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Cash Flow Volatility and Corporate Investment: Evidence from Pakistan's Non-Financial Firms

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Abstract: This study deals with the impact of cash flow volatility on the corporate investment behaviour of Pakistan's non-financial firms. In order to do this analysis, we use the data from 2006 to 2015 for a sample of 274 non-financial firms and apply the Generalized Method of Moments (GMM). We find that cash flow volatility inversely affects investment decisions of the firms. Onwards, we decompose firms in terms of financial constraints and, accordingly, do separate analysis for financially constrained and unconstrained firms. For decomposition of firms, we use the methods of Total Assets and Dividend Pay-Out Ratio. The decomposed analysis shows that the financially constrained firms are more vulnerable to cash flow volatility as compared to unconstrained firms. However, the magnitude of vulnerability is sensitive to the criteria used for decomposition.

Keywords: Cash Flow Volatility, Corporate Investment, Dividend, Non-Financial Firms, Financially Constrained Firms, Financially Unconstrained Firms

JEL Classification: D25, G35, M41, G3

1. Introduction

Cash flow is the amount of cash generated by a firm from its operating activities. It indicates whether a firm is capable of generating sufficient cash flow to maintain or expand its operations. In case of failure, it may require external funds for capital expansion. Thus, understanding the dynamics of uncertainty (volatility) in cash flow behaviour is of primary concern to the agents associated with firms. Cash flow volatility can cause inefficiencyby distracting managers' concentrationfrom productive activities to non-productive activities like defermentin capital expenditure or delay in debt repayments etc.[1] In some instances, variations in cash flow can be smoothened out by making use of external capital (Myser and Majulf, 1984).[2] However, the cost of external capitalare usually higher than those of the internally generated funds. This cost, in particular, causes firms to cut down their investment spending. According to Bond and Meghir (1994), internally-generated funds are available at lower prices than external funds for investment. Moreover, utilizing internal funds also decrease the tax cost for the firm. Nevertheless, a higherlevel of cash flow volatilitycauses deficiency in internally generated cash flow, which, in turn, diminishes the capability offirm to finance its desired

investment.[3] In case of higher volatilecash flow,the expected future cash flow and earnings level of the firms shrink; and, also, their investmentpattern becomesuneven over the time (Smith and Stulz, 1985 and Froot *et al.*, 1993).Thus, firms facing high volatility in cash flow temporarily limit their investment spending and employment until they find precise solution toovercome the problem (Bloom, 2009).

In addition to the internal dynamics, there are external costs associated with volatile cash flow. For instance, it creates information asymmetry which, in turn, diminishes the supply of external funds (Amihud and Mendelson, 1988;Trueman and Titman, 1988; Walther and Willis, 1999). All of these result in increasing the probability of firms' default and can adversely affect firms' value.[4]In contrast, firms that experience lesser volatility in cash flow; their earnings profile are forecasted more accurately which enhances their financial stability. (Waymire, 1985). Financial stability directly affects firms' management decisions and risk management policy. Usually the firms holding smooth cash flows are highly valued by agents relative to those having volatile cash flow. Consequently, the agents (suppliers and customers) do not prefer to engage in business with those firms which exhibit higher cash flow volatility. This in turn lower the future performance of the firms (Shapiro and Titman, 1986).

The investment decisions of firm are certainly sensitive to the cash flow volatility. However, the degree of sensitivity between the two depends upon the underlying financial status and various other characteristics of the firms. Usually, the cash flow investment-sensitivity is perceived to be higher for financially constrained firms as compared toun-constrained firms (Fazari *et al.*, 1988).[5] However, it clearly defends upon the operating situation of firms. For instance, financially constrained firms which operate at profit level are less vulnerable as compared to those which operate at losses (Bhagat *et al.* 2005). It is still undisputed that whenever the financially constrained firms face volatile cash flow; they react more repulsive by cutting their investment spending by a higher portion as compared to unconstrained firms. Alternatively, the relationship between cash flow volatility and firms' investment depends upon the degree of financial constraints of firms (Kefee and Tates, 2013). Additionally, the cash flow volatility is also affected by the amount of financial slack.[6] Firms whose cash flow is more volatile than their competitors maintain a higher level of financial slack. As a result, their investment spending become less sensitive to volatility in internally generated cash funds (Cleary, 2006).

Cash flow volatility encompasses additional information about the performance of a firm. Therefore, while forecasting future cash flow and earnings level of a firm, the volatility of cash flow should be incorporated in forecasting models, in orderto obtain more accurate and less biased results (Brennan and Hughes, 1991; Schipper, 1991 and Minton *et al.* 2002).In the recent research debate cash flowvolatility holdan important part. Unfortunately, the

existing studies on corporate structure principally focused the role of cash flow in level form while forecasting future cash flows, investment decisions and earnings level of the firms.Nevertheless, lesser attention is devotedto an imperativematter that how fluctuations in cash flowaffect the investmentbehaviour of the firms (Minton and Schrand, 1999 and Abadeh and Janatpour, 2014), and howthe investmentstructure of different financial naturefirms (financially constrained and unconstrained) remainsensitiveto volatility incash flow (Han and Qui, 2007 and Keefe and Tates, 2013).

