

Corporate Internationalization and Uncertainty of Cash Holdings: Evidence from an Emerging Market

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Abstract: *Purpose – The purpose of this study is to investigate the empirical relationship between corporate internationalization and uncertainty of cash holding in non-financial listed companies of Pakistan. Secondly, the effect of cash flow, size of firm and capital expenditure on uncertainty of cash is also explored. Design/Methodology/Approach – A panel data of 100 companies over the period starting from 2011 to 2018 is collected from the published annual reports. Data is analyzed using pooled and panel OLS regression. For robustness of results dynamic GMM is used. Findings – The estimated results show a significant negative relationship between corporate internationalization and uncertainty of cash holdings. Moreover, large size firms tend to represent a relatively more stable cash balance as compared to small size firms. Practical Implications – The study concludes that firms engage in international operations are in better position to access external capital market and are able to stabilize their liquidity. Originality/Value – This study uses 3 years standard deviation of cash instead of conventionally used absolute change in cash balance to measure uncertainty of cash. This study is among the first studies to examine such sort of relationships in an emerging economy. Further, for robustness of results dynamic panel GMM is applied.*

Keywords: Corporate internationalization; Uncertainty of cash; Panel data analysis; Dynamic panel GMM; R-Studio syntax

JEL Classification: H63, H81, G32

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Introduction

Liquidity management is among the important tasks performed by firms to ensure short term solvency, smooth business operations and to maintain financial outlook in the external capital market. Firms with stable liquidity can avail prime fund raising opportunities offered by financial institutions and are placed in better grades by stake holders. Liquidity is important either for transaction or precautionary motives and one of the major advantages of maintaining liquidity is that it allows firm to undertake better projects as they arrive. Therefore, while utilizing cash firms seek a tradeoff between both motives. In order to achieve optimality between former and latter motives every firm designs a strategy which represents its cash management skills. This study argues that firms with clear and long term cash management objectives successfully stabilize their cash balance and their cash flows are less sensitive to their operations. The study further argues that firms with national as well as international operations design long term cash management strategies therefore; their cash flows are relatively stable. Mentioned below is a brief discussion on theories which help in understanding firm's cash management motives.

Existing literature provides several theoretical and empirical evidences on firms' cash management motives. For instance, Baumol (1952) and Miller & Orr (1966) support the transactional motive of cash holdings while Acharya et al. (2007) and Bates et al. (2009) explain the role of precautionary motive of cash holdings. In addition to the above Foley et al. (2007) supports tax considerations and Harford et al. (2008) support agency conflict as a main driver of cash holdings. The current study takes support of trade-off theory which argues that management set their target cash holding by assigning weights to the marginal cost and benefits of holding cash with an overall goal to maximize the shareholders' wealth. However, in contrast to the shareholders, managers are more inclined towards holding cash rather spending it, especially in case when their performance is subject to the strict scrutiny by the external capital market. Present study argues that firm with international operations have better access to the external financial market and their management is required to maintain their cash flows because their short term solvency and liquidity is subject to strict scrutiny of external fund suppliers. Holding cash increases managers' discretionary power over firm's financial resources (Dittmar et al., 2003; Jensen, 1986). Therefore, firms with international operations are more serious in avoiding volatility in their cash balances.

Empirically there are several factors which create cash flow volatility in a firm. For instance, financially constrained firms show more cash flow volatility because they are not available with an alternative mode of financing from external capital market. On the contrary firms having access to the external capital markets are in a better position to stabilize their cash balance. Titman and Wessels (1988) argue that large size firms are in a better position to diversify their risks and are less likely to

face financial distress. Large size firms have are less financially constraint and are more likely to show stable cash in hand as compared to small size firms.

One of the obvious reasons behind volatility of cash in hand is cash flow itself. Gueney et al. (2007) argue that firms with volatile cash flows try to mitigate their cost of liquidity by stabilizing their cash in hand. Moreover, higher cash flow volatility increases the probability of financial distress because such firms are less likely to meet their debt servicing commitments in time therefore, stable cash in hand is more important for these firms. However, this is not the case always because higher cash flow from operations is directly linked with firms operations and operational performance of a firm is based on market dynamics. Therefore, firms operating cash flows are likely to be a source of cash volatility for the firm, especially in emerging economies.

