Digital Economy and Financial Constraints

Xinyou Zhang[1]
Zha_2333@163.com

[1] Ocean University of China, Qingdao Shandong 266000, China

Abstract. As a new driver of China's economic growth, the digital economy is improving rapidly and also adding vitality to Chinese enterprises by alleviating information asymmetry. Base on the data of Chinese firms during the period of 2011-2020, this study seeks to explore the relationship between the digital economy and the financial constraints faced by enterprises through empirical research. It concludes that the digital economy can significantly alleviate the financial constraints faced by enterprises. The construction of digital economy is a feasible way for China to enhance its economic capabilities. This study enriches the existing literature on the consequences of digital economy from the perspective of financial constraints and provides implications for policy-makers, listed firms and debtholders.

Keywords: Digital economy, Financial constraints.

1 Introduction

Since the 21st century, China has entered the Internet era and the digital economy has also gradually developed. And in the past five years, with the government's increasing emphasis, digital economy has a more rapid development. According to the "Report on the Development of China's Digital Economy (2022)" released by the China Academy of Information and Communications Technology in 2022, the scale of China's digital economy will reach 45. 5 trillion yuan, a year-on-year nominal increase of 16. 2%, higher than the nominal GDP growth rate in the same period 3. 4 percentage points, accounting for 39% of GDP. 8% by 2021. Thus, the digital economy has become an important engine leading economic growth[1]; At the micro level, the development of the digital economy has led to the emergence and development of new formats, and has also brought new opportunities and challenges to Chinese enterprises.

Small and medium enterprises (hereinafter referred to SMEs) are an important driving force for national economic growth. As of the end of 2021, the number of registered enterprises in the country has reached 48.423 million, of which the number of SMEs exceeded 44 million, accounting for more than 95%. So, SMEs are significant roles of the market main body which contributes more than 50% of fiscal taxation, more than 60% of GDP, more than 70% of technological innovation, and more than 80% of urban labor employment. It can be seen that the development of small and medium-sized enterprises and the digital economy are of great significance to China's economic growth.

The existing literature points out that in the era of digital economy, user value-led and alternative competition (substitution competition), as the two fundamental forces driving enterprise management reform, not only promotes the transformation of enterprise goals and the innovation of governance structure, but also promotes a series of changes in the internal management mode

MSIEID 2022, December 09-11, Chongqing, People's Republic of China

DOI 10.4108/eai.9-12-2022.2327679

of enterprises[2]. The digital economy significantly improves the TFP by improving innovation capabilities and the human capital structure, upgrading producer services and reducing costs, which also provides opportunities for enterprise digital transformation. Zhong Chenglin[3] pointed out earlier that "innovation in science and technology financial business" has enhanced the avoidance ability of "adverse selection risk" and promoted the growth of the financing ability of technology-based small and medium-sized enterprises. Follow-up scholars found that in the production sector, the development of digital finance has eased the financial constraints of SMEs, which is conducive to expanding the reproduction capacity of SMEs and increasing the profits of the production sector[4]. And the development of the digital economy has significantly promoted the real investment of state-owned and large-scale enterprises[5].

Although some results have been achieved in China's research on the impact of the digital economy on enterprises, there are still problems: (1) the literature on the relation between digital economy and investment efficiency is limited. And the current research has no consensus on the relationship between "digital economy and financial constrains". (2) Most of them are limited to deductive reasoning of the mechanism of action but little empirical analysis. So, the research on this topic is very valuable, and it is also necessary to carry out the existing data integration and empirical research.

This paper aims to examine the impact of the development of the digital economy on corporate financial constraints. And the conclusion is that the development of the digital economy has a significant positive effect on alleviating corporate financial constraints. Our results hold after a series of robustness check, including alterative measure of main variables.

Compared with the existing literature, the possible contributions of this paper are mainly as follows: (1) This paper enriches the literature on the consequences of digital economy. Existing literature focuses on digital transformation, the productivity, independent innovation and the risk management of finance and investment, while little attention has been paid on the direct consequences of digital economy. This paper investigates the effect of the digital economy on financial constraints, enriching this strand of literature. (2) This paper fills the gap in the existing ways to ease financial constraints. Most of the literature explores the factors affecting financial constrains from the aspects of financial market environment and its degree of development, political relevance and capital composition of enterprises. And the digital economy is an element that has emerged in recent years. There has been very little research on its impact on financial constraints. (3) This study provides implications to alleviate the financing difficulties and avoid financial crises of SMEs in China for policy-makers, listed firms and debtholder.

