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CORPORATE CASH HOLDINGS AND PRODUCT MARKET COMPETITION: THE EFFECTS OF STOCK-BASED EXECUTIVE COMPENSATION

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ABSTRACT

This study explore the effects of different levels of stock-based reward incentives on the value of corporate cash holdings by the PTM developed by Hansen (1999). Empirical results revealed that the positive effects of executives' cash holdings on corporate value increase concurrently with the sensitivity of the value of their stock-based rewards on the standard deviation of corporate stock returns. Conversely, the positive effects of executives' cash holdings on corporate value diminish concurrently with managerial incentives. Furthermore, the excess cash in companies with strong managerial incentives positively affects corporate value. However, these effects have no substantial economic effects. Finally, the outcomes of this study can serve as a reference for companies and competent authorities when formulating reward agreements to inhibit agency problems by taking into account the positive and negative effects of reward incentives, thereby protecting shareholders' interests and ensuring capital market stability.

Contribution/ Originality: This study explores the effects of different levels of stock-based reward incentives on the value of corporate cash holding. The results of this study can serve as a reference for companies and competent authorities when formulating reward agreements to inhibit agency problems by taking into account the positive and negative effects of reward incentives, thereby protecting shareholders' interests and ensuring capital market stability.

1. INTRODUCTION

Of all company assets, cash is the most liquid. The cash holdings of a company determine its future policies and the equity of its shareholders. Therefore, the amount of cash withheld by a company may affect its future development. From a rational perspective, companies aspire to maintain a cash reserve to reduce transaction costs and obtain investment opportunities that would otherwise be inaccessible because of a lack of resources (Opler *et al.*, 1999; Ozkan and Ozkan, 2004). However, large cash reserves do not guarantee sustainable development. When a company holds excess cash, executives may use unused cash to make inefficient investments, leading to the loss of shareholders' equity and company value. Conversely, a company with insufficient cash holdings may use high-cost

funds to satisfy short-term demand, leading to a drop in competitiveness or even bankruptcy. Thus, effective cash management and maximizing cash value are key concerning in corporate finance management.

Compared with fixed assets, liquid assets are more accessible to company executives and are easier to convert into personal gains through low-cost approaches. Therefore, companies with many liquid assets are more susceptible to agency problems (Myers and Rajan, 1998). In other words, self-interested executives may hoard cash and engage in behaviors that harm shareholders, such as perquisite consumption, management buyouts (MBO), or leveraged buyouts (LBO), resulting in principal–agent problems (Jensen, 1986). Several scholars have analyzed the effects of corporate governance on corporate cash holdings to develop methods for inhibiting the agency problems caused by cash holdings through country-level shareholder protection, firm-level corporate governance, and ownership structure (Harford, 1999; Dittmar *et al.*, 2003; Kalcheva and Lins, 2007). Although existing empirical evidence suggests that corporate governance influences corporate cash holdings and cash value, few studies have analyzed whether executives' reward incentives increase the value of a company's cash holdings.

According to agency theory, offering stock options to executives as a base reward encourages them to focus on maximizing shareholders' wealth and increases corporate value (Jensen and Meckling, 1976; Mehran, 1995; Guay, 1999; Hanlon *et al.*, 2003; Ittner *et al.*, 2003; Nagar *et al.*, 2003; Oluwaseun and Boboye, 2017). However, stock-based rewards contain a specific level because they are associated with stock-price performance. Sometimes, stock-based rewards may motivate executives to maximize personal gains, sacrificing shareholders' equity in the process. High stock-based rewards incentivize executives to pursue performance and enhance their willingness to invest excess cash in high-risk plans and engage in personal gain behaviors (Coles *et al.*, 2006) negatively affecting the value of the company's cash holdings. By contrast, inadequate reward incentives may motivate executives to use corporate cash for perquisite consumption and inefficient investment, reducing the value of cash holdings. Therefore, reward incentives link executives' interest to shareholders' rights, motivating executives to increase corporate cash value and maximize shareholders' wealth. We adopted the panel threshold model (PTM) developed by Hansen (1999) to analyze the effects of different levels of stock-based reward incentives on the value of corporate cash holdings.

A company's cash holding behavior reflects its financial and business strategies and influences its investment and financing behaviors, dividend distribution, and daily operation policies. When companies have sufficient cash on hand, they can use the cash as a safety net for implementing extreme pricing or marketing strategies to overpower their competitors (Bolton and Scharfstein, 1990; Fresard, 2010). Subsequently, the incentive-driven cash value of a company may reflect whether its executives' business strategies are aimed at maximizing corporate value and indirectly highlights its competitiveness in the product market. In this study, we also investigated the effects of different levels of managerial incentive and cash value relationships on future market competitiveness to determine the affiliated relationship between managerial incentives, cash value, and market competitiveness.

Although scholars have increasingly focused on external factors, such as executives' characteristics, corporate finance conditions and attributes, and economic environments to elucidate the causality of corporate cash holdings, factors affecting cash value, and effects of these factors on corporate value, few have addressed these factors on the basis of managerial incentives. Whether managerial incentives effectively inhibit agency problems is a long-standing topic of debate. In fact, different levels of managerial incentives impose different levels of influence on the value of corporate cash holdings and future competitiveness. This study made three major contributions. First, we determined the positive and negative effects of managerial incentives using the PTM to measure the effects of different levels of managerial incentives on the value of corporate cash holdings. We then used the asymmetric relationship that exists between managerial incentives and the value of corporate cash holdings to analyze the changes in future competitiveness, supplementing the inadequacies of the extant literature. Second, the outcomes of this study can be applied to assess corporate value, helping investors make accurate investment decisions by accounting for the asymmetric relationship of reward incentives and cash value as well as the company's future competitiveness. Finally, the outcomes of this study can serve as a reference for companies and competent

authorities when formulating reward agreements to inhibit agency problems by accounting for the positive and negative effects of reward incentives, thereby protecting shareholders' interests and ensuring the stability of the capital market.

2. LITERATURE REVIEW

According to the agency theory, self-interested executives opt to retain an excess cash reserve because cash is the safest asset and the easiest to manipulate. In other words, when companies have substantial cash on hand, executives are more likely to over-invest in projects with negative net realizable values or embezzle from the company, sacrificing shareholders' and consumers' interests for personal gain (Blanchard *et al.*, 1994; Harford, 1999; Opler *et al.*, 1999). Therefore, effectively preventing executives from manipulating company cash to deprive shareholders of their wealth has become a key aspect of corporate financial management and corporate governance.

