The development of digital finance and corporate's investment efficient

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Abstract: Digital finance as an innovative and increasingly popular financial service has brought about a huge impact on the investment efficiency of companies. This paper assesses the relationship between the coverage breadth of digital finance and corporate investment efficient by using data from 2011 to 2018 from Beijing University's Digital Inclusive Finance Index and A-share listed companies in Shanghai and Shenzhen, by conducting ordinary least square regression analysis and heterogeneity analysis on the figures, and by passing a robustness test. The results indicate that the growth of digital finance will reduce corporate investment efficiency, and corporate investment efficiency is not associated with the scale of enterprises. The role of other factors on enterprise investment efficiency is also mentioned. The research in this paper has made it possible to realize that the rise of digital finance will not only benefit companies but that companies need to take steps to reduce the of digital finance and improve their efficiency investments wherever possible.

1. Introduction

The traditional financial system's channel structure has changed as a result of significant advancements in information technology, the means, and tools of financial application have also changed, and digital finance has gradually become the mainstream of the global financial industry.

As digital finance expands, China has experienced the Internet of traditional financial institutions and the era of Internet finance. Finally, in 2017, with traditional institutions also choosing digitization, China has ushered in the real era of digital finance [1]. After about 30 years of development in China, digital finance was manifested in the early stage of China's digital finance, such as banking, securities electronization, and informatization; In 2003, with the formation of the financial industry, such as Alipay, WeChat, the two mobile payment and Internet loan, crowd financing and Person to person Internet finance, the digital finance has developed rapidly in China's financial market [2]. From the initial stage of the development of digital Inclusive Finance, it has become an important measurement factor to illustrate the utilization rate and depth of digital finance from the perspective of coverage [3]. In other words, digital finance mainly brings the following three changes: the first is the change of payment channel structure; Secondly, the organization of transfer and liquidation has changed; The last is the change of data use method. The reason why digital finance in China has developed so rapidly is that the quick progression of digital technologies such as intelligent devices has reduced the cost of risk control and obtaining customers, and greatly improved the feasibility of inclusive development; As well as the restriction of audience groups in the formal financial sector and China's loose regulatory environment, China's digital finance is temporarily ahead [4]. And digital finance relies on the big technology platform, big data, and cloud computing to solve the problem of information asymmetry in finance. But at the same time, it also leads to data asymmetry, because the credit environment is imperfect, the supervision is not strict, the person-to-person industry works without the certificate, grows wantonly, and confusion such as the Ponzi scheme is quite common [5].

In the new economic environment, efficient investment has gradually become an important means to expand the business scale, improve the quality of economic growth and promote economic development. Nowadays, enterprises at home and abroad generally have the phenomenon of over-investment or insufficient investment, which will lead to stagnant capital or slow growth of the

company, so the development of the company is inseparable from the efficiency investment of the enterprise.

As for the investment efficiency of enterprises at the micro-level, the influencing factors are mainly described from three aspects [6]: the first is the principal-agent: mixed-ownership improves the investment efficiency of state-owned enterprises by reducing the principal-agent cost [7]. The next step is corporate governance: companies with good corporate social responsibility [8], and the quality of financial reports [9] will improve investment efficiency. Finally, the external environment: government intervention will affect enterprises to a certain extent; the level of local economic development, the process of marketization, the legal environment, the growth of non-state-owned enterprises, and the growth of the financial market are conducive to increasing the investment benefits of enterprises [10].

As a product of the development of the times, digital finance provides a new channel for enterprise financing; Let enterprises obtain low-cost capital sources from a wide range of financial products with simple and convenient operation in a small risk environment.

For the impact of digital finance at the enterprise level, many studies have shown that digital finance has an inseparable relationship with enterprises. On the positive level, it increases the availability of financing and reduces the financing cost, to promote enterprise investment for financial technology by alleviating enterprise financing constraints [11]; Further research shows that in areas with low marketization levels, the improvement of enterprise investment efficiency is more significant [12]; In addition, technology-based enterprises can alleviate the lack of investment by reducing the cost of debt and increasing cash holdings [13]. On the other hand, the over-investment behavior of enterprises increases the inefficient investment of enterprises; The continuous appreciation of enterprises can weaken the driving effect of digital Finance on enterprise financial investment [14]; In areas where per capita GDP is less than the normal standard, digital inclusive development will inhibit investment efficiency [15]; The development of digital finance will promote the financialization of enterprises, which will lead to the transformation of enterprises from real to virtual, and play a more significant role in promoting non-state-owned enterprises and non-family enterprises [16].

