



International Journal of Business Excellence

ISSN online: 1756-0055 - ISSN print: 1756-0047

<https://www.inderscience.com/ijbex>

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DOI: [10.1504/IJBEX.2026.10077210](https://doi.org/10.1504/IJBEX.2026.10077210)

Article History:

Received:	13 August 2025
Last revised:	16 January 2026
Accepted:	19 January 2026
Published online:	31 March 2026

Evaluating financial performance excellence through application of interest rate derivatives: a research study

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Abstract: This study covers the usage of interest rate derivatives (IRD) in financial risk management. It was conducted on Jaiprakash Associates Limited (JAL) and Jhajjar Power Limited to understand the implications of risk management on Balance sheet management. This paper is diagnostic and uses exploratory and longitudinal case study methodology following Yin (2018). There are wider implications for strategic risk management as elaborated by Chatterjee and Mohanty (2023). Götze and Rudolph (1994) examined how financial risks affect a corporation over time, and these cases underline impact of not using adequate risk management strategies. The report concludes that utilisation of IRD demonstrates planned risk management for companies where external financing is a growth driver. The outcome of this study would enable risk strategies to evolve in debt-intensive sectors. Academic case studies are also few, and this case is an academic exercise in understanding the link between risk and business excellence.

Keywords: case study in derivatives; risk and organisational excellence; interest rate derivatives; IRD; integrated risk strategy; culture and strategy; innovation; hedging; business excellence with risk management.

Reference to this paper should be made as follows: Chatterjee, S. and Mohanty, R.P. (2026) 'Evaluating financial performance excellence through application of interest rate derivatives: a research study', *Int. J. Business Excellence*, Vol. 38, No. 9, pp.1–24.

Biographical notes: Subhamoy Chatterjee has 20 years of experience across the banking industry specialising in treasury, global markets and risk advisory. He has worked across a broad spectrum of banks in the multiple senior management roles in the areas of strategic finance and risk advisory. He also takes an active interest in academics and teaches derivatives and risk in various institutes in western India to post-graduate students. He is currently pursuing his Doctoral studies at SOA University.

R.P. Mohanty has a total experience of 53 years both in academics and industry and has worked both in India and abroad. He has published more than 200 papers in reputed international journals. Currently, he is the Chief Consultant at SOA University where he was the Vice-Chancellor. His current areas of research are related to finance and accounting, SCM, TQM, and OR. He has supervised more than 27 doctoral scholars.

1 Introduction

Peter (1982) introduced the concept of a homogenous blend of strategy and culture in an organisation. They identified key attributes that organisations must possess to achieve excellence. Excellent companies favour a method that encourages an appropriate response to issues at hand, which includes financial risks. They described a ‘chunking’ strategy as a method for breaking down complex problems or tasks into parts, facilitating faster action and learning within organisations. This approach encourages a bias for action, enabling companies to experiment and learn from both successes and failures, thereby driving innovation. We analysed a similar approach to learning and using derivative instruments to hedge risks. They further found that a subject as vast as financial risk management can be addressed by breaking it into components, such as rate risks.

We found a relationship between revenue and ability to manage strategic risks adequately, as well as ability of some organisations to align their various risks for business excellence. Yamin et al. (1999) had analysed relationship between generic strategies and synergising them for organisational performance. We used case studies of two businesses in two sectors to examine how derivative-led risk management improves financial performance.

Patnaik and Shah (2010) analysed the currency and interest rate risk management practices of Indian firms, finding that while derivative usage has increased, many firms remain exposed to significant financial risks. Their work highlights the potential for improved financial risk management practices among Indian companies, particularly those with a higher debt component in their balance sheets.

Hedging is grounded in the concept that companies can use financial instruments to manage risk, particularly to offset potential losses. Modigliani and Miller (1958) proposed the Hedging Irrelevance Theory for perfect markets; hedging may be unnecessary because investors can diversify their own risk. However, real-world imperfections, notably financial distress, taxes, and underinvestment problems, make hedging a valuable component of the pursuit of excellence. Srivastava and Srivastava (2010) evaluated Indian manufacturing enterprises’ interest rate risk management, noting an increasing trend in the use of interest rate swaps (IRS) but also identifying gaps in risk assessment and management capabilities. Indian interest rate futures market development was covered by Ghosh and Chatterjee (2018), highlighting growth in swap volumes and increasing sophistication of market participants. This study analyses companies across the following sectors:

- infrastructure
- power.

This research focuses on three fiscal years (2021–2024) for sample companies in each of the two above-mentioned sectors. We have studied financial statements of companies in each of the above sectors to empirically analyse the use of derivatives in their balance sheets.

Srivastava and Srivastava (2010) evaluated Indian enterprises' interest rate risk management, noting an increasing trend in the use of IRS but also identifying gaps in risk assessment and management capabilities. The Reserve Bank of India's (2011) guidelines on interest rate derivatives (IRD) provide regulatory framework for IRS transactions in India. Understanding these regulations through a framework is crucial for analysing the constraints, as noted by Davidsson et al. (2010), when attempting to align the rate strategy with the organisation's overall strategy. Ghosh and Chatterjee (2018) outlined India's IRD market development, highlighting growth in swap volumes and increasing sophistication of market participants. Key themes relevant to our study:

- The theoretical basis for IRS is well-established, providing a solid foundation for valuation and strategic analysis, and contributing to overall business excellence.
- IRS are used by corporations for risk management and cost reduction objectives for better financial management.
- The power sector and infrastructure sector face unique challenges that make effective financial risk management particularly crucial
- The regulatory environment and market developments in India have essential implications for the implementation of IRS strategies.

Case study

JAL

The study examines how JAL, a company operating in the infrastructure and construction sectors, utilises financial instruments like IRS, embedded derivatives, as well as foreign currency derivatives to manage risks. The study employs a conceptual framework to examine adoption of these derivatives, the type of derivatives used, as suggested by Nishat Faisal et al. (2007), on JAL's financial performance, which studied information risk mitigation. Founded in 1979, JAL initially began as a construction company specialising in infrastructure projects. Over the years, it grew into a multi-disciplinary organisation, expanding into various sectors such as cement manufacturing, power generation, and real estate development. The company became synonymous with large-scale projects, like hydroelectric power plants and dam construction, which significantly contributed to its growth and expansion. Key milestones in JAL's history include the construction of the Sardar Sarovar Dam, India's largest hydroelectric power project, and the Yamuna Expressway, a critical link between Delhi and Agra. Its evolution from a construction company to a conglomerate reflects its ability to adapt to market changes and innovate within its operational sectors.

