

Investment-Cash Flow Sensitivity amidst Geopolitical Risk and Group Affiliation: Insights from Metal Industry

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Abstract: This study explores the Investment-Cash Flow Sensitivity (ICFS) in the metal industry and explores how geopolitical risk (GPR) and group affiliation influence this relationship. The analysis is based on a sample of 244 metal firms from 2012 to 2022. Using a panel fixed-effect regression, the study reveals that Indian metal firms exhibit low ICFS, while this sensitivity intensifies during periods of geopolitical risk. Additionally, the group affiliation of a firm significantly moderates this effect and helps to mitigate ICFS in times of geopolitical uncertainty. This research offers valuable contributions to the existing literature, with implications for economies, firms, managers, and investors. To the best of the authors' knowledge, this study is the first to explore investment-cash flow sensitivity (ICFS) in relation to both geopolitical risk and group affiliation within the metal industry.

1. Introduction

The dependency of firms on internal funds (cash flow) while making investment decisions is referred to as investment-cash flow sensitivity (ICFS). ICFS has been a burning issue in the corporate finance literature since the pioneering work of Fazzari et al., (1998). While scholars' working on ICFS, strongly oppose Modigliani & Miller's, (1958) proposition which delineates investment decisions as independent of financing choices (Sinha & Sawaliya, 2021). In their framework of a perfect capital market, Modigliani & Miller (1958) portrayed internal and external finance as substitutes due to the absence of market friction. However, such an ideal capital market does not exist in the real world as there is a lot of friction in the market (Dash & Sethi, 2024; Kuo & Hung, 2011; Myers & Majluf, 1984a). This friction can result from information asymmetry, as proposed by the pecking order theory (Myers & Majluf, 1984b), agency problems outlined in agency theory (Jensen, 1986), taxes, and various transaction costs emphasised in the static trade-off theory (Myers, 1977). The difference in cost of internal and external funds motivates a manager to choose wisely between these two alternatives, and imperfectness in the capital market makes the external sources of funds even more costlier than internal sources (Gupta, 2022a). Hence, a firm prefers internal funds (cash flow) over external sources in the investment decision when facing financial constraints (Dash et al., 2023a).

Consequently, realising the implication of operating cash flow in the investment decision, researchers across the world have paid substantial attention to investigating the dependency of investment on firms' cash flow.

So far the metals and mining industry is concerned; it has traditionally been capital-intensive, involving long-term projects that demand a well-organised approach. This is largely due to the complex infrastructure, combined with the uncertainties. An often overlooked aspect of this industry is that investments are mostly sunk costs (Rumokoy et al., 2023). Consequently, firms follow a strict capital allocation system, where investment decisions are subject to more thorough evaluation and risk analysis. Another key feature of this industry is its openness to international trade, making it highly integrated into the global economy. As a result, companies are more exposed to macroeconomic fluctuations (Jefferis, 2014). In an already challenging investment landscape, firms must be particularly careful when making decisions in the context of geopolitical risk (GPR).

Geopolitical risk (GPR) is a macroeconomic risk in which the potential hazards stemming from conflicts, terrorist activities, and tensions between countries disrupt the normal course of peaceful international relations (Caldara & Iacoviello, 2022). This GPR also triggers disputes that disturb business cycles and financial markets, resulting in financial difficulties for businesses. So far, in an emerging economy like India, GPR has a potential impact on several grounds, such as India's economy faces challenges due to geopolitical risks, including a slow economic recovery, vulnerability to rising tensions in Asia, and worsening indicators such as inflation, tighter banking conditions, and trade shocks (Gupta, 2023). Key geopolitical concerns for India involve China's interference, the Russia-Ukraine conflict, regional instability, and the ongoing border dispute with China. Additionally, India is exposed to significant risks, such as increasing crude prices and tightening financial conditions. The evidence suggests urgent attention is needed to explore the impact of geopolitical risks on the Indian economy and ICFS. Through this paper, we have made a novel attempt to address some pertinent questions, such as whether Indian metal industry firms depend on their cash flow for investment?. Does geopolitical risk have any impact on investment-cash flow sensitivity? Does group affiliation moderate the GPR-ICFS nexus?

