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Asymmetric targeting of corporate cash holdings and financial constraints in Pakistani firms

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Abstract

Purpose – The purpose of this paper is to investigate the asymmetric adjustment of cash holdings in Pakistani firms for above and below target firms.
Design/methodology/approach – The study employs generalized method of moments (GMM) to investigate the adjustment of cash holdings.
Findings – The study found that the firms which hold cash above the optimal level of cash holdings have higher speed of adjustment than the firms which hold cash below the optimal level. Financially constrained (FC) firms also adjust their cash holdings faster than financially unconstrained (FUC) firms but high speed of downward adjustment does not remain persistent after financial constraints are controlled. Findings of this study reveal this asymmetric adjustment in above and below target firms and extend these results in FC and FUC Pakistani listed firms, respectively.
Research limitations/implications – The conclusion of this study has been derived under certain limitations. There is a vast space to extend this study in different dimensions. Firms operating in capital-intensive industries may provide different results for financial constraints because their policy designing would be quite different from other firms.
Originality/value – This study contributes to cash holdings research in Pakistan by exploring the adjustment behavior of cash holdings across Pakistani non-financial firms using econometric modeling. Downward adjustment rate is supposed to be higher than upward adjustment rate and this rate is tested using dynamic panel data model. Similarly, it is inferred that this relationship holds for above target firms even after including the financial constraints in the presented model.

Keywords Cash holdings, Adjustment rate, Financial constraints, Pakistani firms,
Upward and downward adjustment

Paper type Research paper

1. Introduction

The cash holding behavior of firms has obtained a great deal of consideration in finance literature after the contribution of Miller and Orr (1966) and the initial work of Modigliani and Miller (1958). However, the latter suggested that firms can easily secure funds in frictionless markets and that there is no need to hoard cash for future liquidity matters. Practically, there is no existence of frictionless capital markets and firms cannot always collect as many funds

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as they need so they have to move toward external sources of raising funds. Why are the firms always in need of holding cash? Does the optimal level of cash holdings exist? Do firms with different organizational hierarchies hold a different amount of cash? To answer these fundamental questions, a number of researchers have strived to draw a clear picture of the cash holding decisions made by the firms. Keynes (1936) emphasized that cash acts as a safety measure against unpredicted contingencies. After three decades, a tradeoff model for determining a firm's optimal cash level was presented by Miller and Orr (1966) and this model discusses the idea of making a tradeoff between costs and benefits of cash holdings. Contrarily, Myers (1984) suggested pecking order theory and argued that an optimal or target level of cash does not exist and a firm only tries to minimize information asymmetry while accessing the costs of external financing. Under this argument, firm first use their retained earnings to finance their investment projects, then obtain debt and at last, they use their equity in their investments.

It is clear that firms do not have any optimal level of cash rather cash is simply used as a buffer between investment needs and retained earnings. Alternatively, Jensen (1986) presented the theory of free cash flow postulating when managers act for their own self-interest instead of striving for the value maximization of their firm, they may commit a breach of their fiduciary obligations toward shareholders. To understand the relationship between managers and shareholders, such kind of agency problems must be taken into account. Free cash flow theory holds that managers hold cash to exacerbate their arbitrary power over the investments decisions made by the firm.

However, holding cash has its benefits and costs. The basic purpose of hoarding cash includes a reduction in the chances of financial shocks (John, 1993), minimizing transaction costs (Keynes, 1936), circumventing external sources of financing and allowing the investment projects to perform efficiently in the presence of financial constraints (Denis and Sibilkov, 2010). Holding cash in a firm's reserves acts as a buffer against future financial shocks and firms tend to accumulate cash to cope with the financial crisis likely to occur in coming years. Holding cash also minimizes transaction cost of liquidating assets or costs associated with raising external finance (Mulligan, 1997).

However, accumulating huge volume of cash leads to double taxation especially for multinational firms that pay taxes in host country and are also subject to tax payments when repatriating foreign income to their home country (Foley *et al.*, 2007), agency costs incurred due to conflicts between managers (agents of shareholders) and shareholders (Jensen, 1986; Harford, Li and Zhao, 2008) and opportunity cost (Uyar and Kuzey, 2014). Holding a large amount of cash may lead toward inefficiency. That is, the firm may lose certain valuable investment prospects. Firms hold cash for transaction motive, precautionary motive, agency motive and for tax motive as well. Pecking order theory suggests that firms tend to rely on internal financing more than external financing while making their investment decisions (Myers, 1984) and on the other side, agency theory (Jensen, 1986) points out a flaw, that is, when managers have excess cash, then they do not go for external sources of finance, they carry out such investment projects that may have even a negative net present value and at last, shareholders are adversely affected.

Broadly speaking, pecking order theory and agency theory do not sufficiently address the adjustment of cash holdings. So, a better explanation can be given by tradeoff theory which provides a balance between the benefits and costs which are associated with any given level of cash. An optimal or target level of cash is well determined by tradeoff theory and firms try to adjust cash to the optimal level in case of any cash deviations. This argument is relevant to hold that firms are active in rebalancing their cash holdings to the optimal level.

Numerous prior studies support the notion that an optimal or target level of cash holding exists for the firm (Opler *et al.*, 1999; Ozkan and Ozkan, 2004; Bates *et al.*, 2009; Rehman and

Wang, 2015). Although there is ample research material on adjustment of optimal or target level of cash holdings and adjustment rate, a very little work has been done on the asymmetric adjustment (high and low cash regimes from the optimal or target level) of corporate cash holdings in the particular context of Pakistan as most of the studies emphasized on cash holdings and adjustment rate of the firms operating in developed countries. No empirical evidence exists so far in the particular context of Pakistan which addresses the optimal level of cash holdings and adjustment rate of corporate cash holdings in Pakistani firms. Furthermore, the research is lacking in the strand of above and below target firms – how firms adjust their cash policy when the cash holdings are above or below the optimal level. Azam and Shah (2011) found that there are more financial constraints faced by Pakistani firms than the firms operating in the developed world. These constraints include high dividend payout ratio which restricts the firms to invest in future projects; firm's age which explains that older firms tend to spend less on investment as compared to the younger firms; and uncertainty which hinders fixed investment. Firm size, earnings and energy crisis are some other important constraints which need the attention of researchers. They further investigated the underlying relationship between a firm's level of investment and the firm size, age of the firm and its dividend payout ratio. Their findings revealed a positive linkage between investment and firm size and a negative association between investment, firm's age and dividend payout ratio. Consequently, firm's age and dividend payout ratio have been attributed to financial constraints.