Finally, growing firms have more positive NPV projects therefore, capital expenditure in growing firms impact their cash flows. In line with the operating cash flow argument the current study argues that firms with high capital expenditures tend to represent higher uncertainty in their cash balances. Current study intends to investigate the impact of firm's internationalization, size, operating cash flows and capital expenditure on uncertainty of cash holdings in non-financial listed companies of Pakistan Stock Exchange (PSX).

The remainder of the paper is organized as follows: section 2 deals with review of the literature and development of hypotheses, section 3 provides research methodology, section 4 discusses the estimated results, while section 5 presents the conclusion and direction for future researchers.

Literature Review

Existing literature provides extensive discussion on the impact of corporate internationalization on firm performance. Duru & Reeb, (2002) and Chin et al. (2009) argued that internationalization increases firm operational complexity and decreases its agency problems therefore, decreases its cash sensitivity. According to Svetlicic & Rojec, (2003) international firms have better access to external financial markets therefore, they maintain stable cash balances. There are several motivations behind maintaining stable cash balances. For instance, Baumol, (1952) and Miller and Orr (1966) supported transaction motives of cash while Acharya et al. (2007), Bate et al. (2009) and Opler et al. (1999) supported precautionary motives of cash holding. Moreover, Change & Noorbakhsh (2006) and Dittmar & Smith (2007) supported agency conflict as a main determinant of cash holdings. Opler et al. (1999) based its argument on static tradeoff theory of cash holdings and reported that firms with strong growth opportunities and riskier cash flows hold relatively high ratios of cash to total non-cash assets while firms with better access to external capital markets and large size firms maintain lower balance of cash. Foley et al. (2007) supported tax based explanation of firm's cash holding while

Chiang and Wang (2011) argued that international firms hold more cash as compared to domestic firms. Cash management is among the important indicators of good governance and firms engaged in international operations should have stable cash balances. Empirical evidence suggests that firms engaged in international operations are likely to be well governed (Grant, 1987; Kim et al., 1993; Lu & Beamish, 2004). A brief review of above studies shows that firms keep changing their cash holdings based on their need and market perception and the impact of such needs and perceptions could be more severe for companies engaged in international operations.

Regarding relationship between corporate internationalization and cash flow sensitivity, literature provides mixed results. For instance, Fazzari et al., (1988 and 2000) support negative impact of firm internationalization on cash sensitivity while Ascioğlu et al., (2008); Myers & Majluf, (1984) and Stiglitz & Weiss, (1981) have reported a positive relationship. Doukas & Pantzalis (2003) studied on international and domestic firms using a sample data of 6951 firm-year observations during 1988–1994. Based on linear regression estimation model study found that the agency costs of international firms had more significant and indirect impact on long term debt structure of firm as compared to domestic firms. He concluded that firms adjust their cash holdings as per their international requirements. Ramirez & Tadesse (2007) examined the relationship among national cultures, internationalization of firms and cash holdings.

More recently Benkraiem et al. (2020) studied the relationship between corporate internationalization and corporate cash holding behavior of French-listed firms. Their results show that internationally diversified firms are less inclined to save cash out of their cash flows than their undiversified counterparts. Several hypotheses were developed in this study by using famous financial theories of international firms, for instance, culture and corporate internationalization level effects on cash holding assessment. To test these hypotheses study assembled detailed data on a large panel of firms across 40 countries with close to 70000 firm-year observations for 1990–2000. The firm-level data for the study were obtained from the Worldscope database. The study results showed significant positive relationship between internationalization and cash reserves. Their study concluded that firms having averting culture of high insecurity hold more cash to counter the undesired natural events.