Considering the relevance of cash flow volatilityfrom the aforementioned discussion, this study is intended to explore the consequences of cash flow volatilityfor the investment behaviour of non-financial firms of Pakistan. The unpaid attention to the said phenomena in the context of Pakistan left potential gap to be evaluated.[7] Our contribution to the existing literature is twofold.Firstly, in this study, we dissect the consequences of cash flow volatility for the investment behaviourof non-financial firms of Pakistan. For this purpose, we incorporate cash flow volatility in investment model to evaluate how these firms respond to such volatility. Secondly, we split the aggregate sample into financially constrained and unconstrained firms on the basis of total assets and pay-out ratio to analyse their behaviour separately towards cash flow volatility. The reason behind performing disaggregated analysis is that financially constrained firms face difficulties in acquiring funds from external capital market thus investment spending of financially constrained firms are more sensitive to cash flow and these firms response differently to cash flow shocks (Cleary, 2006; Han and Qui, 2007; Denis and Sibilkov, 2009 and Kefee and Tates, 2013). By differentiating the sample,we are able to avoid any bias that might be caused by the diversified nature of firms. This division of the firms would enhance our understanding to observe that which category of the firms are more sensitive to the cash flow volatility in Pakistan.

Hypothesis Development

Summing the above discussion, it remain an open empirical questions that whether the cash flow volatility effect the investment behaviour of the non-financial firms in Pakistan, and whether the relationship between cash flow volatility and investment spendingdriven by the level of financial tightness, that isthe degree of sensitivity of investment to cash flow volatility affected by the financial position of the firms. To address these questions,we set the following two hypotheses:

*H*1: Cash flow volatility affect the investment behaviour of non-financial firms in Pakistan.

H2: The degree of sensitivity between cash flow volatility and investment spending depends upon the level of financial status of the firms. Financially constrained firms are more sensitive to cash flow volatility than unconstrained firm.

2. Review of Literature

There is considerable research work which focus on the role of cash flows in the investment decisions of firms. This section provides some prior work on cash flow, cash flow volatility and corporate investment, to have some idea about the current development in literature.In the structure of frictionless markets, corporate investment is a direct function of a firm's investment opportunity set (Modigliani and Miller, 1958).[8] Alternatively, corporate investment is considered as independent from internally generated funds and its volatility. However, in case of imperfect capital market, the cost of capital is usually higher which results in a decline in investments of the firms (Fazzari *et al.* 1998; Minton and Schrand, 1999). In this regard, the seminal work of Minton and Schrand (1999) finds that cash flow volatility has significant negative effect on firms' investment and has significant positive effect on the cost of external capital.[9]Minton *et al.* (2002) find similar results by proving that cash flow volatility adversely affects investment outlay and future cash flow of the firms. However, Abadeh and Janatpour (2014) find contrasting results by claiming that cash flow volatility does not contribute to investment decisions of the firms.

Deshmukh and Vogt (2005) while keeping in view hedging, point out that cash flow volatility decreases firms' investment spending; however, hedging of cash flow can help in cash flow stability and investment decisions of firms. In other words, it implies that hedger firms are less sensitive to cash flow volatility as compared to non-hedger firms. Booth and Cleary (2006) reveal that cash flow volatility negatively affects investment decisions of financially constrained and unconstrained firms; but the intensity is high in case of financially constrained firms. However, when these firms hold higher level of financial slack; their investment decisions become less sensitive to volatility as compared to those constrained firms which hold lower level of financial slack. Similarly,Keefe and Tate (2013) show that financially constrained firms decrease their investment expenditures when they experience high volatility and negative growth in cash flow. However, firms do not decrease investment until the growth of cash flow remains positive irrespective of cash flow volatility.

Cleary (2006) examined the investment decisions of different firms from seven largest economies. He observes that investment-cash flow sensitivity of financially unconstrained firms is higher than constrained firms. Firms which experience higher cash flow volatility are found to be less investment-cash flow sensitive. Similarly, in recent work, Mulier *et al.* (2014) confirmed the findings of Cleary (2006) by employing firm level data of six European countries their findings confirm that investment-cash flow sensitivity is higher for financially constrained than for unconstrained firms. The Study also documented that positive shock in cash flow of constrained firms reduces demand and cost of external funds severely which in turn boost up their

investment spending. They also observed that within the same level of constraints, firms whose cash flow are less volatile have higher investment-cash flow sensitivity.Besides its negative effect on investment, volatility also negatively affects corporate employment as shown by the study of Bhagat and Obreja (2013).[10]

Examining the dynamics of corporate cash holding, Bates *et al.*, (2009) consider the largest set of U.S firms over the period of 1996 to 2006. Utilizing the OLS estimation technique, they confirm that firms with volatile cash flow, poor access to external capital market and better investment opportunities accumulate more cash. The adverse shocks in cash flow create fear about funds shortage which adversely affect investment spending of the firms. The study of Han and Qui (2007) although employing different econometric technique (GMM) on quarterly data of U.S firms also support the findings of Bates *et al.*, (2009). They observe a negative relationship between cash flow volatility and investment spending, while theypredictpositive correlation between cash holdings for financially constrained firms, yet this relationship remain insignificant for unconstrained firms. The findings of the study confirm that cash holdings of a firm depend on financial tightness because financial constraints make inter-temporal trade-off between current and future investment.The findings of the prior two studiesabout cash flow volatility is supported by Rizwan and Javed, (2011)in the context of Pakistan for corporate cash flow holding.While, scrutinizingthe behaviour of non-financial firms of Pakistan listed at Karachi Stock Exchange (KSE) the authors perceivethat cash holdings is positively explained by cash flow volatility, net assets, cash flow, whereas negatively correlated with leverage, net working-capital and capital expenditures. The firms accumulate cash because usually they prefer to utilize internal funds while investing in projects that have positive NPV. The findings of Rizwan and Javed, (2011) are supported by Olper *et al.* (1999) who observed that firms with excessive volatile cash flow and involve in riskier activities accumulate more liquid assets. They claimed that firms generally hold more cash and liquid assets for future investment when they expect the future cash flow shortfall and increase in the cost of external funds.

