

The Impact of Cash Holdings on Firm Value and the Moderating Role of Leverage

-- A Time-Series Analysis of Gree Electric

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Abstract

Based on the trade-off theory, priority financing theory, and agency theory, this article selects quarterly financial data of Gree Electric from the first quarter of 2004 to the first quarter of 2026, and uses time series analysis to empirically study the impact of cash holdings on enterprise value and the moderating effect of leverage. The research results show that cash holdings with a lag of one period have a weak positive impact on enterprise value at a significant level of 10%; But leverage did not show any statistical moderating effect. The leverage adjustment effect is not significant, because most of Gree's liabilities are interest free operating liabilities, and interest-bearing liabilities have been at a very low level for a long time, greatly weakening the governance role of debt. To ensure the reliability of the conclusion, this article conducted ADF unit root test, time series regression, and robustness test by excluding samples from the epidemic stage. This study can provide empirical reference for the liquidity management and capital structure decision-making of mature manufacturing enterprises, and also enrich the boundary related theories of cash holding value effects.

Keywords

Cash Holdings; Firm Value; Leverage Moderation; Time-series Analysis; Gree Electric.

1. Introduction

The global economic recovery is slowing down, geopolitical conflicts are frequent, and industry cycles are becoming more volatile, putting increasing pressure on corporate cash management. The uncertainty of external financing is increasing, and companies will reserve more cash to resist risks [1]. But a large amount of idle funds will also reduce the efficiency of fund utilization and lower investment returns [2]. For mature manufacturing enterprises, the contradiction between "holding cash for risk prevention" and "idle and wasteful funds" is particularly prominent. Doing a good job in cash management has become an important part of enterprise strategic planning, risk control, and enhancing enterprise value.

Compared with mature capital markets in the West, China's capital market is still constantly improving and developing. Although quarterly financial reports of listed companies are becoming increasingly standardized and information transparency is constantly improving, domestic enterprises still face strong financing constraints and agency problems [3]. The unique market environment makes the impact of cash holdings on enterprise value significantly different from that of developed country enterprises. Therefore, conducting research based on the actual situation of Chinese enterprises can provide practical references for cash and debt management, investor valuation, and regulatory policy optimization.

However, most existing studies use cross-sectional research, which cannot reflect the dynamic changes in long-term funds of mature manufacturing enterprises, especially industry leaders like Gree, which have high cash and low interest liabilities in the long term. Meanwhile, the

theoretical inference of leverage threshold effect for low debt enterprises lacks empirical evidence from micro enterprises. In response to the above shortcomings, this article conducts time series analysis using Gree Electric as a single sample to study how cash holdings affect enterprise value and whether leverage has a moderating effect.

The research contributions of this paper are reflected in three main aspects. First, the long-window single-firm time-series design controls unobserved heterogeneity, improving causal inference. Second, it provides new micro-level evidence on domestic capital structure and liquidity management. Third, it empirically verifies the boundary conditions of debt governance effects under low interest-bearing debt scenarios.

2. Theoretical Analysis and Research Hypotheses

2.1. The Relationship between Cash Holdings and Enterprise Value

The trade-off theory suggests that maintaining a reasonable cash reserve can serve as a financial buffer, reduce the cost of financial distress, alleviate financing difficulties, help companies seize investment opportunities, and ultimately enhance their value [4]. But this theory assumes that companies can perfectly balance the costs and benefits of holding cash. In reality, information asymmetry combined with limited rationality of managers makes it difficult to achieve this and cannot explain the phenomenon of some companies having cash far above the theoretical reasonable level.

The theory of prioritized financing proposes that in an environment of information asymmetry, a company's own cash is the lowest cost source of financing [5]. Cash is like a reservoir of funds between internal and external financing. When encountering investment opportunities, holding cash eliminates the need to bear high external financing costs. But this theory ignores the agency conflict caused by excessive cash.

The agency theory holds that holding too much cash can easily lead management to engage in selfish behavior and harm shareholder interests [6]. Jensen (1986) proposed that sufficient free cash flow would encourage management to invest in inefficient projects and blindly expand the size of the enterprise, rather than distributing money to shareholders. [7]. Dittmar et al. (2003) found in a cross-national study that the cash value of enterprises in regions with weak investor protection was significantly lower, confirming the agency theory [8].

