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Has the development of the digital economy increased corporate financial asset holdings? --A quasi-natural experiment based on the "Broadband China" policy

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ABSTRACT

A differences-in-differences (DID) model and financial data from Chinese listed firms from 2011 to 2019 are used to empirically investigate the effects of the digital economy on corporate financial asset holdings using the "Broadband China" policy as a quasi-natural experiment. After robustness testing and heterogeneity effects are disposed of, the digital economy dramatically boosts corporate financial asset holdings. According to the channel analysis, the digital economy can reduce corporate financing constraints and boost corporate financial asset holdings, notably based on speculative demand. Heterogeneity analysis shows that the digital economy has a greater impact on corporate financial asset holdings for firms with higher market competition, small-scale firms with a short-listed age, and firms in the western region. This paper provides policy guidance for enterprises returning to the real economy.

KEYWORDS

Digital economy; Corporate financial asset holdings; "Broadband China" policy; Differences-in-differences model; Shifting the economy from a tangible to an intangible state

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1. Introduction

In the past few years, the real economy has faced several difficulties, such as imbalances in the supply and demand structure, a slowdown in economic development, and increased uncertainty in the business climate. As a result, the expectations of market players have diminished, leading to a steady decline in the profitability of actual investments. Consequently, enterprises are now faced with the challenge of identifying new avenues for achieving profit growth. In light of the prevailing conditions, the primary focus of corporate governance has transitioned from accentuating long-term expansion to prioritizing immediate financial gains. Consequently, the management has strategically committed substantial expenditures towards financial industries such as banking and real estate. As a result, the primary motivation for corporate financial asset holdings has shifted from the prevention of liquidity problems to a profit-seeking objective aimed at boosting profitability (Stockhammer, 2004; Foster, 2007; Davis and Kim, 2015; Huang et al., 2021; Gao et al., 2022). The presence of profit-driven financial asset holdings has the potential to impede a firm's investment in industry and R&D (Orhangazi, 2008; Seo et al., 2012; Tori and Onaran, 2018). This, in turn, can have negative consequences for the overall long-term growth and stability of the economy as a whole (Lazonick, 2010; Álvarez, 2015; Tomaskovic-Devey et al., 2015). As illustrated in Figure 1, China's non-financial listed businesses' financial assets to total assets ratio increased significantly up to 2017. From 2017 to 2018, it had a minor downturn before starting to rise again and reaching its peak point. Given this context, there has been much debate in both the theoretical and practical domains about how to stop the tendency of "Shifting the economy from a tangible to a virtual state" with actual corporate funds.

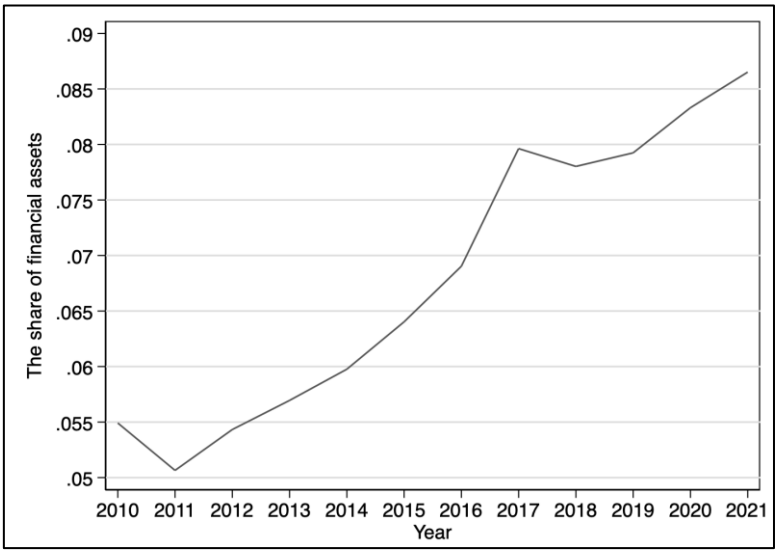

Figure 1. The percentage of financial assets held by non-financial listed companies in China from 2010 to 2021.

In the 20th Party Congress report, President Xi Jinping made it clear that economic development should give the real economy priority in order to address the issue of "Shifting the economy from a tangible to a virtual state". He underlined how important it is to further the complete fusion of the actual and digital economies, as this has provided a new lease on life for the real economy. China's digital economy has experienced leapfrog development in recent years due to the rapid expansion of new technologies like big data and artificial intelligence, and the integration with the real economy is beginning to take shape. Nonetheless, the merger of the digital and real economies has typical reverse traits when seen through the lens of the development structure. This can be seen in the tertiary industry's consumer and financial sectors, which have more advanced integration with the digital economy, while traditional sectors like manufacturing and agriculture have not sufficiently integrated with the digital economy (Song and Yuxin, 2020). So, has the structurally unbalanced character of the digital economy been

an important reason why corporate holdings of financial assets have increased in recent years? If so, through what channels? The aforementioned issues require a thorough investigation, particularly to determine the causal relationship and transmission path between the two. This will be crucial for policymakers hoping to encourage enterprises to "return to the real world from the virtual world" and to further deepen the fusion of the digital economy with the real economy. This paper's primary concern is just this.

Currently, there is a restricted amount of scholarly study that expressly investigates the causal consequences of the growth digital economy on the financial asset holdings of corporations. Moreover, limited research has been conducted on the digital finance and the digitalization of firms on their financial asset portfolios. Several researchers have discovered that digital finance has the potential to significantly decrease the amount of financial assets held by corporations while simultaneously boosting their investments in tangible assets. This phenomenon has the potential to address the issue of corporate financialization (Chunhua et al., 2021; Liu et al., 2023). Previous research has indicated that digital finance can mitigate the financial constraints experienced by firms, thereby enabling them to secure additional funds for investment in financial assets, leading to the acquisition of short-term surplus returns. Notably, this impact is particularly prominent among small sized and publicly traded companies with significant environmental pollution concerns (Jiang et al., 2022; Sun and Shen, 2021). Furthermore, some researchers have conducted analyses on the influence of corporate digital transformation on financial asset holdings, and their findings indicate that such transformation can lead to a substantial reduction in corporate financial asset holdings (Sui and Yao, 2023; Yang and Chen, 2023; Zhang et al., 2023).

When examining the link between the growth of the digital economy and corporate financial asset holdings, two main concerns come out of the existing literature: First, studies examining the digital economy have produced conflicting results on how the sector is affecting corporate financial asset holdings. The subjective creation of indicators for gauging the development of the digital economy is a significant factor contributing to the inconsistency in the body of existing literature. Secondly, these studies frequently do not directly address the influence of the digital economy on corporate financial asset holdings. Furthermore, the subjectivity involved in the development of indicators leads to problems with endogeneity and an unclear causal identification technique, both of which produce biased estimation findings.

