# Spatial Spillover Effects of Cultural Industry Agglomeration on Industrial Structure Upgrading

Xuejia Dang*

School of Economics and Management, Nanjing University of Science and Technology, Nanjing, China

*Corresponding author: xuejiaii@163.com

**Abstract.** Under the general trend of cultural industry agglomeration development, the spatial spillover effect generated by it is studied. Taking 278 prefecture-level cities in China as samples, a spatial Durbin model is constructed under the economic distance weight matrix to study the spatial spillover effects of cultural industry agglomeration on industrial structure upgrading, and analyzed from the perspective of regional heterogeneity. The results show that: there is a positive spatial spillover effect of cultural industry agglomeration on industrial structure upgrading; By regional grouping, the spatial spillover effect of cultural industry agglomeration on industrial structure upgrading is significantly verified in the east and central regions, and the spatial spillover effect is stronger in the east than in the central region, but does not pass the significance level test in the west; improving human capital stock and appropriate government intervention are beneficial to industrial structure upgrading in each region. The above research contents provide a research basis for guiding the development of cultural industry agglomeration and optimizing regional cultural industry division of labor to promote industrial structure upgrading.

**Keywords:** Cultural Industry Cluster; Industrial structure upgrading; Spatial Spillover.

## 1. Introduction

Industrial structure upgrading plays an important role in promoting high-quality economic development. Cultural industry is a sunrise industry, and its role in promoting economic development is becoming more and more prominent. The agglomeration development of cultural industry is the trend of modern economic and social development, and its scale effect and spillover effect provide strong support for regional economic development. This mainly lies in the effects of agglomeration of cultural industries, which have common agglomeration effects such as reducing enterprise transaction costs, accelerating capital and information circulation, promoting resource integration and improving innovation efficiency on the one hand, and characteristic agglomeration effects such as enhancing enterprise innovation capacity, promoting knowledge spillover and breaking geographical constraints to achieve cross-regional cooperation on the other. The famous Hollywood Film District in the United States, the Sheffield Cultural Industry Park in the United Kingdom, and the 798 Art District in Beijing, China, are all successful cases of cultural industry agglomeration helping to transform the regional economic structure. Obviously, cultural industry agglomeration has a direct or indirect impact on regional industrial structure.

## 2. Literature Review

At present, research in the field of industrial structure upgrading focuses on influencing factors such as digital finance[1-3], technological innovation and digital economy[4-6], industrial agglomeration[7,8], human capital[9,10], and government policies[11-13]. The academic research on cultural industry agglomeration mainly involves the influencing factors, distribution characteristics and spillover effects, which are mainly reflected in: first, the influencing factors of cultural industry agglomeration are: cultural resource endowment[14], regional economic development[15,16], human resources[17], government policies[18] and geographical location[19]; second, the agglomeration of Chinese cultural industry shows step-like Secondly, Chinese cultural industry agglomeration has a step-like unbalanced distribution[20], and has undergone a transformation from "sub-grid dispersion"

to "polarization"[21]; Thirdly, cultural industry agglomeration has a significant spatial spillover effect[22,23], which can influence regional economic growth[24], innovation efficiency[25], and cultural industry development efficiency[26], and the role of cultural industry agglomeration is highly dependent on factors such as urbanization[21], transportation level[27], financial support[21], and technology level[22].

Academic research on the influence of industrial agglomeration on industrial structure upgrading is mainly focused on productive services, manufacturing and finance. For the influence of cultural industry agglomeration on industrial structure upgrading, Zhang, Su-Yuan and Gu, Jiang (2022) analyzed with a non-spatial ordinary panel model and found that cultural industry agglomeration has "net-like" characteristics and promotes regional industrial structure upgrading through scale effect, competition effect and spillover effect[28].

However, there are still limitations in the existing literature: first, most of the existing literature uses ordinary panel models for regression analysis, which only considers the influence of cultural industry agglomeration on local industrial structure upgrading, ignoring the spatial dependence between regions; second, most of the existing literature selects the provincial level for research, ignoring the unbalanced development between prefecture-level cities and the spatial structure brings to the research results.

Based on the above, the article will sort out the mechanism of spatial spillover effect of cultural industry agglomeration on urban industrial structure upgrading, taking the data of 278 prefecture-level cities in China from 2012 to 2020 as samples and using spatial measurement methods, in an attempt to address the following questions: does cultural industry agglomeration have a significant spillover effect on the upgrading of industrial structure in the spatial scope of China? What are the differences in the spatial spillover effects of cultural industry agglomeration on industrial structure upgrading under different regions? This will provide a mirror for the development of agglomeration of cultural industries and promote industrial structure upgrading in China.

