Corporate Borrowing and Investment Decisions under Regulatory and Climate risk

By

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Declaration of authenticity and author's rights

This thesis is the result of the author's original research. It has been composed by the author and has not been previously submitted for the examination which has led to the award of a degree.

Signed: *Sandeep Keshava Rao*
Date: May 27, 2020

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Sincerely,

Sandeep Keshava Rao

This piece of work is dedicated to my

Late Grandmother and Grandfather

Statement on published work

This thesis consists of two major empirical chapters. A version of the empirical study on 'corporate borrowing decisions' is now published in the *Journal of Corporate Finance, (2020) Volume 62*. Further, a version of my empirical study on 'corporate investment decisions' has now received a 'minor revise and resubmit' for publication in the *Journal of Corporate Finance* special issue on 'The Finance of Climate Change'.

Both published empirical piece of work and version of the chapter which is now in revise and resubmit are from my original research ideas in my PhD. Further, I undertook the complete literature review, development of various hypotheses, data collection and all of the empirical analysis. After my initial write up of the chapters, my co-authors provided me with suggestions to undertake additional robustness checks and provided critical comments and guidance, which I used to develop the papers to the style and standards required for journal submission.

Signed: *Sandeep Keshava Rao*
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Thesis Abstract

This thesis examines corporate decisions under the legal and environmental dimension of the PESTLE model using two exogenous shocks. First, using a regulatory intervention, I examine the corporate borrowing decision among firms having constrained access to internal capital under the legal dimension of the model. Second, using extreme rainfall conditions, I examine the corporate investment decisions among rain-sensitive firms under the environmental dimension of the model.

To answer the research question as to whether increased creditor rights on corporate borrowing depend on the firm's access to internal capital, I use the creditor protection reform in India as an exogenous regulatory shock. Under this empirical setting, results indicate that strengthening of creditor rights leads to increased corporate borrowing among firms that have constrained access to internal capital compared to those firms having relatively easier access to internal capital. Further, the increased corporate borrowing by firms with constrained access to internal capital, in the post-reform period, is associated with a greater expansion of real investments, improved operational performance, and better market valuation. My findings indicate that, following creditor reforms, firms having constrained access to internal capital decide to borrow more. A version of this empirical study is now published in the *Journal of Corporate Finance*.

Next, using Indian monsoon data, I study whether firms in the rain-sensitive sectors differentially time their investments to generate value in response to diverse abnormal rainfall conditions. I find that rain-sensitive firms suffer a significant decline in their market values in the immediate aftermath of extreme rainfall conditions.

Consistent with the investment timing economic argument, my results show that the follow-up investment response by rain-sensitive firms depends on the nature of extreme rainfall conditions. While rain-sensitive firms increase their investments following *excess* rainfall conditions, the affected firms shrink investments in the aftermath of *deficit* rainfall periods. However, in terms of market-based value implications, all rain-sensitive firms regain their lost market values following both the investment strategies. In all, my findings indicate that corporate investment decision to invest or not invest is dependent on the heterogeneity of exogenous conditions and such decisions when timed well are value relevant. A version of this empirical study has now received a ‘minor revise and resubmit’ by the *Journal of Corporate Finance*.

Overall, through the findings of my thesis, it can be concluded that corporate borrowing and investment decisions among firms are subject to the heterogeneity of both firm characteristics and exogenous events.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

BSE	Bombay Stock Exchange Ltd
CAR	Cumulative abnormal returns
CGE	Computational General Equilibrium model
CMIE	Centre for Monitoring the Indian Economy
DiD	difference-in-differences
DiDiD	difference-in-difference-in-differences
DRTs	Debt recovery tribunals
EBIT	Earnings before interest and taxes
EBITDA	Earnings before interest, taxes, depreciation, and amortization
ES	Event Studies
EU	Expected utility
FSY	False Shock Year
GDP	Gross Domestic Product
ICGR	Internal Capital Growth Rate
IMD	Indian Meteorological Department
INR	Indian Rupees
IPCC	Intergovernmental Panel on Climate Change
IPO	Initial public offer
ITT	Intention-to-treat method
IV	Instrumental Variables
JOBS	Jumpstart Our Business Startups Act
M&As	Mergers and Acquisitions
MSCI ACWI	Morgan Stanley Capital International All Country World Index
NOAA	The National Oceanic and Atmospheric Administration
NPA	Nonperforming assets
NSE	National Stock Exchange of India Ltd
PAT	Profit after tax
PESTLE	Political, economic, socio-cultural, technological, legal, environmental factors
PP&E	Property, Plant, And Equipment
PSM	Propensity score matching
PSM-DiD	Propensity-score matched difference-in-differences
R&D	Research and Development
RDD	Regression Discontinuity designs
RDDB	Recovery of Debts Due to Banks and Financial Institutions Act
ROA	Return on Assets
ROE	Return on Equity
SARFAESI	Securitization and Reconstruction of Financial Assets and Enforcement of Security Interests Act
SOX	Sarbanes-Oxley Act
SWOT	Strengths, Weakness, Opportunities, Threats
USA	United States of America
USD	United States Dollar
WHO	World Health Organization

Chapter 1

Introduction to corporate borrowing and investment decisions

This thesis evaluates corporate decisions under the legal and environmental dimensions of PESTLE model using exogenous regulatory and extreme climatic events. Under the broad corporate policy decision making literature, this thesis aims at a better understanding of the relationship between the strengthening of creditor rights on corporate borrowings decisions and extreme rainfall conditions on value relevant investment decisions. My work is inspired majorly by the growing importance of regulatory interventions affecting corporate decisions and by the contemporary issue of climate change. This chapter provides a summary of motivation, research questions, findings and the key contribution of my PhD thesis.

1. Chapter 1: Introduction

The decision process, in general, is the act of choosing from two or more alternatives. Among the first general theories describing the decision-making process was put forward by philosopher Condorcet (1743-1794) as part of his inspiration for the French constitution of 1793 (Dietrich, 2010). Since then, contributions through the middle 20th century from several academic disciplines have shaped the modern decision theory, which is broadly classified into the descriptive and normative approach. While normative decision theories focus on '*how decisions should be made?*', descriptive theories emphasize '*how decisions are actually made*'. However, under both these descriptive and normative applications, the dominant approach to decision-making in the face of economic risk is based on the concept of maximising Expected Utility (EU) (Hansson, 1994).

Managers broadly take three crucial decisions in a running a firm (i) decisions on capital investments that generate high risk-adjusted returns, (ii) capital financing decisions that is to determine how to fund the capital investments by optimising the capital structure to achieve the lowest possible weighted average cost of capital and (iii) decisions on returning capital to the investors through payout policy decisions (Damodaran, 2010). Examples of such corporate decisions can be on a wide range of issues, from expansion, public offering, mergers and acquisitions (M&As) to research and development (R&D) among others. While undertaking such policy decisions, they evaluate the economic costs and benefits to their firms (Mizruchi and Stearns, 1994). The economic view dictates that managers would undertake these decisions in a way to optimize his/her utility (John et al., 2008). The utility can be derived from value-enhancing decisions that align the interest of insider decision-makers with outside investors. On the contrary, the utility can also be derived from increased private benefits, thus, encouraging managers to take a corporate decision that may be sub-optimal to the shareholders (Vig, 2013).

Extant literature discusses various determinants or factors (both internal and external) that influence the decision-making process. Internal factors could be individual characteristics or internal organizational characteristics. Individual characteristics like the decision maker's past experiences (Juliusson et al., 2005), intellectual and personal biases arising from one's cognitive abilities (Stanovich and West, 2008), demographic characteristics like his/her age and individual differences (De Bruin et al., 2007), belief in personal importance (Acevedo and Krueger, 2004) among others can influence what choices one makes. At the corporate level, firm-specific characteristics such as organization structure, power distribution, strategies, internal systems, firm size, corporate control and past performance could influence corporate decisions (Rajagopalan, 1993; Romanelli and Tushman, 1986). External factors like socio-economic and political conditions (Baker et al., 2015; Bitar et al., 2018; Dixit et al., 1994), regulations (Bargeron et al., 2010; Gulen and Ion, 2016; Koirala et al., 2018; Linck et al., 2008), climatic conditions (Chen et al., 2019; Dessaint and Matray, 2017; Mansur et al., 2008) could also influence the decisions. It is therefore paramount that we understand the significance of these factors in influencing one's decision because the outcome of such a decision-making process depends on them (Dietrich, 2010).

External macro-environmental factors play a significant role in managerial decision making as it could re-direct them towards undertaking value-enhancing decisions. In this regard, one of the important strategic management tool used to monitor and evaluate the external macro-environmental factors is the PESTLE model (Sameni Keivani and Khalili Sourkouhi, 2014). PESTLE is an acronym for Political, Economic, Socio-cultural, Technological, Legal and Environmental factors.[1] Aguilar (1967) introduced a tool ETPS for scanning the macro-environment of the business to analyse the opportunities and threats it faced and help the manager in decision making. This acronym was later tweaked to PEST analysis. Over time two more dimensions L & E were added, making it the PESTLE model. Extended models include additional factors such as Demographics, Intercultural, Ethical and Ecological resulting in variations of the PESTLE model. Managers use the results of PESTLE under SWOT analysis tool to populate the strengths, weakness, opportunities and threats a company could encounter due to these six external environmental dimensions. These six dimensions of the model focus on different groups of external factors that influence managerial decisions.

Political factors like government policies on international trade and tariffs, taxes, environmental law and others provide insights to the managers the extent to which the government interventions affect the economy. Various economic factors like economic growth rates, exchange rates, inflation, unemployment rates, macro demand and supply conditions are essential for the firms' operations and profitability.

The socio-cultural dimension includes factors like demographics, education, lifestyle, cultural values and others which are important factors in product planning and marketing. Similarly, technological changes in the form of innovation,

[1] PESTEL and PESTLE are the two alternatives ways of writing the acronym in the literature. To be consistent I use the acronym ‘PESTLE’.

automation, digitization can impact the product and process lifecycle and cost of operations.

The legal dimension of the model looks into factors like industry regulations, anti-trust laws, labour laws, consumer protection, investor and creditor protection laws. These factors are necessary for the smooth functioning of the firms' operations and can create consequences that may both be beneficial or otherwise to the firms. In these dimensions, political and legal dimensions are interrelated and tend to overlap.

Finally, factors like pollution, climate change, natural disasters, sustainable production and operations and others have come to the forefront in the past few years. These factors come under the environmental or ecological dimension of the PESTLE model.

The primary focus of this thesis is to investigate corporate decisions under the influence of external macro-environmental factors. For this using the PESTLE model, I focus on how the last two dimensions, which are legal and environmental, affect two important areas of corporate decisions which are corporate borrowing and investment decisions.

Under the legal dimension of the PESTLE model, studies show that exogenous regulatory factors influence corporate decisions. For instance, Mackie-Mason (1990) provide clear empirical evidence of substantial tax effects on the financing decision of either issuing debt or equity. Bargeron et al. (2010) find that the Sarbanes-Oxley Act of 2002 (SOX) discourage corporate risk-taking. Further, Jumpstart Our Business Startups Act (JOBS Act) resulted in more firms deciding to undertake initial public offering (IPO) (Dambra et al., 2015). Similarly, Section 16b of the Securities Exchange

Act resulted in managers deciding to deter from trading before mergers (Agrawal and Jaffe, 1995).

Secondly, external macro-environmental factor influencing corporate decision making that my study focuses on is the environment (ecological) dimension of the PESTLE model. Specifically, my research explores extreme weather triggered corporate decisions. Previous studies show weather variations have first degree influences on corporate decisions. For instance, concerns of perceived liquidity risk in the event of hurricanes lead corporate managers to increase cash holding (Dessaint and Matray, 2017). Similarly, Aretz et al. (2018) provide evidence that in the wake of climate change distress, managers skew their asset mixes toward riskier product segments suggesting that managers not only increase risk but also engage in risk-shifting behaviours. Additionally, Hirshleifer and Shumway (2003), show that a trader whose transaction costs are low can benefit by optimizing his trading strategies using the weather conditions.

To summarize, I explore decision making as a corporate response to two important external macro-environmental factors facing a firm, namely the PESTLE dimensions of the environment (ecological) and legal. To do so, I use two exogenous events to analyse corporate borrowing and investment decisions. The first event is regulatory reform and other is extreme weather condition along with an endogenous factor of past experiences of managers.

1.1 Motivation and synopsis

Following a brief discussion of the internal and external environmental factors that influence the corporate decision-making process, in this section, I discuss the motivations for my empirical investigations broadly under two sub-sections. First, what influences corporate borrowing decisions under the exogenous regulatory shock and second, how are corporate investment decisions made under extreme weather shocks.

1.1.1 Corporate borrowing decisions

In a laissez-faire system, regulations are not required as the firms should operate at an optimal level. Since firms in real-world operate in different agency and information related frictions, government and regulatory bodies across the globe work towards designing and enacting various laws and reforms to promote transparency in the marketplace and reduce unfair practices (Claessens and Yurtoglu, 2013). Both industrialists and academicians, therefore, assess the merits and effectiveness of such reforms on the functioning of corporations and benefits accrued to the society at large. There is general agreement among scholars that regulatory interventions can have both intended and/or unintended consequences on corporate decisions (Bargeron et al., 2010; Claessens and Yurtoglu, 2013; Dharmapala and Khanna, 2013; Dimitrov et al., 2015; Vig, 2013 among others). It is, therefore, an appropriate concern for regulatory economists to evaluate the merits and effectiveness of these reforms from various economic outcomes. (Claessens and Yurtoglu, 2013; Glendening et al., 2016; Vig, 2013).

An interesting study by Vig (2013) shows that following the creditor reform regulation in India, resulting in a shift from a pro-debtor regime to a pro-creditor regime, the corporate borrowing among firms reduced. The evidence suggests that corporate decision to reduce their secured borrowing was an unintended consequence of the regulatory reform. The consequences of a regulatory intervention could be positive or negative, depending on the beneficiaries of such outcomes. This is often contested among different schools of thought (Bargeron et al., 2010; Vig, 2013). Continuing with this line of enquiry, an interesting question is whether the corporate decision to shrink their borrowing as a consequence of the regulatory intervention, as shown by Vig (2013), could be generalized to all companies or could other endogenous characteristics influence such decisions? This line of enquiry motivated me to look into the literature as to what determined corporate borrowing decisions.

As per the economic theory, cost of capital and expected future earnings are the primary determinants of corporate borrowing. However, studies suggest alternative factors that play a key role in decisions relating to corporate borrowing. In his seminal works, Donaldson (1969, 1961) found that firms tend to rely more on internal funds. Introducing "modified pecking order" theory of financing, Stewart Myers (1984), also suggested that retained earnings are a more desirable form of capital than external funds as internal funds help in maintaining managerial autonomy.[2] Putting forth the arguments of corporate's autonomy concerning its environment under organizational models, Pfeffer and Salancik (2003) contend that the autonomy is a function of its ability to gain access to resources that are controlled by other organizations.

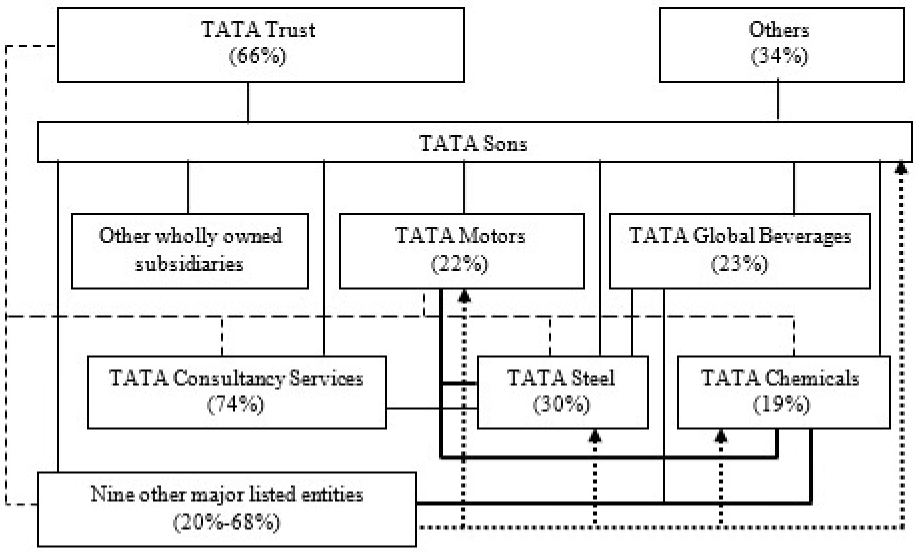
Given that if a firm depends on capital through external sources, the suppliers of such capital will exercise their power over corporate decisions of the firm resulting in loss of managerial autonomy. Under these circumstances, firms will attempt to

[2] The static trade-off, pecking order, and market timing theories are the three important capital sturcture theories (Huang and Ritter, 2009). Several evidences provide conflicting findings on the merits of these theories (Baker and Wurgler, 2002; Frank and Goyal, 2003; Ogden and Wu, 2013; Brown et al., 2019). Which of these theories perfectly explain capital structure decisions still remain a puzzle (Myers, 1984).

minimize their dependence on external financing, especially debt financing. In support of this view, using data on 22 large U.S. manufacturing firms from 1956 through 1983, Mizruchi and Stearns (1994), identify the availability of internal funds as one of the essential factors influencing corporate borrowing.

An important dimension of internal access to funds can be through the intra-group lending and borrowing in the internal capital market of large business conglomerates (Gopalan et al., 2007; Khanna and Yafeh, 2007). Figure 1-1 is an example of TATA group of India, which has several subsidiaries under the parent TATA Sons managed by the TATA trust. The intricate web of holding and cross-holdings among the various entities within the TATA group provides a platform to source capital within the internal capital market via intra-group debt.

Figure 1-1 TATA Group business web



This figure presents the intricate web of intra-group cross-holding among parent company and various subsidiaries of the TATA group. Source: reconstructed from company reports as of the end of March 2016.

Thus, given the impact of creditor protection reform on corporate borrowing as shown by Vig (2013), an important factor this previous study has missed is the role of a firm's access to internal capital. Connecting the literature on access to internal capital with the findings of Vig (2013), the motivation for my first empirical investigation comes from the research gap as to how corporate borrowing decision is influenced by the internal capital market under the influence of exogenous regulatory creditor reform. That is, whether the corporate decision to reduce their borrowing post regulatory reform is determined by the firm's access to internal funds. To this extent, I use the Indian creditor rights regulatory reform and the heterogeneity of firms based on access to internal capital to access the corporate borrowing decisions among firms constrained to access to internal capital.

1.1.2 Corporate investment decisions

The pioneering work on global warming by a Swedish scientist, Svante Arrhenius in 1896 was followed by scattered articles in the newspapers discussing the impact of climate change. In late 1988 The Intergovernmental Panel on Climate Change was established, and since then climate change and its impact have been steadily receiving more attention and importance. In the recent few decades, several academic and scientific research has focused on climate change and its impacts. Henderson et al. (2016) point out that climate change has implications such as rising sea levels, changing weather patterns, extreme weather, increased pressure on food and water, increased political and security risks, human health risks and adverse impact on the entire ecosystem.

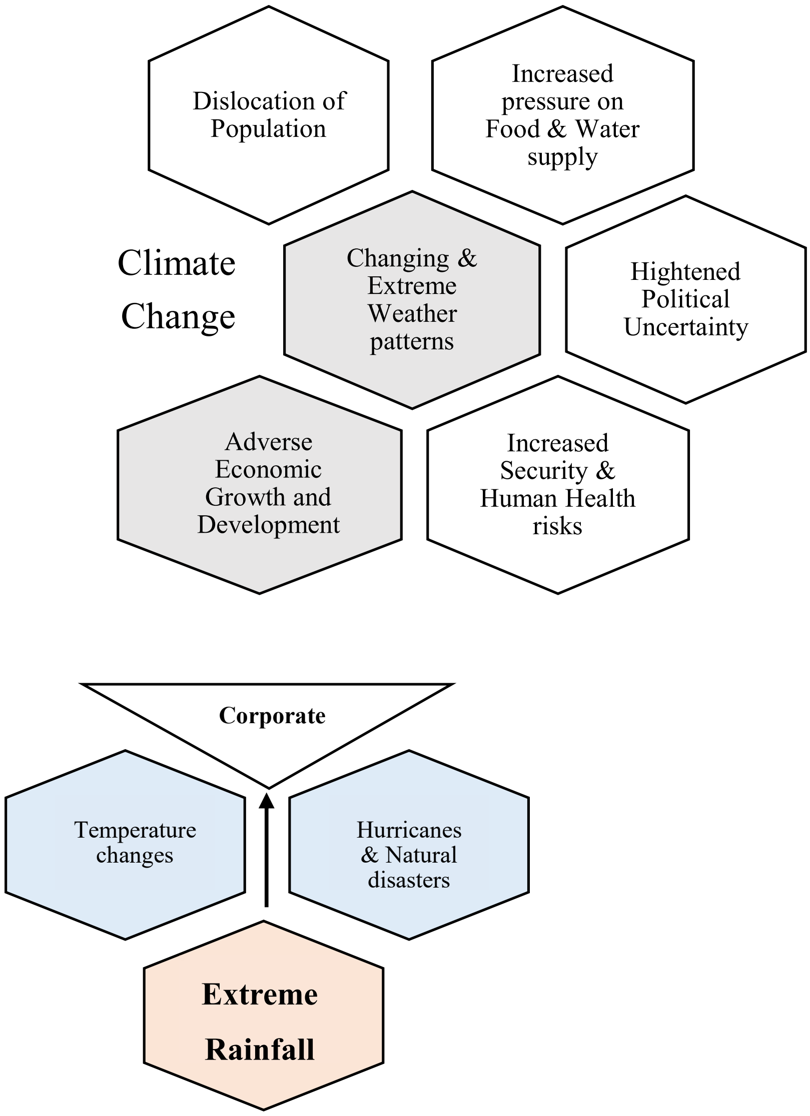
The World Health Organization (WHO) states the following on their website "*Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from malnutrition, malaria, diarrhoea and heat stress alone. The direct damage cost to health is estimated to be between USD 2-4 billion per year by 2030.*"[3] Growing concerns about climate change on health are just one of the problem of society. Several empirical pieces of evidence in the literature provide evidence to the fact that climate change has a direct impact on social and economic conditions of society.

Several studies directly link climate change to dislocation of the population (Black et al., 2011; Perch-Nielsen et al., 2008) adversely impacting economic growth and development (Barrios et al., 2010; Brown et al., 2011; Burke et al., 2015; Dell et al., 2012, 2009; Robson, 1970). Heal and Millner (2014) identify that the social and economic impacts as a result of climate change are imbued with uncertainty. Given these initial pieces of evidence, I look into the literature which discusses the various impact of changing climate and weather conditions on the society at large.

Figure 1-2 provides an overview of the different strands of literature discussing the impact of climate change. Changing climate patterns and extreme weather conditions are known to impact the supply of food and water (Hanjra and Qureshi, 2010), dislocation of the population (Black et al., 2011; Perch-Nielsen et al., 2008), heightened political uncertainty (Nordås and Gleditsch, 2007), increased security and health risks, and adverse impact economic growth and development (Barrios et al., 2010; Burke et al., 2015; Dell et al., 2012, 2009; Robson, 1970).

[3] See https://www.who.int/health-topics/climate-change#tab=tab_1

Figure 1-2 Summary of evidence on the impact of climate change



This figure presents the six focus areas in climate change literature. Further under the Adverse Economic growth and development literature, impact on corporates are mostly studied under temperature extremities, hurricanes and natural disasters.

Adverse impact on economic growth and development is directly linked to the performance of the corporate sector. Hitherto, studies have shown how extreme weather conditions like temperature changes and hurricanes/cyclones impact corporates. Barrot and Sauvagnat (2016) show that natural disasters negatively affect a firm's sales growth, while Dessaint and Matray (2017) document that hurricanes are associated with a reduction in firm value. Further other studies show temperature drops can increase usage of credit lines by corporates, and extreme temperatures can affect firm performance and productivity (Brown et al., 2017; Chen and Yang, 2019; Somanathan et al., 2015; Zhang et al., 2018). However, using extreme abnormal rainfall conditions as an exogenous shock to study corporate decisions concerning investments is yet to be explored.

Impact of abnormal rainfall on human wellbeing and economy are well documented. In this regard, Carrillo (2019) show that the likelihood of severe mental illness and illiteracy is higher among people prenatally exposed to adverse rainfall conditions. Increase in losses of the crop (Cohen et al., 2013; de Sherbinin et al., 2011) and livestock resulting in lower agricultural income (Carter et al., 2006) increased unemployment and poverty (Vos et al., 1999) are the direct results of abnormal rainfall. Thus evidence indicates rainfall conditions have a significant impact of on agricultural output (de Sherbinin et al., 2011; Mall et al., 2006), a key source of rural income and a significant contributor of the Gross Domestic Product (GDP) of many developing economies. This is supported by the argument that increased agricultural productivity leads to increased farmer's income (Mellor, 1999).

Further Hanmer and Naschold (2000) show that there is an increase in employment through forward and backward linkages of non-agricultural sectors of both rural and urban areas as a result of higher agricultural yield. These linkages are further supported by Computational General Equilibrium models (CGE) showing multiplier effects of agricultural growth on other sectors of the economy (Block, 1999; Coxhead et al., 1991; Dorosh and Thurlow, 2018; Haggblade et al., 1991; Lee, 2018). Chaurey, (2015) show firms increase hiring of temporary/contract labours during transitory rainfall shocks, while Gollin et al. (2002) argue that increase in agricultural yield hastens industrialization and have enormous impacts on relative income.

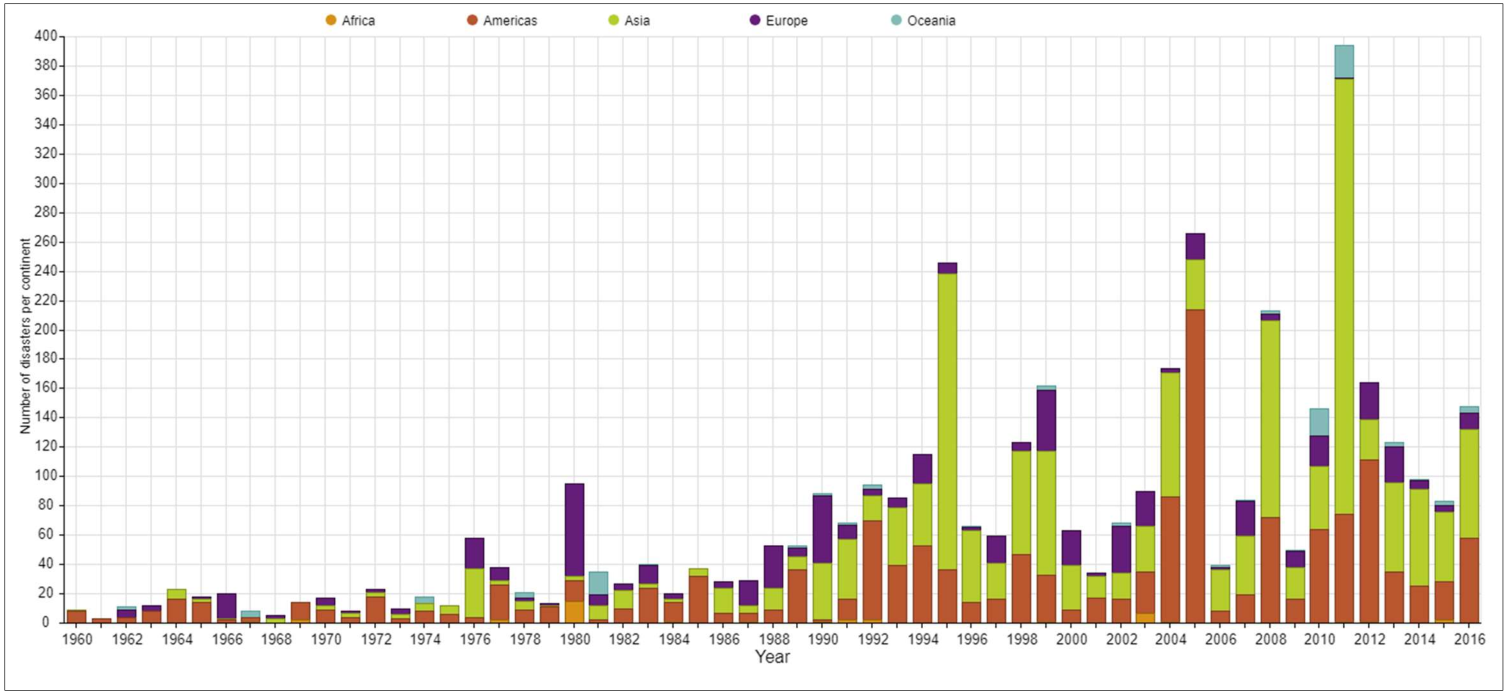
At a sectoral level, certain industries which include forestry, agriculture, conservation, transportation, health, water management, construction, tourism, banking and insurance (Zebisch et al., 2005), tea, fishing, cocoa (Henderson et al., 2016) are known to be impacted more by climate factors due to their sensitivity to the climatic conditions. Studies focusing on weather-related anomalies have been attracting global attention in both practice and academia. Empirical evidence signifies that climatic conditions have been changing in recent years, leading to widespread dislocation of the population (Black et al., 2011; Perch-Nielsen et al., 2008), increased loss of crop and livestock resulting in lower agricultural income, higher unemployment and poverty (Carter et al., 2006; Cohen et al., 2013; de Sherbinin et al., 2011). These consequences are adversely impacting economic growth and development (Barrios et al., 2010; Brown et al., 2011; Dell et al., 2012, 2009).

The IPCC (Intergovernmental Panel on Climate Change) published its special report entitled "Global Warming of 1.5°C" in October 2018. Panmao Zhai, Co-Chair of The Intergovernmental Panel on Climate Change Working Group I stated the following regarding the report "*One of the key messages that comes out very strongly from this report is that we are already seeing the consequences of 1°C of global warming through more extreme weather, rising sea levels and diminishing Arctic sea ice, among other changes*".[4] Worldwide statistics, as seen in Figure 1-3, show that the frequencies of disasters such as floods and droughts have only been increasing,

[4] (https://www.orano.group/en/unpacking-nuclear/all-about-the-ipcc-report-on-climate-change).

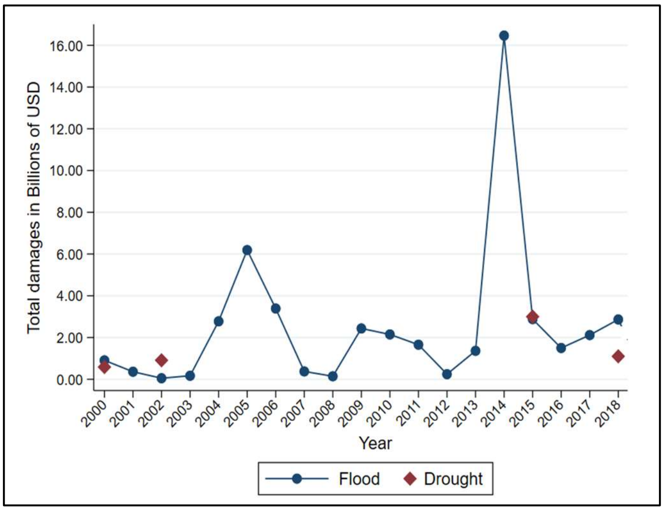
majorly in Asia, during recent decades. Concerning the economic damages, as seen in Figure 1-4 between the years 2000 and 2018, flooding and drought conditions in India have incurred considerable losses. Table 1-1 indicates that these losses incurred to India (2000-2018) are around USD 48.04 billion and USD 5.60 billion due to floods and droughts, respectively. Thus, under the influence of exogenous climate change distress do managers of the distressed firms undertake strategic adaptive decisions that will mitigate the adverse impacts? While corporate investments decisions are aimed at maximization of firm's value (Friedman, 1970; Miller and Modigliani, 1961), the question is given whether some industries that are more sensitive to climate change (rainfall conditions) take differential investment decisions when compared to those that are least affected? The overarching bigger question, however, is whether climate change affects a firm's value?

Figure 1-3 Number of droughts and floods



This figure presents the total worldwide number of floods and drought occurrences for each year between 1960 and 2016, broke down by continent. There is a clearly visible increase in frequencies of natural disasters from 1990. Source: EM-DAT: The Emergency Events Database - Université Catholique de Louvain (UCLouvain) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium

Figure 1-4 Total damages due to floods and droughts in India



This figure presents the total damages in USD billions, due to floods and droughts in India between 2000 and 2018. Source: EM-DAT: The Emergency Events Database - Université Catholique de Louvain (UCLouvain) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium.

Table 1-1 Rainfall departure damages in India (billion, USD)

This table reports the total damage relating to floods and droughts in India from years 2000 to 2018. Source: EM-DAT: The Emergency Events Database - Université Catholique de Louvain (UCLouvain) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium.

Year	**Flood**	**Drought**
2000	0.91	0.59
2001	0.36	
2002	0.05	0.91
2003	0.17	
2004	2.78	
2005	6.19	
2006	3.39	
2007	0.38	
2008	0.15	
2009	2.43	
2010	2.15	
2011	1.66	
2012	0.24	
2013	1.36	
2014	16.47	
2015	2.88	3.00
2016	1.50	
2017	2.12	
2018	2.86	1.10
Total	**48.04**	**5.60**

1.2 Research questions

1.2.1 Corporate borrowing decisions

An important policy question that the regulatory domain faces is whether the strengthening of creditor rights expands or contracts corporate borrowing? There are seemingly two opposing economic views on this issue in finance literature. The first view, which is primarily based on the empirical work of La Porta et al. (1998), conjectures that reforms that empower creditors to enforce contracts efficiently should improve their willingness to lend more. Such an increase in the credit supply should also lower the cost of credit. This, in turn, should improve corporate borrowing and the firm's access to external finance (La Porta et al., 1998). This view has gained empirical support in the literature. For example, Haselmann et al. (2010) show that the lending activities in Central and Eastern European countries experienced a boost following the creation of a collateral registry, which enhanced creditor rights to enforce their contracts. Other previous studies also support the argument that the credit market is enhanced as a result of strong creditor protection (Djankov et al., 2007; Jappelli and Pagano, 2002). Together, these arguments confirm the economic power theory of credit, which suggests that creditors are more willing to lend when they can enforce their rights more easily (Hart and Moore, 1994; Townsend, 1979).

The second and apparently opposite economic view argues that expansion of creditor rights results in deadweight costs arising from the lenders' supremacy in dictating terms, which undermines the decision-making power and flexibility of firms. The associated higher deadweight costs should then, consequently, lower debt financing (Vig, 2013). In other words, the strengthening of creditor rights may carry distorted demand and supply-side effects. Although creditors may be willing to lend more and at a lower interest rate following higher creditor empowerment, the demand side reaction may have unintended consequences on the loan market because of the lowered willingness of debtors to borrow more. In line with this view, Acharya et al. (2011) empirically show that corporate leverage is lower in countries with stronger creditor rights.

Further, in a cross-country study, Cho et al. (2014) also demonstrate that firms avoid long-term cash flow commitments to service debts when facing more robust creditor protection. They do so to evade the risk of losing control in the event of financial distress. Other literature on bankruptcy also suggests inefficiencies in the form of firm liquidation bias associated with excessive creditor rights (Aghion et al., 1992; Hart et al., 1997). In summary, this conjecture of deadweight costs predicts that the strengthening of creditor rights may deter firms' willingness to borrow.

Given the two opposing economic views of inconclusive evidence in literature, I extend this debate by exploring the effect of creditor rights on firms' borrowing on a significant corporate heterogeneity, i.e., whether the borrowing firms have constrained access to internal capital or not. Thus, my first research question is on corporate borrowing decisions.

> '*Are corporate borrowing decisions influenced by access to internal capital under stronger creditor protection regulatory regime?*'

To investigate this question, I outline a detailed literature review and develop a hypothesis in Chapter 2 and present my empirical findings in Chapter 4.

1.2.2 Corporate investment decisions

What are the economic impact of extreme climatic conditions, specifically rainfall deviation from its expected normal (hereafter referred to as *rainfall departures*), on corporate investments and valuations?[5]

Precipitation levels are directly linked to atmospheric temperature and thus, one of the significant factors contributing to climate change conditions (Hardwick Jones et al., 2010). The exponential increase in the water-holding capacity of air with rising temperature, as supported by the Clausius–Clapeyron relation (Lenderink and van Meijgaard, 2008), results in intensification of rainwater cycles, which leads to abnormal rainfall conditions of severe floods and droughts (Henderson et al., 2016).[6] Given the rising extremities in rainfall conditions, the critical question my second empirical study examines is the impact of two extreme *rainfall departure* conditions, i.e. *excess* and *deficit,* on managerial response to investments (corporate investment decisions).[7] Additionally, I also investigate the value relevance of such investment strategies.

Since the growing episodes of *rainfall departures* generate excessive economic uncertainties for the corporate sector, my study draws on two prominent economic views linking uncertainties and investments. One school of thought argues that under the real-options approach firms that have a choice to delay irreversible investment decisions, in the wake of uncertainty, should reduce their current investments (Cooper

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[5] *Rainfall departures* is defined as extreme variance from the normal expected rainfall condition. *Departure* can be either *excess* rainfall or *deficit* rainfall, both relative to the *normal* expected rainfall.
[6] A recent study by NASA's Jet Propulsion Laboratory found that for every 1 degree Celsius rise in ocean surface temperature, 21% more storms are formed, which means a substantial increase in extreme rainfall (NASA, 2019).
[7] See Subsection 5.2.3 for definitions of *excess* and *deficit rainfall departures.*

and Priestley, 2011; Ioulianou et al., 2017; McDonald and Siegel, 1986; Tserlukevich, 2008). An alternative risk-shifting view argues that since shareholders benefit from risky investments, firms facing distress conditions should increase their investments (Eisdorfer, 2008; Jensen and Meckling, 1976; Lim et al., 2019; Marmer and Slade, 2018).

