The Role of Financial Position and Leverage in Cash Holdings Adjustment Speed Using the Dummy Variable and Dynamic Threshold Models

Milad Emamgholipour Archi
Ph.D. Student, Department of Accounting, Babol Branch, Islamic Azad University, Babol, Iran
m.emamgholipour@yahoo.com

Seyed Ali Nabavi Chashmi
Department of Management, Babol Branch, Islamic Azad University, Babol, Iran
(Corresponding Author)
anabavichashmi2003@gmail.com

Iman Dadashi
Assistant Professor of Accounting, Qom University, Qom, Iran.
i.dadashi@qom.ac.ir

Maryam Shafiee Kakhki
Department of Economic, Babol Branch, Islamic Azad University, Babol, Iran
m_shafiee_k@yahoo.com

Submit: 17/10/2021 Accept: 07/12/2021

ABSTRACT
Cash is a crucial resource for businesses, and balancing available cash and needs is the most important business health factor. Therefore, companies seek an optimal cash level according to cost-benefit analysis to maximize their value; and determining optimal cash holdings, target cash holdings adjustment speed, and the effect of firm-specific characteristics are incredibly important to managers. The present study aims to test asymmetric models of cash holdings adjustment speed according to financial positions and leverage. In this regard, 117 firms listed on the Tehran Stock Exchange were selected and their 2009-2018 financial information was analyzed. The findings of asymmetric models are shown and suggest that among firms with high fiscal deficit and leverage, firms with high cash regime reach optimal cash holdings faster than firms with low cash regime. The results indicate an optimal level of cash holdings that allows firms to optimally deviate from target cash holdings. Also, when firms leave the optimal range of cash holdings, rapid adjustments are partial and asymmetric.

Keywords:
Cash Holdings Adjustment Speed, Asymmetric Models, Fiscal Deficit or Surplus, Leverage.

1. Introduction

Nowadays, cash is the most crucial and indispensable resource for all companies and organizations. Cash for companies is akin to life-giving blood in the human body, and without it, companies would be unable to sustain their economic life. In other words, cash flows through all businesses, and any economic activity is unquestionably affected, directly or indirectly, by firms' cash holdings. Therefore, cash holdings is an important factor in determining firms' fiscal policies (Almeida *et al.,* 2014).

Primarily, cash holdings empower firms by using valuable investment opportunities and avoiding expensive external financing (Dastgir *et al.,* 2013). There are two main reasons and motivations for cash holdings in financing and accounting literature: 1. The transactions motive, and 2. the precautionary motive. According to transactions motive, the interest of firms is in holding cash for when external financing is infeasible or very costly (Han & Qiu, 2007; Opler *et al.,* 1999). According to the precautionary motive, companies need cash holdings to safeguard themselves against unforeseen risks of future cash deficits (Han & Qiu, 2007). Nevertheless, cash holdings also have costs. On the one hand, cash holdings create opportunity costs due to their low return (Opler *et al.,* 1999), and on the other, large cash holdings can increase conflicts between managers and shareholders of businesses due to management actions to protect their personal interests (Jensen, 1986). Therefore, according to the cash holdings balance theory, firms should balance the costs and benefits of cash holdings and seek an optimal level with suitable financial activities (Opler *et al.,* 1999). In other words, firms should seek a level of liquidity to prevent major damage in case of cash holdings shortage while making sure that investment opportunities are not lost by holding cash. Firm managers consider this to be the optimal level of cash holdings, which varies according to firm characteristics and different time periods.

In general, there are various theories on the level of cash holdings in firms, the most important of which include: The agency theory, trade-off theory, hierarchy theory, information asymmetry theory, and the free cash-flow theory. Each theory states the reasons for holding cash and introduces the factors that affect its level. According to the numerous theories and variables in level of cash holdings, reaching an optimal level of cash holdings is important to firms. Firms that fail to hold sufficient holdings or those that hold excessive cash holdings will encounter many problems; therefore, these firms will seek an optimal level of cash holdings according to their characteristics and other market factors (Dastgir *et al.,* 2013).

A notable point in this study is how firms reach the optimal level from their current cash holdings. In fact, this study seeks the cash holdings adjustment speed of firms to reduce deviation from the optimal level. There has always been a gap in the domestic literature in how firms manage their cash holdings adjustment speed to achieve the target level. The studies and investigations on cash holdings have considered the trade-off theory. According to this theory, there is an optimal level of cash holdings, and firm can be on any point along this range. Therefore, the trade-off theory is divided into two groups, namely static and dynamic trade-off theory (Venkiteshwaran, 2011). According to the static trade-off theory, firms instantly adjust their cash holdings toward the optimal level to maximize their value according to the costs and benefits of cash holdings (Alles *et al.,* 2012). In other words, an optimal level of cash holdings is set, and it is assumed that firms immediately return to their optimal level after the shock and changing their characteristics (Venkiteshwaran, 2011). The dynamic trade-off theory assumes that adjustment of present cash holdings toward the optimal level is gradual (Dittmar & Duchin, 2010). Therefore, the adjustment speed and how quickly firms adjust their cash holdings toward the optimal level can be related to their specific characteristics.

Therefore, companies with different and unique characteristics have different cash holdings and adjustment speeds. In this regard, studies have neglected the effect of factors such as financial position (fiscal deficit or surplus) and leverage of firms in eliminating the gap between optimal and actual cash holdings.