Moreover, international companies in general hold more cash because of their lengthier trade circles. Chiang & Wang (2011) also did a comparative study using 4140 firm year observation during 2003 to 2008, in which 1286 were from multinational U.S. companies and 2854 were from local U.S. companies. Performing multiple regression analysis the study resulted that multinational corporations had higher cash holdings than that of domestic corporations. The study identified a significant relation in internationalization and cash assets. Arataet al. (2015) based on panel data of 615 observations from 71 Brazilian companies listed at São Paulo Stock Exchange and 52 Mexican companies listed at Mexican Stock Exchange during 2006–2010 studied the internationalization and level of corporate cash management behavior in Mexican

and Brazilian firms. Study performed a multiple regression with a fixed effect panel data and resulted that company's cash reserves significantly grow with increase of company's internationalization. In addition to the above several

Lin et al. (2019) studied a sample of Taiwan listed companies and found that increase in degree of internationalization reduces firms' cash volatility. Existing literature shows two types of impacts of internationalization on cash flow uncertainty: a positive impact, negative relationship of internationalization, and a negative impact, positive relationship between internationalization and cash volatility. Pakistani firms are relatively less competitive to international market and they need to maintain a trust full relationship with their suppliers and customers therefore, they are expected to show more stable cash balances. Although several researchers have contributed toward this topics but their studies provide mixed results and literature on this topic during last decided is virtually nonexistent. The present study attempts to fill this gap by providing evidence on corporate internationalization and uncertainty of cash holdings using dynamic panel GMM in an emerging economy. In the light of existing literature, current study proposes the following research hypothesis:

Ha1: *Corporate internationalization is negatively related with uncertainty of cash holdings.*

In addition to internationalization, firm size is also an important factor which impacts cash sensitivity of firm. Kim et al. (1993) using a sample of 915 American industrial firms' panel data explored cash holding components during 1975 to 1994. The regression results of the study verified that the level of cash reserve grows in proportion to predicted returns, variability of projected cash flows and holding cost and falls with company size. According to Pastor & Gama (2013) sufficient liquid assets are essential for flat business process. As per his study officials had propensity to hold major share of company assets as liquid to re-invest them for their own best interests. Using pooled OLS regression, study analyzed the origins of liquidity in non-financial small and medium enterprises of Portugal for the year 2001-2007. In results it was found that size, banking interaction, borrowing level, growth opportunities and cash flow uncertainties had significant and positive influence on cash holdings. It was also observed that level of retained cash was linked with firm's capital tuning, liquid stream investments, asset management policies, working capital needs, and dividend payouts. Hadlock and Pierce (2010) recommended sales and assets as good proxies of firm size. Present study hypothesizes the following relationship between firm size and uncertainty of cash:

Ha2: *Firm size is negatively related with uncertainty of cash balance.*

Moreover, current study also attempts to investigate the impact of operating cash flows on uncertainty of cash. According to Almeida et al, (2004) firm's propensity to save cash out of cash flows has a relationship with financial constraints. Using a sample consists of 29,954 firm-years observations of manufacturing companies over 1971-2000 they found a positive relationship in firms' cash flows access and cash

sensitivity. The study concluded that companies of well developed economies had less cash flow sensitivity on account of economical external funds plus lower financial constraints. Pinkowiz & Williamson (2007) comparatively analyzed German and Japanese firms against American companies. They used 40 years, 1965 to 2004, data of 13000 public companies and studied the prototypes of liquid assets and found unique liquid asset characteristics in German and Japanese firms as compared to US firms. The results of the study produced an inverse relation between liquid assets and cash flows of German and Japanese companies in contrast to US ones. More recently Lin et al (2019) used operating cash flow and reported a positive relationship between operating cash and cash sensitivity. This study therefore, hypothesizes the following relationship:

Ha3: *Net operating cash flow is positively related with uncertainty of cash balance.*