These two opposing views, however, do not provide us with a unified framework to explain how firms make investment decisions for the two heterogeneous conditions of *excess* and *deficit* rainfall deviations. I, therefore, rely on the Salience theory, which predicts investment policies based on differential past experiences encountered by the managers. Past-experience is an essential internal factor (individual characteristic) that influences decision making. This, under the Salience theory, suggests that when decisions outcomes are positive, people are more likely to decide similarly in a similar situation (Bordalo et al., 2012). On the other hand, repeating past mistakes are often avoided (Sagi and Friedland, 2007). Studies have shown experience (saliency) to influence managerial decisions. For instance, firms run by CEOs who experienced distress take policy decisions leading to maintain lower debt, increased cash holding, and with lower investments (Dittmar and Duchin, 2015). Early-life experiences can lead managers to take differential corporate financing decisions (Malmendier et al., 2011). For instance, Benmelech and Frydman (2015) show that CEOs with military experience pursue lower corporate investments.

Within the context of *rainfall departures*, Salience theory suggests that managers, especially of rain-sensitive firms, are salient to the impacts of *rainfall departures* because of partial destruction of operating assets, underutilization of production capacity, and risk of cash shortages that may arise from a drop in local demand or increased operating costs (Dessaint and Matray, 2017). However, the two different *rainfall departure* conditions may lead to different saliency experiences. For example, while partial destruction of operating assets is more likely in case of *excess* conditions, underutilization of production capacity is highly probable in the *deficit* conditions. Hence, this implies that rain-sensitive firms' managers, who are differentially salient to heterogeneous *rainfall departure* conditions, may time their investments differently to recoup lost market value experienced in the immediate aftermath of *rainfall departures*. That is, they should undertake differential investment decisions.

I investigate the aforesaid conjectures in my empirical set-up using data on unexpected changes in the Indian rainfall conditions (monsoon rains). More specifically, my empirical analysis examines the following three research questions on corporate investment decisions:

(i) *What are the firm valuation effects in the immediate aftermath of extreme rainfall departures, particularly for firms whose operations are highly sensitive to rainfall conditions?*

(ii) What are the corporate investment strategies of rain-sensitive firms following extreme rainfall departures?

(iii) What is the market response to corporate investment decisions induced by extreme rainfall departures of rain-sensitive firms?

To investigate these three research questions, I outline a detailed literature review and develop hypotheses in Chapter 2 and present my empirical findings in Chapter 5.

1.3 Findings

1.3.1 Corporate borrowing decisions

The major findings of my empirical investigations, on the research question in 1.2.1, presented in detail in Chapter 4, are as follows.

Using a sample of 1,978 nonfinancial listed firms affiliated with 641 unique business-groups, along with 3,071 unaffiliated standalone listed firms and exploiting the exogenous variations availed by the Securitization and Reconstruction of Financial Assets and Enforcement of Security Interests Act (SARFAESI Act), my study finds that unaffiliated standalone firms (firms that have constrained access to internal capital) increase their debt financing more relative to business group firms (firms that have access to internal capital) following the creditor rights reform. In terms of economic magnitude, the expansion of creditor rights increases the total borrowing of treated firms in the range of 2% to 4% of total assets, depending on the specification. Similar results are documented when I employ an empirical strategy based on an alternative measure of a firm's access to internal capital, which is the Internal Capital Growth Rate (ICGR).[8]

The core results of my study are robust to a battery of robustness checks, such as the use of different forms of debt structures, different study periods, a propensity-score matched difference-in-differences (PSM-DiD) design and employing an unlisted sub-sample of private firms. All these tests strongly suggest that, compared to their business affiliated peers, unaffiliated standalone firms experience a more significant

[8] Lower ICGR firms are considered to be firms with higher constraints to internal capital. See Subsection 4.3.5.3 for the definition of this variable.

increase in corporate borrowing following the creditor rights reform. Additionally, I take advantage of the heterogeneity based on whether a business group has a financial institution as an affiliated member or not. By exploiting this classification, I show that business group affiliated firms with no affiliated financial institution increase debt financing more than those who have the advantage of having an affiliated financial institution.

My examination of the implications of increased borrowing show standalone financially constrained firms that borrow relatively more in the post creditor protection regime experience more significant improvement in their capital investments, operating performance and market valuation. These findings underscore the positive effect of creditor protection in encouraging real investment, financial performance and investment efficiency for firms that otherwise have constrained access to internal capital.

I interpret these findings as evidence that firms having constrained access to internal capital benefit from the strengthening of creditor rights protection, a view in line with the argument of La Porta et al. (1998) and Haselmann et al. (2010). The findings of my empirical study suggest that the unintended consequences argument of creditor empowerment (Acharya et al., 2011; Vig, 2013), which predicts that a creditor reform hurts corporate borrowing, could be driven by firms that have easier access to alternative sources of capital, particularly that of the internal capital market. My overall findings thus suggest that a policy intervention expanding creditor rights is particularly beneficial for firms that have constrained access to internal capital. Thus, with respect to the corporate borrowing decisions, my findings suggest that, in light of creditor reforms, firms with constrained access to internal capital decide to borrow more whereas firms with access to internal capital reduce their overall borrowing.

1.3.2 Corporate investment decisions

The major findings of my empirical investigations, on the three-research question (i, ii and iii) in 1.2.2, discussed in detail in Chapter 5, are as follows.

Exploiting the exogenous variations caused due to extreme rainfall conditions in Indian set-up, my study reports the following findings. First, relative to all other firms, rain-sensitive firms suffer significant market-based value decline in the immediate aftermath of the *rainfall departures*. Under both *excess* and *deficit* conditions, the firm value declines significantly in the immediate quarter following the end of the monsoon season. It continues to decline up to the end of the fourth quarter of the same year. In economic terms, the decline in firm value (using market-to-book measure) of rain-sensitive sectors is in the range of -10% to -17.7% in *excess* and -1.6% to -5.9% in *deficit* rainfall conditions.

Second, the investigation linking *rainfall departure* and investments reveals several interesting outcomes. I show that under *excess* conditions, firms that are sensitive to these conditions significantly increase their capital expenditure (on average, in the range of 3.4% to 4.8%) compared to *control* firms. Conversely, in *deficit* conditions, firms that are sensitive to these conditions reduce capital expenditure (on average about 3%) when compared to *control* firms. These results are supported by a battery of additional tests which include alternative investment proxies, one-year pair difference-in-differences (DiD) and rainfall sensitivity analyses at different levels of *rainfall departure* intensities (i.e., ±15% to ±30% rainfall deviations).

I also find evidence that the growth in corporate investments among rain-sensitive firms continue to persist for almost three years following *excess* conditions*,* particularly when those conditions are 20% above *normal.* In terms of a further robustness check, using an alternative classification of firms into treated and control groups based on geographic location shows that the significance of rainfall departures on investments under this classification disappears, thus providing support to my classification based on rain-sensitive industries. Overall, my empirical findings lend support to the proposition that diverse *rainfall departure* conditions (*excess* vs *deficit*) are associated with differential responses in terms of corporate investments decisions (increase vs decrease) by rain-sensitive firms.

I next examine the implications of the above investment strategies on firm value. The results show a significant increase in market value a year after *rainfall departure* conditions not only for *excess* rain-sensitive firms (average of 2%) but even for deficit rain-sensitive firms (average 9%). These results suggest that managers' investment decisions (to invest or not to invest) under differential exogenous conditions (*excess* or *deficit*) can lead to value generation. This also suggests that managers can recoup the value lost in the immediate aftermath of *rainfall departure* through their investment strategies. Such outcomes thus support the conjecture that investment-timing strategies induced by *rainfall departures* are associated with increased market valuations of rain-sensitive firms.

1.4 Thesis contribution

1.4.1 Linking PESTEL to Corporate decisions

The findings of my thesis contribute to the extant literature which studies the effect of the external environment on corporate decision making. My findings specifically contribute to the line of studies which use PESTLE model to analyse the strategic decision making of corporates. Extant literature uses this model in disciplines mostly in strategic management and marketing (Leviäkangas, 2016; Peña Ramírez et al., 2020; Sameni Keivani and Khalili Sourkouhi, 2014; Sarangi and Pattnaik, 2018; Yüksel and Jurevicius, 2013). I bring this strategic decision-making model into the area of corporate finance and link it to the line of studies looking into the impact of the legal and ecological environment on corporate financial decision making. My findings contribute to the extant literature which discusses corporate decision making under different regulatory interventions under the legal dimension of the PESTLE model (Agrawal and Jaffe, 1995; Bargeron et al., 2010; Dambra et al., 2015; Gulen and Ion, 2016; Koirala et al., 2018; Linck et al., 2008). Similarly, under the environmental (ecological) dimension of the PESTLE model, my findings contribute to the extant literature which discusses corporate decision making under different climatic conditions (Aretz et al., 2018; Chen et al., 2019; Dessaint and Matray, 2017; Hirshleifer and Shumway, 2003; Mansur et al., 2008).

My thesis makes unique contributions to the broad literature of corporate borrowings, uncertainty and climate change impacts. In the following subsection, I discuss the contribution of my thesis from the two empirical investigations on corporate decisions.

1.4.2 Corporate borrowing decisions

My first empirical investigation on corporate borrowing decision contributes to the ongoing debate on whether an environment of stringent creditor protection encourages or deters corporate borrowing (Acharya et al., 2011; La Porta et al., 1998; Vig, 2013). My study adds to this literature by focusing on one important firm heterogeneity, i.e., firms' access to internal sources of financing. Contrary to the evidence of lower borrowing being a consequence of the regulatory intervention of expanding creditor rights, as documented in previous studies (Vig, 2013), I show that such reforms encourage corporate borrowing among firms with constrained access to internal capital. Thus, from a policy point of view, the results of my findings imply that a regulatory intervention aimed at expanding creditor protection may lead to desired policy outcomes for firms that have constrained access to internal capital. My study further highlights the importance of this outcome on expanding real investments, higher valuation and better performance for standalone firms in the post-reform period. As such, I contribute to the literature on the merit of creditor reform by demonstrating the positive effect of expanding creditor rights in improving allocative efficiency in an emerging economy (Almeida and Wolfenzon, 2006). Finally, my findings that firms having access to internal capital prefer internal funding. In contrast, firms with constrained access to internal capital increase their external borrowings, also seems to support the pecking order theory on capital structure (Brown et al., 2019; Frank and Goyal, 2003; Myers, 1984; Myers and Majluf, 1984).

1.4.3 Corporate investment decisions

My second empirical investigation on corporate investment decision makes important contributions to the following strands of literature. First, my findings add to the literature that investigates the impact of climate and environmental changes on corporate behaviour and market performance. For example, a sizeable number of studies relate climate change to overall stock market returns, market sentiment, liquidity and volatility (Hirshleifer and Shumway, 2003; Kamstra et al., 2003; Rehse et al., 2019; Shahzad, 2019). Although these studies provide useful insights that corporates are not immune to changing climatic conditions, they mostly focus on the implications for stock markets. My focus is on corporate decisions made in the wake of significant climate events. I contribute to the growing area of literature that explores the consequences of natural disasters and extreme weather conditions on firms' corporate decisions. For instance, using the US market setting, Barrot and Sauvagnat (2016) show that natural disasters negatively affect a firm's sales growth, while Dessaint and Matray (2017) document that hurricanes are associated with a reduction in firm value. Similarly, extreme temperature drops can increase usage of credit lines by corporates (Brown et al., 2017), firm performance and productivity (Chen and Yang, 2019; Zhang et al., 2018). Further, Lin et al. (2019) use extreme temperatures variations and show that the optimal production process for firms is affected due to large fluctuations in demand and wholesale prices of electricity. They further show that investment decisions of electric utility companies depend on the frequency of the extreme temperatures in order to improve their operating flexibility. My study adds to this growing literature linking extreme climatic conditions and corporate characteristics, by providing evidence on the association between extreme abnormal rainfall conditions and the firm-level investments and valuations.

Second, my study adds to the literature on risk-taking as I contribute to the ongoing debate of theoretical tensions between the real-options approach and the risk-shifting theory of corporate investments (Eisdorfer, 2008; Ioulianou et al., 2017; Jensen and Meckling, 1976; McDonald and Siegel, 1986). I propose a plausible economic intuition of investment timing using the *Saliency* theory to explain a unique and previously unexplored investment behaviour of firms specifically sensitive to abnormal weather conditions. Thus, my paper contributes to the line of literature that uses the impact of past experiences on subsequent risk-taking and corporate policy choices (Bordalo et al., 2012; Dessaint and Matray, 2017; Malmendier et al., 2011). Finally, as abnormal rainfall conditions lead to economic distress and uncertainty, my study shows the impact of uncertainties induced by extreme rainfall conditions on a firm's investments. I contribute to the growing literature of the impact of uncertainty on corporate policies (Bernanke, 1983; Bloom, 2009; Bonaime et al., 2018; Heal and Millner, 2014; Pástor and Veronesi, 2012) under the climate abnormalities dimension.

1.5 Structure of the thesis

The chapters following are led by the general empirical setting and investigations of the research questions as discussed under Section 1.2. I present the literature review leading to hypothesis development in Chapter 2. In Chapter 3, I discuss the data and the general research methods used to undertake the empirical investigations. Further, I present the empirical evidence of corporate borrowing decisions using the Indian creditor protection regulatory reform in Chapter 4 and empirical investigation of corporate investment decisions using the Indian monsoon rains as an exogenous shock in Chapter 5. Finally, I present a comprehensive write up on the discussion and conclusion to my thesis in Chapter 5. Here, I not only summarise all my findings but also discuss the implications and limitations of my thesis. I conclude my thesis by providing some inputs on the possible direction to future research that could be explored as an extension to the contributions I have made to the various literature domains.

Chapter 2

Literature review and hypotheses development.

Abstract

In this chapter, I begin with providing a detailed background of the creditor rights regulatory reform in India, followed by literature review and development of the hypothesis for investigating the research pertaining to corporate borrowing decisions. Next, I provide details regarding the extreme rainfall conditions in India used as extreme weather shock and information on rain-sensitive firms. This is followed by a literature review and development of hypotheses to investigate the research questions pertaining to corporate investment decisions.

2. Chapter 2: Literature review and hypotheses development.

In this chapter, I present a comprehensive background and literature review leading to the development of hypotheses under legal and environmental dimensions of the PESTLE model. The focus will be on the general setup under which I shall carry out my investigations on corporate borrowing and investment decisions.

Firstly, under the legal dimension (L) of the PESTLE model, studies show that exogenous regulatory factors influence corporate decisions. While Bargeron et al. (2010) show that SOX deter corporate risk-taking, Dambra et al. (2015) show that the JOBS Act resulted in increased IPOs. Similarly, Section 16b of the Securities Exchange Act resulted in managers deciding to deter from trading before mergers (Agrawal and Jaffe, 1995). Given some of these evidence on regulatory interventions exploring various corporate decisions, I explore how the SARFAESI Act, a creditor reform in India influenced corporate borrowing decisions. To this extent under the 'corporate borrowing decisions' subsection 2.1, I begin with a detailed review of the SARFAESI Act, followed by a literature review leading to the development of a testable hypothesis. I explore the literature on theoretical underpinnings influencing corporate borrowing decisions when firms are heterogeneous concerning their access to internal capital.

Secondly, an important external macro-environmental dimension of the PESTLE model is the environment (ecology). under this dimension my research explores extreme weather triggered corporate decisions. Previous studies show weather variations have first degree influences on corporate decisions. While Dessaint and Matray (2017) show that concerns of perceived liquidity risk in the event of hurricanes lead corporate managers to increase cash holding, Aretz et al. (2018) provide evidence that managers skew their asset mixes toward riskier product segments suggesting managers engage in risk-shifting behaviours in the wake of climate change distress. Additionally, Hirshleifer and Shumway (2003), show that a trader whose transaction costs are low can benefit by optimizing his trading strategies using the weather conditions. To this extent under the 'corporate investment decisions' subsection 2.2, I begin with a detailed review on rainfall extremities, followed by a literature review on rain-sensitive industries and corporate investments leading to the development of a testable hypotheses. I explore the literature on theoretical underpinnings influencing corporate investment decisions when firms are exposed to heterogeneous rainfall conditions.

2.1 Corporate borrowing decisions

2.1.1 The SARFAESI Act and creditor protection in India

In the Indian context of the pre-liberalization era of 1991, debt recovery by creditors through seizure and liquidation of assets was a tedious process. This debt recovery involved lengthy legal procedures, bureaucratic delays, and civil suits, resulting in the deterioration of the assets' value, thus making it difficult for creditors to enforce their claims (Ahluwalia, 2002). Further, any reorganization plans were also often blocked and vetoed by workers, adding to further delays (Vig, 2013). The corporate bond markets were almost nonexistent, and the lending market was a near-monopoly of public sector financial institutions and banks (Ahluwalia, 2002). These debt recovery problems led to the mounting of nonperforming assets (NPAs) level.

Post-liberalization, to bring more competition into the lending markets from private lending institutions, improve operating efficiency and remove the bottlenecks in the debt recovery process, the Indian government enacted the Recovery of Debts Due to Banks and Financial Institutions Act (1993) (the RDDB Act). Specialized dedicated debt recovery tribunals (DRTs) were set up by the government under this legislation to recover debts of more than INR one million that were due to banks or financial institutions. DRTs intended to bypass lengthy legal processes for the speedy recovery of debts. However, it was not until 2002 that the Act was finally enforced in a way that was legally compatible with the judicial requirements. DRTs resulted in a significant reduction in the delinquency rates and costs of borrowing (Visaria, 2009).

In the year 2002, retroactive legislation called the Securitization and Reconstruction of Financial Assets and Enforcement of Security Interests Act (The SARFAESI Act) was enacted.[9] This law allowed creditors to bypass the lengthy court process and seize the defaulting firms. The Act applied only to secured loans and empowered the banks and financial institutions to seize and liquidate the secured assets of a defaulting firm.[10] SARFAESI's enforcement was delayed until 2004, as the regime was challenged on constitutional grounds. However, the Supreme Court of India upheld the Act's validity.

Vig (2013, p. 888) notes the following: *"Before the SARFAESI Act, however, Indian law actually prevented creditors from seizing security at any time—whether before or after insolvency proceedings—without a tribunal order. Recovery of security interests was thus effectively stayed, pending the resolution of these tribunal*

[9] The SARFAESI Act was retroactive, i.e., it is applicable to both old as well as new contracts.
[10] A default firm is a firm that has not made payments for more than six months.

proceedings, by the lack of extra-proceeding mechanisms." Thus, in the pre-SARFAESI Act era, laws in India were pro-debtor, in contrast to some European countries, such as the United Kingdom, France, and Germany, where the law allowed secured creditors to seize and liquidate securities without any delays. While these European countries had pro-creditor regimes, the United States creditor protection laws, though stringent, were pro-debtor, as the main objective of the creditor protection laws was to maintain the business as a going concern. Pre-SARFAESI Act regime was similar to that of France, where the primary objective is to safeguard workers' jobs while maintaining business operations (White, 1996). Therefore, the Indian legal environment resembled that of France rather than the United States before the SARFAESI Act (Vig, 2013).

In the post-SARFAESI Act regime, the secured creditor rights were strengthened, and the legal system in India transitioned from a pro-debtor regime to a pro-creditor regime. Some of the important provisions under the SARFAESI Act regime, which enabled this transition, include the right of secured creditors to take over the management of the secured assets or the business itself. The secured creditor now has the right to sell off the secured assets to recover the debt obligation after providing a 60-day notice to the defaulting debtors. In the case of legal proceedings, the post-SARFAESI Act regime has shifted the burden of proof from the creditor to the debtor. Thus, in the post-SARFAESI Act era, the Indian creditor's rights protection significantly improved. In my case, this regime shift facilitates the examination of the effect of creditor rights on the corporate borrowing of firms with different access to internal capital.

Table 2-1 Summary of SARFAESI Act timeline

Before 2002	The year 2002	After 2002
• *Pro-debtor regime* • Lengthy court/tribunal process of recovery (10-15 yrs.) • Workers use veto power to stop reorganizations • Bureaucratic delays and civil suits • Deterioration of the value of NPAs • Law did not allow creditors to seize the firm's assets – w/o tribunal order • The burden of proof on the creditors	• Enactment of SARFAESI Act • Retroactive, i.e., it applies to both old as well as new contracts • No change in property rights • But, changed how security interests are enforced	• *Pro-creditor regime* • Bypass lengthy court process • 60 days' notice to defaulting debtors • Allowed creditors to seize the defaulting firm's assets/business • Liquidate the secured assets • The burden of proof on the debtors (punitive on debtors)

2.1.2 Literature and hypothesis development

The economic power theory of debt suggests that the empowerment of creditors should lead to the expansion of contractual space, as creditors can enforce their rights more easily (Hart and Moore, 1994; Townsend, 1979). Supporting this view, Djankov et al. (2007, p. 300) note: *"When lenders can more easily force repayment, grab collateral, or even gain control of the firm, they are more willing to extend credit."* This implies that any policy shift that makes it easier for the creditors to recover their financial interest and decreases information asymmetry between firms and creditors should accord greater confidence to the lending fraternity in expanding the contractual space at a lower cost (La Porta et al., 1998).[11]

In line with the theory of debt model of Hart and Moore (1994), a hypothetical example may elucidate this proposition. Suppose a firm makes an investment in a real

[11] Taluja, Seth and Berger (2017) show that the SARFAESI Act (which provided easier access to collateral) helps in reducing the problem of *ex ante* information asymmetry.

asset and borrows from a loan market by offering the same asset as security. Let us consider the set-up (model) when the borrower finances an asset in *year 0* which creates cash inflows in *year 1* and *year 2* and where cash-flows can be observed but cannot be not contracted, and that the borrower has completed the bargaining power. Assume that, at $t = 1$, the creditor can liquidate the firm for the value of x. Because by the supposition that the borrower has all the bargaining power, the maximum amount that can be borrowed in such a case is the liquidation value of the asset x. Let us next consider a policy shock that strengthens creditor rights by expanding their access to the hypothecated collateral. This policy reform enables the lenders to liquidate the collateral for a higher value, i.e., $x + \partial$, where $\partial > 0$. This policy reform expands the space of feasible contracts and allows an entrepreneur to borrow more, *ceteris paribus.* In other words, the supply of the lending market should be boosted by such positive changes in regulatory reforms. This supply-side prediction is empirically supported in the literature (Haselmann et al., 2010).

However, there could be a demand-side adaptation induced by the fear among debtors of losing their decision-making flexibility, along with the increased cost of financial distress, including bankruptcy. Such perceived risks may eventually lower the demand for borrowing. Studies attribute this to the generation of high levels of deadweight costs from additional borrowing when creditors impose highly restrictive terms and/or when the associated distress cost, including that of bankruptcy, increases (Aghion et al., 1992; Hart et al., 1997). Studies also offer empirical evidence supporting this unintended side effect of restrictive creditor rights (Acharya et al., 2011; Vig, 2013).

Given the inconclusive evidence on the link between increased creditor rights and firm borrowing, I make a concerted effort to provide some reconciling views and evidence-based on firms' access to internal capital. I argue that the inconsistent evidence observed in the literature may be partly explained when I take into account firms' heterogeneity with respect to the degree of constraints they face when accessing their internal capital market.

Numerous studies argue that the degree of constraints a firm encounter to access cheaper internal capital, which avoids excessive monitoring by external creditors, is also dependent on whether a firm belongs to a business group. A business group comprises a set of related firms that have the advantage of accessing each other's resources (resource-based theory), which creates a significant internal capital market (financial advantage hypothesis). Such advantages arise due to their substantial operational and financial interlinkages and because they are managed by a common group of insiders (Gopalan et al., 2007). According to the resource-based theory, the possession of tangible and intangible resources gives the firm a competitive advantage over other firms as it is difficult or costly to obtain. These resources must be valuable, rare, inimitable, and un-substitutable to maintain the firm's competitive advantage (Barney, 1991). For example, drawing on the resource-based theory, Chang and Hong (2000) provide empirical evidence that firms belonging to Korean business groups (known as Chaebols in Korea) benefit from the resources owned by other affiliates in the same Chaebols (due to economies of scale and scope). Thus, Chang and Hong (2000) show that internal capital markets within business group firms help to reduce the transaction costs incurred by group affiliates and supplement inefficient external capital markets.

Similarly, testing the financing advantage hypothesis, Khanna and Yafeh (2007) demonstrate that the practice of group affiliated firms replacing expensive external debt with cheap intragroup loans is a remedy for firms funding themselves in underdeveloped capital markets. The financing advantage hypothesis is further supported by Buchuk et al. (2014), whereby they show that the operational performance of Chilean group-affiliated firms that receive intragroup loans increases significantly. Their external leverage (external debt over total assets) is approximately 6% lower, demonstrating strong substitution of external debt by intragroup loans in these firms. As the controlling parent company is an interested party to the intra-loan deal, intragroup loans are considered as soft loans. They are easier to negotiate at initiation and further renegotiated at times of financial distress. Such practices may significantly mitigate the default risk, which may ultimately preserve the good reputation of the group (Buchuk et al., 2014). Further, through intragroup lending, the affiliated firms are spared excessive monitoring by external creditors (Lin et al., 2011).

Using Indian firms, Gopalan et al. (2007) empirically demonstrate that a crucial reason that business group firms seek internal financial support from other member affiliates is to avoid spillover reputational damage in case of default by any externally financed member. Gopalan et al. (2007) show that, on average, the intergroup loan flow constitutes 59% of the operating profits in the year a firm receives loans. Khanna and Palepu (2000), also employing Indian firms, offer strong evidence that intergroup loans are the channels through which Indian groups transfer cash across member firms. Thus, such a business group structure often helps the member group firms to not only overcome the limitations of raising costly external capital but also to avoid the deadweight costs of losing financial flexibility in their decision making (He et al., 2013; Hoshi et al., 1991). The conjecture that firms are less likely to access external finance as a result of having the advantage of operating within the group's internal capital markets is also supported by Shin and Park (1999). Thus, under both the resource-based theory and the financial advantage hypothesis, intergroup lending is a vital source of transferring financial resources across group firms and is generally used to enhance the financial condition of the affiliated but financially weaker firms.

Similarly, empirical studies also document that compared to their developed counterparts, the cost of raising external capital is generally higher for firms in emerging markets (Wurgler, 2000). Thus, emerging market firms that are part of a business group structure significantly benefit from relatively cheaper intergroup loans (Gopalan et al., 2007). This benefit of business group firms implies that in the event of any exogenous shift in creditor rights that poses a threat of curbing the flexibility of firms' decision-making power, these firms are in a better position to finance their investment needs from their internal sources. The ability of business group firms to finance their investment needs from their internal sources ensures that they are not exposing themselves to the stricter credit terms and a higher likelihood of financial distress perceived in the new creditor rights regime. As a result, the prediction in these types of group affiliated firms, because of the empowerment in creditor rights, is either no change or a decrease in corporate borrowing.[12]

The expansion of the contractual space and lowered information asymmetry in loan markets, a result of the new creditor protection regime, would see an increase in

[12] I make an implicit assumption that business group firms do not overleverage or overinvest because of reputational concerns, as there might be spillover effects to the entire group in the event of bankruptcy of any one member of the group. Given the evidence in the current literature, this argument seems to be reasonable (see Gopalan et al., 2007).

the supply of the lending offered to unaffiliated standalone and business group firms alike. However, unlike group-affiliated firms, the standalone firms do not have the discretion of borrowing from group affiliates. Therefore, improved creditor rights regime should lead to an increase in debt financing by the unaffiliated standalone firms.

In the context of India, the introduction of the SARFAESI Act, which is aimed at increasing the secured lending and reducing the cost of debt by strengthening creditor rights protection, positively influenced the supply side. This, however, also had an undesirable impact on the demand for corporate borrowing by curtailing financial flexibility and significantly increasing the deadweight costs in the form of a higher probability of bankruptcy (Vig, 2013). Thus, business group firms that have an alternative channel for funding their investment requirements should, therefore, opt to access the relatively cheaper internal capital, an argument in line with the resource-based theory and the financial advantage hypothesis. This alternative source of funding is, however, not available for the unaffiliated standalone firms, which, therefore, should seek external loans through either secured or unsecured borrowing routes. Based on the above economic arguments, I propose to test the following hypothesis.

H_1: Ceteris paribus, following the creditor protection reform (the SARFAESI Act), unaffiliated standalone firms, which have constrained access to internal capital, should borrow more than business group affiliated firms, which have greater access to internal capital.

2.2 Corporate investment decisions

I begin with some background on the definition of climate and how it is distinguished from the weather following Hsiang (2016). Let us consider $\mathbf{V}_{it}$ as a vector of random variables for a given position in the space (*i*) at the moment in time (*t*). The random variables are the various environmental conditions.

$$\mathbf{V}_{it} = [\text{Temperature}_{it},\ \text{Humidity}_{it},\ \text{Precipitation}_{it}, \ldots\ldots] \quad (1.1)$$

$$\mathbf{V}_{it} \sim \Psi(\mathbf{C}_{it}) \quad \forall\, t\ \in \tau \quad (1.2)$$

Where $\Psi(\mathbf{C}_{i\tau})$ is a joint probability distribution for which $\mathbf{V}_{it}$ is drawn between a time interval τ = $[\underline{t}, \bar{t})$ at the point in space (*i*). Further $(\mathbf{C}_{i\tau})$ is a vector of *K* parameters such as location and shape that characterises the distribution. Thus, since $(\mathbf{C}_{i\tau})$ characterizes the distribution of possible realized states $\mathbf{V}_{it}$, it is defined as the climate in the space (*i*) at time τ. The empirical distribution $\Psi(\mathbf{c}_{i\tau})$ characterizes the distribution of states $\mathbf{V}_{i,t\in\tau}$ for each period τ that are realized. While $(\mathbf{C}_{i\tau})$ characterizes the expected distribution of $\mathbf{V}_{it}$, the realized distribution of $\mathbf{V}_{i,t\in\tau}$ is characterised by $(\mathbf{c}_{i\tau})$. Thus, $(\mathbf{c}_{i\tau})$ is defined as a description of the weather during τ.

Following the basic definitions of climate and weather, I provide detailed literature in the following sub-sections.

2.2.1 Rainfall departures

Studies note that the weather-shock approach encompasses strong identification properties, given the fact that extreme rainfall events vary randomly over time for a given spatial area (Dell et al., 2014). There is ample evidence in the literature that the unexpected variations in rainfall are pure exogenous shocks as they cannot be accurately predetermined and thus reverse causation is also unlikely to be a major concern (Auffhammer et al., 2013; Bhomia et al., 2017; Dell et al., 2014). In the panel set-up, since the identification emanates from deviations in levels from the mean (Dell, Jones, and Olken 2014), I take rainfall deviations from their mean values to identify the extreme rainfall conditions (*rainfall departure*).[13]

I choose the Indian set-up for two important reasons. First, there is a significant variation and intensity of *rainfall departures* in India. Table 2-1 shows a simple comparison between the *rainfall departures* of India and the United States of America (USA) in which it is very evident that the average *rainfall departures* in each decile for the study period of 2001 to 2017 for India is higher than the USA.

Table 2-2 Rainfall departure comparison of India and USA

This table provides a comparison of the overall *rainfall departures* in India and USA at each decile for the study period of 2001 to 2017. Source: IMD for India and NCEI (NOAA National Centre for Environmental Information) for the USA

Decile	India	USA
1	**-40.94**	-9.45
2	**-25.52**	-4.32
3	**-17.59**	-2.33
4	-9.70	-0.85
5	-2.80	0.53
6	2.27	1.53
7	7.86	2.99
8	**16.02**	4.51
9	**23.45**	7.06
10	**41.30**	12.28
Mean *rainfall departure*	-0.80	1.16
Standard deviation.	**23.84**	5.94
Maximum *deficit rainfall departure*	**-73.7**	-17.39
Maximum *excess rainfall departure*	**126**	22.33

[13] In their analyses of the economic consequences of early life rainfall, Maccini and Yang (2009) use birth year rain deviations from the norm for an individual's birth district. my study uses a similar approach by taking *rainfall departure.*

While the USA's *rainfall departures* range is between -17.39% and +22.33%, India's extreme *rainfall departures* range between -73.7% and +126%. Second, the contribution of the rain-sensitive primary sectors' (comprising agriculture, forestry, fishing, and mining & quarrying) gross value added to the Indian gross domestic product (GDP) is very high, estimated at 17.1% for the year 2017-18.[14] This contribution translates to USD 466.48 billion for the year, as per World Bank GDP data on India.

2.2.2 Rain-sensitive industries

Climate sensitive industries use climate-related information, such as climatology, temperature, precipitation, sea-level rise, extreme events, and hydrology, weather forecasts, and climate change to take operational/annual/ seasonal/long-terms decisions in business (Lackstrom et al., 2012). Rainfall extremities (*excess* or *deficit* rainfall) can have a differential impact on rain-sensitive industries (industries that are negatively impacted due to extreme rainfall conditions). While some industries are sensitive and negatively impacted exclusively during abnormally high (*excess)* or abnormally low (*deficit)* rain (drought-like) conditions, certain industries are sensitive to both extreme rainfall conditions. In this subsection, I identify rain-sensitive industries from various empirical studies on different climate-sensitive sectors from the literature and news articles.[15]

While reduced form models show that there is a linear relationship between precipitation and both forestry and agriculture (Mendelsohn et al., 2000), the

[14] See, https://pib.gov.in/newsite/PrintRelease.aspx?relid=186413 : Government of India, Ministry of Finance

[15] Climate-sensitivity is defined as "The degree to which a system susceptible to or unable to cope with adverse effects of climate change " (Parry et al., 2007; pp 138)

Ricardian Agricultural Model indicates that a quadratic relationship with an optimum of 10.8 cm/mo exists between precipitation and agriculture (Mendelsohn et al., 1994). Studies provide evidence linking reduced agricultural yield and climate change (Guan et al., 2015; Mueller et al., 2012; Niang et al., 2017; Porter et al., 2014; Rao and Veena, 2018). In the commercial plantation segment cocoa, tea and coffee production yields are adversely influenced by climate change (Henderson et al., 2016). While production of cocoa, an essential raw material for the food industry, is impacted by rainfall distribution and the duration of dry spells (Läderach et al., 2013; Schroth et al., 2016), extreme rainfall departures are harmful to the growth of tea plants (Ahmed et al., 2018) resulting in a product of sub-standard quality (Ahmed and Stepp, 2013). Similarly, other studies show the direct consequences of abnormal precipitation on yields of coffee (Fain et al., 2018), rubber plantations (Ray et al., 2016; Yu et al., 2014), and sugar production (Okom et al., 2017). In a multi-country study using the Palmer Drought Severity Index, Hong et al., (2019) showed that drought negatively impacted the profitability of food processing, beverage and agricultural companies. Additionally, Browne et al. (2013) studied the dryland farming in Australia and showed that the lower rainfall conditions affected the profitability of agriculture allied sectors of beef, canola and dairy enterprises, while those of wheat and lamb were less affected. Other studies have provided support that climate change impacts livestock (Herrero et al., 2015), food (Campbell et al., 2016), and marine/fishery industries (Creighton et al., 2016).

Due to the asymmetric and heavy tail behaviour of rainfall, farmers and financial investors face product pricing risks (López Cabrera et al., 2013), and this may also translate into higher farm credit risk. Pelka et al. (2015) show that excessive rainfall conditions lead to increased credit risk among farmers in Madagascar. Thus, the agricultural sector which is directly impacted by rainfall conditions adopts different coping strategies such as using modern agriculture technology (Howden et al., 2007; Mendelsohn and Dinar, 1999) to improve yields or using of rainfall derivatives as insurance against price volatility (López Cabrera et al., 2013). Further, farmers may also adopt alternative strategies such as adjusting their investments in irrigation and diversifying their crop portfolio. Additionally, chemical industries, specifically the fertilizers and pesticides manufacturers, experience higher production costs during extreme rainfall and temperature conditions (Chang and Brattlof, 2015; Larsbo et al., 2016). Mining and quarrying industries are impacted both during *excess* and *deficit* conditions. While during *deficit* operations are disrupted due to insufficient water supply, excessive damage to infrastructure and the dangers of flooding during *excess* conditions in mines also directly constrain mining and quarrying activities[16].

The auto sector, especially the two-wheeler, small passenger vehicle segments and agricultural tractors demands are greatly affected due to abnormal rainfall in India because of its direct link to the slump in the rural economy[17]. Busse et al. (2015) show that the sales of convertibles and four-wheel-drives are highly influenced by idiosyncratic variation in the weather. Further, electricity generation, transmission and distribution are also sensitive to the rainfall conditions. *Excess* conditions can lead to damages to transmission lines. Hydroelectricity generation is impacted by water levels due to changes in precipitation (Cronin et al., 2018; Golombek et al., 2012). Given

[16] See online articles: https://www.reuters.com/article/us-australia-floods/australia-floods-cause-catastrophic-damage-idUSTRE6BU09620110105 ; https://www.ausimmbulletin.com/feature/climate-impacts-mining-risk-materiality-actions/

[17] "It is expected that the rural market, which contributes around 50 % of the total rural auto segment sales, can pick up with a normal monsoon." : http://gtw3.grantthornton.in/assets/Impact-of-rural-markets-on-automotive-sector.pdf

these arguments of reduced yield, lower farmer income, increased production costs and loss of crops I classify all agriculture and allied industries, the auto sector, electricity generation & transmission sector, and mining & quarrying to be rain-sensitive industries and negatively affected by extreme rainfall conditions (both *excess* and *deficit*).

Outdoor construction activities are often delayed during the *excess* condition which results in cost over-runs negatively affecting the profitability of the firm (Ballesteros-Pérez et al., 2015; Kaming et al., 1997; Kazaz et al., 2012). Further, the negative impact during *excess* condition is exasperated by the disruption in materials supply caused due to physical damages to the urban infrastructure such as road and rail lines in the aftermath of *excess* rainfall resulting in excessive flooding. This physical infrastructure damage also disrupts rail and road transport services[18]. Excess turbulence and other precarious flying conditions during *excess* rainfall also disrupt air transport services leading to the cancellation of flights directly impacting operating costs and profitability of the firms in that sector[19]. Additionally, the adverse impact of disruptions in road, rail and air transportation is directly felt by the courier and tourism sector. *Excess* conditions leading to rises in water levels of both sea and inland water bodies, landslides in mountainous tourist locations pose an extreme danger to tourists.