Discussing the role of cash flow in corporate investment, Saquido (2003) examines 233 firms of Philippine. The author employs OLS and GLS estimation techniques and argued that cash flow is highly significant determinant of investment spending of the firms, however, any distortion in cash flow leads to decrease investment spending. The positive relation of cash flow with investment specify the imperfection of capital market, which leads to finance hierarchy. Haque *et al.*, (2014) alsoexamine the determinant of investment in the setting of Pakistan by using 159 textile firms listed at KSE over the period of 1998 to 2011. They employ OLS estimation method for analysis and conclude that cash flow is significant and positively related with investment expenditures of the firms.The managers initially utilize internally generated

funds for financing of projects then go for external financing in case of internal cash flow deficiency.

3. Models Specification, Data and Methodology

In this section, we provide the methodological framework for our analysis. Besides, we shed light on data and the econometric technique for our analysis.

3.1. Model Specification

We follow Minton and Schrand (1999) in order to see the firms' investment behaviour in the presence of volatile cash flow. To predict firms' investment sensitivity toward cash flow fluctuations, wecontrol for several firms' specific characters such as leverage, market-to- book ratio and sales growth.The following model examines the relationship between investment and cash flow volatility:

$$INV_{i,t} = \beta_1 + \beta_2\sigma_{it} + \Sigma\beta_j X_{i,t} + \varepsilon_{i,t}$$

Whereas '*i*' represent *i*thfirm index and '*t*' denotes index of time period, $INV_{i,t}$ and σ_{it} denote investment spending and cash flow volatilityrespectively.[11] $X_{i,t}$ is the vector of control variables. To control for investment opportunities, we use two proxies: Market-to-Book ratio and Sale Growth. The benefit of using sale growth, which is growth in net sale, as second proxy for investment opportunities is that it shows a non-price-based measure of investment opportunities. Further, we also use additional control variable such as operating cash flow and leverage ratio. Accordingly, equation 1 can be extended accordingly.

$$\text{INVi,t} = \beta_1 + \beta_2\, CF_{i,t} + \beta_3\sigma_{it} + \beta_4\, MBR_{i,t} + \beta_5 SG_{i,t} + \beta_6 Lev_{i,t} + \varepsilon_{i,t} \quad (2)$$

$CF_{i,t}$ is Cash flow from operation. $MBR_{i,t}$ is Market-to-Book ratio and $SG_{i,t}$ is Sale growth. $LEV_{i,t}$ is Leverage ratio and $\varepsilon_{i,t}$ is the corresponding error term.[12] Firstly, we estimate equation 2 forthe entire sample to examine the relationship between cash flow volatility and investment spending of the firms.Onwards, wesplit the sample into financially constrainedand unconstrained firms on the basis of total assets and dividend pay-out ratio. The decomposition is aimed at looking at the intensity of cash flow volatility on investment spending of each of the two sets of the firm. To decompose the firms into financially constrained and unconstrained sets, we use total assets and pay-out ratio.[13] In case of total assets,firms with total assets above the sample median for a given year will be classified as financially unconstrained due to the fact that these firms can easily access external capital market to obtain external finance with lower cost. On the other hand, firms having total assets below the sample median are considered as financially constrained firms. In case of pay-out ratio, firms which do not pay dividend signify that they do not have sufficient internal funds to distribute among shareholders; therefore, they avoid dividend payment. Such firms would be classified as financially constrained firms

whereas firms with a positive pay-out ratio would be categorised into financially unconstrained.

3.2. Sample Selection, Data and Estimation Technique

We use a panel data of 274 non-financial firms of Pakistan listed at Karachi Stock Exchange. Firms' selection is purely based on the availability of the data. The sample cover total time span of ten years, starting from 2006 to 2015. Data for these firms is taken from "Balance Sheet Analysis of Joint Stock Companies" published by the State Bank of Pakistan (SBP). Since, our study is based on panel data, therefore, weresort to Panel Data Models. In the panel data, we have different conventional estimation techniques such as Fixed Effect (FE), Random Effect (RE) and Pooled OLS. However, the problem with these method is that they could not tackle the problem of endogeneity which might be caused by reverse causality in this case.For instance, in the presence of the problem of potential endogeneity, these methods produce bias estimates, which could not be furthered for any policy option. So, in such a situation, the best available option is to move towardsthe Two Stage Fixed Effect (IVFE) model. However, in the presence of the heteroscedasticity the IVFE does not provide efficient estimates, and this could obviously suspect the significance pattern of the parameters estimates.[14] Furthermore, the 2SLS is a static technique where we could not include the lag of the dependent variable as a regressor to correct the problem of autocorrelation. A prominent econometric technique to avoid the aforementioned problems of endogeneity, reverse causality, heteroscedasticity and autocorrelation is Generalized Method of Moment (GMM). GMM is the extension of Instrumental Variable (IV) technique. The Basic advantage of GMM approach is that the model to be estimated is not necessarily to be homoscedastic and serially independent (Blundell and Bond, 1999). Thus, GMM produce consistent and efficient estimates even in the presence of heteroskedasticity (Perera and Lee 2013).[15]. In order to avoid problem of endogeneity and reverse causality, this study favours to use system GMM technique. System GMM estimates a set of two equations, one in level form which uses suitable lag level as an instrument and the other one is difference form that utilizes lag first difference as an instrument. System GMM combines both sets of moment conditions as a linear GMM estimator which cover both level and difference equations. In this study System GMM is applicable because the basic condition for applying GMM is that number of cross section (N) should be greater than number time series (T), and in our case number of cross section is two hundred and seventy four (i.e., N=274) while number of time series is ten (i.e., 10).