Faulkender and Wang (2006) examined small businesses in the United States and identified a significant and negative correlation between executives' shareholdings and corporate cash holdings and reported that cash holdings reduced concurrently with an increase in the number of major shareholders. Guney *et al.* (2007) analyzed businesses in Japan, France, Germany, and the United Kingdom and identified a significant and negative correlation between ownership concentration and cash holdings. Ozkan and Ozkan (2004) examined the effects of corporate ownership structures on cash holdings and determined that corporate cash holdings and executive' shareholdings demonstrated a non-monotonic relationship, suggesting that either the "alignment effect" or the "entrenchment effect" exists in the relationship between management-level ownership and corporate cash holdings. The alignment effect refers to a situation in which executives' willingness to share company profits with shareholders increases and the agency problems between executives and shareholders decrease concurrently with an increase in management-level ownership, thereby elevating the willingness of the company to raise investment funds externally and reduce corporate cash holdings. The entrenchment effect refers to a situation in which executives' decisions to maximize personal gain at the expense of the company and shareholders increase and agency costs increase concurrently with management-level ownership, decreasing the company's efforts in raising funds externally and increasing corporate cash holdings. Ferreira and Vilela (2004); Guney *et al.* (2007) and Amess *et al.* (2015) examined the legal protection of shareholders' and creditors' rights and reported that companies operating in countries that have more effective protection for investors' interests have fewer cash holdings.

Studies have expanded on their analysis of the influence factors of corporate governance and cash holdings to determine whether corporate governance affects the value of corporate cash holdings. Dittmar and Mahrt-Smith (2007) compared the value of cash holdings in companies with excellent corporate governance and that in companies with poor corporate governance to determine the effects of corporate governance on corporate value. Findings showed that corporate governance significantly influences "excess cash," which is a construct of intrinsic corporate value. The researchers found that poorly governed firms wasted cash resources, which reduced the value of the company and, by extension, the market value of the company's cash holdings. Conversely, well-governed firms could roughly double the value of their cash holdings by reducing the negative effects of idle cash on company development. Overall, the impact of corporate governance can increase or decrease every dollar of excess cash by as much as 2.8 folds. These findings suggest that corporate governance has an absolute influence on corporate value regardless of the amount of the firm's excess cash. Kalcheva and Lins (2007) and Pinkowitz *et al.* (2006) analyzed the correlation between country-level shareholder protection environments and the value of corporate cash holdings. Kalcheva and Lins (2007) determined that in countries with inadequate shareholder protection, corporate value decreased concurrently with an increase in the amount of cash reserved by executives. Pinkowitz *et al.* (2006) reported that the correlation between cash holdings and corporate value is weaker and the value of corporate cash holding is lower in countries with substandard investor protection than in countries with favorable investor protection.

To resolve agency problems, companies can monitor their executives through internal and external corporate governance mechanisms or design incentive agreements to ensure that the interests of executives are aligned with those of the company. Different from scholars who had used insiders' holdings or legal environment as the proxy variables for corporate governance, Coles *et al.* (2006) examined the value of executives' rewards to determine the effects of reward incentives on the value of corporate cash holdings. Findings revealed that executives were more likely to make risky investments or finance decisions when the value of their stock-based rewards is sensitive to changes in the company's stock prices. Cash is typically less risky than stocks. Therefore, the value of executives' stock-based rewards is inversely correlated to the sensitivity to changes in the standard deviation of the company's stock return rate and corporate cash holdings.

A literature review validated the effects of corporate governance mechanisms and incentive agreements on corporate cash holdings and cash value. However, few studies have considered the effects of the positive and negative effects of managerial incentives on the value of corporate cash holdings. Anderson *et al.* (2000) determined that the issuance of stock options was significantly and positively correlated to the stock returns in the same year. Larcker (1983) asserted that performance-based pay could curb executives' risk aversion behavior. Thus, when the association between owners' wealth within an agent company becomes stronger, executives' risk preferences become more consistent with those of the owners (Mehran, 1995). When executives' salaries are affected by company performance, salary becomes a major motivator and prompts executives to bear more risk. Cohen *et al.* (2000) analyzed whether stock options prompted executives to implement high-risk investment plans. The researchers adopted wealth elasticity and risk volatility (σ) as the proxy variables. Empirical findings showed that executives were motivated to increase company risk. However, their actions did not affect shareholders. In actuality, incentive agreements could become a means for proxies to lure management authorities to manipulate performance or reward systems for personal gain, consequently creating a different type of agency problem (Healy, 1985; Watts and Zimmerman, 1986; Holthausen *et al.*, 1995). Therefore, inappropriate reward systems cannot effectively link executives' and shareholders' interests. Rather, they could potentially prompt executives to seek personal gain at the expense of shareholders' interests (Stewart, 2003) negatively influencing the future performance of the company (Core *et al.*, 1999). Singh and Yerramilli (2010) determined that stock returns provided incentive but also distorted performance. Basu *et al.* (2007) identified a negative correlation between the excess rewards of high-level executives and accounting performance but identified no significant correlation between excess rewards and market returns. These findings suggest that over-rewarding high-level executives produces no significant effects on the company's future performance. In summary, impractical managerial incentives may become reverse incentives that reduce cash value. Overly high incentives may prompt executives to undertake risky investment projects that are not entirely focused on increasing net realizable value, consequently devaluing cash holdings. Conversely, overly low incentives may prompt executives to overspend and compensate for the dissatisfaction stemming from the lack of incentives, reducing the incremental value associated with cash holdings. In this context, we used the PTM to determine the positive and negative effects of managerial incentives and analyze their effects on the value of corporate cash holdings. The analysis outcomes can serve as a reference when designing reward agreements.

Mikkelson and Partch (2003) determined that companies' cash-holding behavior positively affects corporate growth and business performance. Pinkowitz and Williamson (2007) identified a correlation between companies' business opportunities and the market value of their cash holdings. Fresard (2010) reported that companies with more cash on hand than their competitors had a competitive advantage in the product market. However, when executives' reward incentives are linked to business performance, they may be inclined to cut company research and development (R&D) and other long-term expenditure to improve the company's short-term performance (Hoskisson *et al.*, 1993; Bushee, 1998) and highlight their management prowess. Therefore, when executives exercise their discretionary powers to cut expenses, the cash holdings of the company increase. However, the increase in idle cash may not be reinvested by executives into projects that promote corporate value and

competitiveness. Instead, the cut in expenses for cash may create resource shortages within the company, negatively affecting the company's future competitiveness. Few studies on the relationship between reward incentives and corporate cash value and its effects on the future competitiveness have been published. Therefore, this study aimed to determine the effects of reward incentives using a threshold model to build a classification system for reward incentives and use this system to analyze the relationships between reward incentives, corporate cash value, and future competitiveness.

