Study on the mechanism of the impact of the digital economy on regional coordinated development

Li Weng *

College of Life Science and Technology, Gansu Agricultural University, Lanzhou, China, 730070

* Corresponding Author Email: gsauwl@163.com

Abstract. The implementation of the "East counts, West counts" project can promote the cross-regional flow of data elements between the East and the West, forming a new pattern of coordinated development in the East, Central and West regions with data as a link. On the basis of theoretical guidance, this paper measures the digital economy competitiveness index and regional coordinated development index by constructing the relevant index system based on the data of 31 provinces (municipalities and autonomous regions) in 2016 and 2020, establishes a regression model and introduces the intermediary effect test, in order to explore the mechanism of the digital economy to promote the coordinated development of the region. The study finds that the digital economy effectively promotes regional coordinated development through industrial structure upgrading. The "East Counts West Counts" project is able to break down spatial barriers and realise rapid cross-domain mobility of computing power, which is more powerful in promoting coordinated regional development and narrowing the gap between the East, the Middle East and the West.

Keywords: Digital Economy, Coordinated Regional Development, Upgrading of Industrial Structure, Benchmark Return.

1. Introduction

As an important engine for building a modernized economic system, the digital economy has been deeply integrated with all fields of China's economic and social development, showing strong momentum in driving investment, stimulating consumption and promoting employment, and has become an important reliance on promoting the domestic general circulation and promoting coordinated regional development [1-4].

Regarding the research on digital economy, Yu Li and Feng Yao use Theil index method and grey correlation method to analyse the current situation of regional differences in China's digital economy development and the factors affecting them, and find that the inter-regional digital development differences have a strong positive correlation with the overall development differences of the region [5]. Zuo Pengfei, Jiang Qiping and Chen Jing use the system GMM model to analyse the dynamic effects and regional differences of Internet development, the integration and development of the Internet and urbanization on the transformation and upgrading of the industrial structure, and argue that the digital economy plays a full role in China through technological advantages [6].Chen Xiaodong and Yang Xiaoxia based on grey correlation entropy and dissipative structure theory found that industrial digitalization can promote industrial structure upgrading more significantly than digital industrialization [7].

Previous researchers have studied the relationship between the digital economy and economic growth and the development trend. On the basis of previous research results, this paper mainly analyses the role mechanism of the digital economy in promoting regional coordinated development from two aspects: the digital economy plays a role in regional coordinated development, and the digital economy promotes regional coordinated development by promoting the upgrading of industrial structure.

2. Construction of a forecasting model for the regional coordinated development index

2.1. Regression model construction

In order to verify the direct impact of digital economy on regional coordinated development, the following regression model is constructed:

$$CRD = \alpha_0 + \alpha_1 DEI + \alpha_2 ED + \alpha_3 HC + \alpha_4 LU + \alpha_5 FDI + \alpha_6 GS + \alpha_7 RIC + \varepsilon \quad (1)$$

CRD is the regional coordinated development index; DEI is the digital economy competitiveness index; ED, HC, LU, FDI, GS, and RIC are control variables, denoting the level of economic development, the level of human capital, the level of urbanization, the degree of openness to the outside world, the government's fiscal expenditure, and the level of innovation, respectively; α is the regression coefficient of each explanatory variable; and Ɛ denotes a random disturbance term.

The mediating role model was introduced by using industrial structure upgrading as a mediating variable. The product coefficient test is adopted and the mediating effect test is carried out using Bootstrap sampling method. The mediating effect model is as follows:

$$CRD = \beta_0 + \beta_1 DEI + \beta_2 Z + \mu_1 \quad (2)$$

$$IS = \lambda_0 + \lambda_1 DEI + \lambda_2 Z + \mu_2 \quad (3)$$

$$CRD = \delta_0 + \delta_1 DEI + \delta_2 IS + \delta_3 Z + \mu_3 \quad (4)$$

Equation (2) is the regression analysis of the independent variable Digital Economy Competitiveness Index DEI and the dependent variable Regional Coordinated Development Index CRD to get the total effect value; Equation (3) is the regression analysis of the independent variable Digital Economy Competitiveness Index DEI and the mediator variable Industrial Structure Advanced Index IS to get the value of the intermediate effect process; and Equation (4) is the independent variable DEI, the mediator variable IS and the dependent variable CRD regression analysis to get the direct effect value.