The paper can be organized as follow. Section 2 is literature review and hypothesis development. Section 3 is research design. Section 4 is empirical results and the final section is conclusion.

2 Literature Review and Hypothesis Development

Financial constraints are tough problems that have troubled SMEs in China for a long time. As an important industrial innovation force, SMEs don't have enough money to support startups, which inhibits China's macroeconomic growth a lot. Although the Chinese government has formulated certain policies to alleviate it, this problem is still difficult to be substantively solved

through some short-term policies. The reasons generally recognized by the academic community for financial constraints are as follows:

First, the important reason that hinder the financing of SMEs is information asymmetry, namely adverse selection and moral hazard. The information on operation and management of SMEs is basically internalized and opaque, making it harder for financial institutions to assess risks of financing. Meanwhile, banks are not only concerned about the level of interest rates, but also about the risk of loans. For the banks, raising the interest rate will exclude the low-risk borrower from the market, resulting in adverse selection problem. For SMEs, choosing the project with higher risk will result in moral hazard problem[6]. Stiglitz and Weiss demonstrated that credit rationing will exist as a long-term equilibrium phenomenon when information asymmetry exists. And the degree of information asymmetry between enterprises and creditors affects the constraints on external financing that enterprises are subject to[7].

Second, the low efficiency and high cost of corporate financing increase the burden on companies. According to the scale effect, the larger financing scale an enterprise has, the lower its cost will be. However, the financing scale of SMEs is generally small, so the cost is relatively higher. Generally, financing is divided into two ways: direct and indirect. Direct financing, such as equity and debt financing, requires higher transparency of enterprises, so small and medium-sized enterprises are more likely to choose to get funds through indirect financing, that is, through financial institutions. In recent years, some proposals have been made to set up special small and medium-sized financial institutions to give loans to SMEs. However, due to the loan market monopolized by Chinese state-owned commercial banks[8], the implementation of this plan is still facing many obstacles, and the financing efficiency of small and medium-sized enterprises is low. Moreover, SMEs, which have little asset and collateral, are often have large demand for funding in the initial stage, making the debtholders skeptical of the ability of them to pay the mortgage. And because of that, they are often excluded from the threshold of formal financial services.

Third, the lack of investment confidence of investors. Due to the lack of a strong personal bankruptcy system[6], shareholders only have limited liability when the business is unable to repay the loans and is on the verge of bankruptcy. Banks fear not being paid fairly so that they do not have the confidence to lend to businesses.

As the digital economy develops, there is also a new revolution in the financing field. According to the research of some researchers on digital economy, it is found that digital economy can alleviate the following problems. First, the problem of information asymmetry between enterprises and debtholders is alleviated. Thanks to the third-party platforms produced by the era of the digital economy, for the listed firms, digital economy provides them with alternative information and increases information sources. For debtholders, they can use the technology and various information to identify borrowers. There are some products that help to score credit, therefore reducing possibility of adverse selection[9]. Existing literature shows that in the era of digital economy, digital inclusive finance improves the business credit of small and medium-sized enterprises by improving the degree of enterprise information perfection, thus indirectly alleviating the financial constraints of enterprises, but this role is also regulated by the total leverage of enterprises[10].

Second, risk control during trading is more stringent. The digital economy makes real-time monitoring transactions a reality[11]. In the past, there were time delays in monitoring transactions, which gave customers opportunities to avoid responsibility by fraud, while now, the digital economy offers platforms and banks many products available for credit monitoring.

Third, time and money costs of enterprises are saved. On the one hand, digital economy provides a larger, professional platform and standardized procedures. On the other hand, transaction costs are now constrained within a reasonable range. The advent of platforms has also saved the extra cost on hiring special people, etc. for enterprises. At the same time, the development of digital inclusive finance helps to optimize corporate cash flow, reduce the ratio of corporate financial expenses and corporate leverage ratio, thus easing financial constrains[12]. Digital economy also makes the financing business get rid of the constraints of infrastructure and geographical distance, providing a more convenient platform for enterprises.

Fourth, Enhance investors' investment confidence. Digital economy helps with credit enhancements[13]. Platforms such as P2P can retain the electronic data and transaction information in each link of business on the network with the advantage of digital economy. Particularly, they can also obtain enterprise historical transaction records and business data from the data trading platform to establish a better enterprise credit investigation system. Banks are allowed to use the above information to make more accurate qualification evaluation of enterprises[14].

