

Research Article

Corporate Liquidity Management in Emerging Economies under the Financial Constraints: Evidence from China

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The main purpose of this article is to investigate the impact of the optimum level of cash holdings on corporate performance. Moreover, in this paper, the impact of financial constraints is tested as moderating factor between the relationship of cash holdings and corporate performance. The present study uses the system generalized method of moments (GMM) as the main estimation methodology. Using a sample of companies listed on stock exchanges of China, empirical pieces of evidence find that cash holdings-corporate performance relation is a nonlinear concave and depicts similar evidence for firms with financial constraints. The financially constrained firms maintain optimal cash holding at a higher level, which corresponds to debt rationing, difficulty to access financial markets, and the high cost of external finance. Moreover, propensity-score-matching depicts statistically significant differences in the level of cash holdings amid financially constrained and unconstrained firms. Finally, the difference-in-difference estimator shows that financial crisis affects less financially constrained firms due to low reliance on external financing.

1. Introduction

One of the imperative corporate financial policies is the management of liquidity [1]. Firms manage liquidity using credit lines or cash holdings [2–4]. According to existing literature, cash is highly significant and the most liquid corporate asset [5]. Emerging markets are characterized by market imperfections which lead to the issue of information asymmetry among market participants. Therefore, in the presence of information asymmetry and agency costs, the outside capital becomes costly relatively to internally generated funds [6]. In this scenario, outside capital may not be the perfect substitute for internal funds. In the absence of market imperfections, firms have no restriction to gain external finance; and firms' investment does not depend on the availability of internal finance.

As in the case of China, financial markets are not efficient in allocating resources and releasing financial constraints that lead financially constrained firms to underinvest [7]. In addition, access to capital markets, external financing cost, and availability of internal finance are the financial factors on which a firm's investment depends. Thus, nonstate-owned enterprises in China face difficulty to raise external capital from banks due to their discrimination. Moreover, non-state-owned enterprises face discrimination to gain funding from the equity market. However, some authors [8] suggest that firms that borrowed from state banks slightly increase employment, short-term debts, and cash holdings. Due to hindering financial constraints, private firms' investment deeds depend profoundly on cash relative to companies owned by the state. Therefore, privately held firms face more financial constraints and distress than state-

owned enterprises. Accordingly, the previous literature [9] suggests that a liquid balance sheet benefits firms to carry out valuable projects when they arise. Accordingly, it is evidenced that firms of China also hold 19.4 percent of their total assets in cash, which suggests cash holdings significantly affect a company's profitability, growth prospects, and business [10].

The present study provides a significant rationale to understand the cash holding behavior of Chinese financially constrained and unconstrained enterprises. A growing body of literature focuses on liquidity management through the antecedents of corporate cash holdings. [11–13] give the evidence for the existence of an optimal level of cash holding and verified that cash decisions track the partial adjustment model. The cash holdings and corporate value relationship are roots to maintain the optimal cash holding level to maximize firm value [14]. Therefore, on the basis of pieces of evidence of prior literature our study highlighted the following objectives:

- (i) How does corporate optimal level of cash holding influence firm performance?
- (ii) How does the effect of deviation from the optimal level of cash holding influence firm performance?
- (iii) How do cash holdings above and below the optimal level influence firm performance?
- (iv) What is the influence of financial constraints on the optimal level of cash holding and firm performance relationship?

However, despite the great importance of this topic, a limited number of studies focus on the cost and benefits of cash holding and its impact on firm value. Such as Tong [15] works on the effect of the diversification of a firm on the firm cash holding value by following the methodology of Faulkender and Wang [16] to measure the marginal value of cash holding. Alnori [13] and Martínez-Sola et al. [17] provide evidence that the optimal cash holding level exists, which maximizes firm value. Specifically, in developing and emerging economies, this area of research is not considered at a large scale. The present study focuses on to systematically investigate the critical role of the optimum level of corporate cash holding in maximizing firm value, to examine the role of financial constraints as a contextual factor, and financial fluctuations on the firms' cash holding behavior and the value from the perspective of the economy of China.

Firstly, the main contribution of the present paper is to study the functional form of the relation between cash holdings and firm performance from the perspective of the nonlinear effect. The analysis of the present paper, which literature has not considered previously in the case of China, reveals that there is a nonlinear inverted U-shaped relationship between cash holding and corporate performance. This finding supports precautionary and transaction motives of cash holding at a low level. Conversely, at the high cash holding level, the firm's value declines due to free cash flow and agency costs.

Secondly, to the best of our knowledge, this study is among the few to study the cash holdings and corporate

performance relationship with a trade-off model with the linkage of financial constraints as a moderating factor. Especially in the case of Chinese nonfinancial firms, the present study provides novel insights to indicate that in the presence of a firm's financial constraints, the inverted U-shaped relation between cash holding and corporate performance always holds

Third, using the partial adjustment model, the study analyses the firms' speed of adjustment (SOA) to cash targets. The findings indicate that both financially constrained and unconstrained firms actively adjust their cash holdings towards levels of their cash targets. However, the speed of adjustment of financially constrained firms is faster than unconstrained.

Fourth, the findings of propensity score matching (PSM) and difference-in-difference (DID) estimator results show that financially constrained and unconstrained firms have statistically significant differences in their level of cash holdings. Consistently with [18], financially constrained firms are sensitive to macroeconomic shocks, and this effect is considered more pronounced in constrained firms [19].

Finally, the present study extends the prior literature on the firm optimal level of cash holding and its influence on firm value [12, 15, 17], financial constraints, and macroeconomic and financial fluctuations [3, 6]. Following [20], the study uses the system-generalized method of moments (GMM) estimation technique which is robust to capture endogeneity problems in panel data models.

A number of aspects distinguish emerging marketplaces from established markets. Business monetary strategies and rehearses for instance; management of cash are inclined by institutional influences, containing players' approaches and sluggish institutional growth and rules are significantly fragile in emerging economies relatively to advanced economies [21]. The emerging markets severely face these issues. As stated important imperfections of capital market exemplifying it and its underprivileged circumstance of governance of corporates, the circumstantial of the economy of China delivers tranquil experiment epicenter to study business choices of investment in cash holdings with the existence of financial constraints and agency issues together. Due to the unique institutional context, the government has a central effect on the credit assets circulation in the credit market of the economy of China and the maximum number of credit is granted to state-owned companies. This issue leads to a rise in uncertainty stages about business activities for instance; cash holding and the implementation of a traditional monetary path. Moreover, the companies' investment decision is influenced by information asymmetry, control and financial organizations' agency dispute, firms' majority and minority shareholders' sentiments, and firms' shareholders and control agency issues [22]. As cash flow sensitivity of cash correlates with a firm ability to access capital markets [3], the importance of balance sheet liquidity inclines by the degree to which firms have access to external capital markets. If a firm is unconstrained no need to safeguard against future needs, this scenario makes corporate liquidity irrelevant. Conversely, financially constrained firms with difficulty in accessing external capital have always

liquidity management as the central concern for corporate policy. Still, studies on companies' cash holdings and performance have disregarded serious matters related to emerging economies. Firstly, in the case of China research on the role of optimal level of cash holding on firm performance as a nonlinear relationship is scarce. Especially, how above or below the optimal level of cash holdings influence firm performance has not been carried out. Secondly, financial constraints play a significant role in the cash management policies of firms, which to the best of our knowledge has not been used as moderating factor in the optimal level of cash holdings and performance relationship for the economy of China with trade-off theory and levels of target cash holdings. In addition, the role of business cycle fluctuation's influences firm cash holding arrangements and the value of financially constrained and unconstrained firms', which to the best of our knowledge has not been well uncovered in the case of China with propensity score matching and difference in difference estimators. Specifically, in the case of China, the response of business cycle shocks on cash holding behavior of the firms and firm performance has not been well examined. As the business cycle fluctuations significantly influence financially constrained and unconstrained firms' cash holding measures in emerging economies. Therefore, the present study uncovered all these gaps for the economy of China.

2. Review of Related Literature

There are mixed pieces of evidence for the relationship between cash holdings and firm performance in emerging economies. In the developing and emerging economies, cash literature depicts a positive relationship between cash holdings and performance [23, 24]. Besides, cash literature related to the MENA region finds a bidirectional relationship [25] a nonlinear inverted U-shaped relationship linked to trade-off theory [13], and a positive relationship between cash holdings and firm performance with the influence of stronger institutional settings [26].