Pecking order theory postulates that capital expenditure decisions have significant impact on firms' cash balances. Firms which are engaged in international operations have greater growth opportunities and have greater funding requirements which not only deteriorate their cash balances but also create higher uncertainty in cash balances. Several researchers, for instance, Opler et al. (1999), Chen & Chen (2012) and Uyar and Kuzey (2014) supported positive relationship between growth opportunities and cash sensitivity of firm. Opler et al. (1999) worked on all Compustat companies with more than 5 years data during 1950-1994. Based on first order auto-regression analysis their study evidenced that cash balances were mean reverting. The study further documented that the companies with more growth opportunities significantly hold more cash. Fazzari et al., (1988) also supported a positive relationship between growth opportunities and cash uncertainty of firm. Following is the hypothesized relationship:

Ha4: *Corporate capital expenditure is positively related with uncertainty of cash balance.*

From emerging market of Pakistan few researchers have studied the investment cash flow sensitivity of firms. For instance, Nabi (1989), Khan and Hasan (1998), Chaudhry (1995), Francis et al. (2013), Nazir and Afza (2009) studied working capital aspect of cash, Shah et al. (2005) and Chiang and Wang (2011) studied financing aspect of firm, Khan et al. (2012) and Hussain et al. (2019) studied agency perspective of cash flow. However, none of the above studies focused on cash uncertainty of firm. This study therefore, attempts to fill this gap by providing evidence on impact of firm's internationalization, size, operating cash and capital expenditure on uncertainty of cash.

Research Methodology

For the purpose of estimation, the present study uses the data collected from published annual reports of 100 non-financial listed firms over the period starting from 2011 to 2018. Sample include 38 companies from Textile sector which is one of the largest

sector Pakistan Stock Exchange (PSX) in terms of number of companies, 12 companies form Cement sector, 10 companies from Sugar sector, 6 companies from Pharmaceutical sector, 6 companies from Food and Beverages, 3 companies from Oil and Gas, 4 companies from Jute, 3 companies from Chemical, 4 companies from Glass, 4 companies from Automobile sector, 14 from miscellaneous sectors. The study uses stratified random sampling technique where every industrial sector is considered as strata. Initial sample consists of roughly 800 firm-year observation however, while cleaning for missing values the study excluded 24 firm-year observations. The major cause of missing values is the nature of dependent variable i.e. cash flow sensitivity which is measure by taking three years standard deviation of cash values. Data of three firms was incomplete and it was excluded from analysis leading the final sample consisting of 97 firm over the period starting from 2011 to 2018 i.e. 752 firm year observations.

Table 1 below presents the summary of all the variables of this study.

Table 1: Summary of Variables

Symbol	Variable	Description	References
UCB	Uncertainty of Cash Balance	3 years standard Deviation of Cash Divided by Total Asset	Bates et al.(2009),Hussain et al. (2019) and Hussain et al. (2022)
INT1	Internationalization proxy 1	Exports divided by Total Sales	Doukas&Pantzalis (2003), Chiang&Wang (2011) and Arataet al. (2015)
INT2	Internationalization proxy 2	Exports divided by Total Assets	
SZ	Size	Natural Log of Total Assets	Almeida et al, (2004) Foley et al. (2007), Chang &Noorbakhsh (2006), Chiang&Wang (2011) and Arata et al.(2015)
LVG	Leverage	Total Debt divided by Total Assets	Opler et al. (1999), Gugler&Yurtoglu (2003), Aivazian et al., (2004),Ozkan&Ozkan (2004), Gueney et al. (2007), Kalcheva& Lin (2007), Bates et al. (2009), Chang &Noorbakhsh (2006), Chiang&Wang (2011) and Arataet al. (2015).
LQD	Liquidity	Change in NWC** divided by Total Assets	Ozkan&Ozkan (2004), Almeida et al, (2004), Khurana et al, (2006), Bates et al.(2009)and Chiang & Wang (2011)
DIV	Dividend Dummy	1 If Company Pays Cash Dividend and 0 Otherwise	Opler et al. (1999), Ozkan&Ozkan (2004), Bates et al. (2009), Chiang&Wang (2011) and Arata et al. (2015) and Hussain et al. (2021)
CFL	Cash Flow	Net Operating Cash Flow divided by Total Assets	Opler et al. (1999) Almeida et al. (2004), Khuranaet al, (2006), Bates et al. (2009) and Mirza (2014)
CFC	Cash Change	Change in Cash Balance divided by Total Assets	Almeida et. al. (2004), Khurana et. al. (2006) and Mirza (2014)
CEXP	Capital Expenditure	Capital Expenditure Divided by Total Assets	Aalmeida et al. (2004), Foley et al. (2007) and Bates et al. (2009)