This paper uniquely contributes to the body of knowledge by offering new insights that align theoretical frameworks with empirical evidence in several ways, including adding to the limited literature on "corporate investment, ownership structure and macroeconomic risk" in emerging economies, particularly India. To the best of the authors' knowledge, this study is the first empirical work to explore investment-cash flow sensitivity (ICFS) in relation to both geopolitical risk and group affiliation within the metal industry. The remaining sections include a literature review, research methodology, empirical results, discussion, conclusion and scope for future work.

2. Literature Review and Hypothesis Development

2.1 Investment-Cash Flow Sensitivity

The crucial role of cash flow in guiding investment decisions, referred to as investment-cash flow sensitivity, was first highlighted by Fazzari et al. (1988). This discovery has sparked considerable interest among scholars seeking to understand the factors contributing to this phenomenon. Investment is a key indicator of a firm's growth (Dash and Swain, 2020). Yet, the current VUCA (volatile, uncertain, complex, and ambiguous) environment poses significant challenges to maintaining a steady investment strategy. Therefore, it is essential to examine each factor to make informed investment choices thoroughly. Some firms have positive cash flow sensitivity, while others may have negative ICFS. According to the Fazzari et al. (1988), firms with positive ICFS are more likely to encounter high external capital costs than low ICFS firms. These firms are typically smaller and younger, distribute lower dividends and are remotely expected to possess a bond rating, especially an investment-grade rating. They also exhibit lower asset tangibility (Hovakimian, 2009). They maintain considerably higher financial slack to preempt potential liquidity issues. They demonstrate lower asset tangibility (Hovakimian, 2009) and maintain significantly higher financial slack to mitigate potential liquidity risks. At the same time, some firms also show negative sensitivity towards cash flow when making their investment agenda. To a large extent, the adverse correlation appears to stem from the divergence in trajectories of cash flows and capital expenditures among companies designated as negatively responsive to cash flow changes throughout their existence. Initially, these entities emerge into the public domain endowed with promising investment prospects but meagre earnings. Their capacity to secure substantial debt and equity suggests that market sentiment regards their investment ventures as highly profitable despite their minimal present cash flows. Moreover, their initial cash flow deficiencies render synchronising investments impractical for periods of ample cash. Initially, the cash flow shortage necessitates a prolonged period for it to become a significant financing source. Additionally, abstaining from current investments may impede the realisation of future cash flow increments. Consequently, these companies allocate most of their investments during periods of minimal cash flow, predominantly relying on external funding. As per the corporate life cycle hypothesis, their previous investments yield higher cash flows as they mature, coinciding with a deceleration in investment rates due to diminishing lucrative opportunities. These synchronous shifts in cash flows and investment rates give rise to an adverse empirical correlation between investment and cash flow. So, as far as Indian manufacturing firms are concerned, they are financially constrained due to high market imperfection and lack of a robust financial system (Dash *et al.*, 2023a; Dash & Sethi, 2024; Dash & Swain, 2020). Hence, the following hypothesis may be developed for ICFS in the Indian context.

H1: Indian metal industry firms have positive ICFS.

