

Research on the impact effect of enterprise digitalization on “from real to virtual”: concurrently discuss the regulation effect of macro policy

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Abstract. The digitalization process of enterprises is accelerating day by day, which has brought many influences on the development of enterprises. This paper discusses the impact of digitalization of listed enterprises on financialization from 2013 to 2020 and explores ways and methods to change this relationship combined with macro policies. The results show that: first, when the digitalization degree of enterprises increases, their financialization level will also increase; Second, monetary policy has a significant moderating effect on the economic relationship between enterprise digitalization and financialization. Tight monetary policy helps to slow down the process of “from virtual to real” of enterprises. Third, the regulatory effect of monetary policy on enterprises mainly exists in the quantitative monetary policy. In this way, to revive the real economy, it is necessary to return to the traditional quantitative monetary policy regulation, steadily improve the transmission efficiency of monetary policy tools such as open market operations, and maintain the stable operation of entity enterprises.

Keywords: Enterprise digitization; Enterprises Financialization; From real to virtual; Monetary policy control.

1. Introduction

With the introduction of the 14th Five-Year Plan, the construction of digital China and digital transformation have been accelerated. Digital transformation based on cloud computing, big data, the Internet of Things, artificial intelligence, blockchain and other digital technologies can bring new market opportunities to enterprises, try new business models, and occupy a position in the future business market in advance. From the perspective of enterprises, the arrival of the digital wave has broken the information barrier, changed the traditional production-oriented business model, and increased the ability of enterprises to resist risks. Some studies indicate that Since the COVID-19 pandemic, enterprises with a better degree of digitalization have better resistance to the epidemic impact (Ha, 2022). Therefore, based on the new development stage, we should fully implement the new development concept to improve the digital economy governance system, jointly promote digital industrialization and industrial digitalization, and empower the transformation and upgrading of traditional industries.

However, digital development may also bring the “from real to virtual” problem. “From real to virtual” is to tilt enterprise resources to short-term financial assets. Although holding short-term financial assets can reduce the financial risks faced by enterprises, which is manifested as a “reservoir effect” and a “Batten Down the Hatch” activity, However, excessive enterprise financialization will form a “crowding-out effect”, which will reduce the investment willingness of enterprises in the entity industry, and then increase the virtual economy, which will cause adverse influence to the real economy (Huang et al., 2018).

In this study, we will examine the impact of enterprise digitalization on enterprise financialization. This paper will make contributions in the following aspects: in the second part, we will analyze the influence direction of the degree of digitalization of enterprises on the financialization of enterprises, and in the third part, we will explore the regulating effect of quantitative and price-based monetary policies on the relationship between the two, and finally give some suggestions on restraining the “from real to virtual.”

2. Literature review on the relationship between enterprise digitalization and financialization

In the existing literature, scholars have conducted a lot of research on the development of enterprise digitalization: enterprise digitalization affects enterprise financialization. Some domestic scholars, based on the entity enterprise financialization research perspective, with the use of mediating effect model and moderating effect model, studies the internal driving mechanism and function mechanism of digital finance promoting entity enterprise growth, It was discovered that digital finance might stop the financialization tendency of the enterprises derived from "reaping some profit" and improve the development of enterprises by fostering technological innovation for the enterprises with stronger development strengths and better external environments. Digital finance could limit the financialization tendency of the enterprise generated from "searching for development" and improve enterprise growth by promoting capital accumulation the enterprises with lower development strength and a harsher external environment (Xu and Fan, 2022). From the perspective of financial regulation, Li et al. (2021) studied how the effect of corporate financialization on the application of digital technology is affected by the intensity of financial regulation and concluded that strong financial regulation can effectively reduce the negative impact of corporate financialization on the application of digital technology. Wang and Hu (2022) studied the influence mechanism and effect of CEOs with technical backgrounds on corporate financialization based on the imprinting theory. It is concluded that CEOs with technical backgrounds have a significantly negative impact on corporate financialization behavior. In the highly uncertain environment, the CEOs with the technical background of the overall sample enterprises still insist on abandoning the virtual and following the real, but the CEOs with technical backgrounds of private enterprises have no significant impact on the financialization of enterprises under the above scenarios. In addition, regardless of the level of environmental uncertainty, the inhibitory effect of CEOs with technical backgrounds on the degree of corporate financialization is always insignificant in private enterprises, which is because it is always difficult to solve the financing constraints of private enterprises. Ren Xiaoyi et al. (2022) studied the impact of corporate financialization on digital transformation based on the two main lines of cash flow and financing constraints and concluded that the higher the level of corporate financialization is, the lower the level of digital transformation will be. Further research finds that from the perspective of enterprise attribute structure characteristics, financialization has a more significant inhibitory effect on the digital transformation of state-owned enterprises and high-tech enterprises; From the perspective of the financialization term structure, the negative impact of long-term financialization on digital transformation is more obvious, while the impact of short-term financialization is not significant enough.

