

Cash Holdings Scenario in Indian Manufacturing Firms: Evidence from Financial Crisis

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Abstract: This paper investigates the impact of global financial crisis 2008-2009 on cash holdings by using a sample of 500 Indian manufacturing firms. This paper also examines the impact of firm specific determinants such as Firm size, Growth opportunities, Leverage, Cash flow, Dividend, Net working capital, R&D expenditure, Assets tangibility, Profitability, Interest expenses, Cash conversion cycle, Inverse of Altman's Z Score, Firm age and Cash flow volatility on cash holdings in pre crisis, crisis and post crisis period. Pooled ordinary least squares regression is used for analysing the data. The study finds that financial crisis has impact on cash holdings of the Indian manufacturing firms. Further, the study finds that the impact of firm specific determinants on cash holdings differs in pre crisis, crisis and post crisis period.

Keywords: Cash holdings; Determinants; Financial crisis; Trade-off theory; Pecking order theory; Agency theory

JEL Classification: G01; G30; G32

I. INTRODUCTION

Financial crisis of 2008-2009 has affected firms across the globe and firms have witnessed many substantial changes due to such crisis. Some firms were forced to close and some firms managed to survive. The question arises as to what changes took place in the firms due to such financial crisis and how they managed such changes to ensure their survival. Firms have experienced many changes because of financial crisis. However, this study focuses on what changes have been witnessed in the cash holdings of the Indian manufacturing firms and how the firm specific variables have affected the cash holdings in pre crisis, crisis and post crisis period.

Cash is crucial for every business even if holding cash is costly as it carries low financial return and involves agency costs. Cash is the basic input needed to keep the business running and it is the ultimate output the business expects to realise. Hence, every business needs to hold certain amount of cash and such need is propelled by several motives such as transaction motive, precautionary motive, speculative motive, agency motive, firm's value motive, compensating balance requirement and strategic motive.

Holding of cash by firms is also supported by financial theories. Static trade-off theory by Keynes (1936) [1] states that cash holdings of firms are determined by striking a

balance between the costs and benefits of holding such cash. The pecking order theory by Myers & Majluf (1984) [5] suggests that firms hold cash because they prefer to finance their investments by internal funds and in case of scarcity of internal funds they go for debt and finally at the end they go for equity. When the firms generate enough funds from operation and the funds are sufficient enough to finance the positive NPV (Net Present Value) project then the firms repay the debt first then pileup cash. Agency theory by Jensen (1986) [6] states that managers hold more cash to pursue their own interests which do not coincide with those of shareholders.

On the other hand, capital structure theory by Modigliani & Miller (1958) [2] states that in a friction less world (perfect capital market), firms do not need to hold cash reserve. But in real world, firms operate with lot of frictions (imperfect capital market) where there exist transaction cost, bankruptcy cost, taxes and agency cost. Hence, all these frictions make the cash holdings decision highly important for firms and these frictions emanates from various sources like firm specific factors and micro as well as macroeconomic scenarios.

Many studies focusing on firm specific determinants of cash holdings have been undertaken in developed countries but study focusing on firm specific determinants of cash holdings in Indian context is scant. Anand et al. (2012) [43],

Al-Najjar (2013) [50], Gautam et al. (2014) [54], Saluja & Drolia (2015) [59], Cheung (2016) [64] and Maheshwari & Rao (2017) [65] have studied firm specific determinants of cash holdings of Indian firms. However, no study has focused on the impact of financial crisis 2008-2009 on firm's cash holdings as well as the impact of firm specific determinants on cash holdings in pre crisis, crisis and post crisis period in Indian context.

This study contributes to the existing literature by studying the impact of financial crisis 2008-2009 on cash holdings of Indian manufacturing firms and the impact of firm specific determinants on cash holdings in pre crisis, crisis and post crisis period. The data set consists of 500 Indian manufacturing firms over a period from 2005 to 2017. The study finds that the financial crisis 2008-2009 has impact on cash holdings of Indian manufacturing firms. Further, the study finds that the impact of firm specific determinants on cash holdings also differs in pre crisis, crisis and post crisis period.

The rest part of this paper is organized as follows. Section II deals with Review of Literature, section III deals with Research Methodology, section IV deals with Empirical Results and Discussion and section V concludes the study.

II. REVIEW OF LITERATURE

This section discusses the literature on impact of financial crisis on cash holdings and the impact of firm specific determinants on cash holdings in pre crisis, crisis and post crisis period from different perspectives.

Al-Amarneh (2015) [62] finds Jordanian firms to hold more cash during crisis. In pre crisis period cash flow, investment opportunities, dividend payment and size are positively related to cash holdings whereas capital expenditure, leverage, liquid assets substitutes and profitability are negatively related to cash holdings. During crisis investment opportunities and profitability are positively related to cash holdings whereas capital expenditure cash flow, leverage, dividend payment, liquid assets substitutes and size are negatively related to cash holdings. In post crisis period capital expenditure, investment opportunities, leverage, dividend payment and profitability are positively related to cash holdings whereas cash flow, liquid assets substitutes, and size are negatively related to cash holdings.

