CASH FLOW HARMONIZATION HOW TO MANAGE AND RESPOND TO CASH FLOW VOLATILITY?

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TKI DINALOG
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How to Manage and Respond to Cash Flow Volatility?
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PREFACE

Working Capital Management has become a strategic concern for many firms since the 2008 financial crisis, since it negatively affects their performance (Roundtree, B. et al 2008) as well as increases the cost of capital (Minton, B. et. al., 1999). Efficient working capital management is necessary to ensure a firm's ability to cope up with its operating costs and debt obligations. It is crucial for operations and finance executives to be highly proactive when the firm faces volatile cash flow periods. Based on research in van der Vliet et al. (2015), we know that firms can better control their cash volatility if they smartly gear their payment terms and conditions with suppliers and with customers to one another. In the project 'Cash Flow Harmonization', the consortium partners TU Eindhoven (TU/e), Accenture B.V. and Rabobank aim to conduct applied research using advanced analytical and statistical methodology to provide innovative solutions in enabling firms bring stability in their cash flow. The key highlights in this report are enlisted below:

- We explore the behaviour, actions, and performance of a firm under operating cash flow volatility. The existing literature primarily focus on aggregate level effects of cash flow volatility on firm performance whereas our empirical investigation explores various facets of this relationship considering firm's heterogeneity.
- We evaluate differential responses of a firm to operating cash flow volatility based on their components of the cash conversion cycle, size, liquidity status, and the working capital. Using a dataset of 3475 firms, we also classify this impact and actions based on "shock susceptibility" and "shock response time'' of the firm.
- We find actions (both short and long term) that can help firms to lower their shock response time, hedge against exchange rate risks, and make them less susceptible to cash flow shocks. This would give working capital managers a micro-level short- and long-term perspective on designing shock recovery strategies. We also evaluate if the understanding of shock susceptibility of firms can help retail investors design their investment strategies.

LESSONS, ACTIONS AND STRATEGIES

SHORT TERM ACTIONS TO MANAGE CASH FLOW VOLATILITY

- It is observed that working capital and long-term debt change substantially (median for all firms changes by 31% and 61 % respectively) during a large negative OCF shock period. So, close monitoring of these parameters is recommended.
- Firms that take actions to decrease their DPO, DSO, and long-term debt during a shock period have improved their shock response times than the firms which do the opposite. This observation is predominantly true for the manufacturing sector.
- For mining and construction sectors, decreasing the DPO (i.e., paying suppliers early) helps lower shock response time. In addition, borrowing money to increase working capital and liquidity should be controlled.
- In the transportation sector, reducing borrowings intended to increase working capital and liquidity along with decreasing DPO help firms to have a lower shock response time.
- The three key lessons with respect to operations and financial parameters during the shock period are:
  - Try to collect the receivables as soon as possible,
  - Pay early to suppliers and
  - Avoid any long-term borrowings.

LONG TERM ACTIONS FOR REDUCING SHOCK RESPONSE TIME

- Firms that respond faster have 28.1 % higher days of inventory outstanding and 16.4 %higher cash conversion cycle.
- Firms that respond faster have also 32.4 % higher working capital but have 64.2 % lesser long-term debt.
- The key lesson for the firms in the long term is to increase the working capital but not by increasing the debt. Further, it helps to maintain higher levels of inventory and a little higher CCC to be better prepared to handle a negative OCF shock.

ACTIONS FOR INVESTOR BASED ON FIRMS SHOCK SUSCEPTIBILITY

- Firms that have been impacted significantly by OCF shocks have 15.9% lesser return per unit risk (Sharpe Ratio values).
- It is important for investors to assess how OCF shocks have impacted the firm performance while making investment decisions.

STRATEGIES TO HEDGE AGAINST EXCHANGE RATE FLUCTUATIONS

- The first step is to identify all the sources of cash flow and develop an accurate cash flow forecast.
- After the cash flow forecast is developed, the firms can start implementing the FX hedging practices into their platform. The firms need to be transparent to their clients regarding the usage of the internal hedging strategies.
- Firms should design a hedging proposal and compare the forward exchange rate with today's spot rate. If the proposal is a swap or a forward belonging to an outgoing cashflow/negative net account balance, it should be executed when the forward exchange rate exceeds the spot rate.

"If I had to run a company on three measures, those measures would be customer satisfaction, employee satisfaction, and cash flow."

Jack Welch, Former CEO, General Electric

1 INTRODUCTION

Cash is king for businesses and often a savior in uncertain market conditions (Smith, 2014). A firm may have a great revenue, but a consistent negative cash flow could lead the firm towards bankruptcy. If we look at cash flows, primarily there are three channels for cash generation in a firm - cash flow from operating activities, cash flow from investments and cash flow from financing. Among these, operating cash flow (OCF) is of utmost importance because it is responsible for driving the cash flows from the other two activities. Trapping of cash in operating processes for a long time is likely to be accompanied by a constricted growth, low production, increase in debt and employee dissatisfaction. These implications affect credibility of the firm which in turn leads to limited access of external capital. In such a situation, business failure or shutdown become inevitable. So, it is crucial for firms to maintain a consistent positive cash flow and recover quickly from negative cash flow periods. In this report, we carry out an extensive empirical analysis on firms' responses, behavior, and performance when they face unexpected operating cash flow shocks. The insights from our results are highly relevant to working capital managers and operations executives.