The differences in the above theories indicate that the relationship between cash holdings and firm value is not fixed but changes with firm characteristics and the institutional environment. In mature manufacturing enterprises, stable cash flows and fewer new investment opportunities reduce the marginal value of cash. However, Chinese manufacturers generally face strong external financing constraints. For leading enterprises like Gree, abundant cash reserves help smooth cyclical fluctuations and mitigate external financing pressure, and the resulting positive value effect can partly offset diminishing marginal returns [3]. Therefore, this study proposes the following hypothesis.

Hypothesis 1: After controlling for enterprise characteristics variables, the lagged cash holdings have a significant positive impact on the current enterprise value.

2.2. The Regulatory Role of Leverage

In response to the theoretical differences regarding the cash holding value effect, some scholars began to focus on the moderating role of leverage and formed two competing viewpoints. From the perspective of creditor supervision, high leverage and strict debt contracts can restrain managers' abuse of free cash flow, promote the effective allocation of cash, and enhance the positive effect of cash holdings on firm value [7]. Debt financing introduces an external supervision mechanism, and creditors, in order to protect their own interests, will limit the investment and dividend decisions of the enterprise through contractual terms. This external

governance effect can alleviate the agency conflict between shareholders and managers. Denis and Sibilkov's research also indicate that for enterprises with strong financing constraints, the marginal value of cash holdings is higher, and high leverage further amplifies this positive effect by constraining the discretionary power of management [9].

In contrast, from the perspective of financing constraints, high leverage intensifies repayment pressure and bankruptcy risk, forcing firms to hold cash passively to meet debt obligations, which compresses the space for productive investment and weakens the value-enhancement effect of cash holdings [10]. When the financial leverage of a company is high, a portion of cash is "locked" for debt preparation, making it difficult to flexibly invest in production and investment, and the marginal efficiency of cash use decreases accordingly.

Bolton et al. (2024) further proposed that when a company's interest-bearing liabilities fall below a certain threshold, the governance effect of debt will significantly weaken, and the logic of the cash holding value effect will also change accordingly [11]. This theoretical judgment has important reference significance for understanding the financial behavior of low interest-bearing debt enterprises such as Gree, but there is currently a lack of direct empirical testing at the micro level. For companies like Gree, which have low levels of long-term interest-bearing debt and rely mainly on interest free operating funds, the creditor supervision effect of debt is naturally weak due to the lack of substantial risk constraints. Consequently, marginal increases in leverage reflect higher repayment pressure and financial risk rather than strengthened external governance. Thus, leverage is expected to have a negative moderating effect on the value effect of cash holdings. This study proposes the following hypothesis.

Hypothesis 2: The lagging leverage level has a negative regulatory effect on the relationship between cash holdings and enterprise value.

3. Research Design

3.1. Sample Selection and Data Sources

This paper selects Gree Electric Appliances as the research object. The research period is from the first quarter of 2004 to the first quarter of 2026. The financial data mainly comes from *China Stock Market & Accounting Research Database*. To ensure the reliability of the research results, the following screening is conducted on the initial sample: (1) Remove the observations with missing variable data; (2) Trim the continuous variables at the 1% and 99% quantiles to eliminate outliers. After the above processing and the construction of lag variables, finally 87 sets of quarterly valid time series observation samples are obtained for regression analysis.

The core advantage of the single-firm time-series design lies in controlling unobservable fixed characteristics. However, the small sample size may lead to low statistical power. Therefore, this paper considers both economic and statistical significance when interpreting regression coefficients. The 22-year quarterly time series fully release intra-firm time-varying information, partially compensating for the limited cross-sectional information of single-firm samples.

3.2. Variable Definition and Measurement

Table 1. Variable Definition and Measurement

Type	Name	Symbol	Calculation Method
Explained Variable	Firm value	<i>TQ</i>	(Market Value + Total Liabilities) / Total Assets
Explanatory Variable	Cash Holdings	<i>CH</i>	Cash & Cash Equivalents / Total Assets
Moderating Variable	Leverage Ratio	<i>Lev</i>	Total Liabilities / Total Assets
Interaction Term	Cash Holdings × Leverage Ratio	<i>CH × Lev</i>	Mean-centered interaction term of CH and Lev
Control Variables	Firm Size	<i>Size</i>	Natural Logarithm of Total Assets
	Return on Equity	<i>ROE</i>	Net Profit / Average Shareholders' Equity
	Growth Rate	<i>Growth</i>	Quarterly Revenue Year-on-Year Growth Rate

All variables are defined and measured in accordance with the standard practices adopted in mainstream corporate finance research, as summarized in Table 1.

