Digital Development, Intellectual Property Protection, and the Performance of Cultural Industry

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Abstract. In the era of digital economy, digital technology is constantly penetrating the cultural industry, driving it forward significantly. Meanwhile, intellectual property protection plays an important role in the development of the cultural industry driven by digital technology. This study selects the panel data of 30 provinces in China as the sample to analyze the impact of digital development on the performance of cultural industry, as well as the synergistic effect of intellectual property protection in this process. We find that the digital development and its sub-dimensions will all enhance the performance of cultural industry; Intellectual property protection plays a moderating role in the impact of digital development on cultural industry performance; Regional heterogeneity analysis showed that there were differences in the degree of influence between regions. Therefore, we should promote digital development, pay attention to the protection of intellectual property rights, and constantly promote the development and prosperity of cultural industries.

Keywords: Digital Development, Cultural Industry, Intellectual Property Protection, Synergistic Effect, Regional Heterogeneity

1   Introduction

Cultural industry is a new economic type emerging from the evolution of social, economic and cultural form from the lower stage to the higher stage, and an important product of the transformation from agricultural social economy, industrial social economy to information social economy(2016)[1]. Nowadays, the cultural industry is not only an important part of the national economy and the main force of the tertiary industry, but also an emerging and green industry that promotes the overall economic structural transformation(2023)[2]. As a green industry, it promotes economic growth and is also conducive to social development[3].

In recent years, with the rapid development of global information technology, big data, artificial intelligence, cloud computing, 5G and other technologies have provided a digital ecological environment for the development of cultural industry, resulting in a new economic form of digital cultural industry. The deep integration of digital technology and cultural industry not only improves industrial efficiency, but also makes cultural products have more diversified forms of expression. Gu Jiang (2022) pointed

out that the development of cultural industry relies on the integration with science and technology, and the integration of cross-elements, cross-industries and cross-platforms expands the breadth and depth of the development of cultural industry[4].

At the same time, the development of cultural industry is closely related to the protection of intellectual property rights. The lack of intellectual property protection will discourage people's enthusiasm for cultural innovation, and the infringement will cause serious damage to the cultural ecology(2021)[5]. Compared with traditional cultural products, digital cultural products are easy to spread and can be shared with close to zero cost without compromising the original information(2016)[6], so they are easy to imitate and copy, resulting in infringement. Therefore, it's higher requirements are put forward for the existing rules(2023)[7].

There are a lot of research about the effect of digital development on the development of cultural industry in the academic circle, but most of them are theoretical discussions and lack of empirical analysis. As an important factor affecting the development of cultural industry in the context of digital economy, intellectual property protection is often ignored. The study contributes to previous research. First, we construct an indicator system to verify the impact of digital development and its three sub-dimensions on the performance of the cultural industry. Second, there is a synergy between digitization and the level of intellectual property protection. Third, it verifies that the impact of digital development and intellectual property protection is different among regions.

2   Research Hypothesis

2.1   The Impact of Digital Development on Cultural Industry

The digital economy has promoted the transformation and upgrading of traditional industries. The penetration of digital technology has an impact on the scale and efficiency of cultural industries from different levels.

Firstly, digital development has changed the production and consumption patterns of cultural industries. Digital technology reduces the threshold of creation of cultural products, expands the group of cultural creation, and leads to a sharp increase in the production scale of digital cultural products. For consumers, they can quickly access cultural products and services through mobile devices, thus stimulating diverse cultural needs. Secondly, digital development has given birth to new forms of cultural industry. The emergence and development of new cultural forms such as online video, animation, games and live broadcasting rely on modern digital technology and have the characteristics of convenience, efficiency, vividness and image. Thirdly, digital economy has improved the allocation efficiency of production factors of cultural industry. Goldfarb and Tucker(2019) pointed out that digital technology can reduce five kinds of economic costs, including search cost, replication cost, transportation cost, tracking cost and verification cost[8]. Digital technology digitizes the information of different links of the cultural industry and quantifies the flow of elements, breaking through the mismatch caused by the original time and space constraints, and improving the efficiency of factor allocation[9].

Based on the above analysis, we propose the hypothesis H1.

H1: Digital development plays a positive role in improving the performance of cultural industry.