2 WHY IS MANAGING OPERATING CASH FLOW CRUCIAL?

Analysts, financial managers, investors, shareholders and many other economic agents often use net income as a parameter to judge how the firms are performing. However, sticking to only net income may lead to an over/underestimation of firm performance. Operating cash flow provides an objective measure (Fernandez, 2004) and a more realistic idea of how well the firm is managing its operations and capital. Further, strong positive operating cash flow helps firms meeting working capital requirements and is a key determinant of shareholder's wealth, firm's expansion, better investment opportunities and so on. In this report, we measure OCF as sum of accounting earnings and accrual adjustments (net income plus depreciation less changes in working capital (Rayburn, 1986, Ross et. al. 2000). The prime objective in this study is to understand OCF variations (we call it cash flow volatility) and prepare action and response strategies to manage cash flow (OCF) shocks for effective operations and working capital management. veel over gaat. We kunnen hier wel een onderscheid maken tussen 'substantive policy' en procedural policy'; tussen inhoudelijk en procedureel beleid (Howlett, 2019).

Existing studies have ample reasons to support why operating cash flow should be managed efficiently? as OCF and the firm size are directly related to working capital requirements (Hill et. al, 2000). Earnings along with the operating cash flow are good predictors of future cash flow (Habib, 2010) which essentially determine the market valuation of the firm. An empirical study on relationships between cash flow management strategies and firm performance for manufacturing firms suggests that controlling cash receivables, payments and cost of inventory are essential for keeping check on operating cash flow and managing firms' operations (Kroes and Manikas, 2014). The firm's investment decisions are function of cash flow volatility and models predicting investments have better accuracy when cash flow volatility is included as an explanatory variable (Minton et. al, 2002). In a situation where the firms are uncertain about future cash flows, the firm managers cut out the levels of dividend (Bradley, 1998) and the probability of paying dividends are low (Chay and Su, 2009).

Better management of OCF volatility can lead to better access to external capital from investors. From investment perspective, when there are two assets with equal expected future cash flows, asset with lower cash flow volatility are valued higher (Ikromov and Yavas, 2012). The investors commit cognitive error while pricing the underlying asset and underestimate the information from earnings accruals and cash flow (Houghe and Lougharn, 2000). This suggests how important it is for investors to incorporate cash flow information when they make their investment decisions. So, it is essential not only for working capital managers but the investors to understand the parameters which impacts OCF volatility.

3 THE CASH FLOW HARMONIZATION PROJECT

Since the financial crisis of 2008, firms have been concerned about their working capital management and policies due to the increase in cost and decrease in availability of capital (Ellingsen & Vlachos, 2011). This has led to the rise of innovative financial products and payment solutions. Many banks as well as financial technology firms now offer instruments that fall under the umbrella of Supply Chain Finance (SCF). These are dynamic discounting, reverse factoring, pre-shipment financing, receivables trading, etc. The improvements that can be brought out using SCF is enormous, over €22 billion additional cash flow can be realized in the Netherlands alone (Hiemanga, 2012).

McKinsey's Panorama FinTech database shows that the fastest-growing segment in FinTech is payments solutions. This has led to collaborations like Standard Chartered with GlobalTrade, RBS with Taulia, and Barclays with Wave. Firms increasingly want all their financial needs integrated into a single source. At the same time, improvements in logistics services, payment services and operational practices (e.g., vendor managed inventory) has changed the cash flows of firms. Outsourcing and globalization has led to more complex supply chains of goods, services, information and cash. Cash flow volatility is very crucial and can have major impact on the financial performance of firms (Rountree, B. 2008). Cash volatility has also been shown to affect shareholder value and expected financial distress costs and tax payments (Smith and Stulz, 1985; Froot et. al., 1993). Many firms are already using SCF products, but research shows its use to stabilize cash flows can be optimized further. Based on the research in van der Vliet et. al. (2015), we know that firms can better control their cash flow volatility if they smartly gear their payment terms with suppliers and with their customers to one another.

The research contribution of the "**Cash Flow Harmonization**" project is the firm level analysis to illustrate the differences in impact of operating cash flow volatility on firm's behavior, responses, and performance. We capture the firm's heterogeneity based on their relative cash abundance or shrinkage periods, cash conversion cycle, size, liquidity status and volume of long-term debt. We also look at "Shock Susceptibility" and "Shock Response Time" as a measure of how sensitive firms are to operating cash flow shocks and their ability to recover, respectively. We present specific examples as implications to get insights for operations executives, retail investors and small enterprises with a focus on manufacturing and transportation sector. We present response strategies for managing operating cash flow shocks, exchange rate risks and insights for investment decisions both in short term and long term.

4 OCF VOLATILITY – GOOD OR BAD?

Before a firm can prepare for the response to an operating cash flow volatility, it is important to assess the characteristics of the volatility. We outline a conceptual framework to assess and evaluate changes in operating cash flow leading to the OCF volatility and propose hypotheses to understand the impact and response to the volatility. To make the idea more vivid and motivate the importance of assessing volatility, we present two examples from our dataset. Figure 1a and 1b respectively presents the OCF volatility and firm performance plots for two firms - ANAREN INC and ANDREA GROUP in the electronics sector. The striking point to note here is that the OCF volatility has completely opposite effects on their firm performances. In case of ANAREN INC, the period of high volatility is marked by good firm performance while for the ANDREA GROUP, high volatile periods have poor performances. We may note that the high OCF volatility in case of ANAREN INC is due to sudden positive OCF shocks which indeed indicates a good firm performance.

A general managerial notion and results from existing literature support that the cash flow volatility has a negative impact on the firm's performance, investments, payout decisions and asset valuations. This understanding is often based on the aggregate level negative effects and the examples presented above clearly indicate that at a firm level the story may be entirely different i.e. *cash flow volatility can both be good or bad*. To begin the assessment of the volatility, it is important to look the *"Cash Flow Volatility Matrix"* to understand the macro-state of the firm based on its net income and changes in operating cash flow.