Kinnunen (2015) [57], in the context of Sweden, finds that in both pre and post crisis period cash holdings has negative association with bank debt, size and net working capital whereas cash holdings has positive association with capital expenditure, cash flow, cash flow volatility, growth opportunities, leverage and profitability.

Song & Lee (2012) [41] study the impact of 2008-2009 financial crisis on the firms of 8 East Asian countries namely Hong Kong, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan, and Thailand. The study finds that in pre crisis period profitability has positive association with cash holdings and net working capital has negative association with cash holdings. In post crisis period profitability, growth opportunities, size and dividend have positive association with cash holdings whereas net working capital and leverage have negative association with cash holdings. Growth opportunities, size, leverage and dividend are insignificant in pre crisis period but significant in post crisis period whereas cash flow volatility is significant in both the period.

Pinkowitz et al. (2013) [45] investigate the determinants of cash holdings of U.S. firms during financial crisis 2008-2009 collecting a data set over 1998-2010. The study finds that cash holdings increases with growth opportunities and R&D expenditure whereas cash holdings decreases with size, cash flow, net working capital and leverage. Further, Dividend found to have insignificant impact on cash holdings.

Lian et al. (2011) [33] investigate the impact of 2008-2009 financial crisis on corporate cash holdings of Chinese firms collecting a data set over 1999-2009. The study finds that during crisis cash holdings increases indicating a positive relationship between financial crisis and cash holdings. Further, growth opportunities, cash flow, dividend and cash flow volatility have positive impact on cash holdings whereas size, leverage and net working capital have negative impact on cash holdings.

Bliss et al. (2015) [58], in the context of U.S., find that the reduction in dividend payment and corporate cash holdings are positively related during the financial crisis 2008-2009 which means that firms consider reduction in payout as a source of fund.

Elkinawy & Stater (2007) [22] study the impact of Mexican crisis (1994-1995) and Brazilian crisis (1999) on corporate cash holdings of firms in Latin America such as Argentina, Brazil and Mexico. The study finds that both Mexican and Brazilian crisis have a different impact on the determinants of cash holdings. Size, profit, dividend have positive impact on cash holdings whereas leverage and net working capital have negative impact on cash holdings in both the crisis period. ADR (firms cross listed on U.S. stock exchange) and size-crisis interaction have positive impact on cash holdings whereas ADR-crisis interaction has negative impact on cash holdings during Mexican crisis. However, during Brazilian crisis ADR has negative impact on cash holdings whereas leverage and ADR-crisis interaction have positive impact on cash holdings.

Gao & Yun (2009) [27] document that U.S. firm with less liquidity due to financial crisis 2008-2009 tends to forgo investment opportunities to accumulate cash but firms with high liquidity maintain their business activity at pre crisis level.

Campello et al. (2011) [38] undertake a primary survey of 800 Chief Financial Officers from North America, Europe and Asia. The survey finds that the negative association between line of credit and cash holdings is more intensive during financial crisis 2008-2009 than pre crisis period.

A. Research Gap

From the review of literature, it is found that studies concerning firm specific determinants of cash holdings in developed countries are plenty in number but such studies in Indian context are scant. This study is distinct from prior studies in three senses. Firstly, country like India is taken as the sample. Secondly, this study attempts to investigate the impact of financial crisis 2008-2009 on cash holdings in Indian context. Thirdly, this study assess the impact of firm specific parameters on cash holdings in pre crisis, crisis and post crisis period.

B. Research Questions

Consistent with research gap, the following research questions are developed.

- ❖ Does financial crisis have impact on cash holdings of Indian manufacturing firms?
- ❖ Do firm specific determinants have different impact on cash holdings in financial crisis?

C. Objectives of the Study

The objectives of this study are:

- ❖ To investigate the impact of financial crisis on cash holdings of Indian manufacturing firms.
- ❖ To examine the impact of firm specific determinants on cash holdings in pre crisis, crisis and post crisis period.

D. Scope of the Study

This study is confined to the investigation of impact of financial crisis on cash holdings of Indian manufacturing firms and to examine the impact of firm specific determinants on cash holdings of Indian manufacturing firms in pre crisis, crisis and post crisis period. The study has taken variables such as Firm size, Growth opportunities, Leverage, Cash flow, Dividend, Net working capital, R&D expenditure, Assets tangibility, Profitability, Interest expenses, Cash conversion cycle, Inverse of Altman's Z Score, Firm age, Cash flow volatility and Crisis dummy to study their impact on cash holdings.

E. Rationale of the Study

The financial crisis of 2008-2009 has affected firms across the globe and forced them to change their cash management

policies. Many firms across the globe were forced to close down due to liquidity crunch and many firms managed to survive. In the light of the above backdrop, this study aims at investigating how global financial crisis 2008-2009 has changed the cash holdings policies of Indian manufacturing firms and how firm specific determinants have affected the cash holdings in pre crisis, crisis and post crisis period.

F. Hypotheses

Based on research gap, this study focuses on two dimensions i.e., impact of financial crisis on cash holdings of Indian manufacturing firms and changes in the impact of firm specific determinants on cash holdings in pre crisis, crisis and post crisis period. Hence, following two null hypotheses are developed.

H₀₁: Financial crisis has no impact on cash holdings of Indian manufacturing firms.