Nevertheless, as the digital economy is in its early stages, there is still much room for development in its stability and standardization. And the reform of the entire financial industry is also very uncertain. For example, whether the new financial technology and business model emerging of digital economy are compatible with those of traditional banks? Moreover, the security problem of user privacy information, and the correctness problem of the developed algorithm[9], are all concerning interests of enterprises, debtholders, and even the government, making many creditors very cautious about investing in the digital economy, thus aggravating the financial constraints. Therefore, based on the above analyses, this paper puts forward the following hypothesis:

Hypothesis: Digital economy has no association with financial constraints.

3 Research Design

3.1 Sample and data

The sample of this paper consists of all Chinese listed firms during the period of 2011-2020. The data involves corporate finance, corporate innovation, and corporate governance of the enterprises. The sample starts in 2011 because the Peking University Digital Financial Inclusion Index starts in 2011. Following research practice, we processed the data as follows: first, we apply a 1% bilateral tailing to the main variables in the model to eliminate regression bias due to outliers. Second, we exclude firm-years that are missing necessary data for variables. The data of financial constraints (KZ index) and the data of firms (including firm size, property, plant and equipment, net cash flow, leverage, independent directors, board of directors, Herfindahl-Hirschman Index and CEO-Chairman duality) are obtained from the CSMAR database. And the values of property, plant and equipment, net cash flow, leverage are calculated using raw data from the company's financial statements. See 3.3.3 for the specific processing process.

The Digital Inclusive Financial Index is retrieved from the Institute of Digital Finance, Peking University.

3.2 Empirical model

In order to investigate the impact of the development level of digital economy on the financial constraints of enterprises, this paper establishes the following basic regression model:

$$KZ_{it} = \beta_0 + \beta_1 Digital_{it} + \phi Control_{it} + \sigma_j + \gamma_k + \eta_t + \epsilon_{it}$$

KZ_{it} indicates the financial constrains the firm *i* are faced with in the year *t*, and the larger the absolute value of KZ_{it} is, the stronger the degree of financial constrains faced by enterprises. $Digital_{it}$ denotes the level of development of the digital economy of the province where the firm *i* is located in the year *t*. The subscripts *i, j, k,* and *t* denote companies, provinces, industries, and years, respectively.

In addition, this paper added the year fixed effects and industry fixed effects in order to mitigate the disturbance of potential industry and provincial characteristics and macroeconomic factors on the estimation results.

3.3 Variables

This paper constructed three types of variables including namely the explanatory variables, the main explanatory variables and the control variables. The explanatory variables are the financial constrains faced by enterprises (*KZ*). The main explanatory variables are the level of digital economy development (*Digital*), and the control variables are firm size (*Size*), property, plant and equipment (*PPE*), net cash flow (*Cfo*), leverage (*Lev*), Independent directors (*Indep*), board of directors (*Board*), Herfindahl-Hirschman Index (*HHI*) and CEO-Chairman duality (*Dual*).

3.3.1 The measurement of financial constraints

There are many ways to measure financial constrains in the existing literature, and more scholars tend to select indicators of different dimensions to construct comprehensive financing constraint indicators because they can better solve the endogeneity problem in the model[10]. The most common indicators include KZ index, SA index, WW index and FC index. Besides, some scholars choose to use a certain indicator in corporate finance as a substitute value for financial constraints. This paper selects the KZ index as a proxy for financial constraints.

3.3.2 The measurement of the level of development of the digital economy

Prior literatures propose a variety of methods for measuring the development level of digital economy. The following three types have been widely used:

(1) Peking University Digital Financial Inclusion Index

The index is compiled by a joint research group composed of the Digital Finance Research Center of Peking University and Ant Financial Group, including the digital inclusive financial index, as well as the breadth of digital financial coverage, the depth of digital financial use and the degree of digitalization of inclusive finance, covering Chinese mainland 31 provinces (municipalities directly under the central government, autonomous regions, referred to as "provinces"), 337 cities above the prefecture level (regions, autonomous prefectures, leagues, etc.,

referred to as "cities"), and nearly 2,800 counties (county-level cities, banners, municipal districts, etc., referred to as "counties").