Through univariate and multivariate analysis, the report assesses the efficacy of hedging strategies and their impact on the balance sheet compared to a plan where the company would not have used IRDs. Strategic acquisitions and expansions into new areas of business have primarily driven JAL's growth strategy. The acquisition of Gujarat Anjan Cement Limited and its expansion in the cement industry significantly increased

its market presence. The company has historically been exposed to significant amounts of debt, primarily tied to floating interest rates. According to their yearly reports, JAL has used IRS and embedded derivatives to reduce the financial risks of this exposure.

According to JAL's financial disclosures, IRS was instrumental in shielding the company from the substantial financial impact of interest rate hikes. For example, during the fiscal year 2022–2023, interest rate volatility was heightened due to macroeconomic conditions, such as the tightening of monetary policies by central banks globally. Without IRS, the corporation would have been subject to interest rate changes. The figure underscores the importance of their hedging strategy, as the company's IRS effectively neutralised this risk by stabilising cash flows and protecting profits. In summary, the following benefits of using IRS were observed:

- **Cost stability:** The ability to swap variable-rate obligations for fixed-rate payments enabled JAL to stabilise its borrowing costs. As interest rates fluctuated, the company was insulated from unexpected increases in borrowing costs.
- **Enhanced cash flow management:** Predictable interest payments enabled the company to plan and manage its cash flows more efficiently. This is especially critical in capital-intensive industries, such as construction, where liquidity is often stretched.

Jhajjar Power Ltd.

The power sector, characterised by capital-intensive projects with long gestation periods, is particularly vulnerable to fluctuations in interest rates. This vulnerability stems from the sector's unique characteristics, including high upfront costs, extended construction timelines, and long operational lifespans. The Indian power sector has expanded and reformed over the past two decades. The 2003 Electricity Act introduced competition, de-licensed power generation, and open access.

However, these changes have also introduced new financial challenges. Risk has changed when the sector has shifted from state-owned to privatised. Private companies, unlike their state-owned counterparts, do not have implicit government backing and must manage financial risks more actively. Jhajjar Power Ltd., founded in 2008, runs a 1,320 MW Haryana coal-fired thermal power plant. As a relatively young company in a capital-intensive sector, Jhajjar Power Ltd. faces the dual challenge of managing a substantial debt burden while navigating a competitive and rapidly changing market environment. This paper undertakes a comprehensive economic analysis of IRS in context of Jhajjar Power Ltd. This includes an exploration of the no-arbitrage principle in swap pricing, the role of the yield curve in determining swap rates, and the concept of synthetic fixed or floating rate creation through swaps. The study then delves into the specific case of Jhajjar Power Ltd., analysing its financial structure, risk exposure, and the potential impact of various swap strategies.

1.1 Identification

We identified this research and choice of sectors owing to the following factors:

- The fundamental basis for IRS is well-established across the financial sector including the motivation for usage. In this study we identified debt intensive sectors of infrastructure and power which have grown by leveraging their balance sheets.
- The regulatory environment and market developments in India have essential implications for the implementation of IRS strategies. Regulators have encouraged their usage within frameworks as stated before.
- The power and infra sector faces unique challenges that make effective financial risk management particularly crucial.
- We have selected two balance sheets that have shown high growth and have used large amounts multiple currency debts to fund their growth and as such are open to volatility in exchange rate and interest rates. These companies have also shown usage of derivatives over a period of time enabling us to consider usage across a specific time frame.

1.2 Motivation of the study

The paper aims to cover the study of IRDs in these two cases and relates it to the overall business excellence approach for these two companies. Thus, a need-gap study indicates the following:

- There is an absence of an adequate number of studies on debt intensive sectors to understand the impact of usage IRDs on risk management and the relationship to overall business excellence
- The absence of a framework that would enable entities to understand the benefit of hedging using instruments like IRDs in debt intensive and growing balance sheets
- There is a dearth of academic case studies in this area with emerging economies. This will add and enable discussions and further research

Given how variable interest rates have been lately, the study becomes pertinent. Kumar (2017) conducted research on the use of derivatives by Indian commercial banks, highlighting the variables that affect these banks' ability to use IRDs. This study covers two other sectors of infrastructure and power

1.3 Gap analysis

The gap in literature is evident from the fact that available literature is sporadic in a field that can be studied from both sectoral as well as geographic approaches. The gaps that we aim to fulfil are:

- Case studies are absent in this area. We have made an attempt to write these case studies and create a scope for usage in academic studies.
- An effort to develop a set of case studies to showcase IRD usage as an element of excellence in Risk management.

- It is an effort to create a protocol and framework for case studies for these two sectors, which may be further used by researchers when they analyse other companies.

1.4 Objective

The commonality factor of the above sectors is that they face the dual challenge of managing a substantial debt burden while navigating a rapidly changing market environment. By entering into swap agreements, the companies can potentially:

- Reduce overall borrowing costs by taking advantage of favourable interest rate differentials between currencies and their respective interest rates.
- Manage interest rate risk by aligning interest payments with the company's view on future interest rate movements or with its natural economic exposures, thereby aligning strategies within the overall ambit of the organisation.
- Create a more optimal balance between fixed and floating rate debt, enabling a balanced portfolio.
- Access a broader range of financing options in multiple currencies with lower rates of difference by synthetically creating desired interest rate structures.

We will investigate these companies to analyse their usage of financial derivatives and its impact on their balance sheets for each sector.

2 Literature review

Yin's (2018) framework for research design highlights the four essential requirements for construct validity, design quality, internal validity, reliability, and external validity, especially in case study research. He stresses that these 'yardsticks' should be considered throughout the research process to ensure the quality of the research. Yin distinguishes between three types of case studies: descriptive, explanatory, and exploratory, and challenges the notion that case studies are only suitable for exploratory research, demonstrating their utility in explanatory and generalisable studies. He emphasised the importance of a well-defined research design, multiple sources of evidence (data triangulation), and the use of logic models to explain complex chains of events. The researchers have explored and explained causalities in the two case studies. Data has been mined from multiple sources to establish a more accurate analysis, as advocated in data triangulation. The complex chain starting from high debts to resultant risks and the management of the same has been studied using quantitative models and logical deduction.