Byoun (2008) stated that firms often face fiscal deficits or surpluses, which provides them with an opportunity to adjust at a lower cost. Firms with fiscal deficits are encouraged to cover their fiscal gap by new financing through issuing securities or capital for a chance to move quickly toward their target (Dang, 2011). Leverage is an important factor in Cash holdings adjustment speed. According to the trade-off theory, leverage makes bankruptcy more likely, and highly-leveraged firms are expected to have more cash holdings to reduce financial risk (Zabihi & Sadeqi Moghaddam, 2014). Due to problems with liquidity and financing in the future and maintaining debt capacity, firms with lower cash holdings and higher leverage will adjust faster than companies with high cash holdings.

Accordingly, the present study determined the optimal level of cash holdings to test the moderating role of financial position and leverage on cash holding adjustment speed using dummy variable and threshold regression models. With this methodology, moderating variables are used to divide the statistical sample into firms with fiscal deficits and surpluses or high and low leverage, and asymmetric models of cash holdings adjustment speed are separately estimated for samples. The dummy variable model divided firms into high and low cash regimes according to their deviation from the optimal level of cash holdings. Regarding the threshold regression model, like Bai & Perron (1998), the threshold test was conducted, and the main variable was tested in case of one or multiple thresholds to let turning points to be determined separately.

2. Literature Review

Truong (2021) tested the firm characteristics and cash holdings adjustment speed. The results showed that firms with fiscal deficits adjust cash holdings faster than firms with fiscal surpluses.

Kalak *et al.* (2020) evaluated the effect of managers' overconfidence on cash holdings adjustment speed in American firms. The results suggested that overconfidence increases asymmetry in cash holdings adjustment speed in firms with cash deficits and surpluses. Moreover, companies with cash surpluses adjust cash holdings faster than companies with cash deficits.

Siddiqua *et al.* (2019) evaluated the asymmetric objectives of cash holdings and financial limitation in Pakistani firms. By analyzing the asymmetric adjustment of cash holdings in Pakistani firms with higher and lower-than-optimal cash holdings using the generalized moment method (GMM), they showed that firms with high cash holdings adjust faster than firms with sub-optimal cash holdings. Also, companies with financing limitations adjust cash holdings faster than companies without limitations.

In a study titled "Cash Holdings Adjustment Speed" with a statistical population spanning 1986 to 2012, Orlova & Rao (2018) stated that firms with cash deficits are slower to adjust than firms with cash surpluses.

Chang *et al.* (2017) studied the asymmetric models of cash holdings adjustment speed. The models they used included the dummy variable approach, the cubic model, and the threshold regression model. The results showed that firms that leave the optimal cash holdings range rapidly adjust cash holdings partially as well as asymmetrically, which means that firms with a high cash regime adjust cash holdings faster than companies with low cash regime. Moreover, the non-linear nature and asymmetric behavior of cash holdings adjustment speed relative to various levels of cash holdings is confirmed.

Smith *et al.* (2015) investigated the effect of firms' financial position and industrial characteristics on financial structure adjustment in New Zealand firms. To check the research hypotheses, the financial position variable was divided into financial deficit and surpluses. They expected firms with lower financing deficit and debt and firms with higher financial surpluses and debt ratios than the target to adjust their financial structure faster than others. Their research findings indicate that firms' financial position affects adjustment speed.

Alice *et al.* (2012) studied the factors affecting target cash holding levels and its adjustment speed in Chinese firms. The results pointed to an optimal level of cash holdings in firms that is a function of factors such as leverage, dividends, cash flow, liquidity, tangible assets, investment opportunities, ownership management, and ownership concentration. The test results on cash holdings adjustment speed indicated that contrary to expectations, adjustment to targets occurs instantaneously.

Venkiteshwaran (2011) studied partial adjustment toward optimal cash holdings. The results showed that small firms and those with cash deficits adjusted cash holdings toward the optimal level faster than large firms and those with cash surpluses.

Dittmar & Duchin (2010) investigated how to fill the gap between actual and optimal cash holdings. The results showed that companies fill this gap partially and with a large dispersion over time according to adjustment costs. They also discovered that companies with poor corporate ownership or cash deficits, or large companies, are often slow to adjust.

Karami Taleghani & Vatanparast (2020) investigated the effect of financial distress on cash holdings adjustment speed with an emphasis on growth opportunity and financial limitations. Their results suggested that financially-distressed firms have faster cash holdings adjustment speed than other companies. Also, the effect of financial distress on cash holdings adjustment speed in firms with high growth opportunities and fiscally-constrained firms is higher than other companies.

Fakhaari & Assadzadeh (2017) studied the effect of financial leverage and free cash flow on cash holdings adjustment speed. Their results showed a direct correlation between financial leverage and free cash flow with cash holdings adjustment speed, which was also true for cash deficits but nonexistent for cash surpluses. These findings can further verify the need for managing cash holdings to make optimal cash decisions.

3. Research Hypotheses

According to the theoretical background and literature, this study will test the following hypotheses:

H1: In case of fiscal deficits or surpluses (as measures of firms' financial position), the cash holding adjustment speed is faster in firms with a high cash regime than others.

H2: In case of high and low leverage (as categories of leverage), firms with high cash regime are faster to adjust cash holdings than firms with low cash regime.

4. Research Methodology

The present descriptive accounting study was correlational in methodology and applied in objective. Moreover, since the hypotheses were tested with historical information, it is classified as semi-experimental. Also, this study was empirical in epistemology, inductive in its reasoning, and a field-library research using retrospective historical information.

The statistical population included firms listed on the Tehran Stock Exchange from 2009 to 2018 that meet the following criteria. Some research variables required fiscal information from previous years; therefore, the 2008 fiscal information was also collected.