Further damage to the recreation infrastructure and low tourist footfall impacts the tourism and hotel industry negatively during the *excess* condition.

[18] See news articles: https://www.standard.co.uk/news/uk/yorkshire-dales-flash-flooding-roads-destroyed-and-bridge-collapses-after-shocking-rainfall-a4201981.html ; https://www.telegraph.co.uk/news/2019/08/10/uk-weathertravellers-face-chaos-heavy-rain-shuts-railways-england/

[19] See news articles: https://nypost.com/2019/08/07/heavy-rains-ground-hundreds-of-flights-at-nyc-airports/ ; https://www.sciencealert.com/climate-change-is-already-making-air-travel-bumpier

Table 2-3 Industry classification into rain-sensitive sectors

This table provides grouping and classification of industries into *excess* rain-sensitive, *deficit* rain-sensitive and positively rain-sensitive industries. Source: industry names from CMIE Prowess database.

Industry Name	Rain-sensitive Sector group	Literature evidence	*excess*	*deficit*
Agricultural machinery	Agriculture & processed food	Ahmed et al (2018); Ahmed and Stepp, (2013); Browne et al. (2013); Campbell et al (2016); Creighton et al (2016); Fain et al (2018); Guan et al (2015); Henderson et al (2016); Läderach et al (2013); Mendelsohn et al (1994); Mendelsohn et al (2000); Mueller et al (2012); Niang et al (2017); Okom et al (2017); Porter et al (2014); Rao and Veena (2018); Ray et al (2016); Schroth et al (2016); Yu et al., (2014);	Yes	Yes
Milling products			Yes	Yes
Tea			Yes	Yes
Poultry & meat products			Yes	Yes
Starches			Yes	Yes
Vegetable oils & products			Yes	Yes
Processed foods			Yes	Yes
Floriculture			Yes	Yes
Marine foods			Yes	Yes
Cocoa products & confectionery			Yes	Yes
Tobacco products			Yes	Yes
Bakery products			Yes	Yes
Sugar			Yes	Yes
Dairy products			Yes	Yes
Other agricultural products			Yes	Yes
Coffee			Yes	Yes
Hotels & restaurants	Tourism, Hotels & restaurants	Fukushima et al (2002); Peeters and Dubois (2010); Wall (1998)	Yes	-
Tourism			Yes	-
Two & three-wheelers	Auto sector	Busse et al. (2015); See news articles: https://www.standard.co.uk/news/uk/yorkshire-dales-flash-flooding-roads-destroyed-and-bridge-collapses-after-shocking-rainfall-a4201981.html ; https://www.telegraph.co.uk/news/2019/08/10/uk-weathertravellers-face-chaos-heavy-rain-shuts-railways-england/	Yes	Yes
Passenger vehicles			Yes	Yes
Diversified automobile			Yes	Yes
Commercial vehicles			Yes	Yes
Commercial complexes	Construction & allied activities	(Ballesteros-Pérez et al (2015); Damtoft et al (2008);Kaming et al (1997); Kazaz et al., (2012); Tatum (1987).	Yes	-
Industrial construction			Yes	-
Infrastructural construction			Yes	-
Glass & glassware			Yes	-
Other construction & allied activities			Yes	-
Housing construction			Yes	-
Ceramic products			Yes	-
Air transport services	Transport services	See news articles: https://nypost.com/2019/08/07/heavy-rains-ground-hundreds-of-flights-at-nyc-airports/ ; https://www.sciencealert.com/climate-change-is-already-making-air-travel-bumpier	Yes	-
Railway transport services			Yes	-
Road transport services			Yes	-
Transport logistics services			Yes	-
Electricity distribution	Electricity generation & transmission	Cronin et al. (2018); Golombek et al. (2012).	Yes	Yes
Renewable electricity			Yes	Yes
Electricity transmission			Yes	Yes
Pesticides	Fertilizers & pesticides	Chang and Brattlof (2015); Larsbo et al. (2016).	Yes	Yes
Fertilizers			Yes	Yes
Coal & lignite	Mining & Quarrying	Marmer and Slade (2018); See online articles: https://www.reuters.com/article/us-australia-floods/australia-floods-cause-catastrophic-damage-idUSTRE6BU09620110105 ; https://www.ausimmbulletin.com/feature/climate-impacts-mining-risk-materiality-actions/	Yes	Yes
Minerals			Yes	Yes
Mining & construction equipment			Yes	Yes
Wood & wood products	Other sectors	Cline (1992); McMichael et al (2009); Mendelsohn (1998); Sohngen et al (2000); Sohngen and Sedjo (2005); Sohngen and Sohngen et al (2001); WHO (2007)	-	-
Drugs & pharmaceuticals			-	-
Health services			-	-
Other industries			-	-

Studies provide evidence of the impact of climate on the tourism/leisure industry (Fukushima et al., 2002; Peeters and Dubois, 2010; Wall, 1998). Thus, due to the negative impact on business operations during *excess* conditions I classify construction, transportation, courier services industries and tourism/hospitality industries to be rain-sensitive only in the *excess* condition (*excess*-only rain-sensitive)[20]. Thus, to summarize, I present the *excess* rain-sensitive and *deficit* rain-sensitive industry classification in Table 2-3 based on their sensitivity under extreme rainfall conditions.

Further in order to support the literature evidences, detailed hitherto, that revenues and profitability of these rain-sensitive sectors are indeed sensitive to rainfall conditions, for the broad categories of industries identified in Table 2-3, I conduct a sensitivity analysis of the impact of *rainfall departure* on the firms' sales and present the results in Panel A & Panel B of Table 2-4. I find that across industries, sales reduce significantly when the *rainfall departure* is either *excess* or *deficit*. Using daily firm level market closing price data and monthly *rainfall departure* for the monsoon season, I present the results of price sensitivity to *rainfall departure* for rain-sensitive industries in Panel C.

[Table 2-4 about here]

[20] Banking and insurance sectors are also impacted by extreme rainfall conditions. While lending activities are impacted in the banking sector, the insurance sector face large scale pay-outs(Linnerooth-Bayer and Hochrainer-Stigler, 2015; Surminski et al., 2016). I consider only non-financial sectors in my study and do not include the banking & insurance sectors as these industries are highly regulated, and policy driven.

2.2.3 *Literature and hypotheses development*

2.2.3.1 *Rainfall departure and immediate value decline*

The socio-economic impacts of climate change are beset with uncertainty due to the fat tail probabilities of the extreme climate events (Heal and Millner, 2014; Pindyck, 2007). Thus, any *rainfall departure* should lead to economic distress conditions and destroy financial asset value (Fuss, 2016) leading to a negative effect on economic activities and outputs. In case of *excess* conditions, economy experiences damage to its physical infrastructure, which imposes significant pressure on firms' earnings capacity (Huang et al., 2018). Similarly, the deficits conditions significantly reduces agricultural outputs and rural incomes, a major contributor to the GDP of many developing economies, thus negatively affecting aggregate consumption and market demand (de Sherbinin et al., 2011; Mall et al., 2006).

Given that market prices reflect the information on future cashflows under normal circumstances (normal rainfall). Any *rainfall departure* that impairs a firm's normal production and operations of the rain-sensitive firms creates conditions of uncertainty of its future cashflows. Meanwhile, markets wait for more information on the investment strategies adopted by the rain-sensitive firms to mitigate the impact of cashflow uncertainty due to unexpected *rainfall departure* (Modigliani and Miller, 1958). This initial information asymmetry induced by the uncertainty created by rain-condition being large should result in lower market price (Diamond and Verrecchia, 1991; Johnstone, 2016). From the investors view-point, greater the uncertainty, greater is the stock's risk premium and higher will be the cost of capital by a firm (Easley and O'hara, 2004). Thus, in the wake of higher uncertainty of cashflows and managerial actions, investors demand higher rate of return resulting in increased cost of capital thus impacting the firm's market value in the immediate aftermath of *rainfall departure*. In line with these theoretical arguments and some evidences from literature (Shahzad, 2019 and Wang et al., 2012) we expect that markets reacts negatively to the uncertainty caused due to *rainfall departure*. I thus hypothesize a decline in the firm value in the immediate aftermath of abnormal rainfall conditions

H_2: Following excess (deficit) rainfall conditions, firms belonging to excess (deficit) rain-sensitive industries experience immediate decline in market based firm value.

2.2.3.2 Rainfall departure and investments

Literature provides us with extensive empirical evidence that abnormal *rainfall departures* create conditions of uncertainty in the operations, production and profitability of rain-sensitive firms, resulting in distress conditions. For example, *rainfall departures* adversely impact firms in the agriculture sector in the form of reduced yields (Ahmed et al., 2018; Guan et al., 2015; Läderach et al., 2013; Okom et al., 2017) and profitability (Browne et al., 2013). In a multi-country study using the Palmer Drought Severity Index, Hong et al., (2019) showed that drought impacted the profitability of food processing, beverage and agricultural companies. Due to the asymmetric and heavy tail behaviour of rainfall, farmers and financial investors face product pricing risks (López Cabrera et al., 2013), and this may also translate into higher farm credit risk.

Further evidence suggests escalating costs of production and operations during extreme rainfall and temperature conditions in the chemicals and fertilizer industries, electricity generation & transmission sector, and mining & quarrying sectors (Chang and Brattlof, 2015; Cronin et al., 2018; Golombek et al., 2012; Larsbo et al., 2016).

Outdoor construction activities are often delayed during the *excess* condition which results in cost overruns negatively affecting the profitability of the firms (Ballesteros-Pérez et al., 2015; Kaming et al., 1997; Kazaz et al., 2012). Studies provide evidence of the impact of climate on the tourism/leisure industry in the form of damage to the recreation infrastructure and low tourist footfall (Fukushima et al., 2002; Peeters and Dubois, 2010; Wall, 1998). Also, the negative impact during *excess* conditions is exacerbated by the disruption in materials supply caused due to physical damage to the urban infrastructure, such as road and rail lines in the aftermath of *excess* rainfall resulting in excessive flooding. This physical infrastructure damage also disrupts rail and road transport services.

Given the plethora of evidence summarised above and discussed in detail in subsection 2.2.2, that abnormal rainfall conditions (*excess / deficit*) create uncertainty and distress among rain-sensitive industries, I look into the investment policy decisions under abnormal rainfall conditions. Considering corporate investments are a measure of risk-taking decisions, there are two competing views in the literature which try to address the question of risk-taking under uncertainty and distress.

The first school of thought is in line with the proposition that incentives for the firms to take riskier investment decisions are higher during times of distress (Black and Scholes, 1973). This means that in the interest of shareholders; managers tend to 'risk-shift' from safe assets to riskier assets (Jensen and Meckling, 1976). In support of this theoretical 'risk-shifting' argument, Eisdorfer (2008) shows that in response to increasing uncertainty, distressed firms hasten investments. Using the hurricane as an exogenous event, Aretz et al. (2018) show that distressed firms raise their firm and investment risk. Following on from this line of argument and in the face of abnormal rainfall conditions, which increase uncertainty and generate operationally distressed conditions, investments among rain-sensitive firms should increase.

The second school of thought takes the real-options approach to corporate investment decisions which posits a trade-off between making immediate investment and delaying it in order to gain more information (Cooper and Priestley, 2011; Ioulianou et al., 2017; McDonald and Siegel, 1986; Tserlukevich, 2008). This means, given a choice, a firm will delay its irreversible investment decisions only if the net present value of the investment is lower than the value obtained from delaying that investment (McDonald and Siegel, 1986). Further, studies supporting this line of the approach argue that firms' risk mitigation incentives can outweigh the incentives to take higher risks (Gilje, 2016) and thus firms may avoid risky investments as they approach distress situations (Gormley and Matsa, 2011; Rauh, 2009).[21] Since the aftermath of abnormal rainfall conditions is associated with greater uncertainty and distress for the rain-sensitive firms, the expected investments among those firms should, therefore, decrease (Dixit et al., 1994; McDonald and Siegel, 1986; Trigeorgis, 1996).

Even though these two theoretical views posit plausible economic intuitions behind firms' two opposing investment policies under abnormal rainfall (*excess* or *deficit*) conditions, they fail to explain whether firms devise their investment decisions differentially to the two heterogeneous exogenous rainfall conditions of *excess* and *deficit*. This potential heterogeneous possibility of different investment strategies is, to

[21] Almeida et al. (2011) show that firms facing financing constraints prefer investments that are less risky and with a shorter payback period.

a considerable extent, addressed by the Salience theory, which predicts investment policies based on past experiences encountered by the managers.

As per the Salience theory of choice under risk, as proposed by Bordalo et al. (2012), decision-makers are risk-seeking when they see the upside pay-offs from such decisions to be salient and risk-averse when its downside is salient. Saliency is experienced-based, studies provide evidence showing the link between the effects of past experiences on corporate risk-taking and corporate policy choices (Dittmar and Duchin, 2015; Greenwood and Nagel, 2009; Malmendier and Nagel, 2011). Additionally, studies show that the market value of the firm is also impacted due to the saliency experienced by investors (Barber and Odean, 2008; Ho and Michaely, 1988). The saliency of the *rainfall departure* receives more attention from local firms, especially so by rain-sensitive firms, because of the risk of cash shortages that may arise from a drop in local demand, partial destruction of operating assets, underutilization of production capacity, increased operating costs or new investment arising out of unexpected growth opportunities (Dessaint and Matray, 2017).

I argue that rain-sensitive firms' managers are salient to the impacts of *rainfall departures,* and they take differential investment decisions (increase or decrease investments) in the aftermath of *excess* or *deficit* rainfall conditions. Since Salience theory dictates that the investment choices are context-dependent, extreme *rainfall departure* conditions (i.e., *deficit* vis-à-vis *normal* vs *excess* vis-à-vis *normal* rainfall conditions) present a differential risk-return frontier to rain-sensitive firms. This presents a rational manager with a differential opportunity of investment windows. A utility-maximizing manager would respond to the differential opportunity windows following rainfall abnormalities in a way to maximize the firm value. In other words, a manager would time his/her investments in such a way that capital investments may be boosted when the *rainfall departure* triggered opportunity window is favourable or deterred when the opportunity window is unfavourable. However, both strategies are followed to maximize the value of the firm.

Several studies note that in the years of *rainfall departures*, the conditions in the general economy are more subdued or in a recessionary phase driven by fall in demand, reduced production, disrupted supplies etc. (see de Sherbinin, Warner, and Ehrhart 2011; Cohen et al. 2013, Vos, Velasco, and Labastida 1999 and Carter et al., 2006). This also implies that economic activities must recover in the *normal* years following *rainfall departure*, favourably influencing growth in general demand and production activities.

Based on the aforementioned arguments of salience, I propose that in *excess* rainfall conditions, the production and operations of the *excess* rain-sensitive firms may be negatively impacted not only by the demand and production conditions of a sluggish economy but also by the damages suffered by its physical infrastructure (Huang et al., 2018). Economic logic thus dictates that *excess* rain-sensitive firms should, therefore, make additional investments, in the aftermath of the rainfall departure conditions, at a level to at least recover the lost production capacity and recoup the lost market value. This *excess* period, however, can also provide an opportunity to make additional investments to expand firms' current capacity and implement better technologies, thereby providing a 'favourable opportunity window' to time capital investments.

In contrast, in the *deficit* rainfall condition, *deficit* rain-sensitive firms are negatively impacted by the fall in demand and slowdown in economic conditions and potential underutilization of operational and production capacity (Gadgil and Gadgil, 2006; Saha et al., 1979). Despite not incurring loss or damages of tangible assets, the increase in the cost of operations due to lower production and higher opportunity cost of underutilized capacity should impact the firms' value, at least in the immediate aftermath of the deficit conditions. In such a scenario of underutilized capacity, I argue that any additional investments in the immediate lead periods may only add to the already existing unused capacity, creating deadweight costs. As such, I argue that the *deficit* condition creates an 'unfavourable window' for making any further investments for the *deficit* rain-sensitive firms, all else being equal.

Given the aforesaid arguments and in line with the Salience theory, I conjecture that firms that are rain-sensitive, undertake capital investments to align with the *excess* or *deficit* rainfall conditions. Thus, I hypothesize the following proposition.

H_3: Following excess (deficit) rainfall conditions, firms belonging to excess rain-sensitive (deficit rain-sensitive) industries increase (decrease) their investments.

2.2.3.3 Investment timing and value relevance

In line with shareholder theory (Friedman, 1970; Shleifer and Vishny, 1997), corporate actions with respect to *rainfall departures* calls for closer scrutiny by shareholders who expect managers to take decisions that maximize their wealth, particularly when evidence shows that firms experience almost instantaneous value degradation in the form of immediate negative market reactions to abnormal rainfall conditions (Shahzad, 2019 and Wang et al., 2012).[22] Thus, in the wake of distress conditions due to rainfall abnormalities, it is the fiduciary duty of managers to take investment policy decisions that will maximize the shareholder returns (Becker and Strömberg, 2012). Studies also note that when faced with these exogenous abnormal rainfall events with no consensus on probability distribution of exposure, risk and outcomes, standard risk management tools and cost-benefit analysis may not be the optimal approach of managerial decision making (Kunreuther et al., 2013). As a result, following extreme rainfall conditions, firms belonging to rain-sensitive industries may adopt different coping strategies.

In connection to studies linking investments and firm valuation, literature suggests that the market value of the firm increases when market assess corporate investments as to be value enhancing (Brav et al., 2008; Faccio et al., 2011; Koirala et al., 2018). However, literature also suggests that irrational investments due to managerialism and agency problems can be value destroying because managers tend to maximize their own utility at the expense of the firm's shareholders (Seth et al., 2002). For example, Malmendier and Tate (2008) show that overconfident CEOs take value destroying risks, as they overestimate their ability to generate returns. Clearly, it evident from the literature not all corporate investments lead to value maximization.

Further and as noted earlier, Salience theory posits that the investment decisions are context-dependent and thus extreme *rainfall departure* conditions warrants differential risk-return frontier to rain-sensitive firms. This enables a rational and utility maximizing manager to respond differentially following rainfall

[22] Similar considerations of the consequences of corporate decisions on the overall stakeholder wellbeing and their impact on the firm value are discussed under the stakeholder theory (Fassin, 2009; Freeman and McVea, 2001; Freeman and Reed, 1983)

abnormalities in a way to maximize the firm value. Thus, combining the Salience, shareholder value maximizing and managerial agency economic views of investments, rational managers should boost investments when the *rainfall departure* triggered opportunity window is favourable and deter when it is unfavourable. However, given initial evidence from the literature and arguments under H_2 that such firms experience value depletion in the immediate aftermath of *rainfall departure*, both investment timing strategies should maximize the value of the firm.

Backed by the arguments of value enhancing investment and Salience theories offered in support of hypothesis H_2 in Sub-section 2.2.3.1, it follows that if managers of rain-sensitive industries expand investments in *excess* conditions then such strategies should be favourably received by the market resulting in recuperation of initially lost firm value conditions (Shahzad, 2019 and Wang et al., 2012). However, in case of deficit conditions and given the fact that such firms have already lost value in the immediate aftermath, I do not expect them to exacerbate agency problems and make value-destroying suboptimal investments that leads to deadweight costs. Thus, in case of deficit rainfall conditions, if rational managers optimally exploit their underutilized capacity and thus either maintain or decrease further investments, I expect the market to reward such investment timing strategies favourably.

In summary, I argue that a manager's ability to time the investments appropriately (to invest or not) following specific differential abnormal rainfall conditions is value relevant. I thus hypothesize the following proposition.

H_4: Increase (decrease) in investments following excess (deficit) rainfall conditions is associated with higher firm value.

2.3 Conclusion

Hitherto, in this chapter, I have discussed supporting evidence from literature in developing testable hypotheses under both L and E dimensions of the PESTLE model. I also provided a background on the general set up of SARFASI Act to empirically test the hypothesis relating to corporate borrowing decision and extreme rainfall conditions to empirically test the hypotheses relating to corporate investment decisions. In the following chapter, I will discuss the data and methods to be used for chapters 4 and 5 where I provide results of comprehensive empirical investigations with robustness checks to test the various hypotheses develop in this chapter.

Tables of Chapter 2

Table 2-4 Rain sensitive industries

Panel A reports the sensitivity of rain-sensitive industries towards *Rainfall departure* using the specification below for the industries identified in Table 2-3

$$Sales/total\ assets_{ijt} = \alpha + \beta.Rain_t + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + e_{ijt}$$

where $Sales/total\ assets_{ijt}$ is sales of the rain-sensitive industry j for the year *t* scaled by total assets for year *t-1*. $Rain$ is the value of *rainfall departure*. $\boldsymbol{X_{it}}$ is a vector of control variables including values of *Size, Leverage, Liquidity, OwnCon, M/B* all lagged by one year, as defined in Section 5.2. The *Time* variable absorbs long-running trends. *Time* captures trends and e_{it} is the error term. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is 2001-2017. Source: IMD and CMIE databases.

Excess rain-sensitive industries as per Table 2-3

	Agriculture	Electricity	Mining & Quarrying	Auto	Construction	Transportation	Tourism
Rain	**-0.103***** **(-3.11)**	**-0.106***** **(-3.13)**	**-0.001***** **(-4.41)**	**0.004**** **(2.22)**	**-0.656***** **(-14.53)**	**-0.570***** **(-4.29)**	**-0.117*** **(-1.95)**
Size	12.384*** (6.40)	-7.648*** (-3.52)	0.098*** (4.91)	-7.833*** (-8.88)	-5.981 (-0.67)	-58.185*** (-5.05)	-22.268* (-1.96)
Leverage	1.558*** (4.23)	0.105 (0.72)	0.013*** (14.38)	-0.016 (-0.50)	-12.589*** (-9.66)	1.062 (0.62)	0.335*** (3.32)
Liquidity	-31.863*** (-7.04)	25.604*** (27.07)	-1.514*** (-30.52)	-3.570* (-1.80)	-0.968*** (-13.27)	-5.827 (-0.06)	30.737*** (3.95)
OwnCon	0.263* (1.91)	0.100 (0.52)	-0.000 (-0.98)	0.086*** (17.09)	2.498*** (12.08)	0.610 (1.45)	-0.113 (-0.54)
M/B	0.000*** (5.44)	0.265*** (5.51)	0.006*** (44.62)	0.179*** (9.70)	-0.000*** (-4.33)	-0.038 (-0.36)	1.398*** (10.66)
Time	4.774*** (14.87)	-2.461*** (-6.90)	0.025*** (13.51)	0.844*** (6.86)	-2.779** (-1.98)	3.817*** (2.97)	23.169*** (21.76)
No. of Obs.	5,716	178	811	213	4,920	536	1,335

Deficit rain-sensitive industries as per Table 2-3

	Agriculture	Electricity	Mining & Quarrying	Auto
Rain	**-0.102***** **(-3.08)**	**-0.106***** **(-3.11)**	**-0.001***** **(-5.60)**	**0.006***** **(2.62)**
Size	12.421*** (6.41)	-7.507*** (-3.45)	0.080*** (3.94)	-9.017*** (-7.84)
Leverage	1.595*** (4.33)	0.103 (0.70)	0.012*** (13.70)	-0.053 (-1.28)
Liquidity	-32.275*** (-7.13)	25.632*** (27.06)	-1.427*** (-28.33)	-7.110*** (-2.75)
OwnCon	0.247* (1.79)	0.090 (0.46)	-0.001*** (-3.16)	0.090*** (13.73)
M/B	0.000*** (5.12)	0.264*** (5.47)	0.006*** (44.77)	0.161*** (6.66)
Time	4.773*** (14.86)	-2.445*** (-6.85)	0.027*** (14.29)	1.016*** (6.34)
No. of Obs.	5,716	178	811	213

Panel B reports the sensitivity of rain-sensitive industries towards *rainfall departure* using the specification in panel A for the industries in Table 2-3. In this subsample analysis includes observations where $Rain_t$ takes only the values of *excess/deficit* rainfall departures.

	Agriculture	Electricity	Mining & Quarrying	Auto	Construction	Transportation	Tourism
Excess Rain	-0.108*** (-3.24)	0.017 (0.50)	0.000 (0.24)	-0.006 (-1.05)	-0.349*** (-3.62)	-0.564*** (-4.20)	1.091*** (4.30)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	5,673	36	181	40	1,181	519	296
Deficit Rain	-0.096*** (-2.89)	-0.036 (-0.53)	-0.000 (-0.99)	0.014*** (3.20)			
Controls	Yes	Yes	Yes	Yes			
No. of Obs.	5,684	72	286	105			

Panel C reports the stock market price sensitivity of rain-sensitive industries towards *rainfall departure*. In this subsample analysis, I regress *rainfall departure* announced by IMD for the monsoon months (June, July, August, September) and on the firm level daily fifteen days closing prices.

	Agriculture	Electricity	Mining & Quarrying	Auto	Construction	Transportation	Tourism
Excess Rain	-0.186***	-0.534**	-0.747***	-0.798***	-0.276*	0.966***	-0.088**
	(-3.59)	(-2.12)	(-4.65)	(-5.47)	(-1.82)	(8.55)	(-2.16)
No. of Obs.	23183	776	4,675	2,238	21267	3,226	9,994
Deficit Rain	-0.318***	-0.785*	1.594***	-2.769***			
	(-8.00)	(-1.91)	(6.52)	(-2.98)			
No. of Obs.	58888	933	4,865	3,364			

Chapter 3

Data and research methods.

Abstract

In this chapter, I provide information on the data and research methods used for the investigations presented in Chapter 4 and 5. I provide information on the databases used and how data from different data sources were integrated to create the panel dataset for the sample period of study. Additionally, I provide a general theoretical background on quasi-natural experiments and especially detailing the research methods of difference-in-differences and propensity score-matching methods used for my study.

3. Chapter 3: Data and research methods

3.1 Data

For conducting the empirical investigations for the hypotheses outlined in Chapter 2, I use India, a leading emerging market. For both corporate borrowing and investment decision investigations, India provides me with a unique setting one because of the regulatory reform of the SARFAESI Act and two because the Indian economy is heavily dependent on the monsoon rains. I use the Prowess database maintained by the Centre for Monitoring the Indian Economy (CMIE), a private think tank that provides detailed annual financial and other firm-specific data of both listed and unlisted companies for my empirical investigations. [23]

3.1.1 Corporate borrowing decisions

Prowess database tracks ownership structures and internal networks of Indian business firms and classifies them into business group firms and standalone firms. [24] For my study, I cover all listed nonfinancial firms available in the database for a sample period of 1996 to 2007. My final dataset consists of a sample of 43,877 firm-year observations of 5,049 distinct nonfinancial firms listed either on the Bombay Stock Exchange (BSE) or the National Stock Exchange of India Ltd. (NSE) for the sample

[23] This standard database is used by a number of studies (Bhaumik and Selarka, 2012; Gopalan et al., 2007; Koirala et al., 2018; Lilienfeld-Toal et al., 2012; Vig, 2013).
[24] Gopalan et al. (2007, p. 763) note the following: "*This group affiliation has been previously used in Khanna and Palepu (2000), Bertrand et al. (2002), and other papers. Prowess' classification is based on a continuous monitoring of company announcements and qualitative understanding of group-wise behavior of individual firms and is not solely based on equity ownership. Such broad-based classification, as against a narrow equity-centered classification, is intended to be more representative of group affiliation.*".

period. Of these 5,049 sample firms, 1,978 firms belong to 641 unique business groups, and 3,071 are unaffiliated standalone firms.

3.1.2 Corporate investment decisions

The time-varying rainfall data is obtained from the IMD, Ministry of Earth Sciences website.[25] I use the subdivision level *rainfall departure* data from the Indian monsoon season (June-July-August-September months) for this study. Rainfall data available from the IMD shows that around 85% of the annual rainfall is received during the monsoon season. I present the correlation matrix of rainfall departures between various seasons in Table 3-1. The matrix indicates a very high positive correlation of rainfall departure during the monsoon season with the annual deviation.

Table 3-1 Correlation matrix of rainfall departures

This table provides a correlation matrix of *Rainfall departure* between various seasons in India. The monsoon season is during the months of June-July-August-September. Source: IMD database.

Departures	Annual	Monsoon Season	Jan-Feb	March-April-May
Monsoon Season	**0.9262***** **0.0000**	1		
Jan-Feb	0.0186*** 0.0000	-0.0266*** 0.0000	1	
March-April-May	-0.0296*** 0.0000	-0.148*** 0.0000	-0.0101*** 0.0017	1
Oct-Nov-Dec	0.2717*** 0.0000	0.0586*** 0.0000	-0.0242*** 0.0000	0.0278*** 0.0000

The IMD computes the monthly, seasonal and annual rainfall statistics for 36 meteorological subdivisions belonging to the different States of India based on the daily rainfall data obtained from 3,500 stations spread across India. The IMD

[25] http://imd.gov.in

calculates 'per cent departures of rainfall' (referred to as *rainfall departure* hereafter) as the deviation from the expected normal rainfall. The IMD calculates 'normal' using rainfall records of 50 years (1951-2000) from a network of 2,412 stations all over India.[26] For the firm-level data, I cover all listed non-financial firms available in the database from 2001 to 2017 obtained from Prowess.[27] I integrate the rainfall data from the IMD with firm-level data from Prowess based on the location of the firm.[28] Therefore, in my empirical set-up, firms belonging to the same rainfall subdivision are exposed to the same rainfall conditions. My panel dataset consists of 71,728 firm-year observations of 5,639 non-financial firms listed on either the Bombay Stock Exchange Ltd (BSE) or the National Stock Exchange of India Ltd. (NSE) for the sample period. Of the 71,728 observations, 20,718 are rain-sensitive firm-year observations.

3.2 Research methods

In this subsection, I briefly outline the general empirical method employed in Chapters 4 and 5. However, I discuss the identification strategy to investigate the research questions under each chapter separately in detail.

Endogeneity is an important contentious issue in using ordinary least square and other techniques in research. Endogeneity can be caused due to omitted variables, reverse causation or through heterogeneity issues. It is therefore essential that in order

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[26] The IMD considers *rainfall departure* in excess of ±19% to be an *excess* or *deficit* rainfall condition. This implies *rainfall departures* between ±19% are *normal*. I use a slightly different approach, see sub-section 5.2.3

[27] The IMD calculates 'normal' on rainfall records for the period from 1951-2000. Therefore, I begin my analysis from the immediately succeeding year, i.e., 2001. Also, some of the key control variables used in the study, such as the ownership data, are maintained by Prowess only from 2001. The rainfall data report for 2018 has not yet been officially released by the IMD at the time of this study. Thus, for these reasons, I conduct my analysis for the sample period of 2001 to 2017.

[28] Upon integration of the data, 32 of the 36 rainfall subdivisions remain associated with each listed firm under study.

to establish a causal link, I adopt an identification strategy that minimizes or eliminate the endogeneity. Randomized trials are the most scientific research method that can be employed; however, their effectiveness in behavioural sciences which has variables that may change in the long term is limited (Price and Dahl, 2012). According to Price and Dhal (2012, p363), '*The ''natural experiment'' approach, a quasi-experimental method commonly used by economists, exploits settings in which there is naturally occurring variation that ''randomly'' influences the amount and type of media that individuals are exposed to.*'

Shock-based causal methods; otherwise, natural experiments are used by several research articles in corporate finance (Atanasov and Black, 2016). According to their research 'shocks', which are exogenous, can be used to distinguish between the treatment and control groups providing credible impact information by assessing the counterfactuals using methods like difference-in-difference (DiD), Regression Discontinuity designs (RDD), Instrumental Variables (IV) and Event Studies (ES).

Several studies in corporate finance have used a quasi-natural experiment approach to address the issue of endogeneity and establish causal links. For instance, Chen et al. (2015) use brokerage closures and brokerage mergers as exogenous variation as their DiD shock to analyse the effects of analyst coverage on mitigating managerial expropriation of outside shareholders. Bena et al. (2017) use stock additions/deletions to MSCI All Country World Index (MSCI ACWI) to establish the causal effect of foreign institutional ownership on corporate risk-taking and innovation output. Aggarwal et al. (2011) use the IV approach to establish the proposition that better corporate governance attracts more foreign institutions investors. Similarly, Law and Singh (2014) use IV to study the impact of finance on growth.

Further, Koirala et al. (2018) use both DiD and RDD to establish the causal link between corporate governance and corporate risk-taking. Several market studies have used ES to establish the causal impact of exogenous shocks. For instance, Berkman and Eleswarapu (1998) study the impact of abolition and reinstatement of the forward trading facility (Badla) on share prices and liquidity using the cumulative abnormal returns model (CAR). Similarly, Ma et al. (2019) use the ES approach to study the link between acquirer reference prices and acquisition performance of the stock.

In this thesis, I use DiD method to establish the causal links between the dependent and independent variables in my empirical investigations that I present in Chapter 4 and 5.

3.2.1 Difference-in-differences method (DiD)

DiD is an impact evaluation method which measures the causal impact (Δ) of a program (P). This method considers two groups which are identified randomly and are statistically indistinguishable. The advantage of using randomized selection is that it removes selection bias, and the group will be a fair representation of all the characteristics of the population. One group is the treatment group and the other control/comparison group. A program is implemented on the treatment group, and the outcomes of the program implementation are then compared with the counterfactuals measured from the comparison group. The difference between these two outcomes provides us with the impact of the program. Thus the impact evaluation is given by the specification one (Gertler et al., 2016)

$$\Delta = (Y|P=1)-(Y|P=0) \quad (3.1)$$

In the specification one (Y|P=1) denotes outcomes from the treatment group and (Y|P=0) denotes the counterfactual as measured from the comparison group.

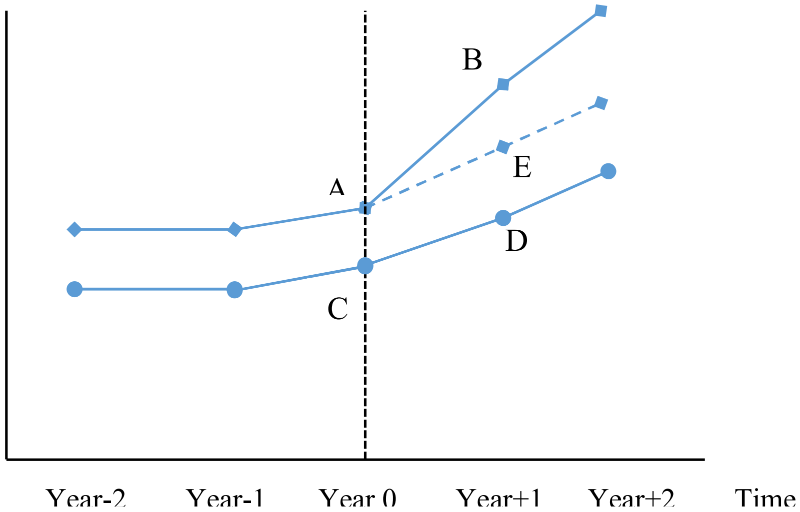
DiD method is widely used in the finance literature to establish causal links (for example Amiram and Frank, 2016; Aretz et al., 2018; Bena et al., 2017; Koirala et al., 2018). This method is useful when we cannot randomly assign units to groups, or we cannot find an exact cut-off like in the RD method. The DiD is the difference between two differences named first and second difference. The first difference measures the difference in outcomes (Y1) of the treatment groups before and after the treatment and the second difference measures the difference in outcomes (Y2) of the control groups before and after under same conditions.

The main advantage of using DiD is that it controls for factors within the treatment group, which are constant over time, and the time-varying factors are captured by the second difference from the control group. Thus, DID removes any bias and provides good estimates of counterfactuals (Gertler et al., 2016).

Figure 1-5 is an example to illustrate the DiD, where the control group and treatment group outcomes are B and D respectively, while their initial values were A and C. Thus, the DID impact is given by a simple difference calculation as shown in the specification (3.2).

$$DID = (B - D) - (A - C) \quad (3.2)$$

Figure 3-1 Difference-in-differences (DiD)



This figure presents trend lines of variable 'y' for both treated (♦) and control group observations (●) before and after the exogenous shock in the year 0.

One of the limitations of DiD is that it may not remove any unobservable characteristics which are correlated to the outcomes and impacts both treatment and comparison groups differently (Fang et al., 2014). We may require to make certain assumptions to use DiD in the case where the program assignment rule is unknown, in such cases this method may not provide reliable estimates (Gertler et al., 2016). The DiD results are valid as long as the underlying trend between the treatment and comparison group is the same before the program. This assumption can be validated using different placebo tests.

3.2.2 Propensity score matching (PSM) method.

In experiments where we have a treatment and control /comparison groups, the nature of treatment may be very diverse (Caliendo and Kopeinig, 2008). In applying the technique of DiD, we would like to know the difference between with and without application of a specific treatment. An important consideration for conducting the DiD is to have a treatment and control group which are highly comparable. However, one drawback in doing so is that we cannot observe the outcomes of both treatment and no-treatment for the same individual at the same time. One approach to resolve this issue is to take the mean outcomes of individuals not participating in the treatment. This, however, may lead to selection bias. Using a matching approach can be one of the solutions to overcome the selection problem. The idea is to find a comparable group of individuals based on certain characteristics (covariates) from a large group of nonparticipants. Once this is done, the differences in outcomes of this matched treated, and the comparable group can be attributed to the treatment. Further, Rosenbaum and Rubin (1983) suggest the use of balancing scores like the propensity score, i.e. the probability of being treated given observed characteristics. Matching procedures based on this balancing score are known as propensity score matching (PSM)

One of the matching algorithms used for PSM is the nearest neighbourhood matching algorithm. Using the nearest neighbour matching comparison units are chosen as a matching pair of the treated unit based on its close proximity in terms of the propensity score. However, this algorithm may have a risk of bad matches if the closest paired neighbour is far away. This can be overcome by imposing a tolerance level on the maximum propensity score distance like the caliper matching, which imposes a common support condition. This will help in improving the matched pair quality (A. Smith and E. Todd, 2005)

I use nearest neighbourhood one-to-one matching calliper algorithm of PSM without replacement to find a matching set of control firms for the treatment sample

(A. Smith and E. Todd, 2005; Rosenbaum and Rubin, 1985, 1983). A probit model, i.e., the probability that a firm is treated, is run using key firm characteristics as covariates to generate the propensity scores in the pre-exogenous shock period. The probit specification is as follows:

$$T_i = \alpha + \boldsymbol{X_{it}}.\boldsymbol{\beta} + \eta_j + e_{it} \tag{3.3}$$

where T_i takes the value of one for treatment firms, and zero otherwise. $\boldsymbol{X_{it}}$ is the vector of the covariates used for PSM and η_j controls for any fixed effects and e_{it} is the error term. Based on the probit model, PSM scores generated are then used to match and identify the distinct treatment and control group firms. Following Koirala et al. (2018), I further conduct a post-matching probit diagnostic test using the same probit specification on the matched sub-sample of treated and control firms generated from the PSM technique to check whether there is any reduction in the possible observable differences among the treated and control group firms. Good match results in the reduced explanatory power of the specification (3.3) compared to pre-match.