For instance, Alnori [13] using data of nonfinancial firm from the economy of Saudi Arabia finds an inverted U-shaped relationship between cash holding and corporate performance. They validate the trade-off theory and suggest an optimal level of cash holdings provides a cost and benefits balance. Nguyen et al. examined the nonlinear association amid companies' value and business holdings of cash for nonfinancial firms sample of Vietnam from 2008–2013. Writers focused on equally regression models of dynamic and static in order to check the nonlinear relation. Authors declared the relation of firm cash holdings and the value of the firm as inverted U-shaped even in the presence of financial constraints as moderating factors which corresponds to the theory of trade-off [27].

Cho et al. used a model of partial adjustment for holding cash with data of Korean firms and find that the influence of managerial capability is not noteworthy while holdings of cash are lesser than the level of the target. They further suggest that this may cause the issue of liquidity shortage and

firms' financial distress as a result of the lower level of cash [28].

A number of studies have investigated the cash holdings and the policies of the firms. Das et al. investigated that how a country specific environment towards business significantly influences the policies of liquidity and cash management. With the seven Asian emerging economies panel of sample from 2001 to 2019. Their study concludes that the significance of variables specific to countries plays a significant part in the mechanism of cash adjustment. They reveal that the financial development of the country plays a significant role in cash management and adjustment of firm cash dynamics. They also validate that with an excess of cash holdings firms usually have a faster speed of adjustment towards the target level of cash. They find that firms usually adjust cash from investment in the case of cash in excess and in the case of cash deficit firms adjust through financing channels [29].

Apart from other studies Jiang and Lie [30] examined the firms' speed of cash adjustment to the level of target and suggests that managers should manage the target cash level at the optimum best because deviation from optimum can harm the firm performance. They also find that on the mean level, the companies near to 31% of the breach amid target and real cash ratio of cash every year. Jiang et al. investigated the cash holdings and relationship of firm performance with several moderators by taking the sample of Chinese firms. Their findings reveal that firm specific characteristics highly influence the cash holdings and firm performance relationship if the firm has a strong governance mechanism. Conclusively, they declare that specific firm attributes are significant to impact the cash holdings and corporate performance relationship [31]. Diaw investigated the cash holdings and corporate relationship with panel data for the firms of emerging economies. Their study reveals that in emerging economies firms with higher liquidity have a bigger size and capital expenditure at low levels. Moreover, the study finds that firm growth opportunities show an inverse relationship, which leads the firm to moral hazard issue. He used the dynamic methodology of system generalized method of moments and declare a slow speed of adjustment towards the target cash level [32].

Batuman and Karan examined the influence of the global financial crisis on the elements of business cash holdings and alterations concerning the level of the target with data of firm from Eastern Europe. They used the two estimation methodologies of GMM and fixed effect estimators to analyze the findings. They find that determinants of cash holdings at the firm level have significant differences in the level of cash holdings pre and postperiod of crisis. They also find that the speed of adjustment postcrisis period is at a slower rate. This study is significantly robust to the issue of endogeneity and reveals that Eastern European firms have a profound effect of the global financial crisis due to a shortage of liquidity and the limited access to funds [33]. A study by Tran [34] examined the cash holdings and the shareholders' protection relationship using an international sample of firms from 40 countries during the global financial crisis. They reveal that the influence of shareholder security on

holdings of cash balances is considerably alleviated by the overall economic crunch. Yildiz finds that after the financial crisis the adjustment speed towards the target level of the capital structure showed the slow movement. Moreover, they declare that the financial crisis is an important aspect not only to explain the clues that hit the decisions regarding firm capital structure but also had a profound impact on the adjustment behavior of firms towards the level of the target [35].

Tsai et al. find that a CEO with a high level of managerial skills and experience can help to lessen the financial constraints of firms and enhance the value of holdings of cash. The study provides a significant rationale to understand the powerful influence of managers' ability in cash management of constrained firms. This study uses the robust method of instrumental variable regression [36]. Jiang and Wu declare that two significant aspects of precautionary motive for cash holdings for funding are: investment and recovery from potential losses of operating activities. They mainly investigated the behavior of the firm in case it deviates from the target level of cash. Moreover, they confirm that firms' speed of adjustment is faster when the firm cash holding level is above the target level. They propose that the dynamics of cash management are highly influenced by cash holding motivations [37].

Existing literature has provided enough rationale to understand the cash holdings and the firm performance relationship. However, the literature from the nonlinear perspective is scant. Therefore, in the present study, our main motivation is to evaluate cash holdings and firm performance from the nonlinear perspective and to know how the chief explanatory variable cash holding at different levels of optimum influences firm performance. Moreover to know how financial constraints as moderator influence cash holdings and firm performance relationship. We follow the well-established literature to measure firm performance with Tobin's-q and return on assets. As we know, ROA illustrates the effective and efficient use of firm assets, which is a measure of earnings before interest and taxes (EBIT) divided by total assets [24]. However, Tobin's-q indicates the true picture of firm value, which is a measure of equity value plus book value of long-term debt plus net current liabilities divided by the value of total assets [2]. Therefore, keeping all aspects of the literature in mind further discussion is carried out in the study.

3. Theoretical Framework and Hypotheses Development

3.1. Influence of Cash Holding on Firm Performance. There are several theories regarding the influence of firms' investment decisions on cash holding. The stakeholder theory encourages firms to hold more cash to build a sound relationship with firms' stakeholders [38]. The pecking order theory concludes that there is no optimum level of cash. Firms use cash as a buffer amid retained earnings and investment necessities. The free cash flow theory endorses holding a large amount of cash by managers to enhance the

control on firms' substantial assets and gain more discretionary hold for investment doings [22], and such corporate policy may result in over-investment. Many research studies on cash holding followed trade-off, pecking order, and free cash flow theories to work on the determinants of cash holding and target cash holding towards adjusting at the optimum. However, there is no clear picture of cash holding level and its impact on firm performance. Therefore, the present study uses a conception of a target cash level derived from the theoretically justified and empirically seasoned seminal work of Kim et al. [12]. Agency cost literature raised two opposing views for holding the liquid balances. As to get away from raising external capital, firms ideally carry cash balances in large amounts since plenty of cash balances put forward no agency cost but give a financial benefit. Conversely, Jensen [39] concludes that large cash balances contain agency costs and provide no advantage of financial flexibility due to this, firms optimally carry liquid balances at the lower levels. Firms' cash holdings involve both agency costs and also confer financial flexibility benefits.

Empirical evidence suggests that the marginal value of cash diminishes with large cash holding [16]. The precautionary motive suggests that firms overcome or hedge cash shortage risk in the future by holding cash. The transaction cost motive illustrates that there is a cost associated with buying and selling of real and financial assets, therefore to carry out the regular day-to-day operation, firms need cash. This discussion of the literature suggests that there is a trade-off between the costs and benefits of holding liquid assets [12]. The present study follows the trade-off theory and assumes that there is a nonlinear inverted U-shaped relationship between cash holding and firm performance. This relationship is shown in Figure 1. Therefore, hypothesis 1 is submitted as follows.

H1: There is a nonlinear concave relationship between cash holdings and corporate performance.

3.2. Influence of Financial Constraints on Cash Holding and Firm Performance Relationship. There is a lot of discussion in existing literature regarding a firm faces financial constraints [40]. To mitigate the risk of distress, financially constrained firms to hold large amounts of cash balances. Financially constrained firms that are unlisted face more financial constraints than listed firms, find it hard to access capital markets, and have a high level of short-term debt. The asymmetric information among firms and external investors drives the high cost of raising external finance [15]. The substitution effect and low investment stimulate high agency issues. External finance becomes costly due to high transaction costs and additional financial constraints. Therefore, in the presence of market imperfections, the manager of firms lowers the cost of external finance and finds it expedient to bring about adequate availability of internal funds. Modigliani and Miller [7] show that in the perfect capital markets, firms can get external financing without any hindrance, and firms do not need to hoard internal finance for investment in this scenario. On the other hand, in the