2.2 GPR and ICFS Relationship

In the past two decades, there has been a remarkable shift in corporate investment policy decisions due to unpredictable changes in cash flow around the globe (Khaib et al., 2021). One prominent factor persuading to change the investment policy is macro-economic risks like GPR (Díez-esteban & García-g, 2020). However, little evidence exists on how GPR affects investment (Comerio & Strozzi, 2019). Geopolitics involves the political dynamics between states in cross-border interactions, focusing on the strategic significance of these relationships for economic dominance, geographical location, and access to vital resources (Fiorillo et al., 2024). Geopolitical risk emerges from the evolving nature of these relations and international affairs. In recent years, escalating tensions between nations and adverse events have threatened global economic stability, leading to a heightened geopolitical risk (Overland, 2019). Consecutively, the ‘DTCC Systemic Risk Barometer Survey¹’ has recognised GPR as one of the top five systematic risks since 2013. Hence, the GPR has become a hurdle for the development of the economy and business as it reduces policy flexibility and increases the cost of production. Taking this argument further, Jackson & Orr, (2019) opine that investors and business groups are concerned about the shifting economic landscape, especially if some policy changes are viewed as unstable or temporary. This situation inherently encourages a firm to postpone the investment and expansion plan and resume such decisions when the probabilities of uncertainty become low. The study of Dejuán & Ghirelli, (2019) also agrees with a similar statement in the context of Spain. They suggest that macroeconomic risk decreases business investment by increasing precautionary reserves or deteriorating lending conditions. Rodrik, (1991) documents that such risks not only affect firm-level investment behaviour but also the country’s macroeconomic fundamentals such as foreign trade, exchange rate, national savings and socio-political stability which in turn create more chaotic situation. For emerging economy like India most of the businesses houses are with limited financial resources (financially constrained firms), Gupta & Mahakud, (2020) exhibit that the macroeconomic environment is very important for business’s smooth investment agenda.

Hence, recognising geopolitical risk’s potential to considerably affect the global financial system's safety, resilience, and stability, it is essential to conduct empirical investigations into this matter. However, inadequate measures for geopolitical risk have been a significant hurdle in empirical research. However, Caldara & Iacoviello, (2022) have addressed this gap by creating a GPR index. This index uses text searches to assess the proportion of articles in major English-language newspapers that discuss unfavorable geopolitical events. Geopolitical risk, as defined in this context, includes ‘the threat, occurrence, and escalation of adverse events related to wars, terrorism, inter-state tensions, and political factors that disrupt the peaceful conduct of international relations.’ Researchers have increasingly used the GPR index to investigate its economic impacts, beginning with its

¹<https://www.dtcc.com/dtcc-connection/articles/2021/december/13/systemic-risk-barometer-2022-forecast>

influence on business. However, there is very little evidence of GPR-ICFS relationship. Gupta, (2023) demonstrated that unfavourable geopolitical events prompt banks to shrink loan sizes and raise interest rates, driving up debt costs for firms. This makes it harder for firms to obtain external financing from banks and financial institutions, forcing them to depend primarily on internal cash flows for investments. Consequently, the study argues that geopolitical risk (GPR) negatively affects lending institutions, reduces market liquidity, and increases the cost of external financing for firms. The substantial cost differential between internal and external financing, aggravated by GPR, impedes firms' borrowing capacity from external markets. Consequently, the firm turns to investing with available internal funds, and GPR intensifies the sensitivity of investments to cash flow fluctuations. Given this, the paper proposes the following hypothesis:

H₂: GPR increases investment-cash flow sensitivity.

2.3 GPR and ICFS Nexus amidst Group Affiliation

Next, this paper debates that ownership structure has a potential impact on a firm's ICFS amidst Business groups, formed through formal and informal ties, operate as unified entities that can pool resources internally and access external market resources (Huang et al., 2021; Sethi, et al., 2021). This internal capital market within business groups helps affiliates overcome financial constraints by providing internal funding, enabling them to invest more in long-run projects without resource allocation issues (Gupta & Mahakud, 2022; Hai et al., 2022; Huang et al., 2021).