Model Specification

To estimate the relationship coefficients, the study proposes a linear model with $CF-S_{it}$ as dependent variable while INT_{it} , SZ_{it} , CFL_{it} and $CEXP_{it}$ are exogenous explanatory variables. The model also includes CFC_{it} , LVG_{it} , LQD_{it} and DIV_{it} to control for omitted variable bias. The model is explained below:

$$UCB_{it} = \beta_0 + \beta_1 INT1_{it} + \beta_2 SZ_{it} + \beta_3 LVG_{it} + \beta_4 LQD_{it} + \beta_5 DIV_{it} + \beta_6 CFC_{it} + \beta_7 CFL_{it} + \beta_8 CEXP_{it} + \varepsilon_{it} \quad (1)$$

$$UCB_{it} = \beta_0 + \beta_1 INT2_{it} + \beta_2 SZ_{it} + \beta_3 LVG_{it} + \beta_4 LQD_{it} + \beta_5 DIV_{it} + \beta_6 CFC_{it} + \beta_7 CFL_{it} + \beta_8 CEXP_{it} + \varepsilon_{it} \quad (2)$$

Where;

UCB_{it} = Uncertainty of Cash Balance

$INT1_{it}$ = Internationalization proxy 1

$INT2_{it}$ = Internationalization proxy 2

SZ_{it} = Size of firm

LVG_{it} = Corporate Leverage

LQD_{it} = Annual Changes in Corporate Net Working Capital

DIV_{it} = Dividend Dummy

CFC_{it} = Cash Flow Change (The Annual Changes in Corporate Cash Balances)

CFL_{it} = Operating Cash Flow

CCE_{it} = Corporate Capital Expenditures

Estimation Techniques

Primarily, the study uses pooled OLS regression techniques to estimate the relationship between dependent and explanatory variables. Further, to control the unmeasured difference between study participants, panel data analysis is applied which is recommended to address unobserved heterogeneity. Finally, for robustness test the study not only uses alternative proxies of dependent variables but also applies dynamic panel GMM estimation technique. The GMM model is famous in addressing the problem of endogenous explanatory variables. In addition to the above the recommended tests of multicollinearity and autocorrelation are also applied.

Statistical Analysis

This section provides summary statistics as well as estimated results of research model.

Table 2: Descriptive Statistics

	Mean	Median	StdDev	Min	Max
UCB	0.015	0.005	0.037	0.000	0.621
INT1	0.303	0.171	0.315	0.000	0.634
INT2	0.339	0.138	0.429	0.000	0.650
SZ	22.480	22.386	1.250	19.016	26.730
LVG	0.341	0.327	0.226	0.000	0.795
LQD	0.056	0.053	0.300	-0.774	0.592
DIV	0.612	1.000	0.487	0.000	1.000
CFC	0.003	0.000	0.091	-0.353	0.361
CFL	0.059	0.041	0.128	-0.468	0.038
CEXP	0.053	0.033	0.069	0.071	0.696

Table 2 provides descriptive analysis of the study variables. Mean and median values of all variables are close which rejects the presence of extreme high of low values (outliers) in the data which rules out the need of applying quantile regression in analysis. All of the study variables are ratios except DIV which is a dummy variable and all variables are deflated by total assets except INT1 which is deflated by total sales. Comparison of mean and median shows that the data is not affected by extreme values and standard deviation of all variables also supports the same.