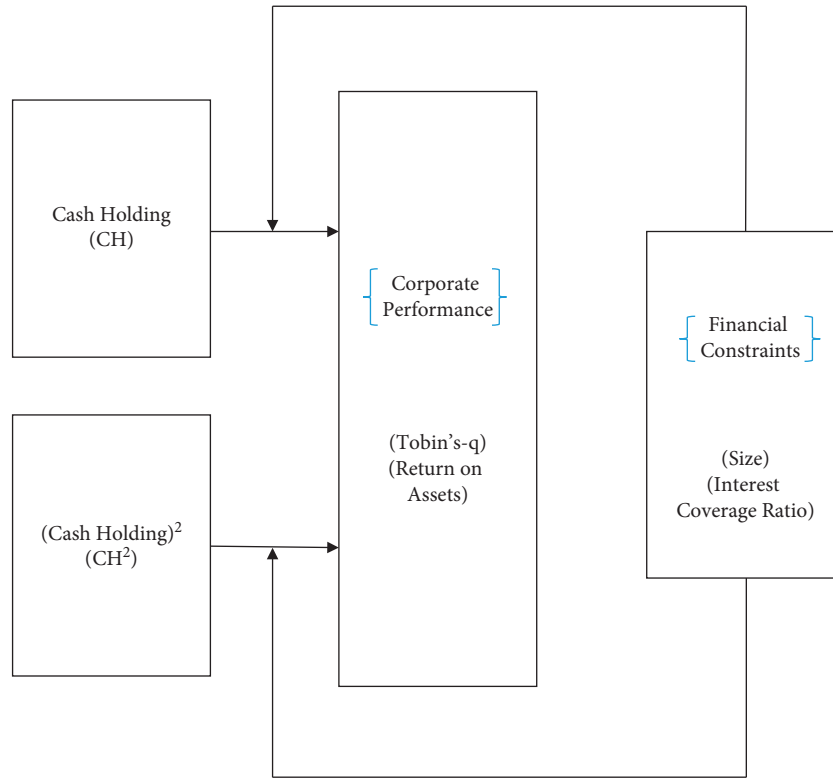


FIGURE 1: Impact of optimal level of cash holdings on corporate performance with the influence of financial constraints as moderating factor.

presence of capital market imperfection, external finance becomes costly relative to funds generated internally [6, 7]. And firms' investment highly depends on financial factors, for instance, capital market access, availability of internal finance, and financing cost. The main advantage of cash holding is to prevent the cost of external finance, and a decline in the external financing cost drives firms to enhance their value. According to Keynes [10], firms hold cash balances to hedge the risk of cash shortage in the future for precautionary purposes. Firms restricted to access capital markets hoard large cash balances to deal with liquidity shortages. Moreover, firms hold large cash balances and liquid assets that expose to high cash flow volatility on average to the industry [2]. And find it hard to access capital markets and have a high level of short-term debt. As holding large cash balances save firms to underperforming relatively to their counterparts with fewer cash holdings. The large cash holding is not just limited to big firms, but small-size firms and risky firms also hold more liquid reserves in their financial statements over time. Accordingly, Bates, Kahle, and Stulz [4] declared that the big companies also have piles of cash, and this record level of cash holding has increased over time. Hence, the above discussion suggests that in the presence of financial constraints relationship between cash holding and corporate performance is likely to be nonlinear concave. This relationship is shown in Figure 1. Therefore, hypothesis 2 is suggested as follows.

H2: In the presence of financial constraints there is a nonlinear concave relationship between cash holdings and corporate performance.

4. Research Design

4.1. Sources of Data and Selection of Sample. The China Stock Market and Accounting Research (CSMAR) database is the prime source of the database of A-share nonfinancial firms of China listed on the Shanghai Stock Exchange (SHSE) and the Shenzhen Stock Exchange (SZSE) over the period 2005 to 2019. This sample window well covers the financial crisis of 2007–2008 for our analysis of business cycle fluctuation's effect on firms' optimal cash holdings. The original sample of the present study covers data range from 2005 to 2019, but for the difference-in-difference approach, the reduced data sample covering the period 2005 to 2010, with 2008–2010 being considered the crisis period. Since, this time window is compatible scrutinizes the effect of liquidity shocks. Moreover, the paper further screened the data samples according to the following criterion: (1) due to industry characteristics and distinction in accounting standards, the present study excluded listed firms in financial industries, (2) the study also omits firms with missing observations for the variables and incorrect data, (3) excluded firms' data with zero equity values and traded period less than five years because five years data is an essential condition of the

number of observations of periods to test for second-order serial correlation, and (4) following Faulkender and Wang [16], the study winsorized data up to one percent tail to safeguard from the potential influence of outliers.

4.2. Model Specifications. The study proposes that the relationship between cash holdings and corporate performance may be nonlinear and the following equation is estimated:

$$\begin{aligned} cp_{i,t} = & \beta_0 + \beta_1 cpi_{i,t-1} + \beta_2 ch_{i,t} + \beta_3 ch_{i,t}^2 + \beta_4 sz_{i,t} \\ & + \beta_5 gr_{i,t} + \beta_6 lev_{i,t} \\ & + \beta_7 cf_{i,t} + \beta_8 fa_{i,t} + \lambda t + \eta i + \varepsilon_{i,t}. \end{aligned} \quad (1)$$

Next, by following the support of existing literature on antecedents of cash holdings, [2, 3, 12, 17], computed the residuals according to the following equation:

$$\begin{aligned} ch_{i,t} = & \beta_0 + \beta_1 chi_{i,t-1} + \beta_2 sz_{i,t} + \beta_3 gr_{i,t} \\ & + \beta_4 lev_{i,t} + \beta_5 cf_{i,t} + \beta_6 liq_{i,t} \\ & + \lambda t + \eta i + \varepsilon_{i,t}. \end{aligned} \quad (2)$$

Here, the dependent variable is cash holding ($ch_{i,t}$), and ($liq_{i,t}$) represents the liquid assets of the firm [17] (note: see details of empirical findings on (2) in Table 12).

Following existing literature on the optimum level of cash holding such as [12], we further investigate the effect of deviation from the optimum level of cash holdings on the firm in the following equation:

$$\begin{aligned} cp_{i,t} = & \beta_0 + \beta_1 cpi_{i,t-1} + \beta_2 dev_{i,t} + \beta_3 sz_{i,t} \\ & + \beta_4 gr_{i,t} + \beta_5 lev_{i,t} + \beta_6 cf_{i,t} \\ & + \beta_7 fa_{i,t} + \lambda t + \eta i + \varepsilon_{i,t}. \end{aligned} \quad (3)$$

Next, we investigate how deviation from above and below optimum levels of cash holding impacts corporate performance. We calculate a dummy variable named (Above Optimal Dummy) considering positive values of residual obtained from the benchmark specifications for antecedents of cash holdings from the estimation (2) as 1, and 0 otherwise. The following equation is computed:

$$\begin{aligned} cp_{i,t} = & \beta_0 + \beta_1 cpi_{i,t-1} + \beta_2 dev_{i,t} + \beta_3 dev_{i,t} * Int_{i,t} \\ & + \beta_4 sz_{i,t} + \beta_5 gr_{i,t} + \beta_6 lev_{i,t} \\ & + \beta_7 cf_{i,t} + \beta_8 fa_{i,t} + \lambda t + \eta i + \varepsilon_{i,t}. \end{aligned} \quad (4)$$

Next, following well-established literature for proxy of financial constraints we use two measures: size (sz) [2, 12] and interest coverage ratio (icr). The proposed equation is

$$\begin{aligned} cp_{i,t} = & \beta_0 + \beta_1 cpi_{i,t-1} + (\beta_2 + \delta_1 fc_{i,t}) ch_{i,t} \\ & + (\beta_3 + \delta_2 fc_{i,t}) ch_{i,t}^2 + \beta_4 sz_{i,t} + \beta_5 gr_{i,t} + \beta_6 lev_{i,t} \\ & + \beta_7 cf_{i,t} + \beta_8 fa_{i,t} + \lambda t + \eta i + \varepsilon_{i,t}. \end{aligned} \quad (5)$$

In Equations (1), (3), (4), and (5), dependent variable corporate performance ($cp_{i,t}$) represents two measures the

Tobin's-q (q) and returns on assets (roa). Following Opler et al. [2] study uses cash holding ($ch_{i,t}$) as the independent variable. The size ($sz_{i,t}$), growth opportunities ($gr_{i,t}$), firm leverage ($lev_{i,t}$), firms' cash flow ($cf_{i,t}$) [13], and fixed assets ratio ($fa_{i,t}$) represent control variables (note: see Table 11 for the detailed definitions of variables).