H₀₂: There is no difference in impact of firm specific determinants on cash holdings in pre crisis, crisis and post crisis period.

III. RESEARCH METHODOLOGY

This section discusses sample selection, data description and model specification.

A. Sample Selection and Data Description

The data used in this study relate to Indian manufacturing firms listed in both National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). The data are collected from PROWESS data base of CMIE (Centre for Monitoring Indian Economy). This study is confined to listed manufacturing firms because listed firms are required to follow the norms prescribed by Securities and Exchange Board of India (SEBI) for financial reporting. Firms from banking and financial services are excluded from the sample as the regulation and financial reporting practice followed by those firms differ from others. In addition, firms with missing data are excluded. Thus, a data set of 6,500 firm-year observation is obtained for 500 sample firms over the study period from 2005 to 2017. Table 1 shows the sample selection procedure. To study the impact of crisis on cash holdings the data set is categorised into 3 different periods such as pre crisis period (2005-2007), crisis period (2008-2009) and post crisis period (2010-2017).

Table 1. Sample Selection Procedure

Criterion	Number of Firms
Initial sample Manufacturing firms collected from PROWESS database of CMIE	17807
Minus firms with missing financial statement information	17307
Final sample	500

Source: Authors' own collection.

B. Model Specification

Consistence with literature, our dependent variable is cash holdings. The independent variables are firm size, growth opportunities, leverage, cash flow, dividend, net working capital, R&D expenditure, assets tangibility, profitability, interest expenses, cash conversion cycle, inverse of Altman's Z score, firm age, cash flow volatility and crisis dummy. To test the hypotheses four models are developed. Model I depicts the impact of financial crisis on cash holdings of Indian manufacturing firms where crisis dummy is used as primary explanatory variable and firm specific determinants are used as control variables. Model II, Model III and Model IV depict the impact of firm specific determinants on cash holdings in pre crisis, crisis and post crisis period respectively. The four models are as follows:

$$\text{CASH}_{it} = \alpha_0 + \beta_1 \text{SIZE}_{it} + \beta_2 \text{GOP}_{it} + \beta_3 \text{LEV}_{it} + \beta_4 \text{CF}_{it} + \beta_5 \text{DIV}_{it} + \beta_6 \text{NWC}_{it} + \beta_7 \text{R \& D}_{it} + \beta_8 \text{TAN}_{it} + \beta_9 \text{PFT}_{it} + \beta_{10} \text{INE}_{it} + \beta_{11} \text{CCC}_{it} + \beta_{12} 1/Z_{it} + \beta_{13} \text{AGE}_{it} + \beta_{14} \text{CFV}_{it} + \beta_{15} \text{DUMC}_{it} + \varepsilon \text{----- (I)}$$

$$\text{CASH}_{it} = \alpha_0 + \beta_1 \text{SIZE}_{it} + \beta_2 \text{GOP}_{it} + \beta_3 \text{LEV}_{it} + \beta_4 \text{CF}_{it} + \beta_5 \text{DIV}_{it} + \beta_6 \text{NWC}_{it} + \beta_7 \text{R \& D}_{it} + \beta_8 \text{TAN}_{it} + \beta_9 \text{PFT}_{it} + \beta_{10} \text{INE}_{it} + \beta_{11} \text{CCC}_{it} + \beta_{12} 1/Z_{it} + \beta_{13} \text{AGE}_{it} + \beta_{14} \text{CFV}_{it} + \varepsilon \text{----- (II)}$$

$$\text{CASH}_{it} = \alpha_0 + \beta_1 \text{SIZE}_{it} + \beta_2 \text{GOP}_{it} + \beta_3 \text{LEV}_{it} + \beta_4 \text{CF}_{it} + \beta_5 \text{DIV}_{it} + \beta_6 \text{NWC}_{it} + \beta_7 \text{R \& D}_{it} + \beta_8 \text{TAN}_{it} + \beta_9 \text{PFT}_{it} + \beta_{10} \text{INE}_{it} + \beta_{11} \text{CCC}_{it} + \beta_{12} 1/Z_{it} + \beta_{13} \text{AGE}_{it} + \beta_{14} \text{CFV}_{it} + \varepsilon \text{----- (III)}$$

$$\text{CASH}_{it} = \alpha_0 + \beta_1 \text{SIZE}_{it} + \beta_2 \text{GOP}_{it} + \beta_3 \text{LEV}_{it} + \beta_4 \text{CF}_{it} + \beta_5 \text{DIV}_{it} + \beta_6 \text{NWC}_{it} + \beta_7 \text{R \& D}_{it} + \beta_8 \text{TAN}_{it} + \beta_9 \text{PFT}_{it} + \beta_{10} \text{INE}_{it} + \beta_{11} \text{CCC}_{it} + \beta_{12} 1/Z_{it} + \beta_{13} \text{AGE}_{it} + \beta_{14} \text{CFV}_{it} + \varepsilon \text{----- (IV)}$$

Where,

CASH_{it} = Cash holdings, measured as ratio of cash and cash equivalents to net assets (total assets minus cash and cash equivalents). The underlying reason for deflating cash and cash equivalents by net assets is that a firm's ability to generate future profit depends upon its net assets. Further, the objective of deflating cash by net assets is to remove the problem of circularity. Hence, all other variables are also deflated by net assets.