(2) Digital Economy Comprehensive Development Index

The index is a city-level measurement system. Referring to the article of Zhao[15], the data of five indicators, including the evaluation index system of China's provincial level digital economy constructed by Liu et al.[16], the city-level Internet development measurement index proposed by Huang[17], and the Beijing Digital Inclusive Financial Index were processed to obtain the comprehensive development index of the digital economy, of which the original data was obtained from the National Bureau of Statistics.

(3) Enterprise digital transformation indicators

Compared to the previous two indices, this indicator focuses on micro-level measurement. Referring to the idea of Wu[18], the word frequency statistical method is used to count the frequency of the indicators of the five modules of artificial intelligence technology, blockchain technology, cloud computing technology, big data technology and digital technology application in the annual reports of listed companies, so as to measure the degree of digital transformation of enterprises, so as to express the level of digital economy development.

(4) Other measurement indicators

Fan[19] established three measurement indicators DT1, DT2 and DT3 from the four dimensions of information and communication technology (ICT) use level, infrastructure level, development environment and economic impact; There are also ways to directly express the level of development of the digital economy in terms of its overall size.

This paper selects the city-level Peking University Digital Financial Inclusion Index as a measure of the development level of the digital economy, and also synthesizes some of the original data in Zhao's measurement system[15].

3.3.3 Control Variables

This paper selects control variables from eight aspects: firm size (*Size*), property, plant and equipment (*PPE*), net cash flow (*Cfo*), leverage (*Lev*), Independent directors (*Indep*), board of directors (*Board)*, Herfindahl-Hirschman Index (*HHI*) and CEO-Chairman duality (*Dual*). Firm size (*Size*) is defined as the natural logarithm of total assets at the fiscal year-end. Property, plant and equipment (*PPE*) is defined as the proportion of fixed assets to total assets. Existing literatures have shown that the liquidity has impacts on corporate financial constraints, so we include net cash flow (*Cfo*), which can be expressed as net cash flow from operation activity scaled by total assets, and leverage, which is the value of total liabilities divided by total assets. Following Luo and Wu[20], we control board characteristics including *Indep*, which are used as the proxy for the number of independent directors divided by the total number of board directors, *Board*, which denotes the natural logarithm of board of directors, and CEO-Chairman duality (*Dual*), which takes the value of 1 if the CEOs of the firms also serve as the chairman of the board. In addition, we control the Herfindahl-Hirschman Index (*HHI*), which indicates market competitiveness.

Table 1. Variable definition and description

Variable	Symbol	Description
Explained Variable	*KZ*	Financial constrains index
Explanatory Variable	*Digital*	Digital economy development level
Control Variable	*Size*	The natural logarithm of total assets at the fiscal year-end
	PPE	Property, plant and equipment, measured as the proportion of fixed assets to total assets
	Cfo	Net cash flow from operation activity scaled by total assets
	Lev	Total liabilities divided by total assets
	Indep	The number of independent directors divided by the total number of board directors
	Board	The natural logarithm of board of directors
	HHI	The Herfindahl-Hirschman Index
	Dual	CEO-Chairman duality. If the CEO and chairman is the same person, then Dual equals one.

Table 1 presents the definitions and descriptions of all variable used in this paper.

4 Empirical Results

4.1 Descriptive statistics

Table 2. Descriptive Statistics

Variable	N	Mean	SD	p25	p50	p75
KZ	26978	0.864	2.251	-0.348	1.078	2.301
Digital	26978	217.200	71.490	169.100	231.100	275.600
Size	26978	22.130	1.313	21.190	21.950	22.880
PPE	26978	0.206	0.160	0.081	0.171	0.294
Cfo	26978	0.045	0.071	0.006	0.045	0.086
Lev	26978	0.423	0.214	0.250	0.411	0.582
Indep	26978	0.382	0.072	0.333	0.364	0.429
Board	26978	2.284	0.255	2.197	2.303	2.485
HHI	26978	0.292	0.119	0.221	0.256	0.308
Dual	26978	0.281	0.450	0.000	0.000	1.000

Table 2 presents the descriptive statistics. The results shows that the mean values of *KZ* and *Digital* are 0.864 and 217.200, respectively. There is a significant difference between the upper quartile and the lower quartile, suggesting a large gap in the internal financial constraints of enterprises. In addition, from the large value of standard deviation of *Digital*, we can know that the level of the digital economy development is large across geographic regions and years. The mean values of *Size*, *PPE* and *Cfo* are 22.130, 0.206 and 0.045, respectively. The mean value of *Lev* is 0.423, suggesting a high leverage of firms. The mean value of *Indep* is 0.382, reflecting

the CSRC's requirements for independent directors' appointments. The mean value of *Board* is 2.284. The mean value of *HHI* is 0.292, with a standard deviation of 0.119, indicating a similar degree in concentration of markets. The mean value of *Dual* is 0.281 and the standard deviation is 0.450, indicating that on average, 28.1% of the CEOs of Chinese firms also serve as the chairman of the board.