3.3. Regression Model Specification

Considering the time lag effect of cash holdings on firm value, and to alleviate potential bidirectional endogeneity, this paper incorporates one-period lags of cash holdings and the leverage ratio into the regression. The regression formula for Hypothesis 1 is as follow:

$$TQ_t = \alpha_0 + \alpha_1 CH_{t-1} + \alpha_2 SIZE_t + \alpha_3 ROE_t + \alpha_4 GROWTH_t + \mu_t \quad (1)$$

The regression formula for Hypothesis 2 is as follow:

$$TQ_t = \alpha_0 + \alpha_1 CH_{t-1} + \alpha_2 LEV_{t-1} + \alpha_3 (CH_{t-1} \times LEV_{t-1}) + \alpha_4 SIZE_t + \alpha_5 ROE_t + \alpha_6 GROWTH_t + \mu_t \quad (2)$$

Among the two formulas, TQ_t represents the current firm value, measured by Tobin's Q. CH_{t-1} is the lagged cash holding level, LEV_{t-1} is the lagged leverage rate, $CH_{t-1} \times LEV_{t-1}$ is the interaction term between cash holdings and leverage rate. $SIZE_t$, ROE_t , and $GROWTH_t$ are control variables. α_0 is the constant term. α_1 to α_6 are the estimated regression coefficients. μ_t is the random disturbance term.

4. Empirical Results

4.1. Descriptive Statistical Analysis

Prior to the unit root test and regression estimation, descriptive statistics are conducted for all continuous variables. The mean, median, range and standard deviation of each variable are presented in Table 2.

Table 2. Descriptive Statistics

Variable	Mean	Median	Maximum	Minimum	Standard Deviation
<i>TQ</i>	1.4704	1.4321	1.9906	1.0655	0.2668
<i>CH</i>	0.1825	0.1505	0.4807	0.0452	0.1160
<i>LEV</i>	0.7217	0.7301	0.8364	0.5757	0.0679
<i>SIZE</i>	25.3854	25.7953	26.7177	23.0460	1.1794
<i>ROE</i>	0.1553	0.1573	0.3368	0.0137	0.0831
<i>GROWTH</i>	0.0863	0.0175	1.4077	-0.5269	0.3842

Table 2 shows that during the sample period, Gree's average value of Tobin's Q was 1.47, higher than the A-share manufacturing average (approximately 1.25), indicating that the market's assessment of firm value exceeded the asset replacement cost. The average cash holding ratio was 18.25%, significantly higher than the average level of A-share manufacturing companies (approximately 12%-15%), confirming its high cash holding characteristic. The average book leverage ratio was 72.17%, slightly higher than the average book leverage ratio of A-share manufacturing companies in the same period (approximately 65%). However, Gree's liabilities consist mainly of non-interest-bearing operating liabilities such as accounts payable and advance receipts, with interest-bearing liabilities accounting for less than 10% of total assets

in the long run, which greatly reduces actual repayment pressure and weakens debt's external governance effect.

The average firm size (*Size*) was 25.39, with a standard deviation of 1.18, indicating that there was a significant inter-period fluctuation in the enterprise's asset scale during the sample period, the range between its minimum value (23.05) and maximum value (26.72) was 3.67, reflecting the cumulative effect of the continuous expansion of the enterprise's asset scale from 2004 to 2026. The average *ROE* was 15.53%, indicating stable profitability. The standard deviation of the revenue growth rate was relatively large (0.3842), reflecting the influence of industry cycles.

4.2. Unit Root Test and Cointegration Test

To avoid spurious regression, the ADF unit root test is implemented for key variables. The specification of each test includes intercept and trend terms according to the data generating process of variables, and lag lengths are selected based on the AIC criterion. The test results are shown in Table 3.

Table 3. Results of ADF Unit Root Test

Variable	Test Type	Test Statistic	Prob.*	Result
<i>TQ</i>	Level	-2.7622	0.2153	Non-stationary
	1st Difference	-10.0287	0.0000	Stationary
<i>CH</i>	Level	-2.1239	0.5253	Non-stationary
	1st Difference	-4.3428	0.0007	Stationary
<i>LEV</i>	Level	-4.0258	0.0112	Stationary
<i>SIZE</i>	Level	-0.1382	0.9935	Non-stationary
	1st Difference	-3.1488	0.0266	Stationary
<i>ROE</i>	Level	-2.5810	0.2899	Non-stationary
	1st Difference	-3.8203	0.0002	Stationary
<i>GROWTH</i>	Level	-4.6305	0.0017	Stationary

The unit root test results show that the original sequences of enterprise value (*TQ*), cash holdings (*CH*), enterprise size (*SIZE*), and return on equity (*ROE*) are non-stationary, but after first-order differencing, they are all stable at the 1% significance level. The original sequence of adjusting the variable leverage ratio (*LEV*) and revenue growth rate (*Growth*) has achieved stationarity.