Chapter 4

Empirical evidence on corporate borrowing decisions

Abstract

I examine whether the effect of increased creditor rights on corporate borrowing depends on the firm's access to internal capital. By exploiting a creditor protection reform in India, empirical outcomes strongly indicate that strengthening of creditor rights leads to increased corporate borrowing among firms that have constrained access to internal capital compared to business group affiliated firms, which have relatively easier access to internal capital. Further, the increased corporate borrowing by firms with constrained access to internal capital, in the post-reform period, is associated with a greater expansion of real investments, improved operational performance, and better market valuation. Together, these findings indicate that expanding creditor rights may aid in improving allocative efficiency.

4. Chapter 4: Empirical evidence on corporate borrowing decisions

4.1 Introduction

Following the research question posed in Subsection 1.2.1 on the corporate borrowing decisions, i.e., '*Are corporate borrowing decisions influenced by access to internal capital under stronger creditor protection regulatory regime?*', a testable hypothesis H_1 was developed in the Subsection 2.1.2. In this chapter, I conduct a detailed empirical investigation to test the hypothesis H_1 restated below

H_1: Ceteris paribus, following the creditor protection reform (the SARFAESI Act), unaffiliated standalone firms, which have constrained access to internal capital, should borrow more than business group affiliated firms, which have greater access to internal capital.

I test this conjecture by exploiting a unique regulatory set-up in India, namely, the SARFAESI Act. This reform strengthened creditor rights by making it much easier for lenders to seamlessly take over the management of secured assets and sell them to recover debt obligations. The SARFAESI Act exogenously provided creditors with the ability to more easily access and dispose of debtors' collateral. This suggests that within the framework of the economic power theory of credit (as discussed earlier), the reform provided greater confidence to creditors to lend more, thus expanding the supply side of the credit market.

Thus, given the two apparently opposing and inconclusive economic views as discussed in Subsection 2.1.2 on whether a firm decides to increase or decrease its borrowing in the light of creditor rights reform, I investigate the effect of creditor rights on firm's borrowing decisions based on an important corporate heterogeneity, i.e., whether the borrowing firms have constrained access to internal capital or not. To gauge this heterogeneity of firm's access to internal capital, in my empirical setup, I classify firms based its business group affiliation. Accordingly, firms that are affiliated to a group are classified as having easy access to internal capital and those standalone firm with no group affiliation as having constrained access to internal capital.

The business group affiliation classification has two important features that determine to what extent a firm has access to internal capital. First, existing studies document that firms affiliated with a business group benefit from resources owned by other affiliates in the same group. As business group firms have significant operational and financial interlinkages and are managed by a common group of insiders, they have the advantage of accessing significant internal capital (Gopalan et al., 2007; Hoshi et al., 1991; Shin and Park, 1999). Further, such an affiliation could efficiently allocate the resources within the group (Chang and Hong, 2000). However, no such resource-based advantage is available for unaffiliated standalone firms, which suggests that these firms face a higher level of constraints to accessing internal capital.

Second, group affiliation could provide a partial substitute for inefficient external financing, which acts as insurance, particularly at times when a firm faces an external financing shock. Testing the financing advantage hypothesis, Khanna and Yafeh (2007) show that group affiliated firms replace expensive external debt with cheaper intragroup loans as a remedy in underdeveloped capital markets. The internal capital markets of group affiliated firms, thus, could reduce the transaction costs for group affiliates and supplement the inefficient external capital markets of emerging economies (Chang and Hong, 2000). Further, the negative externality associated with the presence of business group conglomerates could make it more difficult for standalone firms to raise external capital – a factor that could seriously undermine the growth of these independent firms in developing countries that are at intermediary levels of financial development (H. Almeida and Wolfenzon, 2006).[29] In summary, business group firms have the flexibility not to seek external borrowing following a regime that strengthens the power of creditors in dictating the terms of borrowing. On the other hand, unaffiliated standalone firms do not have such privilege.

From the discussions in previous chapters, heterogeneous access to internal capital argument predicts that compared to business group affiliates, unaffiliated standalone firms should find the expansion of contractual space beneficial. This implies that the standalone firms, relative to business affiliated firms, should opt to borrow more following a positive shift in creditor rights (La Porta et al., 1998).

The rest of the chapter discusses the main dependent variable, independent variable and control variables in Section 4.2 followed by a host of empirical investigations to test the hypothesis H1 in Section 4.3 and a conclusion to the chapter in Section 4.4.

4.2 Data

4.2.1 Dependent variables

In keeping with the existing literature, my dependent variable is firm's borrowing as a proportion of total assets ($Total\ Debt/TA$), where $Total\ Debt$ is total

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[29] The argument is that the unsecured debt market may become a viable alternative for the group affiliated firms who could lower their secured debt and substitute with the unsecured debt, thus making it more difficult for the otherwise standalone firms to access this market segment.

corporate borrowing, and TA is the book value of total assets in a firm's balance sheet (La Porta et al., 1998; Vig, 2013). For additional robustness checks, I also use two other sub-categories of corporate borrowing, i.e., the secured borrowing and unsecured borrowing of the firms, as a proportion of total assets. This subcategorization is an important robustness test, as the SARFAESI Act, by the nature of its provisions, has a direct impact on secured borrowing. It is, therefore, theoretically possible that, given a shock that affects secured borrowing, a firm may reshuffle its debt structure (i.e., lowering its secured borrowing and increasing its unsecured borrowing) without any effect on the overall debt.

4.2.2 Independent variables

The key variable of interest is the interaction of two dummy terms, CIC_i and $Post_t$. The dummy variable CIC_i takes the value of one if a firm (i) is classified as treated firms (unaffiliated standalone firm) or zero for comparison firms (business group affiliated firms). The other dummy variable $Post_t$ takes the value of one for the year (t) following the SARFAESI Act, i.e., for the years 2002-2007, and zero otherwise. The key variable of interest is, thus, the DiD estimator $[CIC_i \times Post_t]$, which captures the causal effect of the SARFAESI Act 2002 on the treated firms that have constrained access to internal capital.

4.2.3 Control variables

In keeping with the existing literature, I use a number of control variables that may contest my variable of interest (expansion of creditor rights) in explaining the variations in corporate borrowing. Following Whited and Wu (2006), I control for firm size *(Size)* by taking the natural logarithm of the book value of total assets, where assets are expressed in millions of INR (Indian rupees). Due to the higher asymmetric information and agency risks, small firms ability to obtain long-term debt is lower when compared to their larger counterparts (Ben-Nasr et al., 2015). I expect *Size* to be positively related to the amount borrowed, to the extent that it represents a firm's reputation for facilitating greater access to external financing (Fombrun and Shanley, 1990; Shane and Cable, 2002; Williams and Barrett, 2000). I also control for the tangibility of assets *(Tangibility)* by using the net fixed assets as a proportion of total assets (Rajan and Zingales, 1995) and expect this to be positively related to borrowing as the tangibility of assets represents the firms' collateral capacity to borrow more (Gan, 2007). I further consider the firm-level operating performance *(Operating Profitability),* measured by earnings before interest, taxes, depreciation, and amortization (EBITDA) scaled by net sales (Vig, 2013). In line with the evidence offered by the existing literature, I expect *Operating Profitability* to be negatively related to corporate borrowing (Vig, 2013). The list of control variables also includes the firm's growth potential/valuation as proxied by the market-to-book *(MB)* value of equity. To the extent that a higher *MB* represents a firm's reputation, especially in emerging markets (Pinkowitz et al., 2006), and that reputable firms have better access to finance, *MB* is expected to be positively associated with firm financing.

I also control for the firm's time-invariant idiosyncrasies by employing firm fixed effects in the regression models. Finally, industry-level shocks, such as investment opportunities arising in different industries (sectors) at different times, could confound my estimation (Koirala et al., 2018). I reduce this possibility by employing the interaction of industry and year fixed effects.

4.3 Empirical results

4.3.1 Descriptive statistics

Table 4-1 contains summary statistics for the dependent and control variables for the pre- SARFAESI Act (1996-2001) and post-SARFAESI Act (2002-2007) periods. Table 4-1 shows an increase in firms' borrowing as a percentage of total assets, i.e., total borrowing (38.11% to 39.07%), secured borrowing (32.8% to 33.01%) and unsecured borrowing (8.61% to 10.19%), in the post-SARFAESI Act period in comparison to the pre-SARFAESI Act period. Three of the four control variables (*Size, Operating Profitability,* and *MB)* witness a significant increase in the post-SARFAESI Act period, which indicates that firms in the post-SARFAESI Act period experience growth in size growth, operational efficiency, and investment opportunities. It can be observed that there is a reduction in *Tangibility.* These changes are consistent with the previous findings (Vig, 2013).

[Table 4-1 about here]

Table 4-2 contains summary statistics for the dependent and control variables for the entire sample period (1996-2007) for the firms classified into unaffiliated standalone firms and business group affiliated firms. A statistically significant difference (at the 1% significance level) in firms' borrowing, i.e., total borrowing (38.36% & 39.49%) and secured borrowing (31.88% & 32.50%), respectively, is observed. Clearly, when I pool the overall sample group, the affiliated firms seem to be significantly higher in terms of total and secured borrowing. This finding is not surprising given the evidence that group affiliated firms are greater in size and hold higher levels of tangible assets. The differences in the control variables strongly indicate that group-affiliated firms are typically larger in their capital base (based on *Size*), have more tangible assets (*Tangibility*), and exhibit added advantage of the group's reputation when compared to the unaffiliated standalone firms, as reflected in their higher *MB*.

[Table 4-2 about here]

4.3.2 Analysis of pre-SARFAESI Act difference in the trends of the treated and comparison firms

From Table 4-2, it can be seen that the borrowing by group affiliated firms is significantly higher for the entire sample period (1996-2007). However, these average figures do not reveal changes in the possible trends in the post-reform period relative to the pre-reform period. It is, therefore, important that I analyze whether the treated and comparison firms differ in their corporate borrowing before and after the enforcement of the SARFAESI Act. Further, as the assumption of a parallel trend constitutes a necessary condition to execute shock-based DiD specifications, the trend analysis also allows me to examine if my DiD specification is reliable (Atanasov and Black, 2016).

I present the graphical trend of the total borrowing for the sample of treated and comparison groups for the period of 1998-2005 in Figure 4-1. This figure presents the yearly rescaled average values of $Total\ Debt/TA$ for the entire sample period by the treated and comparison firms. For each year, rescaling is performed by deducting the three-year average before the SARFAESI reform (i.e., an average of 1998-2000) from each annual average figure of *Total Debt/TA*.[30]

It can be observed that the treated and comparison firms mostly have similar trends in corporate borrowing before the SARFAESI Act. However, this virtually parallel trend changes for the treated firms following the enforcement of the reform, as they witness a substantial jump in their corporate borrowing in the post-SARFAESI Act period. In contrast, the comparison firms witness a slight drop in their post-SARFAESI Act corporate borrowing. These findings, particularly those related to the business group affiliated firms, are consistent with the previous study that documents the unintended consequences of the creditor reform (Vig, 2013). However, it can be seen that the treated standalone nonaffiliated firms' borrowing increases in the post-reform era. In the following Subsections 4.3.3 and 4.3.4, I further test this seemingly differential increase in the borrowing of treated firms in the post-SARFAESI Act period using both univariate DiD, and the more robust multivariate DiD specifications.

[Figure 4-1 about here]

4.3.3 Univariate difference-in-differences (DiD)

I report the univariate DiD estimates of corporate borrowing for the study period of 1996-2007 in Table 4-3. As shown in column 5, the differences in the mean values of the corporate borrowing of the treated firms before and after the SARFAESI Act in 2002, as represented by total debt, secured debt and unsecured debt as proportions of their total assets, are positive and highly significant. This finding

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[30] This rescaling is similar to the spirit of Vig (2013) and Buchuk et al. (2014) which ensures that the beginning of the trend is clustered around the origin, particularly for tractable purposes.

indicates that firms facing greater constraints in accessing internal capital increase their corporate borrowing after the enactment of the SARFAESI Act. The differences in the mean values of the total corporate borrowing for the business group affiliated comparison firms is negative and statistically significant.

[Table 4-3 about here]

In terms of economic magnitude, following the SARFAESI Act reform, the $Total\ Debt/TA$ ($Secured\ Debt/TA$) of the treated firms increases, on average, by 2.76% (3.66%) when compared with a decrease by 0.72% (0.32%) for the comparison firms. I can also be observed that escalations in ($Unsecured\ Debt/TA$) of 3.54% and 1.79% for the treated group and comparison group, respectively. The DiD estimates of the differential borrowing of treated over comparison groups in the post-SARFAESI Act period are positive and statistically significant at the 1% level. The DiD figures for total, secured and unsecured debt (as % of the total asset) in column 7 indicates that compared to the business group affiliated firms, the treated standalone firms increase their borrowing more by 3.48%, 3.98%, and 2.75%, respectively.

Together, these findings indicate that the strengthening of creditor rights encourages greater corporate borrowing for treated firms, which experience higher levels of constraints to accessing internal capital, relative to the business group affiliated firms (comparison), which face lower levels of constraints to accessing internal capital.

4.3.4 Baseline multivariate results

While the univariate DiD examination can provide credible clues, these alone are typically insufficient to determine the causes of the changes in borrowing, particularly in the absence of other control factors. In this subsection, I employ the multivariate regression-based DiD to estimate the causal effect. To do so, I run the general regression specification (4.1) to estimate the causal effect using the sample of the treated firms (unaffiliated standalone firms, which have constrained access to internal capital) and comparison firms (business group firms, which have higher access to internal capital).

$$(Total\ Debt/TA)_{it} = \alpha + \beta.[CIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times CIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it} \quad (4.1)$$

where $(Total\ Debt/TA)_{it}$ is the dependent variable defined as the proportion of total debt to book value of total assets (i denotes the firm and t denotes the year). $Post_t$ is a categorical variable that takes the value of one for the post-SARFAESI Act period and zero otherwise. CIC_i is an indicator variable that takes the value of one for firms that have constrained access to internal capital, and zero otherwise. $\boldsymbol{X_{it}}$ is a vector of the key control variables, as defined in Subsection 4.2.3. γ_i, η_j and τ_t are the firm, industry and time fixed effects respectively. e_{it} is the error term. β is the regression coefficient of my key variable, i.e., the interaction term of $Post_t$ and CIC_i, i.e., of the DiD variable $[CIC_i \times Post_t]$. Standard errors are clustered at the firm level. To remove the effect of obvious outliers, the variables are winsorized at the top and bottom 1% in all the regression models.

Three important features of the estimation specification (4.1) are worth noting. First, the vector of the interaction term $[\boldsymbol{X_{it}} \times Post_t]$ controls for the change in $(Total\ Debt/TA)_{it}$ as a result of the change in firm fundamentals in the post-SARFAESI Act period. Second, the vector of the interaction term $[\boldsymbol{X_{it}} \times CIC_i]$

controls for differences in the evolution of the firm characteristics of the treated and comparison firms. Third, the interaction term $[\eta_j \times \tau_t]$ controls for the change in $(Total\ Debt/TA)_{it}$ as a result of industry-specific shocks arising at different times (see Vig, 2013). I use the Prowess industry classification, which is comparable to the SIC codes used in other popular databases such as Thomson Reuters Datastream. The Prowess industry codes are 15-digit codes with 192 unique industry groups. Excluding the financial sector gives us 138 unique Prowess industry codes for my sample firms. In the spirit of Vig (2013) and Gopalan et al. (2007), I use the first seven digits, which yields 23 unique nonfinancial industry-clusters.[31] I report the DiD regression results of different variants of specification (4.1) in Table 4-4.

The regression estimates, as reported in models [1] to [5], are for the entire sample period of 1996-2007. As a shock-based empirical analysis with a longer study period may introduce additional noise to causal inferences (Koirala et al., 2018), I undertake a multivariate analysis of specification (4.1) for the narrower period of 1998-2005 and report the findings in models [6] to [10]. For both study periods, I start by estimating the coefficients from specification (4.1) using the entire set of observations without including the control variables in models [1] and [6]. To gauge the sensitivity of my results, driven by the missing data on the control variables, models [2] and [7] estimate the DiD without controls for those observations for which there are non-missing control variables. I introduce control variables in the remaining models.

[31] See Chapter 4 appendix Table A4-1 for Prowess industry classification used in this study.

As observed in Table 4-4, the DiD coefficients are positive and highly significant at the 1% significance level for models [1] to [4] and [6] to [9], which indicates consistency in the results for both the study periods. In terms of the economic magnitude across all models, the expansion of creditor rights seems to have increased the corporate borrowing of firms that have constrained access to internal capital, on average, in the range of 2% to 4%. These results support the view that firms with constrained access to internal capital borrow more in comparison to those with higher access to internal capital. While I report standard errors clustered at the firm-level in all my regression specifications throughout the text, the results are robust to the clustering of standard errors at the business group level, which I report for the main regression in the Chapter 4 Appendix Table A4-2.

I further test my argument with an alternative dependent variable, i.e., growth in debt, which is computed as $(TD\_Growth)_{it} = (\Delta Total\ Debt_{t,t-1}\ /\ Total\ Debt_{t-1})$ in models [5] and [10] of Table 2-4. The results reveal an increase in the annual average debt-growth for treated firms by 4.7% and 7.4% for the 1996-2007 and 1998-2005 study periods, respectively.

In terms of the controls, almost all the variables carry the expected signs and are statistically significant, which is consistent with the findings of Vig (2013). The coefficients of the interaction term of the post-reform dummy and firm characteristics reveal that firms with higher *MB*, *Tangibility*, and *Operating Profitability* are associated with lower corporate borrowing in the post-SARFAESI Act period, which is consistent with previous studies on the unintended consequences of the SARFAESI

Act (Vig, 2013).[32] In summary, the results in Table 4-4 highlight the positive effect of creditor protection on corporate borrowing for firms having constrained access to internal capital.

[Table 4-4 about here]

4.3.5 Further robustness checks

In the following Subsections 4.3.5.1 to 4.3.5.4, I perform a number of checks to ensure the robustness of my baseline regression results, as reported in Table 4-4.

4.3.5.1 Placebo Tests

It is important to rule out the possibility that other confounding economic events surrounding the reform shock (i.e., those which might have occurred in the years before the SARFAESI Act enforcement) may be driving my results. To check these possibilities, I undertake placebo tests by estimating the following general regression specification (4.2):

$$(Total\ Debt/TA)_{it} = \alpha + \beta_1.[AFY_{[-1]} \times CIC_i] + \beta_2.[AFY_{[-2]} \times CIC_i] + \beta_3.[AFY_{[-3]} \times CIC_i] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times CIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it} \qquad (4.2)$$

Where, after false shock year ($AFY_{[-t]}$) is a categorical variable that takes the value of one for years following and including the false shock year ($FSY_{[-t]}$), and zero otherwise. My placebo experiment uses three different false shock years, i.e., one year [$FSY_{[-1]}$], two years [$FSY_{[-2]}$], and three years [$FSY_{[-3]}$] before the true creditor protection reform in 2002. I limit my study period to 2001 to prevent the effect of true

[32] I present an alternative DiD specification with treated (control) firms comprised of firms belonging to the upper (lower) tercile on the basis of a 3-year average of the pre-treatment asset tangibility in Table A4-3 of the Chapter 4 appendix. The results are qualitatively consistent with the findings of Vig (2013).

reform on my estimates of placebo-experiment. All the other variables in the specification (4.2) are as defined in Subsection 4.3.4. A significant DiD coefficient of either of the interaction terms $[AFY_{[-1]} \times CIC_i]$, $[AFY_{[-2]} \times CIC_i]$ or $[AFY_{[-3]} \times CIC_i]$ of this placebo-design would undermine the causal effect documented in Tables 4-3 and 4-4, as it opens the possibility that the results are affected by the lead effects of other confounding shocks closer to the SARFAESI Act reform. The results of different variants of specification (4.2) are presented in Table 4-5.

As observed in Table 4-5, the DiD coefficients with FSYs are not significant, either individually in models [1] to [3] or jointly in the model [4]. These results rule out the possibility of any lead effect of other confounding shocks and are, hence, consistent with the key results presented in Tables 4-3 and 4-4. Additionally, the insignificant DiD of the placebo design formally establishes no systematic difference in the variable of ($Total\ Debt/TA$) exists between the treated and comparison firms before the treatment of the creditor protection shock after controlling for firm characteristics.[33]

[Table 4-5 about here]

4.3.5.2 Alternative measures of corporate borrowing and shorter period analysis

While the SARFAESI Act provisions are aimed at protecting only the secured creditors and increasing the total secured borrowing, the law may also have resulted in a spillover effect in the unsecured debt market, which is potentially a result of the reduced cost of debt. For example, Vig (2013) provides evidence of the reduced cost

[33] As there could be an anticipation of legal reforms, given the fact that a law takes some time from initiation to enforcement, the insignificant placebo could mean that firms may be hesitant to act on the reform stimuli, given the higher noise and uncertainty surrounding their implementation. In the event that a firm decides to act *ex ante* on an anticipated reform cue, the causal effect could be underestimated (Dharmapala and Khanna, 2013).

of debt in the post period of the SARFAESI Act. Further, it may be the case that due to the more stringent and costly provisions of the SARFAESI Act and the overall reduced cost of debt, firms access the unsecured debt market more than the secured debt market. This possibility motivates me to perform robustness checks using secured and unsecured corporate borrowing scaled by the book value of total assets as my dependent variable. I present the DiD regression results for both secured and unsecured corporate borrowing in models [1] to [12] of Table 4-6.

I run the regressions for two periods, as noted in Subsection 4.3.4, for both these forms of borrowing. The regression estimates of models [1], [4], [7] and [8] are without any control variables, whereas the regression estimates of models [2], [5], [8] and [11] are for the subsample of firms with non-missing control variables. I allow for control variables in the remaining models. While the longer period may be important to evaluate the persistent effect of the reform, the shorter-term period analysis provides a cleaner effect, as it reduces the effects of other confounding events that are associated with a research design within a wider study period. For both secured and unsecured borrowing, I report the results of the shorter period of 1998-2005 in models [4] to [6] and [10] to [12], while models [1] to [3] and [7] to [9] of Table 4-6 are for the entire study period of 1996-2007.

In line with my main findings of Table 4-4, in the post-SARFAESI Act period, both secured and unsecured corporate borrowing increased significantly (at the 1% significance level) among the treated firms, relative to the comparison groups. These findings confirm the conjecture that strengthening creditor rights encourages corporate borrowing by firms with constrained access to internal capital.

[Table 4-6 about here]

4.3.5.3 An alternative measure of a firm's access to internal capital

My main empirical estimation, discussed in Subsection 4.3.4, assumes that compared to their business affiliate peers, standalone firms have constrained access to internal capital, as extensively argued and empirically shown by the existing literature. This distinction is arguably vivid, as it tracks the firm's connectedness with other business units within a business group to pool resources in the event of capital shock (Gopalan et al., 2007). I now relax this distinction of internal capital constraints to allow firms that could generate and accumulate internal substitute capital to meet their capital demands internally. For example, a growing body of literature shows that firms prefer internal financing sources over external capital due to the higher cost and loss of decision making flexibility associated with external financing (Donaldson, 1961; Leary and Roberts, 2005; Myers, 2003; Myers and Majluf, 1984; Zeidan et al., 2018). Using the tax wedge theory, Becker et al. (2013) show that firms prefer investments using retained earnings (internal equity), as internal equity is cheaper than external equity (share issues). Similarly, Hubbard and Palia (1999) use an average two-year dividend pay-out ratio as one of the measures for identifying the financially unconstrained firms and those that face costly external financing.

In keeping with the literature, I employ a proxy that reflects the firms' internal capital generation capacity, known as the Internal Capital Generation Rate (ICGR). Following Fabozzi and Markowitz (2011), I measure ICGR as a product of the plough back ratio (retention ratio) and return on equity (ROE), as given in specification (4.3). All else equal, a lower ICGR implies higher constraint to internal capital.

$$\text{ICGR} = ROE \times (1 - dividend\ payout\ ratio) \tag{4.3}$$

I test my key hypothesis H_1 using the following DiD regression specification (4.4):

$$(Debt/TA)_{it} = \alpha + \beta.[LowIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times LowIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it} \tag{4.4}$$

where $(Debt/TA)_{it}$ is either $Total\ debt/TA$, $Secured\ debt/TA$ or $Unsecured\ debt/TA$. $LowIC_i$ is a categorical variable that takes a value of one for the firms falling in the lower tercile based on firms' three-year average of ICGR before the SARFAESI Act, i.e., from 1999 to 2001, and zero for the firms falling within the upper tercile. The treated firms are those with the lowest level of ICGR, and the comparison firms are those with the highest level of ICGR. $Post_t$ is a categorical variable that takes the value of one for the years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero otherwise. The other variables are as defined in Subsection 4.3.4. The results of specification (3.4) are presented in Table 4-7.

[Table 4-7 about here]

For each dependent variable $(Debt/TA)_{it}$, i.e., $Total\ debt/TA$, $Secured\ debt/TA$ and $Unsecured\ debt/TA$, models [1], [3] and [5] of Table 4-7 report the DiD coefficients without control variables, and models [2], [4] and [6] include additional firm controls. As reported in models [1] to [4], I find that the DiD coefficients are highly significant and positive at the 1% significance level for the total borrowing and secured borrowing variables and are positively significant at 5% for the unsecured borrowing variable in the model [5]. In terms of the economic magnitude, the strengthening of creditor rights relatively increases the total corporate borrowing (secured borrowing) of firms that have constrained access to internal capital (firms in lower tercile) in the range of 7.7% - 9.6% (7.2% - 8.1%) of total assets more than their less constrained peers (firms in upper tercile). The effect is insignificant for unsecured borrowing after attributing to firm characteristics (model [6]). In terms of controls, all the variables carry the expected signs and consistent with the findings of Vig (2013).

I further employ triple differences (DiDiD) regression to gauge the differential effects of creditor rights expansion on standalone firms with constrained access to internal capital. The fact that business group firms can exercise their connectedness to pooled resources when needed means that the reliance on internally accumulated capital should be more relevant for standalone firms (Gopalan et al., 2007). Thus, I predict the creditor rights reform shock should have a positive borrowing effect on standalone firms that have higher constraints in accessing internal capital and have a lower level of ICGR. To test this prediction, I employ a DiDiD, as noted in the following general regression specification (4.5).

$$(Debt/TA)_{it} = \alpha + \omega.[CIC_i \times Post_t \times LowIC_i] + \beta.[CIC_i \times Post_t] + \lambda.[LowIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times LowIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it} \qquad (4.5)$$

The coefficient ω of the triple interaction term $[CIC_i \times Post_t \times LowIC_i]$ measures the marginal effect of the SARFAESI Act reform on the corporate borrowing of standalone firms with lower ICGR, relative to the other business group affiliated firms with higher levels of ICGR. The interaction term $[CIC_i \times Post_t]$ gauges the differential effect of SARFAESI Act reform on borrowing between unaffiliated standalone and business group affiliated firms. Similarly, the interaction term $[LowIC_{\,i} \times Post_t]$ measures the differential effect of SARFAESI Act reform on borrowing between firms with low and high internal capital generation. All other variables are defined as per specification (4.4). The outputs of the estimations of the different variants of specification (4.5) are presented in Table 4-8.

Models [1], [3] and [5] of Table 4-8 report the DiDiD coefficients with fixed effects; models [2], [4] and [6] include additional firm controls. As reported in models [1] to [4], I find that the DiDiD coefficients are positive and statistically significant, indicating an increase in the total and secured corporate borrowing of firms that have constrained access to internal capital (treated firms having low ICGR). The magnitude of the coefficients is in the range of 2.6% (model [1] for total borrowing scaled by total assets) to 3.7% (model [3] for secured borrowing scaled by total assets) after the expansion of creditor rights. In terms of the controls, all the variables carry the expected signs and are statistically significant, which is consistent with the previous results.

[Table 4-8 about here]

Taken together, the results presented in Tables 4-7 and 4-8 indicate that the firms with lower levels of ICGR or that have otherwise constrained access to internal capital, increase their borrowing relatively more following the SARFAESI Act. This finding again highlights the positive effect of the creditor protection reform on corporate borrowing when firms have constrained access to internal capital.

4.3.5.4 *Propensity score matched difference-in-differences (PSM-DiD)*

My main estimation model is accommodative of the differences among the treated and comparison groups, which may raise the concern of comparability between the two groups. In this section, I take a further step to reduce the possibility that my results could be driven by differences in firms' fundamentals between the treated and comparison groups. Here, I employ the DiD regression between the propensity score matched highly comparable treated and comparison groups.[34] The results of the different estimations related to PSM-DiD are presented in Table 4-9.

I first estimate the pre-SARFAESI Act probit model to measure the likelihood of being included in a treated or comparison group based on the following regression specification:

$$CIC_i = \alpha + \boldsymbol{X_{it}}.\boldsymbol{\beta} + \eta_j + e_{it} \tag{4.6}$$

where CIC_i takes the value of one for unaffiliated standalone firms that have constrained access to internal capital, and zero otherwise. $\boldsymbol{X_{it}}$ is the vector of the control variables defined in Subsection 4.3.4, and η_j controls for industry fixed effects. By applying propensity matching without replacement based on the propensity score between treated-comparison pairs for all the covariates, I identify 719 pairs of matched treated and comparison group firms. I present the results of specification (4.6) for the entire sample and the matched subsample in columns 1 and 2, respectively, of Panel A of Table 4-9. I can be observed that the explanatory power of specification (4.6) is

[34] Even though I have shown in Subsection 4.3.2 that my treated and comparison group firms meet the pre-SARFAESI Act parallel trend assumption, these firms still differ in their firm fundamentals, as presented in Table 4-2. The triangulation of my causal inference with PSM-DiD, therefore, has merit.

reduced from pseudo-R^2 = 0.239 in column 1 for the entire sample to pseudo-R^2 = 0.001 in column 2 for the matched treated and comparison groups. This finding indicates that the matched treated and comparison groups are not systematically different in terms of their firm fundamentals. I further present the pre-SARFAESI Act difference between firm controls in Panel B of Table 4-9, which clearly shows that the matched 719 pairs of treated and comparison firms have similar and comparable firm fundamentals before the SARFAESI Act.

To assess how the SARFAESI Act reform has affected the treated and comparison firms, I present a time series plot of rescaled values (similar to Figure 4-1) of the corporate borrowing of the matched firms from 1998 to 2005 in Figure 4-2. I find that there is no difference in the trend of corporate borrowing before the SARFAESI Act. However, following the SARFAESI Act reform, the corporate borrowing of treated firms has a positive trend compared to a marginal decline in the borrowing of the group affiliated firms, which further confirms the positive effect of the expansion of creditor rights on the corporate borrowing of firms with constrained access to internal capital.

[Figure 2-2 about here]

I supplement my suggested findings from the time series plot with multivariate DiD estimation. I present a PSM-DiD regression for the matched pairs of treated and comparison groups in Panel C of Table 4-9 using the following general specification (4.7).

$$(Debt/TA)_{it} = \alpha + \beta.[CIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + \gamma_i + [\eta_j \times \tau_t] + e_{it} \quad (4.7)$$

where $(Debt/TA)_{it}$ is either $Total\ debt/TA$ or $Secured\ debt/TA$. All the other variables are as defined in Subsection 4.3.4. It can be observed that the DiD coefficient is significantly positive for the subsample of highly comparable treated and comparison group firms, which is consistent with my main results. In terms of the economic magnitude, the matched treated firms increase their total corporate borrowing by 2.8% to 2.9% (models [1] and [2] of Panel C) and secured borrowing by 2.4% to 2.6% (models [3] and [4] of Panel C) following the SARFAESI Act reform. My supplementary results of the univariate DiD analysis in Panel D further support the findings from the multivariate DiD analysis presented in Panel C. I find that the total borrowing and secured borrowing, both scaled by total assets, differentially increase by 2.59% and 2.83%, respectively, for the treated firms in the post-SARFAESI Act period.

[Table 4-9 about here]

4.3.6 Effect of creditor protection on private (non-listed) firms

The argument of the positive effect of creditor protection on the corporate borrowing of the firms that are constrained to internal capital should be more pronounced for private firms, which are presumably more constrained to internal capital than their listed counterparts. However, following similar arguments to those presented in Section 4.3, private firms that belong to a business group can be considered less constrained, as they can pool resources from the group in the face of a creditor protection shock. In this section, I extend my empirical test designed in the specification (4.1) to the sample of private unlisted Indian firms. For the analysis, the treated firms are private unaffiliated standalone firms, and the comparison firms are private firms affiliated to a business group. I collected 32,288 firm-year observations from 8,807 unique private non-listed Indian firms with 6,705 standalone private firms and 2,102 affiliated group firms. I gauge the growth opportunities for this sample of firms by their sales growth. The DiD regression results are reported in Table 4-10.

[Table 4-10 about here]

As reported in models [1] to [4] of Table 4-10, the total debt and secured debt of the unaffiliated private firms significantly increase in the range of 3% to 4.3% compared to their group-affiliated peers. Models [5] and [6] show a significant reduction, in the range of -2.4% to -2.6%, in the unsecured borrowing of treated firms. To the extent that secured debt is cheaper compared to unsecured forms of credit, an implication of the result could be the partial substitution of a costlier financing source by a cheaper source.[35] Alternatively, following the collateral-based creditor protection reform, the unsecured debt market could become a viable alternative for the group affiliated firms who could lower their secured debt and substitute it with the unsecured debt, thus making it more difficult for the otherwise standalone firms to access this market segment.

4.3.7 Heterogeneity within the business group

In this section, I explore two important sources of heterogeneity within business group firms that may affect corporate borrowing differentially. The first source emerges from the affiliation with a financial institution within the business

[35] Vig (2013) documents a decrease in the cost of debt after the SARFAESI Act regime.

group, and the second is related to the net borrowing or lending status of a member firm within the business group.

4.3.7.1 Financial institution as an affiliated member

Having a financial institution as an affiliated member could be an important source of heterogeneity within business group firms that may moderate the link between creditor rights protection and debt financing. It could be argued that business group firms with no affiliated financial institution could be more constrained vis-à-vis their access to internal finance relative to firms that do have a financial institution as an affiliated member. This implies that, in my empirical set-up, business group affiliated firms with no affiliated financial institution and in the post creditor protection reform period of 2002 should increase their borrowing more relative to that of business group firms that have an affiliated financial institution.

I test this conjecture by examining the subsample of my data that includes only business group affiliated firms. By mapping each firm with all other firms within a business group from the universe of financial and nonfinancial firms in my database, I identify 416 (3,895 firm-year observations) distinct business group firms without any affiliated financial institution in their group (treated firms) and 1,562 (11,233 firm-year observations), distinct business peers, with at least one affiliated financial institution in their group (comparison firms). I run the following DiD specification (4.8) with these alternative groups of treated and comparison firms using the subsampled dataset of business firms.

$$(Debt/TA)_{it} = \alpha + \beta.[NonFinConnect_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times NonFinConnect_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it} \quad (4.8)$$

where $(Debt/TA)_{it}$ is either $Total\ debt/TA$, $Secured\ debt/TA$ or $Unsecured\ debt/TA$. $NonFinConnect_i$ is an indicator variable that takes the value of one for business group firms with no affiliated financial institution (treated firms), and zero for those business group firms with an affiliated financial institution (comparison firms). All the other variables are as defined in Subsection 4.3.4. The results of the estimations are reported in Table 4-11.

In Table 4-11, It can be observed that the increase in total corporate borrowing is in the range of 3.33% to 4.28% (models [1] and [2]) and secured borrowing in the range of 2.82% to 3.64% (models [3] and [4]) for more financially constrained business firms with no affiliated financial institution when compared to their business group counterparts with an affiliated financial institution. However, there seems to be no differential change in the unsecured category of borrowing.[36] The findings, generally, further lend support to the view that creditor protection reforms increase corporate borrowing more for firms that are relatively more constrained to their access to internal capital.

[Table 4-11 about here]

[36] This is potentially due to the fact that the SARFAESI Act specifically targeted the secured debt market, and thus, within this subgroup of business firms, no differential changes in unsecured debt is not a surprising finding.