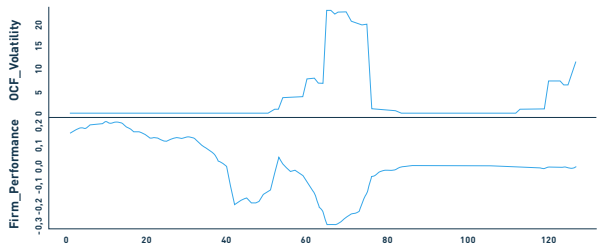

Figure 1a. High Volatility with Low Firm Performance

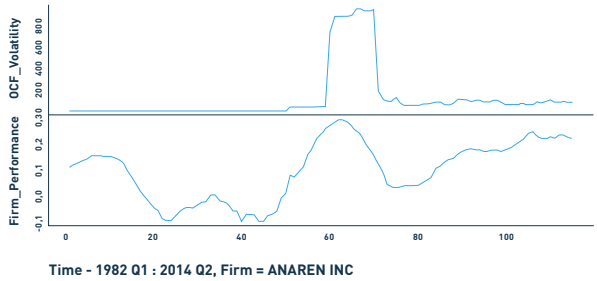

Figure 1b. High Volatility with High Firm Performance

CASH FLOW VOLATILITY MATRIX

Net income is a good indicator to get the first snapshot of the firm performance, however, it may not give a true reflection of a firm's status in terms of its expected future cash flows. So, to better determine the state of a firm, it is important to consider changes in operating cash flow along with net income. These changes capture uncertainty in operating cash flow which we measure by its volatility (variance) in the given time-period. When we look at changes in OCF, we focus on large changes which correspond to high volatility periods. To devise firm's responses/strategies when they face relatively large OCF shocks we propose a conceptual framework and construct 'Operating Cash Flow Volatility (OCFV) Matrix' to describe the state of a firm (Figure 2). Based on the OCFV matrix, every period with large OCF changes in a firm can be classified in a 'state' which signals one of the following phases:

- **State 1: Proliferation Phase:** In this phase, the firms have positive net income and a large positive change (marked by high OCF volatility) in operating cash flow. This signals a booming phase for a firm and reflect relative cash abundance in the firm. In this phase, we expect firms to be more capable to absorb (and less susceptible to) cash flow shocks.
- **State 2: Recovery Phase:** In this phase, the firms with negative net income experiences positive changes in OCF. This may indicate either it is an early-stage firm or recovering from negative shocks in the previous periods. Firms are required to maintain a strong cash flow until they recover to the previous normal growth rate. In this phase,

Operating Cash Flow Volatility Matrix

Net Income	Change in Operating Cash Flow: Positive	Change in Operating Cash Flow: Negative	Operating Cash Flow Volatility
Positive	• Strong Growth Potential • Booming Phase for the firm • Cash Abundance Period • Potential for Growth	• Declining Firm Growth • Cash Shrinkage Phase • Need to Revamp Cash Flow • Signal for Bankruptcy	High
Negative	• Start Up/Recovery Phase • Require Stronger Cash Flow	• High Cash Shrinkage Phase • Require Quick Recovery	High

Figure 2. Cash Flow Volatility Matrix

the firms are likely to be more susceptible to be operating cash flow shocks.

- **State 3: Decline Phase:** In this phase, firms have a positive net income but a large negative change in OCF. This results in high OCF volatility, which can be considered as a warning signal for the firm. This is also relatively cash shrinkage period for the firm, and it needs to revamp the cash flow quickly. Firms are likely to be more susceptible to further cash flow shocks in subsequent periods.
- **State 4: Bankruptcy Phase:** In this phase firms with negative net income faces a large negative operating cash flow shock. This is high cash shrinkage period and have high OCF volatility for the firm. It is a signal for bankruptcy and requires immediate and strong recovery strategies.

The idea of these four phases is to understand the macro state of the firm. The two examples illustrated above suggests that it is important to identify volatility caused by large negative OCF changes. Once such shocks are identified, the next step is to look at key operations and financial parameters to devise a strategy to manage such large negative shocks. In the current project, we specifically tried to answer the following:

Given that a firm faced a large negative OCF shock, what can a firm do differently, in terms managing its operations and financial parameters in a shock and post shock period which would help them respond faster?

The main idea here is that some firms may respond faster whether others may take more time to reach an adjusted post-shock state. A simple interpretation of an adjusted post-shock is the 'new normal' for the firm after the shock. In this new normal, the subsequent changes in OCF are small and the generated volatility vanishes, which indicates there is a lesser cash flow uncertainty for the firm. We note that in the shock response time-period the firm may not be able to reach (recover) to its previous level of operating cash flow or firm performance.

EVALUATING RESPONSE PARAMETERS

To understand the response strategies to corresponding cash flow volatility, we define what a large OCF shock, shock susceptibility and shock response times are in our analysis. *Large OCF shock* for a given firm and time window is the operating cash flow shock for which the OCF volatility is higher than its third quantile (75%) of the historical volatility. Shock Susceptibility of a firm is the average number of large negative operating cash flow shocks faced by the firm per time-period (in our case it is per quarter). *Shock Response Time (SRT)* of a firm for a given large negative OCF shock is the time- period(s) from when the firm performance volatility goes higher than its median historical volatility due to large OCF shock and until it hits the median again.