SIZE_{it} = Size of the firm, measured as natural logarithm of net assets.

GOP_{it} = Growth opportunities, measured as market-to-book ratio. Market-to-book ratio is calculated as ratio of book value of net assets minus book value of equity plus market value of equity to net assets.

LEV_{it} = Leverage, measured as ratio of total debt to net assets.

CF_{it} = Cash flow, measured as ratio of cash flow from operation to net assets.

DIV_{it} = A dummy variable for dividend that takes a value 1 if a firm pays dividend and 0 otherwise.

NWC_{it} = Net working capital, measured as ratio of net working capital minus cash and cash equivalents to net assets.

R&D_{it} = Research and Development expenditure, measured as ratio of R&D expenditure to net assets.

TAN_{it} = Tangibility of assets, measured as ratio of fixed assets to net assets.

PFT_{it} = Profitability, measured as ratio of EBIT (Earnings before Interest and Taxes) to net assets.

INE_{it} = Interest expenses, measured as ratio of interest expenses to net assets.

CCC_{it} = Length of cash conversion cycle, measured as natural logarithm of inventory conversion period plus debtor conversion period minus creditor deferment period.

1/Z_{it} = Inverse of adjusted version of Altman's Z score (1968).

AGE_{it} = Age, measured as natural logarithm of number of year since incorporation of firm.

CFV_{it} = Cash flow volatility, measured as the volatility of a firm's cash flow from operation over the time period. It is the mean of the standard deviations of cash flow over net assets.

DUMC_{it} = A dummy variable for crisis that takes a value 1, for period between 2008 and 2009 and 0 otherwise.

IV. EMPIRICAL RESULTS AND DISCUSSION

This section discusses the empirical results and findings of the study.

A. Trend Analysis

Trends of Cash Holdings

Figure:1 Trend of Cash Holdings over the Study Period (2005-2017)

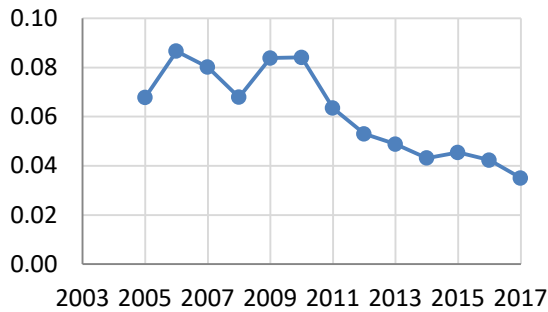


Figure: 2 Trend of Cash Holdings in Pre Crisis Period (2005-2007)

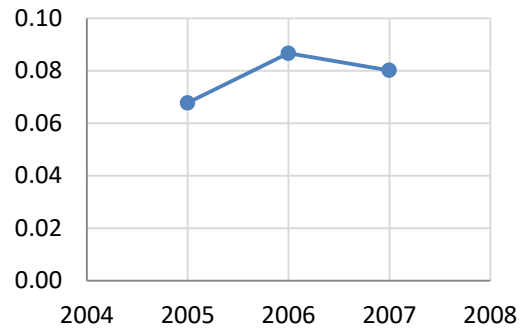


Figure: 3 Trend of Cash Holdings in Crisis Period (2008-2009)

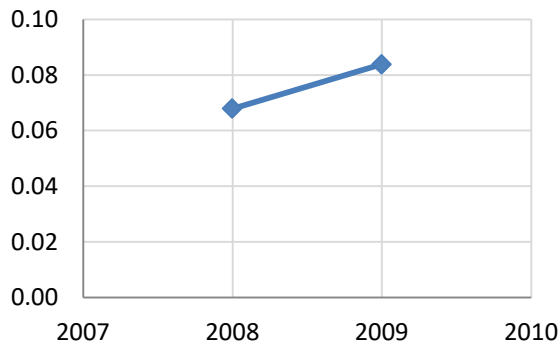


Figure: 4 Trend of Cash Holdings in Post Crisis Period (2010-2017)

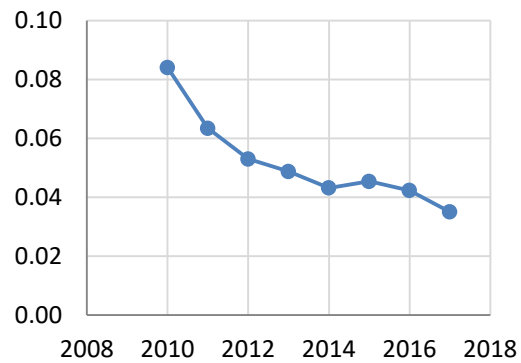


Figure 1 depicts the trend of cash holdings over the study period from 2005 to 2017 and it shows a fluctuating trend. Further, the trends of cash holdings in pre crisis period (2005-2007), crisis period (2008-2009) and post crisis period (2010-2017) are shown separately to get more insight from the trends of cash holdings. Figure 2 depicts the trend of cash holdings in pre crisis period. It shows an upward trend from 2005 to 2006 but from 2006 to 2007 it starts declining which signals the start of crisis. Figure 3 depicts the trend of cash holdings in the crisis period from 2008 to 2009. In 2008, cash holdings declines very sharply because that period is the peak of the crisis and after 2008 cash holdings start increasing. Figure 4 showing cash holdings in post crisis period depicts that the upward trend of cash holdings started in crisis period continues till 2010 and after that it starts decreasing.