Next, the study investigates the speed of with a partial adjustment model as follows:

$$\begin{aligned} \Delta ch = & \alpha + \beta_1 fc_firms * (ch_{i,t-1} - ch_{i,t}) \\ & + \beta_2 (ch_{i,t-1} - ch_{i,t}) \\ & + \beta_3 fc_firms + \varepsilon. \end{aligned} \quad (6)$$

Here, (Δch) is the dependent variable, and the dummy variable (fc_firms) denotes the financially constrained firms. The variable ($ch_{i,t}$) illustrates the predicted values of cash holding, and the term (ε) represents the error term.

5. Results and Empirical Analysis

5.1. Summary Statistics and Correlation Analysis. Table 1 presents the descriptive statistics of the main variables. The average value for the variable Tobin's-q (q) is 1.94 for Chinese nonfinancial firms, on average, have 15.86 cash holdings (ch). The variable size (sz) shows an average of 21.78. The mean value of the growth (gr) is 4.86 and the mean value of the variable leverage (lev) is 53.19. The average cash flow (cf) is 9.69 and the average ratio of fixed assets (fa) of Chinese nonfinancial firms is 1.21. The mean value of variable liquidity (liq) is 18.02 percent.

Table 2 signifies the correlation matrix and variance inflation factor (VIF) results for variables of the study. Moreover, correlation coefficients between all the variables are below the threshold level of 0.80, thereby indicating multicollinearity may not be the case. However, multicollinearity cannot be ignored and may still exist to some degree, although all the variables show low correlation coefficient results. The VIF test also shows no sign of multicollinearity, and the largest (VIF) value is 1.14 in the sample. These results imply that multicollinearity does not exist because the highest value of (VIF) is far from the threshold value of 5.

5.2. Regression Results and Analysis. In Table 3, the study investigates the impact of the optimal level of cash holdings on corporate performance by using model (1), which estimates the functional form. In Table 3, columns 1 and 2 present results for the dependent variables Tobin's-q (q) and return on assets (ROA), respectively. In Model (1) of Table 3, the study finds that the coefficients ($\beta_2 > 0$) of cash holding (ch) at the low level are positive and statistically significant at 1% in columns 1 and 2, and the coefficients ($\beta_3 < 0$) of cash holding (ch^2) at a high level are negative and statistically significant at 10% and 1% in columns 1 and 2, respectively. The coefficients of the cash holding also determine the target or inflection point for cash holding and corporate performance relationship, this optimum comes from the coefficients of ch and ch^2 ($-\beta_2/2\beta_3$).

TABLE 1: Summary statistics of variables.

Variables	Mean	St. dev.	Percentile 25	Median	Percentile 75
<i>q</i>	1.94	2.03	0.72	1.31	2.35
<i>ch</i>	15.86	11.79	7.54	12.86	21.03
<i>sz</i>	21.78	1.30	20.88	21.69	22.58
<i>gr</i>	4.86	6.33	1.02	2.98	5.99
<i>lev</i>	53.19	25.52	36.79	52.13	66.72
<i>roa</i>	2.47	3.52	0.06	1.80	5.13
<i>cf</i>	9.69	16.71	5.72	10.00	15.35
<i>fa</i>	1.21	2.27	0.20	0.33	0.57
<i>liq</i>	18.02	17.74	5.00	15.00	27.00

Notes: this table shows the results of the summary statistics.

TABLE 2: Correlation matrix and variance inflation factor (VIF) of variables.

	<i>Q</i>	<i>Ch</i>	<i>sz</i>	<i>gr</i>	<i>lev</i>	<i>roa</i>	<i>cf</i>	<i>fa</i>
<i>q</i>	1.000							
<i>ch</i>	0.2171***	1.000						
<i>sz</i>	-0.4554***	-0.0999***	1.000					
<i>gr</i>	0.0758***	-0.1311***	-0.0900***	1.000				
<i>lev</i>	-0.1525***	-0.2699***	0.0999***	0.0193**	1.000			
<i>roa</i>	-0.1030***	0.0319***	0.0960***	-0.0319***	-0.0654***	1.000		
<i>cf</i>	0.0945***	0.1187***	0.0791***	-0.0155***	-0.0824***	0.1741***	1.000	
<i>fa</i>	0.0335***	0.0938***	0.0533***	-0.0934***	0.0591***	0.0123	-0.0178**	1.000
VIF		1.14	1.06	1.04	1.11	1.05	1.06	1.03

Notes: subscripts ** and *** indicate the level of significance at the 5% and 1%, respectively.

TABLE 3: Regression results for functional form estimation for cash holding and corporate performance.

	Dependent variable Tobin's-q (1)	Dependent variable (ROA) (2)
<i>ch</i>	0.0213*** (2.89)	0.1875*** (2.59)
<i>ch</i> ²	-0.0003* (-1.93)	-0.0034*** (-2.73)
<i>sz</i>	-0.6397* (-1.77)	1.1528*** (2.58)
<i>gr</i>	-0.2693*** (-3.82)	0.1036 (1.01)
<i>lev</i>	0.0427*** (2.67)	-0.0358* (-1.75)
<i>cf</i>	0.011 (1.41)	0.0400*** (3.14)
<i>fa</i>	0.0935 (1.34)	-0.1150 (-0.63)
IFE and TFE	Yes	Yes
<i>p</i> -value of <i>m</i> ₂	0.373	0.561
<i>F</i> ₁	8.35	6.73
<i>F</i> ₂	3.73	7.46
Hansen test (df)	260.99 (134)	107.82 (100)
Wald Test (<i>p</i> -value)	55.18 (0.000)	8.72 (0.000)
Diff. in Hansen Test- <i>p</i> -value	0.948	0.458
Obs.	13993	14357

Notes: the *t*-statistics are in the brackets. *, **, and *** indicate the level of significance at the 10%, 5%, and 1%, respectively.

In sum, the empirical analysis confirms that the value of the firms is influenced by two distinctive means because of their cash holdings. At the low level of cash holdings, the precautionary and transaction motivations take over, and firm value increases as firms' cash holding increases. Conversely, at a high level lead to opportunity cost and free cash flow issues. This finding is consistent with the research of Alnori [13]. Moreover, based on the cut-off formula for optimal level of cash holdings ($-\beta_2/2\beta_3$) on nonlinear inverted U-shape for *ch* and *ch*², the cut-point on the curve swift for the relationships of cash holdings and Tobin's-Q is (35.50) and for the relationship of cash holdings and ROA is (27.57).

In Table 4, columns 1 and 2 present results for the deviation (dev) and Tobin's-q relationship, and the relationship of deviation (dev) and return on assets (ROA), respectively. The coefficients of deviation (dev) are negative and significant at the 5% level and 1% level, respectively. In Table 4, columns 3 and 4 present the results for the relationship of deviation from above and below the optimal level of cash holding and corporate performance. In Table 4, columns 3 and 4 show results for dependent variables Tobin's-q (*q*) and return on assets (ROA), respectively. The results show negative and significant coefficients of deviation (dev) at the 5% level in columns 3 and 4, respectively. The results show positive and significant coefficients for

TABLE 4: Regression results for the effect of deviation, and deviation from above and below the optimal level of cash holding on firm performance.

	Effect of deviation from optimum level		Effect of deviation from above and below the optimum level	
	(1)	(2)	(3)	(4)
<i>dev</i>	-0.0399**(-2.23)	-0.1785***(-3.60)	-1.6324**(-2.49)	-0.4806**(-2.84)
<i>dev*Int</i>			1.6007** (2.50)	0.2648* (1.77)
<i>lev</i>	0.0211*(1.80)	-0.0698**(-2.65)	0.0553*(1.74)	-0.1064***(-4.01)
<i>sz</i>	-0.7439***(-4.45)	-0.2637*(-1.67)	-1.1478***(-3.39)	-0.3184*(-1.89)
<i>gr</i>	-0.2456***(-3.89)	-0.2434**(-2.28)	-0.6663***(-3.45)	-0.2212**(-2.17)
<i>cf</i>	0.0069*(1.78)	0.0038(0.19)	0.0050(1.05)	-0.0203(-1.22)
<i>fa</i>	-0.1881***(-3.79)	0.03219(0.17)	-0.2980***(-3.01)	0.0588 (0.34)
<i>IFE and TFE</i>	Yes	Yes	Yes	Yes
<i>p-value of m₂</i>	0.632	0.687	0.094	0.236
<i>F1 (p-value)</i>			3.12 (0.0446)	8.28 (0.0003)
<i>Hansen test (df)</i>	86.32 (78)	71.33(71)	31.42 (25)	62.42 (58)
<i>Hansen test-p-value</i>	0.243	0.467	0.175	0.322
<i>Wald Test (p-value)</i>	34.65 (0.000)	77.37(0.000)	35.48 (0.000)	2.37 (0.000)
<i>Diff. in Hansen Test p-value</i>	0.498	0.997	0.542	0.596
<i>Obs.</i>	8190	8386	13992	9904

Notes: the t-statistics are in the brackets. *, **, and *** indicate the level of significance at the 10%, 5%, and 1%, respectively.

interaction (*dev*Int*) at 5% and 10% levels in columns 3 and 4, respectively.