## 3. Theoretical Mechanisms

The role carriers of spatial spillover of cultural industry clusters are elements such as knowledge and human capital. Unlike general industries, cultural industries are usually characterized by high quality human capital as their creativity is the core and the core of cultural products is content, focusing on innovation. While human capital has strong mobility, cultural elements flow with people, and cultural products and cultural services are diffused in the flow of human resources. The mechanisms for the occurrence of spatial spillover effects of cultural industries are mainly: external economy, learning demonstration effect, spatial competition effect, and spatial cooperation effect.

(1) External economy. According to Marshall's "external economy" theory, the influence factors can not only affect the local area, but also have spillover effects on other areas [21]. The clustering of cultural industries makes the division of labor more clear and fine, and the spillover of knowledge extends the value chain of cultural industries in a networked and three-dimensional way [29], and the spillover of production factors through the industrial chain promotes cross-border exchanges between enterprises in clusters and non-clustering areas, which further improves production efficiency and promotes the development of cultural industries outside the clusters.

(2) Learning demonstration effect. The development of information technology makes the communication between regions more convenient and more closely connected. The spatial spillover effect of cultural industry agglomeration can spread the creativity, content ideas and technology of better developed regions to the backward regions, and the latter can learn from this demonstration and make continuous adjustment and improvement according to their own situation, thus increasing the output value of cultural industry and promoting the upgrading of industrial structure.

(3) Spatial competition effect. According to Porter's competitive advantage theory, the entry of local cultural industries into the surrounding areas will intensify the competition of cultural industries in the surrounding areas, and the surrounding areas will innovate and upgrade their products and

services and expand their industrial scale in order to maintain their competitiveness, which will further agglomerate cultural industries and thus promote the upgrading of cultural structure in the surrounding areas.

(4) Spatial cooperation effect. The overflow of cultural industry elements will strengthen the exchange and cooperation among cities, promote the sharing of cultural resource information in the region, realize the close connection between the local cultural industry clusters and the cultural industry clusters in the surrounding areas, form the inter-regional specialized division of labor, improve the cultural industry chain, effectively reduce the average production cost of the cultural industry in the region, and promote the improvement of production efficiency.

## 4. Data, Model and methodology

### 4.1 Variables

Industrial structure upgrading is the process of convergence of industrial structure from lower to higher forms under the continuous improvement of technology level. Industrial structure upgrading has two meanings, the change of the ratio between industries and the improvement of labor productivity of each industry. T The article uses the product sum of the output value of each industry as a share of GDP and labor productivity to express the industrial structure upgrading index, which is calculated as follows:

$$IND = \sum_{i=1}^{3} \frac{Y_i}{Y} \cdot LP_i, \ \ i = 1, \ \ 2, \ \ 3 \tag{1}$$

Where, $IND$ denotes the industrial structure upgrading index, i denotes the primary, secondary and tertiary industries respectively, and $Y_i$ denotes the industrial output value. $LP_i$ denotes the labor productivity of each industry, which is obtained by the ratio of the value added of each industry to the number of employed persons in each industry. Since labor productivity is a dimensional value, the article adopts the normalization method to perform dimensionless processing on $LP_i$ and standardize the data to the interval of [0, 1], and the larger the value of $IND$, the higher the level of industrial structure.

**Table 1**. Variable setting description and data source

| Variable | Name | Description | Data sources |
|---|---|---|---|
| Explained variable | Industrial structure upgrading index | The sum of the product of the ratio of the output of each industry to GDP and labor productivity | China Statistical Yearbook, Provincial and Municipal Statistical Yearbooks |
| Core explanatory variable | Cultural industry aggregation | Zone entropy | China City Statistical Yearbook |
| Control variables | Economic development level | Gross regional product per capita | China City Statistical Yearbook |
| | Informatization level | Total postal services per capita | China City Statistical Yearbook |
| | Human capital stock | Number of students enrolled in general higher education schools per 10,000 people | Statistical Yearbook of Provinces and Cities |
| | Transportation infrastructure | Road area per capita | China Urban Construction Statistical Yearbook |
| | Government control | Local general budget fiscal expenditure as a percentage of GDP | Statistical Yearbook of Provinces and Cities |

(1) Explanatory variables (*IND*). The article selects the sum of the product of the output value of each industry as a proportion of GDP and the labor productivity of each industry to measure the index of industrial structure upgrading in each region.

(2) Core explanatory variables (*CIA*). The spatial Gini coefficient, Herfindahl index, industrial concentration index and locational entropy index can be used to measure the degree of industrial agglomeration, among which the locational entropy index is relatively simple but better reflects the

spatial distribution of industrial agglomeration from the macro level. Due to the availability of data related to the cultural industry, the article adopts the locational entropy index method, which is calculated by the number of people employed in the cultural industry, with the following formula:

$$CIA = \frac{L_{ij}/L_j}{L_i/L} = \frac{L_{ij}}{\sum_{j=1}^{n} L_{ij}} \Big/ \frac{\sum_{i=1}^{n} L_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{n} L_{ij}} \quad (2)$$

where $L_{ij}$ is the number of employees in cultural industries in region $j$, $L_j$ is the total number of employees in all industries in region $j$. $L_i$ is the number of employees in cultural industries in the study area, and $L$ is the total number of employees in all industries in the study area. the larger the value of $CIA$ is, the higher the degree of concentration of cultural industries in the region.

