

A Meta-Analysis-Based Study on the Impact of Digital Economy on High-Quality Economic Development

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Abstract. Numerous scholars currently fail to reach a consensus on whether the digital economy positively affects economic quality development. In order to further investigate the impact of digital economy on high-quality economic development, the article summarizes and reviews 18 empirical papers on the relationship between digital economy and high-quality economic development using meta-analysis method. It was found that the random effects model showed a combined effect value of 0.754 with a 95% confidence interval of 0.633-0.826, which reached a statistically significant level ($p < 0.001$), indicating that the digital economy has a significant positive impact on high-quality economic development. Thus, the research results of this paper can determine the relationship between the digital economy and high-quality economic development and point out the direction for future research on the digital economy.

Keywords: Digital economy; Quality economic development; Meta-analysis

1 Introduction

Currently, Internet technology is the most widely used and mature innovation technology in China, and is a representative of emerging technologies, and a series of new economic forms such as Internet economy or digital economy have emerged ^{[[3]]}. Due to the urgent need of realistic development, China is vigorously promoting the development process of digital economy, which has prompted the rapid development of digital economy and has an important role in improving national consumption, driving investment at home and abroad, enhancing employment rate and strengthening international competitiveness, which provides a feasible path and new momentum for development to promote the high-quality development of China's economy ^{[[2]]}. But on the other hand, Song Jiang's empirical study points out that, at the national level, the digital economy has a strong impact on the real economy, generating a "crowding out effect", which has a negative impact on the quality development of the economy ^{[[4]]}.

At this time, the adoption of meta-analysis method to merge the results of existing empirical studies on the impact of digital economy on high-quality economic development can overcome the shortcomings of traditional review methods, ensure the scientific objectivity and authenticity of the findings. Therefore, this paper will summarize and review 18 empirical literatures from a quantitative review perspective with Chinese cities as the research target, using a meta-analysis approach, in order to clarify whether the digital economy has a positive impact on the high-quality economic development.

2 Review of the literature

Regarding the research on the impact of digital economy on high quality economic development, the existing literature focuses on whether digital economy has a positive impact on high quality economic development ^{[[10]]}. Jianfei Cao constructs a comprehensive index system based on the digital economy index of Chinese cities to measure the level of high-quality economic development, and empirically investigates the impact of digital economy on high-quality economic development of cities, and the results show that digital economy has a positive impact on high-quality economic development ^{[[9]]}.

The academic research on digital economy and economic quality development is rich, but there is no unified conclusion on the impact of digital economy on economic quality development so far ^{[[1]]}. In view of this, this paper makes the hypothesis that the digital economy has a positive contribution to the economic quality development. By reviewing a large amount of literature, this paper summarizes and reviews 18 empirical articles from Chinese cities at home and abroad using meta-analysis, and investigates the impact of digital economy on economic quality development, and provides reference opinions for future research.

3 Research Methodology and Process

Meta-analysis, first proposed by British educational psychologist Gene V. Glass, is a quantitative synthesis of individual experiments and a priori hypotheses for empirical research that allows for the synthesis and analysis of statistical data from quantitative research findings ^{[[6]]}. The basic process of meta-analysis can be summarized as follows: formulation of a research question, retrieval of literature containing common research objectives, development of literature selection criteria, coding of literature content, and quantitative statistical analysis ^{[[7]]}. At present, the use of meta-analysis is more common in the literature of medical field, and less research has been conducted in the field of digital economy using meta-analysis. However, in view of the mixed findings of current empirical studies on the impact of digital economy on high-quality economic development, this paper adopts meta-analysis method to conduct a comprehensive quantitative study on it.