Collectively, these findings of results indicate a negative relationship between deviation (*dev*) and corporate performance. Moreover, interaction (*dev*Int*) shows a positive association with firm performance. The findings of the results are per expectations as positive and negative residuals offset each other. In columns (3) and (4) F1 test shows the addition of two coefficients for β_1 and β_2 as $(\beta_1 + \beta_2)$, and the addition of these two coefficients should be negative and statistically significant [15, 17]. The F1 test indicates that the sum of these two coefficients is statistically significant at the 5% and the 1% level as can be seen in columns 3 and 4, respectively. In Table 4, the analysis shows that the firm value declines due to a deviation on either side of the firms' optimum level of holding cash balances. These results are consistent with those of Alnori [13].

Table 5 reports the results for the relationship of an optimum level of cash holdings and corporate performance with the linkage of financial constraints. In column (1) results for the relationship of cash holdings and Tobin's-q (*q*) show a positive and significant coefficient at a 10% level of significance for the low level of cash holdings (*ch*sz*), and a negative and significant coefficient for a high level of cash holding (*ch2*sz*) at the 5% level of significance. In column (2) results for the relationship of cash holdings and return on assets (ROA) show significant negative coefficient values at the low level of cash holding (*ch*sz*) with a 1% level of significance, and a significant positive coefficient at the high level of cash holding (*ch2*sz*) with a 5% level of significance.

In Table 5, column 3 the results for the relationship of cash holding and Tobin's-q (*q*) for financially constrained firms with high bankruptcy risk show a significant and positive coefficient at the low level of (*ch*Icr*) with a 5% level of significance and significant negative coefficient at the high level of (*ch2*Icr*) with a 10% level of significance. In Table 5, column 4 the results for the relationship of cash holding and

return on assets (ROA) for financially constrained firms with high bankruptcy risk show a significant negative coefficient at the low level of (*ch*Icr*) with a 5% significance level and a significant positive coefficient at the high level of (*ch2*Icr*) with a 5% significance level. Collectively, these findings of results suggest a nonlinear concave relationship between cash holdings and Tobin's-q (*q*) for financially constrained firms based on size and interest coverage ratio groups. On the contrary, the results indicate the U-shaped relationship between cash holding (*ch*) and return on assets (ROA) for financially constrained firms based on size and interest coverage ratio groups. These empirical findings are consistent with the existing literature and show that small-size firms and firms with high business risk hold high cash balances [2, 3, 12]. Therefore, In 2019, the additional significance of trades above the nominated size enlarged by means of 6.7 percent in comparison to 2018 [41].

The previous section's results show that financially constrained firms are more reliant on internal funds, and these firms hold a large number of cash holdings than firms with ease of access to financial markets to raise funds when they need it [16]. Table 6, Panel A, presents results for the size (*sz*) group, and Panel B presents results for the interest coverage ratio (*Icr*) group. Empirical evidence finds that there is a significant difference between the mean values of financially constrained and unconstrained firms in their cash holding levels. In Table 6, Panel (A) results show that firms constrained on size (*sz*) have significantly higher mean values of the level of cash holdings (*ch*) than unconstrained firms.

5.3. Additional Analysis. Following the methodological scheme of Gao, Harford, and Li [42] with a partial adjustment model (6) study provides estimates of the model with empirical findings. In Table 7, columns 1 and 4 present results for a full sample of firms. In column 1, results show

TABLE 5: Regression results for the effect of financial constraint on cash holding and corporate performance relationship.

	Size (sz) group		(Icr) group	
	(1)	(2)	(3)	(4)
<i>ch</i>	0.0163** (2.15)	0.2782*** (3.94)	0.0257*** (3.19)	0.3146*** (3.44)
<i>ch</i> ²	-0.0002* (-1.65)	-0.0049*** (-3.12)	-0.0004** (-2.43)	-0.0070*** (-3.58)
<i>ch</i> * <i>sz</i>	0.0452* (1.86)	-0.2753*** (-3.34)		
<i>ch</i> ² * <i>sz</i>	-0.0009** (-2.10)	0.0049** (2.55)		
<i>ch</i> * <i>Icr</i>			0.0503** (2.16)	-0.1851** (-2.05)
<i>ch</i> ² * <i>Icr</i>			-0.0008* (-1.83)	0.0054** (2.39)
<i>sz</i>	-1.5795*** (-4.02)	-0.3235 (-0.92)	-0.7230* (-1.82)	1.0716** (2.42)
<i>gr</i>	-0.2577*** (-3.66)	0.0845 (1.12)	-0.2663*** (3.70)	0.0769 (0.70)
<i>lev</i>	0.0337*** (3.14)	-0.0545*** (-3.82)	0.0514*** (3.27)	-0.0375** (-1.97)
<i>cf</i>	-0.0033 (-0.27)	0.0317*** (5.61)	0.0110 (1.26)	0.0345** (2.60)
<i>fa</i>	-0.0552 (-0.94)	0.0622 (0.48)	0.0289 (0.36)	-0.1317 (0.70)
IFE and TFE	Yes	Yes	Yes	Yes
<i>p</i> -value of <i>m</i> ₂	0.301	0.381	0.245	0.596
<i>F</i> ₁	4.61	15.51	10.15	11.84
<i>F</i> ₂	2.74	9.71	5.89	12.80
Hansen test (df)	254.87 (132)	218.34 (220)	245.73 (132)	92.87 (98)
Wald Test (<i>p</i> -value)	54.38 (0.000)	10.56 (0.000)	48.47 (0.000)	6.10 (0.000)
Diff. in Hansen Test - <i>p</i> -value	0.817	0.789	0.927	0.572
Obs.	13993	14360	13993	14357

Notes: the *t*-statistics are in the brackets. *, **, and *** indicate the level of significance at the 10%, 5%, and 1%, respectively.

TABLE 6: Group comparison based on financial constraints.

Panel (A): group comparison based on financial constraints of (size) group				
	Financially unconstrained firm (1)	Financially constrained firm (2)	Difference (3)	<i>t</i> -statistics (4)
<i>q</i>	1.2892	2.6197	-1.3305***	-43.22
<i>ch</i>	14.9494	16.7775	-1.8280***	-9.95
<i>sz</i>	22.7908	20.7565	2.0343***	161.51
<i>gr</i>	4.4477	5.2851	-0.8374***	-8.48
<i>lev</i>	56.4031	49.9603	6.4428***	16.27
ROA	2.7665	2.17644	0.5901***	10.77
<i>cf</i>	10.9361	8.42544	2.5106***	9.61
<i>fa</i>	1.3340	1.0919	0.2421***	6.83
Panel (B): group comparison based on financial constraints of interest coverage ratio (ICR) of firms				
Variables	Financially unconstrained firm (1)	Financially constrained firm (2)	Difference (3)	<i>t</i> -statistics (4)
<i>q</i>	1.8479	2.0409	-0.1930***	-5.98
<i>ch</i>	15.1589	16.5612	-1.4022***	-7.62
<i>sz</i>	21.8440	21.7115	0.1325***	6.54
<i>gr</i>	5.1319	4.5974	0.5345***	5.40
<i>lev</i>	50.4569	55.9345	-5.4775***	-13.80
ROAa	2.8100	2.1350	0.6749***	12.33
<i>Cf</i>	11.7146	7.6556	4.0589***	15.64
<i>Fa</i>	0.9946	1.4368	-0.4422***	-12.46

Notes: *** indicates the level of significance at the 1%.

significant and positive coefficients for (ch●-lagged ch) at the 1% level of significance, and the coefficient on *fc_firms**(ch●-lagged ch) is significant and positive at the 1% level of significance. In column 4, results show significant and positive coefficients for (ch●-lagged ch) at the 1% level of significance, and the coefficient on *fc_firms**(ch●-lagged ch) is significant and positive at the 5% level of significance. These findings depict that both classes of firms are

dynamically adjusting their cash holdings towards target levels, and financially constrained firms' speed of adjustment is faster than unconstrained firms. Since firms with cash shortages rebalance their cash holdings slower than cash surplus firms. Existing literature also suggests that small-size firms are more financially constrained and face difficulty in accessing capital markets than large firms [3]. The results for financially constrained small-size firms show a faster speed

TABLE 7: Regression results for the speed of adjustment to the target cash holding level.

