

The Relationship between Digital Transformation and the Investment Efficiency of Gree Electric Appliances

Jiaqi Chen

School of Public Finance and Taxation, Central University of Finance and Economics, Beijing, China

cjq2003ylm@outlook.com

Abstract. With the rapid development of the global digital economy, China's traditional manufacturing industry is facing the pressure of accelerated technological iteration and intensified market competition. Gree Electric Appliances (000651), as a leading enterprise in the air conditioning industry, has been affected by China's macroeconomic fluctuations and the impact of emerging enterprises, resulting in a decline in investment efficiency. This research focuses on the relationship between digital transformation and Gree Electric Appliances' investment efficiency. Based on the annual report data of Gree Electric Appliances from 2012 to 2024, through case analysis and empirical analysis, this study reveals how digitalization influences the capital allocation efficiency of Gree Electric Appliances and provides some advice and references for the whole manufacturing industry. This research finds that the digital transformation significantly improves Gree Electric Appliances' investment efficiency, and the degree of digitalization, cash flow level, and financial leverage are positively correlated with the investment efficiency. Profitability has no significant impact on Gree Electric Appliances' investment efficiency. Based on extensive analysis, this research proposes targeted countermeasures, including strengthening support for research and development of intelligent products, deepening the integration of online and offline channels, and strengthening internal management to optimize operational efficiency.

Keywords: Digital Transformation, Investment Efficiency, Gree Electric Appliances.

1. Introduction

With the rapid development of the digital economy, traditional manufacturing industries are under pressure from accelerated technological iteration and intensified market competition. Gree Electric Appliances (000651), as the leading enterprise in China's air conditioning industry, has prolonged reliance on heavy-asset operations. However, due to the rising costs from recent macroeconomic fluctuations and the impact of emerging technology enterprises, its investment efficiency has shown a downward trend. At the same time, the Chinese government has continuously promoted the "Made in China 2025" and "Cloud Computing for Enterprises" strategies, guiding the manufacturing industry to optimize resource allocation through digital transformation.

At present, some studies suggest that enterprises typically digitize their channels through digital technologies. For instance, Xiao Jinghua believes that when enterprises undergo digital transformation, it essentially involves integrating the digital economy with the real economy [1]. The digital economy provides enterprises with innovative impetus in terms of technology, products, and markets, and also treats data as a production factor.

Furthermore, some studies indicate that enterprises can achieve digitalization through full-chain reforms. Zeng Delin points out that when enterprises undergo digital transformation, they mainly rely on digital technological innovation, the development of digital products, and the establishment of digital infrastructure as supporting points to realize changing management methods, organizational restructuring, talent recruitment, talent cultivation, business models, and value chains [2].

Finally, the internal factors of the enterprise are also very important for the digital transformation of the enterprise. Ji Feng and Mu Yupeng studied the digital transformation of multiple traditional enterprises and found that among various factors affecting the digital transformation, the internal factors of the enterprise are more significant [3]. It mainly manifests as the enterprise using the digital

economy to integrate resources, and managers reforming traditional enterprises through the Internet+ with a long-term development perspective.

Many studies have found that the investment efficiency is related to government policies. Wang Xiongyuan and Xu Jing found that flexible policies are conducive to clarifying the boundaries of government behavior, fostering a level playing field for business, attracting more market entities to enter, and improving the efficiency of market resource allocation [4]. Shen Zhixuan, Zhu Shujin, and Wen Qian concluded through empirical research that in regions where the government actively promotes digital governance, the investment efficiency of enterprises has significantly improved [5]. The digital governance of government cannot only enhance the collaborative governance ability of different government departments, reduce the institutional transaction costs of enterprises, but also improve the information transparency of the government, making enterprises hold more optimistic policy expectations.

In addition, the investment efficiency is also related to the enterprise structure. Xu Yude and Zhou Wei believe that the investment efficiency level of listed companies is significantly affected by the company's capital structure and ownership arrangement [6]. Enterprises with low leverage hardly have the phenomenon of excessive investment, while enterprises with high leverage have very serious excessive investment. Huang Bingyi and Huang Yuting pointed out that employee directors can effectively improve the investment efficiency of listed companies [7]. Employee directors can not only restrain enterprises from excessive investment, but also alleviate enterprises from insufficient investment.