4.3.7.2 Net receivers or suppliers of debt within the group

Intragroup borrowing or lending may be important for business group member firms to avoid default (Gopalan et al., 2007) or attain investment efficiency (Buchuk et al., 2014). However, it may be plausible that compared to their peers that are net suppliers of intragroup loans, net borrower affiliates would respond to a creditor protection reform differently. In this subsection, I exploit the heterogeneity within business group firms based on whether a firm is a net-borrower or net-supplier of the intragroup financing. For group-affiliated firms, the Prowess database reports intragroup lending and intragroup borrowing. Using these data-points for each firm-year observation, I define a group affiliate as a *Supplier (Receiver)* of intra group loans and advances if the difference between total intragroup lending and total intragroup borrowing of a firm is positive (negative) for that year. I identify 4,504 firm-year observations of 1,709 unique *supplier-firms* of intragroup loans and advances, and 1,924 firm-year observations of 1,100 unique *receiver-firms* for my study period (1996-2007). I report the univariate analysis of corporate borrowing in Table 4-12.[37]

[Table 4-12 about here]

Table 4-12 reveals that, compared to the net-supplier firms, which do not change their secured debt borrowing, the net receiver firms (net debtor) lower their secured debt by 3.56% (significant at 1%) in the post-SARFAESI Act regime. The results imply that firms with greater access to internal capital (net-receiving firms in this case) could adapt to substitute external borrowing with internal borrowing when

[37] Due to significant missing observations in this particular dataset on intragroup lending/borrowing, I discuss the heterogeneity on the basis of univariate analysis, as the efficiency of the regression estimations is highly compromised in the regression framework.

facing threats from stronger creditor protection reforms. Similarly, both receiving and supplying firms increase their unsecured borrowing in the post-SARFAESI Act period.[38]

4.3.8 Implications

In this subsection, I examine the implications of increased corporate borrowing by the treated firms in the post-SARFAESI Act reform period. I investigate the effect by employing three implication variables as the dependent variables, i.e., Capital Expenditure (*Capex*), Return on Assets (*ROA*) and proxy of firm valuation (*MB*). Extant literature suggests that greater access to finance should affect real investments positively (Almeida et al., 2017; Campello et al., 2010). Therefore, an improvement in financial access should improve *Capex*. For a year *t*, I calculate *Capex* for a firm *i* as an addition to fixed assets scaled by the book value of total assets. Similarly, I expect an improvement in financial access should lead to improved operational performance, as studies show that greater access to finance encourages profitable investments (Boubakri and Cosset, 1998; King and Levine, 1993). I, therefore, gauge operational performance using *ROA,* which is computed as earnings before interest and taxes (*EBIT*) scaled by the book value of total assets.

Finally, my third implication variable is a market-based measure of firm performance, i.e., market valuation. To the extent that market values improve access to finance (La Porta et al., 2002), I expect improved access to corporate borrowing would lead to higher equity valuations. I compute equity valuation by employing *MB,*

[38] Due to missing data, the sum of secured and unsecured borrowing may not be equal to total borrowing. While the data on intragroup borrowing suffer from missing data problems, the finding is consistent with the argument that unconstrained firms substitute their borrowing to adapt to the threat that a group firm may face due to creditor protection.

as defined earlier. To estimate the effect of increased corporate borrowing on the implication variables, I employ the following estimation specification:

$$Implication_{i,t+1} = \alpha + \beta.[CIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times CIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it} \quad (4.9)$$

where the *Implication* variables are in the lead-year, i.e., *t+1*. I control for firm *Size*, and *Tangibility,* as time-varying differences among these firms' fundamentals could affect the implication variables (Koirala et al., 2018).[39] All the other variables in the specification (4.9) are as defined in Section 34.3.4. The results of the implication regressions are presented in Table 4-13.

[Table 4-13 about here]

It can be seen in the model [1] that the treated firms increase their *Capex* significantly in the lead years by 2.4%, thus indicating a positive effect of increased borrowing on real investment. Similarly, model [2] shows that the treated firms improve their operating performance significantly by 1.3% in the years following their expansion of corporate borrowing, indicating a positive effect on firms' operational performance gauged by *ROA*. Finally, the model [3] indicates that the treated firms experience higher market valuation in the subsequent years, which indicates that the improved corporate borrowing of treated firms also helps improve their market

[39] As one of the implication variables, *MB,* is also the control variable for the main estimation model in specification (4.1), there may arise an obvious concern of a circular loop of regression by swapping the variable position from the right-hand side to the left-hand side of the estimation model. However, *MB,* when used as an implication variable, is expressed in the lead period (t+1) form, whereas *MB,* when used as one of the control variables in specification (4.1), is in a level period form. *MB-lead* in specification (4.9), as a dependent variable, would account for change in a firm's valuation following the improved access to finance of the previously constrained firms.

performance in the following years. Similarly, higher operating performance and valuation accompanying higher capital investments by the standalone firms in the post-SARFAESI Act reform period indicate the positive effects of creditor protection on investment efficiency (Buchuk et al., 2014).

These results presented in this section, which show that the treated firms subsequently invest more, perform better and are valued higher than the non-treated firms, also lend support to the argument that the expansion of creditor rights improves the allocative efficiency by directing capital towards the needy, otherwise constrained, standalone firms in an economy (Almeida and Wolfenzon, 2006). To summarize, the strengthening of creditor rights causes positive investment, performance, and valuation consequences for firms that have constrained access to internal capital.

4.4 Conclusion

The existing literature offers contrasting theoretical perspectives and empirical evidence on the impact of creditor protection on firm borrowing. While one school of thought states that creditor protection should lead to increased firm borrowing, the other takes a contrasting view that such reform may have unintended consequences as creditors become more powerful due to their ability to enforce debt collection, and this may discourage borrowing. Both of these theoretical views are supported by empirical evidence. In this Chapter, I strive to partially resolve this theoretical and empirical tension by linking these contrasting results to a strand of literature that explores the association between business group affiliation and access to internal capital. Specifically, I argue that firms' heterogeneity related to different levels of access to internal capital may explain the link between creditor protection and firm borrowing.

I test this view in a quasi-natural empirical setting by exploiting the enactment of reform, called the SARFAESI Act, which strengthened the rights of creditors in India, where the legal system transitioned from a pro-debtor regime to a pro-creditor regime. Further, I use the business group affiliation literature as the basis to separate firms with varying degrees of constraints to internal capital into treated (standalone firms, which have lower access to internal capital) and comparison groups (business group affiliated firms, which have higher access to internal capital). The findings of my results, supported by extensive robustness checks, offer strong evidence in support of the argument that in the post creditor protection reform regime, firms having constrained access to internal capital borrow more relative to firms that have higher access to internal capital. Thus, the results of my study imply that the corporate borrowing decision of the firms (ie, whether to increase or decrease borrowing) following creditor protection depends on the extent to which firms have constrained access to internal finance.

Table 4-1 Descriptive Statistics

This table reports the average of variables (along with the number of observations presented in the second row for each variable) used in the analysis for the segregated two periods, i.e., before the SARFAESI Act (1996-2001) and after the SARFAESI Act (2002-2007). The variables *Total Debt*, *Secured Debt,* and *Unsecured Debt* are scaled by the book value of *Total Assets* (*TA*). *Size* is the natural logarithm of the book value of total assets expressed in millions of Indian currency (INR). *Tangibility* is net fixed asset as a proportion of book value of Total Assets. *Operating profitability* is earnings before interest and tax. *MB* represents the ratio of the market value of shareholders' equity to its book value. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels respectively. The total sample period ranges from the year 1996 to 2007. Data source: CMIE database.

Variable **No. of obs.**	**Before**	**After**	**Diff**	**t-stat**	**p-value**
$Total\ Debt/TA$	0.3811 22,196	0.3907 21,681	0.0096***	3.0152	0.0000
$Secured\ Debt/TA$	0.3280 20,904	0.3301 19,633	0.0021***	2.9958	0.0000
$Unsecured\ Debt/TA$	0.0861 19,012	0.1019 17,517	0.0158***	6.1463	0.0000
Size	5.7341 22,196	5.8306 21,681	0.0965***	5.7465	0.0000
Tangibility	0.3788 22,040	0.3540 21,276	-0.0249***	-11.7332	0.0000
Operating Profitability	0.0805 22,196	0.1484 21,681	0.0679***	7.9553	0.0000
MB	1.17 16,330	2.07 11,902	0.9000***	30.75	0.0000

Table 4-2 Firms classified into business group firms and standalone firms.

This table reports the average of variables (along with the number of observations presented in the second row for each variable) used in the analysis for unaffiliated standalone (treated) firms and business-group (comparison) firms. *, ** and *** denote statistical significance at 10%, 5%, and 1% levels respectively. The total sample period ranges from the year 1996 to 2007. Data source: CMIE database.

Variable **No. of obs.**	**Standalone firms**	**Business group firms**	**Diff**	**t-stat**
$Total\ Debt/TA$	0.3836	0.3949	0.0113***	8.29
	27,956	15,921		
$Secured\ Debt/TA$	0.3188	0.3250	0.0062***	2.71
	25404	15133		
$Unsecured\ Debt/TA$	0.0937	0.0931	-0.0006	-0.63
	22455	14074		
Size	5.12	7.00	1.88***	122.52
	27956	15921		
Tangibility	0.3658	0.3673	0.0015	0.67
	27,493	15823		
Operating Profitability	0.1187	0.1087	0.0717	1.12
	27,956	15,921		
MB	1.3876	1.8166	0.4290***	14.24
	16,665	11,567		

Table 4-3 Univariate difference-in-differences in corporate borrowing.

This table reports the mean estimates of total debt, secured debt and unsecured debt as a proportion of book value of total assets for the unaffiliated standalone firms (treated firms) and business group firm (comparison firms) before and after the enactment of the SARFAESI Act in 2002. *Before period* represents 1996- 2001 and the *After period* is from 2002-2007. The last column represents the DiD of each of these variables between the treated and comparison groups. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. The sample period is 1996 to 2007. Data source: CMIE database.

Variable [1]	**Firm-type** [2]	**Before** [3]	**After** [4]	**Diff** [5]	**t-stat** [6]	**DiD** [7]
$Total\ Debt/TA$	Treated	0.370	0.397	0.0276***	8.8721	0.0348***
	Comparison	0.396	0.389	-0.0072***	-2.5084	
$Secured\ Debt/TA$	Treated	0.302	0.339	0.0366***	10.376	0.0398***
	Comparison	0.328	0.325	-0.0032	-1.6620	
$Unsecured\ Debt/TA$	Treated	0.084	0.119	0.0354***	18.091	0.0275***
	Comparison	0.088	0.096	0.0079***	5.9098	

Table 4-4 Multivariate analysis access to internal capital and corporate borrowing.

This table reports the results of DiD regression using the following general specification:

$$(Total\ Debt/TA)_{it} = \alpha + \beta.[CIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times CIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $(Total\ Debt/TA)_{it}$ is defined as total debt to book value of total assets in models [1] to [4] and TD-Growth is defined as the growth in total debt in the model [5]. CIC_i is an indicator variable that takes the value of one for treated firms (standalone firms) and zero otherwise (business group affiliated firms). $Post_t$ is a categorical variable that takes the value of one for years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero otherwise. $\boldsymbol{X_{it}}$ is a vector of control variables, including *Size, Tangibility, Operating Profitability,* and *MB*. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. Standard errors, clustered at the firm level, are reported in parentheses. The entire study period ranges from 1996 to 2007, whereas the shorter study period is from 1998 to 2005. Models [1] [2] [6] and [7] report regression without control variables and all other models report regression with control variables. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. Source: CMIE database.

	Study Period (1996-2007)					**Study Period (1998-2005)**				
	Total Debt/TA				**TD-Growth**	**Total Debt/TA**				**TD-Growth**
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**	**[10]**
DiD	0.040***	0.025***	0.031***	0.026***	0.047***	0.028***	0.020***	0.024***	0.026***	0.074***
$[CIC_i \times Post_t]$	(0.0068)	(0.0060)	(0.0058)	(0.0075)	(0.0175)	(0.0061)	(0.0056)	(0.0055)	(0.0071)	(0.0206)
Size			0.028***	0.032***	0.043***			0.010	0.013	0.031
			(0.0043)	(0.0055)	(0.0141)			(0.0065)	(0.0079)	(0.0241)
Tangibility			0.195***	0.247***	0.122**			0.201***	0.259***	0.159*
			(0.0152)	(0.0194)	(0.0565)			(0.0190)	(0.0252)	(0.0913)
Operating Profitability			-0.010***	-0.006***	-0.029***			-0.010***	-0.005**	-0.032***
			(0.0017)	(0.0020)	(0.0077)			(0.0020)	(0.0024)	(0.0096)
MB			0.008***	0.014***	-0.003			0.008***	0.011***	-0.005
			(0.0008)	(0.0013)	(0.0033)			(0.0009)	(0.0016)	(0.0046)

Post × Size				-0.004*	0.003				-0.001	0.011
				(0.0021)	(0.0052)				(0.0020)	(0.0066)
Post × Tangibility				-0.099***	-0.098**				-0.093***	-0.051
				(0.0157)	(0.0403)				(0.0159)	(0.0479)
Post × Operating Profitability				-0.006***	-0.019***				-0.006***	-0.016**
				(0.0013)	(0.0061)				(0.0014)	(0.0071)
Post × MB				-0.006***	-0.001				-0.003**	0.003
				(0.0013)	(0.0034)				(0.0014)	(0.0042)
CIC × Size				0.001	0.023				0.001	0.047
				(0.0076)	(0.0174)				(0.0121)	(0.0318)
CIC × Tangibility				0.036	0.090					0.136
				(0.0300)	(0.0781)					(0.1292)
CIC × Operating Profitability				0.004	0.001					0.007
				(0.0036)	(0.0147)					(0.0181)
CIC × MB				0.003**	0.001					0.005
				(0.0015)	(0.0038)					(0.0052)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry ×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2(Adj.)	0.73	0.70	0.72	0.72	0.19	0.81	0.78	0.79	0.80	0.21
No. of Firms	5,049	3,764	3,764	3,747	3,714	4,535	2,896	2,896	2,896	2845
No. of Obs.	43,877	26,638	26,638	26,638	26,302	28,533	16,411	16,411	16,411	16,127

Table 4-5 Placebo Test.

Access to internal capital and corporate borrowing with false shock years.

This table reports the results of placebo regression results using the following specification:

$$(Total\ Debt/TA)_{it} = \alpha + \beta_1.[AFY_{[-1]} \times CIC_i] + \beta_2.[AFY_{[-2]} \times CIC_i] + \beta_3.[AFY_{[-3]} \times CIC_i] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times CIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $(Total\ Debt/TA)_{it}$ is defined as total debt to book value of total assets. CIC_i is an indicator variable that takes the value of one for treated firms and zero otherwise. $AFY_{[-1]}$, $AFY_{[-2]}$, and $AFY_{[-3]}$ are categorical variables that take the value of one for one, two and three years respectively following and including the false shock year ($FSY_{[-t]}$), and zero otherwise. My Placebo experiment uses three different FSYs, i.e., one year $[FSY_{[-1]}]$, two year $[FSY_{[-2]}]$, and three year $[FSY_{[-3]}]$ before the true creditor protection reform Act in 2002. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Tangibility, Operating Profitability* and *MB*. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. Standard errors, clustered at the firm level, are reported in parentheses. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. The study period ranged from 1996 to 2001. Data source: CMIE database.

	[1]	[2]	[3]	[4]
$AFY_{[-1]}$	0.002			0.002
	(0.0065)			(0.0052)
$AFY_{[-2]}$		0.001		-0.005
		(0.0061)		(0.0047)
$AFY_{[-3]}$			0.005	0.007
			(0.0060)	(0.0054)
Size	-0.009	-0.009	-0.010	-0.010
	(0.0095)	(0.0096)	(0.0096)	(0.0097)
Tangibility	0.194***	0.194***	0.194***	0.193***
	(0.0225)	(0.0224)	(0.0224)	(0.0224)
Operating Profitability	-0.014***	-0.014***	-0.014***	-0.014***
	(0.0028)	(0.0028)	(0.0028)	(0.0028)
MB	0.011***	0.011***	0.011***	0.011***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
CIC × Size	0.002	0.003	-0.000	0.000
	(0.0137)	(0.0143)	(0.0146)	(0.0149)
CIC × Tangibility	0.014	0.014	0.011	0.011
	(0.0352)	(0.0351)	(0.0352)	(0.0353)
CIC × Operating Profitability	0.006	0.006	0.006	0.006
	(0.0061)	(0.0061)	(0.0062)	(0.0062)
CIC × MB	0.005**	0.005**	0.005**	0.004**
	(0.0021)	(0.0021)	(0.0021)	(0.0021)
Firm FE	Yes	Yes	Yes	Yes
Industry FE ×Year FE	Yes	Yes	Yes	Yes
R^2(Adj.)	0.79	0.79	0.79	0.79
No. of Firms	3795	3795	3795	3795
No. of Obs.	15,438	15,438	15,438	15,438

Table 4-6 Robustness Test

Access to internal capital and corporate borrowing with secured and unsecured borrowing as dependent variables.

This table reports the results of DiD regression results using the following general equation:

$$(Debt/TA)_{it} = \alpha + \beta.[CIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times CIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $(Debt/TA)_{it}$ is secured debt to total assets (results reported in models 1 to 6) and unsecured debt to total assets (results reported in models 7 to 12**)**. CIC_i is an indicator variable that takes the value of one for treated firms and zero otherwise. $Post_t$ is a categorical variable that takes the value of one for years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero otherwise. $\boldsymbol{X_{it}}$ is a vector of control variables, including *Size, Tangibility, Operating Profitability,* and *MB*. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. Standard errors, clustered at the firm level, are reported in parentheses. Models [2], [5], [8] and [11] are for the subsample of firms with non-missing control variables. Models 1-3 and 7-8 report the results for the entire study period of 1996 to 2007, whereas models 4-6 and 10-12 present the results for a shorter study period of 1998 to 2005. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. Source: CMIE database.

	$\frac{Secured\ Debt}{TA}$						$\frac{Unsecured\ Debt}{TA}$					
	Study Period (1996-2007)			Study Period (1998-2005)			Study Period (1996-2007)			Study Period (1998-2005)		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
DiD	0.035***	0.018***	0.020***	0.025***	0.023***	0.023***	0.024***	0.012***	0.013**	0.019***	0.014***	0.010**
$[CIC_i \times Post_t]$	(0.0070)	(0.0056)	(0.0073)	(0.0062)	(0.0053)	(0.0067)	(0.0056)	(0.0039)	(0.0052)	(0.0050)	(0.0037)	(0.0049)
Size			0.031***			0.017**			-0.008**			-0.015***
			(0.0052)			(0.0083)			(0.0040)			(0.0058)
Tangibility			0.235***			0.256***			0.022			0.023
			(0.0196)			(0.0277)			(0.0134)			(0.0191)
Operating Profitability			-0.007***			-0.006*			-0.001			-0.003
			(0.0024)			(0.0031)			(0.0016)			(0.0022)
MB			0.010***			0.009***			0.005***			0.004***
			(0.0014)			(0.0017)			(0.0011)			(0.0014)

Post × Size			-0.004**			-0.001			-0.001			-0.002
			(0.0021)			(0.0019)			(0.0015)			(0.0014)
Post × Tangibility			-0.070***			-0.075***			-0.024**			-0.019*
			(0.0156)			(0.0156)			(0.0115)			(0.0113)
Post × Operating Profitability			-0.007***			-0.008***			-0.002*			-0.000
			(0.0016)			(0.0015)			(0.0011)			(0.0009)
Post × MB			-0.006***			-0.003*			0.001			0.001
			(0.0013)			(0.0015)			(0.0010)			(0.0011)
CIC × Size			0.011*			0.009			-0.009			-0.008
			(0.0067)			(0.0110)			(0.0064)			(0.0099)
CIC × Tangibility			0.018			0.037			0.042**			0.041
			(0.0293)			(0.0382)			(0.0195)			(0.0268)
CIC × Operating Profitability			0.000			-0.002			0.003			0.005
			(0.0047)			(0.0051)			(0.0042)			(0.0048)
CIC × MB			0.002			0.001			0.002			0.002
			(0.0015)			(0.0019)			(0.0012)			(0.0016)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE ×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 (Adj.)	0.70	0.68	0.70	0.79	0.76	0.77	0.59	0.50	0.51	0.68	0.58	0.59
No. of Firms	4,764	3,639	3,625	4,249	2,789	2,787	4,681	3,393	3,380	4,100	2,584	2,580
No. of Obs.	40,537	25,393	25,393	26,360	15,587	15,587	36,146	21,946	21,946	23,622	13,512	13,512

Table 4-7 DiD Regression with treated and comparison firms based on internal capital generation rate (ICGR)

This table reports the results of DiD regression using the regression equation:

$$(Debt/TA)_{it} = \alpha + \beta.[LowIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times LowIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $(Debt/TA)_{it}$ is the dependent variable measuring different forms of corporate borrowing (total, secured and unsecured) scaled by total assets (TA). $LowIC_i$ is a categorical variable that takes the value of one for the firms falling in the lower tercile based on firms' three-year average of ICGR before the SARFAESI Act, i.e., from 1999 to 2001, and zero for the firms falling in the upper tercile. I compute ICGR as $ICGR = ROE \times (1 - dividend\ payout\ ratio)$. $Post_t$ is a categorical variable that takes the value of one for years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero otherwise. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Tangibility, Operating Profitability* and *MB*. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. Standard errors, clustered at the firm level, are reported in parentheses. For each dependent variable, i.e., $\frac{Total\ Debt}{TA}$, $\frac{Secured\ Debt}{TA}$, and $\frac{Unsecured\ Debt}{TA}$, models [1], [3] and [5] report the DiD coefficient without control variables, and Models [2], [4], and [6] includes additional firm controls. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. The sample period ranges from 1996 to 2007. Data source: CMIE database.

	$\frac{Total\ Debt}{TA}$		$\frac{Secured\ Debt}{TA}$		$\frac{Unsecured\ Debt}{TA}$	
	[1]	[2]	[3]	[4]	[5]	[6]
DiD	0.096***	0.077***	0.081***	0.072***	0.014**	0.004
$[LowIC_i \times Post_t]$	(0.0081)	(0.0100)	(0.0074)	(0.0089)	(0.0055)	(0.0066)
Tangibility		0.276***		0.262***		0.014
		(0.0292)		(0.0302)		(0.0203)
Size		0.040***		0.047***		-0.015***
		(0.0085)		(0.0082)		(0.0057)
MB		0.012***		0.009***		0.003**
		(0.0017)		(0.0019)		(0.0014)
Profitability		-0.005		0.001		-0.005
		(0.0033)		(0.0042)		(0.0033)

Post × Size		-0.005**		-0.003		-0.004**
		(0.0025)		(0.0023)		(0.0017)
Post × Tangibility		-0.031		-0.016		-0.008
		(0.0217)		(0.0205)		(0.0162)
Post × Profitability		-0.006***		-0.008***		-0.001
		(0.0014)		(0.0016)		(0.0009)
Post × MB		-0.004**		-0.004**		0.001
		(0.0015)		(0.0016)		(0.0014)
LowIC × Size		-0.003		-0.021**		0.022***
		(0.0094)		(0.0087)		(0.0076)
LowIC × Tangibility		-0.166***		-0.128***		-0.031
		(0.0372)		(0.0354)		(0.0263)
LowIC × Profitability		0.006*		-0.004		0.008*
		(0.0036)		(0.0045)		(0.0044)
LowIC × MB		-0.001		-0.004**		0.003
		(0.0019)		(0.0016)		(0.0017)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE ×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 (Adj.)	0.73	0.75	0.71	0.73	0.49	0.51
No. of Firms	1,978	1,978	1,897	1,897	1,772	1,772
No. of Obs.	15,128	15,128	14,366	14,366	12,235	12,235

Table 4-8 DiDiD Regression with treated and comparison firms based on Internal Capital Generation Rate (ICGR).

This table reports the results of DiDiD regression using the regression equation:

$$(Debt/TA)_{it} = \alpha + \omega.[CIC_i \times Post_t \times LowIC_i] + \beta.[CIC_i \times Post_t] + \lambda.[LowIC_{\ i} \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times LowIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $(Debt/TA)_{it}$ is the dependent variable measuring different forms of corporate borrowing (total, secured and unsecured) scaled by total assets (*TA*). CIC_i is an indicator variable that takes the value of one for treated firms and zero otherwise. $Post_t$ is a categorical variable that takes the value of one for years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero otherwise. $Low\ IC_i$ is a categorical variable that takes a value of one for the firms falling in the lower tercile based on a three year average of ICGR before the SARFAESI Act, i.e., from 1999 to 2001 and zero for the firms falling in the upper tercile. I compute ICGR as $ICGR = ROE \times (1 - dividend\ payout\ ratio)$. $\boldsymbol{X_{it}}$ is a vector of control variables, including *Size, Tangibility, Operating Profitability, and MB*. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. Standard errors, clustered at the firm level, are reported in parentheses. For each dependent variable, i.e., $\frac{Total\ Debt}{TA}$, $\frac{Secured\ Debt}{TA}$, and $\frac{Unsecured\ Debt}{TA}$, models [1], [3] and [5] reports the DiDiD and DiD coefficients without control variables. Model [2], [4], and [6] includes additional firm controls. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. The sample period ranges from 1996 to 2007. Data source: CMIE database.

	$\frac{Total\ Debt}{TA}$		$\frac{Secured\ Debt}{TA}$		$\frac{Unsecured\ Debt}{TA}$	
	[1]	[2]	[3]	[4]	[5]	[6]
DiDiD $[CIC_i \times Post_t \times LowIC_i]$	0.026*** (0.010)	0.027** (0.0120)	0.037*** (0.0093)	0.033*** (0.0104)	-0.001 (0.0081)	0.000 (0.0085)
DiD-CIC $[CIC_i \times Post_t]$	0.079*** (0.0106)	0.060*** (0.0124)	0.056*** (0.0092)	0.052*** (0.0106)	0.014* (0.0076)	0.004 (0.0085)
DiD-*LowIC* $[LowIC_{\ i} \times Post_t]$	-0.017 (0.0154)	-0.016 (0.0173)	-0.007 (0.0061)	-0.008 (0.0084)	-0.003 (0.0029)	-0.004 (0.0035)
Tangibility		0.226*** (0.0263)		0.212*** (0.0269)		-0.001 (0.0178)
Size		0.060*** (0.0077)		0.060*** (0.0080)		-0.006 (0.0060)
MB		0.009*** (0.0015)		0.008*** (0.0016)		0.003** (0.0012)
Profitability		-0.005 (0.0033)		0.001 (0.0042)		-0.005 (0.0033)
Post × Size		-0.003 (0.0026)		-0.001 (0.0025)		-0.004* (0.0018)
Post × Tangibility		-0.032 (0.0218)		-0.019 (0.0206)		-0.008 (0.0162)

Post × Profitability		-0.006***		-0.008***		-0.001
		(0.0013)		(0.0016)		(0.0009)
Post × MB		-0.004**		-0.004**		0.001
		(0.0015)		(0.0015)		(0.0014)
LowIC × Size		-0.003		-0.020**		0.022***
		(0.0095)		(0.0087)		(0.0076)
LowIC × Tangibility		-0.162***		-0.123***		-0.031
		(0.0374)		(0.0356)		(0.0263)
LowIC × Profitability		0.006*		-0.004		0.008*
		(0.0036)		(0.0045)		(0.0044)
LowIC × MB		-0.001		-0.003**		0.003
		(0.0019)		(0.0016)		(0.0017)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE ×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2(Adj.)	0.73	0.75	0.71	0.73	0.49	0.51
No. of Firms	1,978	1,978	1,897	1,897	1,772	1,772
No. of Obs.	15,128	15,128	14,366	14,366	12,235	12,235

Table 4-9 PSM-DiD Regression

This table reports the propensity-matched DiD regression results.

Panel A reports the probit model represented by the following equation:

$$CIC_i = \alpha + \boldsymbol{X_{it}}.\boldsymbol{\beta} + \eta_j + e_{it},$$

where CIC_i is an indicator variable that takes the value of one for firms with constrained access to internal capital (treated firms) and zero otherwise (comparison firms). $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Tangibility, Operating Profitability* and *MB*. η_j is the industry fixed effect. The sample period for the probit model is from 1998 to 2001. Column 1 of Panel A presents the pre-SARFAESI Act probit model predicting the likelihood of having constrained access to internal capital (i.e., likelihood to be treated firms) from the entire sample of firms with no missing control variables from 1998 to 2005. Column 2 presents the probit likelihood model for matched treated and comparison firms using PSM without replacement.

Panel A: Pre-SARFAESI Act Propensity-Score Matching: Probit Model

	Total Sample[1]	Post-matched Diagnostic [2]
Size	-0.533***	0.022
	(0.0183)	(0.0244)
Tangibility	0.340***	-0.088
	(0.0741)	(0.0950)
Operating Profitability	-0.010	0.028
	(0.0225)	(0.0280)
MB	-0.005	0.005
	(0.0059)	(0.0070)
Industry FE	Yes	Yes
Pseudo-R^2	0.2390	0.0010
Prob > χ^2	0.00	0.29
No. of Obs.	9,628	5752

Panel B reports the mean of the matched pairs treated and comparison firms along with the difference and t-statistics for the pre-SARFAESI Act period (1998 to 2001).

Panel B: Pre-SARFAESI Act Comparison between Matched Treated and Comparison Firms

Variables	Mean Treated (a)	Mean Comparison (b)	Difference (a-b)	t-stat
Size	6.30	6.31	-0.01	-0.43
Tangibility	0.3783	0.3692	0.0091	1.46
Operating Profitability	0.1008	0.1093	-0.0085	-0.39
MB	1.41	1.43	-0.02	-0.24

Panel C reports the DiD regressions of propensity-matched pairs of firms from Panel A as represented by the following equation:

$$(Debt/TA)_{it} = \alpha + \beta.[CIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + \gamma_i + [\eta_j \times \tau_t] + e_{it},$$

where $(Debt/TA)_{it}$ is debt to total assets. CIC_i is an indicator variable that takes the value of one for treated firms and zero otherwise. $Post_t$ is a categorical variable that takes the value of one for four years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero for four years before 2002. $\boldsymbol{X_{it}}$ is a vector of control variables. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. While models [1] and [2] show DiD regression results for total debt to total assets, models [3] and [4] are the results for secured debt to total assets.

Panel C: PSM-DiD Regression

	[1]	[2]	[3]	[4]
DiD	0.028***	0.029***	0.026**	0.024**
$[CIC_i \times Post_t]$	(0.0093)	(0.0084)	(0.0094)	(0.0085)
Size		0.008		0.009
		(0.0130)		(0.0113)
Tangibility		0.035		0.0304
		(0.0390)		(0.0384)
Operating Profitability		-0.01		-0.005
		(0.0140)		(0.0132)
MB		0.007		0.007
		(0.0120)		(0.0114)
Firm FE	Yes	Yes	Yes	Yes
Industry FE*Year FE	Yes	Yes	Yes	Yes
Adj. R^2	0.78	0.81	0.77	0.80
No. of Firms	1438	1438	1438	1438
No. of Obs.	11504	11504	11504	11504

Panel D reports the univariate DiD of corporate borrowing (total and secured) along with the before and after mean difference of the matched treated and comparison groups. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The sample period ranges from 1998 to 2005. Source: CMIE database.

Panel D. Univariate DiD of Corporate Borrowing of Matched Treated and Comparison Groups

Group		(After)	(Before)	Difference (a-b)	t-stat
Treated	$(Total\ Debt/TA)_{it}$	0.3971	0.3719	0.0252***	3.84
	$(Secured\ Debt/TA)_{it}$	0.3016	0.2735	0.0281***	3.76
Comparison	$(Total\ Debt/TA)_{it}$	0.3765	0.3772	-0.0007	-0.11
	$(Secured\ Debt/TA)_{it}$	0.3016	0.3018	-0.0002	-0.34
			DiD - $(Total\ Debt/TA)_{it}$	0.0259***	
			DiD - $(Secured\ Debt/TA)_{it}$	0.0283***	

Table 4-10 DiD Regression for Unlisted Companies

This table reports the results of DiD regression results using the following general equation:

$$(Debt/TA)_{it} = \alpha + \beta.[CIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times CIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $(Debt/TA)_{it}$ is defined as total debt to book value of total assets in models [1] and [2], secured debt to book value of total assets in models [3] and [4] and unsecured debt to book value of total assets in models [5] and [6]. CIC_i is an indicator variable that takes the value of one for treated firms and zero otherwise. $Post_t$ is a categorical variable that takes the value of one for years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero otherwise. $\boldsymbol{X_{it}}$ is a vector of control variables, including *Size, Tangibility, Operating Profitability,* and *Sales-growth*. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. Standard errors, clustered at the firm level, are reported in parentheses. Models [1], [3] and [5] report regression without control variables and models [2], [4] and [6] report regression with additional control variables. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. The total sample period ranges from 1996 to 2007. Data source: CMIE database.

	$\frac{Total\ Debt}{TA}$		$\frac{Secured\ Debt}{TA}$		$\frac{Unsecured\ Debt}{TA}$	
	[1]	[2]	[3]	[4]	[5]	[6]
DiD	0.038***	0.030***	0.043***	0.042***	-0.024***	-0.026***
$[CIC_i \times Post_t]$	(0.0092)	(0.0096)	(0.0083)	(0.0093)	(0.0081)	(0.0083)
Size		0.001		0.021***		-0.047***
		(0.0067)		(0.0068)		(0.0069)
Tangibility		0.214***		0.225***		0.032
		(0.0263)		(0.0254)		(0.0229)
Operating Profitability		-0.096***		-0.102***		0.010
		(0.0264)		(0.0251)		(0.0242)
Sales-growth		0.002		0.002*		0.000
		(0.0013)		(0.0012)		(0.0014)
Post × Size		0.000		0.006**		-0.009***
		(0.0032)		(0.0029)		(0.0030)
Post × Tangibility		-0.019		0.001		-0.016
		(0.0204)		(0.0192)		(0.0187)
Post × Operating Profitability		-0.18***		-0.16***		-0.05**
		(0.0263)		(0.0257)		(0.0236)
Post × Sales-growth		-0.000		-0.004		0.002
		(0.0027)		(0.0027)		(0.0027)
CIC × Size		-0.03***		-0.012		-0.012
		(0.0120)		(0.0095)		(0.0118)
CIC × Tangibility		-0.063		-0.034		-0.075**
		(0.0403)		(0.0355)		(0.0381)

CIC × Operating Profitability		-0.009		0.062**		-0.061**
		(0.0308)		(0.0307)		(0.0303)
CIC × Sales-growth		-0.003**		-0.003		-0.001
		(0.0018)		(0.0018)		(0.0020)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE ×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2(Adj.)	0.79	0.80	0.75	0.77	0.77	0.79
No. of Firms	8807	8807	7,833	7,833	7529	7529
No. of Obs.	32,288	32,288	28,332	28,332	25,646	25,646

Table 4-11 Heterogeneity within Business Groups and Corporate Financing

This table reports the results of DiDiD regression using the regression equation:

$$(Debt/TA)_{it} = \alpha + \beta.[NonFinConnect_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times NonFinConnect_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $(Debt/TA)_{it}$ is the dependent variable measuring different forms of corporate borrowing (Total, Secured and Unsecured) scaled by total assets (TA). $NonFinConnect_i$ is an indicator variable that takes the value of one for business group firms with no affiliation with financial intermediaries and zero for those business group firms with an affiliation with financial intermediaries. $Post_t$ is a categorical variable that takes the value of one for years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero otherwise. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Tangibility, Operating Profitability* and *MB*. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. Standard errors, clustered at the firm level, are reported in parentheses. Models [1], [3] and [5] report regression without control variables and models [2], [4] and [6] report regression with additional control variables. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. The sample period ranges from 1996 to 2007. Data source: CMIE database.

	$\frac{Total\ Debt}{TA}$		$\frac{Secured\ Debt}{TA}$		$\frac{Unsecured\ Debt}{TA}$	
	[1]	[2]	[3]	[4]	[5]	[6]
DiD $NonFinConnect_i \times Post_t$	0.0428***	0.0333***	0.0364***	0.0282***	0.0040	0.0060
	(0.0110)	(0.0135)	(0.0100)	(0.0119)	(0.0062)	(0.0075)
Tangibility		0.0394***		0.0248***		0.0046
		(0.0082)		(0.0069)		(0.0071)
Size		0.2163***		0.2190***		-0.0156
		(0.0280)		(0.0262)		(0.0190)
Operating Profitability		-0.012***		-0.0107**		-0.0040
		(0.0037)		(0.0053)		(0.0052)
MB		0.0095***		0.0068***		0.0032***
		(0.0014)		(0.0013)		(0.0009)
Post × Size		-0.0017		-0.0024		-0.0011
		(0.0031)		(0.0029)		(0.0022)
Post × Tangibility		-0.118***		-0.076***		-0.0432**
		(0.0252)		(0.0230)		(0.0184)
Post × Profitability		0.0073		0.0123**		-0.0020
		(0.0047)		(0.0057)		(0.0062)
Post × MB		-0.0040**		-0.0032*		0.0000
		(0.0017)		(0.0017)		(0.0015)
$NonFinConnect \times$ Size		-0.0136		-0.0080		-0.0101
		(0.0145)		(0.0127)		(0.0098)
$NonFinConnect \times$ Tangibility		-0.0103		-0.0251		0.0202

		(0.0587)		(0.0533)		(0.0296)
$NonFinConnect$ × Profitability		-0.0198		-0.031***		-0.0009
		(0.0123)		(0.0113)		(0.0055)
$NonFinConnect$ × MB		0.0058***		0.0045**		0.0005
		(0.0020)		(0.0021)		(0.0018)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE ×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2(Adj.)	0.73	0.75	0.71	0.73	0.49	0.51
No. of Firms	1,978	1,978	1,897	1,897	1,772	1,772
No. of Obs.	15,128	15,128	14,366	14,366	12,235	12,235

Table 4-12 Univariate analysis of Before and After of Net Receiving and Net Supplying firms.

This table presents comparative univariate statistics (mean) of Secured Debt/TA, Unsecured Debt/TA and Total Debt/TA before (1996-2001) and after (2002-2007) the SARFAESI Act for the business group firms which are net suppliers and borrowers of intra-group loans. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. The sample period ranges from 1996 to 2007. Data source: CMIE database.

