# Research on the Impact of Tax Sharing on Urban Innovation Level

## Empirical Study Based on 281 Prefecture Level Cities

Qiaoqiao Sun

School of Economics, Anhui University, Hefei, China

2995705693@qq.com

**Abstract.** Based on panel data from 281 prefecture level cities in China from 2009 to 2021, this article empirically analyzes the impact of tax revenue sharing on urban innovation level by establishing a two-way fixed effects model. Research shows that increasing tax revenue sharing can significantly promote urban innovation levels. Through regional investigation, it was found that in the eastern region, tax revenue sharing significantly promotes the level of urban innovation; In the central and western regions, tax revenue sharing will suppress the level of urban innovation. Three suggestions are proposed based on this: firstly, cultivate local dominant tax types and stabilize tax sources; The second is to consider the uneven economic development between regions and implement a differentiated tax sharing system; Thirdly, establish a scientific performance evaluation mechanism and foster innovative concepts.

**Keywords:** tax revenue sharing; Urban innovation level; Local government; Bidirectional fixed effect.

## 1 Introduction

Innovation is a key factor leading economic development. For the development of urban economy, the government is an important builder of the innovation system. How can we promote the high-quality development of urban innovation level? This relies on the joint efforts of the tripartite mechanism of "education enterprise government"[1]. Therefore, urban innovation is not only influenced by market mechanisms, but also the result of continuous guidance from local governments. Fiscal expenditure is one of the important means for local governments to participate in urban innovation and construction, and the tax sharing system is one of the important indicators to characterize the fiscal capacity of local governments. On the one hand, the tax sharing system provides financial incentives for local governments to actively invest in urban innovation and construction. This incentive system is usually directly linked to the tax revenue of local governments, and when local governments achieve significant results in urban innovation, their tax revenue will also increase accordingly. This direct interest relationship has prompted local governments to pay more attention to urban innovation. On the other


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hand, excessive or inappropriate intervention may lead to the loss of the dominant position of urban innovation, that is, the entities that should have been independently innovated by enterprises, research institutions, etc. are excessively controlled by the government, resources are overly concentrated in certain fields or regions, causing vicious competition between cities, damaging the overall innovation environment, and exacerbating regional imbalances. Therefore, studying the relationship between tax revenue sharing system and urban innovation level plays an important guiding role in improving the fiscal decentralization system and guiding local governments to use reasonable methods for urban innovation.

## 2 Theoretical Analysis and Research Hypotheses

The tax sharing system, as an important mechanism for distributing tax revenue between the central government and local governments, is the core content of the tax sharing system in handling the financial relationship between the central and local governments[2]. At present, there is no research or exploration in the academic community on the relationship between tax revenue sharing incentives and urban innovation levels. Most of the research focuses on the relationship between tax revenue sharing incentive system and micro enterprise innovation and macro regional technological innovation. Therefore, this article analyzes the impact of tax revenue sharing system on urban innovation level from the perspective of meso level urban innovation. The tax sharing ratio does play a decisive role in the tax revenue obtained by local governments, which in turn affects government behavior and may ultimately impact urban innovation levels through various means. The following is an analysis of how tax revenue sharing affects urban innovation levels from two main perspectives.

On the one hand, tax incentives. When the tax sharing ratio increases, local governments have the incentive to adjust tax policies, strengthen tax collection and management, in order to maximize their own tax revenue. This behavior may lead to an increase in tax burden faced by enterprises, thereby increasing their innovation costs[3]. An increase in tax burden will compress the profit margin of enterprises, making them more inclined to reduce investment in research and innovation, thereby affecting their innovation capabilities[4]. The increase in tax sharing ratio will also intensify fiscal incentives among local governments, leading to fierce tax competition for the sake of seizing the tax base. This competition may further affect the innovation behavior of enterprises[5]. Based on this, this article proposes:

Assumption H1: A high tax sharing ratio may lead to excessive taxation by local governments, which is not conducive to promoting urban innovation levels.

On the other hand, tax base protection incentives. When the tax sharing ratio increases, the tax revenue that local governments can obtain will increase, which will motivate them to protect the tax base and cultivate tax sources as much as possible[6]. Local governments may take a series of measures, such as increasing corporate subsidies and increasing tax incentives, which can help alleviate the financial pressure on businesses and provide them with more funds for research and innovation activities. Hall and Reenen (2000) confirmed that local government fiscal policies can affect the

technological innovation of enterprises[11]. Atkeson and Burstein (2011) also confirmed that government tax incentives are one of the effective ways to promote innovation[12]. The increase in tax revenue sharing ratio can enhance the financial capacity of local governments, enabling them to better build infrastructure that is conducive to enterprise technological innovation[7]. These infrastructures may include research facilities, incubators, industrial parks, etc., which can provide necessary research and development conditions and cooperation platforms for enterprise innovation. Based on this, this article proposes:

Assumption H2: Tax revenue sharing incentives are beneficial for local governments to achieve their own fiscal revenue, increase innovation subsidies for enterprises, and create a favorable innovation environment, which is conducive to promoting the level of urban innovation.

