ADJUSTMENT BEHAVIOR OF CORPORATE CASH HOLDINGS: EVIDENCE FROM VIETNAM

HÀNH VI ĐIỀU CHỈNH MỨC NẮM GIỮ TIỀN MẶT CỦA CÔNG TY: BẰNG CHỨNG TỪ VIỆT NAM

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Abstract - This paper examines the cash holdings behavior of Vietnamese listed companies, focusing on whether a target cash level exists that maximizes firm value and the speed at which firms adjust towards this target. The study finds that the average cash holding for these firms is approximately 10%. It reveals a nonlinear relationship between cash holdings and firm value, confirming the existence of an optimal cash level. Using pooled OLS, Fixed Effects (FE), and Generalized Method of Moments (GMM) models, the adjustment speed towards the target cash level is estimated to be around 0.58. Vietnamese firms tend to adjust their cash holdings more quickly during a financial crisis, but more slowly during the COVID-19 pandemic. This research contributes to the literature on cash holdings in emerging markets and provides new insights into the speed of adjustment in response to financial crises and the pandemic.

Key words - Adjustment speed; cash holdings; COVID-19; financial crisis; Vietnam

Tóm tắt – Bài báo nghiên cứu hành vi nắm giữ tiền mặt của các công ty niêm yết tại Việt Nam, tập trung vào việc có tồn tại mức tiền mặt mục tiêu tối đa hóa giá trị công ty và tốc độ điều chỉnh về mức mục tiêu này. Kết quả chỉ ra mức tiền mặt trung bình của các công ty khoảng 10%. Nghiên cứu phát hiện mối quan hệ phi tuyến giữa tiền mặt và giá trị công ty, xác nhận sự tồn tại của một mức tiền mặt tối ưu. Sử dụng các phương pháp hồi quy bình phương bé nhất (Pooled OLS), Hiệu ứng cố định (FE) và hồi quy mô-men tổng quát (GMM), tốc độ điều chỉnh về mức tiền mặt mục tiêu ước tính là 0,58. Các công ty Việt Nam có xu hướng điều chỉnh tiền mặt nhanh hơn trong thời kỳ khủng hoảng tài chính, nhưng chậm hơn trong đại dịch COVID-19. Nghiên cứu này đóng góp vào tài liệu nghiên cứu về nắm giữ tiền mặt tại các thị trường mới nổi và cung cấp cái nhìn mới về tốc độ điều chỉnh trong khủng hoảng tài chính và đại dịch.

Từ khóa – Tốc độ điều chỉnh; nắm giữ tiền mặt; COVID-19; khủng hoảng tài chính; Việt Nam.

1. Introduction

Cash and cash equivalents are vital assets for businesses, offering liquidity to meet financial obligations [1, 2]. However, excessive cash can lead to agency problems, where managers focus on holding cash rather than profitable investments, potentially causing negative consequences for the company value [3]. Moreover, cash investments yield lower returns than long-term assets, creating an opportunity cost. While holding fewer cash signals for efficient capital use, it can raise trading costs due to insufficient funds for transactions. Therefore, firms must balance cash holdings to avoid both liquidity issues and inefficient capital use, aiming for an optimal level to maximize value [4].

The literature focuses on the cash-holding decisions in the US and corporations in developed countries. Yet, in the Vietnamese market, the number of studies related to corporate cash holdings behavior is still limited. Most studies in Vietnam identify the determinants of cash ratio as well as the relationship between cash holdings and firm value [5-7]. Interestingly, Vietnamese firms hold higher levels of cash reserves than firms in other countries. Understanding Vietnamese firms' cash-holding behavior, therefore, is an interesting research question.

This study aims to extend the existing literature on cash holding decisions by addressing the following key research questions: (i) do Vietnamese firms have cash target levels, and if so, how quickly do they adjust toward the targets? (ii) Is there any change in their speeds of adjustment (SOAs hereafter) toward these targets during the financial crisis period and the COVID-19 pandemic?