To address the limitations of existing research, this study adopts an improvement strategy that involves identifying a experiment capable of capturing the exogenous shock resulting from the advancement of the digital economy. In pursuit of enhancing China's fiber optic network and network infrastructure, the Ministry of Industry and Information Technology of the People's Republic of China (MIIT) and the National Development and Reform Commission (NDRC) spearheaded the introduction of a pilot policy known as "Broadband China" in 39 cities in 2014. Subsequently, an additional 78 cities were included in this initiative in 2015 and 2016. Since its inception, the "Broadband China" pilot policy has been effectively implemented. The aforementioned strategy has demonstrated its efficacy in capturing the evolving dynamics of the digital economy, as evidenced by the studies conducted by Li et al. (2022) and Tian and Zhang (2022). This research uses the "Broadband China" policy as a proxy variable to represent the exogenous shock that the digital economy is responsible for. The differences-in-differences model (DID) is utilized to address the limitations present in the current literature and successfully mitigate these issues.

The present study makes several notable contributions in comparison to prior research. Firstly, this study examines the influence of external environmental changes on the financial investment choices made by micro enterprises. This investigation serves to enhance the existing body of knowledge on the economic consequences associated with the development of the digital economy. Furthermore, by employing the quasi-natural experiment known as the "Broadband China" policy, we are able to successfully establish the causal connection between the advancement of the digital economy and the accumulation of financial assets by corporations. Ultimately, through an examination of the relationship between the advancement of the digital economy and corporate financial asset

ownership, it becomes feasible to offer more precise guidance for policy formulation sessions aimed at mitigating the phenomenon of corporate financialization and fostering a resurgence of corporations in the tangible economy.

The subsequent parts are organized in the following manner: The subsequent section of this study centers on the policy background of the "Broadband China" initiative and outlines the research hypotheses. The third section of the paper outlines the process of sample selection and the creation of the model. The fourth section of the analysis examines the outcomes of the model estimation. The subsequent section delves into the examination of the heterogeneity in the advancement of the digital economy with regards to corporate financial asset holdings. The last section of the article provides a comprehensive summary of the key findings and arguments presented throughout the study. Additionally, this section offers relevant policy suggestions that are aligned with the research outcomes.

2. Policy Content and Hypothesis Development

2.1. Policy Content

China initiated the construction of a public computer Internet in 1994. Over the course of more than two decades, significant progress has been made in enhancing information infrastructure, particularly in terms of coverage, transmission, and intervention capabilities. Until the end of 2012, 3G networks had achieved full coverage in cities and towns, the household penetration rate of fixed broadband had reached 32.2%, and more than 90% of broadband access users had Internet speeds of more than 2 megabits per second (Mbps). However, China's broadband development in the region is too large, the overall low speed of the network, and other issues restrict the further integration of the real economy and information technology (Cheng et al., 2020). At the same time, countries around the world have begun to pay attention to the construction of broadband networks. According to relevant statistics, since the financial crisis in 2008, 127 countries around the world have implemented a series of action plans related to broadband strategy in order to compete for the commanding heights of the new round of scientific, technological, and industrial changes.

The "Notice on the Issuance of the 'Broadband China' Strategy and Implementation Plan" was released by the State Council of the People's Republic of China in August 2013. This initiative aims to enhance the utilization of broadband networks across various sectors and establish a moderately advanced broadband infrastructure. The "Notice" aligns with the objectives outlined in the "National Informatization Development Strategy for 2006-2020." The aforementioned event signifies the official establishment of the "Broadband China" policy. The policy places emphasis on the advancement of broadband expansion, encompassing the following four primary areas: The primary objective is to facilitate the synchronized regional advancement of broadband networks, spearhead the implementation of network innovation and application enhancement in the eastern area, and provide guidance for the creation of extensive data centers in the central and western regions. Additionally, it highlights the prioritization of enhancing the efficiency and modernization of broadband networks, as well as the establishment of a reasonably sophisticated broadband network framework. Furthermore, it would expedite the extensive implementation of broadband network infrastructure in both production and commercial endeavors, fostering the enhancement and advancement of conventional sectors as well as the swift growth of emerging information technology businesses. In addition, the study will prioritize the advancement of core technology in broadband networks, with the aim of expediting the establishment of exclusive intellectual property rights in important technological domains. This endeavor is intended to enhance the whole industrial ecosystem of broadband networks. Subsequently, in adherence to the instructions outlined in the policy, the Ministry of Industry and Information Technology (MIIT) and the National Development and Reform Commission (NDRC) undertook the task of identifying 117 cities in a phased manner spanning from 2014 to 2016. These selected cities were designated as pilot cities for the

implementation of the "Broadband China" plan. The formal initiation of the execution of the "Broadband China" policy on a nationwide scale was marked by this notable milestone.

In October 2020, the China Academy of Information and Communications Technology (CAICT) published a "white paper on China's broadband development (2020)", which assessed the effect of the implementation of the "Broadband China" policy. The report stated that by June 2020, China's fiber-optic access ports were 858 million, 7.6 times more than in 2013, accounting for about 92.1% of the overall Internet access ports; the penetration rate of 4G subscribers was about 80.4%, far exceeding the global average of 54.5%; and the average monthly household expenditure cost of fixed broadband declined to 35.7 yuan, which is a decrease of about 35% compared with 2014. In addition, the empowering role of broadband facilities has become increasingly significant, fueling a thriving digital economy. In the area of consumption, new forms of online sales, such as live broadcasting, have continued to emerge, and from January to July 2020, the national online retail sales amounted to as much as 6.1 trillion yuan, accounting for 25 percent of the total sales of social consumer goods. In the field of production, the accelerated upgrading of broadband networks has empowered the manufacturing industry to continuously transform and upgrade, and as of June 2020, the prevalence rate of enterprise digital R&D and design tools reached 49%, and the rate of numerical control of key processes reached 69%. The "Broadband China" policy is being continuously integrated with the economic society.

The "Broadband China" strategy's key goals and policy assessment report demonstrate that it can be a proxy variable for the digital economy for various reasons. First, the "Broadband China" strategy has expedited broadband network building and upgrade, providing the infrastructure for digital economy growth. Second, the digital economy relies on data, whereas the traditional economy relies on capital and labor. The strategy explicitly states that Internet data center building should be hastened to improve data storage and transmission, boosting digital economy development. Thirdly, the evaluation report noted the empowering role of broadband infrastructure in production and consumption, including the rise of new digital applications, online sales, and the digital transformation and upgrading of the manufacturing industry, proving the positive externalities of the "Broadband China" policy on the digital economy. The statistical data also shows that since the "Broadband China" policy was implemented, China's digital economy has grown rapidly and become a major engine of economic growth (see Figure 2). In conclusion, the "Broadband China" strategy may be used to measure the digital economy.