Business groups are especially significant in emerging markets, where they help mitigate external capital market imperfections (Almeida & Wolfenzon, 2006; Khanna & Rivkin, 2001). The internal capital market within these groups offers advantages like economies of scope and scale, improved resource allocation, and risk-sharing, enhancing their market value (Hai et al., 2022; Sethi, et al., 2021). Additionally, business groups have a separate management and control system at the group level. However, research has revealed that these internal capital markets can be inefficient. According to agency theory, agents in these relationships might pursue low-profit, high-risk projects for personal gain, leading to issues like tunnelling behaviour and conflicts between large and small shareholders (Hai et al., 2022). The widespread use of pyramid structures in business groups exacerbates these agency problems by increasing the separation between management control and cash flow rights (Hai et al., 2022; Huang et al., 2021). This asymmetry can lead to financial malpractices, such as hollowing out companies, affecting dividend policies, and increasing financial costs, ultimately reducing the market value of holding companies.

In India, most firms are affiliated with business groups (Gupta & Mahakud, 2022). Studying the impact of GPR on internal capital flows for group-affiliated firms is crucial. Research indicates that business group firms face fewer financial constraints than standalone firms (Dash et al., 2023a; Dash and Swain, 2020), which are highly constrained. This is because group firms benefit from internal capital

markets and can easily raise funds due to their reputation and political connections (Hai *et al.*, 2022; Huang *et al.*, 2021). Cash-rich firms, however, may over-invest due to managers' empire-building motivations (Biddle *et al.*, 2009). Thus, group-affiliated firms can have more ICFS than standalone firms and avoid GPR compared to standalone firms. Given this, the paper proposes the following hypothesis:

H₃: The impact of GPR on ICFS is less in group affiliated firms.

3. Research Methodology

3.1. Data and Sample

The data are collected from the “prowess” database of the ‘Centre for Monitoring Indian Economy’ (CMIE) and ‘<https://www.matteoiacoviello.com/gpr.htm>’ for a period of 11 years from 2012-2022. This study is confined to listed manufacturing firms as such firms remain under obligation to pursue the regulatory prescriptions of the SEBI for recording and reporting of financial information. Firms involved in banking and financial services are excluded from the sample as they follow a different set of regulatory and financial reporting practices. Besides, firms having missing data are also not considered. So, a data set of 2,449 firm-year observations is assembled for 244 metal industry firms. Following the methodology of Díez-esteban & García-g, (2020), the study uses the monthly GPR index developed by Caldara & Iacoviello (2022) to measure GPR. After that, the monthly GPR index is converted into an annual average of the index to align that frequency with the sample’s firm-level yearly data. Further, firms associated with any group are classified as group-affiliated firms, while those not associated with any group are treated as standalone firms. It was found in this study that 70 firms belong to business groups, whereas 174 firms are standalone. Data has also been winsorised at 99th and 1st percentile levels to remove outliers.

3.2. Variables

In line with the literature, investment has been taken as the dependent variable, and cash flow has been taken as the independent variable representing internal funds. Here, investment is the function of cash flow, which measures investment-cash flow sensitivity. Further, investment is calculated as the change in the fixed asset from the previous year to the current year, and after that, investment is scaled by the previous year's total asset. So, the beginning year of the sample period is not considered for estimation. This study uses GPR as a first-level moderating variable and group affiliation as a second-level moderating variable. Further, Tobin’s Q, sales growth, firm size, firm age, liquidity, and ROA have been used as control variables to address the influence of possible omitted variables. The description of variables is provided in Table 1.