2.2. Selection of indicators

Regional Coordinated Development Index (CRD): Focusing on the basic goal of regional coordinated development, and drawing on the evaluation index system of China's Regional Coordinated Development Index in the China Regional Coordinated Development Index Report 2020 of CPSS Think Tank, the CRD Index is based on the principles of relevance and data accessibility, and evaluates the level of regional coordinated development by selecting 20 indicators from five major dimensions, namely, disparity in the living standards of the people, equalization of basic public services, accessibility of infrastructures, utilization of the comparative advantages of the regions, and green, low-carbon and coordinated development. 20 indicators are selected from 5 dimensions to evaluate the level of coordinated regional development [8-11]. In order to reflect the longitudinal trend of regional coordinated development in each region, the value of each indicator is standardized and de-quantified with 2016 as the base period, and the reverse indicator is positively treated by taking the inverse of the value of the indicator. The entropy method was chosen to calculate the weight of each indicator, and the regional coordinated development index was obtained by layer-by-layer weighting.

Digital Economy Competitiveness Index (DEI): Focusing on the main indicators of the 14th Five-Year Plan for the Development of Digital Economy, the National Bureau of Statistics (NBS)'s Statistical Classification of the Digital Economy and Its Core Industries (2021), and drawing on the Digital Economy Competitiveness Evaluation Model of the Report on the Development of China's

Digital Economy in Regions and Cities (2020) by the China Institute of Information and Communications Technology (CICT) framework, following the principles of relevance and data accessibility, 20 indicators are selected to evaluate the competitiveness of the digital economy in six dimensions, namely, digital innovation factors, digital infrastructure, core digital industries, digital convergence and application, digital economic demand, and digital policy environment [12-13]. Drawing on the China ICT Institute's Report on the Development of the Digital Economy in China's Regions and Cities (2020), the maximum value of each indicator is adopted as a fixed threshold for standardization. The equal weight assignment method is adopted, giving each three-level indicator the same weight, and each indicator is weighted with 5 points. A comprehensive evaluation using the weighting method resulted in a composite index.

Industrial Structure Upgrading (IS): Adopting the "Industrial Structure Advanced Index" set up by Fu Linghui, the industrial structure upgrading index is constructed through the idea of three-dimensional vector angle of spatial analytical geometry.

Control variables: refer to the control variables set by Zhong Wen; Zheng Ming in "The Influence Effect and Role Mechanism of Digital Economy on Regional Coordinated Development", including the level of economic development, the level of human capital, the level of urbanization, the degree of openness to the outside world, the government's financial expenditure and the level of innovation .The level of economic development (ED) is measured by total factor productivity; the level of human capital (HC) is expressed by the average number of students enrolled in higher education per 100,000 population; the level of urbanization (LU) is directly measured by the urbanization rate; the degree of openness to the outside world (FDI) is expressed by the ratio of the total amount of investment and imports of foreign-invested enterprises (FIEs) to the gross regional product (GDP); and the level of governmental fiscal expenditure (GS) is expressed by the ratio of the general budgetary expenditure of the local government to the GDP. Government expenditure (GS) is measured by the ratio of local government general budget expenditure to GDP; and the level of innovation (RIC) is measured by the ratio of the number of domestic patent applications and authorisations to GDP [14-15].

3. Results

3.1. Source of data

Relevant data from 31 provinces (municipalities and autonomous regions) in China in 2016 and 2020 were selected for analysis, and data from Hong Kong, Macao and Taiwan were removed due to their different statistical systems and in view of data availability issues. Data from the official website of the National Bureau of Statistics (NBS) - national data - annual data by province, and the China Economic Census Yearbook (2018).

3.2. Descriptive statistical analysis

The maximum value of the regional coordinated development index, the level of human capital, the degree of openness to the outside world, and government financial expenditure for a total of four data items exceeds the mean by three standard deviations, indicating that the data fluctuates considerably, which suggests that there are large differences in the level of coordinated development of the region, the level of human capital, the degree of openness to the outside world, and the level of government financial expenditure among the regions of China. There are also some gaps in the digital economy competitiveness index, the level of economic development, the level of urbanization, and the level of innovation. As shown in Table 1.