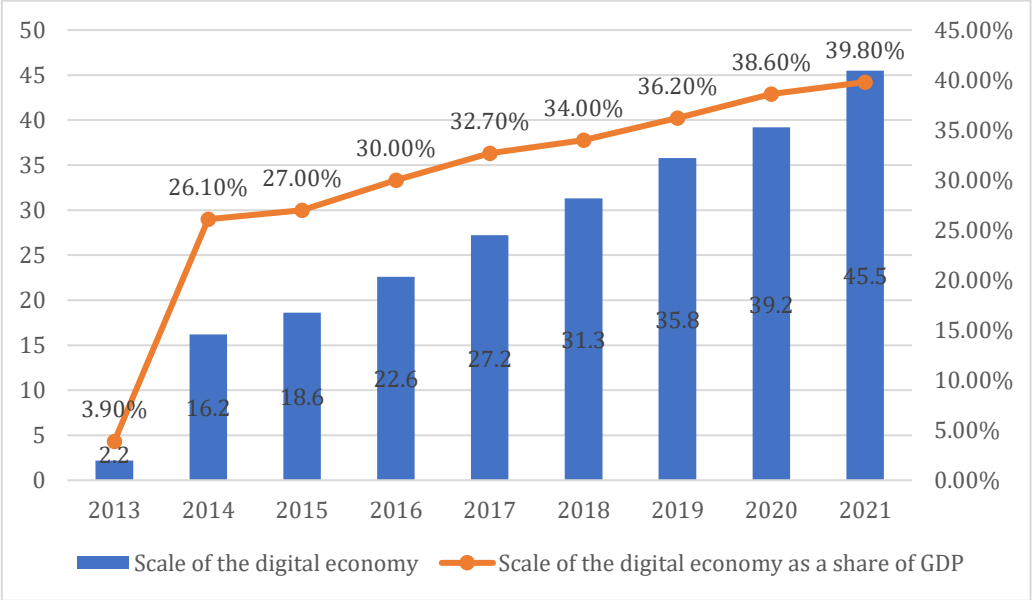

Figure 2. Development of China's digital economy, 2013-2020.

2.2. Theoretical Analysis and Hypothesis Development

In accordance with Keynes's theory of precautionary savings, companies maintain cash and highly liquid financial assets primarily to mitigate the liquidity risk arising from unexpected operational challenges. This behavior is commonly referred to as the precautionary motive, as supported by Opler (1999), Duchin (2010), and Duchin et al. (2017). In particular, corporations may opt to decrease their capital market financing expenses by maintaining a portfolio of highly liquid financial assets in response to elevated external financing costs (Almeida et al., 2004; Bates et al., 2009; Stulz, 1996). Furthermore, companies employ financial assets as a means to efficiently manage their liquidity, reducing the impact of financing limitations. This approach guarantees that organizations have the financial resources to pursue future investments in more advantageous prospects, thereby eventually improving the effectiveness of corporate investment (Almeida et al., 2013; Cunha and Pollet, 2020; Gong et al., 2023). Nevertheless, companies that possess financial assets may also be driven by a speculative inclination to pursue gains. The investment substitution hypothesis posits that in situations where organizations face constraints on their available capital and seek to optimize their profitability, a correlation can be observed between the allocation of investment towards fixed assets and financial assets. The investment choices made by organizations are primarily influenced by the comparative returns and risks associated with financial investments and investments in fixed assets (Orhangazi, 2008; Demir, 2009; Zhang and Zheng, 2020).

The digital economy can affect company financial asset holdings in two ways, according to these motives.

To begin with, the emergence of the digital economy has mitigated the limitations faced by corporations in securing financial resources. On the one hand, the advancement of digital technology and the integration of big data through cloud computing have facilitated borrowers access to a wider range of detailed company information. The aforementioned phenomenon leads to a reduction in the disparity of information between individuals seeking loans and those providing them, resulting in a decrease in the expenses associated with evaluating creditworthiness and the potential hazards associated with lending (Livshits et al., 2016; Sutherland, 2018; Goldfarb and Tucker, 2019). Concurrently, the emergence of financial technology (fintech) within the context of digitalization has had a significant influence on the loan operations of conventional banks, hence augmenting the level of competition among banks (Ding et al., 2022; Yuan et al., 2023), partially mitigating the financial limitations encountered by firms (Zhang et al., 2019; Guo et al., 2023). The influence of limitations on funding availability on the allocation of financial assets by corporations exhibits variability in accordance with diverse theoretical frameworks. When enterprises retain financial assets as a preventive measure for savings, a reduction in financing limitations prompts them to reduce their holdings of financial assets. This is due to their relatively lower priority placed on mitigating liquidity problems or operational challenges since they prioritize reallocating resources towards their primary production endeavors. As a result, the advancement of the digital economy leads to a decrease in the amount of financial assets held by corporations within this particular framework. When companies retain financial assets with the intention of generating speculative profits, the relaxation of financing limitations coincides with their imperative to allocate funds towards investing in financial assets. Consequently, the advancement of the digital economy facilitates the augmentation of corporate financial asset holdings in this particular scenario.

Furthermore, the proliferation of the digital economy has led to heightened levels of rivalry among enterprises. The advent of the digital economy has led to a decrease in expenses associated with consumer search and product transportation. Additionally, the utilization of big data and artificial intelligence has enhanced the ability to replicate products and made market entry more accessible. Consequently, this has resulted in heightened competition among enterprises (Duchin et al., 2017; Goldfarb and Tucker, 2019). According to the social interaction theory, individual actions are not just determined by their own attributes but are also shaped by collectives of persons who have comparable features, hence establishing interdependent and interactive relationships (Becker & Murphy, 2009). The advancement of the digital economy has the potential to surmount geographical constraints and enhance

exchange and rivalry between enterprises. Because of this, there is a greater likelihood of imitation across enterprises, which in turn causes corporations to amass more financial assets.

Based on the theoretical analysis presented above, we formulate a pair of mutually exclusive hypotheses as follows:

H1: The development of the digital economy significantly increases corporate financial asset holdings.

H2: The development of the digital economy significantly reduces corporate financial asset holdings.

3. Empirical Design

3.1. Sample Selection and Data Sources

Since the final pilot of the policy is in 2016 and the CAICT reviews its effect in 2020, we study China A-share Listed Companies from 2011 to 2019. China Stock Market and Accounting Research (CSMAR) provides listed corporations' financial data. The pilot cities are from MIIT's 2014–2016 "Broadband China" demonstration cities. China prefecture-level city statistical yearbooks provide other pertinent statistics.