From the above analysis it is clear that there is a sharp decline in cash holdings of Indian manufacturing firms in 2008 and after 2008 there is a sharp increase in cash holdings which signals the existence of impact of financial crisis on cash holdings of Indian manufacturing firms.

B. Descriptive Statistics

Table 2. Descriptive Statistics

	Pre Crisis					Crisis					Post Crisis				
	Mean	Median	S.D.	Min	Max	Mean	Median	S.D.	Min	Max	Mean	Median	S.D.	Min	Max
CASH	0.078	0.028	0.141	0.000	1.650	0.076	0.025	0.202	0.001	3.510	0.052	0.014	0.140	0.000	2.494
SIZE	8.162	8.015	1.443	4.824	13.960	8.633	8.456	1.485	5.288	14.620	9.143	8.946	1.582	5.100	15.510
GOP	1.866	1.344	1.582	0.398	21.750	1.340	0.993	1.061	0.211	10.920	1.814	1.139	1.876	-0.115	23.350
LEV	0.640	0.646	0.189	0.131	1.699	0.627	0.649	0.186	0.033	1.846	0.607	0.606	0.286	-0.471	5.374
CF	0.096	0.088	0.098	-0.254	0.618	0.094	0.088	0.106	-0.375	0.631	0.088	0.083	0.096	-0.487	1.069
DIV	0.843	1.000	0.364	0.000	1.000	0.789	1.000	0.408	0.000	1.000	0.717	1.000	0.451	0.000	1.000
NWC	1.189	0.859	1.539	-0.530	27.120	0.503	0.426	0.456	-0.604	5.102	0.084	0.079	0.276	-4.770	1.879
R&D	0.006	0.000	0.017	0.000	0.160	0.006	0.000	0.017	0.000	0.192	0.006	0.001	0.016	0.000	0.237
TAN	0.659	0.637	0.281	0.032	1.703	0.621	0.599	0.285	0.033	2.042	0.615	0.587	0.314	0.036	2.764
PFT	1.266	1.121	0.666	0.040	6.721	1.198	1.030	0.740	0.007	6.295	1.143	1.036	0.723	-0.002	8.990
INE	0.022	0.020	0.016	0.000	0.115	0.026	0.025	0.019	0.000	0.105	0.026	0.021	0.025	0.000	0.290
CCC	4.295	4.469	0.982	-2.526	7.240	4.281	4.459	1.055	-2.207	9.287	4.379	4.486	1.115	-4.605	12.620
1/Z	0.174	0.156	0.105	0.017	1.947	0.216	0.177	0.462	0.024	14.170	0.215	0.162	0.628	-14.610	24.320
AGE	3.365	3.258	0.584	1.609	4.970	3.461	3.367	0.533	2.079	4.984	3.621	3.526	0.467	2.303	5.037
CFV	0.086	0.074	0.048	0.019	0.474	0.086	0.074	0.048	0.019	0.474	0.086	0.074	0.048	0.019	0.474

Source: Authors' own calculation.

The descriptive statistics of the firm specific parameters under study are reported in table 2. It depicts that the average cash holdings of Indian manufacturing firms stands at 7.6 % in crisis period as against 7.8% and 5.2% in pre crisis and post crisis period respectively. It indicates that there is decrease in cash holdings in crisis period as compared to pre crisis period and also there is further decrease in cash holdings in post crisis period as compared to crisis period.

C. Correlation Matrix

Table 3. Correlation Matrix (Karl Pearson)

SIZE	GOP	LEV	CF	DIV	NWC	R&D	TAN	PFT	INE	CCC	1/Z	AGE	CFV	
1	0.15	0.01	0.00	0.11	-0.21	0.05	-0.19	-0.19	-0.08	-0.07	0.03	0.27	-0.15	SIZE
	1	-0.05	0.35	0.14	0.02	0.18	-0.21	0.22	-0.28	-0.13	-0.10	0.09	0.21	GOP
		1	-0.12	-0.32	-0.12	-0.12	0.17	0.01	0.58	-0.06	0.06	-0.12	0.04	LEV
			1	0.19	0.01	0.10	0.15	0.29	-0.12	-0.17	-0.08	0.02	0.12	CF
				1	0.10	0.11	-0.18	0.17	-0.41	-0.09	-0.13	0.07	-0.01	DIV
					1	0.03	-0.09	0.15	-0.11	0.00	-0.05	-0.18	0.05	NWC
						1	-0.11	-0.01	-0.16	-0.01	-0.04	0.00	0.17	R&D

1	0.04	0.28	-0.06	0.00	-0.05	-0.07	TAN
	1	-0.08	-0.44	-0.18	-0.03	0.21	PFT
		1	0.05	0.04	-0.15	0.01	INE
			1	0.15	-0.02	-0.04	CCC
				1	0.00	0.00	1/Z
					1	-0.18	AGE
						1	CFV

Source: Authors' own calculation.