3.1 Literature search and screening

For the search of Chinese literature, CNKI full-text database was selected for precise search, and the subject terms were set as "digital economy" and "high-quality economic development" with "empirical research". For the reason of representativeness and reliability, only core journals, CSSCI and AMI were selected, including Management World, Statistics and Decision Making, Nanjing Social Science, etc. Meanwhile, the search period was limited to 2020-2022, and 14 Chinese papers were retrieved. For the search of foreign literature, Web of Science, Elsevier Science Direct, and JSTOR were selected as the major databases for precise search, and the subject terms were set as "digital economy" " high-quality economic development" with "empirical research" and "empirical analysis "The search was conducted from 2020 to 2022, and a total of 4 English-language articles were retrieved.

Strict literature screening requirements were developed after the literature search to meet the needs of the study. In this paper, the 130 pieces of literature retrieved from the initial search

were screened and excluded according to the following criteria: (1) empirical studies with Chinese urban panel data as samples were screened, and non-empirical literature such as case studies and review studies were excluded; (2) the literature takes the level of digital economy development as the core explanatory variable and high-quality economic development as the explanatory variable; (3) Meta-analysis with data on correlation coefficients and sample size, or standard deviation, variance, t-value or p-value and correlation coefficient between digital economy and high-quality economic development^[8]. After strict screening, a total of 18 papers meeting the research criteria were included, including 14 papers in Chinese and 4 papers in English.

3.2 Document coding

Through the search and screening of the literature, the 18 empirical papers after screening need to be coded to facilitate the analysis statistics and effect value calculation at a later stage. The coding is divided into study description items and effect value statistics. The study description items mainly include the source information such as author, year, title, journal name, and study characteristics such as study method, study object, and study conclusion, while the effect value statistics mainly include sample size, correlation coefficient, standard deviation, variance, t-value or p-value, etc.

3.3 Selection of effect values

Effect values can measure the strength of experimental effects or the strength of variable associations. Meta-analysis requires that the results of multiple studies be synthesized into some single effect value, and in the case of different effect values in the literature, they should be converted into consistent effect values and then combined for analysis. In this paper, the correlation coefficient r between digital economy and economic quality development is used as the effect value statistic, and according to each study The weight of each effect value is calculated based on the sample size of each study in order to make the effect value more accurate and credible. The original literature coding information and the information related to the effect values corresponding to each study are shown in Table 1.

Table 1. Calculation of literature coding information and combined effect values

Number	Author (year)	Sample size	Post-conversion effect value	Z-value	Fixed model weights	Random model weights
1	Yunping Zhang (2021)	360	0.862	24.583	3.69	5.60
2	Heping Ge (2021)	87	0.380	3.667	0.87	5.38
3	Zongxian Li (2021)	2722	0.176	9.274	28.09	5.67
4	WenpuYang (2022)	240	0.536	9.214	2.45	5.57
5	Xiaohui Xu (2022)	155	0.801	13.579	1.57	5.51
6	Rui Wu (2022)	240	0.901	22.746	2.45	5.57

7	Yongkun Wan (2022)	90	0.796	10.144	0.90	5.39
8	Zhao Chen (2022)	270	0.718	14.763	2.76	5.58
9	Jianfei Cao (2022)	1152	0.541	20.527	11.87	5.65
10	Yachen Shen (2022)	150	0.946	21.730	1.52	5.50
11	Chenxia Zhang (2022)	450	0.617	15.226	4.62	5.62
12	Shaofu Zhou (2022)	2475	0.659	39.330	25.54	5.67
13	Guangbin Cheng (2022)	240	0.903	22.911	2.45	5.67
14	Tao Zhao(2020)	222	0.537	8.878	2.26	5.56
15	Jianing Pang (2022)	180	0.754	13.067	1.83	5.53
16	Desheng Yu (2022)	279	0.316	5.436	2.85	5.58
17	Wei Zhang (2021)	150	0.958	23.291	1.52	5.50
18	Chenhui Ding (2021)	270	0.787	17.378	2.76	5.58

Note: The author is the first author

4 Analysis of results and discussion

4.1 The impact of the digital economy on the quality development of the economy

According to statistical principles, multiple studies for statistical volume combining must ensure the homogeneity of the data. Therefore, the heterogeneity test of the results of multiple studies can determine whether the studies are homogeneous, and the appropriate effect model can be selected for analysis based on the results of the heterogeneity analysis ^{[[5]]}. When the heterogeneity of the studies is large, a random-effects model should be used; when the heterogeneity of the studies is small, a fixed-effects model should be used.