4.3. Regression Analysis

4.3.1. Test of Hypothesis 1

To test Hypothesis 1, Table 4 reports the OLS estimates of Model (1).

Table 4. Regression results for Hypothesis 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<i>CH (-1)</i>	0.4727	0.2678	1.7651	0.0813
<i>SIZE</i>	0.0533	0.0242	2.2071	0.0301
<i>ROE</i>	-0.0166	0.3786	-0.0437	0.9652
<i>GROWTH</i>	-0.0031	0.0764	-0.0401	0.9681
<i>C</i>	0.0322	0.6182	0.0522	0.9585
<i>R-squared</i>	0.0885	<i>Adjusted R-squared</i>	0.0440	
<i>F-statistic</i>	1.9893	<i>Prob (F-statistic)</i>	0.1038	

The lagged cash holding coefficient is 0.4727, weakly significant at the 10% level ($p=0.0813$). For every one percentage point increase in cash holding ratio, Tobin's Q will increase by approximately 0.0047 units in the next quarter. Combined with Gree's average cash holdings of 18.25%, this effect has practical economic significance. The coefficient of enterprise size is significantly positive (0.0533, $p=0.0301$), indicating that the larger the enterprise size, the higher the market valuation level. The ROE and Growth coefficients are not significant, on the one hand, there is a lag in the transmission of accounting indicators to market value under quarterly frequency; On the other hand, Tobin's Q is a forward-looking indicator that reflects investors' expectations of long-term competitiveness more than short-term accounting performance fluctuations.

The overall goodness of fit of the model is $R^2=8.85\%$, which is in line with the common characteristics of enterprise level time series analysis: enterprise value is influenced by multiple exogenous factors such as macro environment and industry cycles, and financial variables of a single enterprise cannot fully explain value changes. Combined with the above empirical evidence, Hypothesis 1 is verified. After controlling for firm-specific characteristic variables, lagged cash holdings exert a weak positive effect on the market value of Gree Electric.

4.3.2. Test of Hypothesis 2

To test Hypothesis 2, Table 5 presents the estimates of Model (2), which further introduces the lagged leverage ratio and the mean-centered interaction term.

Table 5. Regression results for Hypothesis 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<i>CH (-1)</i>	0.9390	5.0500	0.1859	0.8530
<i>LEV (-1)</i>	-1.3740	1.1123	-1.2353	0.2203
<i>CH (-1) * LEV (-1)</i>	-0.4847	6.9375	-0.0699	0.9445
<i>SIZE</i>	-0.0116	0.0433	-0.2670	0.7901
<i>ROE</i>	0.1887	0.3940	0.4789	0.6333
<i>GROWTH</i>	-0.0051	0.0804	-0.0637	0.9494
<i>C</i>	2.6223	1.6301	1.6087	0.1116
<i>R-squared</i>	0.1243	<i>Adjusted R-squared</i>	0.0587	
<i>F-statistic</i>	1.8933	<i>Prob (F-statistic)</i>	0.0921	

The coefficient for the interaction term ($CH_{t-1} \times LEV_{t-1}$) equals -0.4847 . Although coefficient sign aligns with theoretical expectations, the estimate lacks statistical significance ($p=0.9445$). Hypothesis 2 receives no empirical support from the sample data. A plausible explanation is that Gree's liabilities are largely non-interest-bearing operating payables. Creditors bear little default risk in this structure, so their incentive to monitor management is correspondingly weak. Leverage is unable to effectively regulate the value effect of cash holdings. Gree Electric Appliances' average book leverage ratio is 72.17%, but the liability subjects are mainly non-interest-bearing operating liabilities such as accounts payable and advance receipts, and the proportion of interest-bearing liabilities in total assets has long been below 10%. The actual interest payment and debt repayment pressure is limited, and the governance incentives of creditors are insufficient. Therefore, leverage is unable to effectively regulate the value effect of cash holdings. This also means that in the situation of a low level of interest-bearing debt, the value effect of cash holdings is more influenced by internal governance mechanisms rather than external debt constraints, reflecting the substitution relationship between different governance mechanisms. The changed coefficient magnitude of *CH* after mean-centering the interaction term is a standard statistical phenomenon and does not alter core economic interpretations.