Table 1: Variables used in the study

Variable	Abbreviation	Description	Data Source	Reference
Investment	I/K	Net investment in fixed asset (I) (It - It-1), divided by total assets at the beginning of the period (K)	Prowess Database	(Arslan et al., 2006; Brown & Petersen, 2009)
Cash Flow	CF/K	Profit after tax (PAT) adjusted for the effect of non-cash items divided by total assets at the beginning of the period (K)	Prowess Database	(Arslan et al., 2006; Brown & Petersen, 2009)
Geopolitical Risk	GPR	Average of GPR value	https://www.mattcoiacoviello.com/gpr.htm	(Fiorillo et al., 2024; Gupta, 2023)
Group Affiliation	GAF	A dummy variable '1' if the firm is a group affiliated otherwise '0'.	Prowess Database	(Sethi & Swain, 2019)
Tobin's Q	Q	Market capitalisation plus total assets minus book value of equity whole divided by total assets	Prowess Database	(Attig et al., 2014)
Sales Growth	SG	(Current Year Sales / Previous Sales) – 1	Prowess Database	(Dash & Swain, 2020; Dash et al., 2023)
Liquidity	LIQ	Liquid Asset/ Total Asset	Prowess Database	(Gupta, 2022; Dash & Swain, 2020)
Leverage	LEV	Total debt/Total asset	Prowess Database	(Dash et al., 2023; Gupta, 2022; Sethi & Swain, 2019)
Firm Size	FS	Natural logarithm of Total assets	Prowess Database	(Dash et al., 2023; Gupta, 2022; Sethi & Swain, 2019)
Firm Age	FA	Number of years since incorporation	Prowess Database	(Dash et al., 2023; Gupta, 2022; Sethi & Swain, 2019)
Profitability	ROA	(Profit after Tax/ Total asset) ×100	Prowess Database	(Dash et al., 2023; Sethi & Swain, 2019)

Source: Authors' compilation

3.3. Estimation Approach

The study uses a panel data set due to its distinct benefits like controlling unobservable heterogeneity ((Fazzari and Petersen, 1993; Hsiao, 2003; Moulton, 1986), gathering extensive observations, minimising collinearity, and providing technical efficiency(Das et al., 2023; Koop, G., & Steel, 2001; Sethi & Swain, 2019b) Further, the study applies panel fixed effect regression as suggested by Hausman test to generate robust results. This study has estimated the following model for the analysis.

$$(I/K)_{it} = \beta_0 + \beta_1(CF/K)_{it} + \beta_2(CF/K)_{it} * GPR + \beta_3(CF/K)_{it} * GPR * GAF + \beta_4Q_{it} + \beta_5SG_{it} + \beta_6LIQ_{it} + \beta_7LEV_{it} + \beta_8FS_{it} + \beta_9FA_{it} + \beta_{10}ROA_{it} + \Theta_i + \gamma_t + \epsilon_{it}$$

The descriptions of the variables taken in the models are depicted in Table 1. Additionally, a firm-specific effect Θ_i , and time dummy γ_t , have been considered in the model. The subscript “i” represents firms, and “t” represents years.

3.4 Conceptual model

The study has the following conceptual model for better understanding.

