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Policies of Model Cities for Intellectual Property Protection and the Digitization Level of Cultural Industries: An Empirical Analysis Based on the DID Model

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Abstracts:

Within the realm of the digital economy, the cultural sector aligns with the times' trajectory, experiencing a novel digital evolution, propelled by a mix of technological progress, shifts in market needs, and policy backing. This document aims to examine the effects and influence of the National Model City's Intellectual Property Protection policy on the digital transformation of the cultural sector, and empirically investigates its role in boosting the digital transformation of this industry, particularly regarding the distinct efficacy and performance of intellectual property rights. Findings from the research indicate that enhancing the safeguarding of intellectual property rights plays a role in boosting the market competitiveness of the cultural sector and its associated products, alongside fostering consistent and robust progression in the industry's growth. The research offers fresh theoretical insights and actionable advice for the digital evolution and metamorphosis of the cultural sector, aiding in deepening comprehension and advocating for the superior and advanced growth of the cultural sector within the digital economic sphere.

Keywords: intellectual property protection, cultural industry digitalization, model city policy, DID model, empirical analysis

1. Introduction

In the early years of the 21st century, the emergence of digital technology transformed both production and consumption patterns, positioning the digital economy as the third predominant economic system following agricultural and industrial economies. China is swiftly transitioning into the digital economic age, with its robust developmental progress increasingly evident. According to the "China Digital Economy Development Research Report" by the China Academy of Information and Communications Technology, China's digital economy is projected to grow to 50.2 trillion yuan in 2022, representing 41.5% of its GDP [1].The 2019 Digital Economy Report by UNCTAD highlighted that the digital era and the swift expansion of the digital economy have led to substantial global economic prospects and prosperity. Nonetheless, a distinct aggregation of this wealth is evident, predominantly in the United States and China. Indeed, these nations represent 90 per cent of the globe's leading 70 digital platforms in terms of market value. [2].

The emergence of the digital economy signifies a novel worldwide path, playing a pivotal role in propelling global economic advancement. Public interest has increasingly centered on the digital evolution of the cultural sector, accompanied by a surge in digital transformation within this industry .Regarding policymaking, the "14th Five-Year Plan" of 2021 included the "implementation of the digitalization strategy of cultural industry," succeeded by the 2022 central government's "Opinions on Promoting the Implementation of the Digitalization Strategy of National Culture," indicating a new phase of growth in China's cultural sector amidst the digital economy. This suggests the emergence of a developmental "golden age" in China's cultural sector, set against the digital economic context.[3]. Given its attributes of minimal resource utilization, minimal pollution, and significant value addition, the cultural industry is seen as emblematic of burgeoning and eco-friendly sectors, catalyzing regional and national economic expansion. [4].

As an important part of the economic system, the digital transformation of the cultural industry has not only changed the way of production and consumption of cultural products. Furthermore, it has spurred the emergence of novel business models while revitalizing conventional ones. The digital culture industry promotes the develop-

ment of the industry by linking its three major features of digitization, industrialization and culturalization. [5]. However, the cultural industry also faces multiple challenges in the process of digital transformation, such as the protection of intellectual property rights, digital divide, imperfections in market regulation and industry standards, etc., which greatly restrict the healthy development of the cultural industry [6]. In addition, the content copyright issue, as a common problem in the cultural industry, is characterized by various types of industries depending on the stage of development and the legal environment. Nevertheless, various fields of the cultural industry are still actively laying out high-quality original cultural content [7].

This study will focus on how the policy of model cities for intellectual property protection affects the level of digitization in the cultural industry. Since the State Intellectual Property Office (SIPO) first established 23 cities, including Wuhan, as intellectual property demonstration cities in 2012, 54 more cities have been recognized as such between 2013 and 2019 [8]. In this paper, we will assess the actual effects of these policies in promoting the digital transformation of the cultural industry through empirical research methods, especially by using the DID model, aiming to provide theoretical and empirical support for policy formulation in the cultural industry.