The Figure 3 illustrates the notion of shock response time. The plot shows positive and negative OCF shocks, their corresponding OCF volatilities and their respective firm performance volatility in the given time window (vertical red lines). For the left-hand side vertical red lines, there is a jump in the OCF volatility due to positive OCF shock. However, there is little change in firm performance volatility. In the time window covered by vertical red lines on right hand side, a negative OCF shock leads to a substantial change both OCF and firm performance volatility. This is also an example of a large negative OCF shock for the firm. In this case, the time (shown by horizontal arrow) from when the firm performance

volatility goes higher than its median historical volatility and until it hits the median again is the shock response time of the firm for this OCF shock.

In our analysis, we use following variables to assess cash flow volatility and its impact on operations and financial parameters:

- **Standard Accounting Variables:** Net Income (in million dollars), Working Capital (million dollars), Days of Inventory Outstanding, Days of Payable Outstanding, Cash Conversion Cycle and Long-term Debt (million dollars).
- **Compound Variables:** Firm Size (log of total assets in million dollars), Firm Performance (earnings per share), Operating Cash Flow (million dollars), Operating Cash Flow Volatility, Firm Performance Volatility, Shock Susceptibility, Shock Response Time, Liquidity Status, Cash Abundance, Cash Shrinkage, and Sharpe Ratio.
- **Operating Cash Flow:** Accounting Earnings + Accrual Adjustments = Net Income + Depreciation - Changes in Working Capital
- **OCF or Firm Performance Volatility:** For a given time-period or window, it is simply the variance of the corresponding variable for the duration

We also define Liquidity Status based on standard accounting quick ratio:

$$Liquidity\ States = \frac{(Short\ term\ Cash + Account\ Receivables)}{1 + Current\ Liabilities}$$

We compute first and third quantiles of historical liquidity status (E_l) of the firm. If E_l is more than third quantile value, we call it as a Cash Abundance Period whereas if E_l is less than first quantile then it as a Cash Shrinkage Period. We note that these periods are defined relative to the firm itself. If E_l is in between these two values, we say the firm has neither cash abundance nor shrinkage.

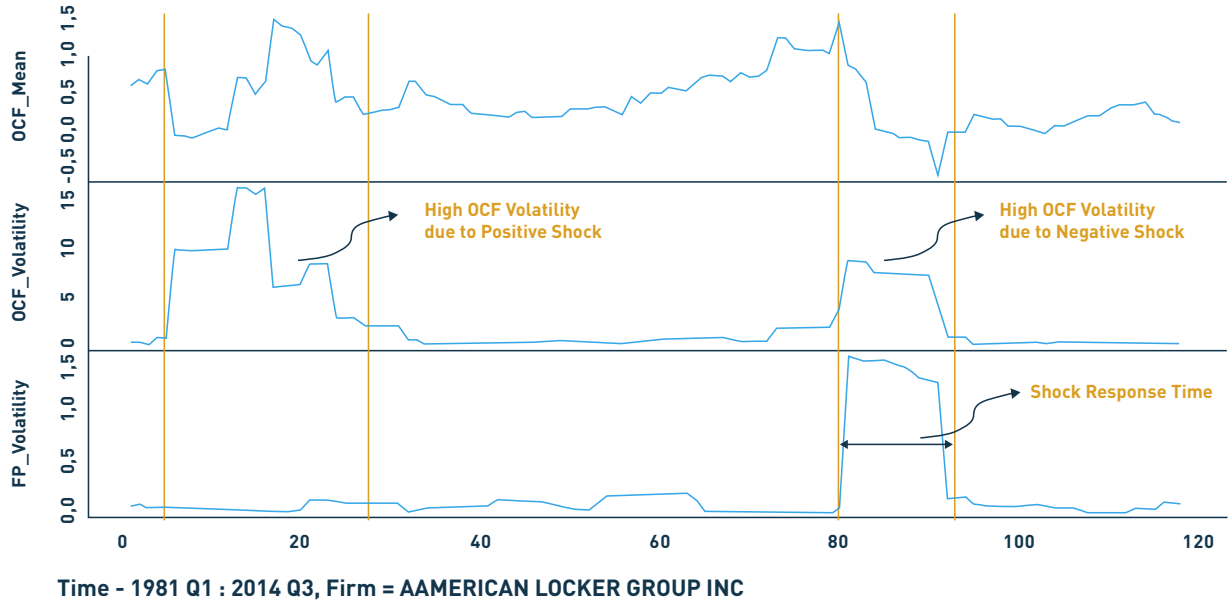

Figure 3. How to measure Shock Response Time?

5 SHOCK RESPONSES, ACTIONS AND STRATEGIES

Based on OCFV matrix we proposed, we present (in Figure 4) a conceptual framework for this research. Large positive OCF shocks in a firm is likely to boost cash status (abundance) and signals firm's high business potential and growth. If a firm experiences a large negative OCF shock, this might indicate relative cash shrinkage period. In case these negative changes are not due to firm's investments, this is likely to impact its growth. The firm is required to take strong recovery actions in such situations else it may face a survival struggle. It is possible that the firm witnesses a complete failure or bankruptcy if it faces multiple large negative shocks in a short time duration. Such failures are common during acute financial crisis. The leftmost part of our conceptual framework explains this phenomenon.