After getting the initial sample, this paper processed the sample raw data as follows: Firstly, this paper identifies the city of a listed firm based on its office address information and matches it with the corresponding city code. Secondly, the samples of listed firms in the financial industry, the ST* category, and those whose corporate office addresses are located in cities under central government jurisdiction are excluded to ensure the generality of the research sample. Again, To verify the completeness of event periods within the research samples, any businesses having data that was lacking during the study period were eliminated. Finally, all continuous data are treated with a two-sided 1% winsorize treatment to avoid the effects of extreme values. After the above processing, this paper finally gets the balanced panel data of 1154 listed firms with a total of 10,386 samples.

3.2. Model Design

3.2.1. Benchmark Model

In order to evaluate the hypothesis, the benchmark regression model is the DID model, which is defined as follows in equation (1).

$$Fin_{i,t} = \alpha_0 + \alpha_1 DID_{i,t} + \beta Controls_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (1)$$

In equation (1), The $Fin_{i,t}$ is the amount of corporate financial assets held by firm i in year t. The greater its worth, the greater the degree of corporate financial asset holdings. The $DID_{i,t}$ variable is a double-difference variable that returns 1 if the area where firm i is situated adopted the policy in year t, and 0 otherwise. $Controls_{i,t}$ is a vector of control variables adopted by firm i in year t. A non-observable component that does not fluctuate with individual businesses is controlled by the individual fixed effect μ_i, while a non-observable factor that does not vary with time is controlled by the temporal fixed effect δ_t. The random error term of the model is represented by $\varepsilon_{i,t}$. Furthermore, in order to get reliable findings, we cluster the standard errors at the firm level.

3.2.2. Dynamic Model

In contrast to the model of static analysis that is used in the benchmark regression, the use of dynamic analysis can make it more intuitive to observe the duration of the exogenous shock of the digital economy. It is also useful for determining if the DID model can support the presumption that the treatment and control groups exhibit parallel trends. As a result, the following equation (2) is used to build the dynamic model in this paper.

$$\mathrm{Fin}_{i,t} = \alpha_0 + \sum_{k=-5}^{k=3} \alpha_k \times DID_{i,t+k} + \gamma \mathrm{Controls}_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (2)$$

In equation (2), the variable $DID_{i,t+k}$ represents a binary indicator. It takes on a value of 1 if the city where firm i is situated is included in the pilot list of policy in the year t+k, if not, it assumes a value of 0. The remaining symbols possess the same significance as those in equation (1). Furthermore, it is explicitly indicated in the policy document that the designated timeframe for the execution of the pilot program is three years. Therefore, when the policy has been in effect for a duration of three years, the variable k is assigned a constant value of 3.

The following is the identification approach for the benchmark model's parallel trend assumption and the dynamic influence of the digital economy's growth on corporate financial asset holdings. When k takes a value between -5 and -1, if α_k does not change statistically substantially from 0, then the benchmark model is said to meet the parallel trend assumption. When k takes values between 0 and 3, and α_k differs from 0 in at least two of those periods, the expansion of the digital economy continues to have a dynamic impact on corporate financial asset holdings.

3.2.3. Channel Model Design

Theoretical study suggests that the rapid growth of the digital economy is of utmost importance in effectively broadening the scope of information sources that are accessible to the capital supply side. Additionally, it serves to decrease the marginal cost associated with evaluating corporate risk and expands the range of financing alternatives available to meet the demand for cash. Consequently, this enhances the external finance landscape for firms grappling with limitations in securing funds, effectively tackling the matter from both the supply and demand standpoints. Consequently, this phenomenon exerts a substantial influence on the financial asset holdings of corporations. In order to investigate the channel effect of financial constraints, the study constructs a model as illustrated in equation (3).

$$\mathrm{Fin}_{i,t} = \alpha_0 + \alpha_1 \mathrm{DI}D_{i,t} + \alpha_2 \mathrm{F}C_{i,t} + \alpha_3 \mathrm{F}C_{i,t} \mathrm{DI}D_{i,t} + \gamma \mathrm{X}_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (3)$$

Equation (3) denotes $\mathrm{F}C_{i,t}$ as the financial restriction encountered by firm i during year t. In the event that the financing constraint encountered by firm i surpasses the average financing restrictions of all firms during the given year, $\mathrm{F}C_{i,t}$ will be assigned a value of 1, indicating a high financing constraint. Conversely, if the financing constraint is below the average, $\mathrm{F}C_{i,t}$ will be assigned a value of 0, indicating a low financing constraint. $\mathrm{F}C_{i,t}\mathrm{DI}D_{i,t}$ represents the interaction variables of double differences and financing constraints.

The identification technique pertaining to the channel of funding restrictions is delineated in the following manner: If the digital economy has the potential to mitigate corporate financing restrictions, it is anticipated that businesses with more financial restrictions will see a more significantly impacted from the digital economy on their financial asset holdings. Otherwise, the coefficient α_3 exhibits statistical significance and a negative relationship.

3.3 Variable Selection

3.3.1. Dependent Variable

The dependent variables in this paper are corporate financial asset holdings (Fin). In accordance with other scholarly works, the present research used the financial assets-to-total assets ratio as a metric for assessing this dependent variable (Demir, 2009; Du et al., 2017; Peng et al., 2018). In particular, the enterprise balance sheet details indicate that this document comprises non-cash financial assets consisting of investment properties, trading

financial assets, derivative financial assets, loans and advances granted, available-for-sale financial assets, and held-to-maturity investments.

3.3.2. Independent Variable

This research examines digital economy development as an independent variable (DID). Based on the aforementioned background study, one may posit that the "Broadband China" strategy has the potential to function as a dependable proxy variable for assessing the advancement of the digital economy. According to the strategy, if a business, denoted as firm i, is situated in a city that has been designated as a pilot city in a certain year, denoted as year t, the DID estimator will take on a value of 1 in year t and following years, and 0 otherwise.

3.3.3. Control Variables

This study also incorporates controls for several firm- and city-level factors that may influence corporate financial asset holdings. This approach aims to mitigate the issue of estimate bias that might arise from the omission of relevant variables. Firm-level control variables mainly include firm size (Size), firm's years on the market (Age), share of fixed assets (Fix), asset-debt ratio (TDR), capital intensity (Cap), return of total assets (ROA), and operating cash flow (Cash). The control variables at the city level mainly include the local economic development (PGDP), the amount of foreign investment (FDI), the level of education (Edu), and the level of fiscal expenditure (FR).