1) To make the information comparable, the fiscal year ends in March.
2) The firms can only be banks and insurance and financial intermediation companies.
3) All the data needed for the study of companies should be available.
4) During the research timeframe, firms should not cease operations or change their fiscal period.

Given these conditions and limitation, 117 firms listed on the Tehran Stock Exchange were selected.

4.1. Research Variables

As mentioned earlier, the goal is to test asymmetric models of cash holdings adjustment speed in firms listed on the Tehran Stock Exchange with fiscal surpluses and deficits and high and low leverage. Therefore, for the purposes of this study and to measure cash holdings adjustment speed, the optimal level of cash holdings should be estimated for firms.

Determining the Optimal Level of Cash Holdings (Target):

This study used the following equation for determining the target (optimal) cash holdings level:

$$Cash_{i.t}^{*} = \beta X_{i,t} \qquad (1)$$

And in this model;

$Cash_{i.t}^{*}$: Optimal cash holdings of firm i in year t.

$X_{i,t}$: characteristics vector of firm i in year t, including the set of factors that affect firm cash holdings.

β: Will be this vector's estimation coefficient which we seek to approximate.

According to the main theories of cash holdings (hierarchy theory, free cash flow theory, and the trade-off theory), the variables present in Opler *et al.* (1999), Bates *et al.* (2009), and Oler & Picconi (2009) were used for determining cash holdings, and some variables were adjusted according to the current situation in Iran:

$$\begin{aligned}\mathrm{CashHoldings}_{i,t} = \beta_0 &+ \beta_1 \mathrm{MB}_{i,t} + \beta_2 \mathrm{FirmSize}_{i,t} \\ &+ \beta_3 \mathrm{CFO}_{i,t} + \beta_4 \mathrm{SalesGrowth}_{i,t} \\ &+ \beta_5 \mathrm{NWC}_{i,t} + \beta_6 \mathrm{CAPX}_{i,t} \\ &+ \beta_8 \mathrm{Leverage}_{i,t} + \beta_9 \mathrm{FirmAge}_{i,t} \\ &+ \beta_{10} \mathrm{DividendDummy}_{i,t} \\ &+ \beta_{11} \mathrm{Tax}_{i,t} + \varepsilon_{i,t} \qquad (2)\end{aligned}$$

Table (1) presents the calculations of variables in model (2):

Next, the theoretical background, the reasons for selecting the variables used for determining optimal cash holdings, and the relationship between variables and cash holdings are discussed.

In model (2), market value variables are expected to have a positive correlation with book value (MB) and sales growth (SalesGrowth), which represent future growth opportunities with cash holdings. Firms with more future growth opportunities hold cash inside the company instead of outside financing to minimize the risk of losing investment opportunities (according to transaction and speculation motives). Meanwhile, companies that can convert their balance sheet to cash have lower cash holdings. The ability to convert assets to cash holdings is measured by net working capital (NWC); and firms with a high cash flow of operations (CFO) are expected to have Keynes' precautionary motive and be less inclined to have cash holdings as they prefer to use the cash they obtain in operations for their needs.

Regarding the divided variable (DividendDummy), firms that pay dividends are expected to have less cash holdings than other firms. One possible reason for this is that paying dividends creates legal obligations for firms, which can stabilize cash flows and reduce the level of cash holdings. Fast access to the capital market, measured using the firm size (FirmSize), firm age (FirmAge), and leverage (Leverage) variables, reduces the cost of external financing, and reduce firm cash holdings. The need for cash holdings for capital expenditures (CAPX) is also expected to increase cash holdings; and also, according to Keynes' transactions motive, firms that pay higher taxes are expected to have more cash holdings.

After fitness of model (2), similar to Chang *et al.* (2017), the model variables are used as the optimal level of cash holdings ($\beta_1, \ldots, \beta_{13}$), and the optimal level of cash holding ($Cash^*_{i.t}$) was obtained by multiplying it in firm characteristics ($X_{i,t}$).

Table (1): The Calculation of Variables in Model (2)

Variables	Calculation
Cash Holdings	Ratio of cash holdings to all assets.
MB	Ratio of market value of dividends to book value of dividends.
Firm Size	Natural logarithm of total assets.
CFO	Operating cash flow divided by total assets.
Sales Growth	The difference between net sales of current and previous year divided by all assets.
NWC	Difference between net working capital and cash holdings divided by total assets.
CAPX	Change in net fixed assets divided by all assets.
Leverage	Ratio of all debts to all assets.
Firm Age	Natural logarithm of years since listed on the Stock Exchange.
Dividend Dummy	1 for paying dividends, otherwise 0.
Tax	Reported tax in cash flow statements divided by total assets.

Measuring Cash Holdings Adjustment Speed Using the Standard Two-Step Partial Adjustment Model:

Similar to Chang *et al.* (2017), this study used the standard two-step partial adjustment model to measure cash holdings adjustment speed as explained in model (3), which is consistent with Bon (2008) and Faulkender *et al.* (2012).

$$\begin{aligned}\mathrm{Cash}_{i,t} - \mathrm{Cash}_{i,t-1} &= \alpha + \lambda\left(\mathrm{Cash}^*_{i,t} - \mathrm{Cash}_{i,t-1}\right) + \varepsilon_{i,t} \\ &= \alpha + \lambda\left(\mathrm{CDE}_{i,t}\right) + \varepsilon_{i,t} \qquad (3)\end{aligned}$$

Where:

$\mathrm{Cash}_{i,t}$: is the cash holdings of firm i in year t, measured using the ratio of cash holdings to book value of firm i's total assets in year t.