Table 3: Correlation Matrix

	UCB	INT1	INT2	SZ	LVG	LQD	DIV	CFC	CFL
INT1	-0.1603	1.0000							
INT2	-0.1013	0.7915	1.0000						
SZ	-0.0503	0.0779	-0.0561	1.0000					
LVG	0.0002	0.0284	0.0575	-0.1450	1.0000				
LQD	0.0604	-0.0164	0.1597	-0.0548	-0.1484	1.0000			
DIV	0.0638	-0.0215	0.0629	0.1687	-0.2898	0.2447	1.0000		
CFC	0.1928	-0.0099	0.0048	-0.0154	-0.0141	-0.0630	0.0381	1.0000	
CFL	0.2663	-0.0335	0.1039	-0.0006	-0.2118	0.2201	0.1959	0.1315	1.0000
CEXP	0.2686	0.0129	0.1593	-0.0072	0.0871	0.1266	0.1315	0.0200	0.1633

Table 3 provides the correlation between the study variables. Exogenous variables i.e. INT1, INT2 and SZ are negatively while CEXP is positively correlated with CFS which is in accordance with the study hypotheses. Correlation matrix also helps in detecting multicollinearity among explanatory variables. The bivariate correlation coefficients among explanatory variables do not show any sign of multicollinearity as

their values are weakly correlated. Size is also negatively associated with cash uncertainty while rest of the variables, including control variables, is positively associated with uncertainty of cash balance.

Table 4: Ordinary Least Square Estimation

	Model 1		Model 2	
	Coefficients	t-value	Coefficients	t-value
(Intercept)	0.0497*	(2.048)	0.0605*	(2.515)
INT1	-0.0124**	(-3.190)	---	---
INT2	---	---	-0.0118***	(-4.131)
SZ	-0.0017	(-1.635)	-0.0022*	(-2.168)
LVG	-0.0055	(-0.879)	-0.0035	(-0.574)
LQD	-0.0063	(-1.362)	-0.0038	(-0.828)
DIV	-0.0055	(-1.895)	-0.0050	(-1.729)
CFL	0.0489***	(4.006)	0.0517***	(4.267)
CFC	0.0928***	(5.716)	0.0933***	(5.794)
CEXP	0.1631***	(7.823)	0.1747***	(8.320)
R-Squared	0.2156		0.2254	
Adj R-Squared	0.2048		0.2149	
F-Statistics	20.06		21.32	
Sig F	0.000		0.000	
Residual SE	0.03149		0.03126	

Dependent Variables: Uncertainty of cash balance (UCB)

Table 4 presents the estimated results of the study model based on OLS estimation method. Model 1 uses INT1 as proxy of corporate internationalization with model 2 uses INT2. The coefficients of both models are significantly a negative which shows that corporate internationalization has a negative relationship with cash volatility. This results is in line with Fazzari et al., (1988 and 2000) and Benkraiem et al. (2020) and also with the hypothesis that firms with international operations tends to maintain stable cash balances because their performance is subject to the strict scrutiny of external capital market. Size also has a significantly negative relationship with cash uncertainty which means that large size firms maintain their cash balance to avoid uncertainty of cash. Similar relationship of size with cash is also observed in model 2. However, cash flow from operations shows a significantly positive relationship with cash uncertainty which is in line with the argument that firms with high cash flow from operations are prone to changes in market dynamics hence their cash balance represents their operating cash flow volatility. Finally, firm's capital spending also has a significantly positive impact on uncertainty of cash balance. The R-squared of model 1 and model 2 are 0.2156 and 0.2254 respectively which means that the estimation captures 21.5% and 22.5% changes in cash balance of the sample firms.