Table 3. Year Distribution

Accounting period	Freq.	Percent
2011	2,059	7.63
2012	2,208	8.18
2013	2,189	8.11
2014	2,231	8.27
2015	2,393	8.87
2016	2,629	9.74
2017	2,993	11.09
2018	3,194	11.84
2019	3,369	12.49
2020	3,713	13.76

Table 3 presents the annual distribution of the sample, which shows that the annual distribution of data is even.

4.2 Baseline Results

The main regression results are presented in Table 4. Columns (1) and (2) use *KZ* as the dependent variable. Each column of regression controlled for industry, province, and annual fixed effects. Column (1) reports model estimates with no control variables added and Column (2) reports the model estimates with all control variables added. In columns (1) and (2), the coefficient estimates of *Digital* are both significant at the 1 % level (Coefficient = -0.011 with t = -16.18; Coefficient = -0.001 with t = -3.00), confirming that the level of development of the digital economy has a significant negative impact on the value of *KZ* index, which means that a higher level of development of digital economy will help alleviate the financial constraints faced by enterprises. So, our results are statistically significant. In an economic sense, for every 1 % increase in the level of development of digital economy, the financial constraints will be alleviated by an average of 0.001%, which is consistent with the prediction of this paper.

Table 4. Baseline Results

	(1) *KZ*	(2) *KZ*
Digital	-0.011***	-0.001***
	(-16.18)	(-3.00)
Size		-0.282***
		(-39.78)

PPE		1.983***
		(38.48)
Cfo		-16.360***
		(-128.77)
Lev		6.266***
		(141.62)
Indep		0.252**
		(2.54)
Board		0.171***
		(5.60)
HHI		-0.626***
		(-3.24)
Dual		-0.128***
		(-7.28)
Constant	3.159***	5.627***
	(22.34)	(31.70)
N	26978	26978
Adj R^2	0.132	0.736

Here, ***, **, and * represent the statistical significance of two-tailed tests at the 1%, 5%, and 10% levels, respectively

5 Conclusions

Based on the current situation of corporate financing characteristics in China, this paper aims to examine the impact of the development of the digital economy on corporate financial constraints. Based on the data of China's listed companies from 2011 to 2019, and based on existing economic theories and literature, this paper concludes that the development of the digital economy has a significant positive effect on alleviating corporate financial constraints, and this conclusion is still valid after the robustness test.

The development of the digital economy can alleviate the financial constrains faced by Chinese enterprises, which is of great significance for the high-quality development of China's economy.

First, for enterprises, the reduction of financial constrains means that the liquidity they have is improved, the capital turnover rate is improved, and SMEs have more opportunities to enter the market and obtain more profits, so SMEs should follow the development trend of the digital economy era, improve the level of science and technology, and accelerate digital transformation;

Second, local banks should gradually relax lending controls on enterprises, take advantage of the information advantages built by the digital economy, give the market enough vitality, stimulate consumption and entrepreneurship, and thus stimulate China's macroeconomy

Third, for the government, the development of the digital economy has further optimized the allocation of resources, so the government should take advantage of the momentum to vigorously promote the development of the digital economy, alleviate local regional gaps, break down regional barriers, and promote the implementation of China's "domestic circulation" strategy

The research in this paper also has certain limitations. The specific mechanism of the impact of the digital economy on financial constrains is complex and unclear. In addition, this article does

not examine the influence of other factors in detail. These unfinished points will be the future research direction of this paper.

References

[1] Tong Feng & Zhang Ge.(2020). The Connotation Characteristics, Unique Advantages and Path Dependence of China's Development of Digital Economy. Science and Technology Management Research (02), 262-266.

[2] Qi Yudong & Xiao Xu.(2020). Transformation of Enterprise Management in the Era of Digital Economy. Journal of Management World (06), 135-152+250. doi:10.19744/j.cnki.11-1235/f.2020.0091.