To do so, firstly, the paper uses a panel of 650 listed companies over the period 2006-2023 to observe the time series properties of Vietnamese firms' cash holdings. Accordingly, Vietnamese listed firms hold around 10% cash of total assets. Second, the research develops a regression model and finds the existence of a nonlinear relationship between cash holding and firm value, therefore confirming an optimal cash level that maximizes firm value. Third, the author estimates the speed at which firms adjust their cash reserves towards the target. The overall SOA for cash holdings is relatively high at 0.58 in Vietnam, indicating that, on average, firms correct more than half of their deviation from the target level within one year. A high SOA is typically seen as evidence that firms maintain a target level of cash holdings and consistently adjust towards it, thus providing support for the trade-off theory of cash holdings. Fourth, to the best of the author's knowledge, this is the first study to explore changes in the SOA of cash holdings during the global financial crisis and the COVID-19 pandemic in Vietnam. The findings reveal that the SOA towards the target cash level was higher during the global financial crisis but slower during the COVID-19 pandemic, compared to periods unaffected by

such events. This insight enhances our understanding of how economic crises influence corporate financing decisions.

2. Literature review

2.1. Theoretical background

This section outlines three main theories explaining cash holding decisions: trade-off, pecking order, and free cash flow theories.

The trade-off theory suggests an optimal cash level that balances the benefits of liquidity with the costs of holding cash, such as opportunity, holding, and agency costs [2]. While cash provides liquidity and avoids external capital costs, excessive cash can incur marginal costs. Firms adjust their cash holdings toward a target level to maximize value [4, 8-10], but adjustment may be prevented by costs like information asymmetry and transaction costs [11]. Firms with lower adjustment costs can make quicker changes. Empirical research supports both the static trade-off theory and the dynamic model of cash holdings [4, 10, 12-16].

Myers and Majluf [11]'s pecking order theory argues that there is no optimal cash level for a company and suggests an order of financing preferences. Instead, firms accumulate cash to fund future investments due to information asymmetry. Companies prefer internal resources over external funding and debt over equity when raising capital [11]. Therefore, holding a considerable amount of cash can reduce the costs of raising funds externally, and serve stockholders' interests. Under this theory, firms are expected to increase their cash holdings to preserve investment opportunities during periods of crisis [17].

The free cash flow theory, proposed by Jensen [18], argues that managers hold excess cash for personal interests, often at the expense of shareholders. Harford et al. [19] argue that cash accumulation can be used for personal benefits or mismanagement, leading to missed investment opportunities and inefficiencies. Excess cash reduces the need for external funding and transparency, which can negatively impact the company's value. [3] highlight that too much cash causes agency problems, prompting shareholders to limit managers' access to it. Previous studies show that free cash flow influences dividend policy, which in turn affects cash holdings [20, 21]. Similar to the pecking order theory, the agency theory does not suggest an optimal level of cash for a company.

2.2. Empirical evidence on firms' optimal cash holdings and SOA towards target level

Previous studies confirm an optimal cash level maximizes firm value, where the marginal cost of holding cash equals its marginal benefit [22-24]. But this optimal level varies across firms and different markets [25, 26].

The SOA to optimal cash holdings is crucial for firms, as faster adjustments enhance liquidity stability and firm value [4, 27, 28]. Numerous studies have explored optimal cash levels and SOA in developed countries [25, 29, 30]. Amin and Williamson [31] find that Scandinavian firms adjust cash levels quickly due to non-target costs and precautionary motives, while Martínez-Sola et al. [32] show that Spanish SMEs with greater growth opportunities or financial distress adjust their cash levels faster, especially during crises with credit constraints.

Recent studies have explored the impact of the global financial crisis on cash holdings and SOA to optimal cash levels. Ferreira and Vilela [25] suggest that cash helps reduce financial distress and bankruptcy risk during difficult financial periods. Other studies [19, 33] also believe that cash holdings lower transaction costs and provide more investment opportunities. However, financial distress and capital market imperfections can delay adjustments to optimal cash levels [10]. Martínez-Sola et al. [32] suggest that firms in financial distress adjust cash holdings faster to mitigate risks. Amin and Williamson [31] conclude that smaller firms adjust cash holdings more quickly during a crisis due to limited external financing. Batuman et al. [17] observe a decline in adjustment speed for Eastern European firms post-crisis, while Melgarejo and Stephen [34] report faster adjustments in general, though multinational corporations in Latin America adjust more slowly.

With the occurrence of COVID-19, Chung et al. [35] report that the pandemic did not change firms' cash policies in Korea, but uncertainty and financial constraints influenced decisions. In Latin America, Melgarejo and Stephen [34] found faster adjustment speeds during the pandemic as firms rushed to meet cash targets to reduce risks. However, multinational corporations in this region adjusted more slowly during the pandemic. Zhou et al. [33] find that firms in China that are severely impacted by COVID-19 have higher cash reserves.