Obviously, digital finance will have a certain impact on the investment efficiency of enterprises, and this impact has two sides. However, many factors affect the investment efficiency of enterprises. Whether the effect of digital finance will also be different due to the change of factors and the degree of impact. This paper will try to answer the above questions to standardize the impact of digital Finance on investment efficiency, and thus we can manage digital finance through conclusions to better improve corporate capacity and promote better social and economic development.

Through the preliminary analysis and comparison of the above relevant literature, the major contributions of this paper are mainly reflected in: first, most of the existing literature only single mentioned a factor related to enterprise investment efficiency to investigate the connection with digital finance, and there are few complete and systematic induction and analysis of the differences under different factors. Therefore, the influence of digital Finance on investment efficiency needs to be studied. Second, this paper will analyze the relevance between digital finance and enterprise inefficient investment from the aspect of the coverage of digital finance, to obtain the impact on enterprise investment efficiency.

The following parts of this paper are structured in the following order: The second section contains the data sources; model setting, variable definitions; and descriptive statistical analysis. The third part contains the empirical results and the analysis of heterogeneity. The fourth part is the robustness test. The fifth part is the conclusion.

2. Research design

2.1. Data sources

The digital inclusive financial index used in this paper comes from the digital inclusive financial index of Beijing University from 2011 to 2018. The sample includes three levels of indexes from 2011

to 2018: 31 provinces in the mainland, 337 cities above the prefecture level, and about 2800 counties. It not only compiled the overall index but also included the coverage, use depth, digitization degree, payment, insurance, loan base, credit, and other sub-indexes of digital Inclusive Finance. It completely depicts the state of digital finance development in China's major regions. The research samples are A-share listed businesses in Shanghai and Shenzhen from 2011 to 2018. The Chinese Stock Market & Accounting Research (CSMAR) database was used to gather the data for this study. CSMAR is an authoritative and accurate financial database developed by Guotai'an company from the needs of academic research, based on the professional standards of internationally renowned databases and combined with China's actual national conditions, in response to the needs of professional scholars in colleges and universities, financial and securities institutions, and social research institutions for China's financial and economic analysis and research.

The reason why 2011 was chosen as the starting point for the study was that it was from 2011 that the Digital Finance Index began to be more fully disclosed. Before the test, the original sample data were processed according to certain conditions as follows: firstly, the sample of companies in the financial sector was excluded, secondly, the sample of companies that were ST and *ST was proposed, and finally, the sample with missing values for the variables was excluded. Considering the effect of extreme values, a bilateral tailing of 1% was applied to the main continuous variables using the winsorize method.

2.2. Model setting and Inefficient investment

To study the influence of digital finance on the investment efficiency of companies, the non-investment efficiency of enterprises is first measured and the following empirical research model is constructed:

$$invest_{it} = \beta_0 + \beta_1 * invest_{it-1} + \beta_2 * size_{it-1} + \beta_3 * lev_{it-1} + \beta_4 * growth_{it-1} + \beta_5 * age_{it-1} + \beta_6 * ret_{it-1} + \beta_7 * CFO_{it-1} + \sum \beta_i \, industry + \sum \beta_j \, year + \varepsilon_{it} \qquad (1)$$

In model 1, the dependent variable $invest_{it}$ is the current investment scale of the enterprise, i and t in the subscript represent the enterprise and year respectively, and it-1 is the previous period of the enterprise. At the same time, the variables are controlled respectively: size is the enterprise-scale, Lev is the capital structure, growth is the growth rate of main business income, age is the enterprise age, RET is the stock return, and CFO is the net cash flow of operating activities; And also control the industry effect an annual effect. ε_{it} is the random error term of the model. This study uses model one to calculate the optimal investment scale of the enterprise in the current period, and then uses the actual investment scale minus the optimal investment scale. The absolute value of the residual part represents the inefficient investment level of the enterprise.