In either case of a large negative or positive shock, the firm faces a high volatility in operating cash flow. A single large jump in one period can induce high volatility in next few periods. This means volatility comes down only when the subsequent changes in OCF are small. This is also evident in Figure 1a and 1b (top part of the diagram). The large jump in OCF suddenly increases the volatility which comes down after a few periods. Since large positive/ negative operating cash flow indicate strong/poor firm performance respectively, periods of high OCF volatility would also have volatile firm performances. So, the extent of volatility in firm performance is a signal of impact of operating cash flow on firm performance. The middle left part of the framework represents that high OCF volatility (cause by either large negative or positive shock) impacts the firm performance. Our proposed conceptual framework leads us to four hypotheses (right side of the diagram):

- **Hypothesis 1: Differential Impact:** The impact of operating cash flow volatility on firm performance is not consistent i.e., it can either be positive or negative or even no impact.
- **Hypothesis 2: Heterogeneous Response:** The shock response times of firms to a large negative OCF shock are not consistent i.e., some firms are able to respond faster than others.
- **Hypothesis 3: Impact of Operations Parameters:** Better working capital management leads to faster OCF shock response times.
- **Hypothesis 4: Impact of Financial Parameters:** Better liquidity management leads to faster OCF shock response times.

For our analysis, we obtain our primary dataset from the Compustat Database which consist of time series data (quarterly and yearly from 1978-2018) of 74 variables for 21652 firms. However, we observed that many firms had insufficient data to run our

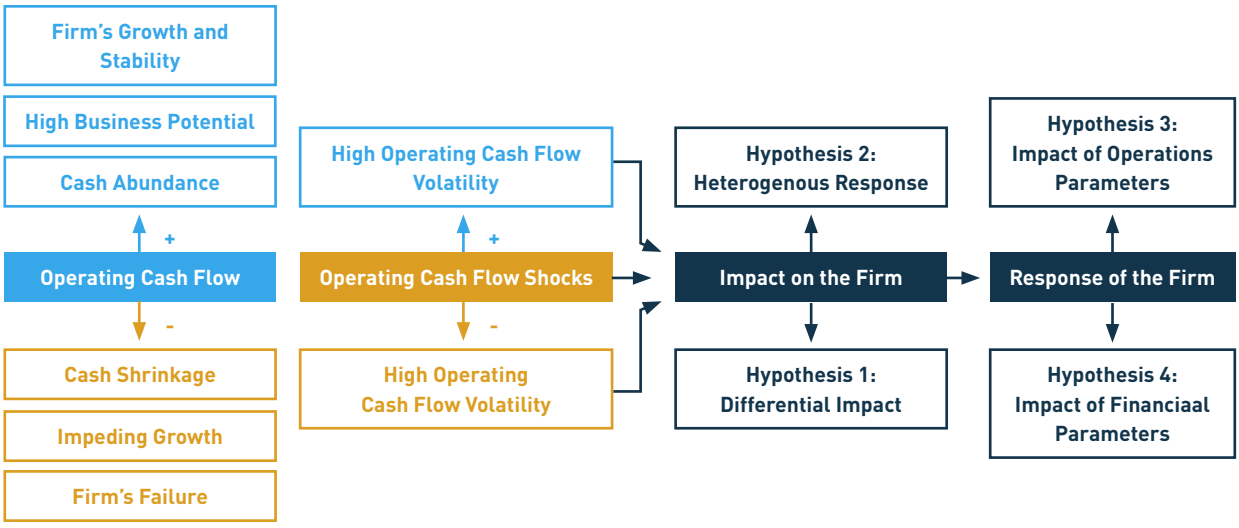

Figure 4. Conceptual Framework to evaluate impact and response of OCF volatility.

Parameters	Median MICON	IQR MICON	Median MANF	IQR MANF	Median TRANS	IQR TRANS	Median RETW	IQR RETW
Firm Size	5.23	3.43	4.74	3.38	7.03	3.31	5.44	2.77
Net Income	0.42	7.72	0.75	7.77	6.76	40.72	1.61	11.38
Working Capital (WC)	7.36	60.66	33.35	144.46	1.45	86.38	42.89	175.43
Operating Cash Flow (OCF)	2.88	26.07	0.95	11.68	14.09	90.34	2.69	18.76
Long Term Debt (LT Debt)	26.71	248.66	7.30	117.06	340.40	1630.95	25.33	171.81
Firm Performance (FP)	0.03	0.29	0.12	0.43	0.34	0.66	0.18	0.41
Days of Inventory Outstanding (DIO)	17.58	54.00	83.41	85.10	15.97	30.28	65.42	86.36
Days of Payable Outstanding (DPO)	87.55	190.62	40.10	33.42	37.73	34.67	34.92	28.06
Days of Sales Outstanding (DSO)	65.58	47.47	56.51	28.87	42.49	27.07	17.02	41.69
Cash Conversion Cycle (CCC)	14.59	163.75	99.73	96.30	25.33	39.86	53.74	83.78
Liquidity Status (CCC)	1.03	1.20	1.15	1.17	0.67	0.64	0.66	0.83

Table 1. Sector wise median and interquartile range for the variables

models and obtain reliable interpretations. So, we selected the sample firms which have: i) sufficient common time series length for each (at least 30 quarters) for the variables we described above and ii) no more than 25% of the missing values in the time series of common set of variables. This resulted in a final sample consisting of 3475 firms. The results in this report primarily focus on the manufacturing, transportation, mining, and retail sectors. The representation of the firms in our selected sample is given in Figure. A summary of median and interquartile range for each variable in this sample is given in Table 1.

To test our hypothesis and understand the relationship between firm performance and operating cash flow volatility, we use detrended cross correlation analysis (DCCA) which captures cross correlation between these the time series of OCFV and performance. We choose DCCA instead of linear models to ensure time scale variations and sudden fluctuations (caused by OCF shocks) are better identified and relationships between these variables are better evaluated. To validate our first two hypotheses, we compute i) DCCA coefficients (Rho_DCCA) (Figure 6) between OCFV and performance ii) Shock response times (Figure 7) to large negative OCF shocks for the firms in our sample.