3. RESEARCH DESIGN

3.1. Research Data

Companies operating in the United States between 2001 and 2014 were analyzed to determine whether different levels of managerial incentives have different effects on the value of corporate cash holdings and whether these effects strengthen or weaken future corporate market competitiveness. Financial variables and data were collected from the COMPUSTAT database. The financial statements and industry characteristics of the finance and regulatory industries significantly differ from those of general industries. Thus, companies belonging to the finance and regulatory industries were excluded from the scope of this study to compare the effects that different levels of competition have on the relationship between executive stock-based compensation incentive and value of corporate cash holdings in different industries. Furthermore, the data for measuring managerial incentives were collected from the ExecuComp database.

3.2. Empirical Model and Research Variables

(1) Empirical Model

Executives' reward agreements may induce management authorities to manipulate performance and sacrifice shareholders' wealth to increase personal gain. Singh and Yerramilli (2010) determined that stock returns provided an incentive but also distorted performance. Basu *et al.* (2007) identified a negative correlation between the excess rewards of high-level executives and accounting performance but identified no correlation between excess rewards and market returns. Therefore, overly high incentives may prompt executives to undertake risky investment projects that are not entirely focused on increasing net realizable value, consequently devaluing cash holdings. Conversely, overly low incentives may prompt executives to overspend and compensate for the dissatisfaction stemming from the lack of incentives, reducing the incremental value associated with cash holdings. Therefore, we hypothesized that an asymmetric relationship exists between different levels of managerial incentives and the value of corporate cash holdings.

To test whether managerial incentives affect the value of corporate cash holdings and whether these effects strengthen or weaken future corporate market competitiveness, the variable of managerial incentives was incorporated into the model proposed by Faulkender and Wang (2006). Subsequently, a new model was developed to test the relationship between managerial incentives and corporate cash holdings.

$$\begin{aligned} r_{i,t} - R_{i,t} = {} & \alpha_0 + \alpha_1 \frac{\Delta C_{i,t}}{M_{i,t-1}} + \alpha_2 \frac{\Delta E_{i,t}}{M_{i,t-1}} + \alpha_3 \frac{\Delta NA_{i,t}}{M_{i,t-1}} + \alpha_4 \frac{\Delta RD_{i,t}}{M_{i,t-1}} + \alpha_5 \frac{\Delta I_{i,t}}{M_{i,t-1}} \\ & + \alpha_6 \frac{\Delta D_{i,t}}{M_{i,t-1}} + \alpha_7 \frac{\Delta C_{i,t-1}}{M_{i,t-1}} + \alpha_8 L_{i,t} + \alpha_9 \frac{NF_{i,t}}{M_{i,t-1}} + \alpha_{10} \frac{C_{i,t}}{M_{i,t-1}} \cdot \frac{\Delta C_{i,t}}{M_{i,t-1}} \\ & + \alpha_{11} L_{i,t} \cdot \frac{\Delta C_{i,t}}{M_{i,t-1}} + \alpha_{12} VEGA_{i,t-1} + \alpha_{13} VEGA_{i,t-1} \cdot \frac{\Delta C_{i,t}}{M_{i,t-1}} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where, $r_{i,t}$ represents the return rate of individual stocks, calculated as the difference between the stock price of

the i^{th} company at the end of period t and the initial stock price divided by initial stock price; $R_{i,t}$ represents the return rate of the overall market, calculated as the difference between the market index at the end of period t and the initial market index divided by the initial market index; M represents market value, calculated as the number of the i^{th} company's shares in circulation in period t multiplied by the current stock price; C represents the cash and cash equivalents on the balance sheet; E represents the pretax surplus; NA represents shareholders' equity on the balance sheet; RD represents R&D expenses; I represents interest expenses on the income statement; D represents cash dividends; L represents leverage, calculated as debt divided by the sum of debt and market value; NF is the proxy variable of capital increase, measured as net issuance of new entitlements plus net new borrowings; $VEGA$ represents the risk incentives of executives' rewards; and ΔX represents the variance of X.

Taking into account that different companies have different financial conditions and firm sizes and therefore have different cash demands, we incorporated managerial incentives into the model proposed by Pinkowitz and Williamson (2007) to determine whether managerial incentives affected the value of corporate cash holdings. The empirical model can be expressed as follows:

$$\begin{aligned}\frac{M_{i,t}}{NA_{i,t}} &= \beta_0 + \beta_1 \frac{E_{i,t}}{NA_{i,t}} + \beta_2 \frac{dE_{i,t}}{NA_{i,t}} + \beta_3 \frac{RD_{i,t}}{NA_{i,t}} + \beta_4 \frac{dRD_{i,t}}{NA_{i,t}} + \beta_5 \frac{D_{i,t}}{NA_{i,t}} + \beta_6 \frac{dD_{i,t}}{NA_{i,t}} + \beta_7 \frac{I_{i,t}}{NA_{i,t}} \\ &+ \beta_8 \frac{dI_{i,t}}{NA_{i,t}} + \beta_9 \frac{dNA_{i,t}}{NA_{i,t}} + \beta_{10} VEGA_{i,t-1} + \beta_{11} \frac{XCASH_{i,t}}{NA_{i,}} + \beta_{12} VEGA_{i,t-1} \cdot \frac{XCASH_{i,t}}{NA_{i,}} + e_{i,t}\end{aligned} \quad (2)$$

where, dX represents the variance of X between t and t-2.