$\text{Cash}^*_{i.t}$: The optimal (target) cash holdings of firm i in year t.

$\text{CDE}_{i,t}$: Deviation between the optimal (target) cash holdings and actual cash holdings of company i in year t.

λ: the firm's holdings adjustment speed, which indicates the rate with which the company's cash holdings are moving toward the optimal (target) level. This coefficient is expected to range from 0 to 1, and higher values represent faster adjustment. All firms are also expected to adjust their cash holdings at the same rate λ. In a fully competitive market, the adjustment speed is 1 ($\lambda = 1$); in other words, if the cost of adjusting cash holdings to the optimal level is zero, the actual cash holdings ($\text{Cash}_{i,t}$) should be equal to the target cash holdings level; or $\text{Cash}_{i,t} = \text{Cash}^*_{i.t}$. However, with costs, adjustment to target cash holdings will be incomplete from t-1 to t, and the cash holding adjustment speed will be less than 1 ($\lambda < 1$). In other words, when this value is 1, there are no adjustment costs, shocks, or unforeseen events in the economy, and the model is a partial adjustment of the static trade-off model. A rate of 0 means that the current cash holdings cannot be adjusted.

$\varepsilon_{i,t}$: is the model's error term.

Most domestic and foreign studies, including Flannery & Rangan (2006), Huang & Ritter (2009), Karami Taleghani & Vatanparast (2020), and Fakhaari & Assadzadeh (2017) used the single-stage partial adjustment model obtained by combining model (1) and model (3), which is shown as model (4):

$$\text{Cash}_{i,t} - \text{Cash}_{i,t-1} = \alpha + \beta X_{i,t} + (1 - \lambda)\text{Cash}_{i,t-1} + \varepsilon_{i,t} \qquad (4)$$

Therefore, there are two problems in estimating model (4). The first problem is that that target cash holdings ($\text{Cash}^*_{i,t}$) is invisible or immeasurable, and the second problem is the interval in last year's cash holdings variable ($\text{Cash}_{i,t-1}$) in descriptive variables. Therefore, due to these problems in the one-step model, the two-step partial adjustment model (model (3)) was used for developing the asymmetric models of study

4.2. Research Models

According to Chang *et al.* (2017), this study will use the following asymmetric models of cash holdings adjustment speed to test the hypotheses:

1) The Dummy Variable Approach

The costs and benefits of cash holdings adjustment toward the target will differ depending on the situations of firms regarding optimal cash holdings (higher or lower cash holdings than the target). Model (5) is estimated for evaluating the difference in adjustment speeds of two groups of firms (high and low cash regime). The literature suggests that companies with more cash holdings than the target (high cash regime) will have slower cash holdings adjustment ($\lambda_H^{DV} > \lambda_L^{DV}$).

$$\text{Cash}_{i,t} - \text{Cash}_{i,t-1} = \alpha + \lambda_H^{DV}\left(\text{CDE}_{i,t} \times \text{D}_{i,t}^{\text{High}}\right) + \lambda_L^{DV}\left(\text{CDE}_{i,t} \times \text{D}_{i,t}^{\text{Low}}\right) + \varepsilon_{i,t} \qquad (5)$$

Where:

$\text{CDE}_{i,t}$: is the deviation from the optimal (target) cash holdings and actual cash holdings, which is used to divide firms into high and low cash regime.

$\text{D}_{i,t}^{\text{High}}$: is the dummy variable. If the firm's actual cash holdings is higher than optimal cash holdings, it is 1, and otherwise, it is 0 and considered high cash regime ($\text{CDE}_{i,t} < 0$ or $\text{Cash}^*_{i,t} < \text{Cash}_{i,t-1}$).

$\text{D}_{i,t}^{\text{Low}}$: is the dummy variable. If the firm's actual cash holdings is lower than the optimal level, it is 1, otherwise 0, indicating low cash regime ($\text{CDE}_{i,t} > 0$ or $\text{Cash}^*_{i,t} > \text{Cash}_{i,t-1}$).

λ_H^{DV} : Adjustment speed of firms with high cash regimes

λ_L^{DV}: Adjustment speed of companies with low cash regime

2) The Threshold Regression Model

The threshold regression model based on Hansen's mixed data (1999) is used to analyze the asymmetry of cash holdings adjustment speed in various holding levels. In the threshold panel approach, the likelihood ratio test is used to determine the threshold effect (Hansen, 1999). In this test, H_0 represents no threshold point, and the alternative hypothesis represents the threshold effect in the model. If H_0 is accepted, the model is linear, and if the threshold effect hypothesis is confirmed (turning point), the model will be nonlinear as follows:

High Cash regime: $\mathrm{Cash_{i,t}} - \mathrm{Cash_{i,t-1}} = \alpha + \lambda_H^{TR}\mathrm{CDE_{i,t}} + \varepsilon_{\mathrm{i,t}} \quad if\ CDE_{i,t} < \mu$

Low Cash regime: $\mathrm{Cash_{i,t}} - \mathrm{Cash_{i,t-1}} = \alpha + \lambda_L^{TR}\mathrm{CDE_{i,t}} + \varepsilon_{\mathrm{i,t}} \quad if\ CDE_{i,t} \geq \mu$ (6)

The threshold regression model allows: 1) To test whether there is such a threshold and where it occurs, and 2) measure the adjustment speed for each regime. Therefore, in case of one turning point, the aforementioned models will be written as model (7), and according to the research literature, firms with a high cash regime are expected to adjust cash holdings faster ($\lambda_H^{TR} > \lambda_L^{TR}$):

$$\mathrm{Cash_{i,t}} - \mathrm{Cash_{i,t-1}} = \alpha + \lambda_H^{TR}\mathrm{CDE_{i,t}}(CDE_{i,t} < \mu) + \lambda_L^{TR}\mathrm{CDE_{i,t}}(CDE_{i,t} \geq \mu) + \varepsilon_{\mathrm{i,t}} \quad (7)$$

Where:

μ: Indicating the hypothetical threshold value.

