Analysis of the Effect of Digital Economy Driving High-Quality Development of Regional Brand Economy

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Abstract: The high-quality development of the brand economy is an important part of China's high-quality economic development. Based on China's provincial panel data, this paper constructs an evaluation indicator system from four dimensions of digital infrastructure, digital industry development, digital R&D innovation, and digital governance environment, and constructs an indicator system of high-quality development level of the regional brand economy from two levels of brand value and brand intellectual property. Empirical tests show that the digital economy drives high-quality development of the regional brand economy, and the driving effect shows that the eastern region is stronger than the central and western regions. Finally, it is proposed that China should accelerate the development of the digital economy by strengthening regional digital infrastructure, promoting regional digital industry development, supporting and promoting regional digital R&D innovation, and optimizing the digital governance environment to achieve high-quality development of the regional brand economy.

1. INTRODUCTION

The report of the Twentieth National Congress proposed that "high-quality development is the primary task of building a socialist modern country in an all-round way". The development of the brand economy is the objective requirement of building an innovative country in China and the inevitable choice of expanding domestic consumption demand\cite{1}. The digital economy has become a new driving force for the development of the world economy\cite{2}. Therefore, it is of theoretical and practical significance to study the effect of the digital economy driving the high-quality development of the regional brand economy.

David first put forward the "brand economy" theory\cite{3}. Domestic scholars studied the brand economy mechanism of regional sustainable development\cite{4,5}, built a brand economy model of manufacturers' market shares\cite{6}, evaluated the coupling state between the city brand economy and the market environment, analyzed the institutional elements that drive the development of the brand economy\cite{7}, and put forward that the sustainable development of the regional brand economy can be achieved through the coupling effect of the regional brand formation mechanism, the market guidance mechanism, the power mechanism, and the governance mechanism. From the perspective of the digital economy, this paper has studied the competitiveness of commercial brands and their optimization and promotion paths\cite{8}, analyzed the research on the value co-creation mechanism of digital brand community, and proposed to build a digital brand ecology to promote the high-quality development of cross-border e-commerce\cite{9}. However, research on the impact of the digital economy on the brand economy is relatively rare. Therefore, this paper empirically analyzes the high-quality development effect of the digital economy driving the brand economy based on China's provincial panel data from 2014 to 2018.

2. METHODS AND DATA

2.1 Model specification

To further test the effect of digital economy on the level of regional brand economy development, the basic regression model is constructed as follows:

\begin{equation}
brand_i = \beta_0 + \beta_1 dig_{it} + \beta_2 Control_{it} + c_i + v_i + \varepsilon_{it}
\end{equation}

In formula (1), $i$ is the province, $t$ is the year, $\beta$ is the parameter to be estimated, $c$ is the individual effect, $v$ is the time effect, $\varepsilon$ denotes the random disturbance term. $brand$ is the regional brand economy development level. $dig$ is the digital economy development level. $Control$ denotes the control variables.

2.2 Variable measurement

The explanatory variable ($brand$). This paper
constructs the evaluation index system from two levels: brand value and brand intellectual property. Brand value includes the number of top 500 brands in the world, brand influence, and total brand value. Brand intellectual property rights include the number of trademark registrations and the number of effective trademark registrations. The article uses the entropy method to measure the brand economy development level of each sample. The data comes from China's 500 Most Valuable Brands.

Core explanatory variable (dig). We refer to the 14th Five-Year Plan for Digital Economy Development and China Digital Economy City Development White Paper (2021), and add indicators related to the environmental governance of the digital economy to construct an evaluation index system. Digital governance is a hot issue that has received much attention, but few papers have included it in the evaluation system of the digital economy. Therefore, this paper innovatively evaluates the development level of the digital economy from four dimensions: digital infrastructure, digital industry development, digital R&D innovation, and digital governance environment, as shown in Figure 1, and uses the entropy weight method to measure the development level of the digital economy of the sample. The data are obtained from the China Statistical Yearbook, China Science and Technology Statistical Yearbook, and the Qichacha platform.

Control variables. The urbanization level is expressed as the proportion of urban population to the total population. The human capital level is measured by the average years of education. The economic development level is measured by the growth rate of real GDP per capita[10]. The external openness level is expressed by the proportion of total import and export of goods to regional GDP.

2.3 Summary statistics

In this paper, 27 provinces (except Tibet, Qinghai, Ningxia, and Yunnan) in China from 2014-2018 were selected as the research samples for regression analysis of the digital economy affecting the level of regional brand economy development, and the descriptive statistics of all variables are shown in Table 1.