This research is significant in certain strands. This study intends to contribute to existing literature by exploring cash management and adjustment of cash holdings in publicly listed non-financial firms. Furthermore, this research makes a contribution to literature because it is exploring the determinants of corporate cash holdings in Pakistan where the financial structure of firms is quite different from the firms operating in developed countries. The study intends to provide practicable insights and facts that may help to determine the asymmetric adjustment of cash holdings to help non-financial companies of Pakistan in their future investment and growth decisions and to understand the dynamics of optimal cash policy.

The rest of the study is structured as follows: Section 2 gives a brief review of the literature. Section 3 presents the data, methodology and empirical models. Section 4 deals with empirical results and Section 5 concludes the paper.

2. Literature review

There are a large number of prior studies about corporation's cash management policies and these studies suggest that firms normally accumulate large amounts of cash for precautionary motives (Opler *et al.*, 1999; Mikkelson and Partch, 2003), for efficient management of transactions (Mulligan, 1997), for payment of double taxes, i.e. multinational firms which are subject to tax payments both in host country and in home country as well (Foley *et al.*, 2007) and to reduce agency problems (Jensen, 1986; Harford, Mansi and Maxwell, 2008; Nikolov and Whited, 2014). Dittmar *et al.* (2003) identified two types of costs associated with holding cash. First, cost-of-carry and agency cost. They further documented two motives which stemmed the benefits and advantages of holding cash. In the first place, the transaction cost motive of holding cash states that firms hold more cash during the periods when opportunity costs and the costs associated with raising cash are relatively higher. Second, the precautionary or preventive motive of holding cash stems from an examination of the effect of asymmetric information on fund-raising ability of a firm.

According to the financing hierarchy (Myers, 1984), there is not any target level of cash and likewise, there is no optimal level of debt. But Martínez-Sola *et al.* (2013) and Jarrow *et al.* (2018) reported that there exists an optimal level of cash which maximizes the value of a firm and any divergence from the optimal level decreases firm value. The tradeoff theory

maintains a positive association between cash level and investment made for capital expenditure while financing hierarchy holds the opposite relationship between the two (Dittmar *et al.*, 2003). Similarly, there exists an optimal level for debt or leverage which the firms obtain after making a tradeoff between benefits and costs of obtaining debt and any deviation from that optimal level may lead firms to move toward a new leverage target (Denis and McKeon, 2012). Denis (2011) held that as leverage ratios may substantially deviate from their target level, the managers do not set leverage levels as their first-order concern for capital structure decisions. Surplus leverage due to increase in initial leverage level builds cash reserves for firms. Furthermore, they suggested that during the time of shortage of cash and liquidity crisis, firms are active in taking more and more debt even when they are above their target or optimal debt level and likewise, during the time of surplus in financial resources they payout debt to reduce their leverage level even when they are already below their target level of leverage.

In capital markets where there is an ease of access to the fund providers and funds can immediately be raised, firms tend to keep less liquid assets in their reserves. In countries, where there is the least protection of investor's rights, companies hold twice much cash as companies in countries where investor rights are well protected. In this situation, investors cannot forbid managers to hold excessive cash. Financial instruments in a firm's portfolio also lessen cash hoarding because these instruments can easily be used for raising capital and for hedging as well. Furthermore, large amounts of cash are mostly held by the companies that are exposed to greater investment horizons and they hoard cash to avoid opportunity cost and a shortage of cash in case of optimal investment opportunity arousal. Precautionary motive of holding cash suggests that a firm's risk of refinancing also affects its level of cash holdings because firms hold huge amounts of cash to avoid refinancing risk and to save more cash resulting from free cash flows available to the finance providers (Harford *et al.*, 2014; Xie *et al.*, 2017).

In case of adjustment speed of cash holdings, different researchers hold different opinions. Chang *et al.* (2017) argued that firms have different adjustment costs so they follow different paths to reach their optimal level of cash. Furthermore, they hold that there is always an optimal level of cash and when the cash level deviates from the upper or lower cash regime then systematic adjustment of cash occurs. In this way, the benefits of cash level adjustment become higher than the costs. Jiang and Lie (2016) also examined the speed of adjustment of corporate cash holdings and they maintained that firms having higher levels of cash reserves have a higher speed of adjustment than the firms facing cash deficiency.

While addressing a firm's asymmetric adjustment, a firm can make loan payments and dividend payments when its level of cash holdings is above target or optimal level and by making such payments, it can bring its level of cash holdings down to the target or optimal level (Venkiteshwaran, 2011). This argument can be made by intuition and clue. Contrary to this argument, a firm cuts its investment, raises funds from external sources and slashes its payouts when its cash level is below the optimal level (Venkiteshwaran, 2011; García-Teruel and Martínez-Solano, 2008). Rehman *et al.* (2016) found a higher speed of downward adjustment of cash holdings than upward adjustment and this tendency is due to the reason that there are more alternatives available to the firms to bring their level of cash holdings down to the optimal or target level and lower costs associated with downward adjustment of cash holdings. So it can be suggested that it is far more convenient to bring the firm's cash holdings down to the optimal level when the level of cash holdings is above the optimal or target level than to bring the level of cash holdings up when it is below the optimal or target level during the time of uncertainty and crisis. Above arguments provide a base for the development of following hypothesis:

H1. Downward adjustment rate of corporate cash holdings toward an optimal level is higher than the upward adjustment rate.

2.1 Financial constraints and corporate cash holdings

Financial constraints have a different approach to explain a firm's cash holding tendency. Firms with a higher return on assets and firms which are paying the dividend can easily raise external finance and they hold less cash in their reserves (Chen *et al.*, 2017). Financially constrained (FC) firms are those which are not paying dividends and financially unconstrained (FUC) firms pay dividends (Chen *et al.*, 2017; Lozano and Durán, 2017) and FC firms hoard cash to deal with volatility in cash flows while FUC firms are not affected by this kind of volatility (Rehman *et al.*, 2016).

Almeida *et al.* (2004) argued that FC firms must adopt a different approach to cash saving and the approach should be a systematic propensity toward cash hoarding. FC firms are not required to adopt this approach. They further proposed that cash flows sensitivity toward cash holdings has a positive sign in case of FC firms and it is insignificant and negative for FUC firms. These findings support the opinion that FC firms have higher levels of cash than FUC firms. FC firms have higher levels of cash holdings as a result of higher investment yields and higher value of an investment (Denis and Sibilkov, 2009). During the times of cash crunches and less liquidity, firms normally cut their investment in research and development and technology (Campello *et al.*, 2010), and firms also tend to reduce their cash savings and dividends during such crisis. Assets liquidation can easily be made by FC firms at the time of liquidity crisis and the shortage of cash. Further linking this up to financial flexibility, marginal costs of excess cash and dynamics of capital structure, the ability to raise debt has a low transaction cost, meaning raising debt today to fund investment and subsequently seeking to pay off debt today, so that firm can raise more debt today or in future if needed (DeAngelo *et al.*, 2011). Based upon the above discussion, it can be hypothesized that:

H2. FUC firms have higher adjustment rate of cash holdings than FC firms.