2.2   Moderating Effect of Intellectual Property Protection

According to Coase theorem, clear property rights are beneficial to optimize resource allocation and promote market equilibrium. The deep penetration of digital technology makes it easier for the cultural industry to free-ride. Protecting intellectual property rights can reduce infringement and play a regulating role in the development of cultural industries.

First, intellectual property rights establish the institutional foundation to encourage innovation and creation, which is conducive to protecting and promoting the creative enthusiasm of cultural creators. Second, it is helpful to reduce R&D spillover losses, promote the increase of patent output and R&D investment of enterprises, and improve innovation ability(2016)[10]. Third, it balances the interests among innovation subjects and is conducive to the healthy and sustainable development of the cultural market. Based on this, we propose hypothesis H2.

H2: Intellectual property protection plays a moderating role in improving the performance of cultural industries through digital development.

3   Research Design

3.1   Variables

Performance of cultural industry development. We divide the development performance of the cultural industry into two levels: industrial scale and economic benefit[11]. The industrial scale includes the number of legal entities, employees, total assets and business income of the cultural industry above the designated scale. The level of economic benefits includes the total profits, the number of patents granted, and the per capita cultural consumption expenditure. We use the entropy weight method to calculate the cultural industry development performance index (Per).

Digital development performance. Based on the previous studies[12], we comprehensively measure the three sub-dimensions of digital infrastructure, digital application and digital innovation, and use the entropy weight method to calculate the digital development index (Dig).

Intellectual property protection. The turnover of technology market contains various information related to intellectual property protection, which can reflect the level of local intellectual property protection to a certain extent[13]. Therefore, we selected the proportion of technology market turnover in local GDP to measure the level of intellectual property rights protection (Ipr).

Control variables. In order to ensure the unbiased regression results as much as possible, we introduce 6 control variables that may affect the development performance of cultural industry. (1) Economic development level (Lngdp), measured by the logarithm of provincial GDP per capita; (2) The level of openness to the outside

world(Open), measured by the total volume of imports and exports of goods; (3) The level of fiscal expenditure (Fin), measured by the proportion of local cultural funds in fiscal expenditure; (4) The level of urbanization (Urban), measured by the proportion of urban population to total population at the end of the year; (5) Education level (Edu), measured by the number of teachers and staff in regional ordinary and vocational colleges and universities; (6) Consumption level (Con), measured by per capita consumption expenditure of residents.

3.2   Research Model

In order to test the direct transmission mechanism of the digital economy on the development performance of the cultural industry, we set the following panel data model(1):

$$Per_{it} = \beta_0 + \beta_1 Dig_{it} + \beta_2 X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \qquad (1)$$

Where X_{it} represents a set of control variables, μ_{it} represents the province fixed effect, λ_{it} represents the time fixed effect, and ε_{it} represents the random disturbance term.

In order to explore the regulatory effect of the level of intellectual property protection on the development of digital cultural industry, we set the following model (2) :

$$Per_{it} = \beta_0 + \beta_1 Dig_{it} + \beta_2 Dig_{it} * Ipr_{it} + \beta_3 X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \qquad (2)$$

In this model, $Dig_{it}*Ipr_{it}$ is the cross-multiplication of the product of digital development and cultural industry performance. If the coefficient of the product cross term β2 is significantly less than 0, it indicates that there is a substitution effect between digital development and intellectual property protection. Otherwise, the two have complementary effect.

3.3   Data Sources

We selected the data of 30 provincial-level administrative regions from 2013 to 2021 as observation samples, and excluded Tibet, Hong Kong and Macao regions due to the absence of some data. The data mainly come from the National Bureau of Statistics, Peking University Digital Inclusive Financial Index and China Stock Market & Accounting Research Database.

4   Empirical Analysis

4.1   Basic Regression Result

Table 1 shows the regression results of the digital economy on the development performance of the cultural industry, column (1) is the basic regression model in which the level of digital development affects the performance of the cultural industry, and column (2) is the regression results after the addition of control variables, and the

impact of digital development is significantly positive at the statistical level of 1%, indicating that the digital economy can effectively improve the development level of the cultural industry.

Columns (3) - (5) respectively show the influence of the digital sub-dimension on the development performance of cultural industry. According to the evaluation index system constructed above, digitalization is divided into three sub-dimensions: digital infrastructure, digital application and digital innovation. The regression results show that digital development affects cultural industry performance from different dimensions.