(3) Control variables. Based on previous studies, the level of industrial structure upgrading is also affected by other factors, which are included in the control variables in the article, and the specific indicators include.

The level of economic development (*PGDP*) The development of industries cannot be supported by the economy, and the improvement of economic development level will bring the development of regional industrial structure to advanced level. The article uses the GDP per capita of each city to measure the level of economic development.

The level of information technology (*INF*). The integration of information technology and traditional industries can promote the technological innovation of traditional industries, thus promoting the upgrading of industrial structure. I use the total postal and telecommunications business per capita to measure it.

Human capital stock (*HR*). An increase in the level of human capital will promote labor productivity, which will enhance the speed and direction of regional industrial structure upgrading. The article uses the number of students enrolled in general higher education schools per 10,000 people in each city to measure the stock of human capital in each region.

Transportation infrastructure (*POAD*). Better transportation infrastructure can lower the cost of transportation between firms. The article uses urban road area per capita to illustrate transportation infrastructure by region.

Government control (*GOV*). Industrial development is closely related to government domination, and government financial expenditure becomes an important driver of industrial structure upgrading. I use the proportion of local general budget fiscal expenditure to GDP to measure the degree of government control.

### 4.2 Data

After eliminating the sample of cities with too much missing data, the article finally selected the panel data of 278 prefecture-level cities in China from 2012 to 2020 for empirical analysis, and some variables were logarithmically processed, outlier identification process and missing value interpolation method to make up the difference. The results of descriptive statistics after data processing are shown in Table 2.

**Table 2**. Variable descriptive statistics

| Variable | Obs. | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| *lnIND* | 2502 | 3.04977 | 0.5536623 | 1.260242 | 4.13763 |
| *lnCIA* | 2502 | 1.587207 | 0.0864184 | 1.451139 | 1.893697 |
| *lnPGDP* | 2502 | 1.576422 | 0.5561387 | 0.3393253 | 2.855119 |
| *lnINF* | 2502 | 6.870472 | 0.7879451 | 4.915686 | 9.706441 |
| *lnHR* | 2502 | 4.748854 | 1.007812 | 2.64198 | 7.065176 |
| *lnROAD* | 2502 | 1.309777 | 0.8584274 | -0.6828068 | 3.620779 |
| *lnGOV* | 2502 | 3.023109 | 0.5465892 | 2.094021 | 4.961073 |

### 4.3 Modal

The article will use spatial econometric models to test the spatial spillover effect of cultural industry agglomeration on industrial structure upgrading. The spatial econometric models mainly include the spatial lag model (SAR), spatial error model (SEM) and spatial Durbin model (SDM), and the SAR model, SEM model and SDM model are constructed for the above variables respectively. The forms of model settings are as follows:

$$lnIND_{it} = \beta_0 + \beta_1 lnCIA_{it} + \beta_2 lnPGDP_{it} + \beta_3 lnINF_{it} + \beta_4 lnHR_{it} + \beta_5 lnROAD_{it} + \beta_6 lnGOV_{it} + \rho \sum_{j=1}^{N} W_{ij}\, lnIND_{jt} + \varepsilon_{it} \quad (3)$$

$$lnIND_{it} = \beta_0 + \beta_1 lnCIA_{it} + \beta_2 lnPGDP_{it} + \beta_3 lnINF_{it} + \beta_4 lnHR_{it} + \beta_5 lnROAD_{it} + \beta_6 lnGOV_{it} + \mu_{it}$$
$$\mu_{it} = \lambda \sum_{j=1}^{N} W_{ij}\mu_{jt} + \varepsilon_{it} \quad (4)$$

$$lnIND_{it} = \rho \sum_{j=1}^{N} W_{ij}\, lnIND_{jt} + \beta_1 lnCIA_{it} + \beta_2 lnPGDP_{it} + \beta_3 lnINF_{it} + \beta_4 lnHR_{it} + \beta_5 lnROAD_{it} + \beta_6 lnGOV_{it} + \beta_7 \sum_{j=1}^{N} W_{ij}\, lnCIA_{jt} + \beta_8 \sum_{j=1}^{N} W_{ij}\, lnPGDP_{it} + \beta_9 \sum_{j=1}^{N} W_{ij}\, lnINF_{it} + \beta_{10} \sum_{j=1}^{N} W_{ij}\, lnHR_{it} + \beta_{11} \sum_{j=1}^{N} W_{ij}\, lnROAD_{it} + \beta_{12} \sum_{j=1}^{N} W_{ij}\, lnGOV_{it} + \varepsilon_{it} \quad (5)$$

Where *t* denotes time, *i* denotes region, $W_{ij}$ is the spatial weight matrix constructed in terms of economic distance, $\rho$ denotes the spatial lag coefficient, which measures the effect of industrial structure upgrading in neighboring regions on industrial structure upgrading in the region, and $\beta_7$ is the spatial spillover coefficient, which measures the effect of cultural industry agglomeration in neighboring regions on local industrial structure upgrading. SDM model is a generalized form of SEM and SAR, which can simultaneously reflect the influence of local and neighboring explanatory variables on the explained variables in this region.