Some foreign scholars, such as Denis & Sibilkov (2010), studied the relationship between financial constraints and investment level based on the perspective of corporate financial constraints. The results show that for constrained firms with high hedging demand, higher cash holdings are associated with higher investment levels, and the positive correlation between investment and the value of constrained firms is significantly stronger than that of unconstrained firms. Some studies, based on the discussion of the implications of financialization for the continuous innovation of non-financial firms, used the Richardson residual measurement model to measure the deviation between the optimal financialization and the optimal financialization of firms, that is, excessive financialization may crowd out the persistence of innovation, but moderate financialization may promote the persistence of innovation(Xie et al., 2020). Klinge (2022) studied that large companies tend to use financial instruments to increase their profits as the degree of digitalization increases and they become monopolistic, based on the perspective of the monopoly formed by the construction of digital infrastructure. This stems from the fact that these firms generate above-average profits, allowing the continuous accumulation of financial assets.

Now, many previous literature studies are studying how enterprise digitalization affects enterprise financialization. The innovation of this paper is to find a regulation method between the two, that is, a way to slow down this transmission relationship.

3. Model design, variable description, and descriptive statistics

3.1 Model design

The empirical model of this paper is designed as follows:

3.2 Variable description

According to the availability of data, this paper takes A-share listed companies from 2013 to 2020 as research samples. The original data are processed as follows : (1) financial listed companies are excluded, because the goal of some financial companies is not profit maximization; (2) Excluding ST and *ST listed companies during the sample period; (3) Eliminate the samples with missing key index values, because it may make the results inaccurate; (4) In addition, there is a word frequency table about enterprise digitalization grabbed by Python in the annual reports of publicly issued enterprises. Used to represent the development degree of enterprise digitalization.

3.3 Explanatory variables

On development degree of enterprise digitalization (Dig) measure is divided into the following steps, first of all, based on keywords, determine the corresponding sifting targets. Second, obtain the 2013-2020 annual financial reports of listed companies, crawl and statistics in Python these words appear in the annual report, and form a word frequency table. The word frequencies in the annual reports of these listed companies are then grouped according to the industry variables to which the enterprises belong, and then the obtained values are normalized to reflect the degree of digitalization development of enterprises, and the variable Dig, which represents the degree of digitalization of enterprises, is obtained.

3.4 Explained variable

The degree of enterprise financialization (Fin) reflects the proportion of short-term financial assets held by enterprises in the total assets of enterprises.

Table 1. Definition of variables

Variable types	Variable code	meaning	Calculation method
Explained variable	<i>Fin</i>	Degree of enterprise financialization	(Trading financial assets + financial derivative+ other receivable + Buying back the sale of financial assets + non-current assets due within 1 year + other liquid asset+ loans and advances + Financial assets available for sale + held-to-maturity investment + long-term equity investment+ investment real estate + other non-current assets)/total assets
Core explanatory variable	<i>Dig</i>	development degree of enterprise digitalization	The data about enterprise digitalization are classified according to the industry and then normalized.
Other explanatory variables	<i>M2s</i>	M2 growth rate	The quantitative monetary policy M2 is processed by the logarithmic difference
moderator variable	<i>Interest_w</i> <i>Interest_{w2}</i>	The interest rate	
Instrumental variable	<i>Dig L1</i>	The development degree of enterprise digitalization lags one period	<i>Dig*M2s</i> <i>Dig*Interest</i>
	<i>Profit</i>	Profit levels	Net profit/total assets
Control variables	<i>Size</i>	The enterprise scale	Natural logarithm of total assets
	<i>TobinQ</i>	Tobin Q value	Total market value/total assets
	<i>CashFlowStatus</i>	Cash flow status	Net operating cash flow/total assets
	<i>Lev</i>	Financial leverage	Total liabilities/total assets

3.5 Descriptive statistics

Table 2 reports the descriptive statistical results of the main variables. The control variables in this paper mainly include the profit level, enterprise size, Tobin Q, cash flow status, financial leverage and other financial statement related variables. Due to the late start of digitalization in China, we choose to use data after 2013 to process. The monetary policy includes quantitative monetary policy and price monetary policy. From the analysis of the digitalization degree of enterprises (normalized) in this paper, the mean value is 0.187, indicating that the digitalization level of enterprises in China is not very high.