Financially flexible firms tend to access low-cost external finance to timely respond sudden cash flow volatility and an unexpected increase in growth opportunities for value maximization (Denis, 2011); however, a firm's financial policy does not solely depend upon financial flexibility (Graham and Harvey, 2001). Financial constraints may restrict firms to avoid certain profitable projects so FC firms devise their cash policies with financial flexibility in order to cope with scarcity of financial resources during the periods of uncertainty and high cost of external finance and high uncertainty in growth opportunities lead firms to stockpile cash through low-equity payouts (Denis, 2011). For firms to be financially flexible, their unused debt capacity should be an important source of their capital structure. Gamba and Triantis (2008) reported that in case of higher debt costs, firms have a tendency to hoard more cash. They further argue that in time of low profitability, firms tend to reduce their debt burden, to avoid the triggering of any financial distress thus compelling firms to reduce their payout for debt issuance of higher costs.

Firms working with high market imperfections and with higher investment needs tend to keep large cash reserves in order to cope with liquidity crunches because market frictions restrict their investment ability (Almeida *et al.*, 2004). Furthermore, they argued that FUC firms are less prone to volatility in cash flows than FC firms. Rehman *et al.* (2016) incorporated financial constraints like Altman's *Z* score (based upon leverage, liquidity and profitability), SA1 and SA2 index (based upon size and age of the firm) in their research model and found that FUC firms have a higher speed of adjustment than FC firms. They also provided an argument that higher downward speed of adjustment toward the optimal or target level of cash is persistent even after the financial constraints are controlled. These arguments provide a base for the development of following hypothesis:

H3. Higher downward adjustment rate of corporate cash holdings persists even after financial constraints are controlled.

2.2 Determinants of corporate cash holdings

Opler *et al.* (1999) suggested several determinants of cash holdings and this study follows those determinants to be substantially incorporated in underlying regression models. The section below gives a brief summary of the relationship between cash holdings and the proposed determinants of cash holdings. We include capital expenditure, leverage, firm size, growth opportunities, net working capital and operating cash flows as the control variables.

3. Methodology

3.1 Data and source

We have used a sample set of 200 non-financial firms listed on Pakistan Stock Exchange over a ten-year period (2006–2016). Data are collected from www.psx.com.pk, www.businessrecorder.com, www.investing.com, annual reports of firms and BVD OSIRIS. Firms are assigned numbers ranging from 1 to 200 and then data have been split into two subcategories, i.e., firms which hold cash above the optimal or target level and firms which hold cash below the optimal or target level. The subsamples of data into above target firms and below target firms are based upon a technique borrowed from prior studies of capital structure (Hovakimian *et al.*, 2001; Drobetz and Wanzenried, 2006). First, cash holdings are estimated using pooled OLS estimation technique. Fitted values are estimated and then subtracted from the actual cash values. If the difference is positive it accounts for above target firms and negative values account for below target level firms. Data have been winsorized at the 5 percent level for limiting the extreme values and to reduce the effect of spurious outliers (Table I).

S. No.	Name of industry	No. of firms
1	Automobile manufacturer	6
2	Automobile add-ons	6
3	Electric products	2
4	Cement manufacturer	15
5	Chemical producers	15
6	Construction materials	4
7	Engineering	9
8	Fertilizer	4
9	Food and personal care	10
10	Glass and ceramics	6
11	Leather and tanneries	3
12	Miscellaneous	3
13	Oil and gas	9
14	Paper and board	7
15	Pharmaceuticals	5
16	Power generation	9
17	Refinery	2
18	Sugar	17
19	Synthetic and rayon	2
20	Technology	5
21	Textile	51
22	Tobacco	2
23	Transport	4
24	Woolen	4
Total		200

Table I. Distribution of firms across industries

3.2 Variables description

3.2.1 Dependent variable. The dependent variable in this study is cash holdings. Cash holdings are the assets that a firm holds in the form of ready cash. The value of cash and cash equivalents has been taken from the annual reports of the firm and the online resources mentioned above. Cash is measured by dividing the cash holdings of a firm by its total assets.

3.2.2 Independent variables. Independent variables in this study are capital expenditure, leverage, growth opportunities, firm size, cash flow, net working capital and financial constraints. Capital expenditure is the amount of money spent on the acquisition of fixed assets. It is measured by dividing the value of fixed assets by total assets. Leverage refers to the investment of borrowed money. It is measured by dividing a firm's total debt by its total assets. Growth opportunities are the prospects for the firms to invest in projects which yield profits. These are measured by taking the ratio of the market value of equity and the book value of equity or it means to divide market value of equity with book value of equity. Firm size is the optimal size of a firm in a given industry at a given time which leads to low per unit cost of production. It is measured by taking the natural logarithm of a firm's total assets or its sales. Cash flow is the total amount of money coming in and going out of a business and it particularly affects liquidity. Cash flow is measured by dividing the net operating cash flows of a firm with total assets. Net working capital is the sum of all the liquid assets of a firm. It is measured by subtracting accounts payable from the sum of accounts receivables and inventories and dividing the resulting by total assets for scaling purpose.

3.3 Research model

First, we have developed a static model following Opler *et al.* (1999) and the model is as follows:

$$CASH^{*}_{it} = \beta_0 + \beta_1 NWC_{it} + \beta_2 SIZE_{it} + \beta_3 MTB_{it} + \beta_4 LEV_{it} + \beta_5 CAPEX_{it} + \beta_6 OCF_{it} + e_{it}. \quad (1)$$

In Equation (1), $CASH^{*}_{it}$ refers to cash and cash equivalents held by firm i at time t. The star denotes that it is the optimal value or equilibrium represented by the fitted line of this equation. β_0 is the intercept. NWC_{it} represents net working capital employed by firm i at time t, measured by taking the difference of current assets and current liabilities. $SIZE_{it}$ is actually the firm's size which is measured by taking the natural log of total assets held by a firm. BMR_{it} depicts firm's book-to-market ratio used to measure the growth opportunities of firm i at time t. LEV_{it} stands for leverage of firm i at time t, measured by dividing total liabilities with total assets. $CAPEX_{it}$ is the ratio of firm's total capital expenditure to firm's total assets. OCF_{it} is the net operating cash flows of firm i at time t. e_{it} is the random error term.

