Financial Engineering and Risk Management (2023)
Clausius Scientific Press, Canada

DOI: 10.23977/ferm.2023.060211
ISSN 2523-2576 Vol. 6 Num. 2

# *Study on the Impact of Financial Agglomeration on the Development of Digital Economy*

**Zhong Yuqin[1,a], Xia Guixiang[1,b], Lu Xiaodan[1,c]**

*[1]Shaoguan University, Shaoguan, China*
*[a]zhongyq5523@163.com, [b]xiaguixiang003@163.com, [c]luxiaodaneins@163.com*

***Keywords:*** Financial Agglomeration; Location Entropy; Digital Economy

***Abstract:*** The digital economy has become an important engine for the high-quality development of China's economy. This paper uses panel data of six central provinces in China from 2013 to 2020 as samples, and measures the financial agglomeration level of each province by using the location entropy of financial output, and explores the influence of financial agglomeration on the development of digital economy by constructing a progressive stepwise regression of fixed-effect model. The results of the analysis show that the financial support for high-tech enterprises' investment and financing still cannot keep up with the rapid development of the digital economy, and put forward policy suggestions such as promoting the digital transformation of inclusive finance, promoting new financial service models such as "artificial intelligence + big data", and accelerating the construction of digital industry.

## 1. Introduction

With the extensive and in-depth use of digital technology in all walks of life, the rapid development of digital economy and digital finance has led to profound changes in the modern economic and financial development model and people's production and lifestyle. The healthy development of digital economy is conducive to promoting the construction of a new development pattern, promoting the construction of a modernized economic system, and promoting the construction of new national competitive advantages. In this context, studying the relationship between China's financial development and the digital economy has important theoretical value and practical significance for the high-quality development of China's economy[1-2].

## 2. Literature Review

Since China first wrote the digital economy into the government work report in 2017, Chinese scholars began to pay greater attention to the research on digital economy issues. The research on digital economy and finance mainly focused on the following three aspects: firstly, scholars focus the research on the relationship between digital economy, finance and economic growth. Shi Dan and Sun Guanglin (2022) studied the relationship between digital economy, financial efficiency and high-quality economic development in China. They found that digital economy can improve the quality of economic development by improving financial efficiency and alleviating the degree of capital

mismatch. Yu Zhiqian, Zhu Ning (2021) used a nonparametric conditional efficiency framework to measure the impact of digital inclusive finance on local economic growth and found that digital finance has a significant positive contribution to local economic growth and improvement of individual efficiency of each indicator. Teng Lei, Ma Degong (2020) based on different high quality development indices and internet financial inclusion indices also affirm that digital finance can indeed promote high quality development.

Secondly, studies are financial fields in the context of digital economy. For example, the research on fintech development, financial risk and regulation in the context of digital economy (Zhou Quan, Han Heyang, 2020). Research on the information sharing mechanism of China's financial holding companies in the context of digital economy (Xing Huiqiang, Jiang Shuai, 2021), etc.

The third type of research is on digital finance. Yang Mengyang, Tang Xiaobin (2023) measured and evaluated the coupling coordination degree of digital finance and high quality economic development. Xu Weicheng, Fan Aijun (2022) explored the endogenous mechanism and mechanism of action of digital finance to promote the growth of enterprises based on the perspective of financialization of enterprises research. Li Zhen, Song Ke, Hou Jinning et al. (2022) argue that for banks in areas with high levels of digital financial services, such as the overall level of digital financial services and their coverage, depth of use and degree of digitalization, the inhibition of economic policy fluctuations on bank liquidity creation was more obvious.

In summary, there is a strong interconnection and driving mechanism between finance and the digital economy, but there is still lack of research on the relationship between financial agglomeration and the level of development of the digital economy at this stage. This paper conducts a preliminary study and proposes policy recommendations, which have theoretical and practical significance for China to accelerate the construction of innovative real industries and achieve the rapid development of digital economy[3-4].

## 3. Empirical Analysis

### 3.1. Empirical model design

This paper empirically analyzes the effect of financial aggregation on the development level of digital economy based on the panel data of six central provinces. The econometric model is constructed as follows.

$$\begin{aligned} Dig_{it} = \alpha + \beta Finance_{it} + \gamma_1 Invest_{it} + \gamma_2 Tech_{it} \\ + \gamma_3 Gov_{it} + \gamma_4 Incom_{it} + \gamma_5 Old_{it} + \varepsilon_{it} \end{aligned} \tag{1}$$

In equation (1), $i$ denotes the provincial administrative regions; $t$ denotes the time; $\alpha$ denotes the constant term; $\varepsilon_{it}$ denotes the error term of the estimation equation; $Dig_{it}$ represents the dependent variable, i.e., digital economy level; $Finance_{it}$ is the core independent variable, representing the entropy of financial agglomeration location. The control variables, including capital level($Invest_{it}$), technology level ($Tech_{it}$), government support ($Gov_{it}$), the income level of urban residents ($Income_{it}$) and aging level($Old_{it}$). In addition, $\alpha$、$\beta$、$\gamma_i (i=1,2,...,6)$ are coefficients to be estimated.