Table 1. Results of descriptive statistical analyses of variables

Designation	Minimum value	Maximum values	Average value	Standard deviation	Median
Regional Coordinated Development Index (CRD)	0.19	12.21	1.70	2.88	0.71
Digital Economy Competitiveness Index (DEI)	0.18	0.75	0.35	0.13	0.32
Index of advanced industrial structure (IS)	6.34	7.66	6.85	0.26	6.78
Level of economic development (ED)	0.36	1.32	0.81	0.30	0.75
Level of human capital (HC)	1499.00	5393.00	3060.36	772.51	2866.00
Level of urbanization (LU)	35.79	89.31	63.73	11.05	62.65
Degree of openness to the outside world (FDI)	2.14	8348.64	1213.05	1719.95	708.16
Government fiscal expenditure (GS)	11.96	116.20	29.52	19.46	24.05
Level of Innovation (RIC)	0.90	6.39	2.67	1.44	2.26

After classifying the 31 provinces (municipalities and autonomous regions) in China according to the scope of implementation of the East Counts West Counts Project, descriptive statistics were analysed. From the mean and median, it can be seen that the CRD and DEI in the region where the project is implemented are higher than those in the region where it is not implemented. From the viewpoint of the implementation area of the "East Counts, West Counts" project, the CRD and DEI of the seven eastern provinces are higher than those of the eight central and western provinces. The results show that the national layout of "East counts West counts" arithmetic network hub nodes, in line with the reality of China's regional economic development. As shown in table 2.

Table 2. Comparison of CRD and DEI levels in the provinces involved in the "East Counts, West Counts" project

Designation	Mean value				Median			
	15 provinces counted east to west	Remaining 16 provinces	7 eastern provinces counted east to west	Remaining 8 provinces counted east to west	15 provinces counted east to west	Remaining 16 provinces	7 eastern provinces counted east to west	Remaining 8 provinces counted east to west
Regional Coordinated Development Index (CRD)	2.804	0.665	5.068	0.823	1.066	0.585	2.688	0.715
Digital Economy Competitiveness Index (DEI)	0.405	0.291	0.509	0.315	0.36	0.281	0.535	0.3

3.3. Benchmark regression analysis

Firstly, the correlation between CRD and a total of eight items, namely DEI, IS, ED, HC, LU, FDI, GS and RIC, respectively, is investigated through Pearson correlation analysis. The analysis shows that there is a significant positive correlation between the coordinated regional development index (CRD) and the digital economy competitiveness index (DEI), the index of advanced industrial structure (IS), the level of human capital (HC), the level of urbanization (LU), the degree of openness to the outside world (FDI) and the level of innovation (RIC).

Secondly, DEI, ED, HC, LU, FDI, GS, RIC as independent variables and CRD as dependent variable were analysed by linear regression. The regression coefficient value of Digital Economy Competitiveness Index (DEI) is 15.673 ($t=2.717$, $p=0.012<0.05$), which means that the Digital

Economy Competitiveness Index (DEI) will have a significant positive influence relationship on Regional Coordinated Development Index (CRD). The digital economy has a significant positive contribution to the coordinated regional development. The R-square value of the model is 0.753, which means that the independent variable can explain 75.3% of the reasons for the changes in the coordinated regional development index (CRD). The model passed the F-test (F=10.041, p=0.000<0.05). If all the VIF values in the model are less than 10, it means that there is no multicollinearity problem in the model and the model is well constructed. As shown in Table 3.

Table 3. Results of linear regression analyses of the impact of the digital economy on coordinated regional development

	regression coefficient	95% CI	VIF
constant	-17.470**	-25.766~-9.173	-
	(-4.127)		
Digital Economy Competitiveness Index (DEI)	15.673*	4.368 ~ 26.978	6.145
	-2.717		
Level of economic development (ED)	2.048	-0.139 ~ 4.236	1.239
	-1.835		
Level of human capital (HC)	0.001*	0.000 ~ 0.002	2.061
	-2.295		
Level of urbanisation (LU)	0.157*	0.044 ~ 0.270	4.549
	-2.726		
Degree of openness to the outside world (FDI)	0	-0.000 ~ 0.001	3.042
	-1.188		
Government fiscal expenditure (GS)	0.050*	0.009 ~ 0.091	1.83
	-2.416		
Level of Innovation (RIC)	-1.401*	-2.473 ~ -0.328	6.996
	(-2.560)		
R2	0.753		
Adjustment of R2	0.678		
F-value	F (7,23) =10.041, p=0.000		
Dependent variable: Coordinated Regional Development Index (CRD)			
D-W value: 2.270			
* p<0.05 ** p<0.01 t-values in parentheses			

Finally, the mediation effect test is carried out using the parallel mediation Bootstrap sampling method. 95% confidence interval does not include 0, indicating that it is significant; a and b are both significant, and c' is not significant, indicating that it is fully mediated, and the results show that the digital economy has an impact on the coordinated development of the region, which needs to be indirectly affected through the upgrading of industrial structure. As shown in Table 4.