Studies have determined that managerial incentives positively and negatively affected corporate value. Impractical managerial incentives may become reverse incentives that reduce cash value. Overly high incentives may prompt executives to undertake risky investment projects that are not entirely focused on increasing net realizable value, consequently devaluing cash holdings. Conversely, overly low incentives may prompt executives to overspend and compensate for the dissatisfaction stemming from the lack of incentives, reducing the incremental value associated with cash holdings. Therefore, we used the PTM to build the following model to determine the positive and negative effects of managerial incentives and analyze their effects on the value of corporate cash holdings:

$$\begin{aligned}r_{i,t} - R_{i,t} &= \alpha_0 + \alpha_1^L \frac{\Delta C_{i,t}}{M_{i,t-1}} + \alpha_2^L \frac{\Delta E_{i,t}}{M_{i,t-1}} + \alpha_3^L \frac{\Delta NA_{i,t}}{M_{i,t-1}} + \alpha_4^L \frac{\Delta RD_{i,t}}{M_{i,t-1}} + \alpha_5^L \frac{\Delta I_{i,t}}{M_{i,t-1}} + \alpha_6^L \frac{\Delta D_{i,t}}{M_{i,t-1}} \\ &+ \alpha_7^L \frac{\Delta C_{i,t-1}}{M_{i,t-1}} + \alpha_8^L L_{i,t} + \alpha_9^L \frac{NF_{i,t}}{M_{i,t-1}} + \alpha_{10}^L \frac{C_{i,t-1}}{M_{i,t-1}} \cdot \frac{\Delta C_{i,t}}{M_{i,t-1}} + \alpha_{11}^L L_{i,t} \cdot \frac{\Delta C_{i,t}}{M_{i,t-1}} + \varepsilon_{i,t}\end{aligned} \quad if\ Sen_{i,t-1} \le \gamma \quad (3)$$

$$\begin{aligned}r_{i,t} - R_{i,t} &= \alpha_0 + \alpha_1^H \frac{\Delta C_{i,t}}{M_{i,t-1}} + \alpha_2^H \frac{\Delta E_{i,t}}{M_{i,t-1}} + \alpha_3^H \frac{\Delta NA_{i,t}}{M_{i,t-1}} + \alpha_4^H \frac{\Delta RD_{i,t}}{M_{i,t-1}} + \alpha_5^H \frac{\Delta I_{i,t}}{M_{i,t-1}} + \alpha_6^H \frac{\Delta D_{i,t}}{M_{i,t-1}} \\ &+ \alpha_7^H \frac{\Delta C_{i,t-1}}{M_{i,t-1}} + \alpha_8^H L_{i,t} + \alpha_9^H \frac{NF_{i,t}}{M_{i,t-1}} + \alpha_{10}^H \frac{C_{i,t}}{M_{i,t-1}} \cdot \frac{\Delta C_{i,t}}{M_{i,t-1}} + \alpha_{11}^H L_{i,t} \cdot \frac{\Delta C_{i,t}}{M_{i,t-1}} + \varepsilon_{i,t}\end{aligned} \quad if\ Sen_{i,t-1} > \gamma \quad (4)$$

The α^L and α^H in Model (3) and Model (4) represent the value of corporate cash holdings with different levels of reward incentives; Sen represents the variable of the managerial incentives, or rather, the variable of risk incentives (Vega); and γ either represents a specific value for high-reward incentives or that for low-reward incentives. Model (3) was used to measure the effects of managerial incentives on the value of corporate cash holdings when they were less than or equal to γ. Model (4) was used to measure the effects of managerial incentives on the value of corporate cash holdings when they were greater than γ. Using specific values to group the research samples risks overlooking key information, leading to sampling bias. To resolve this problem, we used the threshold variables within the sample data to determine the different grouping points and appropriately

estimate threshold values, thereby avoiding errors stemming from using conventional and subjective grouping methods. Model (3), Model (4), and Model (5) were combined with the Panel Threshold Regression Model developed by Hansen (1999) to test the relationships between different levels of reward incentives and the value of corporate cash holdings.

$$\begin{aligned} r_{i,t}-R_{i,t} &= \alpha_0+\alpha_1\frac{\Delta C_{i,t}}{M_{i,t-1}}+\alpha_2\frac{\Delta E_{i,t}}{M_{i,t-1}}+\alpha_3\frac{\Delta NA_{i,t}}{M_{i,t-1}}+\alpha_4\frac{\Delta RD_{i,t}}{M_{i,t-1}}+\alpha_5\frac{\Delta I_{i,t}}{M_{i,t-1}}+\alpha_6\frac{\Delta D_{i,t}}{M_{i,t-1}}+\alpha_7\frac{\Delta C_{i,t-1}}{M_{i,t-1}} \\ &+\alpha_8 L_{i,t}+\alpha_9\frac{NF_{i,t}}{M_{i,t-1}}+\alpha_{10}\frac{C_{i,t}}{M_{i,t-1}}\cdot\frac{\Delta C_{i,t}}{M_{i,t-1}}+\alpha_{11}L_{i,t}\cdot\frac{\Delta C_{i,t}}{M_{i,t-1}}+\alpha_{12}Sen_{i,t} \\ &+\alpha_{13}I\left(Sen_{i,t-1}\le\gamma\right)\cdot\frac{\Delta C_{i,t}}{M_{i,t-1}}+\alpha_{14}I\left(Sen_{i,t-1}>\gamma\right)\cdot\frac{\Delta C_{i,t}}{M_{i,t-1}}+\varepsilon_{i,t} \end{aligned} \tag{5}$$

where, $I(Sen)$ represents the indicator function; Sen represents the threshold variable; and γ represents a specific threshold estimate. If Sen is greater than γ, then the function indicator equals 1; otherwise, the function indicator equals 0. Threshold estimation is a nonlinear estimation method. To simplify nonlinear estimations, Hansen (1999) recommended using a two-stage least squares (2SLS) method to estimate threshold values. During the estimation process, threshold values were successively established, and the least squares method was employed to individually calculate the sum square error ($SSE_1(\gamma)$) of each value. The least SSE was then used to reverse calculate γ. Finally, γ was used to classify the research samples, and a regression model was employed to analyze the effects of different levels of managerial incentives on the value of corporate cash holdings. Similarly, the PTM was adopted in this study to elucidate the effects of managerial incentives on the value of excess cash held by the companies. The threshold estimates were used to classify the research samples, and a regression model was developed to analyze the effects of different managerial incentives on the value of excess cash held by the companies.

Adopting the threshold values estimated using the PTM as a reference for sample classification, an empirical model was developed to analyze the relationship between different levels of managerial incentives and the value of corporate cash holdings and the effects of this relationship on corporate market competitiveness.

$$\begin{aligned} \Delta MS_{i,t} &= \beta_0+\beta_1\frac{\Delta C_{i,t}}{M_{i,t-1}}+\beta_2 VEGAD_{i,t-1}+\beta_3 VEGAD_{i,t-1}\frac{\Delta C_{i,t}}{M_{i,t}}+\beta_4 Ln\left(M_{i,t}\right) \\ &+\beta_5\frac{PPE_{i,t}}{M_{i,t-1}}+\beta_6 MS_{i,t-1}+e_{i,t} \end{aligned} \tag{6}$$

where, MS represents the proxy variable of corporate market competitiveness; PPE represents fixed assets, measured by the overall value of land, facilities, and equipment; and VEGAD is the dummy variable for using the threshold value estimated using the PTM for classification.