Table 5: Panel Data Estimation

	REM – Model 1		REM – Model 2		FEM – Model 1		FEM – Model 2	
	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
(Intercept)	0.0803*	(2.5205)	0.0926**	(2.9183)	---	----	----	----
INT1	-0.0117*	(-2.4413)	----	----	-0.0128*	(-1.7114)	----	----
INT2	---	----	-0.0120***	(-3.4287)	----	----	-0.0201***	(-3.7014)
SZ	-0.0031*	(-2.2136)	-0.0036**	(-2.6571)	-0.0150***	(-4.5060)	-0.0180***	(-5.3135)
LVG	-0.0051	(-0.7391)	-0.0027	(-0.3949)	-0.0063	(-0.7141)	-0.0013***	(-0.1484)
LQD	-0.0069	(-1.3754)	-0.0045	(-0.0045)	-0.0078	(-1.2645)	-0.0046	(-0.7581)
DIV	-0.0051	(-1.5279)	-0.0047	(-1.4269)	-0.0002	(-0.0523)	-0.0003	(-0.0875)
CFL	0.0472***	(3.8750)	0.0503***	(4.1559)	0.0371**	(2.8234)	0.0404**	(3.1144)
CFC	0.0838***	(5.3826)	0.0839***	(5.4351)	0.0648***	(4.1602)	0.0638***	(4.1556)
CEXP	0.1646***	(7.8424)	0.1750***	(8.2746)	0.1471***	(6.3497)	0.1604***	(6.9163)
R-Squared	0.21213		0.22079		0.22197		0.2393	
Adj R-Sq	0.20134		0.21015		0.06573		0.08716	
F-Statistics	154.164		162.789		17.581		19.4649	
Sig F	0.000		0.000		0.000		0.000	
Residual SE	0.50272		0.49815		0.39913		0.39106	
Hausman χ^2	59.984		16.225		59.984		16.225	
Sig χ^2	0.000		0.03927		0.000		0.03927	

Table 5 shows the estimated results of study model based on panel analysis. The model is tested both for random effect and fixed effect. The significance of Husman test shows that the null hypothesis of no fixed effect is rejected and therefore, the data contains firm level fixed effect. The table presented above presents the random effect and fixed effect analysis of both proxies i.e. INT1 and INT2. The estimated results of both random effect and fixed effect model are in line with Lin et al. (2019) and Benkraiem et al. (2020) which argued that firms with international diversification are less inclined towards saving more cash. In order to test robustness of results the study used alternate proxy of corporate internationalization which give consistent results. This confirms that firms engaged in international operations maintain their cash balances and avoid uncertainty in cash.

Table 6: Dynamic Panel GMM Estimation

	Model 1		Model 2	
	Coefficient	z-value	Coefficient	z-value
INT1	-0.0063*	(-2.485)		
INT2	----		-0.00720**	(-2.679)
SZ	-0.00001	(-0.013)	-0.00001	(-0.059)
LVG	-0.00091	(-0.158)	0.00026	(0.051)
LQD	-0.0044	(-0.536)	-0.00294	(-0.378)
DIV	-0.0046	(-1.877)	-0.00429	(-1.734)
CFL	0.05162	(1.793)	0.05214	(1.848)
CFC	0.1892***	(3.544)	0.1891***	(3.601)
CEXP	0.1514	(1.457)	0.1614	(1.536)
CFRT-1	0.61200***	(4.152)	0.6088***	(4.31)
Hansen J. Test	12.03		12.65	
Significance J	0.9567		0.9424	
F Test	83.33		90.41	
Significance	0.000		0.000	

For robustness of results the study has also applied dynamic panel GMM technique which is recommended to address the issues of endogenous explanatory variables. Table 6 presents the estimated results of the study model based on dynamic panel GMM approach. The results are consistent for INT1 and INT2. Both proxies of corporate internationalization have a significantly negative relationship with uncertainty of cash which is in line with Benkraiem et al. (2020). This again confirms that firms engaged in international operations maintain their cash balances and avoid uncertainty in cash. Similarly, large size firms also have a negative relationship with cash uncertainty which is in accordance with the study hypothesis. Moreover, highly levered firms also have stable cash flows and show lesser uncertainty in their cash balances.

Conclusion

Past researchers have studied the impact of corporate internationalization on cash holdings however, the evidence on impact of internationalization on uncertainty of cash holding is very limited especially in emerging economies of South Asia. Present study therefore, attempts to capture impact of corporate internationalization, size, cash flow and capital expenditure on uncertainty of cash holdings in an emerging economy. The estimated results show that firms engaged in international operations tend to stabilize their cash holdings. Similarly, large size firms and firms with high operating cash flows are in better position to reduce fluctuations in their cash holdin-

gs. On the contrary corporate capital expenditure increases its cash volatility. The results of the study are robust to the alternative proxies of internationalization and methods of estimation.