A strategy developed to answer a particular set of questions is called a research strategy, sometimes described as 'research design' (McCombes, 2019). All data collection, processing, and interpretation methods in one framework.

Bicksler and Chen (1986) examined the economic rationale for IRS, highlighting how market imperfections and comparative advantages in different credit markets create opportunities for mutually beneficial swap agreements. Smith et al. (1988) provided an early comprehensive analysis of the implications for corporate use of IRS. They

identified risk management, reduction of financing costs, and creation of preferred financing structures as key components of a comprehensive and correlated strategy. The business risk management framework created by Froot et al. (1993) places a strong emphasis on the function of financial hedging in guaranteeing adequate internal funds for investment. Their work is specifically relevant for capital-intensive industries, such as the ones mentioned above. Bessembinder and Lemmon (2002) examined risk management practices in the power industry, highlighting unique challenges posed by non-storable output and high price volatility. While their focus was on electricity derivatives, their insights are relevant to understanding the risk landscape for power generation companies. Deng and Oren (2006) provided a comprehensive review of electricity derivatives and risk management practices in power industry. Allayannis et al. (2003) investigated how businesses in East Asian economies employ foreign exchange futures, providing insights into derivative usage in emerging markets, particularly in the infrastructure sector. Their findings on relationship among derivative use and firm value are relevant to our analysis of Jhajjar Power Ltd. in the Indian context. Vishwanath and Azmi (2009) examined the challenges and opportunities in Indian power sector, highlighting its need for innovative financing solutions to support the sector's growth. Their work provides an essential context for understanding the financial landscape in which the power company operates.

Ghosh and Chatterjee (2018) gave a summary of the evolution of the Indian interest rate futures market, highlighting growth in swap volumes and increasing sophistication of market participants. This is especially since multi-national firms that have Joint Ventures in the infrastructure sector have been documented to use derivatives extensively to hedge against rate fluctuations and currency risks (Lin et al., 2017).

Studies like those by Stulz (1996) and Froot et al. (1993) demonstrate that companies with significant debt exposure often utilise derivatives to manage interest rate risk. In Indian context, research has shown that companies in the infrastructure sector with significant long-term borrowing are particularly prone to interest rate risk due to floating nature of their debt. Empirical studies support the earlier studies that derivatives help reduce financial distress by stabilising cash flows. In addition to interest rate risks, companies with foreign debt exposure must contend with currency fluctuations. Foreign currency derivatives help mitigate the risk of unfavourable exchange rate movements. Companies like JAL with significant borrowings in foreign currencies, such as external commercial borrowings (ECBs) and foreign currency convertible bonds (FCCBs), often use derivatives to protect themselves from currency volatility.

2.1 Objectives

The commonality factor of the above sectors is that they are both high-growth industries and have faced a rapidly changing regulatory and economic environment. They face the challenge of managing a substantial debt burden while navigating rapid sectoral growth. Risk management is a key element of their balance sheet management since they are exposed to multi-currency interest rates. Usage of IRD enables:

- Showcase reduction of overall risks by corporates in taking advantage of favourable interest rate differentials between currencies and their respective interest rates through ECBs. This can be used by other corporates with similar multi-currency debt on their balance sheet.

- Researching on case studies of two companies that hedge interest rate risk by aligning interest payments with the company's view on future interest rate movements thereby aligning strategies within the overall ambit of the organisation.
- Showcase the gains from a derivative led hedging strategy as opposed to leaving borrowings unhedged.
- Enabling access to a broader range of financing options in multiple currencies with lower rates of difference by synthetically hedge structures. We have investigated these companies to analyse their usage of financial derivatives and its impact on their balance sheets for each sector.

2.2 *Significant learnings*

The learnings from the review of earlier work can be summarised as below:

- The lack of research in this field, particularly about debt-intensive sectors like power and infrastructure, was one finding throughout the literature study. As can be seen, research has been done on industries such as banks and insurance businesses throughout different regions. Since there are not many studies conducted in developing nations like India, this one would help advance the field's research thinking. The impact on the balance sheet of businesses using IRDs for hedging is provided by the analysis. When creating risk management policies, the methodology for such a plan can be applied.
- Because of management's usage of IRD, excessive debt levels have been artificially converted to fixed or floating rates as needed. 'Floating-to-fixed swap' is a helpful risk management strategy that produces a fictitious 'below-market fixed-rate loan'. However, as interest rates decline, this could result in a materially negative fair value or market-to-market, which could be at odds with strategic planning.
- One of the key factors differentiate between non-users and users of IRDs is total debt on the balance sheets. As such, leveraged balance sheets are strongly exposed to Financial Risks, and the benefits of hedging, as given in earlier reviews and in the case studies here, are of large impact.

2.3 *Gaps*

The Gap in literature is evident from the fact that available literature is sporadic in a field that can be studied from both sectoral and geographic approaches. The gap areas which this paper fulfils are:

- Case studies are absent in this area. We have made an attempt to write these case studies and create a scope for usage in academic studies.
- An effort to develop a set of case studies to showcase IRD usage as an element of excellence in risk management by highlighting the impact of IRD usage in two sectors.

- It is an effort to create a protocol and framework for case studies for these two sectors, which may be further used by researchers when they analyse other companies.

3 Methodology

Following the approach of Polit and Beck (2004), this paper is diagnostic by nature. As already highlighted, the paper is a novel attempt at analysing the usage of IRD for deriving institutional excellence. At some point, the case study also aims to identify correlations between risk strategies and improved balance sheet management.

Case selection is a crucial component of empirical research, as it significantly impacts the scope and generalisability of results to the broader target population. As per Yin (2018), case studies are appropriate when the research focuses on ‘how’ and ‘why’ questions about contemporary events, especially when the scholar has little or no control over the phenomenon being studied. In essence, our approach to case study followed the importance of selecting these two cases as they allowed for in-depth exploration of contemporary phenomena within their real-life contexts, using multiple sources of evidence and rigorous analysis to build relevant findings. As such, the underlying commonalities are:

- Both industries are high-growth industries and have high debt on their books.
- Both sets of companies are exposed to rate risks and have used derivatives as elements of their risk management strategies in alignment with their overall strategic interests in recent times, as compared to earlier times.

3.1 Relevance

Case study methodology involves an in-depth, contextual analysis of a specific ‘case’ (individual, group, event, organisation) using multiple data sources (interviews, documents, observation) to answer ‘how’ or ‘why’ questions, providing rich qualitative insights into complex real-world phenomena, often serving as a foundation for broader research or to challenge theories. It’s a flexible, powerful research strategy, particularly in social sciences, focusing on understanding intricate details within the case’s natural setting.