λ_H^{TR} : Adjustment speed of firms with high cash regime.

λ_L^{TR}: Adjustment speed of firms with low cash regime.

If the turning point is confirmed, model (7) will be categorized into three regimes.

5. Results

H_1 Test Results Using the Dummy Variable Model:

In this study, the default regression tests precede the regression models. The most important hypothesis of all regression equations in testing heteroscedasticity of error terms is the first order autocorrelation of disturbance terms and collinearity of descriptive variables. If the sections (117 firms) exceed the time period (10 years from 2009 to 2018), the disturbance terms are expected to have heteroscedasticity. The Breusch–Pagan test was used to test heteroscedasticity, and the first order autocorrelation of disturbance terms was tested using the Wald test. Table (2) presents the default test results and regression model estimation for firms with fiscal deficits and surpluses using the dummy variable model. The sub-10 variance inflation factor (VIF) in the following table indicates no collinearity between descriptive variables of research. The Breusch–Pagan statistic was 2.23 for companies with fiscal deficits with a significance level of 0.135, indicating no heteroscedasticity problems. Moreover, the Wald test statistic was 1.57 with a significance level of 0.220, which represents no first order autocorrelation. However, the significance level of the Breusch–Pagan and the Wald test statistics for companies with fiscal surpluses was 0.000, which indicates heteroscedasticity and first order autocorrelation. To address the heteroscedasticity and serial disturbance term autocorrelation problem for each company, after controlling for year and industry, the regression model fitness was conducted in STATA using the reinforced panel method with the VCE (Cluster Firms) command, and the following table shows the final output.

The results for firms with fiscal surpluses shows that the λ_H^{DV} coefficient was 0.5877 and the λ_L^{DV} coefficient was 0.7751, which are significant within the 5% error level. Therefore, regarding firms with fiscal surpluses, firms with low cash regime adjust cash holdings toward optimal levels faster than firms with high cash regime. In other words, the cash holdings adjustment speed is 77% for firms with fiscal surpluses and low cash regime and 58% for companies with high cash regime, which indicates asymmetric behavior of cash holdings adjustment speed relative to liquidity level. Therefore, H_1 in the dummy variable model, which states that firms with fiscal surpluses and high cash regime are faster to adjust cash holdings than firms with lower cash regime, is rejected.

According to the results of firms with fiscal deficit, the λ_H^{DV} coefficient was 0.6785 and the λ_L^{DV} coefficient was 0.1290. Therefore, the cash holdings adjustment speed was 68% for firms with fiscal deficits and high cash regime and 13% for firms with low cash regime, and the adjustment speed of companies with high cash regime was significant in the 99% confidence level. Therefore, H_1 in the dummy variable approach, which states that the cash holdings adjustment speed of firms with fiscal deficit and high cash regime was faster than firms with low cash regime, is confirmed.

Table (2): The Effect of Financial Position of Firms (Fiscal Deficit or Surplus) on Cash Holdings Adjustment Speed with the Dummy Variable Approach

Variables	Firms with Fiscal Surplus				Firms with Fiscal Deficit			
	Coefficient (λ)	t Statistic	Sig	VIF	Coefficient (λ)	t Statistic	Sig	VIF
Constant	-0.0066	-1.48	0.141	--	0.0255	3.49	0.001	--
$CDE*D^{High}$	0.5877	10.07	0.000	1.17	0.6785	10.14	0.000	1.43
$CDE*D^{Low}$	0.7751	2.96	0.004	1.18	0.1290	0.63	0.529	1.38
Year	Yes				Yes			
Ind	Yes				Yes			
R^2	0.2677				0.4776			
Adjusted R^2	0.2394				0.4239			
F-Statistic (Sig)	11.3723 (0.000)				10.7933 (0.000)			
Breusch-Pagan Statistic (Sig)	125.15 (0.000)				2.23 (0.135)			
Wald Statistic (Sig)	14.424 (0.000)				1.574 (0.220)			

H_1 Test Results Using Threshold Regression:

Part one of Table (3) presents the threshold test. First, the threshold test (zero to one) was conducted for firms with fiscal deficits and surpluses. The F statistic and its significance level showed that H_0, or the lack of threshold point, is rejected, and the alternative hypothesis, or the presence of a turning or threshold point at the sub-5% error level is confirmed, and its values for firms with fiscal surpluses and deficits is respectively -0.0528 and -0.0171. After confirming the existence of a threshold, the two-point turning point test was conducted for this hypotheses (one to two), and the results show that there were not two threshold points. Therefore, the research hypothesis is tested with one threshold, which shows that the adjustment speed changes when the deviation from the optimal cash holdings level (CDE) for the two states is respectively -0.0528 and -0.0171.

According to part two of the following table, a threshold value is determined for the two states, where deviation from the optimal level of cash holdings ($Cash^*_{i,t} - \mathrm{Cash}_{i,t-1}$) in the regression model is categorized into two cash regimes according to observations.