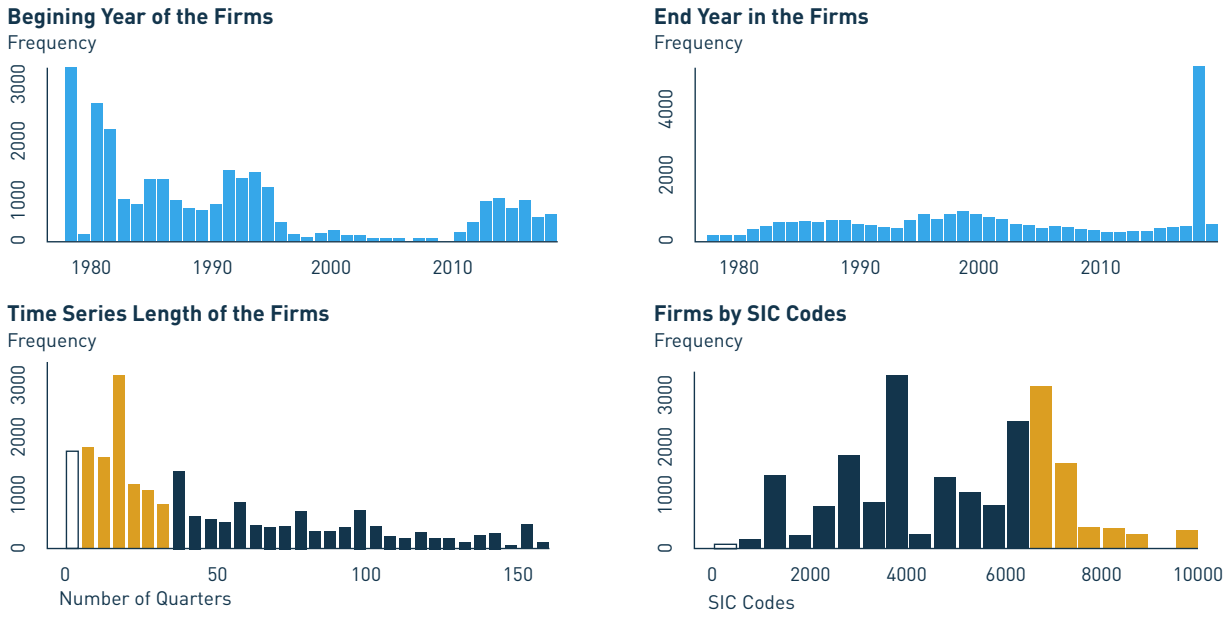

Figure 5. Representation of firms in the sample.

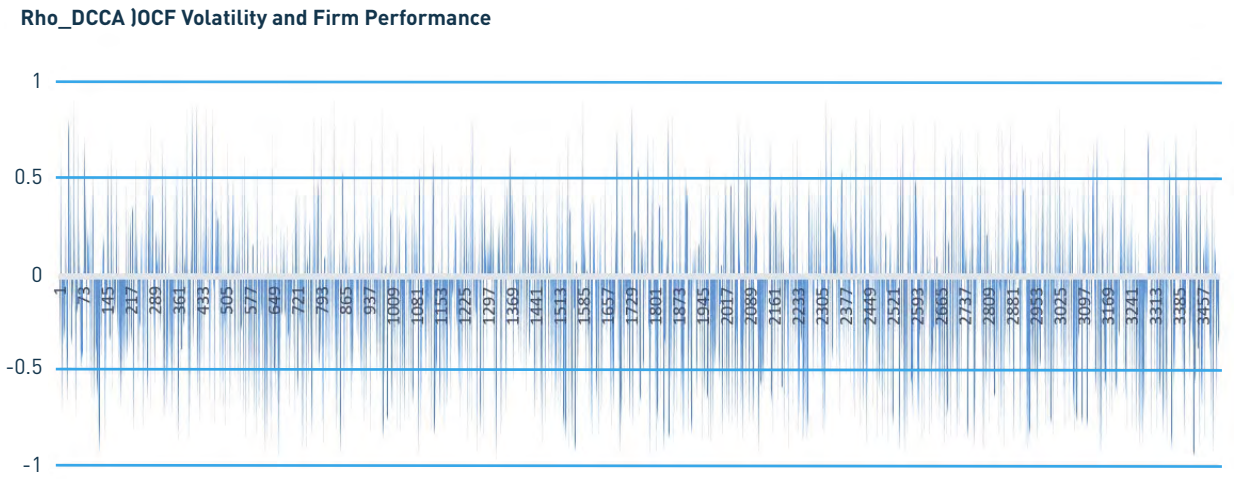

Figure 6. The distribution of DCCA coefficients for the sample.

We observe that both shock response times and DCCA coefficients greatly varies by firms supporting our hypotheses that the firms are impacted different, and they have a heterogenous response to OCF shocks.

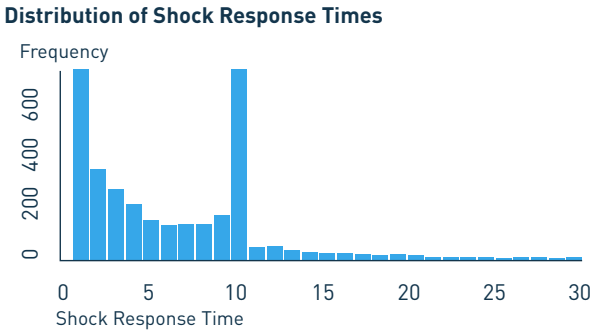

Figure 7. Shock Response Times of Firms for Large Negative OCF Shocks

Based on the shock response times, we grouped firms based on how fast they responded to the OCF shocks. In Table 2, we can observe the median parameter values for the firm which have low shock response time (fast responding firms) and high response times (slow responding firms). This leads us find the long actions for firms to reduce shock response times.