This consistency of IRD usage across both companies is a testament to the efficiency and non-stringency of the instruments and in recognising the relevance of risk management and its relation to business excellence in a volatile rate scenario. Despite the appreciation on the significance of risk management, there are notable variations in the strategies academics use to achieve it. Contemporary literature surveys have narrowed down to specific research area or focused on research methodology, quality and stakeholder engagement. The research becomes relevant for these Indian companies with leveraged balance sheets, which post liberalisation have foreign currency borrowings. To comprehend the work of earlier researchers that may be used for the case studies, pertinent literature was examined. The hypothesis with regards to large debt was used to showcase the benefits that these balance sheets got with hedging using IRDs. The data was collected from the balance sheets of the company and a scenario was created of no

hedge viz-a-viz hedge to showcase multiple scenarios. The nature and significance of the data were taken into account when creating the research design. The data gathering process and the planned empirical analysis were taken into consideration. Variables and data were identified using publicly accessible documents that were exchanged.

Wohlin and Rainer (2022) created a checklist for case studies, which enables us to create a framework for the study.

We have followed Götze and Mikus (2001) in examining the factors that influence the information sought, its use, and the use of surrogates for unavailable information.

The following has been studied:

- 1 A comparison is made on the scenarios wherein IRDs were used and scenarios where they were not used to showcase the impact on the balance sheet.
- 2 Use simulation scenarios to look at multiple possible scenarios leading to the most likely outcomes.
- 3 Analysing the impact such strategies had on parameters like liquidity, cost of loan and cost of hedge.
- 4 Study of the significance of undertaking the IRDs and the impact it has on balance sheet excellence

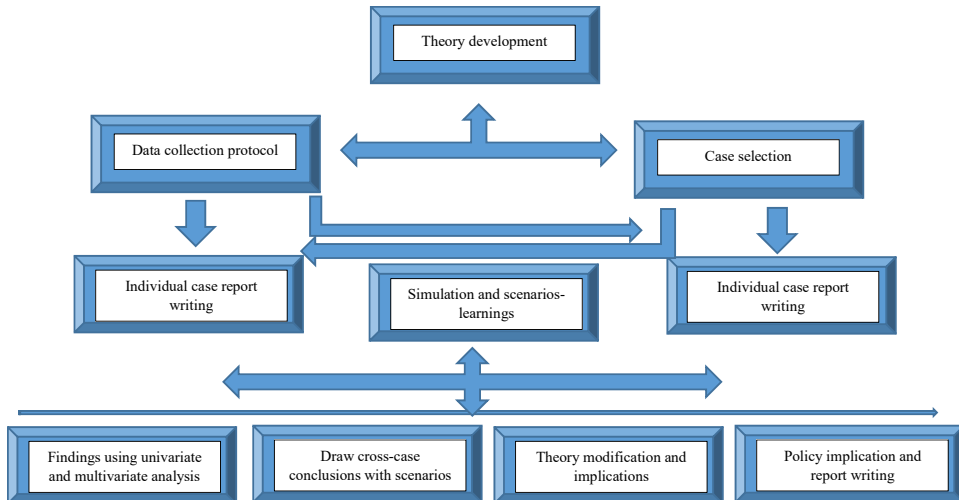
Wohlin and Rainer (2022) created a checklist for case studies, which enables us to create a framework for the study. We have followed Götze and Mikus (2001) in examining the factors that influence the information sought, its use, and the use of surrogates for unavailable information. The analytical framework is based on a combination of univariate and multivariate statistical methods to assess its impact of derivative instruments on Companies financial performance. Univariate analysis is used to examine individual financial variables, such as interest expenses and the gains or losses from derivative contracts. Multivariate analysis, including regression models, is utilised to analyse the relationship between interest rate changes, hedging activities, and profitability. A regression model was developed with interest expenses as the dependent variable, while the independent variables include the company's debt levels, interest rate fluctuations, and the volume of derivative contracts used. This model helps quantify the effectiveness of the hedging strategies employed by the respective sectors. Example of foreign currency exposure: During the fiscal year 2021–2022, JAL had substantial foreign currency debt on its balance sheet. Given the volatility in global currency markets and the depreciation of Indian Rupee, the company faced significant risks related to foreign exchange fluctuations. However, by using foreign currency derivatives, the company was able to hedge its exposure and stabilise its debt-servicing costs.

We collected historical financial data for Jhajjar Power Ltd., encompassing income statements, balance sheets, as well as cash flow statements for the past few years. This data is sourced from the company's annual reports and regulatory filings. We calculated and analysed key financial ratios for Jhajjar Power Ltd., focusing on leverage, liquidity, and interest coverage ratios to evaluate the company's financial position and risk exposure. Utilising the collected financial data, we conducted sensitivity analysis to assess its impact of interest rate changes on Jhajjar Power Ltd.'s financial performance. We employed standard swap valuation techniques, including use of zero-coupon yield curves and present value calculations, to value potential swap agreements for Jhajjar Power Ltd. To account for the uncertainty in future interest rate movements, we used

Monte Carlo simulation to model possible outcomes of different swap strategies under various interest rate scenarios.

The discussion on methodology is summarised in the following flow diagram.

Figure 1 Flow chart of case study (see online version for colours)



Case and time study:

- The diagram would centre on the case(s) being studied from the twin debt-intensive and high growth sectors.
- Time is the base axis, indicating the duration of the study to investigate the impact on the balance sheet.
- Data collection and acquisition points are along the timeline of each of the years when information was gathered.
- Data collection includes:
 - 1 observations in audited financials of the company
 - 2 public documents like balance sheet.
- The broader context of the case(s) includes taking cognisance of relevant external factors, like the economic conditions of global interest rate volatility.
- Analysis and findings:
 - 1 The methodology includes sections for analysis, where the researcher summarised the key findings from each data source and time point.
 - 2 Analysis includes simulation, scenario analysis, and regression models on the raw data to extract meaningful features that can be used for diagnosis.
 - 3 Some features were irrelevant or redundant, and this stage involved selecting the most informative features to improve diagnostic accuracy and efficiency.

- 4 The final diagnosis is presented, along with any supporting information or recommendations. In essence, this represents longitudinal nature of the study, the various data sources, and the context within which the case(s) evolved.