This study explores the following questions:

Point 1: Has the model city policy for intellectual property protection been effective in enhancing the digitization of cultural industries?

Point 2: How effective is the practical application of these policies in the cultural industries?

Point 3: How to optimize intellectual property protection policies for the digital reform and development of cultural industries?

This study will provide theoretical basis and empirical support for policymaking in the cultural industry, especially in formulating more effective IPR protection measures and policies to promote the digital transformation of the cultural industry. The results of the study are expected to provide predictions for supporting cultural industries to achieve long-term sustainable growth, as well as suggestions for possible problems, which will be of reference value to both policy makers and other stakeholders in the cultural industry.

2. Study design and test results

Table 1 Description and definition of variables

Variable type	Variable identification	variable name	Variable Definition
implicit variable	*culture*	Digitization of Cultural Industries	Calculated by the entropy method
independent variable	*did*	Intellectual property protection policy	This variable takes the value of 1 in the year a region is approved as a pilot region for the "IPR Demonstration" program and beyond, and 0 if it is not selected.
control variable	*peo*	Size of population	Logarithms using the number of permanent residents in the area
	indy	industrial structure	Measured using the ratio of tertiary value added to secondary value added
	urban	urbanization rate	Urban population/year-end resident population
	gov	Level of government intervention	Ratio of general government expenditure to gross regional product
	trade	trade level	Measured using the ratio of regional import and export trade to regional GDP

2.1 . Model setup

Basic regression model

The specific regression model setup for this paper is as follows:

$$culture_{it} = \alpha + \beta did_{it} + control_{it} + \varepsilon_{it} \quad (1)$$

where. $culture_{it}$ is the digitization level of cultural industry in province i in year t; the core explanatory variable is a policy dummy variable. did_{it} is a policy dummy variable, which takes the value of 1 in the year of the pilot region of "Intellectual Property Demonstration" and thereafter, and 0 if it is not selected; $control_{it}$ is the relevant

control variable; ε_{it} is the error term.

2.2 . Empirical analysis

2.2.1 . Analysis and statistical description

Table 1 displays the detailed statistical data for the model's key variables. The cultural industry's average digitization rate stands at 0.168, signifying an average of 16.8% within the assessed range. This percentage is relatively low, implying that in most regions, the digital transformation of the cultural industry is still in the primary stage. The standard deviation is 0.107, showing that this variable fluctuates somewhat among different regions, but the fluctuation is not large. The extreme difference between the lowest value of 0.0183 and the highest value of 0.728 reflects the variability at the extremes, where some regions are significantly more digitized in the cultural industry than others. The median value of 0.145 is slightly lower than the mean, indicating that the digitization of cultural industries is at a low level in most regions. Intellectual property protection policy (did) reflects whether the region has implemented intellectual property protection policy, and the mean value is 0.516, implying that nearly half of the regions have been designated as model regions for intellectual property protection. The standard deviation is 0.500, pointing out that the districts in the sample are almost evenly distributed in terms of the implementation status of this policy. The minimum value of 0 and the maximum value of 1 are consistent with the characteristics of a binary variable, and this distribution is useful for further research on the relationship between the implementation of the policy and the digitization of the cultural industry. The population size variable is presented in the form of the natural logarithm of the resident population, with a mean value of 8.129, indicating that the population size of the surveyed regions is generally large. The standard deviation is 0.843, indicating that population size varies significantly between regions. The minimum value of 5.736 and the maximum value of 9.443 show extreme variations in population size, which is crucial for assessing the impact of urbanization, industrial development, and government policies. The median is 8.255, which is slightly higher than the mean value, indicating that population size is concentrated at a higher level in most regions. The mean urbanization rate is 0.579, indicating that on average nearly 58 percent of the population in the surveyed regions live in urban areas. The standard deviation is 0.132, indicating that despite the generally high level of urbanization, there are still considerable variations between districts. The wide range between the minimum value of 0.228 and the maximum value of 0.938 suggests that urbanization is very high in some districts and relatively low in others. The median value of 0.568 is close to the average, further indicating that urbanization has reached a relatively balanced state in most regions. The industrial structure variable is measured by the ratio of value added of the tertiary industry to that of the secondary industry, with a mean of 1.335, implying that the service sector is more developed relative to the manufacturing sector in most regions. The standard deviation is 0.720, indicating that there are significant differences in the industrial structure of different regions, which may be related to the level of economic development of the region, the distribution of resources and policy tendencies. The minimum value of 0.527 and the maximum value of 5.244 show the proportion of service industries from low to very high, and the median of 1.176 is slightly lower than the mean, reflecting the balance between service industries and manufacturing industries in most regions. The degree of government intervention (gov) has a mean value of 0.297, indicating that general government expenditures as a percentage of regional GDP is close to 30 percent. This ratio varies from 0.120 to 1.354 with a standard deviation of 0.210, indicating that the degree of government involvement in the economy varies widely across regions. The median of 0.238 is lower than the mean, pointing to a relatively low level of government economic involvement in most regions. The mean value of the level of trade is 0.269 indicating that total regional imports and exports as a percentage of regional GDP is 26.9%. The standard deviation of 0.287 shows that trade activity varies very much from region to region, with a minimum value of 0.00763 and a maximum value of 1.464. The median value of 0.143 is much lower than the mean, which may imply that while some regions are extremely open, the level of foreign trade is low in most regions.