(2) Research Variables and Operational Definitions

1. Managerial Incentives (*VEGA*)

According to the agency theory, stock-based reward incentives can inhibit the agency problems between executives and shareholders and enhance corporate value. Therefore, *VEGA* was adopted as the proxy variable for managerial incentives. In controlled conditions, *VEGA* measures the sensitivity of the value of executives' stock-based rewards on the standard deviation of corporate stock returns. We used the method proposed by Core and Guay (2002) in which the dividend-adjusted Black–Scholes model was employed to calculate the value of executives'

options. The model can be expressed as follows:

$$VEGA=\frac{\partial value}{\partial \sigma}\times 0.01=e^{-rT}N(d1)S\sqrt{T}\times 0.01 \quad (7)$$

$$d1=\left[\ln(S/X)+(r_f-d+0.5\sigma^2)T\right]/\sigma\sqrt{T}$$

where, S represents the closing stock price on the last day of the fiscal year; X represents the strike prices of options; σ represents the annual standard deviation of monthly stock price returns; r_f represents the risk-free rate; d represents the dividend rate; and T represents the expiration period.

2. Corporate Market Competitiveness (MS)

If the cash holdings in a company are associated with a profitable strategy formulated by the company executive, the performance of the company will ultimately be reflected in the product market. Therefore, we adopted the difference between the sales growth rate of a company in the current period and the overall industrial sales growth rate as the proxy variable for corporate market competitiveness, as proposed by Fresard (2010).

3. Corporate Cash Holdings (*CASH, XCASH*)

The return rate of cash holdings is extremely low. Therefore, when the cash holdings of a company exceed the optimal level, the excess cash in the company may negatively affect business performance, such as slight elevation in capital, merger and acquisition, and dividend expenditures (Opler *et al.*, 1999). In addition to adopting corporate cash holdings as a primary variable, this study also adopted the model proposed by Opler *et al.* (1999) to estimate the level of excess cash holdings in each company, determine the relationships of different levels of managerial incentives on the value of excess cash, and elucidate the effects that these relationships have on corporate market competitiveness.

Firm size is a key factor influencing corporate cash holdings, cash flow conditions, and investment opportunities. Therefore, net asset and free cash flow were also incorporated into the excess cash model. In addition, net working capital was adopted as a proxy variable to control the effects of liquid assets, which could be a substitute for cash. The final model can be expressed as follows:

$$Ln\left(\frac{C_{i,t}}{NA_{i,t}}\right)=\beta_0+\beta_1 Ln\left(NA_{i,t}\right)+\beta_2\frac{FCF_{i,t}}{NA_{i,t}}+\beta_3\frac{NWC_{i,t}}{NA_{i,t}}+\beta_4\left(IndustrySigma\right)_{i,t}+\beta_5\frac{M_{i,t-1}}{NA_{i,t}}+\beta_6\frac{RD_{i,t}}{NA_{i,t}}+\varepsilon_{i,t} \quad (8)$$

where, FCF represents free cash flow, calculated as working margin minus interest and income tax; and NWC represents net working cash, calculated as current assets minus current debt and cash. The residual value obtained from the model was used to calculate the ideal cash holdings in each company, and the actual cash holdings of the company were subtracted from the ideal cash holdings to obtain the excess cash holdings (*XCASH*) of each company.

4. EMPIRICAL RESULTS

4.1. Descriptive Statistics and Correlation Testing

Descriptive statistics (Table 1) show that the average cash and cash equivalents (*CASH*) of the samples between 2001 and 2014 were 549.372, and the standard deviation was 53528, suggesting that during the research period, the cash holdings of different companies significantly differed. A subsequent analysis of excess cash holdings showed

that the average excess cash (*XCASH*) of the samples was −6994.389, suggesting that the majority of the companies did not have excess idle cash. These findings imply that although preventing the production of opportunity costs stems from excess idle cash, the samples were required to raise funds externally to finance investment opportunities. Statistics concerning managerial incentives show that the average risk incentive (*VEGA*) of the research samples between 2001 and 2014 was 0.938, suggesting that when all other conditions were controlled, the sensitivity of the value of executives' stock-based rewards on the standard deviation of corporate stock returns was 0.938. In other words, one unit of deviation in corporate stock returns causes 0.938 units of deviation in the value of executives' rewards. On average, *VEGA* was a positive value, suggesting that executives' stock-based rewards became more valuable as variance in stock returns increased.

Table-1. Descriptive Statistics

Variable	Mean	MAX	MIN	Std. Dev.
CASH	549.372	53528.000	0.000	1543.673
XCASH	-6884.389	8465.225	-473816.100	21616.720
VEGA	0.938	36.758	0.000	1.178
MS	-57.380	65.768	-0.100	1759.493
E	825.161	66290.000	-8722.500	2688.818
NA	3134.075	174399.000	-9660.000	8887.607
RD	157.936	12183.000	0.000	716.067
I	106.069	4891.000	-0.288	255.179
D	4.367	11.568	0.000	6.385
L	0.332	0.996	0.000	0.205
NF	332.095	64868.200	-43531.000	2436.349
M	9321.079	647506.900	2.664	27454.920

Note: M represents market value, calculated as the number of the i^{th} company's shares in circulation in period t multiplied by the current stock price; *Cash* represents the cash and cash equivalents on the balance sheet; *E* represents the pretax surplus; NA represents shareholders' equity on the balance sheet; RD represents R&D expenses; *I* represents interest expenses on the income statement; *D* represents cash dividends; L represents leverage, calculated as debt divided by the sum of debt and market value; NF is the proxy variable of capital increase, measured as net issuance of new entitlements plus net new borrowings; $VEGA$ represents the risk incentives of executives' rewards.

The relationships between cash holdings or excess cash on market competitiveness are tabulated in Table 2. Cash holdings (*CASH*) exhibited a negative correlation with market competitiveness (*MS*). However, the relationship failed to achieve significance (p = −0.007). Excess cash holdings (*XCASH*) achieved a significant and positive correlation with market competitiveness (*MS;* p = 0.102), implying that companies gain more opportunities with sufficient cash holdings. Managerial incentives (*VEGA*) achieved a significant and positive correlation with market competitiveness (*MS;* p = 0.351), implying that executives are more focused on enhancing corporate market competitiveness when the value of their rewards is sensitive to the volatility of stock returns.