## 5. Results and discussion

### 5.1 Spatial autocorrelation test

Before using the spatial econometric model to analyze the spatial spillover effect of cultural industry agglomeration on urban industrial structure, the global Moran index is first used to test whether there is spatial autocorrelation between the index of industrial structure upgrading and the degree of cultural industry agglomeration in each city. Table 3 gives the results of the Moran index test for the two variables of industrial upgrading index and cultural industry agglomeration in Chinese cities from 2012 to 2020 under the economic distance weight matrix. The results show that the Moran indices of both variables pass the significance test at the 1% level and are positive, indicating that there is a certain spatial correlation between industrial structure upgrading and cultural industry agglomeration in each region during the study period.

**Table 3**. Moran Index Results

| Variable | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| *lnIND* | 0.310*** | 0.311*** | 0.356*** | 0.330*** | 0.151*** | 0.332*** | 0.347*** | 0.439*** | 0.406*** |
| | [11.953] | [12.020] | [13.714] | [12.728] | [5.918] | [13.005] | [13.631] | [16.884] | [15.692] |
| *lnCIA* | 0.015*** | 0.020*** | 0.032*** | 0.025*** | 0.026*** | 0.047*** | 0.058*** | 0.037*** | 0.045*** |
| | [2.895] | [3.628] | [5.515] | [4.488] | [4.668] | [7.849] | [9.575] | [6.427] | [7.665] |

Notes: Inside the brackets in the table are the Z-statistics, and *** means p-value <0.01, ** denotes p-value <0.05, * implies p-value <0.1.

The LM test and Hausman test were further applied to select the appropriate spatial econometric model. Table 4 shows the results of each test, in which the Hausman test results show that the selection

of the fixed effects model is more appropriate. the LM test results show that both the SAR model and the SEM model are applicable to the article study, and the Wald test and the LR test need to be performed to make further judgments. Table 4 shows that both the Wald test and LR test significantly reject the original hypothesis at the 1% level, i.e., the model cannot degenerate to SAR and SEM, and therefore, the article selects the spatial Durbin model for empirical testing. According to the estimation results of the effect test, it is better to consider both time and space two-way fixed effect models, so the article selects the two-way fixed effect spatial Durbin model for the final analysis.

**Table 4**. Test results

| Inspection index | Statistical | P-value |
|---|---|---|
| *LM Lag* | 720.618 | 0.000 |
| *LM Error* | 668.398 | 0.000 |
| *R-LM Lag* | 123.513 | 0.000 |
| *R-LM Error* | 71.293 | 0.000 |
| *Hausman test* | 41.29 | 0.0001 |
| *Wald test* (*SAR*) | 16.97 | 0.0094 |
| *Wald test* (*SEM*) | 44.35 | 0.0000 |
| *LR test* (*SAR*) | 18.53 | 0.0050 |
| *LR test* (*SEM*) | 46.25 | 0.0000 |

## 5.2 Estimated results

For comparative analysis, the article also reports the regression results for the general panel model, as shown in Table 5.

**Table 5**. Estimated results

| Variable | FE | SDM-FE |
|---|---|---|
| *lnCIA* | 0.405*** | 0.282** |
| | (2.62) | (2.30) |
| *lnPGDP* | 0.327*** | 0.282*** |
| | (9.75) | (7.65) |
| *lnINF* | 0.0384** | 0.0197 |
| | (2.46) | (1.54) |
| *lnHR* | 0.130*** | 0.0593** |
| | (4.34) | (2.38) |
| *lnROAD* | 0.180*** | 0.0843*** |
| | (5.96) | (3.07) |
| *lnGOV* | -0.235*** | -0.0250 |
| | (-12.28) | (-0.93) |
| *_cons* | 1.488*** | |
| | (4.72) | |
| *W*lnCIA* | | 0.665** |
| | | (2.10) |
| *W*lnPGDP* | | 0.00835 |
| | | (0.17) |
| *W*lnINF* | | 0.0418 |
| | | (1.21) |
| *W*lnHR* | | 0.106* |
| | | (1.80) |
| *W*lnROAD* | | 0.0230 |
| | | (0.38) |
| *W*lnGOV* | | -0.132** |
| | | (-2.28) |
| *Spatial rho* | | 0.413*** |
| | | (12.54) |
| *sigma2 e* | | 0.0574*** |
| | | (34.95) |
| *N* | 2502 | 2502 |

Notes: inside the brackets in the table are the t-statistics, and *** means p-value <0.01, ** denotes p-value <0.05, * implies p-value <0.1.