Table 2 Descriptive statistics

Variable	N	Mean	SD	Min	p50	Max.
culture	310	0.168	0.107	0.0183	0.145	0.728
did	310	0.516	0.500	0	1	1
peo	310	8.129	0.843	5.736	8.255	9.443
urban	310	0.579	0.132	0.228	0.568	0.938

indy	310	1.335	0.720	0.527	1.176	5.244
gov	310	0.297	0.210	0.120	0.238	1.354
trade	310	0.269	0.287	0.00763	0.143	1.464

2.2.2 . Correlation analysis

The results of the correlation analysis of the main variables of the model are shown in Table 2. The correlation coefficient between the implementation of intellectual property protection policies and the degree of digitization of the cultural industry is 0.505, which shows a significant positive correlation ($p < 0.001$). This suggests that those regions that have implemented IPR protection policies usually have higher levels of cultural industry digitization. This relationship may be due to the fact that enhanced IPR protection attracts more investment in the cultural industry, encouraging technological innovation and digital content production. In addition, a better IPR environment improves the confidence of companies and creators in the marketplace, prompting them to participate more actively in the digital transformation. The correlation coefficient between population size and digitization of cultural industries is 0.372, showing a significant positive correlation ($p < 0.001$). This may reflect the fact that regions with larger population sizes usually have stronger market dynamics and richer human resources, which are important factors driving the development of the culture industry in general and digitization in particular. A large population base may imply higher consumption potential and more diverse cultural needs, thus promoting digital innovation in cultural products and services. The correlation coefficient between the urbanization rate and the digitization of cultural industries is 0.445, again showing a significant positive correlation ($p < 0.001$). Urbanization is usually accompanied by improved infrastructure and the spread of information technology, which provides the necessary physical and technical support for the digitization of cultural industries. Residents in cities tend to have higher education levels and technical proficiency, and are more inclined to consume digitized cultural products, thus promoting the digitization of cultural industries. The correlation coefficient of industrial structure is 0.335, indicating that regions with a high ratio of service to manufacturing industries also have relatively higher digitization of cultural industries, and this positive correlation is also significant ($p < 0.001$). The service industry, especially the information service and media industry, tends to be the forerunner in the digitization of cultural industries. When the services sector dominates, the associated technology and capital flows may be more inclined to support the digitization of cultural products, such as online media, digital arts and entertainment. The degree of government intervention shows a negative correlation of -0.297 with the digitization of the cultural industry ($p < 0.001$), which implies that the higher the proportion of government expenditure to GDP, the lower the digitization level of the cultural industry. This phenomenon may be due to the fact that a high proportion of government expenditure may be concentrated in non-commercial areas such as traditional infrastructure or social welfare, rather than directly investing in activities that promote technological innovation and the development of cultural industries. In addition, a high level of government intervention may also inhibit private investment [1 and limit free competition in the market, thus indirectly affecting the digitization process of cultural industries. The correlation coefficient between the level of trade and the digitization of cultural industries is 0.315, showing a positive correlation ($p < 0.001$). This suggests that more open economies and higher levels of trade activities may have facilitated international exchanges and technology introduction in the cultural industry, accelerating its digitization. Open trade policies may help to introduce advanced digital technologies and management experience, while also providing a broader international market for local cultural products.