### 3.2. Variable selection and data sources

#### 3.2.1. Dependent variables

This paper refers to the level of digital economy calculated by Wei Yanyan and Ma Xue (2022) as the dependent variable. According to the indicator system constructed by 18 three-level indicators in the four major aspects of digital foundation, digital application, digital innovation and digital industry, the indicator system is optimized by structural equation. The relevant indicator system and its weight are calculated by entropy method to calculate the digital economic level of Anhui, Shanxi, Jiangxi, Henan, Hubei and Hunan provinces in central China from 2013 to 2020.

#### 3.2.2. Core independent variables

The core independent variable of this paper is financial agglomeration, which refers to the process of financial resources forming densely in a certain geographical space with the development of geographical conditions, i.e., the phenomenon that individual enterprises in the financial industry gather in a certain area. In this paper, the location entropy of financial output is used as a measure of financial agglomeration.

$$LQ_{ji} = \left(X_{ji} / \sum_{j} X_{ji}\right) \Big/ \left(\sum_{i} X_{jx} / \sum_{i} \sum_{j} X_{ji}\right) \tag{2}$$

In equation (2), $j$ is the $j$ industry, $i$ is the $i$ region; $LQ_{ji}$ denotes the regional entropy of the $j$ industry in the $i$ region; $X_{ji}$ denotes the output index of the $j$ industry in the $i$ region. $\Sigma(j)X_{ji}$ is the sum of the output of all industries, i.e., the regional GDP of the $i$ region. $\Sigma(i)X_{ji}$ is the sum of the output of all regions, i.e., the total GDP of $j$ industry in all regions. $\Sigma(ij)X_{ji}$ is the sum of the output of all regions and all industries, i.e., the regional GDP of the whole range. Generally speaking, the higher the $LQ_{ji}$ is, the higher the degree of agglomeration of industry $j$ in region $i$. When the $LQ_{ji}$ is greater than 1, it indicates that the degree of agglomeration of industry $j$ in region $i$ is higher than the overall average. The $j$ industry in this paper is the financial industry, and $X_{ji}$ represents the financial output of $i$ province. The other control variables were selected and described in Table 1.

Table 1 Variable selection and description

| Variable type | Variable name | Symbol | Variable definition |
|---|---|---|---|
| Dependent variable | Development level of digital economy | Dig | Use entropy method to calculate the relevant index system and its weight |
| Independent variable | Financial agglomeration | Finance | Location entropy (Details as above) |
| Control variables | Capital investment level | Invest | Per capita investment in fixed assets of the whole society |
| | Technology investment level | Tech | Expenditure on research and experimental development as a proportion of regional GDP |
| | Government support | Gov | Local fiscal expenditure as a share of regional GDP |
| | Resident income level | Income | Urban residents' annual disposable income per capita |
| | Aging level | Old | Proportion of population over 65 years old in total population |

### 3.2.3. Data source

This paper selects panel data of six central provinces (Anhui, Shanxi, Jiangxi, Henan, Hubei and Hunan province) from 2013 to 2020 as the sample for empirical evidence. The data of the indicators involved are obtained from the official website of the National Bureau of Statistics, the official websites of regional statistical bureaus and Wind database.

## 3.3. Empirical model estimation and analysis of results

### 3.3.1. Sample statistics description

Before conducting the empirical model estimation and analysis, descriptive statistics were conducted on the variables studied to capture the overall picture of the variables. The results of the sample statistical description of each variable are shown in Table 2.