From the results of the non-spatial ordinary panel fixed effects model (FE) econometric regression, there is a significant promotion effect of cultural industry agglomeration on industrial structure upgrading. The regression coefficients of economic development level, level of Informatization, human capital stock, transportation infrastructure level, and government fiscal expenditure are significantly positive, indicating that these control variables can promote the upgrading of industrial outcomes in the region. Next, the regression results of the two-way fixed SDM model are analyzed.

(1) It can be seen that the spatial autoregressive coefficient rho is 0.413, which passes the 1% significance level test, indicating that there is a positive spatial spillover effect of industrial structure upgrading in one region on the industrial structure upgrading in the surrounding areas.

(2) The ordinary regression coefficient of cultural industry agglomeration is 0.282 and the spatial regression coefficient is 0.665, both of which pass the 5% significance test, which indicates that when the degree of industrial agglomeration in the region increases by 1%, the index of industrial structure upgrading in the region will increase by 0.282%, and the promotion effect on the index of industrial structure upgrading in the neighboring cities can reach 0.665%. Therefore, there is not only a local promotion effect of cultural industry agglomeration on industrial structure upgrading, but also a significant positive spatial spillover effect, i.e., local cultural industry agglomeration can promote the industrial structure upgrading in the surrounding areas.

(3) In terms of control variables: both the non-spatial ordinary regression and spatial regression coefficients of human capital stock pass the significance test, and both are positive, indicating that human capital stock can significantly promote industrial structure upgrading in the local area as well as influence the level of industrial structure upgrading in the neighboring areas. This indicates that at this stage, high-level creative talents are still the core element of cultural industry development, and the flow of talents in the cultural industry agglomeration area brings the excellent creativity and content generated as well as new technologies to the surrounding areas, promoting the upgrading of the industrial structure in the surrounding areas. The spatial regression coefficient of government control is significantly negative, indicating that there is a "policy failure" of government in industrial structure upgrading and adjustment, which may have two reasons: First, the development of cultural industry has its own special regularity, and excessive government intervention will lead to the market vitality and innovation being affected, disrupting the rational allocation and free flow of cultural production factors, and affecting the industrial structure upgrading. Secondly, the inefficiency and incomplete information of the relevant government departments lead to the inability of the industrial policy to be adjusted in real time according to the changes in social and economic development, resulting in the lag of the industrial policy and hindering the upgrading of the industrial structure. The ordinary regression coefficients of economic development level and transportation infrastructure level are significantly positive, but the spatial regression coefficients are not significant, which indicates that although the level of economic development and transportation infrastructure promote the upgrading of industrial structure in the region, they do not show spatial spillover effect, and the spillover effect of cultural industry agglomeration still mainly relies on the knowledge spillover of talent flow, rather than the improvement of transportation facilities. The level of informatization promotes the upgrading of industrial structure, but the effect is not significant.

### 5.3 Analysis of decomposition effects

By decomposing the total effect of each variable on industrial structure upgrading, the degree of influence of the spatial spillover effect of cultural industry agglomeration on industrial structure upgrading in the surrounding areas is further tested. The decomposition results of spatial spillover effects are given in Table 6.

**Table 6**. Effect decomposition results

| Variable | LR_Direct | LR_Indirect | LR_Total |
|---|---|---|---|
| *lnCIA* | 0.323** | 1.298** | 1.620*** |
| | (2.50) | (2.35) | (2.71) |
| *lnPGDP* | 0.287*** | 0.205*** | 0.491*** |
| | (8.11) | (2.88) | (6.41) |
| *lnINF* | 0.0234* | 0.0888 | 0.112* |
| | (1.88) | (1.56) | (1.83) |
| *lnHR* | 0.0651*** | 0.219** | 0.284*** |
| | (2.66) | (2.31) | (2.81) |
| *lnROAD* | 0.0872*** | 0.0919 | 0.179* |
| | (3.27) | (0.98) | (1.78) |
| *lnGOV* | -0.0300 | -0.229** | -0.259*** |
| | (-1.14) | (-2.43) | (-2.62) |

Notes: inside the brackets in the table are the t-statistics, and *** means p-value <0.01, ** denotes p-value <0.05, * implies p-value <0.1.

The test results in Table 6 show that the direct effect coefficient of cultural industry agglomeration on industrial structure upgrading is 0.323 and the indirect effect is 1.298, both significant at the 5% level. This indicates that cultural industry agglomeration can not only drive the industrial structure upgrading of the region through the economy of scale effect, competition effect, cultural resource allocation effect and innovation effect, but also generate spatial spillover effect to promote the industrial structure upgrading of the surrounding areas, and the spatial spillover effect is greater than the local promotion effect.