Table 2. Pearson correlation matrix

Variable	*CASH*	*MS*	*D*	*E*	*L*	*M*	*NF*	*NA*	*VEGA*	*XCASH*	*I*	*RD*
CASH	1.000											
MS	-0.007	1.000										
D	0.640***	-0.101	1.000									
E	0.735***	-0.001	0.855***	1.000								
L	0.002	0.103	0.003	-0.002	1.000							
M	0.726***	0.402	0.821***	0.912***	-0.083***	1.000						
NF	0.277***	-0.203	0.223***	0.346***	-0.006	0.343***	1.000					
NA	0.671***	-0.032	0.793***	0.877***	0.013	0.858***	0.353***	1.000				
VEGA	0.151***	0.351*	0.080***	0.173***	-0.178***	0.219***	0.137***	0.141***	1.000			
XCASH	-0.570***	0.102*	-0.726***	-0.772***	-0.053***	-0.743***	-0.276***	-0.921***	-0.088***	1.000		
I	0.426***	0.003	0.512***	0.533***	0.328***	0.457***	0.145***	0.544***	0.027***	-0.563***	1.000	
RD	0.565***	0.527**	0.560***	0.505***	-0.080***	0.617***	0.243***	0.500***	0.085***	-0.380***	0.188***	1.000

Note: All dependent and independent variables are explained in Table 1. ***, **, *indicate significance at 1%, 5% and 10% levels in a two-tailed test, respectively.

4.2. Empirical Results

To elucidate the relationship between managerial incentives and the value of corporate cash holdings and the effects of this relationship on corporate market competitiveness, the PTM was adopted to determine the effects of reward incentives and build a classification system. This system was then applied to analyze the relationships between reward incentives, corporate cash value, and future competitiveness. The relationship between managerial incentives and the value of corporate cash holdings (Table 3; Panel A) indicated that the threshold value of managerial incentives was 0.417, achieving a significant level of 1%. This signifies that a threshold effect is present in the relationship between managerial incentives and the value of corporate cash holdings, and that the samples can be grouped into two quadrants for observation. Therefore, the empirical model can be expressed as follows:

$$\begin{aligned} r_{i,t}-R_{i,t} &= \alpha_0+\alpha_1\frac{\Delta C_{i,t}}{M_{i,t-1}}+\alpha_2\frac{\Delta E_{i,t}}{M_{i,t-1}}+\alpha_3\frac{\Delta NA_{i,t}}{M_{i,t-1}}+\alpha_4\frac{\Delta RD_{i,t}}{M_{i,t-1}}+\alpha_5\frac{\Delta I_{i,t}}{M_{i,t-1}}+\alpha_6\frac{\Delta D_{i,t}}{M_{i,t-1}}+\alpha_7\frac{\Delta C_{i,t-1}}{M_{i,t-1}} \\ &+\alpha_8 L_{i,t}+\alpha_9\frac{NF_{i,t}}{M_{i,t-1}}+\alpha_{10}\frac{C_{i,t}}{M_{i,t-1}}\cdot\frac{\Delta C_{i,t}}{M_{i,t-1}}+\alpha_{11}L_{i,t}\cdot\frac{\Delta C_{i,t}}{M_{i,t-1}}+\alpha_{12}Sen_{i,t} \\ &+\alpha_1^L I\left(VEGA_{i,t-1}\le 0.471\right)\cdot\frac{\Delta C_{i,t}}{M_{i,t-1}}+\alpha_1^H I\left(VEGA_{i,t-1}>0.471\right)\cdot\frac{\Delta C_{i,t}}{M_{i,t-1}}+\varepsilon_{i,t} \end{aligned} \quad (9)$$

In Model (9), the first quadrant ($VEGA_{i,t-1}\le 0.417$) represents the companies with relatively weak managerial incentives, and the second quadrant ($VEGA_{i,t-1}>0.417$) represents the companies with relatively strong managerial incentives. The coefficient values of the two quadrants were 1.153 for α_1^H and −0.177 for α_1^L. Only α_1^H achieved a significance level of 1%. Therefore, the cash holdings in the companies with strong managerial incentives positively affect corporate value. In other words, the positive effects of executives' cash holdings on corporate value increase concurrently with the sensitivity of the value of executives' stock-based rewards on the standard deviation of corporate stock returns. Conversely, in companies with relatively weak managerial incentives (the first quadrant), the effects of executives' cash holdings on corporate value decreases concurrently with a decrease in the sensitivity of the value of executives' stock-based rewards on the standard deviation of corporate stock returns.

The PTM was adopted in this study to elucidate the relationship between managerial incentives and the value of excess cash held by companies. Table 3 Panel B indicates that the threshold value for managerial incentives was 0.803, achieving a significance level of 1%. This signifies that a threshold effect is present in the relationship between managerial incentives and corporate excess cash holdings, and that the samples can be grouped into two quadrants for observation. Therefore, the empirical model can be expressed as follows:

$$\begin{aligned} \frac{M_{i,t}}{NA_{i,t}} &= \beta_0+\beta_1\frac{E_{i,t}}{NA_{i,t}}+\beta_2\frac{dE_{i,t}}{NA_{i,t}}+\beta_3\frac{RD_{i,t}}{NA_{i,t}}+\beta_4\frac{dRD_{i,t}}{NA_{i,t}}+\beta_5\frac{D_{i,t}}{NA_{i,t}}+\beta_6\frac{dD_{i,t}}{NA_{i,t}}+\beta_7\frac{I_{i,t}}{NA_{i,t}} \\ &+\beta_8\frac{dI_{i,t}}{NA_{i,t}}+\beta_9\frac{dNA_{i,t}}{NA_{i,t}}+\beta_{10}\frac{XCASH_{i,t}}{NA_{i,}}+\beta_1^L I\left(VEGA_{i,t-1}\le 0.803\right)\cdot\frac{XCASH_{i,t}}{NA_{i,}} \\ &+\beta_1^H I\left(VEGA_{i,t-1}>0.803\right)\cdot\frac{XCASH_{i,t}}{NA_{i,}}+e_{i,t} \end{aligned} \quad (10)$$

In Model (10), the first quadrant ($VEGA_{i,t-1} \leq 0.803$) represents the companies with relatively weak managerial incentives and the second quadrant ($VEGA_{i,t-1} > 0.803$) represents the companies with relatively strong managerial incentives. The coefficient values of the two quadrants were 0.001 for β_1^H and −0.506 for β_1^L. Only α_1^H achieved a significance level of 1%. Therefore, the excess cash holdings in the companies with strong managerial incentives positively influence corporate value. However, the economic effects of this influence are mediocre.