4 Findings

This study utilises data from JAL' annual reports. These reports contain detailed disclosures about the company's financial liabilities and hedging strategies, including its use of IRS, embedded derivatives, and foreign currency derivatives. Additional information was obtained from industry reports and scholarly articles on the use of derivatives in infrastructure projects. According to JAL' financial disclosures, IRS were instrumental in shielding the company from the substantial financial impact of interest rate hikes. For example, during the fiscal year 2022–2023, interest rate volatility was heightened due to macroeconomic conditions, such as the tightening of monetary policies by central banks globally. Without the use of IRS, the company would have been vulnerable to fluctuations in interest rates. Example from Financial Report (2023): In the 2023 annual report, the company's sensitivity analysis indicates that a 1% increase in interest rates would have increased its interest expenses by ₹747 lakhs. This figure underscores the importance of their hedging strategy, as the company's IRS effectively neutralised this risk by stabilising cash flows and protecting profits. The company's sensitivity analysis, as reported in the annual reports, illustrates the extent to which interest rate fluctuations would have impacted its financial performance.

4.1 Key operational metrics

'Company's debt-to-equity ratio' of 2.5:1 is relatively high but not uncommon for the sector. The interest coverage ratio (EBITDA/interest expense) of 1.56 indicates that, although the company may meet its interest obligations, there is a limited buffer, underscoring the importance of effective interest rate risk management.

- Long-term debt: INR 42,000 million
- Short-term debt: INR 3,000 million
- Average cost of debt: 8.5%
- Debt maturity profile:
 - 1 –0 to 1 year: 5%
 - 2 –1 to 3 years: 15%
 - 3 –3 to 5 years: 25%
 - 4 >5 years: 55%.

Importantly, approximately 60% of the long-term debt is at floating rates, primarily linked to the Mumbai Interbank Offered Rate (MIBOR) plus a spread. This exposes the company to significant interest rate risk. To understand relationship between interest rate movements and JAL's financial metrics, we focused on its impact of IRD on key financial indicators, including profit margins, debt service coverage ratios (DSCR), and

finance costs. Each variable was analysed independently to identify trends over the 2021–2024 period.

Table 1 Financial parameters

<i>Parameter</i>	<i>2021</i>	<i>2022</i>	<i>2023</i>	<i>2024</i>
Margin percentage	14.5	13.9	11	10
Debt service coverage ratio	1.25	1.2	1.15	1.05
Finance costs to service leverage (in INR cr)	850	870	885	913

- In 2021, when interest rates were declining, JAL’s profit margin showed minor improvement. However, during the periods of rising interest rates in 2023 and 2024, JAL’s losses widened, though the use of derivatives had cushioned some of this effect. Profit margins have reduced indicating operational pressure. However, this decline would have been more severe without the hedge against rising interest rates
- Due to interest rate hedging, JAL’s DSCR stayed steady, indicating its capacity to service its debt with operational income. The company managed to maintain above 1, which implies it could meet its interest obligations, albeit with a reduced margin. The ability to maintain this ratio was significantly aided by the use of the IRS, which kept the company’s interest payments relatively predictable
- One of the indicators of interest rate risk is finance costs. The steady increase in finance costs is attributable to the overall increase in debt levels. However, these costs would likely have been much higher without the use of hedging instruments to offset the rise in variable interest rates

4.2 *Multivariate regression analysis*

To explore the relationships between several financial variables, a multivariate regression model was employed. Model dependent variable is finance costs, independent variables include:

- interest rates
- total debt levels
- operating revenue.

Derivative use (represented by a binary variable: 1 if derivatives were used, 0 otherwise).

The objectives of model are to quantify its influence on interest rate hedging on JAL’s ability to manage its debt and finance costs.

Where:

- β_1 measures the impact of interest rate fluctuations on finance costs
- β_2 measures the effect of total debt on finance costs
- β_3 captures the impact of operational revenue on finance costs
- β_4 measures the mitigating effect of derivative use.

Regression results:

- R-squared = 0.82, indicating that 82% of the variance in finance costs is elucidated by the variables in the model.

Key coefficients:

- Interest rate: 0.38 (significant at $p < 0.05$), indicating a direct and positive relationship between rising interest rates and increased finance costs.
- Debt levels: 0.61 ($p < 0.05$), reflecting the strong correlation between rising debt levels and higher finance costs.
- Revenue: -0.14 ($p < 0.1$), suggesting a slight but negative impact of revenue on finance costs, possibly due to operational improvements offsetting some interest expenses.
- Derivative use: -0.20 ($p < 0.05$), indicating a significant reduction in finance costs due to hedging, implying that derivatives had a moderating effect on the company's exposure to interest rate risk.

A detailed examination of Jhajjar Power Ltd.'s financial structure is crucial for understanding its exposure to interest rate risk and the potential impact of swap strategies. As previously noted, Jhajjar Power Ltd.'s capital structure is characterised by a high degree of leverage:

- total assets: INR 85,000 million
- total liabilities: INR 60,000 million
- shareholders' equity: INR 25,000 million
- debt-to-equity ratio: 2.5:1.

This level of leverage is not uncommon in the power sector, given the capital-intensive nature of power generation projects. However, it does expose the company to significant financial risk, particularly in terms of interest rate fluctuations.

A closer look at Jhajjar Power Ltd.'s debt structure reveals:

- long-term debt: INR 42,000 million
- short-term debt: INR 3,000 million
- average cost of debt: 8.5%.

Debt maturity profile:

- 0 to 1 year: 5%
- 1 to 3 years: 15%
- 3 to 5 years: 25%
- 5 years: 55%.

Importantly, approximately 60% of the long-term debt is at floating rates, primarily linked to the MIBOR plus a spread. This exposes the company to significant interest rate risk.

To quantify Jhajjar Power Ltd.'s exposure to interest rate risk, we conduct a sensitivity analysis:

- A 1% increase in MIBOR would result in additional annual interest expense of INR 252 million, representing 5% of EBITDA and 21% of net profit.
- A 2% increase would lead to an additional expense of INR 504 million, or 10% of EBITDA and 42% of net profit. This analysis emphasises the prospective impact of interest rate fluctuations on a company's profitability, while also highlighting the importance of effective interest rate risk management.

Jhajjar Power Ltd.'s cash flow and liquidity position also play a crucial role in assessing its ability to manage interest rate risk:

- operating cash flow: INR 4,500 million
- free cash flow: INR 1,800 million
- current ratio: 1.2
- quick ratio: 0.9.