The decomposition results of the effects of control variables are basically consistent with the previous analysis. The effects of human capital stock on industrial structure upgrading have both local effects and spatial spillover effects, all of which pass the significance test, and the spatial spillover effects of human capital stock are significantly larger than the direct effects in terms of coefficients. This indicates that inter-regional economic activities strengthen the spatial flow of human capital, and human capital brings new technologies, new ideas and new contents to the neighboring regions, which promotes technological innovation and industrial structure upgrading in the neighboring regions. The regression coefficient of the indirect effect of economic development level is 0.205 and the direct effect is 0.287, both of which pass the 1% significance level test. It can be seen that the level of economic development has a positive spatial spillover effect on industrial structure upgrading, but the effect is smaller than the direct effect. The direct effect of government fiscal expenditure is not significant, and the spatial spillover effect is significantly negative, which plays an obstructive role in upgrading the industrial structure in the surrounding areas. The direct effect of information technology level and transportation infrastructure is significantly positive, and the spatial spillover effect is also positive but insignificant. The reason for this is mainly because, although China's information technology and transportation infrastructure construction have been in continuous development, their impact effects have not yet been significantly reflected.

### 5.4 Tests grouped by region

From the previous theoretical analysis and empirical tests, it is clear that cultural industry agglomeration plays a positive spatial spillover role in promoting industrial structure upgrading, however, cultural industry agglomeration in China presents balanced distribution characteristics [30]. Considering the development differences between regions, in order to further explore the spatial spillover effect of cultural industry agglomeration on industrial structure upgrading in different regions, 278 prefecture-level cities were divided into three sample groups of East, Central and West, and the two-way fixed spatial Durbin model was still used, and the results are shown in Table 7.

**Table 7**. Estimated results for the East, Central and West subgroups

| Effect | Variable | LR_Direct | LR_Indirect | LR_Total |
|---|---|---|---|---|
| LR_Direct | *lnCIA* | 0.265** | 0.322** | 0.249* |
| | | (2.55) | (2.10) | (1.73) |
| | *lnPGDP* | 0.130*** | 0.227*** | 0.105** |
| | | (5.70) | (5.53) | (2.44) |
| | *lnINF* | 0.0234* | 0.0255** | 0.0147 |
| | | (1.88) | (2.04) | (1.83) |
| | *lnHR* | 0.0257*** | 0.0913** | 0.0704* |
| | | (2.72) | (2.10) | (1.79) |
| | *lnROAD* | 0.0521*** | 0.0352 | -0.0452 |
| | | (3.48) | (1.05) | (-1.58) |
| | *lnGOV* | -0.0299** | -0.486*** | -0.476*** |
| | | (-1.99) | (-17.30) | (-14.32) |
| LR_Indirect | *lnCIA* | 3.194* | 1.266** | -0.796 |
| | | (1.74) | (2.48) | (-1.11) |
| | *lnPGDP* | 0.349* | -0.0952 | 0.118 |
| | | (1.74) | (-0.84) | (0.63) |
| | *lnINF* | 0.256 | 0.0460 | -0.252** |
| | | (1.51) | (1.01) | (-2.29) |
| | *lnHR* | 15.24*** | 0.347* | 0.468* |
| | | (3.02) | (1.74) | (1.85) |
| | *lnROAD* | 0.0921 | 0.901*** | -0.167 |
| | | (0.43) | (6.52) | (-0.87) |
| | *lnGOV* | -0.370* | -0.181** | 0.259 |
| | | (-1.72) | (-2.06) | (1.25) |
| | *Spatial rho* | 0.597*** | 0.236*** | -0.203 |
| | | (6.71) | (3.85) | (-1.09) |
| | *sigma2 e* | 0.00634*** | 0.0248*** | 0.0212*** |
| | | (21.10) | (21.66) | (17.86) |
| | *N* | 900 | 963 | 639 |

Notes: inside the brackets in the table are the t-statistics, and *** means p-value <0.01, ** denotes p-value <0.05, * implies p-value <0.1.

The results show that the spatial spillover effect of cultural industry agglomeration on industrial structure upgrading is significantly positive in the east and central regions and negative in the west, but it does not pass the significance test, and the spatial spillover coefficient of cultural industry agglomeration on industrial structure upgrading in the east (3.194) is greater than that in the east (1.266), which indicates that cultural industry agglomeration is more prominent than that in the west in enhancing the efficiency of cultural The spatial spillover coefficient of cultural industry agglomeration is greater than that of the eastern region (1.266). Due to the special characteristics of cultural industries, cultural and creative talents generally tend to be located in large cities, and the eastern regions are more likely to attract production factors of cultural industries such as technology, capital and creative talents due to the advantages of economic development level and institutional environment, and in order to obtain production resources more conveniently, cultural enterprises are also concentrated in the eastern regions, and the specialized division of labor and spatial spillover effects within cultural agglomerations are more effective and have a greater impact on industrial structure upgrading. The influence on industrial structure upgrading is greater. The development of cultural industries in the central region is slightly weaker than that in the eastern region, which also leads to a weaker spatial spillover effect of cultural industry clustering on industrial structure upgrading than that in the eastern region. The western region is relatively lagging behind in the development of cultural industries compared with the central and eastern regions. For the western region, its cultural industries are still in the initial and cultivation stage, and the total amount is small,