4. Empirical Results and Discussion

We provide the empirical results of our analysis in this section. Firstly, we discuss the aggregate analysis. Onwards, we discuss the disaggregated analysis.

4.1. Aggregated Analysis

Under the aggregated sample analysis, allthe 274 firms are included in estimation procedure to see the effect of cash flow volatility on investment expendituresof the firms. Table 1presents these results.Before moving to interpret the results obtained through GMM, we check the appropriateness and adequacy of the model. The appropriateness and adequacy of model is tested by using Arellano-Bond AR test and Hansen test of over identifying restrictions. The null hypothesis of Arellano-Bond AR (2) test states that instruments are valid, i.e.Instruments are not correlated with error term. While,the null hypothesis of Hansen test states that instruments as a group are exogenous, i.e. they are the true representors of the endogenous variables. The probability values of Arellano-Bond AR (2) and Hansen test of over-identification restrictions for GMM model (1) are reported in the first column of the table.[16] The probability value of Arellano-Bond AR (2) is0.661which is enough high to accept null hypothesis that instruments are valid.Whereas, the probability value of Hansen test is0.481, indicating that instrument as a group are exogenous.[17] Correspondingly, the probability values of Arellano-Bond AR (2) and Hansen test of the GMM model (2), based on log investment proxy is reported in the second column of the table. The probability values of

Table 1: Impact of Cash Flow Volatility and other Factors on Corporate Investment (FullSample)

	Dependent Variable is Investment/ Lag Fixed Assets	*Dependent Variable is Log Investment (I)*
Explanatory Variables	*GMM Model (1)*	*GMM Model (2)*
Lag Investment	0.614***	0.263***
	(0.006)	(0.042)
Log Cash flow	0.451***	0.176**
	(0.137)	(0.075)
Log Cash flow Volatility	-0.259***	-0.130**
	(0.026)	(0.062)
Market-to-Book ratio	0.384*	0.078**
	(0.205)	(0.035)
Sale growth	0.189**	0.093
	(0.093)	(0.065)
Leverage	-0.152*	-0.063**
	(0.081)	(0.028)
Constant	2.297***	-3.561
	(0.147)	(2.339)
No. of Observation	2,740	2,740
No. of Cross-Section	274	274
Arellano- Bond AR (2)(P-value)	0.661	0.217
Hansen test of overid. restrictions (P-value)	0.481	0.107

Robust standard errors in parentheses, ***, ** and * represent 1%, 5% and 10% significance level respectively.

Arellano-Bond AR (2)and Hansen testis0.217 and0.107respectively, confirming both validity and exogeneity of the instruments.

Considering the results of GMM model (1) we observe that allthe variableshavesignificanteffect on corporate investment. The lag investment appears positive and significantat 1%, which implies that current year corporate investment behaviour (data generating process)is significantly shaped by the previous year investment activities.In other words, the lag investment activities results inspill over effects, whereas such effectssignificantly transfers to the upcoming periods. The coefficient of lag investment indicate that 0.614 unit addition in total current investment is stimulated by the previous year investment activities. Thisfinding is compatible with the studies of Bond and Meghir (1994) and Keefe and Tates (2013). Similarly, the coefficient associated to log cash flow is alsopositive and significant. We perceive that a 1% increase in cash flow increase investment spending of the firms by more than0.451 unitsat 1% level of significance.This implies that investment behaviour of Pakistan's non-financial firms sensitive to the internally generated fund.This is due to the fact that internally generated funds are the dominant source of financing for all the firms. Generally,the firms prefer to finance their investment spending from internally generated cash flow,therefore, any upturn in these funds stimulate firms' investment by a higher magnitude.[18] This result is in line with "Pecking Order" theory which states firms at first prefer to utilize internally generated funds and later periods they rely on external funds if experience shortage in financing their investment activities.Similar results are found by Minton and Schrand (1999), Deshmuk (2005) and Denis and Sibilkov (2009). Furthermore, the coefficient associated to cash flow volatility (which is the primary concern of our study)turned out negative significant.[19]Our findingconfirm that 1% increase in cash flow volatilitysignificantly decrease investment spending of firms by 0.259 units. This results confirm thatfirm's investment decisions are also sensitive to cash flow volatility. The economic rationale behind this negative sign is that firmsgenerally prefer to utilize internally generated funds for investment purposes, however, firms could experiencesignificant cash flow shortage if their internal cash flow becomeuncertain. To response to such shocks they cut downtheir investment spending instead of acquiring external finance having higher opportunity cost. This higher cost is attributed to imperfection in external capital market which prevent the firms from investment. Additionally, the cash flow of non-financial firms are not hedge in Pakistan, thus their investment expenditures observe more sensitive to volatility in cash flow. Whenever, cash flow of the firms are hedge their investment spending become stable and less sensitive to cash flow fluctuation (Froot *et al.* 1993). Our finding regarding cash flow volatility is consistent with the studies of Minton and Schrand (1999) and Keefe and Tate (2013). From the discussion we perceive that investment behaviour of firms are largely shape by the pattern of cash flow. Indeed, the smooth pattern of

cash flow act an incentive for the firm to expend its investment activities, however, any of its uncertain behaviour would compel the firms to reduce investment for not relying on external funds which carries higher cost.