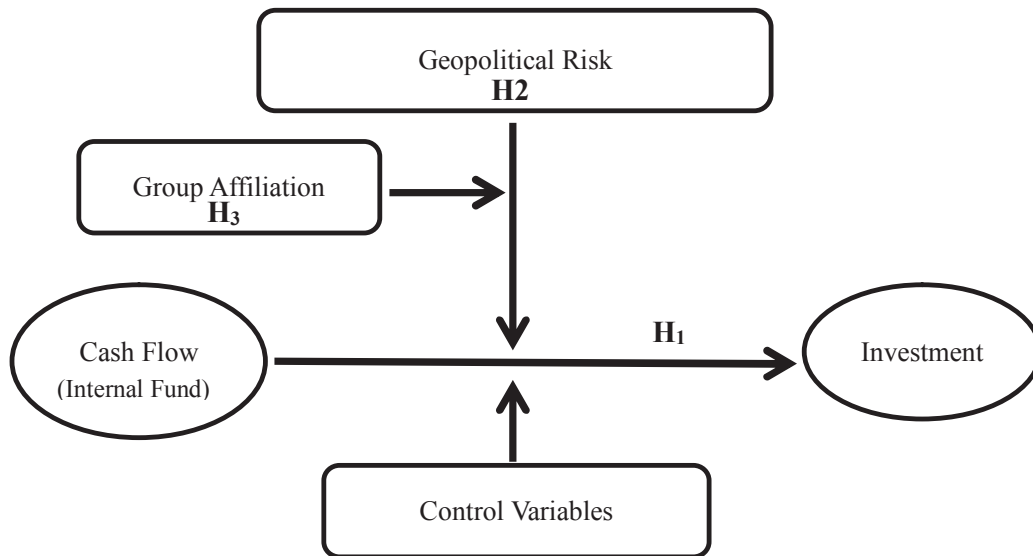


Fig. 1: Conceptual Model

Source: Authors’ creation

4. Results and Discussion

4.1. Summary Statistics

Table 2: Summary Statistics

Variable	Mean	Median	S.D.	Min	Max
I/K	11.1	0.0	51.0	-0.5	258.0
CF/K	15.2	0.1	62.4	-10.2	312.0
GPR	0.2	0.2	0.0	0.1	0.2
Tobin's Q	1.2	1.1	7.9	-399.0	13.0
Sales Growth	0.9	0.1	20.2	-1.0	879.5
Liquidity	0.5	0.5	0.2	0.0	1.0
Leverage	1.6	0.6	45.5	0.0	23.0
Firm Size	7.7	7.6	2.3	-2.3	14.7
Firm Age	31.3	30.0	17.0	1.0	133.0
ROA	-0.1	1.8	41.6	-19.0	113.6

Source: Authors' calculation.

Table 2 illustrates the summary statistics of the variables. The mean of I/K is 0.11.1, which indicates that Indian metal manufacturing firms spend around 11% of their total assets towards capital expenditure every year. The mean of CF/K is 15.2, which suggests that an average Indian firm has a cash flow of around 15% of its total assets. The mean of GPR, Tobin's Q, sales growth, liquidity, leverage, firm size, firm age, and ROA, are 0.2, 1.2, 0.9, 0.5, 1.6, 7.7, 31.3, and -0.1 correspondingly. The values are consistent with the prior work of Dash & Sethi, (2024).

4.2 Correlation Matrix and Multi-collinearity Test

Before applying the multiple regression, it is necessary to check whether there is any strong association among independent variables. If it is so, it leads to a multicollinearity issue. Hence, we tested the multicollinearity highlighted in Table 3 through the correlation matrix and variance inflation factor. Though the correlation coefficient values between 0.001 to 0.994, the highest VIFs of 3.010 (<10) show the absence of a multicollinearity problem, as recommended by (Chatterjee & Hadi, 1977; O'Brien, 2007).

Table 3: Correlation Matrix and Variation Inflation Factor (VIF)

	I/K	CF/K	GPR	Tobin's Q	Sales Growth	Liquidity	Leverage	Firm Size	Firm Age	ROA	VIF
I/K	1										
CF/K	0.994	1									1.139
GPR	-0.014	-0.013	1								3.010
Tobin's Q	-0.001	0.000	0.010	1							1.179
Sales Growth	0.112	0.145	0.034	-0.016	1						1.025
Liquidity	-0.008	-0.008	-0.030	-0.055	0.008	1					1.357
Leverage	-0.0004	-0.001	-0.013	-0.994	-0.002	0.046	1				1.428
Firm Size	0.030	0.032	0.015	0.115	-0.041	-0.433	-0.091	1			1.410
Firm Age	-0.038	-0.040	0.022	0.016	-0.028	-0.218	-0.004	0.330	1		1.111
ROA	0.001	0.002	-0.005	0.964	0.038	-0.021	-0.962	0.117	0.005	1	1.605

Source: Authors' calculation.

4.3 Regression Results

Table 4: Impact of GPR & Group Affiliation on ICFS: Fixed Effect Regression Analysis

Variables	Coefficient (β)		p-value
$(CF/K)_{it}$	-1.201	***	0.000
$(CF/K)_{it}$ x GPR	5.758	***	0.000
$(CF/K)_{it}$ x GPR x GAF	2.091	**	0.008
‘Tobin’s Q’	-0.002		0.766
‘Sales Growth’	0.001	**	0.007
‘Liquidity’	-0.265	***	0.000
‘Leverage’	-0.028	***	0.250
‘Firm Size’	0.025	*	0.055
‘Firm Age’	-0.007	**	0.001
‘ROA’	0.001		0.176
‘Constant’	0.175		0.103
‘Time Effect’	Yes		
Within R Square	0.126	p-value (F)	0.000
Overall R Square	0.064	No. of Observation	2,449

Source: Author’s calculation.