making it difficult to form economies of scale; in terms of human resources, there is a lack of innovative and creative talents, and it is difficult for cultural industry agglomeration to exert spillover effects through the flow of human resources. From the estimation results of the control variables, the human capital stock has a significant promoting effect and spatial spillover effect on the industrial structure in the east, central and west regions, and the spatial spillover effect of government financial expenditure is not conducive to the upgrading of the industrial structure in the east and central regions, while it has a promoting effect on the west region's, but the effect is not significant, probably because the development of cultural industry in the west region is still in the initial stage, and the government The government's attention and active cultivation are conducive to the further development of the industry.

## 6. Conclusion and Recommendation

The article takes cultural industry agglomeration as the core explanatory variable and investigates whether it has a spatial spillover effect on industrial structure upgrading. Based on the theoretical analysis, the spatial spillover effect of cultural industry agglomeration on industrial structure upgrading is tested empirically with the help of a spatial Durbin panel model using the statistical data of 278 prefecture-level cities in China from 2012 to 2020, with economic distance as the spatial weight matrix. The results show that: there is significant spatial autocorrelation between industrial structure upgrading and cultural industry agglomeration; cultural industry agglomeration has a significant promoting effect and positive spatial spillover effect on industrial structure upgrading; by regional grouping, the spatial spillover effect of cultural industry agglomeration on industrial structure upgrading is significantly manifested in the east and central regions, but does not pass the significance level test in the west; increasing the stock of human capital and appropriate The spatial spillover effect of cultural industry agglomeration on industrial structure upgrading is significant in the east and central regions, but not in the west.

Based on the above findings, the following policy recommendations are proposed: (1) Actively guide the development of cultural industry clusters. Local governments should fully exploit the spatial stock in the region, integrate the advantages of infrastructure, strengthen the introduction and cultivation of leading enterprises, actively guide the agglomeration of cultural enterprises, and enhance the level of agglomeration of cultural industries, thus promoting the effect of economies of scale in cultural industries, reducing the production and transaction costs of cultural products, improving industrial efficiency, and promoting the upgrading of industrial structures. (2) Cultivate cultural innovation and creative talents. The development of cultural industry is highly dependent on creative talents, and the flow of talents between different regions is conducive to the spatial spillover effect of cultural industry agglomeration, thus promoting the upgrading of cultural industry structure in the surrounding areas. At the present stage, Chinese cultural and creative talents are scarce and their ability levels vary, so the government needs to play a guiding role, formulate scientific planning for training cultural industry talents, and increase policy and financial support for training innovative and creative talents; schools are needed to create a good atmosphere to encourage innovation and stimulate creativity, and strengthen cooperation between schools and enterprises, promote the integration of industry, academia and research, and cultivate innovative talents. (3) Optimize the layout of regional cultural industries. Regions should fully consider complementarity in the development of cultural industries, base on the comparative advantages of cultural resources in each region, strengthen inter-regional cooperation and exchange, promote the free flow of production factors of cultural products in space, and realize complementary advantages. Each region establishes a reasonable division of labor system, gives full play to the spatial demonstration effect of the agglomeration of cultural industries in the region, and maximizes the spatial spillover effect of the agglomeration of cultural industries to the surrounding areas.

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## References

[1] Kong Haojia, Xu Yun, Zhang Ruizhe,Tang Decai, Boamah Valentina, Wu Guangliang, Zhou Biao. Research on the upgrading of China's regional industrial structure based on the perspective of green finance [J]. Frontiers in Environmental Science, 2023.

[2] Ren Xiaohang, Zeng Gudian, Gozgor Giray. How does digital finance affect industrial structure upgrading? Evidence from Chinese prefecture-level cities [J]. Journal of Environmental Management, 2023, 330.

[3] Tang Decai, Zhao Ziqian, Shen Wenwen, Zhang Jianqun, Kong Yuehong, Boamah Valentina. Research on the Impact of Digital Finance on the Industrial Structure Upgrading of the Yangtze River Economic Belt from the Perspective of R& D Innovation [J]. Sustainability, 2022, 15(1).

[4] Hu, Haiyang, Yao, Chen. Digital economy, technological innovation and advanced industrial structure--an empirical analysis based on provincial panel data [J]. Technology Economics and Management Research, 2023, (02): 7-11.

[5] Wang, Xiaowen, Chen, Mingyue, Chen, Nanxu. Digital economy, green technology innovation and industrial structure upgrading [J]. Economic Issues, 2023, (01): 19-28.

[6] Liu Hedong, Ji Ran. Research on the mechanism and effect of digital economy to promote industrial structure upgrading[J]. Science and Technology Progress and Countermeasures,2023,40(01):61-70.