The results for firms with fiscal surpluses shows that the λ^{TR}_H coefficient was 0.9081 and the λ^{TR}_L coefficient was 0.5088, which are significant within the 5% error level. The Wald statistic and its significance verify the λ^{TR}_H and λ^{TR}_L coefficients. The findings show that the optimal cash holdings adjustment speed of firms with fiscal surpluses and those with high and low cash regimes are respectively 91% and 51%. Therefore, the asymmetry of cash holdings adjustment speed in high and low cash regimes is verified. Hence, the first hypotheses for firms with fiscal surpluses is accepted according to the threshold regression model.

For firms with fiscal deficit, the results show that the cash holdings adjustment speed was 0.7890 and significant for firms with high cash regime (λ^{TR}_H), and 0.0576 and insignificant for firms with low cash regime (λ^{TR}_L). The significance coefficient and level of the Wald test confirms the reliability of λ^{TR}_H and λ^{TR}_L coefficients. Therefore, the cash holdings adjustment speed was 79% for firms with high cash regime, and was low at 6% for companies with low cash regime. As a result, the first hypothesis is accepted for firms with fiscal deficits.

Moreover, the results show that when firms approach their optimal cash holdings threshold, they adjust their holdings slowly, and outside the target range, firms adjust their cash holdings much faster.

The Durbin-Watson statistic was 1.8982 in the first state and 1.9396 in the second state and between 1.5 to 2.5, and there is no autocorrelation problem.

Table (3): Testing Firm Financial Position (Fiscal Deficit or Surplus) in Cash Holdings Adjustment Speed According to the Threshold Regression Model

Breakdown of Samples:	Firms with Fiscal Surplus			Firms with Fiscal Deficit		
Part One: Threshold Test						
Number of Thresholds	**F-Statistic**			**F-Statistic**		
0 to 1 (Threshold Level)	15.0771*			15.7866*		
1 to 2 (Threshold Level)	4.2326			2.5700		
Part Two: The Threshold Regression Model Estimation Results						
Variables	**Coefficient (λ)**	**t Statistic**	**Sig**	**Coefficient (λ)**	**t Statistic**	**Sig**
High Cash regime:	**CDE < -0.0528**			**CDE < -0.0171**		
Constant	0.0608	7.60	0.000	0.0282	8.71	0.000
CDE	0.9081	12.71	0.000	0.7890	18.33	0.000
Low Cash regime:	**CDE ≥ -0.0528**			**CDE ≥ -0.0171**		
Constant	0.0160	9.55	0.000	0.0096	3.60	0.000
CDE	0.5088	6.96	0.000	0.0576	0.30	0.763
R^2	0.2768			0.5490		
Adjusted R^2	0.2742			0.5449		
F-Statistic (Sig)	106.1522 (0.000)			133.9443 (0.000)		
Durbin-Watson	1.8982			1.9396		
Wald Statistic (Sig)	15.2722 (0.000)			13.9023 (0.000)		

* Significant at 5%

H_2 Test Results Using the Dummy Variable Model: Table (4) shows the default test results and regression model estimation for firms with high and low leverage. The variance inflation factor (VIF) in the following table is below 10, which indicates no collinearity between descriptive variables of research. The significance of the Breusch–Pagan and Wald statistics was 0.000 in both states, which suggests heteroscedasticity and serial autocorrelation between error terms. To address the heteroscedasticity and serial disturbance term autocorrelation problem for each firm, after controlling for year and industry, the regression model fitness was conducted in STATA using the reinforced panel method and the VCE (Cluster Firms) command, and the final output is shown in the following table.

The results for firms with high leverage show that the λ_H^{DV} coefficient was 0.5248 and the λ_L^{DV} coefficient was 0.1966. Therefore, the cash holdings adjustment speed was 52% for firms with high leverage and high cash regime and 19% for firms with low cash regime, and the adjustment speed of firms with high cash regime was significant in the 99% confidence interval, which points to asymmetric behavior of cash holdings adjustment speed relative to firm liquidities. Therefore, H_1 in the dummy variable approach, which states that the cash holdings adjustment speed of firms with high leverage and high cash regime was faster than companies with lower cash regime, is accepted.

The results for firms with low leverage shows that the λ_H^{DV} coefficient was 0.7131 and the λ_L^{DV} coefficient was 0.7355, which are significant in the 1% error level. Therefore, when companies have a low ratio of total debts to total assets, the cash holdings adjustment speed for firms with high and low cash regimes is respectively 71% and 73%. In other words, companies with low leverage and low cash regime adjust to the optimal level of cash holdings faster than companies with a high cash regime. Therefore, H_2 in the dummy variable approach, which states that the cash holdings adjustment speed of firms with low leverage and high cash regime was faster than firms with low cash regime, is rejected.

Table (4): Testing Firm Leverage (High or Low Leverage) on Cash Holdings Adjustment Speed with a Dummy Variable Approach

Variables	Firms with High Leverage				Firms with Low Leverage			
	Coefficient (λ)	t Statistic	Sig	VIF	Coefficient (λ)	t Statistic	Sig	VIF
Constant	0.0190	3.50	0.001	--	0.0004	0.10	0.920	--
$CDE*D^{High}$	0.5248	8.60	0.000	1.21	0.7131	12.80	0.000	1.26
$CDE*D^{Low}$	0.1966	0.78	0.435	1.23	0.7355	3.13	0.002	1.24
Year	Yes				Yes			
Ind	Yes				Yes			
R^2	0.2364				0.3670			
Adjusted R^2	0.1947				0.3330			
F-Statistic (Sig)	7.1607 (0.000)				12.5536 (0.000)			
Breusch-Pagan Statistic (Sig)	44.93 (0.000)				97.40 (0.000)			
Wald Statistic (Sig)	19.843 (0.000)				31.169 (0.000)			

H_2 Test Results Using the Threshold Regression Model:

Part one of Table (5) presents the threshold test, where both high-leverage and low-leverage firms have a confirmed turning point at the 95% confidence level, where threshold values for firms with high and low leverage are respectively -0.0500 and -0.0325.