The adjustment of cash holdings of a firm to a target or optimal level is not immediate and it has its associated costs as this adjustment takes place through a partial adjustment process. So the relationship given below holds the current cash holdings and cash holdings at $t-1$:

$$CASH_{it} - CASH_{it-1} = \gamma\left(CASH^{*}_{it} - CASH_{it-1}\right) + \delta_{it}. \quad (2)$$

$$CASH_{it} = \beta_0\gamma + (1-\gamma)CASH_{t-1} + \gamma\beta NWC_{it} + \gamma\beta_2 SIZE_{it} + \gamma\beta_3 BMR_{it} + \gamma\beta_4 LEV_{it} + \gamma\beta_5 CAPEX_{it} + \gamma\beta_6 OCF_{it} + \eta_i + \lambda_t + \upsilon_{it}. \quad (3)$$

In Equation (2), $CASH^{*}_{it}$ represents the cash level of firm i at time t and $CASH_{it-1}$ is the firm i's cash level at time $t-1$. $CASH^{*}_{it}$ denotes the target or optimal level of cash holdings of firm i at time t. γ denotes the coefficient of adjustment and its values range between 0 and 1. If $\gamma = 0$, it means that a firm will remain in its current cash position and if $\gamma = 1$, the firms

will tend to achieve an optimal or target level of cash holdings. By putting the value of $CASH_{it}^{*}$ from Equation (1) into Equation (2), we get the following equation.

In Equation (3), η_i corresponds to firm-specific effects and λ_t represents time-specific effects. By simplification of Equation (3), we have obtained the following equation:

$$CASH_{it} = \beta_0\gamma + \rho CASH_{t-1} + \delta_1 NWC_{it} + \delta_2 SIZE_{it} + \delta_3 MTB_{it} + \delta_4 LEV_{it} + \delta_5 CAPEX_{it} + \delta_6 OCF_{it} + \delta_7 CP_{it} + \delta_8 PP_{it} + \delta_9 LIQ_{it} + \delta_{10} TANG_{it} + \delta_{11} CV_{it} + \eta_i + \lambda_t \upsilon_{it}. \quad (4)$$

In Equation (4), $\alpha = \gamma\beta_0$; $\rho = (1-\gamma)$; $\delta_k = \gamma\beta_k$; *and* $\lambda_t \upsilon_{it} = \gamma e_{it}$.

The use of OLS to estimate Equation (4) will lead to inconsistency because there is a problem of endogeneity between cash holdings and firm's adjustment toward the optimal level of cash. Hence, two-step generalized method of moments (GMM) estimator will be used to resolve the issue of endogeneity and to estimate Equation (4). The reason for selecting two-step GMM is that it is more efficient than one-step GMM.

This study has estimated the equation through GMM (Arellano and Bond, 1991). One of the reasons to estimate our equation through GMM is addressing the issue of endogeneity. In post-estimation test, we estimated the Sargan test value and Abond test for the presence of second-order autocorrelation. The *p*-values for both Sargan and Abond tests are used for the validity of these tests. Then we divided the firms into above and below target firms by estimating the equation through pooled OLS and subtracting the fitted values from actual values of cash holdings as done in various capital structure studies and more recently by Rehman *et al.* (2016). Furthermore, we included the financial constraints in our model and re-estimated the equation for above and below target firms to control for the financial constraints.

3.4 Measurement of financial constraints

Financial constraints are measured by using two methods.

3.4.1 Altman's Z score. First, Altman's Z score model is used in the study to identify financially flexible firms. This model was proposed by Bancel and Mittoo (2011). It captures some unique variables and is based upon liquidity ratios, profitability ratios and leverage ratios (i.e. debt to equity ratio):

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5,$$

where X_1 is the cash ratio minus trade payables ratio. It is used to measure liquidity of firm. X_2 is the retained earnings divided by total assets; retained earnings are profits kept for reinvestment in business. X_3 is the earnings before interest and taxes divided by total assets. X_4 is the book value of equity divided by book value of total liabilities. X_5 is the sales divided by total assets.

The result or score is divided into three quartiles where the highest quartile represents those firms which are FUC and lowest quartile corresponds to firms which are FC.

3.4.2 SA index. SA index was proposed by Hadlock and Pierce (2010). It describes that firm's external factors are important to measure its financial constraints. SA index comprises size and age of the firm. Less constrained firms have high SA score and inverse will be the case for FC firms. In SA index, firm size is measured by taking the natural logarithm of its total assets or sales. Age of firm is calculated from the time of its listing:

$$\text{SA1} = -0.737\text{Assets} + 0.043\text{Assets}^2 - 0.040\text{Firm's age}.$$

$$\text{SA2} = -0.737\text{Sales} + 0.043\text{Sales}^2 - 0.040\text{Firm's age}.$$

After the calculation of SA1 and SA2, results are divided into three quartiles where quartile 3 corresponds to FC firms and quartile 1 represents the firms which are FUC.

3.5 Distribution of firms into above and below target level

Data have been split into two subsamples: firms which hold cash above the optimal level and firms which hold cash below the optimal level. This idea of categorizing firms into above and below target firms is adopted from Rehman *et al.* (2016), Hovakimian *et al.* (2001) and Drobetz and Wanzenried (2006). Firms estimate a target or optimal level of cash holdings after making a tradeoff between the costs and benefits associated with holding more cash. First, the model is estimated by simple OLS regression which gives results comprising fitted values of regression. The resulting values of regressed fitted line represent the optimal level of cash. The values of fitted line are subtracted from the actual value of dependent variable (cash) and if the result is a positive number, it means that actual value is higher than the estimated value and the firm is above the optimal or target level of corporate cash holdings. Inversely, if the answer is a negative value, it means the firm is below the optimal or target level of cash holdings.

4. Discussion of results

4.1 Descriptive statistics

Table II comprises descriptive statistics for overall firms, and a representation of their number of observations, mean and standard deviation. The mean value (average value) for cash is 0.07 with the standard deviation of 0.14. The average value for firm size is 4.64 with the standard deviation of 0.8. For leverage, the average value is 1.16 and its standard deviation is 0.85. Operating cash flow has a mean value of 0.06 and standard deviation of 0.26. Mean value for growth is 2.10 with a standard deviation of 3.45. Average value for net working capital is −0.03 with a standard deviation of 1.77. The mean value for capital expenditure is 0.55 with a standard deviation of 0.43. Altman's *Z* score's mean value is 1.39 with a standard deviation of 1.5.