Declarations

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Conflicts of interest/Competing interests

There is no conflict of interest/Competing interests.

Availability of data and material

The data that support the findings of this study is available upon request.

Code Availability

The R Code Sheet is attached in the appendix.

Authors' Contributions

Hammad Hassan Mirza: Methodology and Investigation. **Haroon Hussain:** Conceptualization and Literature – review and editing, **Ghulam Sarwar:** Estimation of Results **Haroon Habib:** Data Collection

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R Codes

```

#Load Data
attach(Data)

#Library Required
library(plm) #For Panel Data Modelign
library(tidyverse) #For Data Management
library(readr) #For reading CSV files
library(foreign)
library(lmtest) # For linear Regression OLS
library(corrplot) #For Correlation

#Descriptive Statistics
summary(Data)
#First run simple OLS Regression for INT1 as main IV
Ols<- lm(CFR ~ INT1+SZ+LVG+LQD+DIV+CFL+CFS+CEXP)
#Secon Run another OLS Regression for INT2 as alt IV
Ols2 <- lm(CFR ~ INT2+SZ+LVG+LQD+DIV+CFL+CFS+CEXP)
#Check the Summary of Results of OLS and OLS2
summary(Ols)
summary(Ols2)

#Starting Panel Data Analysis
#Declare Data as Panel based on Firms and Years
PD <- pdata.frame(Data, index=c("Panel","Years"), drop.index = TRUE)
#Run a Fixed Effect Model
FEM<-plm(CFR ~ INT1+SZ+LVG+LQD+DIV+CFL+CFS+CEXP, data=PD, model="within")
FEM2<-plm(CFR ~ INT2+SZ+LVG+LQD+DIV+CFL+CFS+CEXP, data=PD, model="within")
#Run a Random Effect Model
REM<-plm(CFR ~ INT1+SZ+LVG+LQD+DIV+CFL+CFS+CEXP, data=PD, model="random")
REM2<-plm(CFR ~ INT2+SZ+LVG+LQD+DIV+CFL+CFS+CEXP, data=PD, model="random")
#Check Summary of FEM and REM
summary(FEM)
summary(FEM2)
summary(REM)
summary(REM2)
#Apply Hausman Test
phtest(FEM, REM)
phtest(FEM2, REM2)

#Application of dynamic panel GMM

dat2<-PD

m1 <- pdynmc(dat = dat2,
varname.i = "Panel",
varname.t = "Years",

```



```
use.mc.diff = TRUE,
use.mc.lev = FALSE,
use.mc.nonlin = FALSE,
inst.stata = TRUE,
include.y = TRUE,
varname.y = "CFR", #Dependent Variable
lagTerms.y = 1,
maxLags.y = 2,
fur.con = TRUE,
fur.con.diff = TRUE,
fur.con.lev = TRUE,
varname.reg.fur = c("INT1", "SZ", "LVG", "LQD", "DIV", "CFS", "CFL", "CEXP"),
lagTerms.reg.fur = c(0,0,0,0,0,0,0),
include.dum = TRUE,
dum.diff = FALSE,
dum.lev = FALSE,
varname.dum = "Years",
w.mat = "iid.err",
w.mat.stata = TRUE,
std.err = "corrected",
estimation = "twostep",
opt.meth = "none")
summary(m1)
##### Extracting Additional Information#####
# Extract coefficient of Fitted Model
coef(m1)
#Extract coefficient of Time Dummies of Fitted Model
dummy.coef(m1)
# Extract Fitted Values of Fitted Model
fitted(m1, step = "2", na.rm=FALSE)
# Extract Instrument Matrix of Fitted Model
model.matrix(m1, sparse = TRUE)
# Extract Instrument Count
ninst(m1)
plot(m1)
#Diagnostic Tests#
#Arrelano and Bond (1992) Serial Correlation Test
mtest.fct(m1, t.order=2)
# Hansan J Test
jtest.fct(m1)
#Wald Test
wald.fct(param="all", m1)
```