In Vietnam, limited access to external funding makes cash holdings vital for business operations and expansion. During crises, firms accumulate more cash to improve liquidity and flexibility [6]. Truong [36] identifies an optimal cash level for Vietnamese firms, with most holding more than this target. His study shows an adjustment speed of 40.68% from 2010-2019, with faster adjustments for firms with smaller discrepancies, higher free cash flow, or financial deficits. However, it does not consider SOA during the global financial crisis or COVID-19 pandemic.

3. Methodology

3.1. Data

The dataset includes non-financial firms listed on the Vietnam Stock Exchange (HOSE and HNX) from 2006 to 2023. Firm data is collected from the FiinPro-X database. Firms without complete financial reports, those that ceased reporting, or those with missing key characteristics are excluded. The final sample consists of 650 firms with 6,637 observations from 2006 to 2023.

3.2. Model

To examine whether there is an optimal cash holding level, this study follows previous studies [22-24, 37] to develop a non-linear model as follows:

$$V_{i,t} = \beta_0 + \beta_1 Cash_{i,t} + \beta_2 Cash_{i,t}^2 + \beta_3 X_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where $V_{i,t}$ is the firm value of firm *i* at time *t*, which can be measured as Tobin's Q (Q) or Market-To-Book ratio (MKBOOK). $Cash_{i,t}$ is the cash ratio of firm *i* at year *t*.

$X_{i,t}$ is a set of firm characteristics for firm *i* at time *t*, including Growth prospects (*GROW*), firm size (*SIZE*), cash flow relative to assets (*CF*), net working capital (*NWC*), leverage (*LEV*), dividend dummy (*DIV*) and capital expenditure ratio (*CAPEX*). These control variables are selected in line with previous research [4, 22, 23, 38].

All variable definitions are provided in Appendix A.

Second, this study uses the partial adjustment model to estimate how quickly a firm corrects deviations from its target [14, 28].

$$\Delta \text{Cash}_{it} = \text{Cash}_{it} - \text{Cash}_{it-1} = \gamma * (\text{Cash}^*_{it} - \text{Cash}_{it-1}) \quad (2)$$

where Cash^*_{it} is the target cash holdings of firm *i* at time *t*.

The Eq. (2) can be further re-arranged as:

$$\text{Cash}_{i,t} = \gamma \text{Cash}^*_{i,t} + (1-\gamma) * \text{Cash}_{i,t-1} \quad (3)$$

The target cash holdings (Cash^*_{it}) cannot be directly observed, so the fitted value of Eq. (4) is used as a proxy for a target.

$$\text{Cash}^*_{i,t} = \beta_i X_{i,t-1} + F_{i,t} \quad (4)$$

From Eq. (3) and Eq. (4), the partial-adjustment model is as follows:

$$\text{Cash}_{i,t} = (1-\gamma) Cash_{i,t-1} + \gamma \beta X_{i,t-1} + \gamma F_{i,t} + \varepsilon_{it} \quad (5)$$

By estimating the coefficient of $\text{Cash}_{i,t-1}$, the study can extract the adjustment speed γ by subtracting the coefficient from 1. A higher value of γ indicates faster adjustment from the actual to the target level of cash.

4. Results

4.1. Variable summary

All descriptive statistics are reported in Table 1. As can be seen, the average value of the Q ratio is 1.14, the average MKBOOK is 1.24. The mean cash ratio is approximately 10%, which is comparable to the ratios observed for the US (9.39% [15]) and UK (9.9% [12]). Additionally, the average cash holdings to total assets ratio (10%) is higher than the average cash flow to assets ratio (9.7%) and capital expenditures to assets ratio (3.97%). Thus, cash holdings constitute a non-trivial percentage of the total assets of Vietnamese firms. This could be attributed to the higher costs of obtaining external credit, which may force Vietnamese firms to rely more on internal financing compared to firms in other countries [16, 39].

Table 1. *Summary statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
Q	6,539	1.14	0.67	0.15	17.17
MKBOOK	6,539	1.24	1.38	0.00	61.67
CASH	6,637	0.10	0.11	0.00	0.96
GROW	6,633	0.10	0.23	-0.24	0.54
SIZE	6,637	27.24	1.55	23.22	32.87
CF	6,637	0.10	0.09	-0.90	0.94
NWC	6,637	0.23	0.23	-0.68	0.99
LEV	6,637	0.47	0.22	0.00	0.99
DIV	6,637	0.80	0.40	0.00	1.00
CAPEX	6,637	0.04	0.10	-2.28	0.92

Table 2 shows pairwise correlation coefficients between variables. There is no significant pattern of multicollinearity issues in this study.