Table 1. Baseline regression results.

Variables	(1) Per	(2) Per	(3) Per	(4) Per	(5) Per
Dig	0.8880***	0.8877***			
	(0.0880)	(0.0738)			
Foundation			0.2840***		
			(0.1020)		
Application				0.4779***	
				(0.0996)	
Innovation					0.5084***
					(0.0588)
Lngdp		0.0637*	0.0712*	0.0565	0.1148**
		(0.0316)	(0.0409)	(0.0405)	(0.0473)
Open		0.0093	0.0160	0.0068	0.0092
		(0.0108)	(0.0137)	(0.0093)	(0.0092)
Fin		0.0123	0.0644	0.0427	0.0053
		(0.0215)	(0.0409)	(0.0284)	(0.0308)
Urban		-0.3065	-0.7624	-0.5762	-0.7049
		(0.3575)	(0.4846)	(0.3393)	(0.6049)
Edu		-0.0173***	0.0127	-0.0004	-0.0054
		(0.0056)	(0.0200)	(0.0152)	(0.0062)
Con		0.0436	0.0810	0.0709*	0.0507
		(0.0419)	(0.0565)	(0.0349)	(0.0425)
Constant	0.0388***	0.1696	0.1253	0.1691	0.2525
	(0.0073)	(0.1953)	(0.2074)	(0.1516)	(0.2878)
Province FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
N	270	270	270	270	270
Adj-R^2	0.7672	0.8395	0.6388	0.6953	0.8001

Note: *, **, and *** denote significant at 10%, 5%, and 1% conditions, respectively.Same as below.

4.2   Robustness Test

To test the robustness of the main result, several robustness tests are performed. Table 2 shows the results of this test. 1. The system GMM model was used for endogeneity test. Column (1) indicates that there is no excessive identification bias, it passes the validity test of instrumental variables, and the estimation results of GMM are valid. 2. Explanatory variables lag one period. Column (2) illustrates the lag effect of digital economy on cultural industry performance. 3. Tail reduction. In order to exclude the influence of possible extreme data, the study conducted 1% indentation processing for all variables, and column (3) is the regression result of the processed data. 4. Change the study sample. Excluding the five provinces of Beijing, Shanghai, Jiangsu, Zhejiang and Guangdong whose digital economy development level is significantly higher than that of other regions, column (4) is the regression result, and the original model is still robust.

Table 2. Robustness test results.

Variables	(1) Per	(2) Per	(3) Per	(4) Per
L.Per	0.9083*** (0.1395)			
L.Dig		0.9426*** (0.0831)		
Dig	0.2326*** (0.0737)		0.8684*** (0.0992)	0.5606*** (0.1882)
Controls	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	240	240	270	225
AR(1)	0.025			
AR(2)	0.880			

4.3   Mechanism Test

In order to explore the moderating effect of intellectual property protection, we analyze by examining the coefficient of the cross-multiplication term. Column (1) in Table 3 is the regression result of model (2), where the coefficient of the cross-multiplication term is 3.0197, and is significant at the level of 1%, indicating that the protection of intellectual property rights can play a positive regulating role in the path of digitalization affecting the development of cultural industry. Hypothesis H2 is verified.

Table 3. Mechanism test results.

Variables	(1) Per
Dig	0.7364***

	(0.0546)
Ipr	-0.4099**
	(0.1972)
Dig*Ipr	3.0197***
	(0.5658)
Controls	Yes
Province FE	Yes
Year FE	Yes
N	270
Adj-R^2	0.8381

4.4   Regional Heterogeneity Analysis

Taking into account the differences in the level of digitization, intellectual property protection and cultural industry development among regions, we divide 30 provinces into eastern, central and western regions. The regression results are shown in Table 4. From columns (1), (3) and (5), it can be seen that digital development in the eastern region has a significantly higher effect on the performance of the cultural industry than that in the central and western regions.

   According to the results of columns (2), (4) and (6), the moderating effect of intellectual property protection in eastern and central regions is significantly positive, while the western region fails the significance test. The possible explanation is that the development level of digital and cultural industries in the western region is low, the economic development is relatively backward, and the innovation vitality is insufficient. Strengthening the protection of intellectual property rights will increase the cost and price of cultural products and services, and cannot play a positive regulating role.