While the company generates strong operating cash flows, its liquidity ratios indicate a relatively tight working capital position. This could potentially limit its flexibility in managing short-term interest rate shocks.

Based on Jhajjar Power Ltd.'s financial structure and market conditions, we analysed several potential swap strategies that the company could adopt.

Plain vanilla swap

We modelled a scenario in which Jhajjar Power Ltd. enters into a 5-year plain vanilla swap to convert INR 10,000 million of its floating-rate debt to a fixed-rate debt. As per present market rates, company would pay a fixed rate of 7.5% and receive the floating MIBOR rate.

Results of 10,000 Monte Carlo simulations show:

- Mean NPV of the swap: INR 120 million
- Probability of positive NPV: 65%
- 95% Value-at-Risk: INR -350 million

While this strategy offers potential cost savings and increased certainty, it also carries the risk of opportunity loss if interest rates remain low.

Forward-starting swap

Given Jhajjar Power Ltd.'s debt maturity profile, we analysed a forward-starting swap to hedge against potential rate increases on future debt issuances. We model a 3-year forward-starting swap on INR 5,000 million of notional debt.

Simulation results:

- mean NPV: INR 80 million
- probability of positive NPV: 60%
- 95% value-at-risk: INR -200 million.

This strategy allows company to lock in future borrowing costs but requires careful timing and market outlook.

Corridor swap

To provide some upside potential while still limiting downside risk, we analysed a corridor swap strategy. This involves entering into a swap where the company pays a fixed rate if MIBOR stays within a specified range and pays MIBOR otherwise.

For a notional amount of INR 7,500 million:

- mean NPV: INR 100 million
- Probability of positive NPV: 70%
- 95% value-at-risk: INR –250 million.

This strategy offers a balance between risk mitigation and potential upside but is more complex to implement and monitor.

Swaption strategy

Finally, we consider the use of swaptions to provide Jhajjar Power Ltd. with the option, but not obligation, to enter into a swap at a predetermined rate. We model a 1-year European swaption on a 5-year swap for INR 5,000 million.

Results:

- mean NPV (including option premium): INR 50 million
- probability of positive NPV: 55%
- 95% value-at-risk: INR -150 million.

While this strategy offers flexibility, it comes at the cost of the option premium.

5 Implications

One of the primary metrics to assess the effectiveness of hedging strategy is the company's interest expenses. During the three fiscal years examined, JAL successfully maintained relatively stable interest expenses, despite an overall increase in market interest rates. This stability can be attributed to the company's extensive use of IRS, which allowed it to convert a portion of its floating-rate liabilities into fixed-rate liabilities. For instance, during FY 2022–2023, when central banks globally raised interest rates to combat inflation, JAL saw only a marginal increase in its interest expenses. This is in contrast to companies that did not hedge their interest rate exposure and consequently faced a steep rise in borrowing costs. The company's sensitivity analysis, as reported in the annual reports, illustrates the extent to which interest rate fluctuations would have impacted its financial performance. A 1% increase in interest rates was projected to increase interest expenses by ₹747 lakhs in FY 2023 without the use of derivatives. However, the actual impact was much lower, thanks to company's hedging strategies.

The company's cost of debt remained largely unaffected by market volatility, demonstrating the effectiveness of its hedging strategy. By locking in fixed rates, JAL was able to maintain a predictable debt servicing cost, which contributed to its financial stability.

Although the company incurred some expenses related to its usage of derivatives, these costs were offset by a reduction in interest expenses, resulting in stable profit margins.

The company's foreign currency exposure was another significant risk factor that could have impacted its financial health. As JAL had foreign-denominated debt, particularly FCCBs and ECBs, any depreciation in the Indian Rupee could have significantly increased its debt servicing costs. The model suggests that without hedging, the effect of rising interest rates and increasing debt levels would have been significantly more severe for JAL. The use of IRS and other derivatives mitigated the impact of increasing rates, reducing the financial cost burden.

Derivatives performance

JAL's financial strategy included a combination of IRS and foreign currency derivatives aimed at reducing both interest rate and exchange rate risk. JAL's primary hedging tool, the IRS, allowed company to exchange its floating-rate debt for fixed payments. This was especially crucial during the period of increasing interest rates in 2022 and 2023. The company was able to lock in fixed rates ranging from 4.5% to 5.5%, effectively capping its exposure to floating rates that could have risen above 6%. The financial statements reveal that IRS contracts covered a significant portion of JAL's variable debt, approximately 60% by 2023. The stability in finance costs, despite rising market interest rates, is a testament to the efficacy of these swaps. JAL also held a considerable amount of foreign currency debt, particularly in USD. Fluctuations in the INR/USD exchange rate posed an additional layer of risk. The company utilised foreign currency derivatives to hedge this exposure. By locking in favourable exchange rates, JAL reduced its vulnerability to currency depreciation, which could have further inflated its interest and principal payments.

The financial performance of 2023 and 2024 shows that despite an adverse movement in the INR/USD rate, JAL's finance costs remained within a manageable range. The hedging strategies employed by JAL, utilising IRS, embedded derivatives, and foreign currency derivatives, are significant in multiple ways, as they reflect both the necessity and the effectiveness of risk management in high-debt, capital-intensive industries like infrastructure and construction. Another significant impact of these hedging strategies is the reduction in financial risk and uncertainty, particularly concerning interest rate exposure. Between 2021 and 2024, interest rates were highly volatile due to global economic factors, including inflationary pressures and adjustments in central bank monetary policy. For a company, especially JAL, operating in a sector that requires long-term borrowing, such volatility could have been disastrous without proper hedging.

The company needed to consider the accounting treatment of swaps under Indian Accounting Standards (Ind AS), including:

- hedge accounting requirements
- fair value measurement and disclosure.

For a company like Jhajjar Power Ltd., with substantial long-term debt obligations, strategic use of IRS can have significant implications for financial stability and performance. By entering into swap agreements, the company can potentially:

- Reduce overall borrowing costs by taking advantage of favourable interest rate differentials among fixed and floating rate markets.
- Manage interest rate risk by aligning interest payments with the company's view on future interest rate movements or with its natural economic exposures.
- Create a more optimal balance between fixed and floating rate debt, enhancing financial flexibility.
- Access a broader range of financing options by synthetically creating desired interest rate structures.