[3] ZHONG Chenglin & HU Xueping.(2021). Research on the influence of digitalization of science and technology finance on financing ability of small and medium-sized enterprises: Based on the perspective of heterogeneity realization form. JOURNAL OF CHONGQING UNIVERSITY (Social Science Edition) (06), 46-58.

[4] Li Jian. (2021).Mechanism and path of digital finance promoting high-quality economic development (Zhongnan University of Economics and Law Ph.D. Dissertation). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CDFDLAST2022&filename=1021686653.nh.

[5] JIANG Hongli,HOU Yan & JIANG Pengcheng. (2022). Whether the development of the digital economy promotes or discourages corporate entity investment: empirical evidence from Chinese listed companies. Modern Finance and Economics-Journal of Tianjin University of Finance and Economics (05),78-94. doi:10.19559/j.cnki.12-1387.2022.05.004.

[6] Yang Fenglai & Huang Yonghang. (2006). Corporate Governance Structure, Information Asymmetry and SME Financing. Journal of Financial Research(05),159-166.

[7] ZHENG Jianghuai,HE Xuqiang,WANG Hua.(2001). The Financing Constraints of Listed Companies' Investment: An Empirical Analysis from the Perspective of Equity Structure Financial Research (11), 92-99

[8] Lin Yifu, Li Yongjun. (2001). Development of Small and Medium-sized Financial Institutions and SME Financing. Economic Research Journal(01),10-18+53-93.

[9] In Lee, Yong Jae Shin (2008). Fintech: Ecosystem, business models, investment decisions, and challenges. Business Horizons (61), 35-46

[10] Li Jianwei, Wei Renyi, Guo Yuanyuan (2022). How Can the Financing Constraints of SMEs Be Eased in China?-Effect Analysis, Heterogeneity Test and Mechanism Identification Based on Digital Inclusive Finance? Frontiers in Environmental Science (10), doi: 10.3389/fenvs.2022.949164. https://www.frontiersin.org/articles/10.3389/fenvs.2022.949164

[11] Gomber, Peter (2018), On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services. Journal of Management Information Systems (35), 220-265

[12] Ren Xiaoyi. (2020). Can the development of digital inclusive finance ease the financing constraints of enterprises? Discussion on Modern Economy (10), 65-75. doi:10.13891/j.cnki.mer.2020.10.010.

[13] Chen Xiaohui & Zhang Hongwei. (2021). How does the digital economy affect the level of corporate risk-taking? Economic Management (05), 93-108. doi:10.19616/j.cnki.bmj.2021.05.006.

[14] Li Jizun. (2015). Thoughts on Internet Finance. Management World (07), 1-7+16. doi:10.19744/j.cnki.11-1235/f.2015.07.002.

[15] ZHAO Tao, ZHANG Zhi & LIANG Shangkun. (2020). Digital Economy, Entrepreneurial Activity and High-quality Development: Empirical Evidence from Chinese Cities. Management World (10), 65-76. doi:10.19744/j.cnki.11-1235/f.2020.0154.
[16] LIU Jun, YANG Yuanjiang & ZHANG Sanfeng. (2020). Research on the measurement and driving factors of China's digital economy. Shanghai Economic Research (06),81-96. doi:10.19626/j.cnki.cn31-1163/f.2020.06.008.
[17] HUANG Qunhui, YU Yongze & ZHANG Songlin. (2019). Internet Development and Manufacturing Productivity Improvement: Internal Mechanisms and China's Experience. China Industrial Economics (08), 5-23. doi:10.19581/j.cnki.ciejournal.2019.08.001.
[18] WU Fei, HU Huizhi, LIN Huiyan & REN Xiaoyi. (2021). Corporate Digital Transformation and Capital Market Performance: Empirical Evidence from Equity Liquidity. Management World (07), 130-144+10. doi:10.19744/j.cnki.11-1235/f.2021.0097.
[19] FAN Xin. (2021). Digital Economy and Exports: An Analysis Based on Heterogeneous Stochastic Frontier Model. Journal of World Economy (02), 64-76+135. doi:10.13516/j.cnki.wes.2021.02.005.
[20] Luo, K., & Wu, S. (2022). Corporate sustainability and analysts' earnings forecast accuracy: Evidence from environmental, social and governance ratings. Corporate Social Responsibility and Environmental Management, 29(5), 1465– 1481. https://doi.org/10.1002/csr.2284