Table 4. Regional heterogeneity analysis.

Variables	Eastern region		Central region		Western region	
	(1)	(2)	(3)	(4)	(5)	(6)
	Per	Per	Per	Per	Per	Per
Dig	0.9043***	0.7719***	0.4887	0.1522	0.6785***	0.6310***
	(0.1024)	(0.1066)	(0.3355)	(0.3528)	(0.1091)	(0.1473)
Ipr		-0.4564		-1.2541**		-0.4728**
		(0.7181)		(0.5082)		(0.2362)
Dig*Ipr		2.9457***		14.8439**		2.9096
		(0.9485)		(6.3371)		(2.5711)
N	99	99	72	72	99	99
Adj-R2	0.8279	0.8279	0.7211	0.7442	0.8050	0.8121

5   Conclusions

Empirical research shows that digital development will improve the development performance of cultural industries, and intellectual property protection can play a positive regulating role. In addition, the effect of digital development on improving the performance of cultural industries is most significant in the eastern region, and the moderating effect of intellectual property rights is still valid in the eastern and central regions.

The above conclusions give us the following inspirations: First, we should vigorously enhance the level of digital development. In the era of digital economy, we should conform to the trend of scientific and technological revolution, actively develop digital cultural industry, promote the digital transformation of cultural enterprises, and enhance hard power. Second, we should pay attention to the protection of intellectual property rights. Clarifying the boundary of property rights, improving the intellectual property protection system for digital cultural industries, and perfecting the intellectual property trading market are conducive to safeguarding the legitimate rights and interests of creators and creating favorable environmental conditions for the development of cultural industries. Third, different regions should adopt different digital development strategies to promote the development of cultural industries, and adapt to local conditions to achieve coordinated development.

References

1. Hu Huilin. On Cultural Industry Development [J]. Journal of Central China Normal University (Humanities and Social Sciences Edition),2016,55(06):63-75.
2. Li Wenjun, Li Qiaoming. The Course and Orientation of Development of Cultural Industries over the Past 40 Years of Reform and Opening-up [J]. Reform,2018,(12):54-64.
3. Sokół Aneta,Pangsy-Kania Sylwia,Biegańska Justyna. Do Cultural Industries Have an Impact on Sustainable Development in EU Countries?[J]. Journal of Cleaner Production,2023,428.
4. Gu Jiang. The Achievements, Experience and Prospects of China's Cultural Industry Development Since the 18th National Congress of the Communist Party of China [J]. Journal of Management World, 2012,38(07):49-60.
5. Wei Pengju. Analysis of Digital Economy and High-Quality Development of Chinese Cultural Industry [J]. Fujian Forum (Humanities and Social Sciences Edition),2021,(11):65-72.
6. Bean C R. Independent Review of UK Economic Statistics[M]. HM Treasury, 2016:1-6.
7. Feng Xiaoqing. A Research on the Challenges, Problems, and Countermeasures of Intellectual Property System in the Digital Environment [J]. Social Science Front,2023,(09):198-212.
8. Goldfarb A , Tucker C .Digital Economics[J].Journal of Economic Literature, 2019, 57(1):3-43.
9. Lu Jianqi, Ren Wenlong. The Mechanism and Path for Digital Economy to Promote the High-Quality Development of Cultural Industry: Empirical Study Based on Provincial Panel Data [J]. Social Sciences in Nanjing,2022,(05):142-151.

10. Wu Chaopeng, Tang Di. Enforcement Intensity of Intellectual Property Protection, Technological Innovation and Firm Performance: Evidence from Chinese Listed Companies [J]. Economic Research,2016,51(11):125-139.
11. Zhu Jian, Chen Nengjun, LIU Muziyun. Financial Agglomeration, Spatial Externality and Cultural Industry Development:Evidence from China's Provincial Spatial Panel Model [J]. Economic Issues,2020,(07):45-52.]
12. Huang Qunhui, Yu Yongze, Zhang Songlin. Internet Development and Productivity Growth in Manufacturing Industry:Internal Mechanism and China Experiences [J]. China Industrial Economics,2019,(08):5-23.
13. Li Li, Yan Bin, Gu Chunxia. Intellectual Property Protection, Information Asymmetry and Capital Structure of High-Tech Enterprises [J]. Management World,2014,(11):1-9.