The investment efficiency is also affected by other factors. For example, Shen Danlin, Jiang Xuanyu found that social trust is significantly correlated with the investment efficiency of enterprises' labor investment positively, and the improvement of social trust can help to enhance the investment efficiency for enterprises [8]. Liu Jinyang pointed out that after listed companies were randomly inspected by the China Securities Regulatory Commission, their investment efficiency significantly increased, and the second random inspection could significantly enhance the positive correlation of how random inspection affects enterprise investment efficiency [9].

However, most existing studies focus on macro industry analysis and lack micro empirical discussions on how the digital transformation of leading enterprises specifically affects investment efficiency, especially lacking targeted research about GREE Electric Appliances and other enterprises as samples. Therefore, This study explores how GREE's digital transformation practices have influenced its capital allocation efficiency to provide a quantifiable theoretical model for subsequent related research. At the same time, this paper can also provide a reference transformation path for enterprises in the same industry, responding to the national "cost reduction and efficiency improvement" industrial upgrading goal, promoting China's manufacturing industry to shift from scale expansion to high-quality, driven, sustainable development.

2. The Digital Transformation Journey of Gree Electric Appliances

2.1. The Initial Informatization Stage (2012 - 2014)

Since 2011, Gree Electric Appliances has been implementing fully automated production. In 2012, it established a dedicated department for automated production operations and a research and development center to independently develop core technologies, forming a multi-link and full-chain automated operation system. In 2013, it established an Information Department to optimize the company's internal management system and accelerate the company's network construction. In 2014, it established automated business divisions, research departments and production equipment departments nationwide. At the same time, Gree Electric Appliances independently developed an engineering management system based on Gree Production Management System (GPMS), using big data technology to maintain and improve the company's internal engineering management system, enabling it to efficiently control the entire engineering process and accurately respond to customers' demands.

2.2. Exploration Phase of Digital Transformation (2015 - 2017)

In 2015, Gree Electric Appliances established an intelligent research institute, which was specifically responsible for the company's digital research and development. In 2016, it constructed an information-sharing platform to optimize the collaboration between production factors and human-machine interaction. In 2017, Gree Electric Appliances launched an industrial internet platform based on technologies such as the Internet of Things, big data, and cloud computing, collecting data in real time for in-depth analysis. This year, a Selective Compliance Assembly Robot Arm(SCARA) was developed and integrated with Computer Numerical Control(CNC) equipment, achieving full-line automation. Additionally, Gree Electric Appliances also developed a series of automatic logistics facilities to provide intelligent warehousing and distribution services for the entire supply chain's logistics system. At the same time, the company used big data to analyze consumer behavior, providing a scientific basis for marketing decisions for the enterprise.

2.3. Digital Transformation and Upgrading Phase (Since 2018)

In 2018, Gree Electric Appliances responded to the "Digital Upgrade" strategy and embarked on the path of digital overhaul, focusing on building a digital platform, an intelligent manufacturing system, and achieving digital upgrading of the supply chain. In 2019, Gree collaborated with China Unicom, based on State-of-the-art technologies like 5G, the Internet of Things (IoT), and artificial intelligence (AI), creating a 5G intelligent manufacturing demonstration base, and on this basis, formed an industry-wide ecological collaboration system. In October of the same year, Gree Electric Appliances initiated the "Digital Operation" plan and, on this basis, constructed a user database to drive product design, marketing strategies, and pre-sales and after-sales services.

Since 2020, Gree Electric Appliances has continuously deepened and accelerated its digital transformation, using the Internet of Things to manage equipment throughout its life cycle and achieve integrated maintenance and repair. At the same time, Gree Electric Appliances is also actively exploring new models of intelligent new retail, integrating the "new retail" system with digital technology. Online, it achieves accurate contact with users, and offline, it combines AI, Augmented Reality (AR), and Virtual Reality (VR) technologies through innovative smart touch technologies to create a digital interaction model for physical stores, and through the cloud platform for product display and real-time pricing, to enhance the shopping experience of customers. In the field of intelligent customer service, Gree optimizes resource allocation through intelligent distribution to improve the accuracy and effectiveness of services. In intelligent management, Gree conducts in-depth analysis of various commercial data to make data transparent and operation management intelligent, supporting the digital transformation of enterprises.