Table-3. Tests for threshold estimation

Panel A. Stock-based compensation incentives and the value of cash holdings			**Panel B. Stock-based compensation incentives and the value of excess cash holdings**		
Threshole Variable	**Estimator of Regime**		**Threshole Variable**	**Estimator of Regime**	
	Estimator	**LR**		**Estimator**	**LR**
$VEGA_{i,t-1}$	0.471***	6.058	$VEGA_{i,t-1}$	0.803***	35.413
$\Delta C_{i,t}/M_{i,t-1}$	Coeff.	t	$XCASH_{i,t}/NA_{i,}$	Coeff.	t
α_1^H	1.153***	2.363	β_1^L	0.001***	5.688
α_1^L	-0.177	0.611	β_1^H	-0.506	-0.310
Variables	Coeff.	t	Variables	Coeff.	t
α_0	0.020	0.090	β_0	0.001	0.007
$\Delta E_{i,t}/M_{i,t-1}$	-0.020	-0.147	$E_{i,t}/NA_{i,t}$	-0.004	0.007
$\Delta NA_{i,t}/M_{i,t-1}$	-2.904***	-2.166	$dE_{i,t}/NA_{i,t}$	0.000	0.010
$\Delta RD_{i,t}/M_{i,t-1}$	0.254	0.190	$RD_{i,t}/NA_{i,t}$	0.000	0.001
$\Delta I_{i,t}/M_{i,t-1}$	0.747	1.008	$dRD_{i,t}/NA_{i,t}$	-0.001	0.016
$\Delta D_{i,t}/M_{i,t-1}$	0.002	0.065	$D_{i,t}/NA_{i,t}$	0.007	0.016
$\Delta C_{i,t-1}/M_{i,t-1}$	0.011	0.066	$dD_{i,t}/NA_{i,t}$	-0.001	0.009
$L_{i,t}$	-0.034	-0.381	$I_{i,t}/NA_{i,t}$	0.001	0.005
$NF_{i,t}/M_{i,t-1}$	0.066	0.058	$dI_{i,t}/NA_{i,t}$	-0.001	0.006
$\frac{C_{i,t}}{M_{i,t-1}} * \frac{\Delta C_{i,t}}{M_{i,t-1}}$	0.064	0.088	$dNA_{i,t}/NA_{i,t}$	0.011	0.828
$\frac{\Delta C_{i,t}}{M_{i,t-1}} * L_{i,t}$	0.007	0.029			

Note: All dependent and independent variables are explained in Table 1. ***，**，*indicate significance at 1%, 5% and 10% levels in a two-tailed test, respectively.

In addition, the PTM was adopted in this study to determine the effects of managerial incentives and classify the research samples. Subsequently, a regression model was adopted to elucidate the relationships between different levels of managerial incentives and the value of corporate cash holdings. The empirical results tabulated in the second column of Table 4 show that the cross-factor coefficients of cash and managerial incentives achieve a significant and positive correlation, indicating that the positive effects of cash holdings on corporate value increase concurrently with the sensitivity of the value of executives' stock-based rewards on the standard deviation of corporate stock returns. In addition, excess returns achieved a significant and positive correlation with corporate cash holdings. These findings imply that in companies with strong managerial incentives, each $1 of cash in the

company created \$2.306 of value. By comparison, each \$1 created \$1.325 of value in companies with weak managerial incentives.

Table-4. Tests for OLS: The relationships between different levels stock-based compensations incentive and the value of cash holdings

Variable	(1)	(2)
Constant	0.346*** (0.050)	0.432*** (0.083)
$\Delta C_{i,t}/M_{i,t-1}$	1.703*** (0.511)	1.325 (0.865)
$VEGAD_{i,t-1}$	-0.095*** (0.033)	-0.096*** (0.033)
$\frac{\Delta C_{i,t}}{M_{i,t-1}} * \mathrm{VEGAD}_{i,t-1}$	0.902** (0.388)	0.981** (0.394)
$\Delta E_{i,t}/M_{i,t-1}$		0.441* (0.261)
$\Delta NA_{i,t}/M_{i,t-1}$		-0.517** (0.519)
$\Delta RD_{i,t}/M_{i,t-1}$		-0.824 (1.615)
$\Delta I_{i,t}/M_{i,t-1}$		0.712 (1.590)
$\Delta D_{i,t}/M_{i,t-1}$		4.542*** (0.893)
$\Delta C_{i,t-1}/M_{i,t-1}$		0.026 (0.038)
$L_{i,t}$		-0.218* (0.195)
$NF_{i,t}/M_{i,t-1}$		0.008 (0.103)
$\frac{C_{i,t}}{M_{i,t-1}} * \frac{\Delta C_{i,t}}{M_{i,t-1}}$		-2.186* (1.195)
$\frac{\Delta C_{i,t}}{M_{i,t-1}} * \mathrm{L}_{i,t}$		1.929 (1.290)
F	6.948***	4.926***
$Adj.R^2$	0.002	0.004

Note:
1. VEGAD represents the dummy variable that has value 1 if the manager's VEGA is larger than 0.471, and 0 otherwise.
2. All dependent and independent variables are explained in Table 1. ***，**，*indicate significance at 1%, 5% and 10% levels in a two-tailed test, respectively.

Table 5 shows that corporate excess cash holdings were significantly and negatively correlated with corporate market value, suggesting that an excessive amount of cash in the company decreases its market value. This was attributed to the fact that a company's cash holdings cannot create revenue for the company, and that the cash return is extremely low. Cash is typically held in a company for the provision of routine working expenses rather than for profit. Therefore, retaining an excess of cash in the company is impractical and may lead to increased opportunity expenses, reducing corporate market value. The cross-factor coefficients of excess cash and managerial incentives achieved a significant and positive correlation, indicating that excess cash positively affects corporate market value in companies with strong managerial incentives. In other words, companies with strong managerial incentives can use their excess cash holdings to offset the negative impact of excess cash on their market value.

Finally, the correlations between managerial incentives, cash holdings value, and corporate market competitiveness (Table 6) show that corporate cash holdings are significantly and positively correlated with corporate market competitiveness and that excess cash is significantly and negatively correlated with corporate market competitiveness. These results suggest that although corporate cash holdings can enhance product competitiveness,

retaining an excess amount of cash may negatively affect corporate market competitiveness. The significant and positive correlation between the cross items of managerial incentives and corporate cash holdings imply that the positive effects of cash holdings on corporate market competitiveness increase concurrent with managerial incentives. However, results concerning the effects that the relationship between managerial incentives and excess cash holdings have on market competitiveness show that although the cross item of managerial incentives is significantly and positively correlated to that of excess cash holdings, excess cash was significantly and negatively correlated to corporate market competitiveness, suggesting that companies with strong managerial incentives can use their excess cash holdings to reduce the negative impact of excess cash on corporate market competitiveness.