Table 3 shows the Karl Pearson correlation among the firm specific parameters. The correlation coefficient ranges from 0.01 to 0.58 which indicates a low correlation among the firm specific parameters. In addition, variance inflation factor (VIF) is used to check the multicollinearity among the firm specific parameters. The highest VIF is 1.873 which indicates that there is no multicollinearity among the firm specific parameters used in this study.

D. Analysis of Variance (ANOVA)

Table 4. ANOVA Result

ANOVA (Pre Crisis, Crisis and Post Crisis)					
Source of Variation	SS	DF	MS	F	P-value
Between Groups	0.993	2	0.496	21.679	0.000
Within Groups	148.789	6497	0.023		
Total	149.782	6499			

Source: Authors' own calculation.

Table 4 shows the result of single factor ANOVA for the period from 2005 to 2017. The entire data period is categorised into 3 different periods such as pre crisis period (2005-2007), crisis period (2008-2009) and post crisis period (2010-2017) to analyse the null hypothesis of no difference in cash holdings of the sample Indian manufacturing firms in those periods. F statistics of 21.679 with P- value of 0.000 shows that there is significant difference in cash holdings of Indian manufacturing firms in pre crisis, crisis and post crisis period. This difference provides an inquisitiveness to further investigate the impact of financial crisis on cash holdings through regression analysis.

E. Regression Results

Table 5. Regression Result of Model I

Dependent Variable			CASH		
Independent Variable	Coefficient	T-test	P-values	VIF	
Intercept	-3.611	-16.787	0.000		
SIZE	-0.139***	-11.188	0.000	1.296	
GOP	0.075***	6.190	0.000	1.451	
LEV	1.259***	14.441	0.000	1.624	
CF	1.571***	7.702	0.000	1.336	
DIV	0.338***	7.283	0.000	1.324	

NWC	0.095***	4.718	0.000	1.127
R&D	4.240***	3.820	0.000	1.088
TAN	-0.250***	-3.889	0.000	1.262
PFT	0.185***	6.155	0.000	1.541
INE	-20.674***	-19.328	0.000	1.873
CCC	-0.021	-1.167	0.243	1.306
1/Z	-0.047	-1.391	0.164	1.062
AGE	0.003	0.088	0.930	1.169
CFV	0.070	0.176	0.860	1.184
DUMC	0.410***	8.448	0.000	1.024
F- test	F(15, 6484)	103.594	0.000	
Adjusted R ²	0.191			
Observations	6500			

Source: Authors' own calculation.

Note: ***, ** and * indicate significant level at 1%, 5% and 10% respectively.

Table 5 shows the result of regression analysis of Indian manufacturing firms for the period from 2005 to 2017 using crisis as a target variable. Crisis variable is used as dummy variable that takes a value 1, for period between 2008 and 2009 and 0 otherwise. To study the impact of crisis on cash holdings, crisis dummy is used as primary explanatory variable and other variables such as firm size, growth opportunities, leverage, cash flows, dividend, net working capital, R&D expenditure, assets tangibility, profitability, interest expenses, cash conversion cycle, inverse of Altman's Z score, firm age and cash flow volatility are used as control variables. The crisis dummy (Coefficient 0.410, P-value 0.000) has significant impact on cash holdings. This result indicates that crisis is a factor that influences the cash holdings of Indian manufacturing firms. Further, this analysis provides an inquisitiveness to investigate the impact of firm specific determinants on cash holdings in pre crisis, crisis and post crisis period.

Table 6. Regression Result of Model II, Model III and Model IV

Independent Variable	Pre Crisis (Model II)			Crisis (Model III)			Post Crisis (Model IV)			VIF
	Coefficient	T-test	P-values	Coefficient	T-test	P-values	Coefficient	T-test	P-values	
Intercept	-3.666	-8.565	0.000	-4.173	-8.530	0.000	-3.835	-12.830	0.000	
SIZE	-0.053**	-2.027	0.043	-0.050*	-1.663	0.097	-0.149***	-9.143	0.000	1.296
GOP	0.093***	3.599	0.000	-0.002	-0.042	0.967	0.066***	4.396	0.000	1.451
LEV	1.982***	9.284	0.000	1.581***	5.828	0.000	1.203***	9.580	0.000	1.624
CF	1.640***	4.166	0.000	1.879***	4.456	0.000	1.462***	5.233	0.000	1.336
DIV	-0.064	-0.640	0.522	0.107	1.011	0.312	0.360***	5.927	0.000	1.324
NWC	-0.012	-0.530	0.596	0.046	0.488	0.626	0.453***	3.950	0.000	1.127

R&D	4.593**	2.298	0.022	1.787	0.773	0.440	4.561***	2.952	0.003	1.088
TAN	-0.435***	-3.298	0.001	-0.232	-1.489	0.137	-0.216**	-2.557	0.011	1.262
PFT	-0.124*	-1.748	0.081	0.212***	3.060	0.002	0.234***	5.926	0.000	1.541
INE	-18.173***	-6.969	0.000	-26.759***	-9.305	0.000	-18.516***	-14.082	0.000	1.873
CCC	0.038	0.960	0.337	0.023	0.528	0.598	-0.036	-1.537	0.124	1.306
1/Z	-2.188***	-4.947	0.000	-0.132	-1.493	0.136	-0.017	-0.450	0.652	1.062
AGE	0.032	0.517	0.605	0.039	0.503	0.615	0.045	0.857	0.392	1.169
CFV	-0.057	-0.078	0.938	1.497	1.677	0.094	0.429	0.794	0.427	1.184
F- test	F(14, 1485)	19.911	0.000	F(14, 985)	16.471	0.000	F(14, 3985)	62.792	0.000	
Adjusted R²	0.150			0.178			0.178			
Observations	1500			1000			4000			

Source: Authors' own calculation.