	Financially constrained firms (<i>fc_firms</i>) based on size			Financially constrained firms (<i>fc_firms</i>) based on interest coverage ratio (ICR)		
	Full sample (1)	(<i>ch</i> [●] -lagged <i>ch</i>) < P25 (2)	(<i>ch</i> [●] -lagged <i>ch</i>) > P75 (3)	Full sample (4)	(<i>ch</i> [●] -lagged <i>ch</i>) < P25 (5)	(<i>ch</i> [●] -lagged <i>ch</i>) > P75 (6)
<i>fc_firms</i> * (<i>ch</i> [●] -lagged <i>ch</i>)	0.1211*** [0.0246]	0.3324*** [0.0947]	2.76515*** [0.4749]	0.0563** [0.0273]	-0.6374*** [0.1063]	0.4058*** [0.1236]
<i>ch</i> [●] -lagged <i>ch</i>	0.11645*** [0.0083]	0.2209*** [0.0239]	2.7246*** [0.3404]	0.1153*** [0.0176]	0.6958*** [0.1016]	4.3808*** [0.5704]
<i>fc_firms</i>	86.6454*** [13.3105]	278.4421*** [70.9736]	292.7663*** [40.1739]	48.1824*** [13.7483]	-368.6265*** [65.7636]	41.9335*** [21.7204]
Constant	45.8904*** [3.3406]	150.7038*** [15.1939]	222.9311*** [22.8151]	56.4788*** [7.2909]	443.3974*** [65.9452]	384.1316*** [42.2947]
R-Squared	0.0208	0.0590	0.0572	0.0108	0.0752	0.0410
F-Stats (prob > F)	100.33 (0.0000)	40.69 (0.0000)	29.17 (0.0000)	36.77 (0.0000)	20.68 (0.0000)	22.74 (0.0000)
Obs.	14811	3109	3702	13282	3109	3702

Notes: quartiles bottom (P25) and top (P75). Robust (vec) standard errors stated in parentheses. *, **, and *** represent the level of significance at 10%, 5%, and 1%, respectively.

of adjustment to target cash level than unconstrained firms. In columns 2, 3, 5, and 6, for a subsample of financially constrained and unconstrained firms with their real cash holding level dropping above or below their level of cash targets, equation (6) is separately estimated. To diminish the fear of not knowing the accurate model for the target cash, by the measure of (*ch*[●]-lagged *ch*), the study states two subsamples as “excess cash” and “cash shortfall” by two quartiles bottom (P25) and top (P75) of the population of the study. These results show that financially constrained firms adjust their cash holdings towards their target cash levels much faster than financially unconstrained firms when holding less cash than the target levels.

To examine the differences in the cash holding levels between financially constrained and unconstrained firms, the study employs the propensity score matching (PSM) technique. The technique of PSM is useful to control the selection bias grounded on the observable firm characteristics. In the analysis, the study applies the nearest neighbor matching technique following Heckman et al. [43].

Table 8, Panel A shows the results for the propensity score matching estimation. The results in columns 1 through 4 show that financially constrained and unconstrained firms have statistically significant differences in their level of cash holdings. As the coefficient of cash holdings (*ch*) obtained from the probit regression is positive and statistically significant in all estimations of columns 1 through 4, suggesting that firms with high cash holdings are more likely to be financially constrained. The findings of results for average treatment effect on treated (ATT) obtained from nearest neighbor matching in columns 1 through 4 show statistically significant and positive values.

Next, the study employed a difference-in-difference (DID) estimator as the uncontrolled firm-level heterogeneity may influence and confound inferences. Therefore, to verify the robustness, the present study addresses the potential

problem of firm-level heterogeneity with a matching estimator. The sample consists of financially constrained and unconstrained firms; therefore, to keep the study sample in mind, the study employed financially constrained firms as “treated” and the matched unconstrained firms as control firms.

Table 8, panel B shows the results for the difference-in-difference (DID) estimation analysis. The original sample of the present study covers data range from 2005 to 2019, however, for the difference-in-difference approach, the study reduced the data sample covering the period 2005 to 2010, with 2008–2010 being considered the crisis period, as this time window is compatible to scrutinize the effect of liquidity shocks. The results for the interaction (*ch***Dct*) show significant and positive coefficients in columns 1 through 4. These results suggest that for unconstrained firms’ the value of cash holdings increases in a financial crisis. These findings of results are consistent with that of Chang et al. [18]. Moreover, the coefficients of (*ch***fc*) are significant and positive in columns 1 through 4, indicating that cash holdings are of higher value to financially constrained firms. These findings of results are consistent with the existing literature [18]. The findings of triple-interaction (i.e., *ch***Dct***fc*), the coefficients are statistically significant and negative in columns 1 through 4. These results of triple-interaction submit that for financially constrained firms, the impact of cash holdings on firm value turns into less positive at the time of financial crisis and reduces demand for investment during the financial crisis.

6. Robustness Analysis

In addition, to check the robustness of results, the present study applied an alternate fixed effect estimator and sensitivity analysis on the baseline model (1) for functional form estimation and on the model (5) to investigate the influence of financial constraints as a moderating factor. Table 9 demonstrates the results of the fixed effect estimator. In Table 9, Panel (A) reports results for the functional form

TABLE 8: Propensity score matching (PSM) and difference-in-difference (DID) estimation results.

Panel (A) : propensity score matching (PSM) analysis				
	Financial constraints criteria = size (sz)		Financial constraints criteria = interest coverage ratio (ICR)	
	(1)	(2)	(3)	(4)
<i>ch</i>	0.0061*** [6.83]	0.0054*** [5.69]	0.0044*** [5.08]	0.0088*** [9.50]
ATT(NN)	1.208*** (25.52)	1.182*** (25.20)	0.095** (2.08)	0.199*** (3.84)
Panel (B) : difference-in-difference (DID) estimation analysis (reduced sample 2005–2010)				
	Financial constraints criteria = SIZE (sz)		Financial constraints criteria = interest coverage ratio (ICR)	
	(1)	(2)	(3)	(4)
<i>ch</i>	0.0163*** (8.42)	0.0132*** (6.73)	0.0125*** (6.51)	0.0094*** (4.88)
<i>ch*Dct</i>	0.0120*** (6.71)	0.0112*** (6.35)	0.0173*** (3.96)	0.0193*** (4.47)
<i>ch*fc</i>	0.0265*** (10.60)	0.0267*** (10.76)	0.0306*** (11.10)	0.0239*** (8.69)
<i>ch*Dct*fc</i>	-0.01460*** (-3.96)	-0.0146*** (-4.01)	-0.0163*** (-2.77)	-0.0187*** (-3.23)
<i>Dct*fc</i>	0.2711*** (3.10)	0.2886*** (3.32)	0.2014* (1.67)	-0.2622** (-2.20)
<i>Fc</i>	1.0568*** (22.67)	1.0208*** (22.03)	-0.3433*** (-5.90)	-0.1336** (-2.27)
<i>Dct</i>	-0.1446*** (-2.84)	-0.1486*** (-2.94)	-0.0744 (-0.87)	-0.1119 (-1.33)
Controls	No	Yes	No	Yes
Constant	0.9809*** (27.02)	1.0189*** (17.46)	1.6767*** (41.79)	1.9567*** (32.40)
Adj. R-squared	0.1689	0.1854	0.0408	0.0669
Obs.	14,374	14,359	14,374	14,359

Notes: the *t*-statistics are in the brackets. *, **, and *** indicate the level of significance at the 10%, at 5%, and 1%, respectively.

estimation results, and Panel (B) reports results for the financial constraints estimation. The study finds similar results to those presented in Tables 3 and 5. In Table 9, Panel (B) columns 3 and 5, the findings of results indicate that in the presence of financial constraints, at a low level of cash holdings, the relationship between cash holdings and firm performance is positive and significant. Moreover, at a high level of cash holdings, the relationship between cash holdings and corporate performance is negative and significant. Conclusively, the findings of fixed effect estimator results also confirm the robustness of the core estimation results of Tables 3 and 5. In Table 10, we further employ sensitivity analysis specifications and applied an alternate pooled ordinary least square (OLS) estimator on the baseline models (1) and (5) with lagged variables to check the influence of the previous period on firm performance. We find similar results to our previously reported findings for alternative fixed effect estimator in Table 9 for robustness checks and empirical findings of Tables 3 and 5.