Finally, the impact of tax revenue sharing incentives on eastern cities may be different from that on central and western cities. In the eastern region, innovation has become an important driving factor for high-quality economic development. Local governments have a high enthusiasm for participating in urban innovation, and tax incentives can fully play the leading role of local governments in urban innovation, improving their awareness of innovation responsibility and fiscal expenditure efficiency.

Based on this, this article proposes hypothesis H3: compared to cities in the central and western regions, the incentive effect of tax sharing in eastern cities is more significant.

## 3 Research Design

### 3.1 Model Setting

In order to test the theoretical expectations of the previous text and verify the corresponding research hypotheses, this paper establishes a bidirectional fixed effects model, as shown in equation (1)

$$inno_{it} = \alpha_0 + \alpha_1 \text{share}_{it} + \sum_{j=1}^{n} \alpha_j \text{Controls}_{jit} + u_i + v_t + \varepsilon_{it} \quad (1)$$

Among them: inno represents the level of urban innovation; Share is an incentive for tax revenue sharing; Conrtols is a series of control variables; i is the city; t is the year; $\alpha_0$ is a constant term; $\alpha_1$ is the coefficient to be estimated, and ε is the random perturbation term.

### 3.2 Variable Selection

The dependent variable: the level of urban innovation (inno). In existing research, many scholars such as Lü L and Chen Y(2023)[8], and Li Xianyin (2022) [9] choose patent application data to measure urban innovation capability. The indicators are too single to comprehensively measure the level of urban innovation. Therefore, this article draws on the comprehensive measurement algorithm of Miao Lijing (2021)[10], constructs a

multi index system, and uses principal component analysis to calculate the level of urban innovation.

Core explanatory variable: Tax sharing ratio (share). This article refers to the alternative calculation method proposed by Lv Bingyang et al. (2016). Since the tax sharing ratio of all prefecture level cities within a province is the same, the tax revenue retained by all prefecture level cities in that province is used to replace the tax sharing ratio of the city in that province with the total tax revenue organized by the tax department of that province.

The control variables selected in this article include government innovation preference (gov), industrial structure (ind), financial development level (fdl), urban economic density (ed), government self-sufficiency (fc), government intervention level (gic), and human capital level (hum).

### 3.3 Data Explanation and Descriptive Statistics

The original data for this article comes from the "China Urban Statistical Yearbook", "China Tax Statistical Yearbook", and "National Fiscal Statistics of Cities and Counties". Panel data from 281 prefecture level cities from 2009 to 2021 were selected as samples. It should be noted that firstly, due to differences in tax sharing arrangements between each municipality and other provinces, Beijing, Shanghai, Tianjin, and Chongqing were excluded. Second, Xinjiang and Xizang were also excluded from the sample due to the lack of data. Thirdly, due to significant differences in tax systems compared to mainland China, the sample does not include Hong Kong, Macau, and Taiwan. A comprehensive descriptive statistical analysis was conducted on the selected variables in order to provide solid data support for subsequent empirical research. The results are shown in Table 1

**Table 1.** Descriptive Statistics

| Meaning | Indicator Description | Numbr | mean | Std | min | max |
|---|---|---|---|---|---|---|
| (inno) | Urban innovation level | 3601 | 0.121 | 0.049 | 0.026 | 0.494 |
| (share) | Tax sharing rate | 3601 | 0.473 | 0.053 | 0.256 | 0.609 |
| (gov) | Fiscal technology education expenditure/total fiscal expenditure | 3601 | 0.016 | 0.016 | 0.001 | 0.207 |
| (ind) | GDP of the tertiary industry/GDP of the primary and secondary industries | 3601 | 0.998 | 0.548 | 0.175 | 5.348 |
| (fdl) | Total balance of local deposits and loans/regional GDP | 3601 | 2.405 | 1.155 | 0.590 | 21.300 |
| (ed) | Regional Gross Domestic Product/Administrative Land Area | 3601 | 0.296 | 0.715 | 0.002 | 15.355 |
| (fc) | Local fiscal revenue/local fiscal expenditure | 3601 | 0.446 | 0.218 | 0.054 | 1.107 |

| | | | | | | |
|---|---|---|---|---|---|---|
| (gic) | Local fiscal expenditure/regional gross domestic product | 3601 | 0.197 | 0.102 | 0.035 | 1.027 |
| (hum) | Number of regular undergraduate and junior college students/total population at the end of the year | 3601 | 0.019 | 0.025 | 0.008 | 0.164 |

# 4 Empirical Result Analysis

## 4.1 Benchmark Regression Results

**Table 2.** The Impact of Tax Sharing on Urban Innovation Level

| variable | (1) inno | (2) inno |
|---|---|---|
| share | 0.0212*** (3.26) | 0.0148** (2.56) |
| control variable | NO | YES |
| Urban fixed effects | YES | YES |
| Fixed time effect | YES | YES |
| sample size | 3601 | 3601 |
| Goodness of fit | 0.8343 | 0.8781 |

Note: *, * *, * * * represent variables that are significant at the 0.1, 0.05, and 0.01 levels, respectively; The values in parentheses are t values, the same applies below.