3.3.4. Channel Variable

The present research used the KZ index, as introduced by Kaplan and Zingales (1997), as a quantitative measure to evaluate the financial constraints faced by companies. Furthermore, the financing constraints of firms are classified based on the average value of the KZ index. When the KZ index of firm i in year t surpasses the average KZ index of all firms in that year, the variable FC is assigned a value of 1, showing the presence of strong financing restrictions. Conversely, if the KZ index does not exceed the average, FC is assigned a value of 0, indicating the absence of significant financing constraints.

Detailed symbols for the main variables and their corresponding calculation formulas can be found in Appendix A1.

4. Empirical Results and Analysis

4.1 Descriptive Analysis of Variables

Table 1 displays the descriptive statistics pertaining to the primary factors examined in this study. The sample exhibits significant variability in Fin, as seen by the large range between the lowest and greatest values of 0.364. The average value of Fin is 0.032, and the standard deviation is 0.063, indicating that Fin varies widely across the sample. The average value of the DID is 0.408, suggesting that around 40.8% of individuals in the sample had an impact throughout the duration of the research. Additionally, the standard deviation of the DID is 0.491, indicating a rather high level of variability and proximity to 0.5. Furthermore, the descriptive statistics of the other control variables exhibit a close resemblance to those reported in the relevant literature, suggesting that the conclusions drawn are rational.

Table 1. Descriptive statistics of variables.

Variables	N	Mean	Sd	Min	Max
Fin	10,386	0.032	0.063	0.000	0.364
DID	10,386	0.408	0.491	0.000	1.000
Size	10,386	22.260	1.221	19.486	25.419
Age	10,386	2.475	0.589	0.693	3.258
Fix	10,386	0.246	0.173	0.004	0.740
TDR	10,386	0.459	0.213	0.056	0.974
Cap	10,386	2.448	2.203	0.350	14.660
ROA	10,386	0.031	0.064	-0.279	0.196
Cash	10,386	0.044	0.067	-0.153	0.232
PGDP	10,386	11.261	0.541	9.908	12.223
FDI	10,386	11.758	1.681	6.358	14.023
Edu	10,386	11.923	1.254	8.795	13.871
FR	10,386	0.144	0.051	0.077	0.371
FC	9,738	0.609	0.488	0.000	1.000

4.2 Benchmark Regression Analysis

The benchmark regression estimates are shown in Table 2. Control variables are not included in column (1) of Table 2. In column (2), additional firm-level control factors are included, while in column (3), city-level control variables are also included. All of the results add firm- and year-fixed effects. The findings presented in Table 2 demonstrate that the coefficients associated with the DID term exhibit statistically significant positive effects at a 5% level of significance, irrespective of the inclusion or exclusion of control variables. These results provide support for H1 as posited in this study.

In addition, it is also useful to dig out some interesting information from the control variables. The coefficients of Size and Fix are negative at the 1% level, implying that larger firms with a higher proportion of fixed assets hold lower levels of financial assets, possibly because this group of firms has more access to external financing and therefore holds fewer financial assets due to the precautionary motive. However, for small-sized firms, this means that they may need to increase their holdings of speculative financial assets in order to generate higher returns and thereby differentiate themselves in the competitive market. As illustrated above, the development of the digital economy exerts heterogeneous effects on the financial asset holdings of firms with varying characteristics, warranting further in-depth examination.

4.3 Dynamic Analysis

The estimated results of equation (2) are shown in Figure 3. Figure 3 illustrates the temporal progression surrounding the implementation of the policy. The horizontal coordinates -5, -4, -3, -2, and -1 correspond to the five-year period preceding the policy implementation, while 0, 1, 2, and 3 represent the current year of policy implementation, the first, second, and third years following the implementation, respectively. The vertical coordinates correspond to the estimated values of the regression coefficient α_k. The findings shown in Figure 3 indicate that there is no statistically significant difference between the firms belonging to the control group and those belonging to the treatment group prior to the policy's adoption. This outcome aligns with the parallel trend hypothesis.

Table 2. Benchmark regression results.

	(1)	(2)	(3)
Variables	Fin	Fin	Fin
DID	0.0049**	0.0051***	0.0047**
	(0.0020)	(0.0020)	(0.0019)
Size		-0.0095***	-0.0096***
		(0.0027)	(0.0027)
Age		0.0219***	0.0217***
		(0.0044)	(0.0044)
Fix		-0.0427***	-0.0431***
		(0.0097)	(0.0097)
TDR		-0.0122	-0.0118
		(0.0099)	(0.0099)
Cap		0.0017**	0.0017**
		(0.0008)	(0.0008)
ROA		-0.0013	-0.0013
		(0.0111)	(0.0111)
Cash		-0.0132	-0.0131
		(0.0101)	(0.0101)
PGDP			0.0041
			(0.0046)
FDI			0.0011
			(0.0009)
Edu			-0.0108*
			(0.0064)
FR			-0.0538
			(0.0352)
Constant	0.0302***	0.1992***	0.2797***
	(0.0008)	(0.0565)	(0.1051)
Observations	10,386	10,386	10,386
R-squared	0.6449	0.6534	0.6540
Firm-FE	YES	YES	YES
Year-FE	YES	YES	YES

*Notes: *, **, and *** indicate 10%, 5%, and 1% statistical significance. Parentheses indicate robust standard errors for firm-level regression coefficients.*

Additionally, with regards to the dynamic effects of the policy post-implementation, firms selected for the treatment group exhibit a more pronounced increase in their financial holdings during the year of policy implementation. This behavior suggests that firms, as rational investors, respond swiftly to changes in the exogenous environment. Moreover, corporate financial asset holdings were observed to be higher in the third year following the policy's implementation compared to the year of its inception. This observation implies that firms are better positioned to engage in financial investment activities, facilitated by digital technology and other means, when the digital economy has reached a certain level of development.

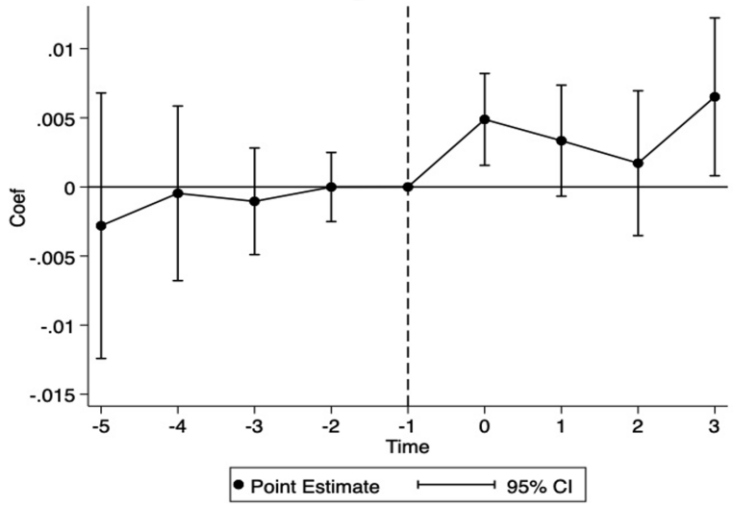

Figure 3. Dynamic analysis results.