7. Discussions of Findings

The main objective of the present research is to investigate the relation between cash holdings and corporate performance with the linkage of financial constraints as a

moderating factor. In the study, hypothesis 1 suggests that there is a nonlinear concave relationship between cash holdings and corporate performance. Theoretically, first, the empirical evidence of the findings supports the precautionary and transaction motives [10], where managers would prefer to increase the cash holding at lower levels of cash holdings to overcome or hedge against cash shortage risk in the future. To avail future investment projects, to carry out a routine operation of the firm, and to buy and sell financial and fixed assets at a lower level of cash holdings. However, there is a level of cash holding at which a higher cash holding begins to be negative in terms of value creation due to the free cash flow [39], that involves agency cost of managerial discretion [6], and opportunity cost. Therefore, at a high level of cash holdings, an increase in cash holding decreases firm performance. Theoretically, secondly, our study justifies the trade-off theory, which suggests that a firm's holding of cash balances at an optimum level is the consequence of the trade-off between firm costs and benefits of holding liquid assets to drive an optimal level of cash. Our first hypothesis of the study is accepted and it is consistent with the studies of [13, 27].

Hypothesis 2 proposed that in the presence of financial constraints there is a nonlinear concave relationship

TABLE 9: Estimation results for financial constraints, cash holding, and corporate performance (fixed effect estimator).

	Panel (A) : functional form estimation results			Panel (B) : financial constraints estimation results		
	Full sample			Size group		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>ch</i>	10.1792*** (10.13)	0.0224** (2.28)	0.0148*** (5.04)	4.2293*** (8.56)	4.3679*** (3.62)	4.1055*** (8.31)
<i>ch</i> ²	-0.1989*** (-11.94)	-0.0004** (-2.03)	-0.0001* (-1.84)	-0.1118*** (-13.94)	-0.0785*** (-3.15)	-0.1157*** (-14.43)
<i>ch</i> * <i>sz</i>			0.0118*** (7.09)	-3.0201*** (-5.45)		
<i>ch</i> ² * <i>sz</i>			-0.0001* (-1.83)	0.0838*** (6.93)		
<i>ch</i> * <i>Icr</i>					1.3420*** (3.35)	-2.2420*** (-5.29)
<i>ch</i> ² * <i>Icr</i>					-0.0296*** (-3.08)	0.0966*** (9.08)
<i>sz</i>	-57.9744*** (-7.93)	0.1636*** (2.89)	-1.2341*** (-44.65)	-26.7746*** (-7.27)	-49.3141*** (-6.75)	-23.1762*** (-6.68)
<i>gr</i>	-0.2302761 (-0.35)	-0.0119* (-1.64)	-0.0023 (-0.72)	-0.3526 (-0.79)	-0.3680 (-0.41)	-0.3522 (-0.79)
<i>lev</i>	0.0928*** (19.15)	0.0020 (1.13)	0.0005*** (6.15)	0.0122*** (5.04)	0.0950*** (19.54)	0.0126*** (5.20)
<i>cf</i>	-0.1268*** (-23.51)	0.0319*** (17.51)	0.0076*** (9.61)	-0.0165*** (-12.06)	-0.1270*** (-23.45)	-0.0164*** (-12.00)
<i>fa</i>	1.1578 (0.61)	0.0251* (1.64)	0.0082 (1.31)	0.6361 (0.66)	-0.9120 (-0.48)	0.5151 (0.53)
Constant	1141.969*** (7.33)	-0.3814 (-0.20)	28.8466*** (48.72)	556.3671*** (7.01)	997.2424*** (6.39)	471.452*** (6.36)
<i>IFE and TFE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>F1</i>	102.63	5.20	50.31	29.71	11.20	27.98
<i>F2</i>	142.45	4.13	3.33	47.96	9.47	82.44
Wald Test (prob. > F)	74.56 (0.0000)	22.41 (0.0000)	289.57 (0.0000)	28.05 (0.0000)	60.58 (0.0000)	32.00 (0.0000)
Hausman Test (prob. > Chi ²)	84.38 (0.0000)	67.52 (0.0000)	201.59 (0.0000)	368.39 (0.0000)	56.82 (0.0000)	146.94 (0.0000)
<i>R</i> -squared	0.0579	0.0157	0.3599	0.0147	0.0821	0.0153
Obs.	14355	14805	12569	14802	14355	14802

Notes: the *t*-statistics are in the brackets. *, **, and *** indicate level of significance at the 10%, 5%, and 1%, respectively.

TABLE 10: Sensitivity analysis: estimation results for financial constraints, cash holding, and corporate performance.

	Panel (A): functional form estimation results			Panel (B): financial constraints estimation results				
	Full sample	Size group	(ICR) Group	(1)	(2)	(3)	(4)	(5)
ch_{t-1}	8.5189*** (7.99)	0.0643*** (8.64)	11.3724*** (6.91)	1.4536*** (3.32)	7.72214*** (6.32)	0.0655*** (10.80)		
ch^2_{t-1}	-0.1252*** (-5.68)	-0.0013*** (-8.99)	-0.1649*** (-4.88)	-0.0316*** (-3.83)	-0.0614** (-2.17)	-0.0009*** (-8.33)		
ch^*sz_{t-1}			2.1193*** (2.86)	-4.1643*** (-7.53)				
$ch^{*2}sz_{t-1}$			-0.0754*** (-4.97)	0.1086*** (7.85)				
ch^*ICR_{t-1}					0.9528** (2.40)	-0.0349*** (-5.25)		
$ch^{*2}ICR_{t-1}$					-0.0906*** (-6.50)	0.0006*** (3.09)		
sz_{t-1}	-23.7906*** (-7.55)	0.2469*** (10.45)	-17.7487*** (-3.48)	-14.0528*** (-7.24)	-18.6234*** (-5.24)	0.2618*** (11.37)		
gr_{t-1}	-0.4353 (-0.68)	-0.0086* (-1.89)	-1.0855 (-1.14)	-0.3321 (-1.11)	-0.5220 (-0.73)	-0.0098** (-2.13)		
lev_{t-1}	1.4332*** (8.66)	0.3329*** (9.60)	0.0005*** (6.15)	0.0363*** (15.35)	0.2422*** (10.34)	-0.0001*** (-2.55)		
cf_{t-1}	0.5660** (2.34)	0.0300*** (17.63)	-0.0133* (-1.81)	0.0002 (0.16)	0.0008 (0.13)	-0.0003 (-1.17)		
fa_{t-1}	-2.0551 (-1.14)	0.0174 (1.35)	-5.4655** (-2.08)	-0.8549 (-1.02)	-2.6533 (-1.32)	0.0093 (0.71)		
Constant	349.2226*** (5.05)	-3.2835*** (-6.35)	229.1919* (1.84)	305.0992*** (7.16)	252.354* (1.81)	-3.7703*** (-6.36)		
IFE and TFE	Yes	Yes	Yes	Yes	Yes	Yes		
Wald Test (prob. > F)	10.46 (0.0000)	34.38 (0.0000)	9.49 (0.0000)	17.58 (0.0000)	9.74 (0.0000)	15.47 (0.0000)		
R- squared	0.0159	0.0466	0.0294	0.0283	0.0265	0.0235		
Obs.	12,965	14,808	8,504	13,286	11,502	14,808		

Notes: the t -statistics are in the brackets. *, **, and *** indicate level of significance at the 10%, 5%, and 1%, respectively.

between cash holdings and corporate performance. Since our study shows that the nonlinear concave relationship between cash holding and corporate performance still holds in the presence of financial constraints at a lower level of cash holdings due to difficulty to access capital markets and high information asymmetries and high cost of capital. The evidence shows that firms with financial constraints at the low level of cash holdings would prefer to increase cash holdings, and an increase in cash holdings increases firm performance. Because cash flow sensitivity of cash correlates with a firm ability to access capital markets [3], and the importance of balance sheet liquidity inclines by the degree to which firms have access to external capital markets [10]. However, there is an optimum level of cash holding at which above the optimum level of cash a rise in the cash holding in the presence of financial constraints declines firm performance. Theoretically, due to agency cost and free cash flow, an increase in cash holdings decreases firm performance. Practically, since, firms with higher information asymmetries find it troublesome to raise funds outside because financial markets make sure the marketable securities they buy are not overpriced and accordingly discount them applicably. Moreover, due to these issues customer loyalty towards these firms declined [44]. Our second hypothesis of the study is accepted and it is consistent with the study of [27].