Table 3 Correlation coefficient analysis

	culture	did	peo	urban	indy	gov	trade
culture	1						
did	0.505***	1					
peo	0.372***	0.506***	1				
urban	0.445***	0.260***	0.0790	1			
indy	0.335***	0.0150	-0.313***	0.454***	1		
gov	-0.297***	-0.395***	-0.766***	-0.476***	0.104*	1	

trade	0.315***	0.097*	0.094*	0.736***	0.441***	-0.308***	1

2.2.3 . Benchmark regression analysis

Based on the formula (1) and employing least squares estimation, Table 3 displays the regression outcomes regarding how the demonstration policy of intellectual property protection affects the digital transformation of the cultural sector. Columns (1) in Table 3 display the regression outcomes without incorporating control variables, while columns (2)-(6) display the regression findings post the incremental inclusion of control variables. Post-addition, the influence of the intellectual property protection demonstration policy on the digital transformation of the cultural sector is notably enhanced at a 1% significant level. Findings presented in columns (2)-(6) to uniformly show that the proposed IPR protection policy positively influences the digital transformation of cultural sectors. One plausible explanation for this phenomenon could be that improved intellectual property safeguards enhance the trust of content creators and cultural entities, thereby increasing their readiness to invest in novel technologies and creative endeavors. In an IPR-protected environment, creators and investors can expect that their original works and technological innovations will not be easily infringed upon or copied, thus guaranteeing them a return on their earnings, which directly stimulates the creation of cultural content and the adoption of technology. In addition, model IPR protection policies are usually accompanied by a range of legal, economic and technical support measures, such as facilitated copyright registration, more efficient infringement litigation and IPR legal assistance, which have greatly contributed to the rapid development of the cultural industry, especially in the digital sector. For example, digital music and online video platforms are able to better manage copyright issues in such an environment, attracting more creativity and investment into the market. At the same time, the protection of intellectual property rights also helps to establish a healthy competitive environment in the market. In such an environment, innovators and creative workers are not only protected by the law, but also receive appropriate market rewards through legal channels, further incentivizing them to continue to create and innovate. Such positive incentives are particularly important for promoting the digital transformation of cultural products and services. Intellectual property protection can also help attract foreign direct investment, especially in areas such as film production, music production and digital media. Foreign companies and international creators are more willing to invest and cooperate in markets where IPRs are well protected, thus bringing in advanced technology and management experience to accelerate the digitization of local cultural industries.

Table 4 Benchmark regression results

	(1)	(2)	(3)	(4)	(5)	(6)
	culture	culture	culture	culture	culture	culture
did	0.108***	0.091***	0.069***	0.062***	0.049***	0.041***
	(0.010)	(0.012)	(0.011)	(0.011)	(0.010)	(0.011)
peo		0.020***	0.023***	0.040***	0.090***	0.100***
		(0.007)	(0.007)	(0.007)	(0.010)	(0.011)
urban			0.279***	0.151***	0.352***	0.473***
			(0.037)	(0.040)	(0.050)	(0.065)
indy				0.051***	0.045***	0.049***
				(0.008)	(0.007)	(0.007)
gov					0.262***	0.291***
					(0.042)	(0.043)
trade						-0.067***
						(0.023)
_cons	0.112***	-0.040	-0.216***	-0.348***	-0.930***	-1.073***
	(0.008)	(0.055)	(0.056)	(0.056)	(0.108)	(0.118)
N	310.000	310.000	310.000	310.000	310.000	310.000