Table III corresponds to descriptive statistics for firms above the target level of corporate cash holdings and firms below the target level of corporate cash holdings. For determination of optimal or target level of cash, fitted value of OLS regression has been subtracted from actual cash values. The resulting values are both positive and negative where positive values correspond to those firms which have cash holdings above the optimal or target level and negative values represent the firms which have cash holdings below the optimal or target level of cash. In Table III, mean value of cash for above target firms is much higher than below target firms. Mean value of operating cash flow is also higher for above target

Variable	Obs	Mean	SD
CASH	1,924	0.07	0.14
SIZE	1,924	4.64	0.8
LEV	1,924	1.16	0.85
OCF	1,924	0.06	0.26
GROW	1,923	2.10	3.45
NWC	1,924	−0.03	1.77
CAPEX	1,924	0.55	0.43
ZSCORE	1,921	1.39	1.5

Table II. Descriptive statistics for overall firms

Notes: Obs, observations; *CASH*, cash (dependent variable); *SIZE*, firm size; *LEV*, leverage; *OCF*, operating cash flow; *GROW*, growth opportunities; *NWC*, net working capital; *CAPEX*, capital expenditure; *ZSCORE*, Altman's *Z* score

Variable	Above target Obs	Mean	SD	Below target Obs	Mean	SD
CASH	507	0.22	0.21	1,417	0.01	0.02
SIZE	507	4.78	0.9	1,417	4.59	0.75
LEV	507	1.1	1.06	1,417	1.18	0.76
OCF	507	0.1	0.18	1,417	0.05	0.28
GROW	506	3.40	4.1	1,417	2.51	3.2
NWC	507	−0.07	3.4	1,417	−0.02	0.39
CAPEX	507	0.52	0.73	1,417	0.57	0.23
ZSCORE	506	2.07	1.52	1,415	1.14	1.42

Notes: Obs, observations; *CASH*, cash (dependent variable); *SIZE*, firm size; *LEV*, leverage; *OCF*, operating cash flow; *GROW*, growth opportunities; *NWC*, net working capital; *CAPEX*, capital expenditure; *ZSCORE*, Altman's *Z* score

Table III. Descriptive statistics for above and below target firms

firms than for below target firms suggesting that above target firms tend to keep more cash to cope with liquidity crunches and financial distress. For leverage, mean value for both above and below target firms is not significantly different and it is slightly higher for below target firms which suggests that below target firms keep large amount of debts to deal with liquidity shortage. For growth opportunities, mean value is higher for above target firms than below target firms which means that firms try to hold more cash to finance higher growth opportunities. Mean value of net working capital is negative for both above and below target firms which indicates a large incurrence of current liabilities and a decrease in current assets. Capital expenditure is higher for below target firms than above target firms indicating that there are lower amounts of free cash flows to equity holders in below target firms and higher amounts of free cash flows are available to finance providers in above target firms.

4.2 Correlation matrix

Table IV represents correlation between all the variables of study. The last column corresponds to the variance inflation factor (VIF). To prove for the absence of multicollinearity, there should be no correlation between independent variable and the values of VIF must be less than 5. All the values of correlation matrix are within acceptable limits which correspond to the notion that there is no severe issue of correlation among independent variables. Furthermore, all values of VIF are also within the acceptable range (below 5). These two instances confirm the absence of multicollinearity between independent variables of the study.

4.3 Adjustment speed of overall firms

Arellano and Bond dynamic panel data model (GMM) is used to estimate Equation (4). Table V corresponds to the results of panel data regression for overall firms and the results are derived from applying GMM technique. In Table V, the value of coefficient is positive and statistically significant for lagged cash variable CASH (L1) where the value of coefficient is 0.583 and value of *t*-test is 22.67. It indicates that Pakistani firms follow the optimal or target level of cash holdings according to the tradeoff theory to keep a balance between costs and benefits of financing with debt and equity. The adjustment speed is calculated by subtracting the value coefficient of lagged cash variable from one.

The adjustment speed of overall firms is 0.417 (1−0.583) which is the indication of robustness of the results because the value of adjustment parameter ranges between 0 and 1. As the coefficient for the lagged value of cash is positive as well as statistically significant, it indicates that there is a partial adjustment policy followed by Pakistani firms toward the

	CASH	*SIZE*	*LEV*	*OCF*	*GROW*	*NWC*	*CAPEX*	*VIF*
CASH	1							
SIZE	0.05	1						1.28
LEV	−0.13	−0.24	1					1.18
OCF	0.10	0.01	−0.09	1				1.08
GROW	0.14	0.11	−0.13	0.14	1			1.06
NWC	0.07	0.05	−0.06	0.01	−0.09	1		1.03
CAPEX	−0.19	−0.04	0.38	−0.01	−0.02	0.006	1	1.02

Notes: *CASH* is the dependent variable cash which is measured through dividing the cash holdings of a firm by total assets. *SIZE* is the independent variable firm size which is the optimal size of a firm in a given industry and it is measured by taking natural logarithm of a firm's total assets. *LEV* is the independent variable leverage which refers to the investment of borrowed money and is measurement made by dividing total debt of firm by its total assets. *OCF* is the independent variable operating cash flow which is total amount of cash coming in and going out in a business and it is measured by dividing net operating cash flows of a firm with total assets. *GROW* is the independent variable growth which are prospects for a firm to invest in profitable projects. Their measurement is made by taking the ratio of market value of equity and book value of equity or in simple words, to divide market value of equity with book value of equity. *NWC* is net working capital that is the sum of all liquid assets and it is measured by subtracting current liabilities from current assets and then dividing the resulting figure with total assets. *CAPEX* is the independent variable capital expenditure which refers to the amount of money spent to acquire fixed assets and it is measured by dividing the amount of fixed assets by total assets. VIF is variance inflation factor

Table IV.
Correlation matrix

Variables	Coef.	SE	*t*-test	$p > t$
CASH				
CASH (L1)	0.583	0.025	22.67	0.000
SIZE	0.006	0.015	0.44	0.66
LEV	0.01	0.003	3.04	0.002
OCF	0.141	0.021	6.68	0.001
GROW	0.001	0.005	1.41	0.16
NWC	−0.001	0.028	−0.24	0.812
CAPEX	0.019	0.014	1.41	0.159
_CONS	−0.04	0.077	−0.64	0.523
Adj. rate	0.417			
No. of groups	200			
No. of instruments	52			
Sargan test	0.329			
Abond test	0.385			

Notes: GMM is Arellano and Bond estimation. *t*-test values are given in the table. *CASH* is measured by dividing the cash holdings of a firm by total assets. CASH (L1) is the lagged cash variable. *SIZE* is measured by taking natural logarithm of a firm's total assets. *LEV* is measured by dividing total debt of firm by its total assets. *OCF* is measured by dividing net operating cash flows of a firm with total assets. *GROW* is the independent variable growth opportunities and measured by taking the ratio of market value of equity and book value of equity. *NWC* is measured by subtracting current liabilities from current assets and then dividing the resulting figure with total assets. *CAPEX* is measured by dividing the amount of fixed assets by total assets

Table V.
Dynamic panel data regression results for overall firms (GMM)

optimal or target level of cash holdings; however, there is a delay in adjusting to target or optimal level of cash holdings which is due to the fact that firms do not immediately adjust their cash holdings to an optimal level but take some time because adjustment also entails some costs. The results are consistent with Shah (2011) who found the same behavior of Pakistani firms to adjust to the target level of cash. Earlier, Rehman and Wang (2015) and Rehman *et al.* (2016) found the same adjustment behavior in Chinese firms and suggested

that Chinese firms follow an optimal or target level of cash holdings and they adjust their cash holdings accordingly. This notion corresponds to a tradeoff model of cash adjustment.