The Q test and the I^2 test are often used as tests of heterogeneity. For the Q test, heterogeneity exists between studies when $p < 0.10$.

The I^2 statistic can reflect the size of sample heterogeneity. The value of I^2 is taken between 0 and 100, and the larger the value of I^2 , the greater the heterogeneity. Heterogeneity I^2 is judged by the following criteria: 0%-25% is low heterogeneity; 25%-50% is medium heterogeneity; 50%-75% has large heterogeneity; 75%-100% has large heterogeneity.

Table 2 shows the combined effect values of the 18 studies, and the Q statistic shows that each effect value is heterogeneous ($Q=1728.527$, $p < 0.001$); I^2 is 99.017, indicating that 99.017% of

the observed variance is due to true differences in effect values, indicating a high degree of heterogeneity between samples, so a random effects model should be selected for analysis.

According to the random effects model in Table 2, it can be seen that the combined effect value is 0.754, with a 95% confidence interval of (0.633, 0.826), which excludes "0" and reaches a statistically significant level ($p < 0.001$), which indicates that the digital economy has a positive and positive This indicates that the digital economy has a positive impact on high-quality economic development.

Table 2. Distribution of overall effect values and heterogeneity test results

Models	Sample size	Merger effect value	95 confidence interval	Progressive		Heterogeneity test			
				Z-value	P-value	Q	Df(Q)	P	I ²
Fixed effects	18	0.588	(0.575,0.601)	66.359	0.000	1728.527	17.000	0.000	99.017
Random effects	18	0.754	(0.633,0.826)	8.755	0.000				

4.2 Publication bias test

Bias is also known as systematic error, and the results of meta-analysis need to be tested for publication bias in the study to find out whether the results of the study have deviations from the true values, and only by correctly evaluating the degree of publication bias can its influence on the results of meta-analysis be reduced.

Publication bias can be identified by funnel plots. The shape of the funnel plot that shows is asymmetric means that the meta-analysis did not include insignificant articles; if the points on the funnel plot are not balanced or symmetric, it indicates that the meta-analysis has articles that were not included and there is bias. As seen in Figure 1, most of the points on the funnel plot are divided in a symmetrical form on the left and right sides, and basically at the top of the funnel plot, which indicates that the possibility of publication bias in the meta-analysis of this paper is low.

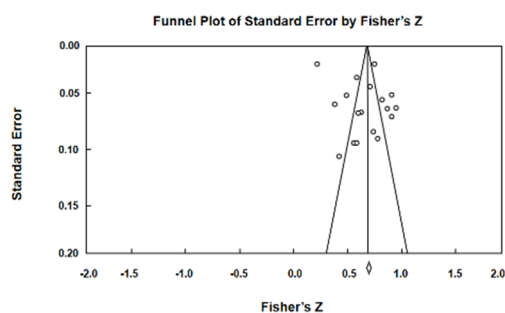


Fig. 1. Funnel diagram of digital economy and high-quality economic development

5 Summary

This paper uses meta-analysis to systematically and quantitatively analyze the excellent domestic empirical literature on digital economy and highly refine the existing theories to conclude that digital economy has a positive impact on high quality economic development, which is important for promoting the rapid development of China's economy and is an important supplement to the existing research on digital economy and high-quality economic development.

However, China's digital economy is in the emerging stage, and the research base on digital economy is still weak, and the research literature on how digital economy affects high-quality economic development is small, and many scholars have not yet reached a consensus on the conclusion of how digital economy affects high-quality economic development. Future scholars can learn more deeply about the digital economy based on the previous studies.

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