Thus, monitoring markets and macroeconomic indicators requires significant resource inputs, especially given present interest rate volatility and globalisation. The conclusions derived from this study highlights the benefits of risk management and its relationship to excellence thereby providing a reference for other corporates in these segments to enter into IRDs.

The study of literature surveys indicates the need for a broad-based analysis of this topic with a certain degree of uniformity to see the benefits of hedging strategy in debt intensive balance sheets. These literature surveys had been done for a specific research objective and depended on quantifying the benefits of IRDs in saving costs. The study of previous literature surveys points towards the need for a broad-based analysis of relevant research publications to find the existing trends based on certain hypothesis like debt. Academic implications include the case studies in the area of IRDs. It also identifies the basis on which classifications of such cases can be done, which in turn helps identify the knowledge gap areas in terms of areas that have been studied. This enables us to suggest areas for future research.

Our approach has demonstrated the need to take care of crucial aspects of the sector, industry type, geography, and various aspects of derivatives to ensure a lasting improvement in formulating adequate risk management policies. Taking care of just one or two aspects is counterproductive. This case study demonstrates that our research is a long way from embracing such a systems approach, and there are apparent gaps in emerging economies and adequate research into small-sized corporates and their motivation for undertaking derivatives. This study will help prioritise the research direction and emphasise evaluating the overall impact of derivatives and distinguishing between entities that undertake derivatives and those that do not. The research that is currently available is dynamic.

One managerial implication of this study is that it would help risk managers as a reference point to decide on their strategies of risk management to hedge interest rate risks by comparing with other IRD users and their approach. Academic implications include the identification of variables that act as proxies for the comparison between users and non-users of IRDs. It also identifies factors unique to users of IRDs.

IRs are used in the cases as a synthetic tool to hedge against rising interest rates or take advantage of falling rates of interest without having to make any replacements in the balance sheet. However, all such instruments should be used with due knowledge and as a part of strategic risk management. Corporates in the medium enterprise segment are

especially vulnerable to market risks as they are not in a position to invest in building up separate treasury functions. Such corporates need to develop risk management strategies. Such a study distinguish users of IRDs from non-users, evolves causality relations and thereby enables risk managers to formulate their approaches. The impact can be summarised next:

- 1 contribute to the study of IRDs among debt intensive sectors in India
- 2 compare sectors in terms of usage
- 3 understand and replicate advantages of risk management using IRDs.

Thus, this paper has a dual implication: one is academic which enables case study in classrooms while the other is risk oriented as it helps to create a framework for decision making with regards to risk strategies.

6 Conclusions

The study evaluates the reasons behind the adoption of these derivatives and their impact on the financial performance of JAL. Through regression and multivariate analysis, the report assesses the efficacy of hedging strategies and the financial gains (or losses) realised. The findings suggest that while derivatives do impact the company's overall financial health. The investigation concludes that effective utilisation of IRD is crucial for companies with substantial debt exposure and operating in industries where external financing is a key growth driver. This Jhajjar Power case study presents an analysis of IRS, focusing on their application and impact on Jhajjar Power Ltd., and showcasing that they contribute to evolved and better risk management practices. IRS have become increasingly important tools for managing financial risk in the power sector, particularly for companies with significant long-term debt exposure. Through an examination of Jhajjar Power Ltd.'s financial structure and the broader economic context of the Indian power sector, this study evaluates the effectiveness of IRS in mitigating interest rate risk and optimising the company's financial performance.

A mixed-method approach is implemented in the investigation, which integrates quantitative analysis of financial data with qualitative evaluations of market conditions and company strategy. Key findings indicate that judicious use of IRS can provide substantial benefits in terms of cost savings and risk management for Jhajjar Power Ltd. However, the study also highlights potential pitfalls and limitations of swap agreements, emphasising the need for careful structuring and ongoing monitoring of these financial instruments.

A key goal of hedging is to mitigate volatility in cash flows and ensure predictable financial outcomes, particularly when a company has substantial exposure to variable interest rates or foreign currency fluctuations. For JAL, this stability was critical because the company carried large amounts of debt, with a significant portion tied to floating interest rates and foreign-denominated liabilities. By employing IRS, JAL was able to convert a portion of its floating-rate debt into fixed-rate liabilities. This action insulated the company from rising interest rates, which were prevalent during the study period (2021–2024) due to the tightening of global monetary policies. The fixed-rate obligations allowed the company to plan its future interest payments more effectively and avoid unexpected spikes in borrowing costs.

Foreign currency derivatives also played a critical role in stabilising company's financial position. The company had significant exposure to foreign-denominated borrowings, including ECBs and FCCBs. Any depreciation of Indian Rupee against foreign currencies would have resulted in higher debt servicing costs. By utilising currency forwards and options, JAL effectively mitigated the risk of unfavourable currency movements, ensuring that its debt obligations remained stable even during periods of currency volatility.

As per outcomes of the research, the following are determined for JAL and similar companies that rely heavily on debt financing:

- Continue hedging key risks: Given the effectiveness of the current hedging strategies in reducing financial volatility, it is recommended that JAL continue to hedge its exposure to interest rate and currency risks in the interest of an adequate risk management strategy. Utilising IRS should be maintained for floating-rate liabilities, especially during periods of anticipated interest rate hikes.
- Regular review of hedging strategies: Financial markets are inherently dynamic, and the effectiveness of hedging strategies can change over time. It is essential for the company to regularly review its hedging strategies to ensure they remain cost-effective and aligned with its financial goals.
- Enhance financial reporting on derivatives: While the annual reports provide detailed information on the company's derivative instruments, greater transparency could be achieved by including more comprehensive disclosures on the performance of these derivatives.
- Explore new hedging instruments: As the company's operations expand and its exposure to different types of financial risks grows, it may be beneficial to explore new hedging instruments or strategies.
- Balance between hedging and cost: While hedging is essential for mitigating financial risks, it is vital to strike a balance between cost of hedging and the benefits it provides.

IRS provide Jhajjar Power Ltd. with a crucial tool for managing its substantial interest rate risk exposure. While challenges exist in implementation and ongoing management, a well-designed swap strategy can contribute meaningfully to company's financial stability and performance. Dynamic nature of both power sector and financial markets necessitates an adaptive approach. Jhajjar Power Ltd. must remain vigilant in monitoring market conditions, regulatory developments, and its own evolving financial needs to optimise its interest rate risk management strategy over time. This case study illustrates the complexity of financial risk management in power sector and underscores the necessity for a tailored, company-specific approach. While the findings are specific to Jhajjar Power Ltd., the analytical framework and key considerations are broadly applicable to other companies in the Indian power sector and beyond.