The explanatory variable of the econometric model is inefficient investment. Whether the enterprise is inefficient investment is measured by calculating the difference of investment scale. By using the residual measurement (Richardson) model, the absolute value of the residual of model 1 is taken, so the greater the value, the smaller the investment efficiency [17]. In particular, the absolute value of the residual indicates the amount of ineffective investment made by the enterprise. If the residual is bigger than 0, it indicates excessive investment; if the residual is lower than 0, it indicates insufficient investment. The specific calculation formula of investment is: enterprise's new capital investment = (fixed assets + intangible assets + other long-term assets - disposal of fixed assets - intangible assets - cash amount recovered from other long-term assets) / total assets at the beginning of the period.

2.3. Variable definition

The core explanatory variable is the coverage breadth of digital finance. By using the Peking University Digital inclusive finance index as the proxy variable of digital finance and the massive data of ant Financial Services Group on digital Inclusive Finance, it can more appropriately and scientifically reflect the growth status of China's digital HP finance under the trend of China's innovative digital finance. This article will focus on the correlation between the coverage of digital

finance and the outcome variable. The coverage of China's digital finance was the most important factor to promote the growth of the index in the early stage. The coverage of digital finance increased from the provincial capital, municipalities directly under the central government, and coastal cities in the east of central China in 2011. By 2018, only four or five regions in Southwest China did not reach 60% of the cities with the highest financial index. It shows that digital finance has a wider penetration ability inaccessibility [18].

In addition to the explanatory variable digital finance, other control variables that may affect the investment efficiency of enterprises are added to the measurement model to reduce the omission bias. The control variables are mainly selected from two aspects. The first is the enterprise characteristic variables: including the conclusion of the period's total asset and total liabilities, the age of the enterprise, the nature of the enterprise, and the rate of return on assets; The second is corporate governance variables: ownership concentration, the board size, number of independent directors and executive compensation. The specific definitions of all variables in this paper are shown in Table I.

Table.1. Variable Definition

Variable	Definition
Coverage breadth	The breadth of digital financial development, as defined in the text
Inefficient investment	As defined in the text
Asset	Total assets show at the end of the period
Debt	Total liabilities shows at the end of the period
Age	Length of time for a company to be listed
Top1	The greatest shareholder's shareholding ratio. The greatest shareholder's percentage of shares increases as the value of the company rises.
SOE=1	State-owned enterprises = 1, Non-state-owned enterprises = 0
Foreign=1	Foreign-owned enterprises = 1, Non- Foreign-owned enterprises = 0
Board Size	Number of directors on the board
No. of Independent Director	Number of independent directors
Salary	Executive compensation, including salary, bonus, and long-term incentive compensation
ROA, %	Return on assets, net profit to total assets at the end of the period

2.4. Descriptive statistical analysis

Table II shows the descriptive statistics for the main variables. The mean value of the breadth of digital financial inclusion coverage is 193.2397, with a standard deviation of 60.7071, and the level of vertical development of digital finance is generally quite good. The mean value of the inefficient investment is at 2.7, while the maximum value is 37.021. The average net worth of enterprises is 507,382.7 (unit: 10,000 yuan). The average time to market for companies is about 9.5. The average shareholding of the first largest shareholder is 35.082%. The mean value of SOEs is 0.3766, indicating that 37.66% of the sample observations are SOEs, while the mean value of FOREIGN is 0.0482, indicating that only 4.82% of the sample data are foreign-owned. With an average board size of approximately 8.6 and a mean number of independent directors of approximately 3.2, companies do not vary significantly in terms of board composition. The standard deviation of executive remuneration is 357.9202, implying a wide variation in the level of senior officials' salaries. The mean value above the return on assets was 4.4138%, slightly below normal, with an overall average level of corporate profitability.