LONG TERM ACTIONS

We observe that the firms which respond faster have 28.1 % higher days of inventory outstanding and 16.4 % higher cash conversion cycle. Also, firms which respond faster have also 32.4 % higher working capital but have 64.2 % lesser long-term debt. Based on these results, the proposed key actions for the firms are:

- Increase the working capital but not by increasing the debt.
- It is important for firms to more or buffer inventory and maintain a higher CCC to be better prepared to handle a negative OCF shock.

To evaluate actions for short term, we compute the median value of the parameter till the shock starting point and compute change in the parameter value during the shock period. This gives us percentage change in parameter due to a particular OCF shock. This percentage change represents the action of the firm to reduce the shock response time. We classify the firm's action to be strong positive if the percentage change is higher than third quantile value (75%) value for all firms for the given parameter. The action is strong negative if the percentage change is lower than first quantile value (25%) value for all firms for the given parameter. The quantile values of

Firms/ Parameter Medians	DIO	DPO	DSO	CCC	WC	LT Debt	LQ Status
Slow Responding Firms	59.357	42.630	56.337	71.457	18.099	32.619	6.40
Fast Responding Firms	76.088	42.837	55.606	83.189	23.963	11.676	6.31
Percentage Difference (*100)	0.282	0.005	-0.013	0.164	0.324	-0.642	-0.01

Table 2. Action difference between fast and slow responding firms.

these parameters are given in Table 2. We compare shock response times of firms who took strong positive or strong negative actions to evaluate if these actions helped reduce their shock response time. The results for the entire sample and each sector are given in Table 2. The results suggest following short term actions:

Short Term Actions

It is observed that working capital and long-term debt change substantially (median for all firms changes by 31% and 61 % respectively) during a large negative OCF shock period. So, a close monitoring of these parameters is recommended. Firms which take actions to decrease their DPO, DSO and long-term debt during a shock period have improved shock response times than the firms which do the opposite. This observation is predominantly true for manufacturing sector. For mining and construction sectors, firms which reduce their DSO and long-term debt witness lower shock response time. For retail sector, increasing liquidity by borrowing increases shock response time. In transportation sector, reducing borrowing to increase working capital and liquidity along with decreasing DPO help firms to have lower shock response time. The key actions for firms with respect to parameters during the shock period are:

- Try to collect the receivables as soon as possible,
- Pay early to suppliers and
- Avoid any long-term borrowings.

Parameter Median Values during the Shock Period

Quantiles/Variables	SRT	DIO	DPO	DSO	CCC	WC	LT Debt	LQ Status
Q1	3.00	-0.22	-0.11	-0.11	-0.27	-0.26	-0.11	-0.29
Q2	5.00	-0.02	0.06	0.02	-0.03	0.31	0.63	-0.07
Q3	9.00	0.19	0.30	0.20	0.18	1.67	3.07	0.17

Change in Shock Response Times with Strong Parameter Actions

For Entire Samp

Action/Variables	DIO	DPO	DSO	CCC	WC	LT Debt	LQ Status
Strong_Positive Action	6.43	7.37	7.27	6.24	6.86	7.14	6.40
Strong_Negative Action_	6.60	6.26	5.99	6.73	6.51	5.57	6.31
Change in SRT	0.03	-0.18	-0.21	0.07	-0.05	-0.28	-0.01

For Manufacturing Sector

Action/Variables	DIO	DPO	DSO	CCC	WC	LT Debt	LQ Status
Strong_Positive Action	6.48	7.01	7.01	6.12	6.84	6.88	6.21
Strong_Negative Action_	6.03	6.07	6.09	6.19	6.37	5.73	6.42
Change in SRT	-0.08	-0.15	-0.15	0.01	-0.08	-0.20	0.03

For Mining and Construction Sector

Action/Variables	DIO	DPO	DSO	CCC	WC	LT Debt	LQ Status
Strong_Positive Action	6.55	7.95	8.15	7.30	7.88	7.70	5.90
Strong_Negative Action_	6.78	7.75	7.13	7.58	7.00	5.83	6.18
Change in SRT	0.03	-0.03	-0.14	0.04	-0.13	-0.32	0.04

For Retail Sector

Action/Variables	DIO	DPO	DSO	CCC	WC	LT Debt	LQ Status
Strong_Positive Action	6.05	5.62	6.40	6.40	5.97	6.90	6.00
Strong_Negative Action_	6.16	6.12	5.21	6.43	6.45	4.93	5.14
Change in SRT	0.02	0.08	-0.23	0.01	0.07	-0.40	-0.17

For Transportation Sector

Action/Variables	DIO	DPO	DSO	CCC	WC	LT Debt	LQ Status
Strong_Positive Action	6.13	8.83	8.70	6.63	8.11	7.74	7.85
Strong_Negative Action_	7.91	5.94	5.48	7.96	6.41	5.48	6.69
Change in SRT	0.22	-0.49	-0.59	0.17	-0.27	-0.41	-0.17

Table 2. Results for Short Term OCF Shock Analysis

Strategies for Retail Investors

Using DCCA coefficients, we group firms based on the impact of OCF volatility on the firm's performance. For each group (highly or less impacted), we compute Sharpe ratio for each firm in the group. The average Sharpe Ratio for the groups are given Table 3. Firms which have been impacted significantly by OCF shocks have 15.9% lesser Sharpe Ratio values.