6.1 Contribution

This paper has successfully established the following:

- There are very few or no case studies on corporates in India that continue to utilise IRD, regardless of the necessity for management to employ synthetic structures as a hedge. There is also virtually no analysis done in pursuit of excellence to create synergies between multiple strategies and plans. This finding is similar to those in countries such as the USA and Western Europe, where studies have been conducted on the use of these products in large corporate entities; however, case studies are scarce. More studies are required for academic purposes as well as for the managerial implications highlighted in the study. Additionally, regulations may serve as an influential variable. Causality relations and longitudinal studies have helped compare balance sheets with and without derivatives.
- Several investigations have been undertaken across a variety of sectors worldwide to ascertain the motivation and outcomes of entities that engage in IRD. The aforementioned researchers' findings have been employed in this paper to inform the approach to the case study to establish the focus on business excellence. We have been able to establish the advantage of using IRDs in risk management strategies for corporates with high debt in their balance sheet vis-à-vis when they do not have such an approach. They have further established the homogeneity of multiple strategies by highlighting the use of derivatives to ensure liquidity and cash flow. This, in turn, leads to a blend of culture of excellence and various strategies in the organisation.
- Although the primary objective of IRD is to mitigate the interest rate risks on balance sheet, advantages of debt-intensive balance sheets are manifold. There is a clear distinction in terms of impact on liquidity and cash flows when considering periods before and after execution of IRDs in both case studies. Simulation results demonstrate the effect of the derivative strategy, thereby establishing strategic excellence in this approach to risk management. Our results align with previous research, showing that size of a company's debt is an essential factor in distinguishing users from non-users of such instruments. This suggests that debt size could be a decisive consideration for other companies when evaluating whether to adopt IRS. A distinctive outcome of current research is observation that firms engaging in IRDs typically carry larger debt levels, as the potential impact is greater – a pattern that holds true when comparing users to non-users. Many companies in sectors examined are currently in a growth stage, which naturally correlates with higher debt levels.
- Absence of existing case studies may be attributed to the fact that these entities, particularly in India, have differing forms of balance statements. Treatment of derivatives has been varied, and as such, the balance sheets are statements of finance rather than descriptions of results of managerial interventions and plans. Data such as total debt and others may have been utilised with customised definitions. Uniquely, this paper establishes the advantages of IRD usage among the two entities in India.

6.1.1 Novelty of study

The paper makes the following contribution to the knowledge in research of this area:

- It has analysed two debt intensive sectors and the impact of hedging on their balance sheets using a case study methodology.

- The study classifies research into case studies. This enables the researchers to deduce the research gap, allowing others to analyse similar case studies in other sectors.
- The study brings out gaps in derivatives and risk management research, namely case studies that showcase the benefits of using IRDs as an element of risk management which finally leads to business excellence.
- There is low usage of IRDs among infra and power corporates in India, despite the need among management to use synthetic structures to hedge. This lower usage of derivatives could be among others due to lower levels of awareness and expertise in using derivative products. The benefits of hedging is clearly exhibited in the two cases.
- There have been multiple studies done in various sectors across the globe to determine the motivation of entities to enter into IRDs – specifically swaps, and across various segments like non-financial entities, health organisations, banks and insurance companies. This paper has used longitudinal cases on two segments which have not been researched into earlier.
- While the basic motivation of IRDs by an organisation is to hedge the interest rate risks that are in the balance sheet, other factors differentiate between users and non-users. As such the approach to usage in our case studies may be a key factor for other corporates to decide whether to go in for an IRS. The other unique finding of this study is that the hypothesis that entities entering into IRDs will have larger amounts of debt since the impact is higher holds when users and non-users are compared.
- One of the key reasons for the difference from other existing studies could be that these entities tend to have different types of balance sheets, especially in India. The data that have been used like total debt and others may have customised definitions. This paper is unique in establishing IRD usage among the target segment in India.

6.2 *Scope for further research*

This analysis contributes to the growing body of literature on financial risk management in the power and infra sector and provides practical insights for financial managers in similar companies. Further, some of our observations were:

- Our literature review revealed a significant gap in research on this topic, particularly in the form of case studies. While existing studies have examined banks and the financial sector across different regions, research within emerging economies remains scarce. Expanding the range of industries studied in such contexts could stimulate further exploration in this field and contribute to developing risk management strategies as an integral part of achieving organisational excellence.
- Use of case studies enables research in areas where case studies are few. This would encourage case studies for academic interests and usage in classroom teaching. Further case studies on other sectors, as well as other companies in these two sectors, can be written and used for academic interests.
- Our case studies were drawn from the two debt-intensive sectors. It would be intriguing to investigate the extent of derivative financial instrument activities among

other entities, especially small and medium enterprises. Similar dynamics have been observed in various geographies in the context of SMEs. Similar structures are shared by other non-profit organisations, notably colleges, universities, and voluntary health and welfare organisations; however, they are less capital-intensive enterprises. Identifying the similarities and differences in interest rates. Derivative usage in various sectors can result in beneficial advancements in finance theory.

Our review revealed notable differences in how the contingent sections of balance sheets reported information on derivative transactions. For example, in one case study, the organisation did not provide the fair value of its derivative instruments. Investigating the factors that drive such disclosure practices in external financial reporting could help establish a connection between transparency in accounting and financial excellence, especially within regulated sectors. Additionally, future studies could employ multivariate analysis to control for variations in independent variables when examining similar cases. As a concluding note to guide future research, we highlight that business decisions are always made in the presence of risk, with the ultimate aim of achieving organisational excellence. Effective decision-makers work toward this goal while ensuring alignment between various strategies. Certain risks stem from the very nature of the business itself, such as uncertainties in future sales or fluctuations in input costs – these are known as business risks. In this study, however, our focus has been on a different category of risk – specifically, those arising from uncertainties in interest rates. In the current context, the unpredictable fluctuations in interest rates have created significant uncertainty, making it difficult for firms to secure financing at an affordable cost. While the Indian financial market inherently carries various risks, this study seeks to address such challenges through the use of derivatives as a risk management tool. However, we do not present our propositions and findings as definitive and acknowledge that further refinement is possible.

Declarations

All authors declare that they have no conflicts of interest.

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