Table 2. Descriptive statistics

variable	The mean	The standard deviation	The minimum	The maximum
<i>Fin</i>	0.146	0.137	0.001	0.928
<i>Dig</i>	0.187	0.224	0.000	1
<i>Profit</i>	0.029	0.202	-4.946	7.446
<i>Size</i>	22.051	1.132	19.218	28.257
<i>TobinQ</i>	2.462	1.823	0.756	31.4
<i>CashFlowStatus</i>	0.051	0.081	-0.524	0.64
<i>Lev</i>	0.381	0.245	0.011	4.995
<i>Interest</i>	1.844	0.599	1.500	3
<i>M2s</i>	0.097	0.015	0.079	0.125

4. Empirical analysis

4.1 Benchmark model estimation

It can be seen from the benchmark regression results in Table 3 that enterprise digitalization has a positive influence on enterprise financialization, and the regression coefficient is significant at the level of 1%. This shows that with the increasing degree of digitalization of enterprises, the degree of financialization of enterprises is also increasing. From the perspective of control variables, the profit margin of enterprises curbs financialization, and the regression coefficient is significant at the level of 1%. The enterprise size has a promoting effect on "moving from real to virtual," indicating that enterprises with larger scale are more willing to hold short-term financial assets and carry out financial business. Financial leverage has a significantly negative impact on financialization, which indicates that companies with large liabilities are not willing to increase the level of financialization, which may be caused by the financial supervision and financing constraints.

Table 3. Benchmark regression results

Variable types	Y: <i>Fin</i>	Estimation results
Core explanatory variable	<i>Dig</i>	0.040*** (0.011)
	<i>Profit</i>	-0.140*** (0.021)
	<i>Size</i>	0.013*** (0.003)
	<i>TobinQ</i>	0.004*** (0.004)
	<i>CashFlowStatus</i>	-0.055** (0.031)
Control variables	<i>Lev</i>	-0.169*** (0.016)
	<i>_cons</i>	-0.086 (0.063)

Note: The figures in the bracket are robust standard errors, and *, ** and *** represent significance at the levels of 10%, 5% and 1%, respectively.

4.2 Robustness test

4.1 Replacement sample test

This paper conducts the replacement sample test by changing the observation period. The period of the original sample is from 2013 to 2020. This paper conducts a robustness test by eliminating data of 2013 and 2020. It is not difficult to find from Table 4 that the coefficient of *Dig* changes from 0.040 to 0.029 and 0.053, and the coefficient changes are not obvious, indicating that the different sample selection does not have a great impact on our conclusion, and the research is still robust.

Table 4. Robustness test: replacement sample test

Variable types	<i>Y: Fin</i>	(1) Excluding 2013 samples	(2) Excluding 2020 samples
Core explanatory variable	<i>X: Dig</i>	0.029** (0.012)	0.053*** (0.012)
	<i>Profit</i>	-0.133*** (0.022)	-0.150*** (0.023)
	<i>Size</i>	0.007** (0.003)	0.016*** (0.003)
	<i>TobinQ</i>	0.294 (0.001)	0.005*** (0.001)
	<i>CashFlowStatus</i>	-0.056** (0.033)	-0.046 (0.032)
Control variables	<i>Lev</i>	-0.183*** (0.018)	-0.172*** (0.018)
	<i>_cons</i>	0.073 (0.068)	-0.170** (0.069)

Note: The figures in the bracket are robust standard errors, and *, ** and *** represent significance at the levels of 10%, 5% and 1%, respectively.

4.2 Bidirectional causality test

There may be a bidirectional causality between enterprise digitalization and enterprise financialization, that is, enterprise financialization will promote enterprise digitalization in turn, and this mutual reverse causality will lead to endogeneity problems. We conduct counterfactual tests and find that the impact of corporate financialization on corporate digitalization is indeed positive and significant, which proves the existence of endogeneity. This may indicate that the level of enterprise financialization will in turn promote the degree of digitalization of enterprises.

To this end, this paper uses the one-period lagged data *Dig* L1 of enterprise digitalization degree as the instrumental variable of enterprise digitalization. This is because the one-period lag data of *Dig* has a certain correlation with *Dig* itself, and the digitalization achievements of last year will affect the development trend of enterprise digitalization this year to meet the endogeneity of instrumental variables; On the other hand, the one-period lagged *Dig* data has very little impact on the current degree of corporate financialization and meets the exogeneity of instrumental variables. The empirical results of this paper based on the two-stage instrumental variable estimation method are shown in the following table.