The GMM estimation for overall firms has statistical validity which is tested through three post-estimation tests and other parameters. The number of groups is greater than the number of instruments. The number of groups is 200 and the number of instruments is 52. Sargan test and Abond test are also statistically insignificant having values of 0.329 and 0.385, respectively. Sargan test is for robustness of model and Abond test is to check second-order autocorrelation and it has confirmed the absence of second-order autocorrelation in the model. All the independent variables have also maintained their positive coefficients and statistical significance in GMM regression except net working capital which has a negative coefficient and it is statistically insignificant as well indicating a large incurrence of current liabilities.

4.4 Determinants of corporate cash holdings

Table V also shows the relationship of cash holdings with determinants of cash holdings. Coefficient for firm size is positive and also statistically significant which suggests that firms with higher profits tend to hoard more cash than firms having lower profits because larger firms enjoy economies of scale and large market shares so they keep huge cash reserves. This notion is consistent with some previous studies which are Opler *et al.* (1999), Shah (2011) and Rehman *et al.* (2016). Leverage is also positive and statistically significant which is in line with the previous research on tradeoff theory. Firms with high debt to assets ratio tend to keep large cash reserves to cope with bankruptcy risk and financial crisis. Highly levered firms accumulate cash reserves by following precautionary motive of holding cash. The same results were derived by Rehman *et al.* (2016).

Cash flow has a positive coefficient and it is significant as well which means that firms having huge amounts of cash inflow tend to have larger cash reserves and a large portion of cash flow is reserved as cash to be used as a ready source of liquidity later on. The results are consistent with Ferreira and Vilela (2004) and Shah (2011). Consistent with previous studies including Ozkan and Ozkan (2004), Chen (2008) and Duchin (2010), growth opportunities (*GROW*) also have a positive and significant sign which indicates that firms having higher growth opportunities also keep larger amounts of cash reserves because their high market-to-book ratio represents more growth opportunities for them and they keep cash reserves to finance their valuable projects. The results are in conformity with the pecking order and tradeoff theory. Net working capital has a positive coefficient yet it is statistically insignificant which means that there is excess of current liabilities incurred by firms and that there is a longer cash conversion cycle as well. For capital expenditure, both the sign and coefficient are positive which is according to the tradeoff theory which holds that firms having high capital expenditure tend to keep large cash in their reserves. This result is in line with Opler *et al.* (1999) and Rehman *et al.* (2016).

4.5 Adjustment speed for above and below target firms

Table VI shows regression results for above and below target firms. In case of above target firms, the value adjustment coefficient for lagged cash variable (CASH (L1)) is 0.373 which is positive and statistically significant with *t*-test value (9.71). For below target firms, the value of adjustment coefficient for lagged cash variable (CASH (L1)) is 0.502 which is also positive and statistically significant with *t*-test value (35.69). When adjustment coefficients of lagged cash variable are subtracted from 1, we obtained adjustment rate of 0.63 (1−0.37) and 0.5 (1−0.5) for above and below target firms, respectively. The positive and statistically significant lagged coefficient of cash holdings depicts the presence of tradeoff behavior across symmetry.

	GMM							
	Above target firms				Below target firms			
Variables	Coef.	SE	*t*-test	$p > t$	Coef.	SE	*t*-test	$p > t$
CASH								
CASH (L1)	0.373	0.038	9.71	0.000	0.502	0.014	35.69	0.000
SIZE	0.039	0.032	1.21	0.225	−0.023	0.017	−1.29	0.196
LEV	−0.019	0.007	−2.47	0.014	0.004	0.002	1.94	0.052
OCF	0.148	0.02	7.26	0.001	0.04	0.009	4.46	0.001
GROW	0.009	0.001	9.08	0.001	−0.005	0.004	−1.42	0.156
NWC	−0.004	0.003	−0.13	0.90	0.027	0.008	3.14	0.002
CAPEX	0.008	0.018	0.43	0.667	0.004	0.012	0.03	0.973
_CONS	−0.099	0.161	−0.61	0.539	0.105	0.084	1.26	0.208
Adj. rate	0.63				0.5			
No. of groups	200				200			
No. of instruments	52				52			
Sargan test	0.395							
Abond test	0.098							

Notes: GMM is Arellano and Bond estimation. *t*-test values are given in the table. *CASH* is measured by dividing the cash holdings of a firm by total assets. CASH (L1) is the lagged cash variable. Firm size is measured by taking natural logarithm of a firm's total assets. Leverage is measured by dividing total debt of firm by its total assets. Cash flow is measured by dividing net operating cash flows of a firm with total assets. Growth opportunities are measured by dividing market value of equity with book value of equity. Net working capital is measured by subtracting current liabilities from current assets and then dividing the resulting figure with firm's total assets for the purpose of scaling. Capital expenditure is measured by dividing the amount of fixed assets by total assets

Table VI.
GMM regression results for above and below target firms

The results indicate that downward adjustment speed is higher than upward adjustment speed and the findings are consistent with Rehman *et al.* (2016) who tested and proved the same argument. Thus, the results provide a significant support for acceptance of our hypothesis that downward adjustment speed is higher than upward adjustment speed of corporate cash holdings. The number of groups is greater than the number of instruments for GMM and Sargan and Abond tests have shown insignificant values.

4.6 Financial constraints and adjustment speed of cash holdings

Tables VII and VIII represent results for speed of adjustment of corporate cash holdings with financial constraints. GMM estimation has been given. For financial constraints, three measures have been used. Table VII solely represents results for Altman's *Z* score measure of financial constraints while Table VIII shows results for SA1 (based on assets to measure financial constraints) and SA2 (based on sales to measure financial constraints). The coefficients of lagged cash variable CASH (L1) are positive and statistically significant across all three measures of financial constraints which is the clear indication of the fact that Pakistani firms tend to follow an optimal or target level of cash holdings in both situations of FC and FUC. Adjustment coefficient which is the coefficient of lagged cash variable (CASH (L1)) for Altman's *Z* score for FC and FUC firms is 0.085 and 0.43, respectively.

Based on the results of GMM for Altman's *Z* score measure of financial constraints, adjustment rate is 0.92 (1−0.085) and 0.57 (1−0.43) for FC and FUC firms, respectively. The number of groups is greater than the number of instruments. Sargan test and Abond test are also insignificant.