Table 2. *Correlation matrix*

Variables	CASH	Q	MKBOOK	GROW	SIZE	CF	NWC	LEV	DIV	CAPEX
CASH	1									
Q	0.151	1								
MKBOOK	0.108	0.759	1							
GROW	0.001	0.031	0.021	1						
SIZE	-0.136	0.042	0.087	0.035	1					
CF	0.247	0.388	0.231	0.153	-0.057	1				
NWC	0.376	0.118	0.032	-0.064	-0.302	0.203	1			
LEV	-0.255	-0.175	-0.062	0.106	0.314	-0.362	-0.656	1		
DIV	0.161	0.120	0.073	-0.017	0.081	0.272	0.034	-0.015	1	
CAPEX	-0.041	0.030	0.022	0.128	0.069	0.130	-0.145	0.058	0.061	1

4.2. Corporate cash holdings and firm value

Table 3 shows the estimated results of Eq. (1) using two different proxies for firm value.

Table 3. *Corporate cash holdings and firm value*

Variables	Q	MKBOOK
Constant	-0.281	-1.862***
	(-1.433)	(-3.966)
CASH	**0.682*** **	**1.741*** **
	(2.941)	**(4.367)**
$CASH^2$	**-1.886*** **	**-3.807*** **
	(-3.311)	**(-3.763)**
GROW	-0.058*	-0.028
	(-1.841)	(-0.345)
SIZE	0.038***	0.096***
	(5.417)	(4.888)
LEV	-0.059	-0.037
	(-1.012)	(-0.341)
DIV	0.030	-0.001
	(1.280)	(-0.021)
CAPEX	-0.072	-0.149
	(-1.148)	(-1.174)
CF	2.832***	3.565***
	(15.122)	(10.200)
NWC	0.154***	0.109
	(2.642)	(0.792)
Observations	6,539	6,539
R-squared	0.178	0.075
Year FE	YES	YES

*Robust t-statistics are given in parentheses. ***, ** and * denote significance at 1%, 5% and 10% levels, respectively.*

As expected, the estimated coefficients of *CASH* are positive and statistically significant whereas those of $CASH^2$ are significantly negative at the 1% level for both proxies of firm value, suggesting a non-linear relationship between cash holdings and firm value. This result implies that cash holdings increase the value of the firm up to the optimal point, beyond this point, cash holdings would reduce the firm value. This finding also confirms the existence of an optimal point in the relationship between cash holdings and firm value in the Vietnamese market.

4.3. Adjustment speed of cash holdings

Table 4 presents the SOA of cash holdings towards the optimal level for Vietnamese companies using three methods, including GMM, pooled OLS, and fixed-effects (FE) estimations.

Table 4. *Adjustment speed toward target cash level*[1]

Variables	GMM	FE	OLS
Constant	0.090*	0.144**	0.061***
	(1.897)	(2.034)	(2.707)
CASH	0.420***	0.370***	0.637***
	(10.492)	(15.371)	(28.018)
Adjustment speed	**0.580**	**0.630**	**0.363**
GROW	0.007	0.005	0.005
	(1.364)	(1.170)	(1.279)
SIZE	-0.002	-0.003	-0.002***
	(-0.997)	(-1.269)	(-2.738)
LEV	-0.040***	-0.030**	-0.020***
	(-3.731)	(-2.026)	(-2.741)
DIV	0.012***	-0.001	0.011***
	(3.845)	(-0.296)	(4.432)
CF	0.035	0.058**	0.056***
	(1.261)	(2.106)	(2.711)
NW	0.016	0.003	0.015**
	(1.382)	(0.224)	(1.965)
CAPEX	-0.008	-0.023**	-0.020*
	(-1.256)	(-2.273)	(-1.931)
Observations	6,637	6,637	6,637
R-squared		0.187	0.498
Adj. R-squared		0.184	0.496
Hansen J statistic	19.18		
p-value of Hansen statistic	0.206		
Firm FE		YES	NO
Year FE		YES	YES

*Standard errors are clustered at the firm level. Robust t-statistics are given in parentheses. ***, ** and * denote significance at 1%, 5% and 10% levels, respectively.*