Amongother control variables, the impact of market-to-book ratio on corporate investment is positive and significant. The coefficient suggest that a 1 unit rise in investment opportunities of the firms rise their investment by 0.384 units with 10% level of significance.The positive association between the two is due to the fact that investment opportunities increase sales of the firms which in turn enhancethe generation of internal funds and facilitate investment spending. This result is reliable with the findings of Minton and Schrand (1999) and Cleary (2006). Besides market-to-book ratio thesale growth is also included in the model to capture the non-price investment opportunities of the firms. Sale growth has a positive and significant relation with investment, meaning that firms significantly invest whenever sales opportunities appear. The coefficient associated to sales growth suggest that 1 unit increase in sales growth significantly stimulate the firms' investment by 0.189 units. The result regarding sale growth is in line with the studies of Hovakimian (2009) who also reported positive and significant relation of sale growth with investment outlay of the firms. Furthermore, leverage ratio is observed negative and significant at 10%, indicating that 1 unit increase in leverage ratio of the firm will decrease investment expenditures by 0.152 units.The negative sign is because of tax-bankruptcy cost associated with level of the debt. Firms have to bear bankruptcy cost with increase in debt level which in turn reduces investment spending, additionally the higher leverage ratio reduce cash amount available with firm that can be used for investment.Bond and Meghir (1994) and Cleary (2006) also report negative impact of leverage on investment spending of firms in their respective studies.

Turning to the results of GMM model (2), where we use log investment as a dependent variable to check the validity of our estimates that they are not driven by the nature of the measured variable. we observe that model (2) estimatesclosely match to model (1) model with respect to sign and significance of the covariates, except the sales growth which appears insignificant in the currentmodel;nonetheless, the coefficients magnitudes are significantly different in both models; for instance the coefficient of lag investment indicate that more than 26% addition in total current year investment is stimulated by the previous year investment activities, similarly the associated coefficients of cash flow predict that 1% rise in cash flow encourage investment byalmost 18% with 5% level of significance; however 1% rise in its volatility significantly discourage the investment of the non-financial firms by 13% units. It isthusobvious that irrespective of the investment proxies, cash flow volatility adversely affect the investment decision of the firms, nevertheless, the effect of magnitude directly depends on the proxies used for corporate investment.Moreover, coefficients of market-to-book ratio and sales growth

suggest that 1 unit rise in the variables promoteinvestment by 7% and 9% respectively, however, the sales growth do not significantly shapethe investment behaviour of the firms.This finding is compatible withAivazian *et al.*, (2005). Furthermore, The 1 unit rise in leverage ratio decrease firms' investment expenditures by 6%.

4.2. Disaggregated Analysis

After explaining aggregated sample results, we now proceed to sub-samples (financially constrained and unconstrained firms) analysis. The economic rationale behind making disaggregated analysis is that aggregated sample estimates might be biased due to the diversified nature of financially constrained and unconstrained firms in our sample set. As apparent in earlier studies such as Cleary (2006), Denis and Sibilkov (2009) and Kefee and Tates (2013) that financially constrained firms face higherstumbling block in acquiring funds from external market,thus it is anticipated that investment behaviour of financially constrained firms might be more sensitive to cash flow and these firms could response differently to cash flow uncertainty. Hence, it seems necessary to separately analyse the effects of cash flow volatility on investment spending of financially constrained and unconstrained firms.

4.2.1. Total Asset Based Comparison of Financial Constrained and Unconstrained Firms

After establishing the validity and exogeneity of instruments as group, we do sensitivity check of our results for financially constrained and unconstrained firms. This comparison is based on the approach of total assets. The corresponding results are shown in Table 2. Similar to the aforementioned procedure we use to different proxies of investment for robustness check.

Like aggregated analysis, here in disaggregated analysis the coefficient associated with lag investment also appear positive and significant at 1% for both set of firms. The positive sign indicate that firm's previous investment behaviour transfer significantly to the next periods in the form of smooth investment policy, it is obvious that non-financial firms of both naturein Pakistan show a stable investment policy. However, this spill over effect of smooth investment policy remain larger for financially unconstrained firms than financially constrained.Similarly, the coefficient associated with cash flow is also positive and significant forboth set of firms. The coefficients reveal that 1% increase in cash flow increases the current investment outlay of financially constrained and unconstrained firms by 0.125 and 0.391 units respectively. Clearly the scale of coefficient associated to cash flow is higher for financially unconstrained than financially constrained firms. These results can be justified by argument of Cleary (2006) who assert that financially unconstrained firms are internally less constrained but they are more sensitive to internally generated funds as constrained firms have great business opportunitiesand higher financial risk. The coefficient associated with cash flow volatility, which

Table 2: Impact of Cash flow volatility and other factors on investment of financially constrained and unconstrained firms (Comparison Based on Total Assets): Dependent Variable is Log Investment