Table 2 shows the estimation results of the tax sharing rate of prefecture level cities on urban innovation level. Column (1) separately estimates the impact of tax sharing rate on urban innovation level, while column (2) includes control variables such as government innovation preference, industrial structure, and financial development level. Both columns (1) and (2) control for urban fixed effects and time fixed effects. The results showed that the level of urban innovation (inno) was significantly positively correlated with the tax sharing ratio (share). Although the coefficient and significance level of the tax sharing ratio decreased after controlling for variables, they were still significantly positive at the 5% statistical level. The decrease in regression coefficient is not significant, which effectively controls various factors that affect the level of urban innovation. The empirical results show that an increase in tax sharing ratio leads to an increase in urban innovation level. The possible reason is that compared to tax incentives, tax base protection incentives are more obvious. That is, in cities with higher tax sharing ratios, local governments are more willing to improve urban innovation level by protecting the tax base, increasing innovation subsidies for enterprises, and creating a good innovation environment, in order to achieve more tax revenue in the long run.

### 4.2 Heterogeneity Test

This paper considers the heterogeneity of urban regions, and the regression results are shown in Table 3, in the eastern region, innovation has become an important driving factor for high-quality economic development, and local governments have a higher enthusiasm to participate in urban innovation, so the eastern region is more sensitive to the change of tax sharing ratio and the incentive effect is more significant. However, the central and western regions will use more tax revenue for people's livelihood construction, so the change in the tax share ratio may be negatively correlated.

**Table 3.** Heterogeneity test

| | Eastern region | Central and Western Regions |
|---|---|---|
| | (1) | (2) |
| | Inno | Inno |
| share | 0.051*** | -0.021** |
| | (5.75) | (-2.99) |
| control variable | YES | YES |
| Urban fixed effects | YES | YES |
| Fixed time effect | YES | YES |
| sample size | 1729 | 1872 |
| Goodness of fit | 0.8712 | 0.8988 |

## 5 Conclusion and Policy Suggestions

The tax revenue sharing incentive mechanism not only has a certain impact on micro level corporate behavior and macro level regional development, but also affects the level of urban innovation at the meso level by influencing local fiscal expenditure autonomy. This article selects 281 city level panel data from 2009 to 2021 to analyze the impact of tax revenue sharing incentive mechanisms on urban innovation levels. The main conclusions are as follows:

For local cities, the tax base protection incentive effect of the tax sharing system far outweighs the negative effects brought by tax incentives. The increase in tax revenue sharing rate will stimulate local governments to increase innovation subsidies and tax incentives for enterprises. At the same time, local governments will actively create a good innovation atmosphere, increase local innovation infrastructure construction, and promote the improvement of urban innovation level. Specifically,

Tax revenue sharing incentives in the eastern region can significantly enhance urban innovation levels, while tax revenue sharing incentives in the central and western regions have a restraining effect on urban innovation levels, which may be due to differences in economic foundations and innovation resources between the eastern, central, and western regions.

Based on the above research conclusions, this article has the following policy implications:

Cultivate local dominant tax categories. Tax revenue sharing incentives can significantly increase local fiscal revenue, increase local fiscal autonomy, and promote urban innovation levels. Therefore, in order to further increase the fiscal revenue of local governments, it is possible to adjust the local tax system structure, increase the cultivation of local main tax categories, adapt to the requirements of national innovation and development, and stimulate innovation vitality. Moderately delegate tax management authority from the central government to local governments, accelerate the division of tax revenue between the central and local governments, expand local tax sources as much as possible, and stabilize local main tax categories.

Implement a differentiated tax sharing system. To improve the level of urban innovation through tax incentives, attention should be paid to adapting to local conditions. Due to the differences in economic development and innovation resources among different regions in the eastern, central, and western regions, there are certain differences in tax capacity, tax sources, and other aspects. Avoiding excessive taxation by local governments due to high tax sharing ratios may to some extent hinder the improvement of urban innovation levels. Therefore, in the formulation of the tax system, the uneven development between regions should be considered, and a differentiated tax sharing management model should be adopted.

Establish a scientific performance evaluation mechanism. Strengthen the policy orientation of innovation driven development. The government should always regard innovation driven development as an important guiding ideology when formulating and implementing various policies, encourage and support various forms of innovation activities, and cultivate and develop emerging industries and formats.

The assessment methods for local government officials should be combined with innovation driven approaches, and innovative concepts should be constantly established.

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