Table-5. Tests for OLS: The relationships between different levels of stock-based compensations incentive and the value of excess cash holdings

Variable	(1)	(2)
Constant	0.323	1.797***
		(0.076)
$XCASH_{i,t}/NA_{i,t-1}$	-1.329**	-2.205*
	(0.714)	(1.194)
$VEGAD_{i,t-1}$	3.055***	-1.313***
	(0.791)	(0.495)
$\frac{XCASH_{i,t}}{NA_{i,t-1}} * \text{VEGAD}_{i,t-1}$	0.821*	1.040***
	(0.344)	(0.392)
$E_{i,t}/NA_{i,t}$		2.412***
		(0.564)
$dE_{i,t}/NA_{i,t}$		0.492
		(0.258)*
$RD_{i,t}/NA_{i,t}$		-0.496***
		(0.159)
$dRD_{i,t}/NA_{i,t}$		-0.916
		(1.613)
$D_{i,t}/NA_{i,t}$		0.640
		(1.589)
$dD_{i,t}/NA_{i,t}$		4.563***
		(0.892)
$I_{i,t}/NA_{i,t}$		0.025
		(0.038)
$dI_{i,t}/NA_{i,t}$		-0.168
		(0.194)
$dNA_{i,t}/NA_{i,t}$		0.020
		(0.102)
F	5.094	5.054
$Adj.R^2$	0.001	0.004

Note:
1. VEGAD represents the dummy variable that has value 1 if the manager's VEGA is larger than 0.803, and 0 otherwise.
2. All dependent and independent variables are explained in Table 1. *** , ** , *indicate significance at 1%, 5% and 10% levels in a two-tailed test, respectively.

5. CONCLUSION

Cash is a liquid asset that can be easily manipulated by executives to satisfy personal gains. It is also a precursor for agency problems. Therefore, effectively managing cash to minimize the occurrence of agency problems and maximize corporate value is a key component of corporate and financial management. Stock-based reward incentives aim to resolve the agency problem of inconsistent executives' and shareholders' interests. However, the association between stock-based rewards and stock price performance may motivate executives to maximize self-interest at the expense of shareholders' equity. That is, overly high stock-based reward incentives may increase executives' willingness to invest excess cash into risky projects or engage in self-interested activities while pursuing corporate performance, consequently negatively affecting the value of corporate cash holdings. By comparison, insufficient stock-based reward incentives are unattractive to executives, prompting them to allocate cash to perquisite consumption or inefficient investments, reducing the value of cash holdings. In this context, the PTM

developed by Hansen (1999) was adopted in this study to elucidate the effects of different levels of stock-based reward incentives on the value of corporate cash holdings. In addition, cash value driven by managerial incentives may directly reflect whether the working strategies implemented by executives focus on maximizing corporate value and indirectly reflect the competitiveness of the company in the product market. Therefore, we also examined the relationships of different levels of managerial incentives on the value of cash holdings and the effects that these relationships have on corporate market competitiveness to elucidate the affiliated relationships that exist between managerial incentives, cash holdings, and corporate market competitiveness.

Table-6. Tests for OLS: Stock-based compensation incentives, value of corporate cash holdings, and the product market competition

Variable	(1)	(2)
Constant	-4.069* (2.147)	-8.926*** (2.619)
$\Delta C_{i,t}/M_{i,t-1}$	0.314*** (0.042)	
$VEGAD^{CASH}_{i,t-1}$	0.231* (0.127)	
$\frac{\Delta C_{i,t}}{M_{i,t}} * VEGAD^{CASH}_{i,t-1}$	0.082*** (0.016)	
$XCASH_{i,t}/M_{i,t-1}$		-0.058*** (0.019)
$VEGAD^{XCASH}_{i,t-1}$		0.348* (0.199)
$\frac{XCASH_{i,t}}{M_{i,t-1}} * VEGAD^{XCASH}_{i,t-1}$		0.047* (0.026)
$\ln(M_{i,t})$	1.473 (0.947)	1.054 (0.956)
$PPE_{i,t}/M_{i,t}$	0.116 (0.293)	0.098 (0.105)
$MS_{i,t-1}$	1.001*** (0.127)	0.674*** (0.116)
F	3.467	3.182
$Adj.R^2$	0.059	0.051

Note:
1. VEGADCASH represents the dummy variable that has value 1 if the manager's VEGA is larger than 0.471, and 0 otherwise.
2. VEGADXCASH represents the dummy variable that has value 1 if the manager's VEGA is larger than 0.803, and 0 otherwise.
3. All dependent and independent variables are explained in Table 1. *** , ** , *indicate significance at 1%, 5% and 10% levels in a two-tailed test, respectively.

Empirical results revealed that the positive effects of executives' cash holdings on corporate value increase concurrently with the sensitivity of the value of their stock-based rewards on the standard deviation of corporate stock returns. Conversely, the positive effects of executives' cash holdings on corporate value diminish concurrently with managerial incentives. Furthermore, the excess cash in companies with strong managerial incentives positively affects corporate value. However, these effects have no substantial economic effects.

The PTM was also adopted in this study to identify the effects of managerial incentives. These effects served as a reference for sample classification.

The results of a regression analysis revealed that the value created for every dollar retained by companies with strong managerial incentives was higher than that in companies with weak managerial incentives. Moreover, the excess cash in companies with strong managerial incentives can offset the negative impact of excess cash on corporate market value.

Finally, the results of an empirical analysis of the associations between managerial incentives, cash holdings value, and corporate market competitiveness show that the cash holdings of companies with strong managerial

incentives facilitate market competitiveness and that the excess cash holdings of companies with strong managerial incentives reduce the negative impact of excess cash on corporate market competitiveness.

The outcomes of this study can be applied to assess corporate value, helping investors make accurate investment decisions by considering the asymmetric relationship of reward incentives and cash value, as well as the company's future competitiveness. Finally, the outcomes of this study can serve as a reference for companies and competent authorities when formulating reward agreements to inhibit agency problems by taking into account the positive and negative effects of reward incentives, thereby protecting shareholders' interests and ensuring capital market stability.

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