	Financially constrained firms (Based on Total Assets)		*Financially Unconstrained firms (Based on Total Assets)*	
Explanatory Variables	*Dependent Variable is Investment/Lag Fixed Asset*	*Dependent Variable is Log Investment (I)*	*Dependent Variable is Investment/Lag Fixed Asset*	*Dependent Variable is Log Investment (I)*
	GMM Model (1)	*GMM Model (2)*	*GMM Model (1)*	*GMM Model (2)*
Lag Investment	0.439***	0.196***	0.541***	0.358***
	(0.017)	(0.064)	(0.014)	(0.037)
Log Cash flow	0.125*	0.075**	0.391*	0.219**
	(0.072)	(0.036)	(0.219)	(0.107)
Log Cash flow Volatility	-0.413***	-0.322**	-0.281***	-0.149*
	(0.103)	(0.142)	(0.031)	(0.086)
Market to Book ratio	0.521**	0.215*	0.277*	0.176*
	(0.239)	(0.125)	(0.162)	(0.097)
Sale growth	0.152***	0.093	0.561***	0.138**
	(0.031)	(0.174)	(0.012)	(0.066)
Leverage	-0.273**	-0.045***	-0.135*	-0.021**
	(0.137)	(0.012)	(0.074)	(0.009)
Intercept	-1.347	-1.211	5.21***	6.199*
	(0.947)	(1.761)	(1.72)	(3.168)
No. of Observation	1140	1140	1590	1590
No. of Cross-Section	114	114	159	159
Arellano- Bond AR (2) (P-value)	0.412	0.109	0.182	0.216
Hansen test of overid: restrictions (P-value)	0.381	0.115	0.521	0.219

Robust standard errors in parentheses, ***, ** and * represent 1%, 5% and 10% significance level respectively.

is the main consideration of this study has a negative and significant effect on investment spending of both sets of firms. However, the magnitude of coefficient variessignificantly between the two set of firms. We observe that that 1% increase in cash flow volatility decrease current investment of financially constrained and unconstrained firms by 0.413 and 0.281 units respectively at 1% level of significance.Thus the uncertain behaviour ofcash flow alter the trajectory of the investment behaviour of two set of firms in Pakistan. Yet, financial constrained firms are seen more vulnerable to cash flow volatilityas these firms significantly reduce their investment spending. This finding is supported by theKefee and Tates (2013) who documented that the strength of indirect relation between cash flow volatility and investment

increases with degree of financial constraint. The main reason lies in the fact that financially constrained firms face constrained amount of external funds, hence increase in cash flow volatility further worsen internally generated funds which in turn negatively affect investment spending of constrained firms. This result also confirm that investment spending of financially constrained firm are more sensitive toward any shock in internally generated funds. This result is reliable with Mulier *et al.* (2014).

The effect of market-to-book ratioon investment is positive and significant. The associated coefficient to market-to-book ratio indicate that 1 unit increase in investment opportunities of the firms significantly rise the investment spending of financially constrained and unconstrained by 0.521 and 0.277 units respectively. It is clear that the coefficient value is larger for financially constrained firms, this is because that financially constrained firms face constrained amount of external funds hence increase in growth opportunities enable them to generate internal cash flow and decrease reliance on external finance that in turn directly effects their investment spending. Similar results are found by Denis and Sibilkov (2009). Furthermore, the sale growth has a positive and significant effect on the investment of the both nature of firms. We observe that 1 unit increase in sale growth increases current investment spending of financially unconstrained and unconstrained by firms by 0.152 and 0.561 units respectivelywith 1% level of significance.This is due to the fact that financially unconstrained firms avail every profitable investment opportunity and so increase in sales growth work as stimulus for unconstrained firms to invest more. On other hand, financially constrained firms are risk averse and do not indulge in every investment opportunity until the project is beneficial for them in monetary terms. Among other, the estimated coefficients of leverage ratio indicate negative impact on investment spending of both types of firms. The magnitude is higher in case of financially constrained firms because investment of these firms are highly sensitive to cost of external funds hence any increase in debt level will increase bankruptcy cost that in turn reduces their investment spending. Cleary (2006) also draw negative association between leverage ratio and investment spending of financially constrained and unconstrained firms.

For sensitivity analysis like the aggregated analysis here in disaggregated analysis we consider the estimates of GMM models (2) to verify that the results are not driven by the nature of regressand.[20] We observe that like aggregate sample analysis, the estimates are similar for both the investment proxieswith respect to significance and signs except sales growth which appear insignificant for constrained firms in GMM model (2). Although the magnitude ofestimates are different in both model (1) and (2), yet it is still interesting to note that cash flow volatility has negative effect on corporate investment and the this effect remain larger for constrained firms, thus the estimates are not driven by the using different proxies for investment.

4.2.2. Payout Ratio Based Comparison of Financial Constrained and Unconstrained Firms

For robustness check this study also differentiates the firms into a financially constrained and unconstrained using their pay-out ratio. Since, it is quite possible that results obtained in earlier section might be methodological specific, i.e. our findings might be motivated by the measure used to separate the firm into two sets. Hence, it seems necessary to examine the effects of cash flow volatility into two forms of firms utilizing the average pay-out ratio technique. Again, after testing for the validity and exogeneity of instruments, we do separate analysis for financially constrained and unconstrained firms. The corresponding results are shown in Table 3.