Dependent Variable	Supplier / Receiver	Before (b)	After (a)	Observations .	Difference (a-b)	t-stat
Secured D/TA	Supplier	0.2914	0.2894	3777	-0.0020	-0.8334
	Receiver	0.3191	0.2835	1261	-0.0356***	-2.5362
Unsecured D/TA	Supplier	0.1394	0.1512	3628	0.0118***	2.5101
	Receiver	0.1427	0.1717	1626	0.0290***	3.5029
Total Debt/TA	Supplier	0.3753	0.3809	4126	0.0056**	2.0713
	Receiver	0.3705	0.3677	1780	-0.0028**	-2.0005

Table 4-13 Implications

This table reports the implications of improved access to finance among firms having constrained access to internal capital following improvement in creditor rights given using the following model:

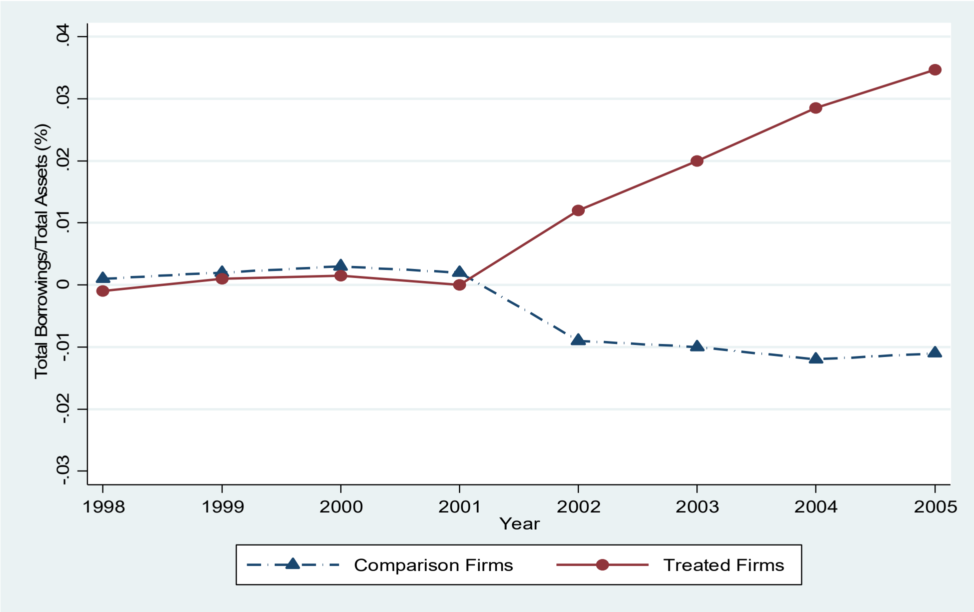
$$Implication_{i,t+1} = \alpha + \beta.[CIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times CIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $Implication_{i,t+1}$ is an implication variable expressed in lead-year (t+1). I present three implication variables: *Capex, ROA,* and *MB*. For a year *t*, I calculate *Capex* for a firm *i* as an addition to fixed assets scaled by the book value of total assets. *ROA* is computed as earnings before interest and taxes (EBIT) scaled by the book value of total assets. *MB* is defined as the ratio of market to book value of equity. CIC_i is an indicator variable that takes the value of one for treated firms and zero otherwise. $Post_t$ is a categorical variable that takes the value of one for years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero otherwise. Firm controls include *Size, Tangibility* and *Operating Profitability* (except model [2. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. Standard errors, clustered at the firm level, are reported in parentheses. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. The sample period ranges from 1996 to 2007. Source: CMIE database

	Capex(lead)	ROA(lead)	MB(lead)
	[1]	[2]	[3]
DiD	0.024***	0.013***	0.009**
$[CIC_i \times Post_t]$	(0.0044)	(0.0046)	(0.0041)
Size	0.076***	-0.016***	-0.016***
	(0.0041)	(0.0037)	(0.0030)
Tangibility	0.421***	0.049***	-0.067***
	(0.0187)	(0.0119)	(0.0100)
Operating Profitability	0.005***		0.001
	(0.0017)		(0.0016)
Post × Size	-0.017***	-0.001	0.000
	(0.0013)	(0.0013)	(0.0012)
Post × Tangibility	-0.043***	0.024***	0.032***
	(0.0106)	(0.0093)	(0.0076)
Post × Operating Profitability	0.000		0.008
	(0.0003)		(0.0063)
CIC × Size	-0.015**	0.005	0.009**
	(0.0058)	(0.0047)	(0.0037)
CIC × Tangibility	-0.062**	-0.022	0.005
	(0.0257)	(0.0155)	(0.0131)
CIC × Operating Profitability	-0.004		-0.021
	(0.0024)		(0.0239)
Firm FE	Yes	Yes	Yes
Industry FE ×Year FE	Yes	Yes	Yes
R^2 (Adj.)	0.26	0.49	0.42
No. of Firms	4,075	4,075	4,075
No. of Obs.	26,861	26,861	26,861

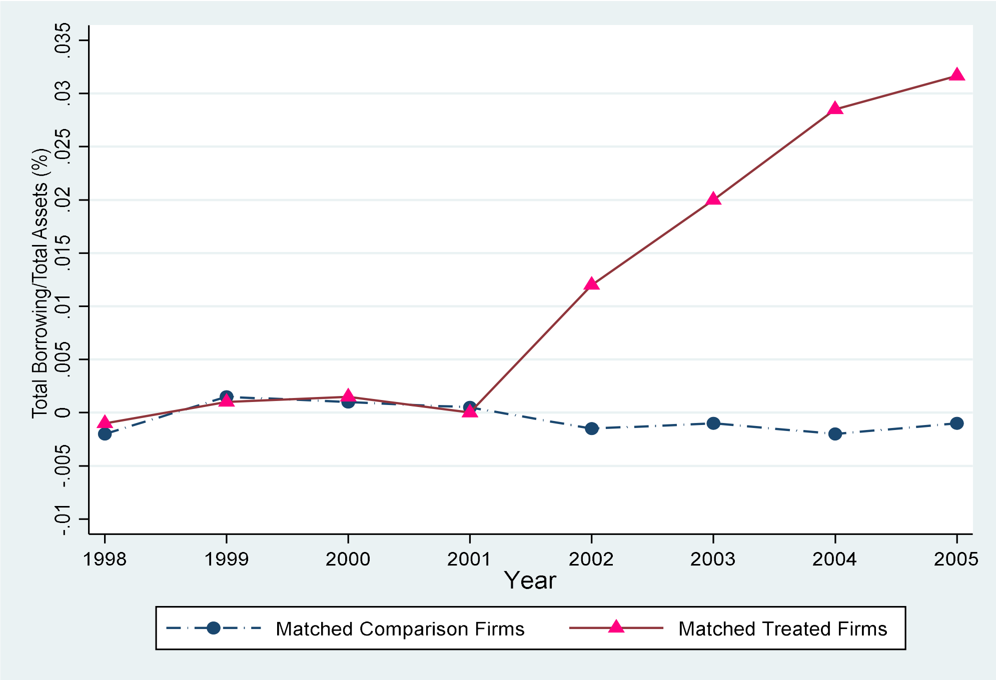
Figures of Chapter 4

Figure 4-1 Time-series plot of treated and comparison firms.



This figure presents the yearly rescaled average values of *Total Debt/TA* (total borrowing scaled by the book value of total assets) for the entire sample by treated and comparison firms. For each year the rescaling is done by deducting the three-year average before the SARFAESI reform (i.e., an average of 1998-2000) from each annual average figure of *Total Debt/TA*. The treated firms are standalone Indian firms having constrained access to internal capital, and comparison firms are business group firms with higher access to internal capital. The sample period is 1998 to 2005. Source: CMIE database.

Figure 4-2 Time-series plot of matched treated and comparison firms.



This figure presents the yearly rescaled average values of *Total Debt/TA* (total borrowing scaled by the book value of total assets) for the propensity score matched sample of treated and comparison firms. For each year the rescaling is done by deducting the three-year average before the SARFAESI reform (i.e., an average of 1998-2000) from each annual average figure of *Total Debt/TA*. The treated firms are standalone Indian firms having constrained access to internal capital, and comparison firms are business group firms with higher access to internal capital. The sample period is 1998 to 2005. Source: CMIE database.

Appendix to Chapter 4

Table A2-1: Industry classification.

7 Digit Prowess Code	Industry Clusters	Number of Observations	Percentage
1010111	Agricultural product and food	3,652	8.32%
1010115	Cloth and textile	4,359	9.93%
1010120	Chemicals, drugs, and Pharmaceuticals	7,133	16.26%
1010125	Consumer electronics, cosmetics, toiletries etc.	1,524	3.47%
1010130	Cements and Construction materials	1,667	3.80%
1010135	Metals and Steel	3,359	7.66%
1010140	Machinery, wires and cables	3,140	7.16%
1010145	Vehicles and automobile ancillaries	1,764	4.02%
1010150	Paper, glasses and media prints	1,303	2.97%
1010155	Diversified	989	2.25%
1010201	Coal and lignite	54	0.12%
1010202	Crude oil & natural gas	38	0.09%
1010203	Minerals	303	0.69%
1010301	Conventional and Renewable electricity	233	0.53%
1010302	Electricity transmission & distribution	43	0.10%
1010401	Hotels and Tourism	811	1.85%
1010404	Trading (Wholesale and retail)	5,645	12.87%
1010405	Transport	429	0.98%
1010406	Telecommunication and Courier services	188	0.43%
1010408	Computer and IT services	1,505	3.43%
1010415	Movies, animations, business consultancies other miscellaneous services	3,489	7.95%
1010601	Commercial complexes and Housing construction	444	1.01%
1010602	Industrial and Infrastructural constructions	1,805	4.11%
Total		43,877	100.00%

Table A2-2: Robustness Test with Standard Error Clustered at Business-group Level

This table reports the results of DiD regression using the following general specification:

$$(Total\ Debt/TA)_{it} = \alpha + \beta.[CIC_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + [\boldsymbol{X_{it}} \times CIC_i].\boldsymbol{\rho} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $(Total\ Debt/TA)_{it}$ is defined as total debt to book value of total assets in models [1] to [4] and *TD_Growth* is defined as the growth in total debt in the model [5]. CIC_i is an indicator variable that takes the value of one for treated firms (standalone firms) and zero otherwise (business group affiliated firms). $Post_t$ is a categorical variable that takes the value of one for years following and including the year of introduction of the SARFAESI Act, i.e., 2002, and zero otherwise. $\boldsymbol{X_{it}}$ is a vector of control variables, including *Size, Tangibility, Operating Profitability,* and *MB*. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks and e_{it} is the error term. Standard errors are clustered at the business group level (with 3712 unique clusters including 641 unique business groups and 3071 unique clusters for stand-alone firms) and are reported in parentheses. The entire study period ranges from 1996 to 2007, whereas the shorter study period is from 1998 to 2005. Models [1] [2] [6] and [7] report regression without control variables and all other models report regression with control variables. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. Source: CMIE database

	Study Period (1996-2007)					Study Period (1998-2005)				
	Total Debt/TA				TD_Growth	Total Debt/TA				TD_Growth
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
DiD	0.040***	0.025***	0.031***	0.026***	0.047***	0.028***	0.020***	0.024***	0.026***	0.074***
$[CIC_i \times Post_t]$	(0.0109)	(0.0089)	(0.0082)	(0.0079)	(0.0173)	(0.0080)	(0.0064)	(0.0059)	(0.0081)	(0.0222)
Size			0.028***	0.031***	0.043***			0.010*	0.013***	0.031
			(0.0046)	(0.0025)	(0.0159)			(0.0060)	(0.0046)	(0.0355)
Tangibility			0.195***	0.247***	0.125***			0.201***	0.256***	0.149***
			(0.0152)	(0.0177)	(0.0226)			(0.0181)	(0.0208)	(0.0294)
Operating Profitability			-0.010***	-0.007***	-0.029***			-0.010***	-0.005***	-0.032***
			(0.0014)	(0.0005)	(0.0041)			(0.0020)	(0.0010)	(0.0027)
MB			0.008***	0.014***	-0.003**			0.008***	0.011***	-0.005**
			(0.0006)	(0.0011)	(0.0015)			(0.0006)	(0.0014)	(0.0018)

Post × Size				-0.004**	0.003				-0.002	0.011
				(0.0017)	(0.0055)				(0.0020)	(0.0078)
Post × Tangibility				-0.099***	-0.098***				-0.094***	-0.048
				(0.0111)	(0.0329)				(0.0133)	(0.0341)
Post × Operating Profitability				-0.006***	-0.019***				-0.006***	-0.016***
				(0.0008)	(0.0042)				(0.0010)	(0.0046)
Post × MB				-0.006***	-0.001				-0.003*	0.003
				(0.0011)	(0.0031)				(0.0016)	(0.0038)
CIC × Size				0.002	0.023				-0.001	0.048
				(0.0066)	(0.0145)				(0.0105)	(0.0396)
CIC × Tangibility				-0.030	-0.090				-0.044	-0.125
				(0.0281)	(0.0593)				(0.0335)	(0.0984)
CIC × Operating Profitability				-0.004	-0.001				-0.006*	-0.007
				(0.0031)	(0.0125)				(0.0033)	(0.0161)
CIC × MB				-0.003***	-0.000				-0.002*	-0.005
				(0.0009)	(0.0024)				(0.0010)	(0.0035)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE ×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2(Adj.)	0.73	0.70	0.72	0.72	0.19	0.81	0.78	0.79	0.80	0.22
No. of Firms	5,049	3,764	3,764	3,747	3,714	4,535	2,896	2,896	2,896	2845
No. of Obs.	43,611	26,638	26,638	26,638	26,302	28,533	16,411	16,411	16,411	16,127

Table A2-3: DiD Regression based on Tangibility Tercile.

This table reports the results of DiD regression using the regression equation:

$$(Total\ Debt/TA)_{it} = \alpha + \beta.[High\ Tang_i \times Post_t] + \boldsymbol{X_{it}}.\boldsymbol{\delta} + [\boldsymbol{X_{it}} \times Post_t].\boldsymbol{\vartheta} + \gamma_i + [\eta_j \times \tau_t] + e_{it}$$

where $(Total\ Debt/TA)_{it}$ is the dependent variable measuring corporate borrowing. CIC_i is an indicator variable that takes the value of one for treated firms and zero otherwise. $Post_t$ is a categorical variable that takes the value of one for years following and including the year of introduction of the SARFAESI Act, i.e., 2002 (SA), and zero otherwise. $High\ Tang$ is a categorical variable that takes a value of one for the firms falling in the upper tercile based on a three year average of firm tangibility before the SARFAESI Act, i.e., from 1999 to 2001 and zero for the firms falling in the lower tercile. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Operating Profitability,* and MB. γ_i controls for the firm fixed effect. The interaction term $[\eta_j \times \tau_t]$ controls for time-variant industry-level shocks. e_{it} is the error term. Standard errors, clustered at the firm level, are reported in parentheses. *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. The sample period in the model [1] is from 1996 to 2007. For models [2] to [4], I report DiD for shorter periods. Model [5] represents the sample period of Vig (2013). Source: CMIE database.

	[1]	[2]	[3]	[4]	[5]
	[SA ± 6 year]	[SA ±5 year]	[SA ± 4year]	[SA ± 3 year]	1997-2004
DiD-Tangibility-Tercile	-0.030***	-0.038***	-0.038***	-0.032***	-0.030***
$[High\ Tang_i \times Post_t]$	(0.0072)	(0.0073)	(0.0072)	(0.0069)	(0.0074)
Size	0.031***	0.025***	0.008	-0.004	0.005
	(0.0059)	(0.0070)	(0.0080)	(0.0099)	(0.0083)
Operating Profitability	-0.005***	-0.005***	-0.004**	-0.001	-0.006***
	(0.0018)	(0.0019)	(0.0018)	(0.0021)	(0.0022)
MB	0.009***	0.008***	0.007***	0.006***	0.008***
	(0.0013)	(0.0014)	(0.0014)	(0.0016)	(0.0015)
Post × Size	-0.006***	-0.005**	-0.004*	-0.002	-0.003
	(0.0023)	(0.0023)	(0.0022)	(0.0021)	(0.0023)
Post × Operating Profitability	-0.006***	-0.005***	-0.006***	-0.006***	-0.005***
	(0.0013)	(0.0014)	(0.0015)	(0.0015)	(0.0017)
Post × MB	-0.004**	-0.002	0.000	0.002	0.000
	(0.0016)	(0.0017)	(0.0018)	(0.0019)	(0.0020)
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry FE ×Year FE	Yes	Yes	Yes	Yes	Yes
R^2 (Adj.)	0.74	0.77	0.81	0.84	0.80
No. of Obs.	16,716	13,431	10,405	7,720	11,066

Chapter 5

Empirical evidence on corporate investment decisions.

Abstract

Using Indian monsoon data, I study whether firms in the rain-sensitive sectors differentially time their investments to generate value in response to diverse abnormal rainfall conditions. I find that rain-sensitive firms suffer a significant decline in their market values in the immediate aftermath of extreme rainfall conditions. Consistent with investment timing economic argument, results show that the follow-up investment response by rain-sensitive firms depends on the nature of extreme rainfall conditions. While rain-sensitive firms increase their investments following *excess* rainfall conditions, the affected firms shrink investments in the aftermath of *deficit* rainfall periods. However, in terms of market-based value implications, all rain-sensitive firms regain their lost market values following both the investment strategies.

5. Chapter 5: Empirical evidence on corporate investment decisions

5.1 Introduction

Following research questions were posed in Subsection 1.2.2 on the corporate investment decisions, i.e.,

(iv) *What are the firm valuation effects in the immediate aftermath of extreme rainfall departures, particularly for firms whose operations are highly sensitive to rainfall conditions?*

(v) What are the corporate investment strategies of rain-sensitive firms following extreme rainfall departures?

(vi) What is the market response to corporate investment decisions induced by extreme rainfall departures of rain-sensitive firms?

With respect to the afore stated questions, testable hypothesis H_2, H_3 *and* H_4 were developed in Subsection 2.2.3. In this chapter, I conduct a detailed empirical investigation to test the hypothesis H_2, H_3 *and* H_4 restated below

H_2*: Following excess (deficit) rainfall conditions, firms belonging to excess (deficit) rain-sensitive industries experience immediate decline in market based firm value.*

H_3*: Following excess (deficit) rainfall conditions, firms belonging to excess rain-sensitive (deficit rain-sensitive) industries increase (decrease) their investments.*

H_4*: Increase (decrease) in investments following excess (deficit) rainfall conditions is associated with higher firm value.*

I test these hypotheses by exploiting unique exogenous variations in the monsoon rainfall conditions in India. Since the growing episodes of *rainfall departures* generate excessive economic uncertainties for the corporate sector, my study draws on two prominent economic views linking uncertainties and investments. The two opposing economic views of real-options approach that predicts that firms should reduce the increase their investments and alternative risk-shifting approach that predicts firms should increase their current investments does not satisfactorily explain why firms must take differential investment decisions in the wake of different *rainfall departure* conditions.

I use the unifying Salience theory, which predicts investment policies based on differential past experiences encountered by the managers to explain the possible heterogeneous investment decisions taken under the two extreme *rainfall departures* (*excess* and *deficit*). The two different *rainfall departure* conditions may lead to different saliency experiences. Hence, this implies that rain-sensitive firms' managers, who are differentially salient to heterogeneous *rainfall departure* conditions, may time their investments differently in the immediate aftermath of *rainfall departures*.

Drawing on extensive literature (outlined in Section 2.2), I first classify industries into sectors that are highly sensitive to *rainfall departures*. I consider firms belonging to the rain-sensitive sectors as the treated group and the remaining firms as the control group. The treated group is further classified into *excess* rainfall sensitive and *deficit* rainfall sensitive firms, depending on whether firms' operational performance would be more negatively affected by *excess* and *deficit* conditions, respectively. I estimate *rainfall departures,* using the rainfall deviation data provided by the Indian Meteorological Department (IMD), as exogenous shocks to capture the effects of extreme *rainfall departures* on the firm's investment policies and firm value. Due to the complexity of the *rainfall departures* data, I use different techniques, including methodological approach similar to difference-in-differences (*DiD*), to establish causal links between *rainfall departures* and corporate investment policy decisions.

In this chapter, I discuss the main variables used for the empirical study in Section 5.2 followed by a host of empirical investigations to test the hypotheses H_2, H_3 and H_4 in Section 5.3 and a conclusion to the chapter in Section 5.4.

5.2 Data

5.2.1 Investment and firm value measures

Drawing on the existing literature, I use the ratio of the firm's actual capital expenditure to the stock of long-term assets (property, plant, and equipment) (*Capex)* as the main measure of corporate investments (*Investment*) (Black et al., 2014; Holderness, 2009; Villalonga and Amit, 2006). Following the industry convention, I calculate the actual capital expenditure of the firm as the sum of the change in property, plant, and equipment (ΔPP&E) and current depreciation. Besides, for robustness checks, I consider two alternative measures of *Investment*. One, I use the sum of the firm's PP&E and research and development (R&D) spending for the year scaled by the lagged book value of total assets (*Capex_RD*) (Bhandari and Javakhadze, 2017). Two, following Koirala et al. (2018) I take the ratio of year-on-year changes in long-term tangible fixed assets, reflecting the size of tangible investments (*Capex_LT*).

In terms of firm value (*Firm_value*), I use market-to-book value (*MB*) of a firm's equity (Baker and Wurgler, 2002; Koirala et al., 2018) as the main proxy in my study. To capture the impact of *rainfall departure* on *Firm_value,* I use *MB* calculated both at the end of the monsoon season, i.e., the September quarter (Q2), as well as at the end of the fiscal year (Q4). I further use Tobin's q (*Tobin's q*), defined as the sum of the book value of debt, preferred stock and market value of equity as a ratio of the book value of assets, as an alternative measure of *Firm_value* to conduct robustness checks (Desai and Dharmapala, 2009).

5.2.2 Control variables

In line with the existing studies, I take account of a number of variables that could also explain the cross-sectional and temporal changes in my dependent variables. Size of a firm can play a key role in a firm's ability and appetite to make investment decisions (Whited and Wu, 2006). I control for size by taking the natural logarithm of total assets (*Size*). I expect a positive relation between *Size* and investments. The literature, however, offers an inconclusive prediction on the association between *Size* and firm value. On the one hand, *Size* can suggest firm visibility and maturity, implying a positive association between the two (Koirala et al., 2018). In contrast, to the extent *MB* (the proxy of firm value) gauges future growth expectation, the *Size* could relate negatively with the *MB.*

The firm's investment decisions are directly influenced by the firm's capital structure (Almeida and Campello, 2007; Campello et al., 2010). I control for leverage (*Leverage*) by taking the ratio of the book value of total debt to equity. I expect leverage to be negatively associated with investments because the creditors of the firm, in enjoying a fiduciary stake and concave payoff, have interests that are different from those of shareholders when it comes to a firm's risky investment appetite (Acharya et al., 2011). To the extent that *Leverage* measures a firm's access to external financing, higher leverage should be positively associated with a firm's valuation (Beck and Demirgüç-Kunt, 2008). Notwithstanding, higher leverage could invite more debtholder-shareholder agency issues, increasing investment conservatism and hurting firm performance (Acharya et al., 2011).

Liquidity is shown to influence corporate investments as a hedge against future possible credit shocks (Koirala et al., 2018). Thus, firms that expect financing uncertainty can build up liquidity in the form of higher cash reserves or liquid assets. Following Bargeron et al. (2010), I control for liquidity (*Liquidity)* measured as total cash holdings, which is the sum of year-end cash and short-term securities, scaled by total sales. Similarly, liquidity is factored in the cost of equity and hence should positively affect firm value (Lang et al., 2012).

Further, dominant shareholders might have authority and incentives to reduce the discretion enjoyed by managers to implement conservative investment policies (Shleifer and Vishny, 1986). In the context of India, promoters being insiders and dominant shareholders of the firm and potentially having a controlling stake, can therefore negatively affect the level of corporate investments (John et al., 2008). Further concentrated ownership could improve firm performance by better aligning insiders' and outsiders' interests (Singal and Singal, 2011). Alternatively, increased firm's opacity associated with more closely held firms could increase information asymmetry, thereby deterring firm performance (Anderson et al., 2009). I, therefore, control for ownership concentration (*OwnCon*) as the proportion of total shares held by promoters (Koirala et al., 2018). Finally, I also control the ratio of market-to-book value of its equity (*MB*). Following Maccini and Yang (2009), I include a linear time trend (*Time*) to absorb any long-running trends in *rainfall departures*. *Time* is a continuous variable starting from the value of 1 for the first year of the sample, i.e., 1 for the year 2001, 2 for 2002, and so on. All control variables are winsorized at 2% and 98% and lagged by one year (Bena et al., 2017).

5.2.3 Normal and rainfall departure periods

For the empirical setting, I have two groups of rainfall condition periods. The first is the *normal* rainfall condition and the second the *rainfall departure* condition.

For this study, I sort the rainfall deviation data obtained from the IMD into quintiles and classify the *rainfall departure* in any year falling in the uppermost quintile, i.e., above 20.1% *rainfall departure,* as excess rainfall (*excess*) and the lowermost quintile as deficit rainfall (*deficit*), i.e., below -23% *rainfall departure.* The mid-quintile (i.e., quintile three) observations are falling in the *rainfall departure* range of -7.5% to 3%, are identified as normal rainfall (*normal*). Every year, each of the 32 rainfall subdivisions is exposed to either *excess, deficit* or *normal* rainfall conditions. For each subdivision and year combination, I define *RDyr* as a dummy variable taking the value of one for the panel observations belonging to either the *excess* or *deficit* rainfall years and zero for the panel observations belonging to the years where rainfall is *normal*.[40]

[40] Econometrically, the *RDyr* dummy variable not only captures the *rainfall departure* but also the location-specific effect of the firm. Since I interact *RDyr* with the dummy variable *treated* in my empirical set-up (in Section 5.3), the variable *RDyr* ensures that I am only using firms in the same subdivision as my *control* firms and any subdivision-specific differences in spending/investments are also taken into consideration.

5.2.4 Treated and control firms

In their technical report to the national climate assessment, Lackstrom et al. (2012) outline how climate-sensitive industries use climate-related information, such climatology, temperature, precipitation, sea-level rise, extreme events, hydrology, weather forecasts, and climate change, to take operational/annual/seasonal/long-term decisions in business. *Rainfall departures* (*excess* or *deficit*) can have a differential impact on different industries. I identify rain-sensitive industries from various empirical studies on different climate-sensitive sectors from the literature and news articles (see Subsection 2.2.2). As some sectors are sensitive to *excess* and others to *deficit* rainfall conditions, I construct two pairs of treated and control groups. *Treated* is a categorical variable that takes a value of one for the firms belonging to *excess* rain-sensitive sectors or *deficit* rain-sensitive and zero for the control group of firms that are insensitive or least sensitive to rainfall conditions.

When testing for the impact of *excess* rainfall conditions, *excess* rain-sensitive sectors include firms belonging to the agricultural machinery, agriculture & processed food, air transport services, tourism, hotels & restaurants, the auto sector, construction & allied activities, courier services, transport services, electricity generation & transmission, fertilizers & pesticides, and mining & quarrying. All other firms belonging to other sectors are control group firms. Similarly, when testing for the impact of *deficit* rainfall conditions, *deficit* rain-sensitive sectors include firms belonging to the agricultural machinery, agriculture & processed food, auto sector, electricity generation & transmission, fertilizers & pesticides and mining & quarrying sectors. All other firms belonging to other sectors are control group firms. In the *deficit* treatment analysis, I do not include firms belonging to air transport services, tourism, hotels & restaurants, construction & allied activities, courier services, transport services sectors in the subsample of the study as these are purely *excess* rain-sensitive sectors and including them in the *deficit* analysis subsample study may interfere with the empirical outcomes.

As noted above, I have a set of *normal* and *rainfall departure* periods, and a group of rain-sensitive (*treated*) firms and another group of non-sensitive (*control*) firms. I use for my empirical identification, a shock-based set-up similar to *DiD*.

5.3 Empirical Results

5.3.1 Descriptive statistics

Panel A of Table 5-1 reports the descriptive statistic summary of *rainfall departure, Capex, Size, Leverage, Liquidity, OwnCon and MB* for the sample period 2001 to 2017. It can be observed that the median value of *OwnCon* is 36.86%, which indicates a large promoter shareholding in Indian firms. This also reinforces the dominant promoter ownership influence on investment decision arguments (Shleifer and Vishny, 1986) as discussed in Subsection 5.2.2. Also, the average *Capex* indicates that year-on-year capital expenditure is around 24%. *Rainfall departure* is the percentage deviation of the monsoon rainfall from the long-term normal mean rainfall, as obtained from the IMD. It is observed that the variation in *rainfall departure* has a standard deviation of 24.6% with the maximum *deficit rainfall departure* of an extreme of -73.7% and maximum *excess rainfall departure* of 126%. This extreme volatility in *rainfall departure* provides us with an ideal experimental set-up to undertake my investigations within the Indian geographic context.

[Table 5-1 about here]

Panel B of Table 5-1 indicates that I have 13,804 observations that belong to *excess treatment*, 6,914 belonging to *deficit treatment* and 57,924 *control* group observations in the overall sample period. Panel C of Table 5-1 reports the differences in the dependent and independent variables among the *treated* firms (*excess* and *deficit* rain-sensitive) with the *control* firms (firms that are not sensitive to rainfall) for the overall sample. It can be observed that there is a significant difference in the *Capex* among the *treated* and *control* group firms, while the difference in *MB* is significant for *excess* rain-sensitive *treated* firms.

Table 5-2 Panel A shows the *rainfall departure* during the monsoon season months of June-July-August-September in 32 rainfall subdivisions of India (listed in Panel B) from years 2000 to 2017. While *deficit rainfall departures* in the Table 5-2 matrix, as indicated by red cells, are below -15%, *excess rainfall departures* above 15% are indicated by blue cells. Other uncoloured cells indicate *normal* rainfall conditions. Also, for both *excess* and *deficit*, the intensity of every 5% additional deviation is as indicated with different colour codes of red and blue, as shown in the table legend. Table 5-2 shows the complexity of the *rainfall departure* data in India. My study uses 32 subdivision levels of *rainfall departure* for each year, instead of aggregating a single *rainfall departure* value per year for the country. The intensification of *rainfall departure* is varied across years and subdivisions, making *rainfall departure* a good exogenous event.

[Table 5-2 about here]

5.3.2 Rainfall departure and immediate impact on firm value

As noted earlier, the monsoon period (June-September) receives almost 85% of the total rainfall in India. Generally, by the end of September (Q2 of the fiscal year), it becomes apparent whether rainfall conditions are *deficit, excess* or *normal*. As such, I begin the analysis by examining the impact of *rainfall departures* on firm value (proxied by *MB*) at the end of quarter two (Q2) and quarter four (Q4) of the same fiscal year.[41] Accordingly, I run the following specification to test hypothesis H_2:

$$Firm\_value_{it} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it} \quad (5.1)$$

where $Firm\_value_{it}$ is *MB,* calculated at the end of the September quarter (Q2) or at the end of the fiscal year, i.e., fourth quarter (Q4). $RDyr$ is a dummy variable which takes the value of one for years with *rainfall departure* (either *excess* or *deficit* depending on the specification) and zeroes for *normal* years. *Treated* is a dummy variable as defined in Subsection 5.2.4. Thus, the interaction term ($RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}$) is the main variable of interest. $\boldsymbol{X_{it}}$ is a vector of control variables that includes *Size, Leverage, Liquidity* and *OwnCon* as defined in Subsection 5.2.2*,* all lagged by one fiscal year.[42] The *Time* variable absorbs long-running trends in rainfall conditions. γ_i controls for firm fixed effects and e_{it} is the error term.[43]

Table 5-3 shows that under both *excess* and *deficit* rainfall conditions, I observe a significant decline in *MB* both in Q2 and Q4. The firm value (*MB*) for *excess (deficit)*

[41] Quarter 4 (Q4) is the end of the fiscal year i.e., 31 March of the next calendar year.
[42] I take the values at the end of the March quarter of the previous fiscal year. The fiscal year in India begins on 1 April and ends on 31 March of the next calendar year.
[43] Since *rainfall departure* is time varying, I do not include time fixed effects because by doing so the temporal variations in the rainfall departure are neutralised. Instead, to control for any long run trends in rainfall conditions I introduce the *Time* control variable in my specification.

rain-sensitive firms reduces in the range of 10% to 17.7% (-1.7% to 5.8%) in the immediate aftermath of *excess (deficit)* rainfall. The fall in firm value is greater in the case of *excess* relative to *deficit* conditions as well as in Q4 relative to Q2, indicating that the market fully captures the extent of the damage only after the end of the monsoon period. These results support the hypothesis H_2.

[Table 5-3 about here]

5.3.3 Rainfall departure and investments

As noted above, my main identification strategy resembles a *DiD* approach, where firms (treated & control) are exposed each year to either *excess*, *deficit* or *normal* rainfall conditions depending on which of the 32 rainfall subdivisions the firm is located in. I test the hypothesis H_3 separately on *excess* and *deficit* rainfall subsamples using the following general specification:

$$Investment_{it} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it} \quad (5.2)$$

In specification (5.2), $Investment_{it}$ is the investment proxy (*Capex, Capex_RD* or *Capex_LT)* for firm *i* in year *t*. The interaction term $(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}})$ is the main variable of interest. $\boldsymbol{X_{it-1}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon* and *MB* all lagged by one year. γ_i controls for firm fixed effects and e_{it} is the error term. All other variables are as defined for specification (5.1).

I first present the results of univariate *DiD* in Panel A of Table 5-4. I find a significant difference in *Capex* between the treated and control group firms following *excess* and *deficit rainfall departure,* which is statistically significant at a 5% significance level. The results indicate that *excess* (*deficit*) rain-sensitive firms increase (decrease) their *Capex* following the *excess* (*deficit*) *rainfall departure* by 2.6% (3.3%) compared to the control group firms.

I present the results of the multivariate specification (5.2) in Panel B of Table 5-4. Consistent with the results in Panel A, I find that the coefficients of the *Interaction* term are significantly positive for *excess* and significantly negative for *deficit* rainfall conditions. These results indicate that following the *excess rainfall departure*, treated firms increase their *Capex* in the range of 3.4% to 4.8% more than the *control* group firms. Conversely, in the deficit *rainfall departure*, treated firms reduce their *Capex* on average by 3.1% compared to *control* group firms.[44] These results provide initial evidence in support of hypothesis H_3.

[Table 5-4 about here]

I present the results of the robustness test for specification (5.2) in Table 5-5 using alternative measures of $Investment_{it}$ which are *Capex_RD* and *Capex_LT*. I observe that the results using these alternative *Investment* proxies (capital expenditure with R&D and change in long-term tangible assets) are consistent with the general findings of Table 5-4. My results show that in *excess* (*deficit*) *rainfall departure* treated firms increase (decrease) their investments in the range of 3.5% to 4.5% (3.6% to 6%) compared to *control* group firms. These robustness results provide further evidence in support of hypothesis H_3.

[Table 5-5 about here]

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[44] Due to Subsection 5.3.9, I also conduct a robustness test for specification (5.2) by excluding the positively affected rain-sensitive industries. The results are presented in Chapter 3 Appendix Table A5-1 and are consistent with the general findings.

5.3.4 Rainfall departure and investments: using sequential one-year pair observations

One concern with my analysis is that the experimental DiD set-up in Subsection 5.3.3 may have a limitation in the sense that a cleaner DiD set-up would require a few *normal* years to be followed by a continuous period of either *excess* or *deficit* periods. However, as evident from Table 5-2, each subdivision every year has an equal probability of experiencing all three types of rainfall conditions (*excess, normal* or *deficit*). In order to alleviate this concern, I generate pairs of years for each subdivision in which the *normal* periods are sequentially followed by *rainfall departure* periods.

Empirically, I subdivide the *departure rainfall periods* into *excess* (as presented in Table 5-6 Panel A), and *deficit* (as presented in Table 5-6 Panel B) *rainfall departure* years, both preceded by *normal* rainfall years. Following this sequential classification, I re-run specification (5.2) by defining $RDyr$ as an indicator variable that takes the value of one for years with *excess* or *deficit rainfall departure* for a specific subdivision and zeroes for preceding years which receive *normal* rainfall. Thus, for each subdivision, I code the *normal* years as pre-shock years and *excess/deficit rainfall departure* years as post-shock years to run the *DiD* analysis.

I present the results of this analysis in Panel C of Table 5-6. The DiD *Interaction* coefficient is positive and significant at 1% in models [1], [2] and [3] with the size of the coefficient indicating that on average *excess*-rain-sensitive firms increase their *Capex* in the range of 10.4% to 14.3% compared to the control group firms in *excess rainfall departure*. Further, in support of hypothesis H_3, the DiD

Interaction coefficient is significantly negative in models [4], [5] and [6] with the size of the coefficient indicating *deficit*-rain-sensitive firms decreasing their investments in the range of 5.7% to 7.7% in *deficit rainfall departure*.

[Table 5-6 about here]

5.3.5 Rainfall departure sensitivity analysis

Even though the results in Subsections 5.3.3 and 5.3.4 indicate a strong positive (negative) relationship between *Capex* and *excess (deficit) rainfall departure*, it would be interesting to observe if this pattern holds at different levels of *rainfall departure.* I conduct a sensitivity analysis of specification (5.2) and redefine the $RDyr$ dummy variable as having a value of one in the years with a 1% incremental *rainfall departure* from 15% (-15%) and greater, and zero for *rainfall departure* in the range of (-15% to 15%). The results of this sensitivity analysis are presented in Table 5-7 for both *excess* and *deficit rainfall departures*.

In Table 5-7, I observe that the coefficient of the *interaction* term is positive at each *excess rainfall departure* increment by 1%. However, it is significant when *excess rainfall departure* is 20% or more in the range of 4.5% to 7.7%. For *deficit rainfall departure* conditions, the coefficient of the interaction term is significant for *rainfall departure* below -18% in the range of -4.3% to -10%. The results of rainfall sensitivity analysis support my investment increase (decrease) conjecture during *excess* (*deficit)* conditions. Also, the 20% (-18%) cut-off aligns with the IMD's ±19% rainfall deviation, as specified in footnote 26.

[Table 3-7 about here]

5.3.6 Impact persistence

Given the significantly positive impact of rainfall departure on Investment, I further investigate the persistence of the rainfall departure over time. For this, I run specification (3) for four different scenarios, where the dummy variable *RDyr* takes the value of one if the excess (deficit) rainfall departure is 15% and greater, 20% and greater, 25% and greater, and 30% and greater, and the value of zero otherwise.

$$Investment_{it} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \sum_{n=1}^{5} \lambda_n(Rain_{\boldsymbol{t-n}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it} \quad (5.3)$$

where, $Rain_{\boldsymbol{t-n}}$ is the percentage of *rainfall departure* (*excess / deficit*) in the lagged up to 5 years. All other variables in these specifications are as defined for specification (5.2). The results of specification (5.3) are reported in Table 5-8.