4.4 Robustness Check

4.4.1. Considering Treatment Effect Heterogeneity

Although the benchmark regression model mentioned above passed the parallel trend test, variations in the timing of treatments and their durations in the multi-period DID analysis led to a situation where individuals treated earlier effectively served as the control group for those treated later. This condition resulted in deviations between the estimated effects obtained from the two-way fixed regression and the actual effects and, in some cases, even yielded opposite outcomes (Goodman-Bacon, 2021). In this paper, we use the bacondecomp command in the StataMP 17.0 software to re-estimate the multi-period DID estimator in order to obtain a heteroscedasticity-robust estimator (Goodman-Bacon et al., 2022). Figure 4 shows the results of the decomposition for each group of weights and their estimates. In Figure 4, the coefficient for the weighted DID term remains significantly positive. The estimated coefficient for the within-group difference (Within) is in the opposite direction to the coefficient for the DID term. However, its weight is only 1.29%, indicating that the heterogeneity of the treatment effect does not significantly impact the results of the benchmark regression in this paper and thus confirming the robustness of the benchmark regression estimation.

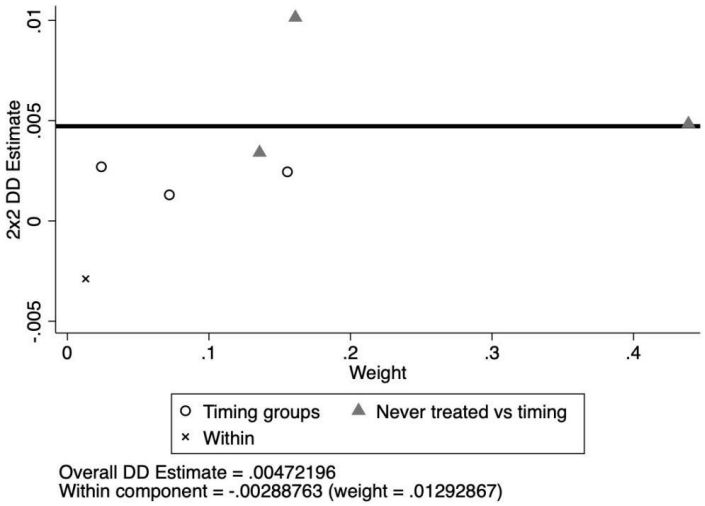

Figure 4. Bacon decomposition results.

4.4.2. Placebo Test

This paper proceeds to conduct a city-level placebo test to substantiate that the aforementioned benchmark findings are not influenced by unobservable economic factors. In a more detailed explanation, this entails the random selection of a city, with the assumption that the city initiates policy implementation in a randomly chosen year within the sample period. Firms within that selected city are then designated as a dummy treatment group, thereby creating a new DID variable. Subsequently, Equation (1) is recalibrated by substituting the existing DID variable with this new DID variable.

To safeguard the stability of the findings derived through this procedure, this paper iterates the aforementioned process 5000 times and ultimately yields the estimation results depicted in Figure 5 below. The results within the figure reveal that the coefficients associated with the new DID variables do not exhibit statistically significant deviations from zero at the 10% significance level. This observation implies that unobservable economic factors do not account for the upsurge in the financial assets of firms. Therefore, the conclusions drawn in the benchmark regression analysis are substantiated and robust.

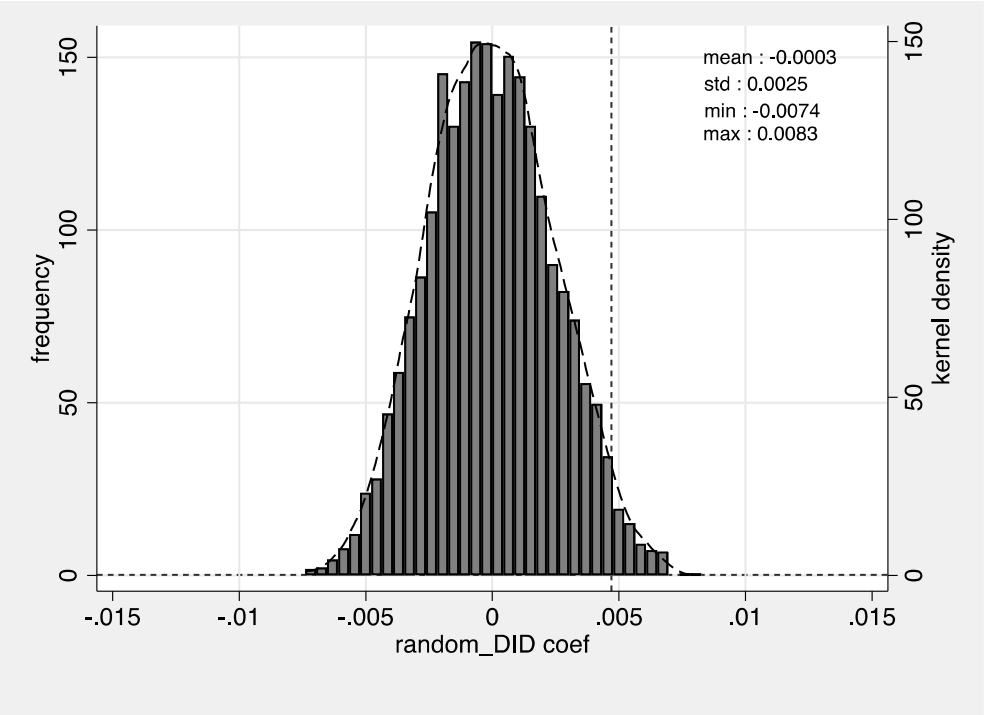

Figure 5. Placebo test results.

4.4.3. Changing Model Settings

Moreover, this study designates these three years as the overarching time frame to establish a DID model in a generalized manner. It derives a generalized DID estimation by contrasting the disparities in financial asset holdings between treatment group firms before 2014 and after 2016, in comparison to control group firms. The findings of the estimations are presented in Table 3. The results suggest that when a generalized DID model is used to replace the estimates, there are no statistically significant differences seen compared to the benchmark regression. The robustness and validity of the results derived from the benchmark regression analysis carried out in this scholarly study are underscored.

Table 3. Generalized DID estimation result.