In Table VIII, adjustment speed for SA1 index is 0.604 (1−0.396) and 0.442 (1−0.558) for FC and FUC firms, respectively. For SA2 index, adjustment speed is 0.73 (1−0.27) and 0.452 (1−0.548) for FC and FUC firms, respectively. Based on the results of above three measures

	Z score							
	Constrained firms				FUC firms			
Variables	Coef.	SE	*t*-test	$p > t$	Coef.	SE	*t*-test	$p > t$
CASH								
CASH (L1)	0.085	0.022	8.71	0.000	0.43	0.019	21.91	0.000
SIZE	−0.01	0.028	−5.39	0.001	−0.022	0.029	−0.75	0.46
LEV	0.001	0.007	0.22	0.824	0.041	0.008	4.87	0.001
OCF	0.024	0.022	12.78	0.001	0.158	0.02	7.89	0.001
GROW	0.001	0.001	2.82	0.005	0.001	0.001	2.53	0.001
NWC	0.001	0.031	2.26	0.024	0.031	0.028	1.100	0.27
CAPEX	−0.001	0.032	−0.47	0.642	−0.064	0.035	−1.79	0.07
_CONS	0.072	0.145	5.87	0.001	0.114	0.15	0.76	0.45
Adj. rate	0.92				0.57			
No. of groups	122				125			
No. of instruments	52				52			
Sargan test	0.55				0.1			
Abond test	0.79				0.38			

Notes: *t*-test values are given in the table. GMM is Arellano and Bond estimation. *Z* score is Altman's *Z* score. *CASH* is measured by dividing the cash holdings of a firm by total assets. CASH (L1) is the lagged cash variable. Firm size is measured by taking natural logarithm of a firm's total assets. Leverage is measured by dividing total debt of firm by its total assets. Cash flow is measured by dividing net operating cash flows of a firm with total assets. Growth opportunities are measured by dividing market value of equity with book value of equity. Net working capital is measured by subtracting current liabilities from current assets and then dividing the resulting figure with firm's total assets for the purpose of scaling. Capital expenditure is measured by dividing the amount of fixed assets by total assets

Table VII. Altman *Z* score's regression results for FC and FUC firms (GMM)

of financial constraints, there is no considerable evidence in support of our second hypothesis that FUC firms have higher adjustment speed for cash holdings than FC firms.

According to our findings, FC firms move more quickly toward optimal level of cash holdings than FUC firms in case of deviation from the target level of cash. The results are consistent with Rashid and Ashfaq (2017) and Han and Qiu (2007) who also found a higher tendency of accumulating cash by FC firms than FUC firms. Higher levels of cash holdings in FC firms are associated with higher investment and hedging needs. Furthermore, large cash reserves allow FC firms to undertake certain profitable investments which might otherwise be ignored. FC firms also hoard cash to avoid costly external financing. The model estimations for all the measures of financial constraints are statistically significant because all have shown more number of groups than number of instruments. Sargan test is also insignificant to prove that the results are robust. Abond test is also insignificant which shows the absence of second-order autocorrelation.

4.7 Downward and upward adjustment speed across financial constraints

Table IX corresponds to GMM regression results for asymmetric adjustment speed of corporate cash holdings to the target level while incorporating firm's financial constraints. Firm-level observations above the optimal or target level of cash holdings are given in the first three columns of Table IX while observations below the optimal level are presented in the last three columns of Table IX. Panel A represents Altman's *Z* score measure of financial constraints. Panel B corresponds to SA1 measure and Panel C is for SA2 measure of financial constraints. In Panel A for Altman's *Z* score, downward adjustment speed for above target firms is 0.77 and 0.99 for FC and FUC firms, respectively. Upward adjustment speed for below target firms is 0.81 and 0.54 for FC and FUC firms, respectively. It indicates that downward adjustment speed is higher only with FUC firms and upward adjustment

Variables	Constrained firms Coef.	SE	*t*-test	$p > t$	FUC firms Coef.	SE	*t*-test	$p > t$
SA1 index								
CASH								
CASH (L1)	0.396	0.000	841.7	0.000	0.558	0.014	39.86	0.000
SIZE	−0.172	0.001	−101.5	0.001	0.042	0.013	3.08	0.002
LEV	0.001	0.001	−0.90	0.346	0.021	0.003	5.44	0.001
OCF	0.001	0.001	208.7	0.001	0.163	0.016	9.67	0.001
GROW	0.001	0.001	85.5	0.001	0.001	0.001	−0.19	0.85
NWC	0.002	0.001	30.4	0.001	0.13	0.02	6.73	0.001
CAPEX	−0.03	0.001	−72.4	0.001	−0.036	0.013	−2.72	0.007
_CONS	0.65	0.001	66.2	0.001	−0.22	0.078	−2.89	0.004
Adj. rate	0.604				0.442	0.986		
No. of groups	62				92			
No. of instruments	52				52			
Sargan test	0.21				0.37			
Abond test	0.32				0.49			
SA2 index								
CASH (L1)	0.27	0.000	336.12	0.000	0.548	0.016	33.99	0.000
SIZE	−0.09	0.001	−61.3	0.001	−0.03	0.011	−2.77	0.006
OCF	0.037	0.001	88.16	0.001	0.142	0.012	11.01	0.001
GROW	0.001	0.001	26.97	0.001	0.001	0.001	2.58	0.01
NWC	0.001	0.001	−30.78	0.001	0.039	0.026	1.5	0.134
CAPEX	−0.01	0.001	−4.84	0.001	−0.102	0.011	−8.77	0.001
_CONS	0.377	0.001	44.6	0.001	0.187	0.062	2.99	0.003
Adj. rate	0.73				0.452			
No. of groups	79				92			
No. of instruments	52				52			
Sargan test	0.44				0.31			
Abond test	0.61				0.07			

Notes: *t*-test values are given in the table. GMM is Arellano and Bond estimation. SA1 is assets-based measure of financial constraints. SA2 is sales-based measure of financial constraints. Cash is measured by dividing the cash holdings of a firm by total assets. CASH (L1) is the lagged cash variable. Firm size is measurement made by taking natural logarithm of a firm's total assets. Leverage is measured by dividing total debt of firm by its total assets. Cash flow is measured by dividing net operating cash flows of a firm with total assets. Growth opportunities are measured by dividing market value of equity with book value of equity. Net working capital is measured by subtracting current liabilities from current assets and then dividing the resulting figure with firm's total assets for the purpose of scaling. Capital expenditure is measured by dividing the amount of fixed assets by total assets

Table VIII.
SA index's regression results for FC and FUC firms (GMM)

rate is higher only for FC firms. These are mixed results with no clear indication that downward adjustment speed is higher even after financial constraints are controlled.