[7] Xiang Xin, Tong Fei, Huang Huan. Analysis of the impact of industrial agglomeration on industrial structure upgrading in key urban clusters [J]. Regional Economic Review, 2021, (05): 84-90.

[8] Zhang Zhidong, Huang Qianli. The impact of industrial agglomeration on industrial structure upgrading--an empirical analysis based on spatial measurement and panel threshold model [J]. Contemporary Economic Management, 2021, 43(02): 57-64.

[9] Wang Fangqin. An empirical study on the coordinated development of human capital, resource agglomeration and industrial structure [J]. Resources and Industry, 2022, 24(04): 113-123.

[10] Wang Xinyang, Cheng Yu, Wang Jingjing, Yuan Wenxuan. Research on the impact of human capital on industrial structure transformation in China [J]. Journal of Natural Sciences, Hunan Normal University, 2022, 45(05): 41-50+73.

[11] Zhang Chi, Wang Mancang. The impact of science and technology finance on the upgrading of urban industrial structure: a quasi-natural experiment based on the policy of "promoting the integration of science, technology and finance" [J]. Exploration of Economic Issues, 2023, (01): 73-86.

[12] Xiong Lichun, Zhao Liyuan, Wang Fengting. Progress of research on the influence of industrial policy on the optimization of forestry industry structure [J]. World Forestry Research, 2022, 35(04): 76-81.

[13] Hou Fangmiao, Li Xiaoyi, Wu Chengliang, Yin Yufei, Xiao Hui. The Impact of Foreign Direct Investment on the Forestry Industry Structure Upgrading: The Moderating Effect on Labor Migration [J]. International Journal of Environmental Research and Public Health, 2023, 20(3).

[14] Wei, Heqing, Li, Ying. Analysis of spatial characteristics and influencing factors of provincial cultural industry agglomeration in China [J]. Statistics and Decision Making, 2021, 37(16): 66-70.

[15] He YJ. Fu LP. Simulation Model of Cultural Industry Agglomeration Based on S-D Dynamics Theory. [J] Key Engineering Materials, 2014, 584(10): 312-317.

[16] Chai G. The correlation of urban cluster and cultural industry cluster[C]//Proceedings of the 21st International Conference on Industrial Engineering and Engineering Management 2014. Atlantis Press, Paris, 2015: 487-490.

[17] Ye Qianlin, Liu Haiyu, Zhu Wenxing. Measurement of regional cultural and creative industry agglomeration level and analysis of influencing factors [J]. Statistics and Decision Making, 2022, 38(04): 84-87.

[18] Zarlenga M I, Ulldemolins J R, Morató A R. Cultural clusters and social interaction dynamics: The case of Barcelona [J]. European Urban and Regional Studies, 2016, 23(3): 422-440.

[19] H. Mommaas, Cultural Clusters and the Post-in - dustrial City: Towards the Remapping of Urban Cultural Policy, Urban Studies, 2012, 41(3), pp.507-532.

[20] Yang Xuyun, Li Min, Li Yangzi. Dynamics, characteristics and evolution of spatial agglomeration of cultural industries in China [J]. Contemporary Economic Science, 2021, 43(01): 118-134.

[21] Feng Xinyu, Dai Junzang, Sun Dongqi. Analysis of provincial spatial agglomeration and its spillover effect of cultural industry in China [J]. Economic Geography, 2021, 41(10): 233-240.

[22] Ma Yanyan, Xue Dongqian, Song Yongyong, Gong Ying, Pang Xianfeng. Spatial clustering and spillover effects of major industries in China's cultural industry [J]. Journal of Shaanxi Normal University (Natural Science Edition): 1-14.

[23] Cao Ruzhong, Zhang Yang, Hu Yanling, Guo Hua. Study on the spatial agglomeration and impact effect of cultural and creative industries in the Yangtze River Delta city cluster [J]. Silk, 2022, 59(08): 79-89.

[24] Zhang Na, Zhao Xuechun, Lin Bing. The impact of cultural industry agglomeration on regional economic growth--analysis of spatial spillover effects based on provincial-level data in China [J]. Cultural Soft Power, 2021, 6(01): 79-88.

[25] Zhou JX, Tan FQ. Study on the effect of cultural industry agglomeration on regional innovation efficiency based on spatial measurement [J]. Cultural Industry Research, 2020, (01): 102-116.

[26] Feng X. The spatial spillover effect of cultural industry agglomeration on the development efficiency of cultural industry [J]. Journal of Xi'an University of Finance and Economics, 2021, 34(04): 118-128.

[27] Tan Na and Huang Wei, "Have cultural industry agglomeration policies driven regional tourism economic growth? --Evidence from a quasi-natural experiment on the selection of cultural and creative parks," Soft Science China, 2021, no. 1.

[28] Zhang Su-yuan,Gu Jiang. How cultural industry agglomeration empowers regional industrial structure upgrading--an analysis of the mediating effect based on city branding [J]. Jiangsu Social Science, 2022, (05): 172-181+243-244.