[Table 5-8 about here]

It can be observed that following *excess rainfall departure*, *Capex* significantly increases in the *excess*-rain-sensitive firms. The *Interaction* coefficient indicates that the impact of *excess rainfall departure* on *Investment* is positive and highly significant, in line with the general results in Tables 5-4 and 5-7, further supporting H_3. Additionally, it can be observed that the impact of *excess rainfall departure* on *Investment* seems to persist for up to three years following the *rainfall departure* – specifically when the rainfall departure is in the range of 20-25% and above. However, the persistence of *deficit rainfall departure* seems to be weak and results suggest that it loses its significance beyond one year.

5.3.7 In the path of rainfall departure

Some empirical studies using extreme weather events as exogenous shocks, classifying firms located in the geographic regions affected by extreme weather as treated firms. For instance, Aretz et al. (2018) classify firms located in a county struck by hurricanes as treated group firms, whereas Dessaint and Matray (2017) classify firms located in the nearest neighbouring county as treated firms. I use this classification method to identify an alternative treated and control group of firms. I re-generate pairs of years beginning from 2001 up to 2017 such that in each pair the first year receives *normal* rainfall and the second year receives either *excess* or *deficit* rainfall. I then redefine $RDyr$ as a dummy variable that takes the value of one for the second year (year of *rain departure*) and zero for the first year (pre-*rain departure* year). Further, I classify all firms located in the geographic subdivisions which experience *excess* (*deficit*) *rainfall departure* in the second year (irrespective of their rain-sensitivity) as treated ($geo\_treated$) taking the value of one. Firms in the subdivisions that receive *normal* rainfall in both years for the same year pairs are classified as *controls,* i.e., $geo\_treated$ with a value of zero. I run the following specification for *excess* and *deficit* subsamples separately.

$$Investment_{it} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times geo\_treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it} \quad (5.4)$$

In specification (5.4) ($RDyr_{\boldsymbol{t}} \times geo\_treated_{\boldsymbol{i}}$) is a dummy *Interaction* term which is the main variable of interest (represented as DiD_{Geo} hereafter). All other variables are as defined for specification (5.2). γ_i controls for the industry fixed effects and e_{it} is the error term. I present the results of specification (5.4) in Table 5-9 for each pair of years. I also provide details of geographic subdivisions experiencing *excess* and *deficit rainfall departure* considered for generating $geo\_treated$ group firms, and geographic subdivisions which receive *normal* rainfall. Table 5-9 shows that barring a few years; the DiD_{Geo} estimation does not yield any significant result for most of the year pairs. This may perhaps indicate that the classification of $geo\_treated$ based on the location of the firm in affected vs non-affected *rainfall departure* subdivisions does not properly capture the impact of rainfall extremities on corporate investment decisions. Furthermore, this also indicates that not all firms located in the geographic location exposed to extreme rainfall conditions are affected in the same way. These results thus provide support to the treatment classification based on rainfall sensitivity of the firms.

[Table 5-9 about here]

5.3.8 Rainfall departure, investment timing and firm value

So far, I have shown that firms experience a negative impact on their market value following episodes of *rainfall departures.* I also provide empirical evidence in support of hypothesis H_3 that firms' investment policies following *rainfall departures* depend on the nature of such departures (*excess* and *deficit*). I next examine whether such differential investment strategies are value relevant. I use the more standard approach to unveil the effects of investment on firm value by repeating the baseline specification (5.2) and simply replacing the main dependent variable with *MB* and *Tobin's q*. This equates to an intention-to-treat (ITT) specification, wherein, through the "treatment on *Capex*" firm value is ultimately affected.[45] To this end, I perform empirical tests using the following specification.

$$Firm\_value_{it+1} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t}}.\boldsymbol{\delta} + \tau\,.Time + \gamma_i + e_{it} \quad (5.5)$$

I use two different proxies of $Firm\_value_{it+1}$ for the firm '*i*' for year '*t+1*': (i) *MB* and (ii) Tobin's q (*Tobin's q*). My main variable of interest is the $(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}})$ *Interaction* term. $\boldsymbol{X_{it}}$ is a vector of control variables *Size, Leverage, Liquidity* and *OwnCon.* All other variables are defined under specification (5.2). I present the results of specification (5.5) using *MB* in Table 5-10 and using *Tobin's q* in Table 5-11.

[Table 5-10 about here]

[Table 5-11 about here]

As shown in Tables 5-10 and 5-11, it can be observed that the value of the rain-sensitive firms increases significantly in the lead years following *rainfall departure*. For instance, using *Tobin's q* as a proxy (Table 5-11), it can be observed that in the year following *excess rainfall departure*, the market value of *excess*-rain-sensitive firms increases in the range of 14% to 16.5% when compared to *control* group firms (significant at the 1% significance level). Further, I also find that in the year following *deficit rainfall departure*, market values of *deficit* rain-sensitive firms increase in the range of 6% to 17.3% when compared to *control* group firms (significant at the 5% significance level), in support of hypothesis H_4.

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[45] Thapa et al (2020) use a similar approach to unveil effects of borrowing on capital expenditure, return on assets (*ROA*) and *MB*. Further, Belloni et al. (2017), Berger et al. (2019) and Kitagawa and Tetenov (2018) among others provide more details on intention to treat (ITT) method for establishing causal inference.

To further establish that the increase in market valuation in *excess* rain-sensitive and *deficit* rain-sensitive firms is due to the investment-timing strategy adopted by managers, i.e., increase investments in *excess* and decrease investments in *deficit* conditions, I conduct subsample analysis using only rain-sensitive firms. I conduct this test using two models.

In the first model, I run specification (5.5) on a subsample of *excess* and *deficit* rain-sensitive firms, in which the rain-sensitive firms are classified into treated and control groups based on whether the *Capex_LT* was positive or negative in the *rainfall departure* year. Thus, in the specification (5.5), while analyzing *excess* rain-sensitive firms I define *treated* as a categorical variable that takes a value of one for firms with capital expenditure >0 and zero otherwise. Similarly, while analyzing *deficit* rain-sensitive firms, I define *treated* as a categorical variable that takes a value of one for firms with capital expenditure <0 and zero otherwise. All other variables are as defined for specification (5.5).

In the second model, I run specification (5.5) using a subsample of *excess* and *deficit* rain-sensitive firms, in which the rain-sensitive firms are classified into treated and control groups based on the tercile of *Capex* in the *rainfall departure* year. Accordingly, in the specification (5.5) I define *treated* as a categorical variable that takes a value of one for the *excess (deficit)* rain-sensitive firms with capital expenditure in the upper (lower) tercile and zero for the lower (upper) tercile. All other variables are as defined for specification (5.5).

I present the results of the two models in Table 5-12. For both *excess* rain-sensitive and *deficit* rain-sensitive firms within the group subsample analysis (in both positive/negative & tercile-based models), I find a significant increase in market value for treated firms in the lead period. The market value of *excess* rain-sensitive firms that have positive *Capex_LT* or whose *Capex* falls in the upper tercile increases in the range of 12.8% to 20.9% (1% significance level) when compared to *excess* rain-sensitive firms that have negative *Capex_LT* or whose *Capex* falls in the lower tercile. Similarly, the value of *deficit* rain-sensitive firms that have negative *Capex_LT* or whose *Capex* falls in the lower tercile increases in the range of 7% to 25.4% (1% significance level) when compared to *deficit* rain-sensitive firms that have positive *Capex_LT* or whose *Capex* falls in the upper tercile. Thus, the results of Table 5-12 provide further strong evidence in support of hypothesis H_4 and the argument that investment-timing is value relevant.

[Table 5-12 about here]

5.3.9 Positively rain-sensitive industries

So far, I have focused mostly on rain-sensitive industries, i.e., industries which are negatively affected by extreme *rainfall departures*. However, the literature also provides support for the view that some industries positively benefit in the years following *excess rainfall departures*. Industries such as the construction, fertilizer & pesticides, health & pharmaceuticals and timber are more likely to experience a positive impact from increased sales and revenue growth in the years following *excess rainfall departure* (Hsiang, 2010).

For construction companies, *excess rainfall departure* also provides opportunities for higher sales growth in terms of rebuilding damaged infrastructure using new designs and technology (Damtoft et al., 2008; Tatum, 1987). Further, other studies provide evidence of the impact of climate change on the health sector, translating into higher demand for medicines and medical services due to water-borne diseases in the aftermath of *excess rainfall departure* (McMichael et al., 2009; WHO, 2007) thus benefitting drugs & pharmaceuticals industries and health services. Chemical industries, specifically the fertilizers and pesticides sectors, experience increased usage by farmers (Chang and Brattlof, 2015) due to the deterioration of soil quality through soil erosion resulting from *excess* rainfall and temperature conditions (Larsbo et al., 2016), and increased rise in rodents, pests and crop diseases (Chang and Brattlof, 2015). Timber markets are directly impacted by climate change. While earlier studies show that the climate changes have a negative impact on forestry thus impacting timber production (Cline, 1992), recent studies provide a more optimistic view of increased forest productivity with climate change (Mendelsohn et al., 2012; Sohngen and Sedjo, 2005). Using a dynamic economic model Sohngen and Mendelsohn (1998) show that increase in atmospheric temperature is beneficial for timber markets, increasing the timber supply; these findings are supported by Sohngen et al. (2001) in their world timber market study.

As an extended investigation, I test whether total sales and returns of positively rain-sensitive industries increase in the post *excess rainfall departure* years. I conduct a t-test on the mean values of four variables of interest: *Sales, Sales/total assets, EBITDA/total assets, PAT/total assets* before and after the *excess rainfall departure* (Pankratz, 2018; Singh, 1986). The results of the t-test are presented in Table 5-13. In support of the existing literature, I find that the post *excess rainfall departure* sales among positively rain-sensitive industries increase by INR 2,971.91 million (significant at the 5% significance level). Similarly, I find that *EBITDA/total assets* and *PAT/total assets,* increase significantly by 3.12 and 0.9676 times, respectively.

[Table 5-13 about here]

5.4 Conclusion

Recent macroeconomic statistics indicate the significant impact of extreme climatic conditions on economic activities. As macroeconomic outputs are directly associated with the corporate sector, I examine the economic impact of extreme climatic conditions, specifically rainfall deviation from its expected normal (*rainfall departure)*, on corporate investments and valuations. Using the extreme *rainfall departure* of *excess* or *deficit* conditions, I investigate whether corporate managers time their investment strategies to mitigate the negative effects of extreme rainfall conditions and if these investment strategies carry value implications.

While one strand of the literature argues that in the wake of heightened uncertainties caused by extreme *rainfall departure*, firms should reduce their current investments, the other school contends that firms facing such conditions should display 'risk-shifting' behaviour and therefore increase investments. Given the two opposing views on investments, I rely on the accommodating Salience theory, which argues that two different *rainfall departure* conditions (*excess* and *deficit*) may lead to different saliency experiences and hence different investment-timing (strategy) responses.

Using Indian monsoon data, my results show that the market-based valuations of rain-sensitive firms significantly decline in the immediate aftermath of extreme rainfall deviations. In terms of the cross-sectional variance of extreme rainfall conditions and consistent with differential investment timing economic argument, the results show that relative to *normal* rainfall conditions, affected rain-sensitive firms seem to increase their investments following *excess* rainfall periods. In contrast, results indicate a reduction in investments following *deficit* rainfall periods. However, in both cases, firms seem to regain the lost market-based values in the lead periods of extreme rainfall deviations.

Table 5-1 Descriptive statistics

Panel A reports the average of variables *rain departure, Size, Leverage, Liquidity, OwnCon, MB, Capex,* and *Tobin's q*. Where *rain departure* is the percentage deviation of the monsoon rainfall from the long-term normal mean rainfall, *Size* is the natural logarithm of the total assets, *Leverage* is the debt to equity ratio, *Liquidity* is the cash holdings scaled by total assets, *OwnCon* is the percentage of promoter ownership, *MB* represents the ratio of the market value of shareholders' equity to its book value, *Capex* is the ratio of actual capital expenditure to long-term assets, and *Tobin's q* is the sum of book value of debt, preferred stock and market value of equity as a ratio of the book value of assets. The total sample period ranges from 2001 to 2017. Source: IMD and CMIE databases.

Variable	No. of Obs.	Mean	Std. Dev.	Minimum	Median	Maximum
Rainfall departure	71,728	-1.41	24.6	-73.7	-0.7	126
Capex	71,728	0.24	0.48	-0.31	0.07	2.19
Size	71,552	6.21	2.34	0.26	6.12	12.38
Leverage	69,462	3.11	10.71	0	0.71	107.58
Liquidity	55,340	0.11	0.4	0	0.01	3
OwnCon	71,728	33.46	28.5	0	36.86	89.02
MB	43,152	19.05	40.26	-0.19	6.6	243.62

Panel B reports the number of treatment group observations for rainfall departure for the sample period

Rainfall departure	Treatment	Control	Total Observations
Excess	13,804	57,924	71,728
Deficit	6,914	57,924	64,838

Panel C reports the differences in variables *control* firms with both *excess*-rain-sensitive *treated* firms and *deficit*-rain-sensitive *treated* firms for the entire sample period.

	excess rain-sensitive firms					*deficit* rain-sensitive firms			
Variable Obs.	*control* firms	*treated firms*	Diff	t-stat	p-value	*treated firms*	Diff	t-stat	p-value
Capex	0.1625 (57,924)	0.1750 (13,804)	0.0125	2.2997	0.0215	0.1290 (6914)	-0.033	-4.6391	0.0000
Size	6.1227 (57,772)	6.5522 (13,780)	0.4295	19.4097	0.0000	6.4315 (6895)	0.3089	10.4174	0.0000
Leverage	2.9920 (56,053)	3.5954 (13,409)	0.6035	5.8629	0.0000	4.5045 (6734)	1.5125	10.7729	0.0000
Liquidity	0.1115 (44,413)	0.1178 (10,927)	0.0063	1.4714	0.1412	0.0721 (5445)	-0.039	-6.9838	0.0000
OwnCon	48.8299 (39,344)	52.0176 (9201)	3.1877	13.6194	0.0000	51.5729 (4479)	2.7431	8.6176	0.0000
MB	20.9330 (36,637)	22.3329 (8502)	1.3999	2.5610	0.0104	21.2190 (4103)	0.2860	0.3858	0.6997

Table 5-2 Rainfall departure and rainfall subdivisions of India

Table 2 Panel A shows the *rainfall departure* from the normal expected rainfall during the monsoon season months of June-July-August-September in 32 rainfall subdivisions of India from years 2000 to 2017. While *deficit rainfall departure* in the matrix indicated by red cells is below -15%, *excess* rain with departure above 15% is indicated by blue cells. Other uncoloured cells indicate *normal* rainfall condition. Each *rainfall departure* is then indicated with different shades of red and blue with a 5% range as indicated in the legend. Panel B lists the rainfall subdivisions of India as classified by the IMD.

Legends of *Rainfall Departure*

-15% to -20%	15% to 20%
-20% to -25%	20% to 25%
25% to -30%	25% to 30%
Below -30%	Above 30%

Panel A: Subdivision-wise rainfall departure

Sub-division→	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
2000	-3.6	2.3	-26.4	17.4	-2.4	-19.8	-30.8	-0.5	2.2	-42.1	-29.7	-18	-5.5	-3.3	-14.1	1.8	-16.5	-5.8	5.7	-19.1	-29.3	32.7	-39.2	24.7	2.3	21.5	23.7	29.4	8.8	-32.2	-11.8	-2.5
2001	-18.2	-7.2	20.9	-8.7	-10.5	-5.6	-15.6	-1.3	-1.9	-8	-15	-20.3	6.2	-5.3	-6.5	-20	-14.2	-18.6	-17	23.6	-22.8	-3.8	8.6	-6.8	-19.1	-55	-11.1	8.7	-2.6	-18.5	-4.7	-18.5
2002	-8	-7.9	-32.9	-33.6	-25.9	-20.1	-57.2	-32.2	10.3	-28.3	-45.4	-37.7	NA	-17.2	-32.9	-12.3	-10.2	-3.4	-33.9	-19.8	-50.6	-29.7	-33.5	-33.5	-11.3	-71.7	-22	-1.8	-9.6	-24.8	-73.7	-27.6
2003	-9	5.7	22.6	-3.2	-5.3	25.2	-0.8	16.5	-17.8	30.6	19.4	-21.4	NA	-20.2	-23.8	-0.7	-3.5	-2.3	-34.7	6.6	-29.9	20.3	47.8	-29.1	-11.4	-58.9	1.8	16.3	-0.3	7.2	33.7	31.5
2004	7	-6.6	-16	-12.8	-14.2	-16.6	-5.9	-24.9	5.6	11	-21.5	-40.1	NA	-15.2	-17.5	3.4	25	-17.2	-11.8	-10.4	-49.4	-15.3	-2.9	4.9	-7.4	24.3	-34.8	-15.7	-31	-9.1	-36	-29.1
2005	-11.8	-22.2	-8.9	13.5	5.8	12.7	-8.7	-20.3	-11.2	49	-3.1	-18	18.6	-28.4	6.6	26.2	53.2	21.3	19.1	-0.5	-10.6	4.5	36.3	24.5	-9	0.7	13.8	-6.3	7.3	-16.9	-15.6	-9.1
2006	-30.1	-8.5	1	16.4	6.3	-22.8	20.1	-34.1	24.8	66.1	-40.7	-6.2	59	17.6	8.4	8.8	70.2	13.9	-6.9	30.1	9.1	-13.7	51.1	1.7	-22	-15.6	10.5	-27.3	11.4	25.2	27.1	-38.1
2007	14.3	33.8	-3.3	36.2	19.9	-46.7	-9.9	-28.7	43.9	33.4	-29.1	-19.2	-1.6	13.3	32.8	20.8	38.3	4	35	23.2	-3	66	91.8	35.7	-4.5	20.3	-0.1	31.7	17.3	-10.9	-3.3	-38
2008	-2.6	5.8	-14	17.7	-5.6	-10.8	1.3	5.3	12.7	1.3	37	-4	19	10.9	-17.4	5.7	12.9	-11.5	-10.4	20.2	36	-15.2	28.4	11.8	-1	-3.3	9.5	-4.4	-15.5	-11.2	5.6	4.1
2009	-14.8	-30.9	-29.4	-19.3	9.1	-30.2	-35.5	-43.1	-13.7	-31.3	-21.8	-29.5	10.35	-24.2	-3.2	-18.2	-4.2	-20.8	18.5	-3.2	-35.1	-3.6	28.2	21.1	-27.5	-15.6	-30	-46.2	-32	-19.6	-45.2	-39
2010	-2.2	-47.6	-2.9	45.6	0.5	-15.9	4.8	-26	-31.7	17.3	35.7	9	1.7	-46.9	-4.7	24.3	16.9	34.3	24.9	-16.3	-14.6	43.2	126	8.7	-10.2	9.9	38.4	10.7	26.8	-12.7	72.1	5.7
2011	-28.5	-5.8	0.9	-4.1	17.9	16.7	31	-15.1	23.4	0.9	-0.6	2	-30.5	15.5	9.1	32.5	5.5	-6.1	-6.3	0.7	33.5	1.9	60.2	1	-13.1	-7.8	-12.2	17.3	-8.7	23.2	55.2	-0.6
2012	8.5	-9.7	4.8	19.8	-5.4	-8.1	13.1	-34.3	-14.1	-19.9	-18.5	-12.1	1.7	-16.6	-24.1	1.8	-20.6	-32	-28.8	-0.5	-18	-6.1	-30.7	-17.6	-3.8	-21.9	9.8	-5.2	10.2	19.3	19.3	-49.9
2013	-32.1	-29.5	-3.9	-16.8	25.3	23	29.5	-0.9	2	20.1	-17.9	-4.2	-9.4	-22.5	26.5	19.9	19.1	11.5	6	-3.8	3.7	10.6	39.1	21	-19.7	-3.3	35.7	21.3	41.2	49.3	32.9	4.6
2014	-1.3	-17.1	-8.7	-20.7	6.3	-30.8	3.2	-40.7	-10.2	-21.5	-54.8	-37.7	21.2	-14.6	7	-6.5	-7.8	-40.4	-4.4	8.3	-47.1	-17.3	-19.2	16.2	-12.9	-5.2	-28.2	-20.7	-15.1	-10	2.9	-53.5
2015	0	-27.5	-16.3	21.1	-15.9	-30.9	-7.1	-45.9	15.6	-31.3	-33.3	-22.2	19.4	-13.8	-25.2	-31.6	-32.1	-38.3	-29.2	-10.8	-27.3	-6.2	-6.9	-7.6	-11.9	-14	-11.6	-22.1	-11.9	6.7	50.5	-40.3
2016	-26	-3	2	15	-21	19	32	-12	-1	-24	-26	-24	-10	1	-34	22	13	21	4	-10	-25	-2	-13	-22	0	-20	19	-10	10	19	20	-17
2017	-3	-9	-10	15	-16	-24	-8	-28	-2	9	-23	-13	2	-9	-9	10	17	-6	3	-8	-21	27	35	1	2	31	-12	-2	-23	-16	39	-30

Source: Reconstructed from data obtained from the IMD, Government of India

Panel B: Rainfall subdivisions in India

code	rainfall subdivision	code	rainfall subdivision	code	rainfall subdivision	code	rainfall subdivision
1	Assam & Meghalaya	9	Gangetic West Bengal	17	Madhya Maharashtra	25	Sub Himalayan West Bengal
2	Bihar	10	Gujarat Region	18	Matathwada	26	Tamil Nadu
3	Chhattisgarh	11	Haryana Delhi & Chandigarh	19	North Interior Karnataka	27	Telangana
4	Coastal Andhra Pradesh	12	Himachal Pradesh	20	Orissa	28	Uttarakhand
5	Coastal Karnataka	13	Jammu & Kashmir	21	Punjab	29	Vidarbha
6	East Madhya Pradesh	14	Jharkhand	22	Rayalseema	30	West Madhya Pradesh
7	East Rajasthan	15	Kerala	23	Saurashtra & Kutch	31	West Rajasthan
8	East Uttar Pradesh	16	Konkan & Goa	24	South Interior Karna	32	West Uttar Pradesh

Table 5-3 Rainfall departure and immediate value decline.

This table reports the regression results of the following general equation:

$$Firm\_value_{it} = \alpha + \beta.(RDyr_t \times treated_i) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where $Firm\_value_{it}$ is the market-to-book value of equity (*MB)* as calculated at the end of the September quarter (Q2) which marks the end of the monsoon season in India, or fiscal year-end (Q4) MB value. $RDyr$ is a dummy variable which takes the value of one for years with *rainfall departure* (*excess*/*deficit*) and zero for *normal* years. *treated* is a categorical variable that takes a value of one for the firms belonging to the *excess*-rain-sensitive industries or *deficit*-rain-sensitive industries and zero otherwise for *control firms*. $(RDyr_t \times treated_i)$ is an *Interaction* term which is the main variable of interest. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon* all lagged by one year. The *Time* variable absorbs long-running trends. γ_i controls for firm fixed effects and e_{it} is the error term. Standard errors are clustered at the firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is 2001 to 2017. Source: IMD and CMIE databases.

	excess rainfall departure				***deficit rainfall departure***			
	MB_Q2	MB_Q2	MB_Q4	MB_Q4	MB_Q2	MB_Q2	MB_Q4	MB_Q4
Interaction	**-12.685****	**-10.099****	**-13.179****	**-17.698****	**-2.099****	**-4.622****	**-1.609****	**-5.858*****
	(-2.67)	**(-3.01)**	**(-2.24)**	**(-2.37)**	**(-2.55)**	**(-2.76)**	**(-3.25)**	**(-4.46)**
Size		-30.414**		-22.232***		-12.756***		-11.467***
		(-2.50)		(-9.96)		(-4.57)		(-7.91)
Leverage		3.039*		0.785*		1.496***		1.647***
		(1.98)		(1.92)		(8.88)		(6.21)
Liquidity		-12.274**		-8.606***		-5.348***		3.782***
		(-2.57)		(-4.91)		(-10.16)		(7.09)
OwnCon		-0.045		0.177		0.049***		0.182**
		(-0.14)		(0.95)		(3.89)		(2.54)
Time		2.175		1.114		0.386		0.146
		(1.25)		(1.57)		(0.77)		(0.28)
R^2 (adjusted)	0.31	0.42	0.32	0.37	0.36	0.51	0.45	0.46
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Firms	3,823	3,638	3,823	3,638	4,587	4,197	4,587	4,197
No. of Obs.	23,988	21,291	23,988	21,291	40,579	34,444	40,579	34,444

Table 5-4 Capex & rainfall departure

Panel A of Table 4 shows the univariate *DiD* in the *Capex* for *treated* and *control* group firms in the *normal* rainfall period with *excess* and *deficit rainfall departure* periods. *Capex* is the ratio of actual capital expenditure to long-term assets. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is from 2001 to 2017. Source: IMD and CMIE databases.

	Excess Rainfall departure				*Deficit Rainfall departure*			
Variable	No. of Obs.	Capex [1]	t-value [2]	p-value [3]	No. of Obs.	Capex [4]	t-value [5]	p-value [6]
Before								
Control group firms	11097	0.121			10383	0.235		
Treated group firms	2642	0.130			1328	0.243		
Difference	13739	0.009	0.96	0.335	11711	0.008	0.57	0.565
After								
Control group firms	13237	0.148			19939	0.190		
Treated group firms	2891	0.182			2680	0.165		
Difference	16128	0.035	4.13	0.000***	22619	-0.025	2.68	0.007***
Difference-in-Differences	**29867**	**0.026**	**2.04**	**0.041****	**34330**	**-0.033**	**1.97**	**0.049****

Panel B of Table 4 reports the results of multivariate regression results of the following general equation:

$$Investment_{it} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where $Investment_{it}$ is the investment proxy *Capex* of firm *i* for the year *t*. $RDyr$ is a dummy variable which takes the value of one for years with *rainfall departure* (*excess/deficit*) and zero for *normal* years. *treated* is a categorical variable that takes a value of one for the firms belonging to the *excess*-rain-sensitive industries or *deficit*-rain-sensitive industries and zero otherwise for *control firms*. $(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}})$ is an *Interaction* term which is the main variable of interest. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon, MB* all lagged by one year. The *Time* variable absorbs long-running trends. γ_i controls for firm fixed effects and e_{it} is the error term. Standard errors are clustered at the firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is 2001 to 2017. Source: IMD and CMIE databases.

	Excess Rainfall departure		*Deficit Rainfall departure*	
Variables	[1]	[3]	[4]	[6]
Interaction	**0.048*****	**0.034****	**-0.0318 *****	**-0.310****
	(4.98)	**(2.21)**	**(-4.58)**	**(-2.40)**
Size		0.064***		-0.025
		(4.81)		(-0.17)
Leverage		-0.003**		0.017
		(-2.35)		(0.76)
Liquidity		0.030**		0.529
		(2.35)		(1.22)
OwnCon		0.001***		-0.001
		(4.68)		(-0.21)
MB		0.001***		0.002
		(6.46)		(1.69)
Time		-0.012***		-0.004
		(-7.10)		(-0.19)
R^2(within)	0.001	0.014	0.001	0.002
Firm FE	Yes	Yes	Yes	Yes
No. of Firms	5,299	3,408	4,887	3,443
No. of Obs.	29867	15996	34330	20106

Table 5-5 Capex & rainfall departure using alternative measures

This table reports the results of multivariate regression results of the following general equation:

$$Investment_{it} = \alpha + \beta.(RDyr_t \times treated_i) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where $Investment_{it}$ is the investment proxy using alternative measures of *Capex_RD* and *Capex_LT* of firm *i* for the year *t*. $RDyr$ is a dummy variable which takes the value of one for years with *rainfall departure* (*excess*/*deficit*) and zero for *normal* years. *treated* is a categorical variable that takes a value of one for the firms belonging to the *excess*-rain-sensitive industries or *deficit*-rain-sensitive industries and zero otherwise for *control firms*. $(RDyr_t \times treated_i)$ is an *Interaction* term which is the main variable of interest. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon, MB* all lagged by one year. The *Time* variable absorbs long-running trends. γ_i controls for the firm fixed effects and e_{it} is the error term. Standard errors are clustered at the firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is from 2001 to 2017. Source: IMD and CMIE databases.

	Excess Rainfall departure		*Deficit Rainfall departure*	
	Capex_RD	Capex_LT	Capex RD	Capex_LT
Variables	[1]	[2]	[3]	[4]
Interaction	**0.035****	**0.045*****	**-0.067***	**-0.036****
	(2.27)	**(4.07)**	**(-1.86)**	**(-2.86)**
Size	0.064***	0.088***	0.096*	0.121***
	(4.82)	(8.56)	(1.84)	(14.74)
Leverage	-0.003**	-0.004***	-0.002	-0.004**
	(-2.41)	(-4.18)	(-0.53)	(-2.53)
Liquidity	0.033***	0.073***	0.220**	0.064***
	(2.66)	(5.73)	(2.72)	(4.05)
OwnCon	0.001***	0.002***	0.001	0.001***
	(4.67)	(9.74)	(1.05)	(6.20)
MB	0.001***	0.001***	0.001**	0.001***
	(6.47)	(10.44)	(2.38)	(7.95)
Time	-0.012***	-0.017***	-0.015*	-0.024***
	(-7.11)	(-17.12)	(-2.15)	(-12.85)
R^2(within)	0.015	0.057	0.005	0.029
Firm FE	Yes	Yes	Yes	Yes
No. of Firms	3,408	3,477	3,443	3,447
No. of Obs.	15,997	16,214	20,106	20116

Table 5-6 Capex & rainfall (one-year pair difference-in-differences)

Table 6 Panel A: Subdivision-wise *excess rainfall departure* for one-year pair DiD

Panel A of Table 6 is a matrix that indicates the pairs of years in each rainfall subdivision in which a *normal* rainfall year is succeeded by *excess rainfall departure* of +19% and above following the IMD's definition of *excess rainfall departure*. The study period is 2001 to 2017 for 32 subdivisions of India. I observe that the pairing is not possible for years 2001 and 2002 and for subdivisions 1, 3, 8, 11, 12, 14 and 32 as no values fall under the criteria mentioned above. Source: IMD.

Sub-division	2	4	5	6	7	9	10	13	15	16	17	18	19	20	21	22	23	24	26	27	28	29	30	31
2003											-3.5													
2004							11			3.4	**25**	-17.2	-11.8				-2.9	4.9						
2005					-8.7	-11.2	**49**	18.6		**26.2**		**21.3**	**19.1**	-0.5			**36.3**	**24.5**					-16.9	-15.6
2006	-8.5	16.4	6.3		**20.1**	**24.8**		**59**	8.4	8.8			-6.9	**30.1**		-13.7		1.7	-15.6				**25.2**	**27.1**
2007	**33.8**	**36.2**	**19.9**					-1.6	**32.8**	**20.8**			**35**		-3	**66**		**35.7**	**20.3**					
2008								**19**							**36**			11.8						
2009										-18.2			18.5			-3.6		**21.1**						
2010					4.8					**24.3**			**24.9**		-14.6	**43.2**							-12.7	
2011		-4.1			**31**										**33.5**								**23.2**	
2012		**19.8**	-5.4	-8.1	13.1					1.8								-17.6		9.8	-5.2	10.2		
2013			**25.3**	**23**	**29.5**			-9.4		**19.9**								**21**		**35.7**	**21.3**	**41.2**		
2014								**21.2**		-6.5														2.9
2015					-7.1																		6.7	**50.5**
2016					**32**											-2	-13						**19**	
2017																**27**	**35**							

Source: Reconstructed from data obtained from the IMD, Government of India

Table 6 Panel B: Subdivision-wise *deficit rainfall departure* for one-year pair DiD

Panel B of Table 6 is a matrix that indicates the pairs of years in each rainfall subdivision in which a *normal* rainfall year is succeeded by *deficit rainfall departure* of -19% and above following the IMD's definition of *deficit rainfall departure*. The study period is 2001 to 2017 for 32 subdivisions of India. I observe that the pairing is not possible for subdivision 20 as no values fall under the criteria mentioned above. Source: IMD

Sub-division	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	21	22	23	24	25	26	27	28	29	30	31	32
2001				-8.7	-10.5	-5.6	-15.6	-1.3		-8	-15				-6.5				-17		-3.8	8.6	-6.8			-11.1			-18.5	-4.7	-18.5
2002				**-34**	**-26**	**-20**	**-57**	**-32**		**-28**	**-45**			-17.2	**-33**				**-34**		**-30**	**-34**	**-34**			**-22**			**-25**	**-74**	**-28**
2003								16.5						**-20**												1.8		-0.3			
2004		-6.6						**-25**						-15.2												**-35**		**-31**			
2005	-11.8	**-22**				12.7					-3.1			**-28**										-9			-6.3				-9.1
2006	**-30**					**-23**					**-41**	-6.2												**-22**			**-27**				**-38**
2007												**-19**																			
2008		5.8	-14	17.7		-10.8	1.3	5.3		1.3		-4		10.9				-11.5						-1		9.5	-4.4	-15.5	-11.2	5.6	4.1
2009		**-31**	**-29**	**-19**		**-30**	**-36**	**-43**	-13.7	**-31**		**-30**		**-24**				**-21**						**-28**		**-30**	**-46**	**-32**	**-20**	**-45**	**-39**
2010	-2.2								**-32**				1.7																		
2011	**-29**							-15.1		0.9			**-31**		9.1		5.5	-6.1	-6.3						-7.8						-0.6
2012	8.5	-9.7						**-34**		**-20**				-16.6	**-24**		**-21**	**-32**	**-29**					-3.8	**-22**						**-50**
2013	**-32**	**-30**		-16.8				-0.9			-17.9	-4.2		**-23**				11.5		3.7				**-20**							
2014		-17.1		**-21**				**-41**			**-55**	**-38**			7	-6.5	-7.8	**-40**	-4.4	**-47**											
2015	0	**-28**			-15.9										**-25**	**-32**	**-32**		**-29**				-7.6		-14						
2016	**-26**				**-21**			-12															**-22**		**-20**			10			-17
2017								**-28**																				**-23**			**-30**

Source: Reconstructed from data obtained from the IMD, Government of India

Table 6 Panel C: Subdivision-wise r*ainfall departure* for one-year pair DiD

Panel C of Table 6 reports the results of the one-year pair *DiD* regression results of the following general equation:

$$Investment_{it} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where $Investment_{it}$ is the investment proxy *Capex* of firm *i* for the year *t*. $RDyr$ is a dummy variable which takes the value of one for years with *rainfall departure* (*excess*/*deficit*) and zero for *normal* years. *treated* is a categorical variable that takes a value of one for the firms belonging to the *excess*-rain-sensitive industries or *deficit*-rain-sensitive industries and zero otherwise for *control firms*. $(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}})$ is an *Interaction* term which is the main variable of interest. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon, MB* all lagged by one year. The *Time* variable absorbs long-running trends. γ_i controls for firm fixed effects and e_{it} is the error term. Standard errors are clustered at the firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is 2001 to 2017. Source: IMD and CMIE databases.

	Excess Rainfall departure			*Deficit Rainfall departure*		
	[1]	[2]	[3]	[4]	[5]	[6]
DiD Interaction	**0.104*** **	**0.143*** **	**0.141** **	**-0.025**	**-0.057** **	**-0.077*** **
	(2.66)	**(2.76)**	**(2.50)**	**(-0.71)**	**(-2.07)**	**(-2.76)**
Size		-0.312***	-0.004		-0.056	0.008
		(-3.23)	(-0.36)		(-1.40)	(1.09)
Leverage		-0.001	-0.005***		-0.001**	-0.002***
		(-0.24)	(-2.99)		(-2.29)	(-5.59)
Liquidity		-0.052	-0.077***		0.043	-0.044
		(-1.03)	(-3.07)		(0.57)	(-0.96)
OwnCon		0.003	0.001		0.002	0.002
		(0.73)	(1.56)		(1.28)	(1.15)
MB		0.001*	0.001***		0.001***	0.001**
		(1.68)	(2.73)		(3.07)	(2.36)
Time		0.019**	-0.008		-0.015**	-0.019***
		(2.30)	(-1.35)		(-2.07)	(-4.90)
R (within)	0.03	0.03	0.01	0.06	0.04	0.01
Firm FE	Yes	Yes	-	Yes	Yes	-
Industry FE	-	-	Yes	-	-	Yes
No. of Firms	3,980	2,151	2,151	4,483	2,488	2,488
No. of Obs.	18,440	7,805	7,805	15,406	5,534	5,534

Table 5-7 Capex & excess rainfall sensitivity analysis

This table reports the results of *excess* and *deficit* rainfall sensitivity analysis using the following general equation:

$$Investment_{it} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where $Investment_{it}$ is the investment proxy *Capex* of firm *i* for the year *t*. $RDyr$ is a dummy variable which takes the value of one for years with *rainfall departure* in *excess* of *15%, 16%* (in *deficit* of *-15%, -16%*) and so on and zero for *normal* years. *treated* is a categorical variable that takes a value of one for the firms belonging to the *excess*-rain-sensitive (*deficit*-rain-sensitive) industries and zero otherwise for *control firms*. $(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}})$ is an *Interaction* term which is the main variable of interest. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon, MB* all lagged by one year. The *Time* variable absorbs long-running trends. γ_i controls for firm fixed effects and e_{it} is the error term. Standard errors are clustered at the firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is from 2001 to 2017. Source: IMD and CMIE databases.