Note: ***, ** and * indicate significant level at 1%, 5% and 10% respectively.

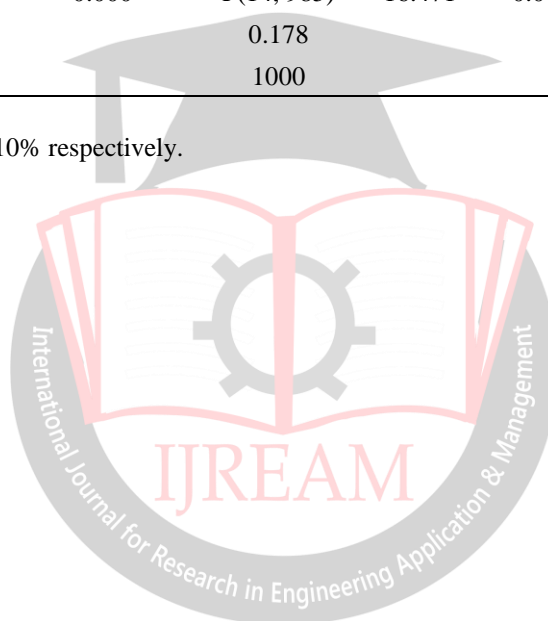


Table 6 shows the result of Pooled Ordinary Least Squares regression measuring the impact of firm specific determinants on cash holdings in three different periods such as pre crisis (Model II), crisis (Model III) and post crisis period (Model IV).

The result finds that the adjusted R^2 in pre crisis, crisis and post crisis period is 0.150, 0.178 and 0.178 respectively. It indicates that the models explain 15%, 17.8% and 17.8% of cash holdings in pre crisis, crisis and post crisis period respectively.

Firm size (SIZE) has significantly negative association with cash holdings in pre crisis (-0.053, 0.043), crisis (-0.050, 0.097) and post crisis period (-0.149, 0.000). It means large firms hold less cash than small firms in all periods which support the trade-off theory. However, the impact of size in crisis period is less as compared to pre crisis and post crisis period which states that large firms becomes less conservative in financial crisis.

Growth opportunities (GOP) have positive impact on cash holdings in pre crisis (0.093, 0.000) and post crisis period (0.066, 0.000) which supports both trade-off theory and pecking order theory. However, in crisis period such impact is found to be insignificant (-0.002, 0.967) due to absence of investment opportunities.

Leverage (LEV) has significantly positive impact on cash holdings in pre crisis (1.982, 0.000), crisis (1.581, 0.000) and post crisis period (1.203, 0.000). This result shows that firms having more debt hold more cash in all the periods to avoid bankruptcy and high cost of raising further debt. Moreover, leverage has less impact on cash holdings in crisis period.

Cash flow (CF) is positively associated with cash holdings in pre crisis (1.640, 0.000), crisis (1.879, 0.000) and post crisis period (1.462, 0.000). It means firm with more cash flows hold more cash for future investment in all periods which supports the pecking order theory. Moreover, the impact of cash flow on cash holdings is more in crisis period as compared to pre crisis and post crisis period.

Dividend (DIV) has positive impact on cash holdings in post crisis period (0.360, 0.000) which means that dividend paying firms hold more cash. However, in pre crisis (-0.064, 0.522) and crisis period (0.107, 0.312) such impact is insignificant.

Net working capital (NWC) is found to have positive impact on cash holdings in post crisis period (0.453, 0.000). It shows that in post crisis period, firm's major portion of the net working capital consists of highly liquid assets. However, such impact is insignificant in both pre crisis (-0.012, 0.596) and crisis period (0.046, 0.626).

R&D expenditure (R&D) is positively associated with cash holdings in both pre crisis (4.593, 0.022) and post crisis period (4.561, 0.003) which states that firms making expenditure on R&D hold more cash because R&D driven innovations are difficult to finance through external financing due to their uncertain outcome, intangible nature and asymmetric information problems. However, such impact is insignificant in crisis period (1.787, 0.440).

The study finds assets tangibility (TAN) to have negative impact on cash holdings in both pre crisis (-0.435, 0.001) and post crisis period (-0.216, 0.011). This is because, firms with more collateral as fixed assets encounter less problem in issuing debt. Hence, such firms have less need to hold cash reserve. But such impact is insignificant in crisis period (-0.232, 0.137) because in crisis, access to debt financing is very tight despite of collaterals.

Profitability (PFT) is negatively associated with cash holdings in pre crisis period (-0.124, 0.081) which supports the trade-off theory that profit is an immediate source of liquidity for firms. However, profitability is positively associated with cash holdings in crisis (0.212, 0.002) and post crisis period (0.234, 0.000) which supports the pecking order theory that more profitable firms hold more cash for future needs.