Table 4. Results of the test of the mediating effect of the digital economy Competitiveness index on regional coordinated development

term		Digital Economy Competitiveness Index (DEI) => Index of Advanced Industrial Structure (IS) => Index of Coordinated Regional Development (CRD)
c	aggregate effect	12.104**
a		1.331**
b		10.025**
a*b	value of intermediary effect	13.34
a*b	(Boot SE)	0.187
a*b	(z-value)	71.313
a*b	(p-value)	0
a*b	(95% BootCI)	0.003 ~ 0.821
c’	direct effect	-1.236
Test Conclusion		Fully intermediated

4. Conclusion

The digital economy can effectively promote the coordinated development of the region, and the need to promote the coordinated development of the region through the upgrading of industrial structure in the regions where the "East Counts West Counts" project has been implemented, the digital economy can significantly influence regional coordinated development by promoting industrial structure upgrading. In regions where the "East Counts West Counts" project has not been implemented, the impact of the digital economy on regional coordinated development is not significant.

The role of the digital economy in leading the transformation and upgrading of China's economy as a new driving force will continue to be strengthened, and production, investment, consumption and trade will recover and grow under the leadership of the digital economy. It is suggested that the whole country should lay out the development path of digital economy from the perspective of upgrading industrial structure, and the central and western provinces and cities should seize the strategic opportunity of implementing the "East Counts, West Counts" project, so as to reverse and narrow the gap with the eastern part of the country.

References

[1] LI Qinghua, HE Aiping. Research on the Influence Effect and Role Mechanism of Digital Economy on the Coordinated Development of Regional Economy [J]. Exploration of Economic Issues, 2022 (8): 1 - 13.

[2] He Chunhua, Zhao Yongxiang, Zhang Yanhe, et al. Expert Perspectives: Research and Judgment on the Development of Data Centre Industry - Editor-in-Chief's Interview with the Editorial Board of Data Centre Construction+ Magazine [J]. Data Centre Construction+, 2022 (002): 000.

[3] Li Jinru. Constructing a new development pattern based on unimpeded national economic cycle: theoretical connotation and practice in Jiangsu [J]. Journal of Party School of CPC Nanjing Municipal Committee, 2021, 000 (004): 77 - 82, 90.

[4] JI Yujun, NIU Yaxin. Manufacturing agglomeration under the influence of digital economy: new mechanism and new evidence [J]. Science and Technology Management Research, 2023 (18): 137 - 147.

[5] Yu Li Feng Yao. Analysis of Regional Differences and Influencing Factors of China's Digital Economy Development [J]. Market Week: Theoretical Research, 2021, 034 (003): P.72 - 75.

[6] ZUO Pengfei, JIANG Qiping, CHEN Jing. Internet development, urbanization and transformation and upgrading of China's industrial structure [J]. 2021 (2020-7): 71 - 91.

[7] Chen Xiaodong, Yang Xiaoxia. The impact of digital economy development on industrial structure upgrading - A study based on grey correlation entropy and dissipative structure theory [J]. Reform, 2021 (3): 14.

[8] Xie Yize. Common wealth in the digital economy: opportunities, challenges and responses [J]. Xinjiang Social Science, 2023 (6): 23 - 32, 167.

[9] Xue Yang, Hu Lina. Some Thoughts on Tax Reform Enabling China's Digital Economy to Improve International Competitiveness [J]. Proceedings of the Chinese Academy of Sciences, 2023 (11): 1729 - 1739.

[10] LI Zhanfeng, SU Wenyuan. Research on the impact of digital economy on green total factor productivity [J]. Journal of Xi'an University of Finance and Economics, 2023 (6): 58 - 69.

[11] Gu Yufei. Research on the impact of digital economy on high-quality economic development [J]. Science and Technology Economic Market, 2023 (10): 69 - 71.

[12] Bi Juan, Wang Peng. Typical correlation analysis of digital government and digital economy - based on Chinese provincial regional panel data [J]. Beijing Social Science, 2023 (8): 68 - 76.

[13] Wang Tien. Response Strategies to the Development Trend of Digital Economy [J]. China Economy, 2023 (17): 170 - 172.

[14] Li Danyang. Development status and national development strategy of digital economy at home and abroad [J]. Modernisation of Shopping Malls, 2023 (16): 127 - 129.

[15] Liang Chao. Study on the dynamic evolution of digital economy measurement and its distribution in Shandong [J]. Journal of Dezhou College, 2023 (6): 83 - 87.