Rainfall in *excess* of	**15%**	**16%**	**17%**	**18%**	**19%**	**20%**	**21%**	**22%**	**23%**	**24%**	**25%**	**26%**	**27%**	**28%**	**29%**	**30%**
Interaction	0.224	0.039	0.044	0.038	0.038	**0.046****	**0.045***	**0.040***	**0.062****	**0.065****	**0.073****	**0.069****	**0.077****	**0.077****	**0.077****	**0.076****
	(0.92)	(1.32)	(1.36)	(1.26)	(1.26)	**(2.04)**	**(1.92)**	**(1.65)**	**(2.39)**	**(2.37)**	**(2.30)**	**(2.28)**	**(2.34)**	**(2.34)**	**(2.34)**	**(2.32)**
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Firms	3,600	3,598	3,595	3,589	3,589	3,562	3,545	3,541	3,534	3,534	3,529	3,526	3,526	3,525	3,525	3,525
No. of Obs.	24,105	23,915	23,687	23,299	23,293	21,958	20,888	20,663	19,917	19,693	18,736	18,615	18,085	18,076	18,039	17,974

Rainfall in *deficit* of	**15%**	**16%**	**17%**	**18%**	**19%**	**20%**	**21%**	**22%**	**23%**	**24%**	**25%**	**26%**	**27%**	**28%**	**29%**	**30%**
Interaction	-0.040	-0.067	-0.069	**-0.043***	**-0.050***	**-0.052***	**-0.042***	**-0.048***	**-0.087***	**-0.097***	**-0.097****	**-0.095***	**-0.086***	**-0.079***	-0.086	**-0.100***
	(-1.64)	(-1.08)	(-1.10)	(-1.74)	(-1.86)	(-1.94)	(-1.78)	(-1.85)	(-2.06)	(-2.04)	(-2.24)	(-2.18)	(-2.04)	(-1.86)	(-1.78)	(-2.14)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Firms	3,184	3,179	3,162	3,143	3,123	3,098	3,078	3,184	3,057	2,984	2,961	2,917	2,914	2,898	2,896	2,811
No. of Obs.	14,642	14,243	14,111	13,541	12,685	12,329	11,958	14,642	10,980	10,617	10,280	9,916	9,840	9,510	9,415	9,007

Table 5-8 Persistence effects of excess rainfall departure.

This table reports the results of persistence of *excess* (*deficit*) rainfall on investment using the following equation:

$$Investment_{it} = \alpha + \beta.(RDyr_t \times treated_i) + \sum_{n=1}^{5} \boldsymbol{\lambda}_n (\boldsymbol{Rain_{t-n}} \times \boldsymbol{treated_i}) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where $Investment_{it}$ is the investment proxy *Capex* of firm *i* for the year *t*. I conduct a sensitivity analysis using the specification with a 5% incremental rainfall departure from 15% up to 30% with $RDyr$ as a dummy variable which takes the value of one for years with *excess/deficit rainfall departure* and zero for *normal* years. *treated* is a categorical variable that takes a value of one for the firms belonging to the *excess/deficit* rain-sensitive industries and zero otherwise for *control firms*. $(RDyr_t \times treated_i)$ is an *Interaction* term. $Rain_{t-n}$ is the percentage of *rainfall departure* (*excess / deficit*) in the lagged up to 5 years. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon, M/B* all lagged by one year. The *Time* variable absorbs long-running trends. γ_i controls for firm fixed effects and e_{it} is the error term. Standard errors are clustered at the firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is 2001 to 2017. Source: IMD and CMIE databases.

	Excess rainfall departure				*Deficit rainfall departure*			
	15%	20%	25%	30%	15%	20%	25%	30%
Interaction	**0.0497****	**0.0599*****	**0.0778****	**0.0720****	**-0.104****	**-0.129***	**-0.107***	-0.105
	(2.44)	**(2.69)**	(2.49)	(2.22)	**(-2.01)**	**(-1.87)**	**(-1.67)**	(-1.54)
Rain [n-1]	**0.00177*****	**0.00146****	0.00107	0.000987	-0.0000241	-0.00775	-0.0104	-0.00962
	(2.67)	**(2.26)**	(1.47)	(1.34)	(-0.02)	(-1.10)	(-1.12)	(-0.81)
Rain [n-2]	**0.00180****	**0.00174*****	**0.00151***	**0.00152***	0.00376***	0.00632	0.0120*	0.00128
	(2.26)	**(6.04)**	**(1.82)**	(1.78)	(3.92)	(0.72)	(1.67)	(0.56)
Rain [n-3]	0.000991	**0.00178****	**0.00200****	0.00104	0.00184	0.0212*	-0.00200	-0.00113
	(1.16)	**(2.10)**	**(2.05)**	(1.04)	(1.12)	(1.70)	(-0.66)	(-0.61)
Rain [n-4]	0.000365	0.00120	0.000471	0.000968	0.000231	0.00293	0.000811	0.00131
	(0.47)	(1.51)	(0.50)	(0.96)	(0.26)	(0.78)	(0.39)	(0.46)
Rain [n-5]	0.000474	0.000247	0.000760	0.000149	0.000453	0.00613*	0.00289	0.00481
	(0.71)	(0.38)	(1.09)	(0.20)	(0.34)	(1.73)	(1.15)	(1.38)
Size	0.118***	0.116***	0.118***	0.119***	0.285***	0.275**	0.259**	0.282***
	(10.47)	(10.32)	(10.53)	(10.54)	(6.36)	(2.24)	(2.56)	(2.63)
Leverage	-0.00366***	-0.00362***	-0.00366***	-0.00366***	-0.0132*	0.00446	0.000114	0.0241
	(-6.26)	(-6.19)	(-6.23)	(-6.27)	(-1.92)	(0.11)	(0.56)	(0.57)
Liquidity	0.0361	0.0349	0.0368	0.0366	-0.125	0.0385	0.986	1.000

	(1.46)	(1.42)	(1.49)	(1.48)	(-0.22)	(0.04)	(1.14)	(1.06)
OwnCon	0.00138**	0.00146**	0.00138**	0.00138**	-0.000953	-0.0170	-0.0143	-0.00402
	(2.16)	(2.29)	(2.16)	(2.17)	(-0.39)	(-1.23)	(-1.22)	(-1.13)
M/B	0.00109***	0.00106***	0.00109***	0.00110***	0.00528***	0.0159	0.00593	0.00523
	(5.77)	(5.58)	(5.80)	(5.82)	(3.22)	(1.36)	(1.30)	(1.05)
Time	-0.0309***	-0.0308***	-0.0308***	-0.0309***	-0.0512***	-0.0642***	-0.0358**	-0.0410***
	(-21.83)	(-21.90)	(-21.72)	(-21.79)	(-7.27)	(-4.75)	(-2.50)	(-2.73)
R^2 (adjusted)	0.0332	0.0350	0.0334	0.0330	0.0900	0.311	0.592	0.385
Firms FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Firms	3600	3562	3529	3525	3393	3375	3320	3261
No. of Obs.	24,105	21,958	18,736	17,974	23108	20743	18413	17092

Table 5-9 Capex & rainfall departure with geographic treatment and control group firms

This table reports the results of *excess* and *deficit* rainfall sensitivity analysis using the following general equation:

$$Investment_{it} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times geo\_treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where, $Investment_{it}$ is the investment proxy *Capex* of firm *i* for the year *t*. $geo\_treated$ is a categorical variable that takes a value of one for the firms located in the subdivision with *excess rainfall departure* and zero for *control firms*, $(RDyr_{\boldsymbol{t}} \times geo\_treated_{\boldsymbol{i}})$ is a dummy variable (*DiD_{Geo}*) which is an interaction of *RDyr* with *geo_treated.* In pairs of years, *RDyr* is a dummy variable that takes the value of zero for the first year which receives *normal* rain and value of one for second year which *excess/deficit rainfall*. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon, MB* all lagged by one year. The *Time* variable absorbs long-running trends. γ_i controls for the fixed effects of industry and e_{it} is the error term. Standard errors are clustered at the firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The total sample period of study is 2001 to 2017 (for *excess* 2001-2002 and 2002-2003 and for *deficit* 2007-2008 year pairs have no observations). Source: IMD and CMIE databases.

Year Pair	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
DiD_{Geo} (t-stat)	No Obs.	No Obs.	0.0671 (0.98)	0.0272 (1.27)	0.0209 (0.55)	-0.00880 (-0.34)	-0.0839 (-1.52)	-0.0755 (-1.33)	0.00780 (0.20)	**-0.09*** (-3.51)**	-0.0648 (-0.87)	-0.00672 (-0.35)	-0.00672 (-0.35)	-0.0202 (-0.97)	0.0197 (0.43)	0.122 (1.39)
Excess Rainfall departure Subdivisions	No Obs.	No Obs.	17	10 , 16 , 18 , 19, 23 , 24	7 , 9 , 13 , 20 , 30 , 31	2 , 4 , 5 , 15 , 16 , 19 , 22 , 24 , 26	13 , 21	24	16 , 19 , 22	7 , 21 , 30	4	5 , 6 , 7 , 16 , 24 , 27 , 28 , 29	13	31	7 , 27 , 30	22 , 23
Normal rainfall Subdivisions	No Obs.	No Obs.	1 , 2 , 4 , 5 , 7 , 9 , 16 , 18 , 20 , 25 , 28 , 30	1 , 3 , 4 , 5 , 6 , 7 ,9 , 15 , 20 , 22 , 25 , 28 , 30	3 , 4 , 5 , 12 , 15 , 21 , 22 , 26 , 27 , 29	3 , 14 , 18 , 21 , 27 , 29	1 , 3 , 7 , 14 , 18 , 25 , 27 , 29 , 30 , 31	1 , 5 , 9 , 15 , 16 , 17 , 19 , 22 , 26 , 24	1 , 5 , 13 , 15 , 17 , 20 , 26	3 , 5 , 6 , 10 , 12 , 15 , 17 , 20 , 24 , 25 , 26 , 28 , 32	2 , 3 , 5 , 6 , 11 , 12 , 14 , 20 , 22 , 24 , 25 , 27 , 28 , 29	3 , 9 , 11 , 12 , 13 , 20 , 21 , 22	3 , 9 , 19 , 20 , 22 , 26	1 , 3 , 5 , 7 , 9 , 14 , 20 , 22 , 24 , 25 , 26 , 29 , 30	3 , 9 , 14 , 20 , 22 , 23 , 25 , 29	2 , 3 , 4 , 9 , 13 , 14 , 17 , 19 , 20 , 25 , 28
DiD_{Geo} (t-stat)	-0.885 (-1.51)	0.0736 (0.33)	**0.0638* (1.88)**	-0.0301 (-0.99)	0.0617 (0.89)	-0.122 (-1.19)	No Obs.	-0.0259 (-1.21)	0.0166 (0.37)	0.0173 (0.18)	0.00769 (0.37)	-0.362 (-1.08)	0.0309 (1.15)	**-0.0283* (-1.66)**	0.413 (0.29)	-0.00402 (-0.06)
Deficit Rainfall departure Subdivisions	4 , 5 , 6 , 7 , 8 , 10 , 11 , 15 , 19 , 22 , 23 , 24 , 27 , 30 , 31 , 32	14	8 , 27 , 29	2 , 14	1 , 6 , 11 , 25 , 28 , 32	12	No Obs.	2 , 3 , 4 , 6 , 7 , 8 , 10 , 12 , 14 , 18 , 25 , 27 , 28 , 29 , 30	9	1 , 13	8 , 10 , 15 , 17 , 18 , 19 , 26 , 32	3 , 9 , 11 , 12 , 13 , 20 , 21 , 22	3 , 9 , 19 , 20 , 22 , 26	2 , 15 , 16 , 17 , 19	1 , 5 , 24 , 26	8 , 29 , 32
Normal rainfall Subdivisions	1 , 2 , 9 , 14 , 17 , 18 , 28 , 29	1 , 2 , 9 , 16 , 17 , 18 , 25 , 28 , 29	1 , 2 , 4 , 5 , 7 , 9 , 16 , 18 , 20 , 25 , 28 , 30	1 , 3 , 4 , 5 , 6 , 7 , 9 , 15 , 20 , 22 , 25 , 28 , 30	3 , 4 , 5 , 12 , 15 , 21 , 22 , 26 , 27 , 29	3 , 14 , 18 , 21 , 27 , 29	No Obs.	1 , 5 , 9 , 15 , 16 , 17 , 19 , 22 , 26	1 , 5 , 13 , 15 , 17 , 20 , 26	3 , 5 , 6 , 10 , 12 , 15 , 17 , 20 , 24 , 25 , 26 , 28 , 32	2 , 3 , 5 , 6 , 11 , 12 , 14 , 20 , 22 , 24 , 25 , 27 , 28 , 29	1 , 2 , 14 , 25	4 , 8 , 11 , 12 , 18 , 21 , 32	1 , 3 , 5 , 7 , 9 , 14 , 20 , 22 , 24 , 25 , 26 , 29 , 30	3 , 9 , 14 , 20 , 22 , 23 , 25 , 29	2 , 3 , 4 , 9 , 13 , 14 , 17 , 19 , 20 , 25 , 28
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

No Obs. – No Observations available

Table 5-10 Implications of rainfall departure (*MB*)

This table reports the regression results of the following general equation:

$$Firm\_value_{it+1} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X}_{\boldsymbol{i,t}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where $Firm\_value_{it}$ is market-to-book value of equity (*MB)* as calculated at the fiscal year end for firm *i* and lead year t+1. $RDyr$ is a dummy variable which takes the value of one for years with *rainfall departure* (*excess*/*deficit*) and zero for *normal* years. *treated* is a categorical variable that takes a value of one for the firms belonging to the *excess*-rain-sensitive industries or *deficit*-rain-sensitive industries and zero otherwise for *control firms*. $(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}})$ is an *Interaction* term which is the main variable of interest. $\boldsymbol{X}_{\boldsymbol{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon*. The *Time* variable absorbs long-running trends. γ_i controls for firm fixed effects and e_{it} is the error term. Standard errors are clustered at the firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is 2001 to 2017. Source: IMD and CMIE databases.

	Excess Rainfall departure		*Deficit Rainfall departure*	
	[1]	[2]	[3]	[4]
Interaction	**2.061****	**2.045*****	**8.689***	**9.235****
	(3.08)	**(3.66)**	**(2.22)**	**(2.49)**
Size		-7.473***		-17.048***
		(-21.85)		(-12.80)
Leverage		0.231***		2.012***
		(5.56)		(4.48)
Liquidity		-1.329		-0.622
		(-1.26)		(-0.31)
OwnCon		0.164***		0.373***
		(26.77)		(6.91)
Time		0.069		0.912
		(1.15)		(1.65)
R^2 (adjusted)	0.52	0.56	0.31	0.34
Firm FE	Yes	Yes	Yes	Yes
No. of Firms	3,620.00	3,358.00	3,500.00	3,373.00
No. of Obs.	22,387.00	19,251.00	28,406.00	25,761.00

Table 5-11 Implications of rainfall departure *(Tobin's q)*

This table reports the regression results of the following general equation:

$$Firm\_value_{it+1} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where Tobin's q (*Tobin's q*) is the proxy for $Firm\_value_{it}$ and future growth opportunities of the firm '*i*' for the year '*t+1*' and is equal to the sum of book value of debt, preference stock and market value of equity as a ratio of the book value of assets. $RDyr$ is a dummy variable which takes the value of one for years with *rainfall departure* (*excess*/*deficit*) and zero for *normal* years. *treated* is a categorical variable that takes a value of one for the firms belonging to the *excess*-rain-sensitive industries or *deficit*-rain-sensitive industries and zero otherwise for *control firms*. $(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}})$ is an *Interaction* term which is the main variable of interest. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon*. The *Time* variable absorbs long-running trends. γ_i controls for firm fixed effects and e_{it} is the error term. Standard errors are clustered at the firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is 2001 to 2017. Source: IMD and CMIE databases.

	Excess Rainfall departure			*Deficit Rainfall departure*		
	[1]	[2]	[3]	[4]	[5]	[6]
Interaction	**0.140****	**0.165*****	**0.158*****	**0.0625****	**0.0644***	**0.173****
	(2.25)	**(3.84)**	**(4.22)**	**(2.76)**	**(1.82)**	**(2.25)**
Size		-0.111**	0.0209		-0.00171	0.0267*
		(-2.84)	(1.06)		(-0.11)	(1.97)
Leverage		0.0078**	0.0114***		-0.00026	0.0036
		(2.37)	(3.08)		(-0.21)	(1.36)
Liquidity		-0.0499**	0.0812**		-0.0069	0.0635***
		(-2.83)	(2.39)		(-0.45)	(3.13)
OwnCon		-0.00014	0.00299***		0.00047	-0.00086
		(-0.12)	(3.50)		(0.58)	(-0.70)
Time		0.0298**	0.0199		0.000572	0.000878
		(2.83)	(1.42)		(0.40)	(0.24)
R^2 (adjusted)	0.57	0.58	0.017	0.45	0.46	0.005
Firm FE	Yes	Yes	No	Yes	Yes	No
Industry FE	No	No	Yes	No	No	Yes
No. of Firms	4427	3029	3029	4712	2766	2766
No. of Obs.	22025	13993	14545	29926	12975	13650

Table 5-12 Implications of rainfall departure subsample analysis

This table reports the regression results of the following general equation:

$$Firm\_value_{it+1} = \alpha + \beta.(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}}) + \boldsymbol{X_{i,t}}.\boldsymbol{\delta} + \tau.Time + \gamma_i + e_{it}$$

where Tobin's q (*Tobin's q*) is the proxy for $Firm\_value_{it}$ and future growth opportunities of the firm '*i*' for the year '*t+1*' and is equal to the sum of book value of debt, preference stock and market value of equity as a ratio of the book value of assets. $RDyr$ is a dummy variable which takes the value of one for years with *rainfall departure* (*excess*/*deficit*) and zero for *normal* years. For columns [1] and [2] *treated* is a categorical variable that takes a value of one for the *excess* rain-sensitive firms with capital expenditure of >0 and zero otherwise, and for columns [3] and [4] $treated$ is a categorical variable that takes a value of one for *deficit* rain-sensitive with capital expenditure <0 and zero for *control firms*. Further, for columns [5] and [6] *treated* is a categorical variable that takes a value of one for the *excess* rain-sensitive firms with capital expenditure in the upper tercile and zero for the lower tercile and for columns [7] and [8] $treated$ is a categorical variable that takes a value of one for *deficit* rain-sensitive with capital expenditure in the lower tercile and zero for capital expenditure in the *upper tercile*. $(RDyr_{\boldsymbol{t}} \times treated_{\boldsymbol{i}})$ is an *Interaction* term which is the main variable of interest. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon*. The *Time* variable absorbs long-running trends. γ_i controls for the fixed effects of firm/industry and e_{it} is the error term. Standard errors are clustered at firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is 2001 to 2017. Source: IMD and CMIE databases.

	Based on positive / negative *Capex_LT*				Based on tercile of *Capex*			
	Excess		*Deficit*		*Excess*		*Deficit*	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Interaction	**0.136*****	**0.128*****	**0.254*****	**0.094***	**0.160****	**0.209*****	**0.088****	**0.070****
	(5.10)	**(3.14)**	**(3.39)**	**(2.00)**	**(2.18)**	**(3.22)**	**(2.26)**	**(2.18)**
Size		0.012		0.084		-0.111		-0.022
		(0.42)		(1.10)		(-1.33)		(-0.27)
Leverage		0.004		0.005		0.000		0.003
		(1.48)		(1.49)		(0.05)		(1.43)
Liquidity		0.019		0.581*		-0.091		-0.002
		(0.25)		(2.05)		(-1.15)		(-0.01)
OwnCon		0.002		-0.003		0.001		-0.003
		(1.12)		(-1.35)		(0.60)		(-0.93)
Time		0.016		0.037**		0.030***		0.050***
		(1.45)		(2.30)		(3.20)		(4.17)
R^2 (within)	0.01	0.01	0.01	0.07	0.01	0.03	0.00	0.09
Industry FE	Yes	Yes	Yes	Yes	No	No	No	No
Firm FE	No	No	No	No	Yes	Yes	Yes	Yes
No. of Obs.	4,237	2,712	5,216	2,530	3,242	1,961	3,499	1,771

Table 5-13 Positively rain-sensitive industries and excess rainfall departure

This table reports the results from the t-test on the mean values of Sales, Sales/total assets, EBITDA/total assets and PAT/total assets for the positively rain-sensitive firms before and after the *excess Rainfall departure*. *, ** and *** denote statistical significance at the 10%, 5% and 1% significance levels respectively. The total sample period of study is 2001 to 2017. Source: IMD and CMIE databases.

Variable	**Obs.**	***Year after excess* rain**	***excess* rain year**	**Difference**	**t-stat**	**p-value**
Sales (INR millions)	5922	5072.4452	2100.5344	2971.91**	2.1863	0.0288
Sales/total assets	5478	34.8962	14.6871	20.21*	1.9189	0.0551
EBITDA/total assets	5913	4.9870	1.8665	3.12**	2.2387	0.0252
PAT/total assets	5911	1.6072	0.6396	0.9676*	1.9335	0.0532

Table A5-1: Capex & rainfall departures (excluding positively rain-sensitive firms)

$$Investment_{it} = \alpha + \beta.(RDyr_t \times treated_i) + \boldsymbol{X_{i,t-1}}.\boldsymbol{\delta}+\tau.Time + \gamma_i + e_{it}$$

where $Investment_{it}$ is the risk-taking investment proxy *Capex* of firm i for the year *t*. $RDyr$ is a dummy variable which takes the value of 1 for years with *rainfall departure* (either *excess* or *deficit* depending on the empirical study) and zero for *normal* years. *treated* is a categorical variable that takes a value of one for the firms belonging to the *excess*-rain-sensitive industries or *deficit*-rain-sensitive industries and zero otherwise for *control firms*. $(RDyr_t \times treated_i)$ is an *Interaction* term which is the main variable of interest. $\boldsymbol{X_{it}}$ is a vector of control variables including *Size, Leverage, Liquidity, OwnCon, MB* all lagged by one year. The *Time* variable absorbs long-running trends. *Time* captures trends. γ_i controls for firm fixed effects and e_{it} is the error term. Standard errors are double clustered at the year and firm level. *, ** and *** denote statistical significance at 10%, 5% and 1% significance levels respectively. The study period is 2001-2017. Source: IMD and CMIE databases.

	Excess Rainfall departure		*Deficit Rainfall departure*	
Variables	**[1]**	**[2]**	**[3]**	**[4]**
Interaction	**0.040****	**0.056*****	**-0.064*****	**-0.053*****
	(2.19)	**(2.92)**	**(-2.94)**	**(-2.93)**
Size	-0.003	-0.235***	0.048***	0.028
	(-1.12)	(-12.48)	(4.30)	(0.85)
Leverage	-0.003***	-0.002***	-0.002***	-0.003***
	(-9.88)	(-5.63)	(-5.38)	(-3.72)
Liquidity	0.086***	0.060**	-0.234	-0.344
	(4.00)	(2.12)	(-1.29)	(-1.26)
OwnCon	0.000	0.000	-0.002	0.001
	(0.01)	(0.43)	(-1.05)	(1.13)
MB	0.001***	0.001***	0.001***	0.001**
	(4.89)	(2.97)	(4.27)	(2.32)
Time	-0.003***	0.017***	-0.015***	-0.019***
	(-3.76)	(7.98)	(-4.27)	(-3.06)
R^2 (adjusted)	0.019	0.208	0.003	0.106
Industry FE	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes
No. of Obs.	10,919	10,919	16,916	16,916

Chapter 6

Discussion and Conclusion

Abstract

After having stated my research questions in Chapter 1, develop suitable hypotheses in Chapter 2 and empirically investigate the hypotheses in Chapters 4 and 5, I provide a discussion on my findings, overall implications of my study and the limitations and direction for future research in this concluding chapter.

6. Chapter 6: Discussion and conclusion

My thesis provides empirical investigations in the area of corporate decisions. Using the PESTLE model, I investigate how firms would respond with corporate borrowing and investment decisions to the opportunity (as in creditors' protection) or threat (extreme weather trigger) faced by them under the legal and environmental dimensions of the model respectively.

I began this thesis by outlining the motivations and research questions followed by testable hypotheses in the initial chapters. I then used the regulatory setup of SARFAESI Act and the extreme *rainfall departure* conditions to test these hypotheses in my empirical chapters 4 and 5. In my empirical investigations, I show that regulatory and climate change are two critical external factors which can have considerable influence on corporate decisions. The two empirical investigations are commonly linked under the overarching theme of the PESTLE model of decision making. Further, under both investigations, I establish that the underlying value of the firm is positively impacted when firms undertake suitable strategic corporate borrowing and investment decisions in the wake of regulatory change and extreme weather uncertainty. Further, a common link in both investigations is the method used to establish the causal links, which is the difference-in-differences. While the exogenous treatment effect is caused by the regulatory interventions under the corporate borrowing decisions chapter, the rainfall extremities cause the exogenous treatment effect in the corporate investments decisions chapter. In the following section, I summarize the major findings and implications of my study.

6.1 Summary of major findings

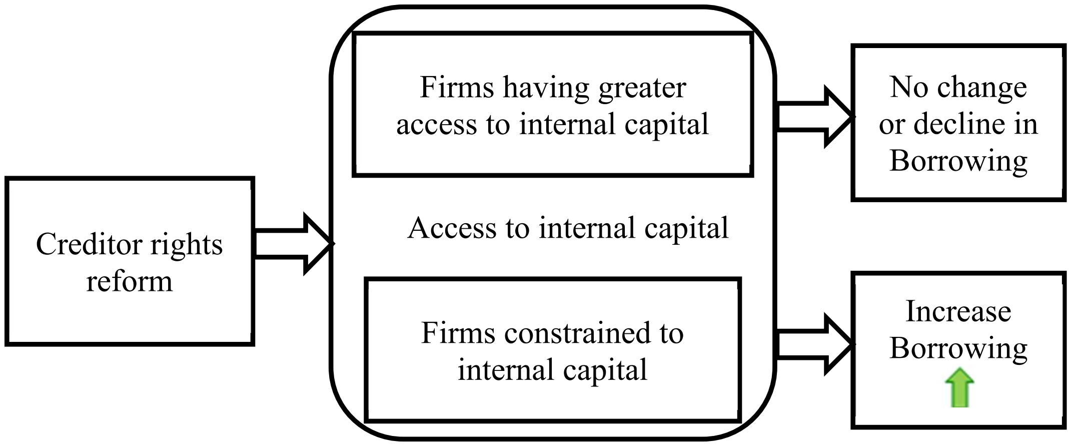
6.1.1 Corporate borrowing decisions

The legal dimension of the PESTLE model is one of the factors that can influence corporate borrowing decisions. While internal factors within the system are controllable by managers, factors like the regulatory reforms under the legal dimension are external to the system. Regulatory reforms, most of the times, are exogenous in the sense that the firms cannot choose to be or not be under the purview of the regulation. Under such circumstances, it is essential to understand whether the exogenous regulatory reforms lead to intended or unintended consequences. In the context of India, the SARFAESI Act 2002 was one such creditor protection regulatory reform whose main intention was to expand the contractual space of lending. However, Vig (2013) show that the unintended consequence of the reform was in the form of reduced borrowing by the corporates.

Motivated by the fact that India has a large number of business groups, and that the ability of the group affiliates to access their internal capital market under stricter creditor regimes, I investigate whether firms that have access to internal capital increase or decrease their borrowing in the light of the creditor protection reforms.

Figure 6-1 summarizes my empirical investigations on corporate borrowing decisions. Using the DiD and PSM-DiD I provide evidence that firms that have constrained access to internal capital (that is the standalone firms) increase their borrowing (2% to 4% of total assets) in the post creditor reform period when compared to those firms which have easy access to internal capital (business group firms).

Figure 6-1 Creditor right reform and corporate borrowing decision



This figure presents the summary of corporate borrowing decisions following creditor reforms.

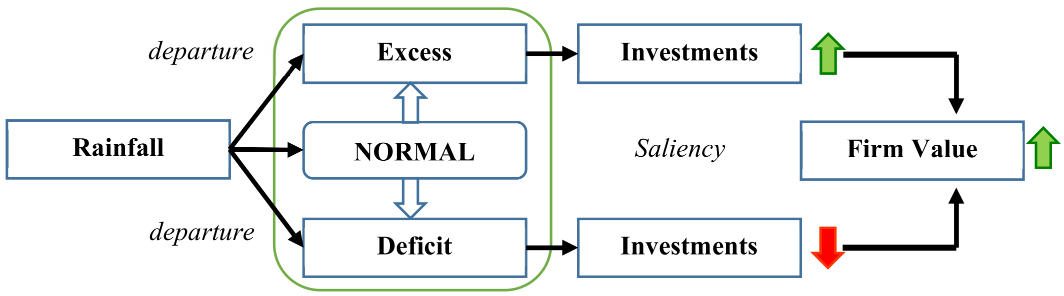
My results are robust to a host of robustness checks, including secured and unsecured borrowings placebo tests and using ICGR an alternative form of internal capital. Additionally, within the business group firms sub-sample, I show that group affiliates that do not have a financial firm as a group member bowwow more than other group firms with financial firm members.

I contribute the literature, by showing that one of the main factors that influence the corporate borrowing decisions considering exogenous regulatory reform is the heterogeneity in the access to internal capital. My findings are in line with studies that show expansion of lending following reforms that empower creditors (Haselmann et al., 2010; La Porta et al., 1998). My study also shows that the expansion of creditor rights improves allocative efficiency by channelling capital to the financially constrained units, which is particularly relevant in emerging economies like India (H. Almeida and Wolfenzon, 2006). The findings in this chapter that firms having access to internal capital prefer internal funding while firms with constrained access to internal capital increase their external borrowings also seems to support the pecking order theory on capital structure (Myers, 1984; Myers and Majluf, 1984).

6.1.2 Corporate investment decisions

Changes in climatic conditions have a material impact on economic activities as evidence through extant literature in Chapter 2. Further, I also provide a discussion on evidence from the literature that at the firm level, managers of the firms which are sensitive to extreme climatic conditions are salient to the effects of such exogenous climate events. In this line of studies, I investigate corporate investment decisions under the exogenous climate settings, i.e., *rainfall departure* (excess or deficit) conditions. Using the Indian monsoon data, I first show that in the immediate aftermath of the rainfall departure, the market-based value of rain-sensitive firms declines significantly (in the range of -10% to -17.7% in *excess* and -1.6% to -5.9% in *deficit* rainfall conditions) when compared to other non-sensitive firms.

Figure 6-2 Rainfall departure and corporate investment decisions



This figure presents the summary of corporate investment decisions following rainfall departures.

Figure 6-2 summarizes the findings of my investigations on corporate investment decisions. Using the salience theory framework, I show that corporate investment decisions are conditioned upon the heterogeneity of the *rainfall departure*.

Rain-sensitive firms significantly increase their investments in the *excess* period (on average, in the range of 3.4% to 4.8%) and decrease their investments (on average about 3%) in the *deficit* periods. Such differential decisions to invest and not invest in the different rainfall departure conditions are value relevant. I show using a host of robustness tests that the firm value of rain-sensitive firms increases (2% to 8% for *excess* and *deficit* rain-sensitive firms respectively) in the following year when such relevant heterogeneous investment strategies are adopted.

6.2 Overall Implications

My findings indicate that under exogenous regulatory and climate change events, corporates who take appropriate borrowing and investment decisions generate value to their shareholders. This is in line with the utility maximization theory, which conjectures that decisions are taken in a way to maximize one's utility. In this section, I discuss the overall implications of the corporate decisions for the firm as well as implications of my findings on other stakeholders like investors, government and society at large.

First, I investigate the implications of increased corporate borrowing decisions by the firms which have constrained access to internal capital in the post-SARFAESI Act reform period. I find that in the years following their expansion of corporate borrowing, treated firms increase their *Capex* significantly in the lead years by 2.4%, improve their operating performance significantly by 1.3% and experience higher market valuation in the subsequent years. My investigations of borrowing decisions on the firms' *Capex*, *ROA* and *MB* suggest a positive effect of increased borrowing decisions for firms that have constrained access to internal capital on their real investment, operational performance and valuations.

My findings on the implications of increased borrowing are also consistent with the efficient capital allocation argument put forth by Almeida and Wolfenzon (2006), whereby they argue that efficient capital allocation activities are constrained by the extent of financial development of an economy. Their model predicts that, in an economy that is at an intermediary level of financial development, the effect of conglomeration can create a negative externality that makes it more difficult for the nonaffiliated standalone firms to raise the required capital. To this end, my study provides evidence that the expansion of creditor rights improves allocative efficiency by channelling capital to the financially constrained units in an emerging economy (H. Almeida and Wolfenzon, 2006). Higher operating performance and valuation accompanying higher capital investments by the standalone firms in the post-SARFAESI Act reform period indicate the positive effects of creditor protection on investment efficiency (Buchuk et al., 2014). My results thus support the argument that the expansion of creditor rights improves the allocative efficiency by directing capital towards the needy, otherwise constrained, firms in an economy (Almeida and Wolfenzon, 2006).

For the policymakers, my findings of the consequences of the SARFAESI Act provides insights as to how internal factors like the access to internal capital and group affiliation can influence the capital structure decisions, especially concerning borrowing. Even though the policy to expand creditor rights intended to increase the contractual space of lending, it had an unintended consequence to the extent that firms which have easier access to internal capital reduced their borrowing. A key takeaway, however, from my study is that the policy was able to achieve its intentions among standalone firms with constrained access to internal capital. This benefitted a large number of standalone firms to access the debt market more easily, leading to allocative efficiency by directing capital towards the needy.

Second, I investigate the implications of increased corporate investment decisions by the firms that are rain-sensitive in the post *rainfall departure* conditions. Following the corporate decision to significantly increase investments during the *excess* period the market value of *excess* rain-sensitive firms increases significantly by about of 2% (*MB*) and range of 14% to 16.5% (*Tobin's q*) when compared to control group firms. Similarly, the corporate decision to significantly reduce investments during deficit period also leads to an increase in market values of *deficit* rain-sensitive firms increase by about 8% (*MB*) and range of 6% to 17.3% (*Tobin's q*).

Further, my investigations reveal, that in terms of rainfall extremities, the rain-sensitivity of the firms' industry is a better gauge than the location of the firm in accessing the extent to which the firms are impacted. The consequence of this finding is that certain rain-sensitive firms like those in mining, tourism, agriculture cannot self-select their location and move to regions with *normal* conditions. This is because (i) their business operations are directly influenced by the location. For example, mining firms are located where mines are found. Similarly, tourism and agriculture industries are located due to location-specific factors. (ii) The cost of re-location is exceptionally high and would not be economical, as the *rainfall departures* are exogenous events with very high uncertainty, and it is impossible to predict whether the deviations in a particular year would be extreme or within the *normal* range.

Further, the sensitivity analysis indicates that rainfall departures within the range of ± 19-20% have minimal impact on corporate investment decisions. This could provide cues to the investors who hold rain-sensitive firms in their portfolios to invest/ make trading decisions (buy or sell) based on the annual rainfall event. The investors always have a put option on the stock they hold and can exercise their option to sell the stock when rain-sensitive firms do not take appropriate value-enhancing investment decisions in the aftermath of *rainfall departure*.

6.3 Limitations

6.3.1 Limitations of corporate borrowing decisions investigations

In the investigations presented in Chapter 4, I make an implicit assumption that business group firms do not overleverage or overinvest. On account of reputational concerns, as there might be spillover effects to the entire group in the event of bankruptcy of any one member of the group (Gopalan et al., 2007). However, in the wake of expanding credit supply following the SARFAESI Act, group firms may, especially with over-confident CEOs, indulge in external borrowings and undertake additional risky investments (Malmendier and Tate, 2008, 2005). On other limitation could be that the study focuses on a single emerging market. It could be argued that the results may not be generalized even for developed markets where there is lower information asymmetry. Further tests in this regard are therefore necessary.

6.3.2 Limitations of corporate investment decisions investigations

One of the limitations of this chapter could be that firms could locate themselves into locations where extreme rainfall condition is less probable. Secondly, I acknowledge that to the extent that firms' exposure to extreme *rainfall departures* is based on the location of the head-quarters, my results could be limited to the scope where a significant part of the operations is located in the same subdivision as that of the headquarters. Further, given the small number of observations in some subdivisions, the margin of the contribution of these observations to the overall estimates could be insignificant. Finally, the literature indicates that firms adopt coping strategies in the long run (Dell et al., 2012). This could be in the form of innovation, changes to operating procedures or adoption of new technology. For example, agriculture is witnessing a revolution in the form of hybrid seeds and modern irrigation. Such, coping strategies could weaken the effects of my findings in the long run.

6.4 Future research

Limitations of any empirical study provide opportunities for future research. In this section, I briefly propose the possible avenues and direction for future research in the line of enquires presented in this thesis.

With respect to the internal capital and creditor rights, analyzing the impact of corporate borrowings on the firm's cost of capital could be an interesting question for further research. Since my research indicates that standalone companies increase their borrowing, further investigations on the choice of capital structure among financially distressed companies could be investigated.

In the area of climate research, the impact of extreme weather conditions on firms' adaptation and coping strategies can be examined. More specifically, the question of whether extreme weather conditions lead to increased innovation in the form of R&D and patenting is an area open for further investigation. The literature on weather variations on economy provides evidence that developed economies usually tend to adapt faster to the changing weather conditions, and thus, the impact of extreme temperature is milder in developed economies compared to other weaker economies (Burke and Tanutama, 2019; Dell et al., 2012; Hsiang, 2010). This phenomenon could be tested with respect to the abnormal rainfall conditions as well. Additionally, given that certain firms are rain-sensitive, an enquiry into the changing ownership patters of institutional investor (foreign and domestic) ownership following extreme weather conditions can be conducted. Finally, given the evidence in the literature regarding climate-related migration, studying the impact of extreme weather-induced migration on labour-intensive industries could be a good area for future research.

6.5 Concluding remarks

Decision making is a complex process. When corporate managers take decisions, they have to navigate through the complex web of internal and external information and take decisions that ultimately maximizes utility. Given the plethora of factors that influence corporate decisions, in this thesis, I investigate how corporate borrowing and investment decisions are made under the influence of exogenous regulatory and climate change shocks, respectively. My empirical investigations reveal that firms that are constrained to internal capital decide to borrow more in the event of stricter creditor protection reforms. Additionally, using extreme *rainfall departure* conditions, my investigation reveals that corporate investment policies are dependent on the heterogeneity of the exogenous climatic condition, and this decision to invest or not depends on the past experience of the manager. In all both borrowing and investment corporate decisions under these specific exogenous factors are value relevant.

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