The results for firms with high leverage shows that the λ_H^{TR} coefficient was 0.7365 and the λ_L^{TR} coefficient was 0.3805, which are significant within the 5% error level. The Wald statistic and its significance verify the λ_H^{TR} and λ_L^{TR} coefficients. The findings show that cash holdings adjustment speed to the optimal level in highly-leveraged firms with high and low cash regimes are respectively 73% and 38%. Therefore, the asymmetry of cash holdings adjustment speed in high and low cash regimes is verified. Also, the second hypothesis for firms with high leverage using the threshold regression model is accepted.

Table (5): Testing Firm Leverage (High and Low) on Cash Holdings Adjustment Speed According to the Threshold Regression Model

Breakdown of Samples:	Firms with High Leverage			Firms with Low Leverage		
Part One: Threshold Test						
Number of Thresholds	**F-Statistic**			**F-Statistic**		
0 to 1 (Threshold Level)	6.5717*			9.9586*		
1 to 2 (Threshold Level)	2.1422			1.5512		
Part Two: The Threshold Regression Model Estimation Results						
Variables	**Coefficient (λ)**	**t Statistic**	**Sig**	**Coefficient (λ)**	**t Statistic**	**Sig**
High Cash regime:	**CDE < -0.0500**			**CDE< -0.0325**		
Constant	0.0398	5.17	0.000	0.0443	7.40	0.000
CDE	0.7365	8.64	0.000	0.8573	14.95	0.000
Low Cash regime:	**CDE ≥ -0.0500**			**CDE ≥ -0.0325**		
Constant	0.0118	7.04	0.000	0.0159	7.03	0.000
CDE	0.3805	5.15	0.000	0.5884	5.18	0.000
R^2	0.2331			0.3854		
Adjusted R^2	0.2292			0.3823		
F-Statistic (Sig)	58.3906 (0.000)			122.5346 (0.000)		
Durbin-Watson	2.1170			2.0649		
Wald Statistic (Sig)	9.9753 (0.001)			4.4799 (0.034)		

* Significant at 5%

The results for low-leverage firms show that the cash holdings adjustment speed of companies with high (λ_H^{TR}) and low (λ_L^{TR}) cash regimes was respectively 0.8573 and 0.5884, and significant in the 99% confidence level. The coefficient and significance level of the Wald test confirms the reliability of λ_H^{TR} and λ_L^{TR} coefficients. Therefore, the cash holdings adjustment speed was approximately 85% for firms with high cash regime and 58% for firms with low cash regime. Therefore, the second hypothesis for firms with low leverage is accepted.

The Durbin-Watson statistic, which represent autocorrelation, is 2.1170 and 2.0649 respectively for high and low leverage firms, and should be between 1.5 to 2.5.

Table (6) presents the summarized results of testing hypotheses for each adjustment variable and asymmetric models:

Table (6): Summary of Hypotheses Test Results

Hypotheses	Categorization of Variables	Asymmetric Models	
		Dummy Variable	Threshold
1	Fiscal Surplus	Rejected - Low Cash regime	Confirmed - High Cash regime
	Fiscal Deficit	Confirmed - High Cash regime	Confirmed - High Cash regime
2	High Leverage	Confirmed - High Cash regime	Confirmed - High Cash regime
	Low Leverage	Rejected - Low Cash regime	Confirmed - High Cash regime

6. Conclusion

According to the literature and research hypotheses, the cash holdings adjustment speed of firms with high cash regime is expected to be faster than firms with low cash regime. The reason is that firms that operate conservatively always keep enough cash for emergencies. This study evaluated the asymmetric models of cash holdings adjustment speed in firms with fiscal deficits and surpluses and firms with high and low leverage. The fiscal information of 117 companies listed on the Tehran Stock Exchange was used to test the research hypotheses, which were selected for this study after applying certain limitations.

The results confirm the research hypotheses for companies with fiscal deficit and high leverage using asymmetric models. Therefore, the findings suggested that firms with high cash regime adjust toward the optimal level of cash holdings faster than firms with low cash regime. However, the results of firms with fiscal surplus and low leverage using the dynamic threshold model showed faster cash holdings adjustment in firms with high cash regime than firms with low cash regime. Yet, the adjustment speed of these firms according to the dummy variable model was the opposite. Therefore, the cash holdings adjustment speed has asymmetric behavior relative to firm liquidity levels.

Kalak *et al.* (2020) concluded that firms with fiscal surpluses were faster to adjust cash holdings than firms with fiscal deficit. Siddiqua *et al.* (2019) showed that fiscally-limited firms adjust their cash holdings faster than firms without financial constraints. Additionally, Orlova and Rao (2018) discovered that firms with fiscal deficits are slower to adjust than firms with surpluses. Therefore, the findings are consistent with these studies, but inconsistent with the results from Truong (2021), who found that firms with fiscal deficit are faster to adjust their cash holdings than firms with surpluses.