3. Model Setup

In Table 1, the estimation model for investment efficiency is as follows:

$$Inv = \alpha_0 + \alpha_1 Lev + \alpha_2 Cash + \alpha_3 Yreteq + \varepsilon \quad (1)$$

Here, *Inv* represents the actual investment expenditure of the enterprise in the current year, which is the proportion of its capital expenditure (CapEx) to the total assets at the beginning of the period.

The residuals t obtained from the regression in Eviews are taken, and the absolute value of t is used as the investment efficiency (*Inv*) of the enterprise.

Table 1. Variable settings and interpretation explanation

variable name		variable declaration
Dependent variable	Investment efficiency (Inv)	After conducting a regression analysis on the asset-liability ratio, cash holdings, and stock yield, the absolute values of the regression residuals were used to represent the investment efficiency of the enterprise [10].
Independent variable	Digital degree (Digital)	The proportion of the amounts related to digitalization in the detailed list of intangible assets disclosed in the financial report of Gree Electric Appliances was used as the measurement criterion [11].
Control variable	Financial leverage (Lev) Cash flow level (CFO) Profitability (ROA)	

A regression analysis was conducted on the variables in Table 1. The regression model used is as follows: The regression results are presented in Table 2.

$$Inv = \beta_0 + \beta_1 Digital + \beta_2 Lev + \beta_3 CFO + \beta_4 ROA + \varepsilon \quad (2)$$

4. Regression Analysis

4.1. Regression Conclusion

As shown in Table 2, the standard errors of the regression variables are all relatively small, indicating that the estimations of each explanatory variable are relatively reliable.

The autocorrelation test was conducted on the regression results in Table 2. From $DW \approx 2.29$, it can be concluded that there is no autocorrelation in this regression.

It can be seen from Table 2 that $\beta_0 \approx -0.02$, $\beta_1 \approx 0.23$, $\beta_2 \approx 0.02$, $\beta_3 \approx 0$, $\beta_4 \approx 0.05$. This indicates that the investment efficiency of Gree Electric Appliances is positively correlated with the enterprise's digitalization level, cash flow level, and financial leverage, but has little relation with profitability.

Table 2. Baseline regression results

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	-0.0184	0.0226	-0.8125	0.4400
DIGITAL	0.2315	0.2015	1.1489	0.2838
LEV	0.0162	0.0276	0.5853	0.5745
CFO	0.0000	0.0000	-0.7712	0.4628
ROA	0.0484	0.1092	0.4432	0.6693
R-squared	0.2134	Mean dependent var	0.0047	
Adjusted R-squared	-0.1800	S.D. dependent var	0.0039	
S.E. of regression	0.0043	Akaike info criterion	-7.7838	
Sum squared resid	0.0001	Schwarz criterion	-7.5665	
Log likelihood	55.5944	Hannan-Quinn criter	-7.8284	
F-statistic	0.5426	Durbin-Watson stat	2.2948	
Prob(F-statistic)	0.7096			

4.2. Residual Test

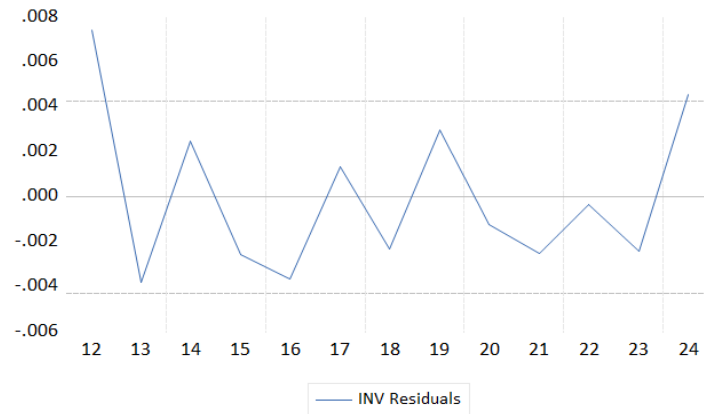


Figure. 1. Residual test chart (Picture credit: Original).