Variables	(1) Fin	(2) Fin	(3) Fin
DID	0.0078**	0.0081***	0.0072**
	(0.0031)	(0.0030)	(0.0030)
Observations	6,924	6,924	6,924
R-squared	0.6259	0.6358	0.6365
Firm-Controls	NO	YES	YES
City-Controls	NO	NO	YES
Firm-FE	YES	YES	YES
Year-FE	YES	YES	YES

Notes：, **, and *** indicate 10%, 5%, and 1% statistical significance. Parentheses indicate robust standard errors for firm-level regression coefficients.*

4.5 Channel Examination

In order to validate the significance of financing constraints as the channel in the advancement of the digital economy that impact corporate financial asset holdings, this study calculates Equation (3) and presents the resultant estimated results in Table 4. The findings suggest that the interaction term's coefficient exhibits a statistically significant negative relationship, even after controlling for other factors. This discovery implies that the growth of the digital economy has the potential to decrease the financial asset holdings of enterprises that have significant limitations in obtaining financing. Thus, this outcome lends credence to the idea that finance limitations function as a channel in this particular situation. Furthermore, the findings shown in Table 4 demonstrate variations in the influence of digital economy growth on company financial asset holdings, contingent upon distinct motives. The pre-FC coefficient exhibits a statistically significant negative effect at a significance level of 5%, suggesting that companies experiencing greater limitations in obtaining financing prefer to store larger amounts of financial assets.

Table 4. Channel examination results.

VARIABLES	(1) Fin	(2) Fin	(3) Fin
DID	0.0066***	0.0063***	0.0058***
	(0.0019)	(0.0019)	(0.0019)
FC	0.0034**	0.0034**	0.0033**
	(0.0014)	(0.0015)	(0.0015)
DID×FC	-0.0045**	-0.0036*	-0.0035*
	(0.0020)	(0.0019)	(0.0019)
Observations	9,738	9,738	9,738
R-squared	0.6400	0.6503	0.6508
Firm-Controls	NO	YES	YES
City-Controls	NO	NO	YES
Firm-FE	YES	YES	YES
Year-FE	YES	YES	YES

*Note: The regression sample excludes samples with missing FC. *, **, and *** indicate 10%, 5%, and 1% statistical significance. Parentheses indicate robust standard errors for firm-level regression coefficients.*

This behavior aligns with the notion of storing financial assets as a precautionary measure. The observed interaction term coefficient exhibits a statistically significant negative relationship, suggesting that the growth of

the digital economy has successfully diminished the financial assets retained by enterprises motivated by precautionary considerations. The coefficient of the DID variable has a positive effect, surpassing the interaction term. This observation implies a growth in the overall quantity of financial assets will lead to a substantial rise in corporate ownership of financial assets motivated by speculation, surpassing the decrease in ownership of financial assets motivated by precautionary reasons. In brief, the influence of digital economy has resulted in a notable decrease in businesses' financial assets allocated for precautionary reserves while concurrently increasing the financial assets kept by enterprises driven by speculative intentions.

5. Heterogeneity analysis

5.1 Heterogeneity in Market Competition Intensity

In this paper, we utilize the Herfindahl-Hirschman Index (HHI) to assess the degree of rivalry within markets in which enterprises are active. We subsequently categorize our sample into two groups based on high and low competitive intensity, using the median of the HHI index. We then proceed to re-estimate Equation (1) to investigate the influence of digital economy development on corporate financial asset holdings under varying degrees of market competition. Table 5 below shows the outcomes of this regression study. In this context, HHIA and HHIB represent the HHI index calculated based on primary revenue and firm size, respectively. It's noteworthy that a lower HHI index signifies a more competitive market environment.

The findings displayed in Table 5 indicate that the influence of digital economy advancement on corporate financial asset holdings exhibits notable variations contingent upon the degree of market rivalry. Specifically, The influence of advancements in the digital economy on the financial asset holdings of corporations is more noticeable in highly competitive marketplaces compared to less competitive contexts.

Table 5. Analysis of heterogeneity based on market competition intensity.

Group	(1)	(2)	(3)	(4)
	Low HHIA	High HHIA	Low HHIB	High HHIB
VARIABLES	Fin	Fin	Fin	Fin
DID	0.0053***	0.0042	0.0052***	0.0038
	(0.0019)	(0.0027)	(0.0018)	(0.0029)
Observations	7,083	3,285	7,452	2,934
R-squared	0.6458	0.7039	0.6354	0.6973
Firm-Controls	YES	YES	YES	YES
City-Controls	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES
Year-FE	YES	YES	YES	YES

Notes：, **, and *** indicate 10%, 5%, and 1% statistical significance. Parentheses indicate robust standard errors for firm-level regression coefficients.*

The main factor contributing to this diverse impact may be attributed to the extensive integration of digital technology and the utilization of big data. Firstly, these technologies have spurred the emergence of numerous new businesses, offering enterprises increased opportunities for physical investment and enhancing their investment efficiency (Huo, 2022). Additionally, the digital economy has intensified the relationship between enterprises and the financial market, leading to a greater inclination among firms to invest in the financial sector. In highly competitive industries with high product substitutability and low market entry barriers, individuals are more

motivated to view investments in financial instruments as a strategy for achieving short-term returns that exceed the industry average and short-term excess returns (Song and Lu, 2015). They reallocate funds initially designated for their core business into the financial industry, deeming it a sort of "life-saving straw." Conversely, in scenarios of weak market competition, firms typically find themselves in mature stages with fewer substitutable products, enabling them to consistently generate profits from their primary operations. As a result, there is less need for them to venture into the financial market, which carries higher risks.

5.2 Heterogeneity in Firm Size and Age

This article provides a deeper analysis of the consequences of the progress made in the digital economy on the diversity of financial assets held by corporations of different sizes and ages. Table 6 below displays the regression estimates after categorizing firms based on firm size and the median age at listing.

The influence of digital economy advancements on financial asset holdings is more prominent among small enterprises in the first phases of initial public offering compared to small firms with a longer market presence, as shown in the group of small firms categorized in columns (1) and (2) of Table 6. In the large-scale firm group, as indicated by columns (3) and (4) of Table 6, the influence of the digital economy significantly increases corporate financial asset holdings at the onset of listing, achieving a 1% level of significance. The growth of the digital economy, however, dramatically lowers corporate financial asset holdings among companies with a longer listing history.

It is evident from the aforementioned regression results that, irrespective of the firm's size, the influence of the digital economy raises the size of financial assets at the start of the listing period. This phenomenon primarily arises from the fact that firms in their early listing stages typically require substantial capital to support their growth and operations. In order to satisfy this demand, these enterprises must strive to achieve returns that above the typical earnings of the market. The expansion of the digital economy has provided firms with an increased range of financing alternatives, prompting them to allocate a portion of their funds into financial assets with the aim of augmenting their profitability.

Table 6. Analysis of heterogeneity based on firm age and size.