Table 3: Impact of Cash flow volatility and other factors on investment of financially constrained and unconstrained firms (Comparison based on Pay-out Ratio): Dependent Variable is Log Investment

	Financially constrained firms (Based on Dividend Pay-Out-Ratio)		*Financially Unconstrained firms (Based on Dividend Pay-Out-Ratio)*	
Explanatory Variables	*Dependent Variable is Investment/Lag Fixed Asset*	*Dependent Variable is Log Investment (I)*	*Dependent Variable is Investment/Lag Fixed Asset*	*Dependent Variable is Log Investment (I)*
	GMM Model (1)	*GMM Model (2)*	*GMM Model (1)*	*GMM Model (2)*
Lag Investment	0.372***	0.266***	0.661***	0.462***
	(0.015)	(0.105)	(0.002)	(0.064)
Log Cash flow	0.103*	0.136**	0.221***	0.150***
	(0.052)	(0.058)	(0.071)	(0.054)
Log Cash flow Volatility	-0.593***	-0.437***	-0.271**	-0.203***
	(0.137)	(0.086)	(0.147)	(0.028)
Market to Book ratio	0.131*	0.346**	0.172***	0.414***
	(0.073)	(0.174)	(0.076)	(0.071)
Sale growth	0.216**	-0.028***	0.312*	0.068***
	(0.091)	(0.005)	(0.173)	(0.005)
Leverage	-0.104***	-0.048	-0.425***	-0.024*
	(0.031)	(0.097)	(0.106)	(0.014)
Intercept	0.951***	4.797*	2.371	2.313*
	(0.001)	(2.759)	(1.562)	(1.193)
No. of Observation	1260	1260	1600	1600
No. of Cross-Section	126	126	160	160
R-Square				
Arellano- Bond AR (2) (P-value)	0.361	0.236	0.128	0.116
Hansen test of overid: restrictions (P-value)	0.291	0.215	0.635	0.157

Robust standard errors in parentheses, ***, ** and * represent 1%, 5% and 10% significance level respectively.

Based on the pay-out ratio, the lag investment is positive and significant at 1% for both set of firms which indicateand support the presence of smooth investment policy as depicted by the earlier discussion as well. The estimated coefficients of cash flow have positive and significant effect on investment spending of both categories of firms. The associated coefficient with cash flow reveal that 1% increase in internally generated funds increases the current investment of financially unconstrained and constrained firms by 0.103 and 0.221 units respectively.Moreover the coefficients associated with cash flow volatility depicts that 1% increase in cash flow volatility reduce investment spending of financially constrained and unconstrained firms by 0.593 and 0.271 units respectively. Although primarilyour results about cash flow volatility match-up with the earlier criteria, yet the coefficient magnitude of cash flow volatility is higher in this criteria. This suggest that our results are sensitive to the criteria used for the separation of financially constrained and unconstrained firms. Nevertheless, it is well established fact from the findings that cash flow volatility in no case is desirable for the firms.

Market-to-book and sales growth turn out statistically significant and positive with investment spending for both categories of firms which support the finding of the previous criteria. Further, the estimated coefficient of leverage appears with negative sign, indicating that leverage reduces the cash amount which in turn decreases investment spending and dividend payment, yet this effect remain insignificant in case of financially constrained firms. This results are in line with Bond and Meghir (1994).

Considering GMM models (2) for the sensitivity analysis (based on log investment proxy). We observe that estimates of both the investment proxies are almost similar like earlier disaggregated model; here the coefficients associated to cash flow volatility also remain negative significant and theadverse effect of cash flow volatility appear higher for financially constrained firms. Yet, it is worth to note that using this criteria (Pay-out ratio) the coefficient estimates associated to cash flow volatility appears larger than Total assets based approach. Furthermore, using log investment as investment proxy the coefficients of sale growth produce mix results, in case of financially constrained firms coefficient of sale growth is negative and significant while positive significant for financially unconstrained firms. The possible explanation for the negative relationship is shortage of funds and lack of investment opportunities for constrained firms, hence these firms cut down their investment spending as sales tend to grow. Moreover, these firms are supposed to financial distress, therefore, they cut much portion of investment spending due to lack of internal funds.[21] However, financially unconstrained firms increase investment expenditures as their sales tend to grow.

5. Conclusion

The main objective of the study is to examine impact of cash flow volatility on corporate investment by using firm level data of 274 non-financial firms of

Pakistan. We consider a time period from 2006 to 2015 and employ the Generalized Method of Moments (GMM). We measure cash flow volatility by using three year moving average standard deviation approach. Firstly, we estimate the investment model for the whole sample. Onwards, we divide our sample into financially constrained and unconstrained firms on the basis of total assets and pay-out ratio. The decomposed analysis is supposed to show the sensitivity to the financial constraints. We find that cash flow volatility retard investment spending of non-financial firms of Pakistan. Further, financially constrained firms are more sensitive to cash flow variation as compared to unconstrained firms. The main justification is that financially constrained firms face shortage of external funds while volatility in cash flow worsen their internally generate funds which, in turn, retard their investment spending. However, the magnitude of response to cash flow volatility is sensitive to the criteria used for the separation of the firms. Our analysis suggest that being sensitive to cash flow volatility, the non-financial firms of Pakistan should not be prodigal in good times; rather cash flow volatility should be considered in their risk management decisions. Certainly, more studies are needed in order to have clear policy guidelines in this regard.

Notes

1. Cash flow volatility causes variations in internal cash flow which lead to cash flow shortfall, and firm responds to these variations through reduction in investment spending instead of acquiring external finance. For detailed discussion see Minton and Schrand (1999).
2. External capitals are funds which are raised from outside sources by firm for financing purposes.
3. Risk management theory proposed the relation between investment and volatility; when there exists imperfection in market then cost of external capital is higher than internal capital and cash flow volatility is associated with underinvestment. See Myser (1977) for further details.
4. Frim value is proxy by Tobin Q: It is the ratio of market value of total assets divide by its replacement cost.
5. Financially constrained firms are those firms which do not have enough internal funds to finance their investment activities. See Guariglia (2008) for detail.
6. Financial slack also called firm's saving. It is the extra money available with firm in case of downshift in sale, revenue or profit.
7. The study of Rizwan and Javed (2011) in the context of Pakistan discuss the role of cash flow volatility in cash holding.
8. This is because of the reason that, in such idealized structure, any of the shortfall in internal generated funds would be flawlessly covered by the external market.
9. The study uses quarterly data of 1287 U.S firms for the period 1989 to 1995 and applies OLS.The study argues that cash flow volatility decreases internal funds, therefore, in response to such shocks, firms decrease their investment spending.