Table 2 Descriptive statistics of variables

| Variable | Obs | Mean | Std. dev | Min | Max |
|---|---|---|---|---|---|
| Dig | 48 | 0.349 | 0.172 | 0.088 | 0.761 |
| Finance | 48 | 0.751 | 0.185 | 0.46 | 1.26 |
| Invest | 48 | 10.53 | 0.726 | 7.193 | 11.148 |
| Tech | 48 | 15.225 | 0.630 | 14.097 | 16.169 |
| Gov | 48 | 17.872 | 0.312 | 17.227 | 18.457 |
| Income | 48 | 10.312 | 0.183 | 9.987 | 10.638 |
| Old | 48 | 11.183 | 1.883 | 7.97 | 15.424 |

Source: The official website of the National Bureau of Statistics, the official websites of regional statistical bureaus and Wind database

Table 2 shows that the mean of digital economy is 0.349, the minimum is 0.088, and the maximum is 0.761. There are great differences in the level of digital economy in different provinces. Among them, Hubei, Henan and Anhui governments attach great importance to the development of digital economy industry, and their digital economy level is higher than other provinces. The average location entropy is 0.751, the minimum is 0.46 and the maximum is 1.26, which indicates that there are significant differences in the level of financial agglomeration in different provinces. The rest of the descriptive statistical results of the variables are detailed in Table 2.

### 3.3.2. Pearson correlation analysis

In order to test whether there is serious multicollinearity in the model, Pearson correlation test is conducted for each variable in this paper. The correlation coefficient matrix is detailed in Table 3.

Table 3 Pearson correlation test

| | | Dig | Finance | Invest | Tech | Gov | Income |
|---|---|---|---|---|---|---|---|
| Dig | | 1 | | | | | |
| Finance | | -0.180 | 1 | | | | |
| Invest | | 0.441*** | -0.217 | 1 | | | |
| Tech | | 0.887*** | -0.353** | 0.527*** | 1 | | |
| Gov | | 0.841*** | -0.344** | 0.408*** | 0.904*** | 1 | |
| Income | | 0.601*** | 0.099 | 0.182 | 0.596*** | 0.693*** | 1 |
| Old | | 0.726*** | -0.123 | 0.223 | 0.802*** | 0.734*** | 0.815*** |

*** p<0.01, ** p<0.05, and * p<0.1.

Table 3 shows that the level of technology input is highly correlated with the digital economy, the

level of technology input with government expenditure, and the level of government expenditure with digital economy at a significant level of 1%. Therefore, it is necessary to further test whether the model has multicollinearity problem[5-9].

### 3.3.3. Variable multicollinearity test

If there is multicollinearity among the variables, it will have an impact on the accuracy of the model, so the variables need to be tested for multicollinearity before regression. The test results are shown in Table 4.

Table 4 Variable multicollinearity test

| | Finance | Invest | Tech | Gov | Income | Old |
|---|---|---|---|---|---|---|
| VIF | 2.40 | 1.70 | 5.39 | 2.71 | 3.94 | 4.34 |
| 1/VIF | 0.41 | 0.59 | 0.19 | 0.37 | 0.25 | 0.23 |

In general, if VIF is greater than 10 or 1/VIF is less than 0.1, there is multicollinearity among the variables. As shown in Table 4, the VIF of all variables is less than 10 and 1/VIF is greater than 0.1. Therefore, there is no serious multicollinearity among the variables and subsequent regression analysis can be carried out.

### 3.3.4 Regression analysis

In this paper, the LM test and Hausman test were conducted for the mixed-effects model, random-effects model and fixed-effects model for the sample data, and the final p-value was 0.000, which rejected the original hypothesis. Thus, the fixed-effects model was chosen to be used for estimation. For the robustness of model parameter estimation, this paper first imported the core independent variables into the regression, and then imported the control variables one by one. The basic regression estimation results are shown in Table 5.

Table 5 Basic regression estimation results

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Finance | 0.396** | 0.456** | -0.186 | -0.396*** | -0.514*** | -0.522*** |
| | (2.54) | (2.24) | (-1.22) | (-4.21) | (-5.33) | (-5.36) |
| Invest | | -0.0175 | 0.0232 | 0.0928*** | 0.103*** | 0.108*** |
| | | (-0.47) | (0.96) | (5.56) | (6.52) | (6.34) |
| Tech | | | 0.305*** | -0.187*** | -0.246*** | -0.265*** |
| | | | (7.84) | (-2.99) | (-4.00) | (-4.00) |
| Gov | | | | 0.840*** | 0.396** | 0.384** |
| | | | | (8.45) | (2.16) | (2.07) |
| Income | | | | | 0.668*** | 0.659*** |
| | | | | | (2.79) | (2.74) |
| old | | | | | | 0.00786 |
| | | | | | | (0.80) |
| _cons | 0.0478 | 0.187 | -4.396*** | -12.49*** | -10.57*** | -10.09*** |
| | (0.40) | (0.58) | (-7.11) | (-12.17) | (-9.05) | (-7.67) |
| *N* | 48 | 48 | 48 | 48 | 48 | 48 |

t statistics in brackets; *** p<0.01, ** p<0.05, and * p<0.1.