Table.2. Variable Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Coverage Breadth	193.2397	60.7071	-10.49	290.3175
Inefficient investment	2.7092	5.6641	0	37.021
Asset, unit: 10000 Yuan	1309503	4177095.3	18657.975	45434239
Debt, unit: 10000 Yuan	802120.3	2967420.7	3627.572	33624640
Age	9.5128	7.2835	0	25
top1	35.082	15.2319	.29	99
SOE=1	.3766	.4845	0	1
Foreign=1	.0482	.2141	0	1
Board Size	8.6247	1.7189	5	15
No. of Independent Director	3.1852	.5694	2	5
Salary, unit: 10000 Yuan	370.8776	357.9202	15.7712	2411.08
ROA, %	4.4138	6.3487	-32.8121	23.4179

3. Empirical results

3.1. Baseline regression results

Table III reports the results of the impact of digital financial coverage breadth on firms' inefficient investment by performing ordinary least square regression analysis on the data. Column (1) shows that in the absence of any control variables and the absence of time dummy variables and industry dummy variables, the results find that the breadth of digital financial coverage is positively related to inefficient investment and is significant at the 5% level, indicating that the breadth of digital financial coverage promotes inefficient investment by firms; column (2) shows that these findings remain after the inclusion of two major types of control variables, namely firm characteristics, and corporate governance These findings remain unchanged when the two control variables of firm characteristics and corporate governance are included in column (2).

To determine more precisely the impact of the breadth of coverage on inefficient investment, the regression coefficient of the breadth of coverage on inefficient investment in column (3) is negative and not significantly correlated when only the two dummy variables of time and industry are included; while in column (4), after the inclusion of control variables, it can be found that for every 1 unit increase in the breadth of digital financial coverage, the level of inefficient investment of firms increases by 0.0044 units, statistically highly significant at the 1% level, with the result that digital financial development reduces firms' investment efficiency.

Regarding the results between the control variables and inefficient investment, it can be seen from column (4) that the length of time a firm has been listed, the firm's total debt, and the number of independent directors in the firm are all positively related to inefficient investment in the firm and are highly significant at the 1% level; while the number of independent directors has the hugest effect on inefficient investment among these three control variables when the number of independent directors rises by one unit, the firm's inefficient investment level rises by 0.3396 units. The coefficients of director size, executive pay, and return on assets are negative and highly significant at 1%; when all three control variables increase by one unit, the level of inefficient investment decreases by 0.1015, 0.3288, and 0.0495 units respectively, thus showing that executive pay has the greatest effect on reducing inefficient investment. Age squared, total firm assets, and whether the firm is foreign-owned or not are negatively correlated at a significant level of 5%, and these factors likewise reduce inefficient

investment in the firm. Finally, the first largest shareholder and whether the firm is a state-owned enterprise have no significant positive correlation with inefficient investment.

Table.3. Benchmark regression

VARIABLES	(1) OLS Inefficient Investment	(2) OLS Inefficient Investment	(3) OLS Inefficient Investment	(4) OLS Inefficient Investment
Coverage Breadth	0.0014**	0.0013**	-0.0013	0.0044***
	(0.0006)	(0.0007)	(0.0016)	(0.0016)
Age		0.1285***		0.1449***
		(0.0230)		(0.0239)
Age-sq		-0.0008		-0.0022**
		(0.0010)		(0.0011)
Ln asset		-0.3978***		-0.2779**
		(0.1119)		(0.1157)
Ln debt		0.4212***		0.2404***
		(0.0829)		(0.0871)
top1		0.0043		0.0001
		(0.0029)		(0.0031)
SOE=1		0.0632		0.1246
		(0.1164)		(0.1247)
Foreign=1		-0.3294**		-0.3145**
		(0.1480)		(0.1486)
Board Size		-0.1366***		-0.1015***
		(0.0373)		(0.0381)
No. of Independent Director		0.3684***		0.3396***
		(0.1157)		(0.1167)
Ln salary		-0.2378***		-0.3288***
		(0.0674)		(0.0705)
ROA, %		-0.0540***		-0.0495***
		(0.0098)		(0.0100)
Constant	2.4397***	4.8603***	2.2521***	7.3010***
	(0.1301)	(1.1923)	(0.4899)	(1.3375)
Observations	18,854	18,854	18,854	18,854
R-squared	0.0002	0.0419	0.0365	0.0624
Data	Unbalanced	Unbalanced	Unbalanced	Unbalanced
Industry Dummy	No	No	Yes	Yes
Year Dummy	No	No	Yes	Yes

Note: * significant at 10% level
** significant at 5% level
*** highly significant at 1% level

3.2. Heterogeneity analysis

In this section, table IV examines whether digital financial development has a heterogeneous influence on the efficiency of corporate investment by altering dummy variables and their interaction

terms with the breadth of digital financial coverage.