10. Using U.S firm level data they investigated the rate of investment and employment before and after crisis of 2008-2009. Results indicate a strong negative correlation between cash flow volatility, corporate employment and investment expenditures.
11. We use two different proxies of investment the one used by Aivazian *et al.,* (2005) and the other log investment. The reason behind the use of two different proxies of investment is to do sensitivity analysis to confirm that our estimates are not driven by a specific investment proxy.
12. Definitions, constructions, descriptive statistics and correlation matrix of the variables could be found in the appendix A.
13. For detailed discussion see also Cleary (2006).
14. Due to the diversified financial nature of firms in our panel set we suspect to have the problem of Heteroscedasticity in our model.
15. For dynamic panel data modelling, GMM has mainly been used by Arellano and Bond (1991), then by Arellano and Bover (1996) and later on, Blundell and Bond (1999) specifically used GMM to cope the problem of endogeneity in the production function.
16. GMM model (1) measured variable based on Aivazian *et al.,* (2005).
17. When robust standard error is used then p-value of Hansen test should be taken into consideration instead of Sargan test.
18. For detail discussion see also Minton and Schrand (1999).
19. It is interesting to note that coefficient associated with cash flow volatility is negative and significant in all 5 models. Yet we retain our discussion to GMM only because other estimates is expected to bias due to different econometric problems.
20. Both GMM model (2) based on the log investment proxy.
21. See Bhagat *et al.* (2005) for more detail.

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Table A1: Definition and Constructions of Variables

Variables	*Definition*	*Construction*
Investment	Investment can be defined as the total expenses of a firm on fixed assets including machinery, equipment and plant. Investment includes all corporate capital expenditures, Research and development cost and advertisement expenses. It is calculated as current year's expenditure on fixed assets less prior year's expenditure on fixed assets plus depreciation cost. Whereas depreciation includes annual wear and tear of fixed assets.	$I_{it} = K_{it} - K_{it-1} + D_{it}$
Dividend Pay-out ratio	Dividend is defined as the portion of earnings, firm is paying to its shareholders from its total income. Dividend includes cash payment, shares of stock or other property.	$DP_{it} = \frac{Total\ Dividends}{Net\ Income}$
Cash flow	Operating cash flow is defined as the level of cash generated by firms from operating activities. Cash flow can be obtained as sales less cost of goods sold (CGS) less selling, general and administrative expenses (G & A) plus depreciation expense less tax provision plus/minus the change in working capital (WC) for the period.	$CF_{it} = Sale - CGS - G\&A\exp ense + Depreciation - Tax \pm \Delta NWC$
Cash flow volatility	Cash flow volatility is defined as the degree of variations in operating cash flow of the firm.	$CFV_{it} = \sqrt{\frac{(CF_{it} - \overline{CF})^2}{n-1}}$
Market-to-Book ratio	Market-to-Book ratio of a company indicates the market value of a company compared to its book value. It can be obtained as the market value of equity divided by book value of equity. Whereas the market value of equity is the market price ofthe share time total number of outstanding shares, while book value of equity is equal book value per share time total number of outstanding shares.	$MBR_{it} = \frac{Market\ value\ of\ equity}{Book\ value\ of\ equity}$
Leverage Ratio	Financial leverage ratio represents the amount of total assets that are levered by debt. This ratio also indicates the ability of a firm to meet its obligation. It is the ratio of firm total debts to total assets. Whereas total debts include both short term and long term debts. It can be calculated as dividing total debt by total assets of the firm.	$LEV_{it} = \frac{Total\ liabilities}{Total\ assets}$
Sale growth	Sale growth can be defined as the average annual change in sales of a firm. It can be calculated as current year's sale less previous year's sale scaled by previous year's sale.	$SG_{it} = \frac{Current\ year\ Scale - Previous\ Year\ Sale}{Previous\ year\ sale}$

Table A2: Summary Statistics

Variables	*Observations*	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*
Log investment	2,668	14.12173	1.765626	4.574711	19.32341
Investment/Lag Fixed Assets	2,740	0.512614	0.375945	-6.091632	4.03675
Log cash flow volatility	2,462	11.39556	1.938648	3.439678	16.73392
Log cash flow	2,462	12.82431	1.821417	4.844187	17.99114
Market-to-Book ratio	2,462	1.389	1.357	0.663	1.577
Sale growth	2,740	0.1310795	0.4006565	-1	3.579315
Leverage	*2,740*	*2.189939*	*1.399898*	*0.5273476*	*12.55399*

Table A3: Correlation Matrix

	Log cash flow volatility	*Log cash flow*	*Sale growth*	*Leverage*	*Market-to-Book ratio*
Log cash flow volatility	1.00				
Log cash flow	0.41	1.00			
Sale growth	0.16	0.38	1.00		
Leverage	0.27	0.26	-0.22	1.00	
Market-to-Book ratio	0.21	0.18	-0.05	-0.01	1.00