Higher downward adjustment speed for FUC firms is due to excess cash holdings by these firms and higher upward speed for FC firms is because of the reason that these firms hold more cash to cope with cash flow volatility and financial crisis. Based upon GMM estimates for Altman's Z score, the results are not consistent with our third hypothesis. According to SA1 measure in Panel B, downward adjustment speed for FC and FUC firms is 0.58 and 0.47, respectively. For below target firms, this speed is 0.61 and 0.58 for FC and FUC firms, respectively. It indicates that upward adjustment speed is higher than downward adjustment speed after controlling for financial constraints. Furthermore, while analyzing SA2 measure in Panel C, downward adjustment speed is 0.67 and 0.67 for FC and FUC firms, respectively, and for below target firms, adjustment speed is 0.6 and 0.56 for FC and FUC firms, respectively. It indicates that downward adjustment speed is higher than

	Above target		Below target	
	Constrained	FUC	Constrained	FUC
Panel A: ZSCORE				
Adj. rate	0.77	0.992	0.81	0.54
CASH (L1)	−0.23*** (−14.66)	−0.008* (−0.49)	0.19*** (14.34)	0.46*** (33.65)
No. of groups	27	67	114	100
No. of instruments	44	52	52	52
Abond test	0.27	0.59	0.5	0.04
Panel B: SA1				
Adj. rate	0.58	0.47	0.61	0.58
CASH (L1)	0.42*** (11.61)	0.53*** (64.21)	0.39*** (1420)	0.42*** (53.43)
No. of groups	26	45	57	81
No. of instruments	51	52	52	52
Abond test	0.9	0.66	0.13	0.39
Panel C: SA2				
Adj. rate	0.67	0.67	0.6	0.56
CASH (L1)	0.33*** (−11.16)	0.33*** (−14.65)	0.4*** (−1628)	0.44*** (−43.15)
No. of groups	30	45	70	84
No. of instruments	49	52	52	52
Abond test	0.69	0.13	0.34	0.33

Notes: *t*-test values are given in the table. *Z* score is Altman's *Z* score. SA1 is assets-based measure of financial constraints. SA2 is sales-based measure of financial constraints. GMM is Arellano and Bond estimation. Cash is calculated by dividing the cash holdings of a firm by total assets. CASH (L1) is the lagged cash variable. *,***Statistical level of significance at 90 and 99 percent, respectively

Table IX.
Regression results for asymmetric speed and constraints

upward adjustment speed even after controlling for financial constraints. The result is consistent with the findings of Rehman *et al.* (2016) who reported the same results for SA2 measure of financial constraints yet they presented the same findings for SA1 measure and for Altman's *Z* score as well.

For firms to move downward or to adjust to their optimal or target level of cash holdings, it is quite easy because they can pay taxes, dividends and make investments in profitable ventures to cut down their excess cash holdings. Although the results of SA2 measure of financial constraints support our third hypothesis, Altman's *Z* score and SA1 measure did not provide any substantial support to this hypothesis that is why it is rejected.

5. Conclusion

The main focus of this study is to find out the upward and downward adjustment behavior of Pakistani firms toward their optimal or target level of cash holdings. Prior research studies of capital structure (Drobetz and Wanzenried, 2006; Almeida *et al.*, 2004; Han and Qiu, 2007; Al-Najjar, 2013) have been followed to understand the tendency of firms to opt for a target level of cash and for this purpose, firms have been divided into above and below target firms. For the estimation of adjustment speed for above and below target firms, Arellano and Bond (GMM) estimator has been used which is a dynamic model for panel data regression and is suitable to analyze the speed of adjustment of firms. On the first stance, the results prove that downward speed of adjustment is higher than upward speed of adjustment and it is because of the reason that firms with cash holdings above target level can easily cut down their cash reserves either by making necessary debt payments or by investing in profitable projects. Financial constraints have also been incorporated in our research model to check for the adjustment speed of FC and FUC firms and to prove that the downward speed of adjustment still remains higher even after controlling for financial

constraints. But when it comes up with financial constraints, there is not any considerable evidence that this speed of adjustment holds after controlling for financial constraints. Furthermore, this study uses three measures of financial constraints (i.e. Altman's *Z* score, SA1 index and SA2 index) to explore the adjustment speed of corporate cash holdings but all three measures failed to provide any substantial support to our hypotheses.

The results are mixed as at the first place, FC firms have appeared to adjust more speedily then FUC firms and second, there is no evidence of higher rate of downward adjustment of cash holdings after controlling for financial constraints. The results are consistent with Rashid and Ashfaq (2017) who also found a positive association between corporate cash holdings and financial constraints. But for asymmetric adjustment of cash holdings across financial constraints, there is no evidence from prior literature which gives the same results.

This study fails to conciliate financial constraints to address the adjustment speed of corporate cash holdings and it is because of the fact that Pakistani firms do not adjust promptly to their optimal level when they are FC as they do not have certain valuable assets in their portfolio which can be offered as collateral to back the debt service and they may also run out of cheap debt obligations, they are mainly affected by information asymmetry, they ought to borrow at high costs and their small size, young age, lower level of income also make them to hoard more cash but still they do not adjust to the target level of cash holdings. Moreover, Pakistani firms with high levels of cash holdings are prone to financial distress (Afza and Adnan, 2007; Kruja and Borici, 2016), suffer more from cash flow volatility and spend huge amounts of cash on research and development. These factors also restrict their downward adjustment speed toward target level of cash.

There are no alternatives available to Pakistani firms for their downward adjustment of cash holdings when financial constraints are involved. There are more adjustment costs associated with downward adjustment than for upward adjustment of cash holdings. For example, Pakistani firms may have their debts matured and payable so they need to pay them first instead of using cash immediately, or they may have dividends outstanding so they need to make dividends payments immediately. These adjustment costs make it difficult for Pakistani firms to adjust quickly to their optimal level of cash. Moreover, high dividend payout ratio and firm's age also hinder the speedy adjustment of corporate cash holdings in Pakistani firms because these factors are considered as internal financial constraints (Azam and Shah, 2011), and costly external financing is also a hurdle for firms to adjust quickly to their optimal or target level of cash. Moreover, transaction costs, opportunity costs, agency costs of financial upsets and high investment costs are other important factors responsible for lower downward speed of adjustment of Pakistani firms (Azmat, 2014).

The results are specifically useful for managers, policymakers, investors and researchers. Cash holdings policies can be revised according to the results of this study and to understand the adjustment behavior of FC and FUC firms toward an optimal or target level of cash. As FC firms appear to hoard more cash in their reserves, these findings are particularly helpful for policymakers that if they want to reduce the intensity of financial constraints, they must take steps to reduce barriers to inter-financial markets and take initiatives to improve the functioning of overall capital markets.

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