A residual test was conducted on the above regression, and the residual plot is shown in Figure 1. From Figure 1, it can be seen that the residuals are randomly distributed near the 0 axis and show no regular trend, indicating that the model prediction is relatively reliable.

4.3. Heteroscedasticity Test

Null Hypothesis (H0): Homoscedasticity

Alternative Hypothesis (H1): Heteroscedasticity

Based on the above hypotheses, a BP test was conducted, and the results are as follows:

Set $\alpha = 0.05$. The P-value $\approx 0.81 > \alpha$. Therefore, the null hypothesis cannot be rejected, supporting homoscedasticity. That is, there is no heteroscedasticity among the variables Digital, Lev, CFO, and ROA. The result of the hypothesis test is reliable.

5. Conclusion

Based on the relevant data of Gree Electric Appliances from 2012 to 2024, Gree Electric Appliances was selected as the case study object. This paper analyzed and studied the relevant research and paths of Gree Electric Appliances' digital transformation. Through specific data analysis, the following conclusions were drawn: The digital transformation of Gree Electric Appliances significantly improved investment efficiency. Moreover, as the digitalization level of Gree Electric Appliances, the level of cash flow, and the financial leverage level increase, the enterprise investment efficiency also increases. The investment efficiency of Gree Electric Appliances has little relation to the enterprise's profitability.

The targeted recommendations obtained from the research can be summarized as follows: First, increase support for the development of intelligent products. Gree Electric Appliances needs to carry out research and innovation, make good use of intelligent digital technology, center on consumer demands, and continuously develop and innovate intelligent household appliances through artificial intelligence, big data, blockchain and other digital technologies.

Second, accelerate the integration of online and offline channels. When enterprises carry out digital marketing and transform to online channels, they must not neglect the development of offline channels. In the online channels, enterprises should actively optimize online sales through self-built platforms, e-commerce platforms, social platforms and live streaming, etc.; in the offline channels, enterprises should use digital technology to continuously improve offline stores and increase consumers' experience.

Third, improve internal enterprise management. During the digital transformation process of Gree Electric Appliances, it is necessary to continuously improve and strengthen internal management, strengthen control over inventory, accounts receivable and assets, and both reduce costs and enhance internal operational capabilities, thereby improving enterprise performance.

References

- [1] Xiao, J.: Enterprise cross-sector digital transformation and management adaptability change. *Transformation* 6(4), 37-49 (2020).
- [2] Zeng, D., Cai, J., Ouyang, T.: Digital transformation research: integrated framework and future prospects. *Foreign Economics and Management* 7(5), 63-76 (2021).
- [3] Ji, F., Mu, Y.: Research on the influencing factors of traditional enterprises' internet transformation based on grounded theory. *Hunan Social Sciences* 22(6), 141-146 (2016).
- [4] Wang, X., Xu, J.: Does relaxing market access regulation improve enterprise investment efficiency? - a quasi-natural experiment based on the pilot of "negative list of market access". *Financial Research* 11(9), 169-187 (2022).
- [5] Shen, Z., Zhu, S., Wen, Q., et al.: Empowering effective markets with an active government: government digital governance and enterprise investment efficiency. *World Economy* 48(2), 166-195 (2025).
- [6] Xu, Y., Zhou, W.: Measurement of investment efficiency under different capital structures and ownership arrangements - empirical evidence from China's A-share market. *China Industrial Economy* 32(11), 131-140 (2009).
- [7] Huang, B., Huang, Y.: Do employee directors affect enterprise investment efficiency? - based on empirical evidence from China's capital market. *Accounting Research* 55(5), 77-91 (2022).
- [8] Shen, D., Jiang, X.: Social trust and enterprise labor investment efficiency. *Financial Research* 35(9), 152-168 (2022).
- [9] Liu, J.: Administrative supervision of the CSRC and company investment efficiency - a quasi-natural experiment based on the random inspection system. *Accounting Research* 78(4), 126-136 (2024).
- [10] Lu, Y., Peng, Z., Feng, J.: Research on the impact of margin trading and short selling on listed company governance. *Journal of Management Science* 21(11), 92-111 (2018).
- [11] Richardson, S.: Over-investment of free cash flow. *Review of Accounting Studies* 11(12), 159-189 (2006).