also conducted a placebo test: randomly selected the cities from the experimental group and the opening years of their new campus, and randomly regressed 1000 times according to the preliminary model. According to the regression results, the regression estimation coefficients obtained by random sampling are by no means close to the regression results of this study. Thus, the regression results of this article cannot be affected by randomly changing the policy intervention time.

### ***Disparities in the Impact of Newly Built Campuses***

### *(i) Differences in the Influence of Newly Built Campuses of Different Types*

We attempted to replace the core explanatory variables in the preliminary regression model with the numbers of newly built campuses by regular universities and by vocational colleges to compare the difference in their impact on the local cities' innovation. It was found that the two types of new campuses both had significant positive effects on the number of inventions and patents in the local cities. New campuses of regular universities mainly affect the innovation of individuals, businesses, and tertiary education schools, while those of vocational colleges generally influence the invention of businesses and tertiary education schools. Both of them have a positive impact on corporate innovation, and the impact of the latter is slightly stronger than that of the former in this regard; Regular universities exerts more prominent influence on individuals' invention and innovation.

### *(ii) Variations in the Impact of Newly Built Campuses with Different Locations*

We tried to replace the core explanatory variables in the preliminary regression model with the numbers of “newly established campuses”, “relocated campuses in the original cities”, and “relocated campuses in new cities” to examine the gaps in their effects on the cities' innovation. It was discovered that the impact of “relocated campuses in new cities” was the strongest, which was mainly imposed on the invention of businesses and individuals; and that there is no significant difference in the effects on the cities' innovation between “newly established campuses” and “relocated campuses in the original cities” and the effects are posed on individuals, businesses and tertiary education schools.

### *The Cumulative Effects of Time*

After controlling for the covariates, there was no perceptible difference between the experimental group and the control group before the intervention, and the “counterfactual” estimation in the model was basically reliable. The analysis results also showed that the impact of the new campuses on the innovation capacity of the city gradually increased over time, in a cumulative pattern.

### *An Expanded Analysis of Influencing Mechanisms*

There may exist multiple paths for the influence of newly built college campuses on the innovation of their cities. On the basis of foregoing regression results, this study further examined the comprehensive influence of the new campuses on the patentable innovations of the city in the following four aspects.

- *Direct Collaboration or Indirect Involvement*

In order to determine which form of engagement on part of the newly built college campuses, direct cooperation or indirect involvement, has the more substantial promoting effect on the innovation of the city, we experimented with replacing the explanatory variables in the regression model with the number of invention patents under universities' direct participation and the number of invention patents which did not involve universities' direct engagement, and then a grouped regression was carried out. The results revealed that the indirect involvement rather than the direct engagement of new campuses yields a more substantial promoting effect on the local city's innovation and development.

- *Converging Inventions or Balanced Development*

This study first used as the proxy indicator the logarithm of the difference between the 90% quantile and the 10% quantile of the number of invention patents granted to all districts and counties within a city to examine the degree of concentration and distribution of innovation activities among different areas in the city after the new campuses were put into operation. The results showed that the estimated coefficients of each regression equation were significantly positive, which indicated that innovation activities in various districts and counties in the city have shown a certain degree of convergence after the new campuses were put into use. Based on this finding, this study used the variance of the number of invention patents granted to each district and county as the regression result of the substitution index, which also verifies the above conclusion.

- *The Impact of the Concentration of Newly Built University Campuses*

The greater the number of university campuses in a unit area, the more likely that the innovation actor there will benefit from their knowledge spillovers, and the overall impact of universities on the city's innovation will be more significant. We attempted to replace the core explanatory variables in the preliminary model with the number of college campuses per hundred square kilometers to evaluate the influence of college density on the city's innovation and found that the denser the university campuses per unit area, the more prominent the knowledge spillovers on the overall invention and innovation of the city, and that businesses there are the major beneficiaries.

- *The Influence of the Old Campuses*

We incorporated into model two the interaction between the number of new campuses and the variable of whether there being corresponding old campuses in the same city to examine the relationship between them and its long-term trend. Overall, the existence of the old campus somewhat reinforced the promoting effect of the new campus on the innovation and invention of the city, and this effect was consistently enhanced over time, which was a sign that the new and the old campus have gradually established a close connection in research cooperation.

## Conclusions

The operation of newly built college campuses has promoted the innovation and invention of the city where they are located, including the invention of individuals, businesses, and other actors. The promoting effect of the new campuses is cumulative, which strengthens with the increase in years of their operation. The newly built campuses of regular colleges and universities are beneficial for the innovation of individuals and businesses, while those of vocational colleges mainly benefit businesses and other actors. Compared with “newly established campuses”, “relocated campuses in the original cities”, “relocated campuses in new cities” can impose a more substantial impact on the city’s innovation. The expanded analysis shows that compared with their direct cooperation with other innovation actors in the city, new campuses’ indirect involvement has more significant influences on the number of invention patents of those actors. After the new campuses being put into use, the innovation and invention activities in the city tend to converge; the higher density of college campuses is in a unit area, the stronger promoting impact they have on the city’s innovation. The existence of old college campuses may enhance the promoting function of new campuses, and this enhancing effect will get stronger over time.

*The Chinese version of this article has been published in Peking University Education Review, 20(2):127-146. The English version has been authorized for being publication in BECE by the author(s) and the Chinese journal.*

*陈东阳,&哈巍. 高校与城市创新能力-基于新建校区的准实验研究.北京大学教育评论, 2022, 20(2):127-146.*

*Received: 11 October 2022*

*Revised: 27 October 2022*

*Accepted: 15 November 2022*