The GMM procedure yields a coefficient of 0.42, which corresponds to an SOA towards target cash holdings of 0.58 (i.e., 1 – 0.42). The result indicates imperfect adjustment because firms only close 58% of the gap between current and optimal cash levels within one year. This estimated adjustment speed is comparable to those for US firms (i.e. 0.566 [10]) but it is slightly lower than those found for UK firms (i.e. 0.605 [12]), which were obtained using a similar estimation methodology. The relatively low adjustment speed in Vietnam is due to higher adjustment costs, which have resulted from the high liquidity risk, significant information asymmetries problem, and frictions that characterize the Vietnamese economy. It would prevent Vietnamese firms from quickly moving their cash reserves toward the target level.

Using pooled OLS, the SOA of cash holdings of 0.363, while a fixed-effects specification yields an adjustment speed of cash holdings of 0.630. It has been shown that the system GMM estimate (0.58) lies between the pooled OLS estimate (lower bound) and the fixed-effects estimate (upper bound). This pattern is consistent with the previous studies [16]. Table 4 also shows that firms paying dividend and cash flow tend to hold more cash whereas leverage affects cash holdings negatively. These findings confirm that Vietnamese firms actively adjust their cash holdings toward the target optimal level, despite some lag in rebalancing due to adjustment costs.

4.4. SOA towards optimal cash holdings level during the global financial crisis and the COVID-19 pandemic

To capture the possible differences in the SOA during the global financial crisis and the COVID-19 pandemic, compared to the period without such events, the study includes dummy variables for the events and an interaction term between cash ratio and dummy variables. Thus, this study modifies model (5) and develops the new model:

$$\mathrm{Cash}_{i,t} = (1-\gamma)Cash_{i,t-1} + \gamma\beta \mathrm{X}_{i,t-1} + \gamma F_{i,t} + \beta_1 DUMMY + \beta_2 \mathrm{DUMMY} * \mathrm{Cash}_{it-1} + \varepsilon_{it} \quad (6)$$

where, *DUMMY* is a dummy variable, which either equals to 1 for the global financial crisis period (i.e, years 2008, 2009, 2010) or equals to 1 for the COVID-19 period (i.e, years 2020, 2021) and otherwise, equals to 0 for the other years.

Table 5. *Adjustment speed toward target cash level: global financial crisis and COVID-19*

Variables	CRISIS (1)	COVID-19 (2)
Constant	0.084***	0.060***
	(3.710)	(2.689)
CASH	0.647***	0.628***
	(26.634)	(26.422)
Adjustment speed	**0.353**	**0.372**
DUMMY	-0.015*	0.018**
	(-1.862)	(2.130)
DUMMY*CASH	**-0.078***	**0.110****
	(-1.877)	**(2.443)**
Observations	6,637	6,637
Controls	YES	YES
Year FE	YES	YES
Adj. R-squared	0.497	0.497

*Standard errors are clustered at the firm level. Robust t-statistics are given in parentheses. ***, ** and * denote significance at 1%, 5% and 10% levels, respectively.*

Table 5 presents the estimation results of Eq. (6) to examine the effect of the global financial crisis (column 1) and the COVID-19 (column 2) on the SOA of cash holdings. Control variables are included in each regression but are suppressed for brevity.

The results show that the SOA difference between the

[1] For the robustness test, Net Cash = Cash/(Total assets - Cash) is used as an alternative measure of CASH variable. The results remain unchanged. The author is thankful to the anonymous reviewer for this suggestion.

crisis and non-crisis periods is 0.078, significant at 10%. This suggests firms adjust their cash holdings more quickly during crises to avoid capital rationing and investment reductions. Another reason for the higher SOA during the crisis period is limited external financing and the need to avoid financial distress [31]. Column (2) shows a significantly positive coefficient on the COVID-19 dummy variable (0.018), indicating firms hold more cash during the pandemic. Additionally, the interaction between the COVID-19 dummy and cash variable is positive (0.110) and significant at 5%, suggesting firms adjust more slowly to their optimal cash levels during COVID-19 compared to non-COVID periods.

4.5. Robustness tests

For robustness tests, the study divides the sample into two subsamples: firms during the global financial crisis (2008-2010) and firms in the non-crisis period. The research also splits the sample into three subsamples-before, during, and after COVID-19-to assess the effect of the pandemic on cash holding adjustments. Table 6 reports the results.