r2	0.255	0.273	0.385	0.464	0.524	0.537

2.2.4 . Robustness Tests

The robustness test is further used in this paper to test the reliability of the underlying regression results. (1) Considering that the model policy for intellectual property protection may have a certain time lag on the digitization of the cultural industry, i.e., the policy pilot may have an impact on the digitization of the cultural industry only after a period of time, this paper introduces the consideration of the time dimension in the analysis. By lagging the explanatory variables, i.e., the policy pilot, by one period for regression analysis, it is found that there is still a positive correlation between the demonstration policy of intellectual property protection on the digitization of cultural industry, which is consistent with the previous empirical results. (2) This research utilizes a robustness test approach, substituting the sample time interval, to guarantee the solidity of its results and to mitigate the effects of external anomalies, notably the possible effects of the COVID-19 outbreak on the digital transformation of the cultural sector. The research specifically e stablishes the sample's timeframe as 2011 to 2019, a timeframe preceding the COVID-19 epidemic outbreak, to eliminate the epidemic's unpredictability and irregular impacts. Thus, the research seeks to gain a more precise and dependable insight into the actual scenario concerning how model IPR protection policies affect the digital transformation of the cultural sector. In Table 4, the regression coefficient in column (2) stands at 0.042, showing no notable deviation from the fundamental regression.

Table 5 Robustness test

	(1)	(2)
	culture	culture
L. did	0.049***	
	(0.011)	
did		0.042***
		(0.010)
peo	0.096***	0.089***
	(0.012)	(0.010)
urban	0.432***	0.351***
	(0.073)	(0.060)
indy	0.048***	0.039***
	(0.008)	(0.007)
gov	0.277***	0.241***
	(0.047)	(0.040)
trade	-0.046*	-0.027
	(0.027)	(0.022)
_cons	-1.016***	-0.905***
	(0.131)	(0.109)
N	279.000	279.000
r2	0.523	0.539

3. Conclusion

This study verifies through empirical analysis that the demonstration policy of intellectual property protection has a significant positive impact on the digitization of the cultural industry. The regression analysis shows that the digitization level of cultural industries in cities designated as demonstration areas for intellectual property protection is significantly higher than that in other areas. In addition,

variables such as population size, urbanization rate and industrial structure are also positively correlated with the digitization level of the cultural industry, showing the facilitating effect of these factors on the development of the cultural industry. On the contrary, the increase in government intervention seems to have a negative impact on the digitization of cultural industries. These findings are further confirmed as reliable through robustness tests.

Given the positive impact of intellectual property protection on the digitization of the cultural industry, it is recommended that the Government expand the implementation of the model policy on intellectual property protection nationwide, especially in cities and regions with a high concentration of cultural industries. In addition, the legal framework for IPR can be further strengthened to increase the legal costs of infringement, while optimizing the copyright registration and protection process to reduce the cost of copyright protection for cultural enterprises and creators. To counter the possible negative impact of government intervention on the digitization of the cultural industry, it is recommended that the government take more open and market-oriented measures to reduce unnecessary intervention and create a more favorable environment for the free development of the cultural industry.

"This study is subject to certain limitations. Firstly, constraints arise from data availability and sample size, the study in this paper is limited to certain provinces and cities in China and may not fully reflect the actual situation in all regions. Second, while this paper endeavors to account for numerous potential confounding variables, there remains a possibility of unobserved factors influencing the accuracy of the findings. In future studies, the introduction of data from more regions can be considered to improve the representativeness and generalization of the study. In addition, future research could further explore the impact of IPR protection on specific areas of the cultural industry (e.g., music, movies, digital arts, etc.), as well as explore the specific role of different types of IPR protection (e.g., patents, trademarks, copyrights) on the development of the cultural industry.

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