

# **OPTIMIZING DIVIDEND POLICY FOR EQUITY MANAGEMENT USING OPERATION RESEARCH TECHNIQUES**

Submitted in partial fulfilment of the requirements for the award of

**MASTER OF BUSINESS ADMINISTRATION**

By

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**DEPARTMENT OF BUSINESS  
ADMINISTRATIONSCHOOL OF MANAGEMENT  
STUDIES**

## **SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY  
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade “A++” by NAAC I 12B Status by UGC I  
CATEGORY - 1 UNIVERSITY BY UGC I Approved by AICTE  
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**December 2023**



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SCHOOL OF MANAGEMENT STUDIES

## **BONAFIDE CERTIFICATE**

This is to certify that this Project Report is the Bonafide work **SHRUTHIKA S 42410265** who carried out the Project Training “**OPTIMIZING DIVIDEND POLICY FOR EQUITY MANAGEMENT USING OPERATION RESEARCH TECHNIQUES**” under my supervision from October 2023 to December 2023.

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## **DECLARATION**

I **SHRUTHIKA S (42410265)** hereby declare that the Project Report entitled **“OPTIMIZING DIVIDEND POLICY FOR EQUITY MANAGEMENT USING OPERATION RESEARCH TECHNIQUES”** done by me under the guidance of **DR.YASMEEN BANO** is submitted in partial fulfilment of the requirements for the award of Master of Business Administration degree.

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## ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my sincere thanks to **Dr. G. Bhuvaneswari, MBA., Ph.D., Dean - School of Management Studies** and **Dr. A. Palani, M.Com., M.Phil., M.B.A., Ph.D., - Head - School of Management Studies** for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **DR.YASMEEN BANO** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **School of Management Studies** who were helpful in many ways for the completion of the Training.

**SHRUTHIKA S**

## TABLE OF CONTENTS

| CHAPTER NO. | TITLE                                        | PAGE NO.   |
|-------------|----------------------------------------------|------------|
|             | <b>Abstract</b>                              | <b>(i)</b> |
|             | <b>INTRODUCTION</b>                          | <b>1</b>   |
|             | 1.1 . Introduction                           | 1          |
|             | 1.2 . Defining the objective function        | 2          |
|             | 1.3 . Need for the study                     | 6          |
|             | 1.4 . Statement of the problem               | 7          |
|             | 1.5 . Scope of the study                     | 7          |
|             | 1.6 Limitation of the study                  | 9          |
|             | <b>REVIEW OF LITERATURE</b>                  | <b>10</b>  |
|             | 3.1. Research Design                         | 17         |
|             | 3.2. Sources of data                         | 17         |
|             | 3.3. Area of the study                       | 18         |
|             | 3.4. Hypothesis                              | 19         |
|             | <b>MATHEMATICAL ANALYSIS AND FORMULATION</b> | <b>20</b>  |
|             | 4.1 Formulation of the constraints           | 20         |
|             | 4.2. Mathematical modelling                  | 22         |
|             | 4.3. Linear programming                      | 25         |
|             | 4.4. Sensitivity Analysis                    | 30         |
|             | 4.5. Optimal dividend policy                 | 35         |
|             | 4.6. Hypothesis testing                      | 38         |
|             | <b>FINDINGS, SUGGESTIONS AND CONCLUSION</b>  | <b>43</b>  |
|             | 5.1. Findings of the study                   | 43         |
|             | 5.2. Suggestions & recommendations           | 44         |
|             | 5.3. Conclusion                              | 45         |

## **Abstract**

This research explores the application of Operations Research (OR) techniques in optimizing dividend policy for effective equity management. Dividend policy is a critical decision for companies, influencing shareholder value and financial performance. The study leverages mathematical models and analytical tools from Operations Research to develop a systematic approach for determining an optimal dividend policy.

The research methodology involves the formulation of mathematical models that consider various factors, such as cash flow, earnings, risk, and investor preferences. Optimization techniques, including linear programming, simulation, and sensitivity analysis, are employed to evaluate different scenarios and identify the dividend policy that maximizes shareholder wealth while aligning with organizational goals.

The findings of this study contribute to the enhancement of decision-making processes related to dividend distribution, providing insights for executives and financial managers to navigate complex trade-offs. By incorporating Operations Research techniques, this research aims to offer a quantitative framework that considers the dynamic and multifaceted nature of equity management, enabling companies to adapt their dividend policies to changing market conditions and investor expectations. The optimization approach presented in this study serves as a valuable tool for companies seeking to strike a balance between rewarding shareholders and maintaining financial stability.

In conclusion, this research establishes a foundation for integrating Operations Research methodologies into the strategic management of dividends, offering a data-driven and systematic approach for organizations to optimize their equity management practices in an ever-evolving financial landscape.