4.4. Robustness Test

To ensure that the results are not driven by short-term macro shocks, this paper excludes observations during the COVID-19 pandemic (2020Q1–2022Q4). Pandemic-period unconventional monetary measures and supply-chain disruptions could distort corporate cash-holding behaviours as well as equity-market valuations. The regressions were re-estimated, and the results are shown in Tables 6 and 7.

Table 6. Robustness test for Hypothesis 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<i>CH (-1)</i>	0.5454	0.2786	1.9574	0.0543
<i>SIZE</i>	0.0445	0.0259	1.7192	0.0900
<i>ROE</i>	0.1659	0.4032	0.4116	0.6819
<i>GROWTH</i>	-0.0326	0.0907	-0.3595	0.7203
<i>C</i>	0.2058	0.6504	0.3163	0.7527
<i>R-squared</i>	0.1167	<i>Adjusted R-squared</i>	0.0663	
<i>F-statistic</i>	2.3127	<i>Prob (F-statistic)</i>	0.0660	

After excluding the samples related to the epidemic, the positive effect of holding cash in firm value has strengthened. The coefficient has risen from 0.4727 in the main regression to 0.5454, and the significance level has increased from marginally significant at 10% to nearly 5% level ($p = 0.0543$). This suggests that pandemic disturbances obscured the baseline relationship, supporting the robustness of Hypothesis 1.

Table 7. Robustness test for Hypothesis 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<i>CH (-1)</i>	4.6769	5.3158	0.8798	0.3821
<i>LEV (-1)</i>	1.1560	1.3977	0.8270	0.4111
<i>CH (-1) * LEV (-1)</i>	-5.7187	7.3099	-0.7823	0.4367
<i>SIZE</i>	0.0605	0.0493	1.2276	0.2238
<i>ROE</i>	0.1671	0.4230	0.3951	0.6940
<i>GROWTH</i>	-0.0077	0.0972	-0.0796	0.9368
<i>C</i>	-1.0305	2.0055	-0.5138	0.6090
<i>R-squared</i>	0.1265	<i>Adjusted R-squared</i>	0.0495	
<i>F-statistic</i>	1.6420	<i>Prob (F-statistic)</i>	0.1490	

After excluding the samples related to the epidemic, the interaction term remained insignificant ($p = 0.4367$), which is consistent with the main regression conclusion. Although the coefficient estimates have undergone significant numerical changes, their economic implications have not changed - the moderating effect of leverage on the debt level of enterprises with a low level of debt always cannot be reliably identified. This result precisely confirms the theoretical judgment made earlier: when the debt scale of enterprises remains at a low level for a long time, the external governance function of debt tends to fail. Therefore, the conclusion of Hypothesis 2 is robust.

5. Conclusion

Using quarterly data from 2004Q1 to 2026Q1, this paper finds that lagged cash holdings have a marginally significant positive impact on firm value at the 10% level, while the moderating effect of leverage is statistically insignificant. From the research results, it can be seen that the cash held by mature manufacturing enterprises still has value effects, but the effectiveness of

debt governance is conditional. Once a company's interest-bearing liabilities remain below a specific threshold for a long time, the willingness of creditors to supervise will significantly decrease, and leverage will not be able to regulate the value effect of cash. Companies need to rely more on internal governance measures such as board supervision and incentive constraints.

At the practical level of enterprises, the management of mature enterprises with low interest-bearing debt should not overestimate the external governance effect of debt, and should focus on strengthening board governance, improving incentive and restraint mechanisms, and enhancing cash allocation efficiency. From the perspective of investors, analyzing such enterprises should not only focus on book leverage, but also distinguish between interest free operating liabilities and interest-bearing liabilities, judge the true debt repayment pressure based on cash flow situation, and reasonably evaluate the value of cash reserves.

However, the research design of single enterprise time series has its own limitations. Although it can control individual fixed heterogeneity and facilitate the observation of long-term dynamic changes in corporate financial strategies, the research conclusions are difficult to directly generalize to other enterprises. Gree has unique industry advantages, financing channels, and cash reserve capabilities. At the same time, the sample period has undergone multiple rounds of strategic adjustments, and the cash holding motives in different periods are not completely the same. In the future, the sample can be expanded to conduct multi enterprise comparisons and sub sample regression to further validate the conclusions of this article.

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