Group	(1) Small Size Small Age	(2) Small Size Large Age	(3) Large Size Small Age	(4) Large Size Large Age
VARIABLES	Fin	Fin	Fin	Fin
DID	0.0057**	0.0051	0.0089***	-0.0039*
	(0.0027)	(0.0039)	(0.0034)	(0.0024)
Observations	2,937	2,633	1,502	3,225
R-squared	0.5307	0.7081	0.5904	0.7612
Firm-Controls	YES	YES	YES	YES
City-Controls	YES	YES	YES	YES
Firm-FE	YES	YES	YES	YES
Year-FE	YES	YES	YES	YES

*Notes: *, **, and *** indicate 10%, 5%, and 1% statistical significance. Parentheses indicate robust standard errors for firm-level regression coefficients.*

It Is noteworthy to mention that the effects of digital economy advancements on large-scale corporations with extended listing durations are fundamentally different from the effects on other individuals. The reason for this discrepancy might be because listed companies that have been around for a long time typically rely more on internal

funding sources. Therefore, the advancements in the external financial environment resulting from the expansion of the digital economy are unlikely to have a disproportionate influence on them. Furthermore, for large-scale companies with a long listing term, the development of the digital economy has resulted in significant returns from physical investments that surpass the unpredictable returns from financial assets. Because of this, these companies typically spend more on physical assets in order to achieve steady returns while maintaining fewer financial assets.

5.3 Heterogeneity in Regions

Different areas have different resources, which contribute to large differences in the levels of economic growth. These differences also result in different levels of development in the financial markets that support the various regions. In light of this, the article splits the corporations based on the regions in which their offices are situated into three sub-samples: the eastern, middle, and western areas. The purpose of this section is to look at how the expansion of the digital economy has affected corporate financial asset holdings in different regions. Table 7 below displays the estimation findings. The outcomes of the analysis indicate that the rise of the digital economy has a considerably greater influence on the financial asset holdings of corporations in the Western area, but its impact is not statistically significant in the middle and western regions.

There are two main causes of this scenario. On the one hand, the eastern and middle areas have more developed economies than the western region in terms of regional development. As such, they already have rather sophisticated financial ecosystems. This suggests that the influence of the digital economy on the financial sector in the eastern and middle regions has been rather insignificant. But the emergence of the digital economy has a more noticeable impact on the improvement of the financial market in the western area. On the other hand, the subpar transportation infrastructure in the western area presents obstacles. In comparison to the eastern areas, this has led to economic inequities and less developed financial markets. However, geographical barriers can be successfully surmounted by the growth of the digital economy, upending established financial network services (Xun et al., 2020). As a result, there have been notable advancements in the western region's financial market growth and external funding environment for businesses. Consequently, the expansion of the digital economy has a greater influence on corporate financial asset holdings in the western area.

Table 7. Analysis of Heterogeneity Based on Regional Heterogeneity.

Group	(1)	(2)	(3)
	East	Middle	West
VARIABLES	Fin	Fin	Fin
DID	0.0014	0.0041	0.0123***
	(0.0023)	(0.0030)	(0.0031)
Observations	5,634	2,160	1,854
R-squared	0.6526	0.6775	0.6977
Firm-Controls	YES	YES	YES
City-Controls	YES	YES	YES
Firm-FE	YES	YES	YES
YEAR-FE	YES	YES	YES

Notes：, **, and *** indicate 10%, 5%, and 1% statistical significance. Parentheses indicate robust standard errors for firm-level regression coefficients.*

6. Conclusions and Policy Recommendations

In the contemporary period characterized by significant advancements in digital technology, the ongoing rise in corporate financial asset holdings has attracted substantial scholarly interest. However, the question of whether the growth of the digital economy facilitates or hinders the accumulation of financial assets is a subject that continues to be discussed and debated among scholars. In order to examine this matter, the present study used the quasi-natural experiment of the "Broadband China" policy as a surrogate variable for the advancement of the digital economy. This study utilizes data from A-share businesses listed on the Shanghai and Shenzhen stock exchanges in China. It applies a differences-in-differences model to comprehensively examine the effects of digital economy growth on corporate financial asset holdings. The findings indicate that there is a substantial positive relationship between the growth of the digital economy and the accumulation of financial assets by corporations. Additional examination of channels indicates that the advancement of the digital economy alleviates limitations on business financing and diminishes the need for corporations to keep financial assets as a preventive measure. Nevertheless, it results in a rise in corporate financial asset ownership driven by speculative intentions. Furthermore, the study reveals, through the utilization of heterogeneity analysis, that the impact of digital economy advancement on corporate financial asset holdings is particularly significant for companies with greater market intensity, smaller size and age at listing, and those situated in the western area.

The aforementioned findings suggest that we must completely acknowledge the complex ways in which the digital economy has affected businesses' investment decisions. In addition to keeping an eye out for the investment possibilities that come with the merger of the digital and physical economies, we also need to be vigilant about any new hazards that can surface throughout this process. Big data, cloud computing, and digital technologies should be actively used by regulators to keep an eye on how companies use the money they borrow, evaluate the risk involved, and make sure the money isn't going back into the financial markets. In order to address potential issues with the integration of the digital and real economies, government departments should simultaneously develop pertinent policies to pique businesses' interest in digital transformation. This will help to prevent the situation known as " Shifting the economy from a tangible to an intangible state". By lowering the possibility of systemic risks and promoting the sustainable growth of the digital economy, these laws and regulations will support the stability of the financial system and protect the steady and robust growth of the national economy.

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Conflict of interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

Appendix

A1. Description of variable calculations.

$Fin_{i,t}$: Ratio of financial assets to total assets at the end of the period

$DID_{i,t}$: If the firm i's city is selected as a Broadband China pilot in year t, the DID is given a value of 1, otherwise it is

given a value of 0.

$Size_{i,t}$: Ln (Total asset size)

$Age_{i,t}$: Ln(1+Current statistical year - Year of listing)

$Fix_{i,t}$: Fixed asset size/Total asset size

$TDR_{i,t}$: Total debt size/Total asset size

$Cap_{i,t}$: Size of fixed assets/Total employees

$ROA_{i,t}$: Net profit/Total asset size

$Cash_{i,t}$: Operating activities/Total asset size

$PGDP_{i,t}$: Ln (Regional GDP per person)

$FDI_{i,t}$: Ln (Total regional foreign investment)

$Edu_{i,t}$: Ln(Enrolled in regional general higher education institutions)

$FR_{i,t}$: Regional fiscal expenditure/Regional GDP

$FC_{i,t}$: Measured using the KZ index, and grouping firms' financing constraints by the mean value of the KZ index, with high financing constraints when FC = 1 and low financing constraints when FC = 0

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