<table>
<thead>
<tr>
<th>Variable Type</th>
<th>Variable Name</th>
<th>Definition</th>
<th>Mean</th>
<th>St. De.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explained variable</td>
<td>Regional brand economy development at level</td>
<td>Entropy method calculations obtained</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>56</td>
<td>0</td>
<td>18</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Explained variable</td>
<td>Digital economy development at level</td>
<td>Entropy method calculations obtained</td>
<td>0.3</td>
<td>0.1</td>
<td>0.1</td>
<td>0.8</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>05</td>
<td>54</td>
<td>0</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Control Variable</td>
<td>The urbanization level</td>
<td>Share of urban population (%)</td>
<td>0.5</td>
<td>0.1</td>
<td>0.1</td>
<td>0.8</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>96</td>
<td>8</td>
<td>0</td>
<td>96</td>
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<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Control Variable</td>
<td>The human capital level</td>
<td>Average years of education (year)</td>
<td>9.3</td>
<td>0.8</td>
<td>7.7</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>69</td>
<td>64</td>
<td>66</td>
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<td></td>
<td></td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>50</td>
</tr>
<tr>
<td>Control Variable</td>
<td>The economic development</td>
<td>Real GDP per capita growth (%)</td>
<td>6.7</td>
<td>1.9</td>
<td>2</td>
<td>14</td>
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<tr>
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<td></td>
<td></td>
<td>61</td>
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<td></td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>28</td>
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</tbody>
</table>
pattern, which indicates that there is multi-polar differentiation in the regional brand economy development level of each province in China. Second, the Kernel curve has a right-tailed elongated distribution pattern, which indicates that there is still a spatial gap between regions in the regional brand economy development level of each province in China.

### 3. RESULTS AND DISCUSSION

#### 3.1 Baseline regression analysis

Before conducting the panel estimation analysis, this paper performs unit root test and multicollinearity test for each indicator variable, and the results show that the panel data are smooth and there is no multicollinearity. After conducting the heteroskedasticity and autocorrelation tests, it was found that the panel data had between-group heteroskedasticity and within-group autocorrelation. According to model (1), the regression results of testing the digital economy on the level of regional brand economy development are shown in Table 2. The OLS regression results and the PCSE model estimation results performed to correct the heteroskedasticity and autocorrelation problems are reported in turn. The sample is further divided into eastern, middle, and western regions to test regional heterogeneity.

<table>
<thead>
<tr>
<th>Variables</th>
<th>OLS Model</th>
<th>PCSE Model</th>
<th>Eastern Region</th>
<th>Middle Region</th>
<th>Western Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>dig</td>
<td>0.6372**</td>
<td>0.6201**</td>
<td>0.6397**</td>
<td>0.3052**</td>
<td>0.2928**</td>
</tr>
<tr>
<td></td>
<td>(0.1745)</td>
<td>(0.1386)</td>
<td>(0.2541)</td>
<td>(0.0235)</td>
<td>(0.1443)</td>
</tr>
<tr>
<td>The urbanization level</td>
<td>-0.6349** (0.3199)</td>
<td>-0.2641 (0.1970)</td>
<td>0.0149 (0.2932)</td>
<td>-0.0109 (0.0433)</td>
<td>-0.0363 (0.0395)</td>
</tr>
<tr>
<td>The human capital level</td>
<td>0.0922** (0.0552)</td>
<td>0.0609** (0.0148)</td>
<td>0.0594** (0.0276)</td>
<td>0.0306** (0.0076)</td>
<td>0.0034 (0.0036)</td>
</tr>
<tr>
<td>The economic development level</td>
<td>0.0027 (0.0051)</td>
<td>0.0017 (0.0014)</td>
<td>0.0003 (0.0013)</td>
<td>-0.0004 (0.0008)</td>
<td>0.0004 (0.0010)</td>
</tr>
<tr>
<td>The external openness level</td>
<td>0.2290** (0.1274)</td>
<td>0.1388** (0.0886)</td>
<td>0.0985 (0.1083)</td>
<td>0.0138 (0.0663)</td>
<td>0.0106 (0.0215)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.5816 (0.4074)</td>
<td>-0.4644** (0.1238)</td>
<td>-0.5813** (0.2364)</td>
<td>-0.2075** (0.0716)</td>
<td>0.0452 (0.0326)</td>
</tr>
<tr>
<td>Fixed year</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses. **p < 0.01, *p < 0.05, p < 0.1, as below.

From the estimation results of the PCSE model in Table 2, it shows that there is a significant contribution of the digital economy development level to the regional brand economy development level, with a force level of 0.6201. Considering the control variables, human capital, economic development environment, and the level of openness to the outside world all have positive effects on the regional brand economy development level. It indicates that each region should pay attention to the
introduction of talent, continuously improve the regional business environment, and actively develop openness and cooperation, so as to improve the regional brand economy development level. Considering regional heterogeneity, the promotion effect of the digital economy on the regional brand economy development level shows a stronger trend in eastern regions than in middle and western regions.