The impact of interest expenses (INE) on cash holdings is negative in pre crisis (-18.173, 0.000), crisis (-26.759, 0.000) and post crisis period (-18.516, 0.000). This indicates that firms paying more interest hold less cash. Moreover, such impact is more in crisis period as compared to pre crisis and post crisis period.

The impact of cash conversion cycle (CCC) on cash holdings is insignificant in pre crisis (0.038, 0.337), crisis (0.023, 0.598) and post crisis period (-0.036, 0.124).

Inverse of Altman's Z score (1/Z) has negative impact on cash holdings in pre crisis period (-2.188, 0.000) which states that financially distressed firms hold less cash due to reduced financial performance. However, such impact is not significant in crisis (-0.132, 0.136) and post crisis period (-0.017, 0.652).

Firm age (AGE) does not have significant impact on cash holdings in pre crisis (0.032, 0.605), crisis (0.039, 0.615) and post crisis period (0.045, 0.392).

In line with the trade-off theory, Cash flow volatility (CFV) has positive impact on cash holdings in crisis period (1.497, 0.094). This is because firms with more volatile cash flow hold more cash as buffer. However, such impact becomes

insignificant in pre crisis (-0.057, 0.938) and post crisis period (0.429, 0.427).

F. Findings

This study finds that the financial crisis of 2008-2009 has impact on cash holdings of Indian manufacturing firms and the impact of firm specific determinants on cash holdings also differs in pre crisis, crisis and post crisis period. Firm size has negative impact on cash holdings in all the periods which support the trade-off theory. Growth opportunities have positive impact cash holdings in pre crisis and post crisis period which supports both trade-off theory and pecking order theory. However, the impact of growth opportunities is insignificant in crisis period. Leverage has positive impact on cash holdings in pre crisis, crisis and post crisis period. Cash flow is positively associated with cash holdings in pre crisis, crisis and post crisis period which supports the pecking order theory. Dividend has positive impact on cash holdings in post crisis period. However, such impact is insignificant in pre crisis and crisis period. Net working capital has positive impact on cash holdings in post crisis period. However, such impact is insignificant in pre crisis and crisis period. R&D expenditure is positively associated with cash holdings in pre crisis and post crisis period. However, such association is insignificant in crisis period. Assets tangibility is found to have negative impact on cash holdings in pre crisis and post crisis period. However, such impact is insignificant in crisis period. Profitability is negatively associated with cash holdings in pre crisis period which supports the trade-off theory. However, profitability is positively associated with cash holdings in crisis and post crisis period which supports the pecking order theory. The impact of interest expenses on cash holdings is negative in pre crisis, crisis and post crisis period. Inverse of Altman's Z score has negative impact on cash holdings in pre crisis period. However, such impact is insignificant in crisis and post crisis period. Cash flow volatility has positive impact on cash holdings in crisis period which is in line with the trade-off theory. However, such impact becomes insignificant in pre crisis and post crisis period. The impact of cash conversion cycle and firm age on cash holdings is insignificant in pre crisis, crisis and post crisis period.

V. CONCLUSION

This study investigates the impact of financial crisis 2008-2009 on cash holdings of Indian manufacturing firms. Further, the study examines the impact of firm specific determinants such as Firm size, Growth opportunities, Leverage, Cash flow, Dividend, Net working capital, R&D expenditure, Assets tangibility, Profitability, Interest expenses, Cash conversion cycle, Inverse of Altman's Z

Score, Firm age and Cash flow volatility on cash holdings in pre crisis, crisis and post crisis period. The study finds that financial crisis has impact on cash holdings of Indian manufacturing firms. Further, it demonstrates that the impact of firm specific determinants on cash holdings differs in pre crisis, crisis and post crisis period. In pre crisis period, Growth opportunities, Leverage, Cash flow and R&D expenditure have positive impact on cash holdings whereas Firm size, Assets tangibility, Profitability, Interest expenses and Inverse of Altman's Z Score have negative impact on cash holdings. However, the impact of Dividend, Net working capital, Cash conversion cycle, Firm age and Cash flow volatility is insignificant. In crisis period, Leverage, Cash flow, Profitability and Cash flow volatility have positive impact on cash holdings whereas Firm size and Interest expenses have negative impact on cash holdings. However, the impact of Growth opportunities, Dividend, Net working capital, R&D expenditure, Assets tangibility, Cash conversion cycle, Inverse of Altman's Z Score and Firm age is insignificant. In post crisis period, Growth opportunities, Leverage, Cash flow, Dividend, Net working capital, R&D expenditure and Profitability have positive impact on cash holdings whereas Firm size, Assets tangibility and Interest expenses have negative impact on cash holdings. However, the impact of Cash conversion cycle, Inverse of Altman's Z Score, Firm age and Cash flow volatility is insignificant.

This study is limited to Indian manufacturing firms only and the study considers only fourteen determinants of cash holdings which are not exhaustive. The findings of this study are useful for corporate boards, managers, investors and rating agencies while taking decisions. The study has further scope to extend the work to other concerns and to study other variables which may have impact on cash holdings.

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