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

Table 4 presents the fixed effect regression results of the study. The findings suggest that firms in the Indian metal industry rely less on internal cash flows for their investment decisions, indicating that they are financially unconstrained and have easy access to external funds. However, this situation changes during geopolitical risk (GPR) periods, when the internal cash flow sensitivity (ICFS) increases significantly. During such times, GPR negatively impacts the economy and financial institutions, increasing the cost of external funds and compelling firms to rely more on internal resources for investment decisions. Additionally, as most Indian firms are group affiliates (Gupta & Mahakud, 2022), there are differing views on the role of ownership structure (group affiliates vs standalone firms) in the ICFS relationship nexus (Almeida & Wolfenzon, 2006; Haiet *al.*, 2022; Huang *et al.*, 2021; Khanna&Rivkin, 2001; Sethiet *al.*, 2021). This disparity in evidence motivates an examination of the association between group affiliation, GPR, and ICFS in the Indian context. The results show that group affiliation moderates the GPR-ICFS relationship by reducing the sensitivity induced by GPR. This indicates that group firms provide a form of co-insurance for their sister firms,

enhancing confidence in utilising internal cash flows. Group firms can also engage in intercorporate borrowing, which helps mitigate the negative effects of GPR.

5. Conclusion and Implications

This study explores firms' internal cash flow sensitivity (ICFS) in the Indian metal industry, focusing on the influence of geopolitical risk (GPR) and the moderating role of group affiliation. The results indicate that, under normal conditions, Indian metal firms show low ICFS. However, during periods of heightened geopolitical risk, this sensitivity increases. Furthermore, the findings highlight that group affiliation plays a crucial role in moderating the impact of GPR, helping to reduce ICFS during times of geopolitical uncertainty.

The findings of this research offer valuable insights for project managers, investors, regulators, lenders, financial institutions, and academics. First, the study enhances the understanding of corporate investment behaviour and ICFS, benefiting businesses, scholars, and policymakers. Second, it raises awareness among companies about the negative impact of geopolitical risk (GPR) and encourages the development of policy initiatives that can support economic growth and help firms navigate such risks. Third, loan agencies, investors, and stakeholders should closely consider a firm's ownership structure (group-affiliated vs. standalone) when making investment or lending decisions. Lastly, regulators should implement appropriate policy measures, such as maintaining low interest rates, simplifying investment procedures, and ensuring easy access to external funds to support firms in mitigating the challenges posed by GPR.

5.1 Limitations of the Study and Scope for Future Research

This study focuses exclusively on firms in the metal industry, but future research could extend the analysis to include other manufacturing firms for broader insights. Additionally, cross-country comparisons could provide a more comprehensive understanding of the topic. The current research relies on quantitative financial data from financial statements. Still, future studies could incorporate qualitative factors—such as the personal attributes of project managers and CEOs and the type of investment projects—which may significantly influence a firm's investment decisions. While this study considers group affiliation, future research could explore other components of ownership structures, such as varying holding patterns, to further enrich the literature. Further, Small and Medium Enterprises (SMEs) play a vital role in the economic development of the country (Dash, et al., 2023). Future research can explore the ICFS in the SME context.

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Appendix

Table A1: Hausman test Results

Hausman test statistic:	Selection of Model (Fixed Effect / Random Effect)
H = 39.0275 with p-value = prob.(chi-square(13) > 39.0275) = 0.00019	Fixed Effect

Source: Author’s own calculation

Note- A low p-value counts against the null hypothesis that the random effects model is consistent, in favour of the fixed effects model