Venkiteshwaran (2011) presented two likely reasons for different cash holdings adjustment speeds in firms with cash surpluses and cash deficits. The first reason according to the agency theory was that managers of firms with cash surpluses are not only inclined to collect cash, but quickly spend it in case of investment opportunities outside the company. The second reason is that cash expenditures are normally significantly lower than the costs of accumulation. Therefore, to reduce cash holdings toward the optimal level takes less than to increase it. Hence, firms with cash surpluses in their financial statements adjust cash holdings faster than firms with fiscal deficits.

References

1) Alles, L., Lian, Y., and Xu, C.Y. (2012). The Determinants of Target Cash Holdings and Adjustment Speeds: An Empirical Analysis of Chinese firm. In 2012. Financial Markets & Corporate Governance Conference in Singapore http://dx.doi.org/10.2139/ssrn.1981818.
2) Almeida, H., Campello, M., and Weisbach, M. (2004). The cash flow sensitivity of cash. The Journal of Finance, 59, pp. 1777-1804.
3) Bai, J., and Perron, P. (2003). Computation and analysis of multiple structural change models. Journal of Applied Econometrics, 18, pp. 1-22.
4) Bates, T., Kahle, K., and Stulz, R. (2009). Why do US firms hold so much more cash than they used to? The Journal of Finance, pp. 1985-2022.
5) Byoun, S. (2008). How and when do firms adjust their capital structures toward targets? Journal of Finance, 63, pp. 3069-3096.
6) Chang, Y., Benson, K.L., and Faff, R.W. (2017). Asymmetric Modelling of the Cash holdings adjustment speed. Working Paper. http://dx.doi.org/10.2139/ssrn.2914986.
7) Dang, V.A. (2011). Leverage, debt maturity and firm investment: An empirical analysis. Journal of Business Finance & Accounting. 38(1-2), pp. 225-258.
8) Dastgir, M., Yousefi, A., and Imani, K. (2013). The Cash holdings adjustment speed and firm characteristics. Accounting Research, 3(3), 19-33.
9) Dittmar, A., and Duchin, R. (2010). The Dynamics of Cash. Pacific-Basin Finance Journal, 55(2), pp. 270-282.
10) Fakhaari, H., and Asadzadeh, A. (2017). The effect of leverage and free cash flow on the Cash holdings adjustment speed. Financial Management Strategy, 5(4), 1-23.
11) Faulkender, M., Flannery, M.J., Hankins, K.W., and Smith, J.M. (2012). Cash flows and leverage adjustments. Journal of Financial Economics, 103, pp. 632-646 .
12) Flannery, M.J., and Rangan, K.P. (2006). Partial adjustment toward target capital structures. Journal of Financial Economics, 79, pp. 469-506.
13) Han, S., and Qiu., J. (2007). Corporate Precautionary Cash Holdings. Journal of Corporate Finance 13, pp. 43-57.
14) Hansen, B.E. (1999). Threshold Effects in Non-Dynamic Panels: Estimation, Testing, and Inference. Journal of Econometrics, 93, pp. 345-368.
15) Huang, R., and Ritter, J. (2009). Testing theories of capital structure and estimating the speed of adjustment. Journal of Financial and Quantitative Analysis, 44.
16) Jensen, M. (1986). Agency costs of free cash flow, corporate finance, and takeovers. The American Economic Review, 76, pp. 323-329.
17) Kalak, I., Goergen, M., and Guney, Y. (2020). CEO Overconfidence and the Speed of Adjustment of Cash Holdings. Finance Working Paper. http://dx.doi.org/10.2139/ssrn.3547283.
18) Karami Taleghani, F., and Vatanparast, M. R. (2020). The effect of financial distress on the adjustment speed of cash holding with an emphasis on growth opportunities and fiscal constraints. Accounting and Management Outlook, 3(36), 26-46.
19) Khani, A., and Yousefi, A. (2013). Analyzing cash holding adjustment speed toward the optimal level in firms listed on the Tehran Stock Exchange using the generalized motion method. Second National Conference on Accounting, Financial Management and Investment, Gorgan, Scientific and Professional Association of Golestan Managers and Accountants.
20) Oler, D. and Picconi, M. (2009). Implications of insufficient and excess cash for future performance. Journal of Financial Economics, Vol. 65, pp. 223-247.
21) Opler, T., Pinkowitz, L., Stulz, R., and Williamson, R. (1999). The determinants and implications of corporate cash holdings. Journal of Financial Economics, 52.
22) Orlova, S.V. and Rao, R.P. (2018). Cash Holdings Speed of Adjustment. International Review of Economics and Finance. http://dx.doi.org/10.1016/j.iref.2017.12.011.
23) Siddiqua, G.A., Rehman, A., and Hussain, S. (2019). Asymmetric targeting of corporate cash holdings and financial constraints in Pakistani firms. Journal of Asian Business and Economic Studies, 26(1), pp. 76-97.
24) Smith, D., Chen, J., and Anderson, H. (2015). The influence of firm financial position and industry characteristics on capital structure adjustment. Accounting and Finance, 55, pp. 1135-1169.

25) Truong. K.D. (2021). Firm Characteristics and Cash Holdings Speed of Adjustment: Evidence from Vietnam. The Journal of Asian Finance, Economics and Business, 8(8), pp. 137-148.
26) Venkiteshwaran, V. (2011). Partial Adjustment Toward Optimal Cash Holding Levels. Review of Financial Economics, 20(3), pp. 113-121.
27) Zabihi, F., and Sadeghi Moghadam, S. (2014). Factors of cash holdings level in companies: Evidence from the Tehran Stock Exchange. Proceedings from the National Conference on the Role of Accounting in Realizing Multi-Year Government Development Plans