Column (1) of Table 4 also demonstrates that in the absence of control variables and time and industry dummy variables, the coefficient of interaction term has a significant positive correlation of 10%. Column (2) displays that the coefficient on the indicator is positive and passes the 5% statistical significance test when control variables are included. This illustrates that the development of digital finance has a greater impact on the investment efficiency of firms with total assets in the 50th percentile of the firm's current year.

Next, after adding year and industry dummy variables to the variable conditions in (1) and (2) respectively, no significant relationship was found between the interaction terms. This suggests that there is no size heterogeneity in the effect of digital financial development on firms' investment efficiency.

Table.4. Heterogeneity analysis results

VARIABLES	(1) OLS Inefficient Investment	(2) OLS Inefficient Investment	(3) OLS Inefficient Investment	(4) OLS Inefficient Investment
Coverage Breadth	0.0010	0.0017**	-0.0017	0.0040**
	(0.0007)	(0.0007)	(0.0017)	(0.0017)
Dummy	-1.6334	-3.0259***	-1.3319	-1.3150
	(1.0805)	(1.0965)	(1.1523)	(1.1618)
Dummy × Coverage Breadth	0.0071*	0.0101**	0.0049	0.0036
	(0.0042)	(0.0043)	(0.0044)	(0.0044)
Constant	2.4940***	4.3430***	2.2790***	6.9278***
	(0.1350)	(1.2064)	(0.4919)	(1.3655)
Observations	18,854	18,854	18,854	18,854
R-squared	0.0004	0.0424	0.0366	0.0626
Data	Unbalanced	Unbalanced	Unbalanced	Unbalanced
Controls	No	Yes	No	Yes
Industry Dummy	No	No	Yes	Yes
Year Dummy	No	No	Yes	Yes

4. Robustness test

To assure the reliability of the main conclusions of this paper, the fixed-effect model is used to re-estimate the model. As shown in Table V, the data in these four columns are balanced panel data. In column (1), there is a highly significant positive correlation between the coverage of digital finance and inefficient investment of 1% before adding year dummy variables and control variables; however, there is no significant correlation between coverage and inefficient investment after adding control variables in column (2). Next, the time fixed effect is controlled, that is, the year dummy variable is added, but there is no control variable in column (3), so there is no significant correlation; When all control variables are included in column (4), the regression coefficient is positive and correlates with 5%. Thus, the robust test results show that the above conclusions are still robust.

Table.5. Robust test

VARIABLES	(1) Panel FE Inefficient Investment	(2) Panel FE Inefficient Investment	(3) Panel FE Inefficient Investment	(4) Panel FE Inefficient Investment
Coverage Breadth	0.0044***	-0.0001	0.0030	0.0061**
	(0.0009)	(0.0011)	(0.0024)	(0.0025)
Constant	1.9747***	2.0720	2.1041	4.2852*
	(0.1622)	(1.9942)	(1.4096)	(2.4640)
Observations	13,344	13,344	13,344	13,344
Number of id	1,668	1,668	1,668	1,668
Data	Balanced	Balanced	Balanced	Balanced
Controls	No	Yes	No	Yes
Year Dummy	No	No	Yes	Yes

5. Conclusion

Using the inclusive index of digital finance of Peking University from 2011 to 2018 and the enterprise data from A-share listed companies in Shenzhen and Shanghai, this paper explores the impact of digital Finance on the investment efficiency of enterprises. The results suggested that the development of digital finance coverage breadth reduces the investment efficiency of enterprises. And the investment efficiency has nothing to do with whether the enterprise is a large-scale enterprise or a small and medium-sized enterprise. The coverage of digital finance does have effects on the investment efficiency of enterprises, and has a negative effect; there is no heterogeneity of enterprise-scale in the impact of the growth of digital Finance on enterprise investment efficiency.