Table 5 shows that the estimated coefficients of location entropy are significant in all regression models except for model (3). The model (6) shows that at a significant level of 1%, the location entropy increases by 1 unit, and the level of digital economy decreases by 0.522 units. The control

variables, such as capital investment, government support and urban residents' income, are significantly positively correlated with the level of digital economy, while the level of technology investment is significantly negatively correlated with the level of digital economy. In model (6), only the estimated parameters of aging are insignificant among the independent variables[10].

## 4. Conclusions and Policy Implications

Based on the panel data of six central provinces in China from 2013 to 2020, this paper uses a fixed effect model to explore the impact of financial agglomeration on the development level of digital economy. The following conclusions are drawn: firstly, with the continuous concentration and development of the financial industry in the six central provinces, the financial support for high-tech enterprises in various regions still cannot keep up with the improvement of the level of digital economy. Secondly, technology investment is still in the stage of high input and relatively low output, and the level of research and experimental development expenditure is greater than the growth rate of digital economy. Finally, the income level of urban residents and government support have a greater role on the digital economy, while the level of capital investment has a certain impact on the digital economy.

Based on the results of the empirical study, this paper draws the following policy implications. 1. Promote the digital transformation of inclusive finance. Strengthen the deep integration of finance and technology, promote the integration of "digitalization" + inclusive finance and improve the accessibility of financial services to different groups and fields. 2. Promote "artificial intelligence + big data", "blockchain + Internet of things" and other new financial services. Improved relevant laws and regulations and established to control the risks that may arise. Promote the development of digital inclusive finance so as to provide a good institutional environment for the healthy development of digital inclusive finance. 3. Accelerate the construction of digital industrialization. In the process of financial services for the real economy, improve the digital economy efficiency of the industry. Integrate the internal and external systems of the internet among the industrial chains. Improve the ability of the enterprise industrial chain in acquiring and applying data and information and make the enterprises and the industrial chain digital and intelligent in all aspects of production and operation management.4. Cultivate digital technology and artificial intelligence talents. Reform the talent training mechanism, and provide policy and financial support for talents through tripartite collaboration among the government, enterprises and higher education institutions to guarantee their further study and practical output.

## Acknowledgement

1) Shaoguan Philosophy and Social Science Planning Project (G2020010).
Research on the impact of financial agglomeration on regional economic growth
2) Social science topics in Guangdong province (GD22CGL02).
Research on financial risk prevention and control mechanism and governance countermeasures of low-carbon transformation of heavily polluting enterprises under the goal of "double carbon".

## References

*[1] Shi Dan, Sun Guanglin. Digital economy, financial efficiency and high-quality development of China's economy [J]. Enterprise Economy, 2022, 41 (01): 5-16+2.*
*[2] Yu Zhiqian, Zhu Ning. Digital economy, inclusive finance and economic growth [J]. Journal of Jinan (Philosophy and Social Sciences), 2021, 43 (11): 51-61.*
*[3] Teng Lei, Ma Degong. Can digital finance promote high-quality development? [J] Statistical Research, 2020, 37 (11): 80-92.*

*[4] Zhou Quan, Han Heyang. Fintech development, risk and regulation in the era of digital economy [J]. Scientific Management Research, 2020,38 (05): 148-153.*
*[5] Xing Huiqiang, Jiang Shuai. Improvement of information sharing mechanism of China's financial holding companies in the context of digital economy [J]. Financial Review, 2021,13 (06): 24-39+118.*
*[6] Yang Mengyang, Tang Xiaobin. Evaluation of the coupling coordination degree of digital finance and high-quality economic development [J]. Statistics and Decision, 2023,39 (03): 126-130.*
*[7] Li Zhen, Song Ke, Hou Jinning, et al. Economic policy volatility, digital finance development and bank liquidity creation [J]. Financial Regulation Research, 2022, No.129 (09): 21-40.*
*[8] Xu Weicheng, Fan Aijun. Digital finance, endogenous mechanism and real economic growth: A research perspective based on the financialization of real enterprises[J]. Journal of Shanxi University of Finance and Economics,2022,44(01):28-42.*
*[9] Wei Yanyan, Ma Xue. Measurement and analysis of digital economy development level in six central provinces[J]. Industrial Innovation Research, 2022,No.100(23):18-20.*
*[10] Wang Dingxiang, Hu Jian, Li Lingli. Interactive development mechanism and policy guarantee of digital finance and digital economy [J]. Contemporary Financial Studies,2023,6(01):1-17.*