The estimated coefficient of the first stage is 0.735 and significant at the level of 1%, indicating that *Dig* L1 has a significantly positive impact on *Dig*. The following table reports the regression results for the second stage using instrumental variables. From the results, after solving the endogeneity problem, digitalization has a positive promoting effect on corporate financialization, and the regression coefficient is significant at the level of 1%, which is basically consistent with the benchmark regression, confirming the robustness of the estimation results.

Table 5. Counterfactual test

Variable types	<i>Y: Dig</i>	Estimation results
Core explanatory variable	<i>Fin</i>	0.106*** (0.030)
	<i>Profit</i>	-0.066** (0.035)
	<i>Size</i>	0.047*** (0.005)
	<i>TobinQ</i>	0.003 (0.002)
	<i>CashFlowStatus</i>	-0.312*** (0.050)
Control variables	<i>Lev</i>	-0.060*** (0.027)
	<i>_cons</i>	-0.825*** (0.102)

Note: The figures in the bracket are robust standard errors, and *, ** and *** represent significance at the levels of 10%, 5% and 1%, respectively.

Table 6. Endogeneity test: two-stage least squares method

Variable types	The first stage		The second stage	
	<i>Y: Dig</i>	Estimation results	<i>Y: Dig L1</i>	Estimation results
Explanatory variables	<i>Dig L1.</i>	0.735*** (0.015)	<i>Dig</i>	0.059*** 0.017

Note: The figures in the bracket are robust standard errors, and *, ** and *** represent significance at the levels of 10%, 5% and 1%, respectively.

5. Test on the moderating effect of monetary policy on the phenomenon of "from real to virtual"

We further consider how monetary policy regulates this relationship, including how quantitative monetary policy M2 and price monetary policy interest rate affect this relationship. Here we will introduce the mediating effect model.

First, we do the logarithmic difference of quantitative monetary policy M2 to obtain the growth rate of M2: M2s. We will use M2s to study, and at the same time use the moderating effect model to study the relationship. We let the $w = \text{Dig} * \text{M2s}$

Table 7. Moderating effect model Quantitative monetary policy

Variable types	<i>Y: Fin</i>	Estimation results
Core explanatory variable	<i>Dig</i>	-0.099 (0.074)
Other explanatory variables	<i>M2s</i>	-1.459*** (0.231)
Moderator variable	<i>w</i>	1.277* (0.774)

It can be seen from the table that w has a positive and significant moderating effect, which is significant at the level of 1%, indicating that quantitative monetary policy regulation can affect the relationship between the two, and can inhibit the impact of digitalization on financialization. Therefore, the government can reduce the "from real to virtual" of enterprises through contractionary quantitative monetary policy. We also substitute $w2 = \text{Dig} * \text{Interest}$ into the Interest rate for regression.

It can be seen from the table that the result of $w2$ is not significant, and it can be concluded that price-based policy regulation does not significantly affect the relationship between the two. This

shows that the price-based monetary policy has not yet affected the level of enterprise financialization in China.

Table 8. Moderating effect model Price-based monetary policy

Variable types	<i>Y: Fin</i>	Estimation results
Core explanatory variable	<i>Dig</i>	0.003 (0.041)
Other explanatory variables	<i>Interest</i>	-0.047*** (0.005)
Moderator variable	<i>w2</i>	0.009 (0.024)

6. Conclusions and empirical implications

Digital transformation has become an urgent development road for enterprises. Under the influence of COVID-19 and global economic recession, digitalization can bring new business modes to enterprises and effectively improve the vitality of enterprises. However, the ensuing problem of "from real to virtual" is also worth our attention.

This paper mainly studies the impact of the degree of digitalization on the financialization of enterprises. This paper takes A-share non-financial listed companies since 2013 as samples, and the regression results show that enterprise digitalization can significantly improve the degree of enterprise financialization. In the process of the robustness test, the analysis results are proved to be robust by replacing the time sample test and endogeneity test. However, we find that there are endogenous factors between enterprise digitalization and enterprise financialization, so we use the lagged data as the instrumental variable of enterprise digitalization to solve the endogeneity problem and prove the robustness of the regression results.

In addition, this paper further explores the moderating effect of national monetary policy on the relationship between enterprise digitalization and enterprise financialization. The study finds that the tight quantitative monetary policy does have a significant inhibitory effect on the "from real to virtual" of enterprises. However, the price-based monetary policy cannot significantly show that it has a restraining effect on corporate financialization. The results play a good reference role for the government to slow down the level of enterprise financialization by formulating proper monetary policy.

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