So, a key strategy for the retail investors could be to assess how OCF shocks have impacted the firm performance while making investment decisions.

Groups	Sharpe Ratio
Highly Impacted Group	0.1147
Less Impacted Group	0.099
Percentage Difference	15.9

Table 3. Sharpe Ratios for Highly and Less Impacted Group

Hedging Against Exchange Rate Fluctuations

In 2014-15, when Euro plunged down by nearly 30% in a matter of few months, European retail market witnessed a big impact due increased sourcing cost. For example – H & M, a fast fashion retail in Europe faced a high-pressure situation to raise their prices else it would forgo the profits (Wall St. J., 2015). If H&M tried to raise their prices in this case while their competitors kept the same, the firm will lose a big market. In such situations, it is pertinent for firms to keep a check on exchange rate fluctuations and have their hedging strategies to effectively overcome periods of volatile exchange rates. In this research we also aimed to determine strategies which can help the company to have an accurate cashflow forecast before it decides to hedge itself against the foreign exchange (FX) risk. Before the strategy for hedging FX risk can be determined, it is important to know which type of foreign currency exposure a firm can face.

In general, there can be stated that there are three main types of foreign currency exposure (Eun & Resnick, 2014):

- **Transaction exposure,** which arises when a company undertakes transactions in a foreign currency (so other than the company's base currency). This means that a company is exposed to transaction exposure in case it makes or receives payments in a foreign currency and therefore exposed to unexpected changes in the exchange rate.
- **Translation exposure,** which arises when a company has assets or liabilities that are denominated in a foreign currency. Therefore, changes in exchange rates can lead to financial statements of a firm to be affected.
- **Economic exposure,** which is defined as the extent to which the value of the firm would be affected by unanticipated changes in exchange rates (Eun & Resnick, 2014). For this research the focus is on transaction exposure. Since cashflows in a foreign currency are considered to find out which strategy and financial instrument a company can best use to hedge itself against adverse movements in the exchange rates.

We proposed a theoretical model using Compound Poisson process to evaluate actions to manage the exchange rate risks. The key strategies as from the model are outlined below:

- **Determine the Cash Flow Forecast:** The first step is to identify the data, so which data is necessary to complete the forecast: Determining the cash in – and outflows. The earlier described categories can be used here to make distinctions between the cashflows. The second step is to identify the sources were the data on the cashflows comes from. Examples are operating budgets, capital budgets, ERP (account payables/ receivables), business units and cash history. The third step is to verify the accuracy and completeness of the data. The fourth step is to set the forecast timeframe, but this differs per organization and depends on how much certainty cashflow forecasts can be made in the future. Finally, the forecast technique should be selected, the data should be daily monitored, and forecast output should be reviewed.
- **Find Internal Hedging Strategies and Instruments:** After the cashflow forecast is developed, the companies can start implementing the FX hedging practices into its platform. The companies can be transparent to its clients regarding the usage of the internal hedging strategies. Research from Popov & Stutzman (2003) states that theory recommends companies to first use internal hedging techniques, because these are a part of a company's organizational financial management and are therefore usually less expensive. Moreover, according to ING treasury center (2018), the use of internal hedging instruments is the optimal approach. Company X can use the information.
- **Use Hedging proposals based on forward spot rate comparison:** To find out if a hedging proposal is beneficial the company should compare the forward exchange rate with today's spot rate. If the proposed hedge based on the scenarios is a swap or a forward belonging to an outgoing cashflow/ negative net account balance the proposed hedge should be executed if the forward exchange rate exceeds the spot rate. For a forward contract belonging to an incoming cashflow/positive net account balance the proposed hedge should be executed if the forward exchange rate is below the spot rate. Otherwise, if these conditions do not hold true the company should either buy/sell at spot or leave the incoming amount in the account to make the future payment in case of swap. However, in case the number of days is too large, it should proceed with the original hedge, because if the company does not hedge itself, it would be exposed to FX risk.

CONCLUSIONS

The extensive analysis in the research results in multiple relevant contributions and directions for future research.

AMONG THE CONTRIBUTIONS, WE EXPLORE:

A. **Differential impact of OCF Shocks:** in this analysis, we illustrate that the existing notion of negative impact of cash flow volatility on firm performance does not really hold at a firm level. This suggest that the OCF volatility may not always be bad for the firm, and it is important to understand the cause of high volatility.

B. **Heterogeneous Response to OCF Shocks:** here we show that not all firms equally susceptible to operating cash flow shocks and have different shock recovery/response times. We also validate this result by considering various firm parameters such as - size, liquidity status, cash conversion cycles and long-term debt. This helps us to understand which operations/financial parameters play a role in firm's response to OCF volatility.

C. **Impact of Crucial Operations Parameters:** Our subsequent analysis focus on negative OCF shocks and operations parameters. We empirically determine the differences in these parameters in a negative shock versus a normal period. The gives insights on shock recovery strategies based on operations parameters. We proposed actions in both short term and long term for operations and working capital managers.

D. **Impact of Crucial Financial Parameters:** We repeat the exercise for financial parameters with a focus on liquidity status, working capital and long-term debt and propose actions for short and long term. We explore why should retail investor's have an interest in this research by evaluation returns on investment strategies.

E. **Impact for Foreign Exchange Risk on Cash Flows:** The exchange rate risks can be stressful for firms if the exchange rate volatility is high. We proposed a theoretical model and determined strategies for hedging exchange risks while managing cash flows and working capital.

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