In addition, to validate the findings, the present study applied additional analysis with a partial adjustment model, propensity score matching, and difference in difference estimators. The empirical findings of the partial adjustment model reveal that the speed of adjustment of financially constrained firms is faster than unconstrained firms to their target cash levels when holding cash below the target levels. This evidence of the empirical findings presents that financially constrained firms of China more promptly adjust their cash holdings to their target level of cash while their actual cash holding level is below their target level. Since it is relaxed and not much more costly to decrease holdings of cash over liability settlement and repurchase of stock than to enhance the level of cash holding with costly external financing. Moreover, practically, Firms small in size are more financially constrained and face difficulty accessing the capital markets than large firms. Therefore, firms small in size show a faster speed of adjustment to target cash level than financially unconstrained firms and depict a greater propensity to return to optimal cash holding levels than large firms. These empirical findings of our study are consistent with the studies of [29, 30].

The empirical evidence of the propensity score matching estimator shows that firms more likely to be financially constrained are higher in value and hold more cash than unconstrained firms. Since a higher level of cash holdings is associated with a higher level of investment. Therefore, financially constrained firms with high hedging need investment and value show, a significantly stronger positive association than unconstrained firms. Practically, these findings of our study conclude that constrained firms with high cash holdings have a value-increasing response to costly external finance. As in this scenario, high cash holdings help financially constrained firms to undertake potential positive

net present value projects that otherwise have bypassed. These empirical findings of our study are consistent with the study of [33].

The empirical findings of the difference in difference estimator show that for unconstrained firms' value of cash holdings increases in a financial crisis. Theoretically, these empirical findings indicate that cash holdings value is high to constrained firms due to the high cost of external finance. Moreover, financially constrained firms heavily rely on internally generated funds for precautionary and transaction motives [13]. This ultimately leads financially constrained firms to market value addition (in terms of the high market to book ratio) and economic value addition (in terms of investment in new projects) due to the availability of internal finance. Practically, these empirical results submit that for financially constrained firms, the impact of cash holdings on firm value turns into a lesser positive at the financial crisis time due to a decrease in investment demand [33]. Moreover, a financial crisis impacts more to unconstrained firms more due to heavy reliance on external financing. Since financially unconstrained firms most probably use cash holdings for debt retirement to diminish the default risk. Therefore, at the time of a financial crisis, high cash holdings value more to financially unconstrained firms and offer more benefits. These empirical findings of our study are consistent with the study of [18].

8. Conclusion, Limitations, and Guidance for Future Research

8.1. Conclusion. The main contribution of the present research is to investigate the relationship between cash holdings and corporate performance with the linkage of financial constraints as a moderating factor. Using a balanced panel of non-financial companies listed on the Shanghai and the Shenzhen stock exchanges from 2005 to 2019, the study finds nonlinear inverted U-shaped relation between cash holdings and firm value. The evidence of the empirical findings supports the precautionary motive, as managers would prefer to increase the cash holding at lower levels to overcome or hedge against cash shortage risk in the future. Secondly, for transaction motive to avail future investment projects to carry out a routine operation of the firm and to buy and sell financial and fixed assets.

The empirical findings also illustrate that the nonlinear concave relationship between cash holding and corporate performance still holds in the presence of financial constraints. The evidence shows that firms with financial constraints at the low level of cash holdings would prefer to increase cash holdings. Since firms with higher information asymmetries find it troublesome to raise funds outside. The results show a higher level of cash holdings for financially constrained firms relative to unconstrained firms. The former have high financial constraints. As cash flow sensitivity of cash correlates with a firm ability to access capital markets and the importance of balance sheet liquidity inclines by the degree to which firms have access to external capital markets.

The study results also find the speed of adjustment of financially constrained firms that is faster than for

TABLE 11: Definition of variables.

Variable	Abbreviation	Description
Tobin's-q	q	Equity value plus book value of long-term debt plus net current liabilities divided by the value of total assets.
Return on assets	ROA	Earnings before interest and taxes (EBIT) divided by total assets.
Cash holdings	ch	Cash and cash equivalents are divided by total assets.
Firm size	sz	Natural logarithm of total assets.
Growth opportunities	gr	The ratio of the book value of intangible assets to total assets.
Firm leverage	lev	The ratio of total debt to total assets.
Cash flows	cf	Earnings before interest and taxes (EBIT) plus depreciation divided by total assets.
Fixed assets	fa	The tangible fixed assets is a ratio of fixed assets to total assets.
Liquidity	liq	Liquidity is measured as working capital minus total cash and short-term investment divided by total assets.
Interest coverage ratio	Icr	Earnings before interest and taxes (EBIT) divided by financial expense.
Deviation	dev	The (dev) represents absolute values of residuals obtained from the model (2).
Interaction	Int	A dummy variable represents the cash holdings at above optimal level computed as a dummy variable indicating 1 for positive values of residuals, and 0 otherwise.
Cash holding (CH^\bullet)	ch^\bullet	The variable (ch^\bullet) illustrates the predicted values of cash holding.
Financially constrained firms	fc_firms/fc	The dummy variable to indicate financially constrained firms represents a dummy variable indicated by 1 for financially constrained firms, and 0 otherwise.
Dummy variable for financial crisis time	Dct	The dummy variable to indicate crisis time (Dct) equals 1 for the financial crisis period (2008 to 2010), and 0 for before the crisis period (2005 to 2007)
Industry fixed effects	IFE	Dummies of industries to control the potential influence of industries.
Time/Year fixed effects	TFE	Dummies of years to control the effect of time or years.

unconstrained firms to their target cash levels when holding cash below the target levels. This evidence of the empirical findings suggests that financially constrained firms of China more promptly adjust their cash holdings to their target level of cash while their actual cash holding level is below their target level. The present study provides additional evidence on the cash holding with the propensity score matching and difference-in-difference estimators. The propensity score matching estimator shows that firms more likely to be financially constrained are higher in value and hold more cash than unconstrained firms. The empirical findings of difference-in-difference estimator show that for unconstrained firms' value of cash holdings increases in a financial crisis. Practically, the findings of our research assist firm managers and policymakers to optimally carrying the liquid balances and developing effective and efficient strategies to balance the cost and benefits of cash holding to maximize firms' value.

8.2. Limitations and Guidance for Future Research. The empirical investigations of this study support the vital role of financial constraints in investment decisions. Several limitations may be relevant for our study regarding cash holding and liquidity management. First, the data and missing values in the sample are striking issues due to exit and entry of firms in the sample window. Second, our study uses Tobin's-Q and return on assets as the dependent variables; as other performance variables can also be used. Third, our study considers only secondary data, however primary and survey data can also be used to uncover the hidden dynamics of cash holdings for the economy of China.

The present study proposes two measures, size (Sz) and interest coverage ratio (ICR), as criteria for financial constraints; however, as future research directions researchers may also use other financial constraints proxies as a

TABLE 12: Calculation of residuals for cash holding deviation estimation (GMM estimator).

Variables and empirical tests	Dependent variable (cash holding)
lev	-0.1315***(-4.11)
sz	-1.775 (-1.62)
gr	-0.4450***(-2.85)
cf	0.0212**(2.31)
liq	-22.1479***(-3.02)
TFE and IFE	Yes
p-value of m_2	0.969
Hansen test (degrees of freedom)	129.62 (122)
Hansen test-p-value	0.122
Wald Test (p-value) [degrees of freedom]	146.13 (0.000) [21]
Difference in Hansen Test (p-value)	0.925
Obs.	14363

Notes: values in the parentheses are t-values. *, **, and *** indicates the level of significance at the 10%, 5%, and 1%, respectively.

contextual factor to uncover the unknown changing aspects. Moreover, financial constraints proxies as a contextual factor for corporate cash holdings and firm value relationship should be considered from the view point of emerging economies by taking the market imperfection framework. Tables 11 and 12

Data Availability

The data used in this study are in the public domain, and the relevant sources are cited in the text.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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