Table 6. *Robustness tests*

Variables	Non-CRISIS	CRISIS	Pre-COVID (2006-2019)	COVID-19 (2020-2021)	Post-COVID (2022-2023)
	(1)	(2)	(3)	(4)	(5)
Constant	0.074*	0.188**	0.136***	0.102**	0.152***
	(1.737)	(2.485)	(2.836)	(2.431)	(2.968)
CASH	0.433***	0.364***	0.431***	0.672***	0.154*
	(9.451)	(4.346)	(9.595)	(4.230)	(1.662)
Adjustment speed	**0.567**	**0.636**	**0.569**	**0.328**	**0.846**
Observations	5,815	822	4,740	906	991
Controls	YES	YES	YES	YES	YES
Hansen J statistic	12.06	7.462	13.18	0.314	0.0196
p-value of Hansen statistic	0.441	0.0240	0.282	0.575	0.889

*Standard errors are clustered at the firm level. Robust t-statistics are given in parentheses. ***, ** and * denote significance at 1%, 5% and 10% levels, respectively.*

In column (2), the coefficient of *CASH* is 0.364, indicating an SOA of 0.636 during the global financial crisis, compared to 0.567 for the non-crisis period. Both coefficients are significant at the 1% level, confirming faster cash adjustments during crises. The reduction in bank credit during crises raises external financing costs [40], prompting firms to hold more cash for transactional and precautionary reasons. Faster cash adjustments thus provide them with greater flexibility in managing their finances during significant market fluctuations.

Moreover, the results show that the SOA of cash holdings during the COVID-19 pandemic is slower than in the pre- and post-pandemic periods. The lagged dependent variable coefficient during COVID-19 (column 4) is 0.672, corresponding to an SOA of 0.328, compared to 0.569 pre-COVID (column 3) and 0.846 post-COVID (column 5). This result is consistent with the case of multinational corporations in Latin America [34]. Vietnamese firms have slower adjustment speeds during the COVID-19 pandemic because of the high transaction costs, higher liquidity risk, and then higher adjustment costs, which prevent firms from quickly adjusting their cash reserves towards the target level. Interestingly, Vietnamese firms rebalanced their cash levels even quicker after the pandemic, compared to before the COVID-19 period. After the period of unexpected risk, high uncertainty, and many difficulties with accessing credit, firms may have felt more comfortable operating at target cash levels. Therefore, they are likely to adjust their cash holdings faster towards their target.

5. Conclusion

In this paper, the author examines the cash holdings behavior of Vietnamese listed companies over the period 2006-2023. The study finds the nonlinear relationship between cash ratio and firm value, suggesting the existence of a target cash level that maximizes firm value. The research contributes new insights into the optimal cash level for Vietnamese firms. Additionally, the paper identifies the overall SOA for cash holdings in Vietnam is relatively high at 0.58, supporting the trade-off theory. This finding enhances the existing literature on cash-holdings behavior in Vietnamese companies. For the first time, the paper shows that companies adjust their cash ratio toward the target level more rapidly during the global financial crisis, but at a slower pace during the COVID-19 pandemic, providing valuable insights into how cash holdings respond to economic shocks that negatively impact the economy.

The decisions regarding cash holdings and adjustments toward the target cash level are largely influenced by managerial decisions, especially during times of economic uncertainty such as the global financial crisis and the COVID-19 pandemic. However, this study does not account for these managerial factors, which limits its ability to fully explain the dynamics of cash adjustment in response to these events. A natural extension of the study would be to explore how manager characteristics influence the pace of cash holdings behavior and the rate at which firms adjust to their target cash levels.

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Appendix A. *Variable definitions*

Variable	Definitions	Measurement
Q	Tobin's Q	(Market value of equity + book value of total debt)/Book value of total assets
MKBOOK	Market-to-book ratio	Market value of equity/Book value of equity.
CASH	Cash ratio	Cash and cash equivalent/Total assets
GROW	Growth prospects	$(Sales_t - Sales_{t-1})/Sales_{t-1}$
SIZE	Firm size	Ln(Total assets)
CF	Cash flows	(Pre-tax profit + Depreciation)/Total assets.
NWC	Net working capital	Net working capital/Total assets
LEV	Leverage	Total debts/Total assets
DIV	Dividend	Equals 1 in a given year if the firm makes dividend payment in that year, and 0 otherwise.
CAPEX	Capital expenditures	Capital expenditures/Total assets.