Combined with the conclusions of this paper and relevant literature, show that digital finance as an innovative development is bound to have advantages and disadvantages, and the findings of this paper also confirm that the expansion of financial figures can have a harmful influence on the investment efficiency of both large and medium and small-sized enterprises. As one of the most important criteria for evaluating the development of corporate investment, it is important for companies to focus on the advantages and disadvantages of digital finance to make better use of it and to avoid harm, as increasing the coverage of digital finance will only lead to a reduction in efficiency, but to focus on how to use it in depth to bring benefits to the company.

References

[1] L. Zhou, A review of research on the development of digital inclusive finance[J]. China: Finance and Accounting Monthly, 2022(01). p. 147-153.

[2] H. Huang, The development of digital finance in China: Convergence and change[J]. China Development Monitor, 2018(16). p. 27-28.

[3] F. Guo, J. Wang, F. Wang, T. Kong, X. Zhang, and Z. Cheng, Measuring the development of digital inclusive finance in China: Index compilation and spatial characteristics. Quarterly Journal of Economics, 2020. p. 1401-1418.

[4] Y. Huang, and Z. Zhuo, Digital financial development in China: present and future[J]. Economics Quarterly, 2018(04). p. 1489-1502.

[5] Z. Wang, H. Li, and L. Sun, The development and governance of digital finance: from information asymmetry to data asymmetry[J]. Financial Theory and Practice, 2019(12). p. 25-30.

[6] P. Xia, and J. Cui, A review: on investment efficiency[J]. Times Economic and Trade, 2018, No.443(18). p. 86-87.

[7] S. Chen, X. Huo, and Y. Ren, Mixed ownership reform and investment efficiency of state-owned enterprises - based on the perspective of principal-agent conflict and inter-shareholder conflict[J]. Friends of Accounting, 2021, No.664(16). p.143-150.

[8] M. Benlemlih, and M. Bitar, Corporate Social Responsibility and Investment Efficiency. J Bus Ethics, 2018(148). p. 647–671.

[9] R. S. Verdi, Financial Reporting Quality and Investment Efficiency, 2006.

[10] W. Xie, Research on inter-provincial differences in investment efficiency of Chinese enterprises and the influencing factors[J]. Research on Quantitative Economics and Technology Economics, 2018, 35(09). p. 41-59.

[11] R. Zhang, Y. Zhang, and J. Liu, A study on fin tech and corporate investment behavior - an impact mechanism based on financing constraints[J]. Management Review, 2021, 33(11):312-323.

[12] P. Lv, and H. Xiong, Can FinTech improve corporate investment efficiency? Evidence from China. Research in International Business and Finance, 2022, v.60.

[13] Y. Zhang, and Y. Chang, An empirical test of the impact of digital finance on the investment efficiency of technology-based enterprises[J]. Statistics and Decision Making, 2020, v.36; No.556(16). p. 179-183.

[14] J. Sun, and Y. Shen, How does digital finance affect the financial investment of real enterprises? --Heterogeneity characteristics, mechanism testing and motivation identification[J]. Modern Economic Inquiry,2021(09). p. 56-68.

[15] X. Li, The impact of digital inclusive finance development on investment efficiency of real economy[D]. Chongqing University of Technology, 2020.

[16] Z. Li, and Q. Yang, Digital finance and financialization of enterprises[J]. Journal of Yunnan University of Finance and Economics, 2021,37(12). p. 52-70.

[17] Z. Yang, F. Liu, and M. Li, Interest rate marketization, inefficient investment and capital allocation--a natural experiment based on the People's Bank of China's removal of upper and lower limits on lending rates[J]. China: Financial Research, 2017(05). p. 81-96.

[18] F. Guo, J. Wang, F. Wang, T. Kong, X. Zhang, and Z. Cheng, Measuring the development of digital inclusive finance in China: index compilation and spatial characteristics. Working paper, Digital Finance Research Center, Peking University, 2019.