3.2 Robustness test

In this paper, four methods are used for robustness and endogeneity tests. First, replace the key variables. This paper uses the total digital inclusive finance index measured by the Digital Finance Research Center of Peking University to replace the core explanatory variables, and the control variables remain unchanged. The estimated results are shown in column (1) of Table 3, and the estimated coefficients are significantly negatively correlated at the 1% level, proving the robustness of the baseline regression results. Second, the reverse causality test. Drawing on Guo and Luo\cite{11}, \( \text{dig} \) lagged one period is regressed as the core explanatory variable, and the estimation results in column (2) in Table 3 show that the estimated results of the core explanatory variables do not change significantly compared to the previous paper. Third, the sample intervals are adjusted. This paper refers to Liu et al.'s\cite{12} practice of 1% bilateral tailing of the variables. The regression results in column (3) of Table 3 shows that the results are still robust after excluding the effect of outliers. Fourth, the treatment of the endogeneity problem. The GMM instrumental variable method is the main method to deal with the endogeneity problem, and this paper selects the \( \text{dig} \) lagged one period as the current period's instrumental variable. The results of the unidentifiable instrumental variables test show that the \( p \)-value of Kleibergen-Paap rk LM statistic is 0.000, and the original hypothesis of "insufficient identification of instrumental variables" is rejected. The Cragg-Donald Wald F statistic and the Kleibergen-Paap Wald F statistic are both greater than the Stock-Yogo 10% threshold, i.e., there are no weak instrumental variables. Column (4) of Table 3 shows that the empirical findings remain robust after considering the endogeneity issue.

3.3 Heterogeneity analysis

To further examine the heterogeneity analysis of the digital economy on the level of regional brand economy development, this paper examines the differential impact effects under different levels of digital economy development, regional brand economy development, and urbanization, respectively. The test results in Table 4 show that the digital economy can drive the level of regional brand economy development to a greater extent under a high digital economy development level, high brand economy development level, and low urbanization level.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline
\textbf{Variables} & \textbf{Digital economy development level} & \textbf{Brand economy development level} & \textbf{The level of Urbanization} \\
\hline
\textbf{dig} & 0.2628*** (0.088) & 0.683*** (0.29) & 0.1527*** (0.006) & 0.4982*** (0.182) & 0.4570*** (0.286) & 0.383*** (0.16) \\
\hline
\textbf{Contro

\hline
\textbf{Fixed year} & YES & YES & YES & YES & YES & YES \\
\hline
\textbf{N} & 67 & 68 & 67 & 68 & 67 & 68 \\
\hline
\textbf{R²} & 0.5819 & 0.787 & 0.9957 & 0.8355 & 0.9860 & 0.670 \\
\hline
\end{tabular}
\caption{Heterogeneity analysis.}
\end{table}

4. CONCLUSION AND SUGGESTION

This paper combines the provincial panel data of 27 provinces in China from 2014-2018, constructs the evaluation index system of the digital economy development level and the regional brand economy development level, empirically tests the effect of the digital economy on the regional brand economy development level and concludes that there is a significant contribution of the digital economy to the brand economy development level. In terms of regional heterogeneity, this effect shows a stronger trend in the eastern regions than in the middle and western regions. Moreover, the digital economy can drive the brand economy development level to a greater extent under a high digital economy development level, high brand economy development level, and low urbanization level. Considering the control variables, the human capital, economic development environment, and openness level have positive effects on the brand economy development level. After further robustness tests, the study findings remain robust.

Therefore, China should accelerate the development of the digital economy by strengthening regional digital infrastructure, promoting the development of the regional digital industry, supporting and promoting regional digital R&D innovation, and optimizing the digital governance environment, to promote China's regional brand economy to become bigger and stronger, and achieve high-quality development of the regional brand economy. This paper puts forward the following suggestions: First, strengthen the construction of regional digital infrastructure by building a digital whole industry chain platform, a digital circulation system, a digital trade service platform, etc., give play to the scale effect and long tail effect of the regional brand economy, and drive the high-quality development of the regional brand economy. Second, promote the development of the
regional digital industry by building a digital industry community, digital platform economy, digital industry ecosystem, etc., provide an industrial development environment for the regional brand economy, and drive high-quality development of the regional brand economy. The third is to promote regional digital R&D innovation by increasing the regional digital talent introduction, digital R&D innovation level, digital R&D funds, and other support, to provide innovative vitality for high-quality development of the regional brand economy. Fourth, optimize the digital governance environment by strengthening digital platform supervision, digital property rights protection, data supervision system, etc., to provide sustainable development impetus for high-quality development of the regional brand economy.

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REFERENCES