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1. Introduction:**

#### **Optimizing Dividend Policy for Equity Management Using Operations Research Techniques:**

Dividend policy is a critical aspect of corporate financial management, influencing the relationship between a company and its shareholders. Striking the right balance between distributing profits and retaining earnings for growth is a delicate task that requires careful consideration. Optimization techniques from the field of operations research can provide a systematic approach to decision-making in this domain. In this comprehensive exploration, we delve into the intricacies of optimizing dividend policy, emphasizing the definition and role of the objective function.

The management of corporate dividends has been a perennial challenge for financial executives, requiring a delicate balance between rewarding shareholders and ensuring the financial health and growth prospects of the organization. Traditionally, dividend policies have been influenced by historical practices and broad industry norms. However, in the face of increasing financial complexities, market uncertainties, and evolving shareholder expectations, there is a growing imperative to adopt advanced analytical methodologies. This project, titled "Optimizing Dividend Policy for Equity Management Using Operations Research Techniques," seeks to address this imperative by employing sophisticated operations research tools to refine and enhance the process of determining an optimal dividend policy.

#### **1.1.1. The Significance of Dividend Policy**

Dividend policy plays a pivotal role in shaping the financial landscape of a company and influencing investor perceptions. It serves as a mechanism for distributing profits to shareholders, acting as a conduit for wealth transfer. The decision to pay dividends, the frequency of payouts, and the amount distributed are strategic choices that impact both the company and its investors. Striking an optimal dividend policy involves considering various

financial and market-related factors to align with the overarching goals of the organization.

## 1.2. Defining the Objective Function

The objective function in the context of dividend policy optimization serves as the cornerstone of the mathematical model. It encapsulates the primary goal or purpose the optimisation seeks to achieve. The formulation of the objective function is inherently tied to the strategic priorities of the company and the expectations of its shareholders. Let us delve into three distinct objective functions, each representing a unique goal in the optimization process.

### 1.2.1. Maximizing Shareholder Wealth

The overarching goal for many companies is to maximize shareholder wealth. This entails creating long-term value for investors by balancing dividend payouts with reinvestment in the business. The objective function for this goal could be defined as:

$$\text{Maximise Shareholder Wealth} = \text{Present Value of Future Dividends} + \text{Present Value of Future Stock Price}$$

In this formulation, the present value of future dividends captures the immediate returns to shareholders, while the present value of future stock prices accounts for the potential capital appreciation resulting from sound investment and growth strategies. This objective function aligns with a holistic view of shareholder wealth, acknowledging that both dividends and stock value contribute to investor prosperity.

### 1.2.2. Ensuring a Stable Income Stream

For investors seeking a consistent and predictable income stream, stability in dividend payments is paramount. The objective function for this goal could be articulated as:

$$\text{Maximise Stability} = \text{Minimize Variability in Dividend Payments}$$

Here, the focus is on minimizing the fluctuations or volatility in dividend payments over time. A stable income stream fosters investor confidence and

can be particularly appealing to income-focused investors who rely on dividends for regular cash flow. This objective function reflects the company's commitment to providing financial predictability to its shareholders.

### **1.2.3. Achieving a Target Dividend Yield**

Some companies may set a specific target dividend yield to attract a certain type of investor or align with industry norms. The objective function for this goal could be expressed as:

$$\text{Maximize Dividend Yield} = \text{Dividends Paid} / \text{Stock Price}$$

Subject to the constraint,

$$\text{Dividend Yield} = \text{Target Dividend Yield}$$

This objective function seeks to maximize the dividend yield while ensuring it meets a predefined target. This goal is particularly relevant for companies aiming to attract income-focused investors who prioritize dividend income relative to the stock price.

#### **➤ Advancing Knowledge in Dividend Policy Optimization:**

The primary purpose is to contribute to the academic body of knowledge in the field of corporate finance, specifically in the domain of dividend policy optimization. By leveraging operations research techniques, the project aims to offer innovative insights and methodologies that advance the understanding of how organizations can optimize their dividend policies.

#### **➤ Enhancing Decision-Making in Corporate Finance:**

The project is driven by a practical purpose of providing actionable insights for financial managers and decision-makers. By optimizing dividend policy, the project seeks to enhance decision-making frameworks related to equity management. The goal is to empower organizations to make informed, strategic choices that maximize shareholder value and ensure financial stability.

➤ **Integrating Operations Research Methodologies:**

A fundamental purpose is to showcase the applicability and effectiveness of operations research methodologies in addressing complex financial decision-making problems. By integrating mathematical modelling, optimization algorithms, and risk analysis, the project demonstrates how these techniques can be valuable tools for corporate finance professionals.

➤ **Addressing Real-World Financial Challenges:**

The project's purpose extends to addressing real-world challenges faced by organizations in managing their equity. Financial markets are dynamic, and uncertainties abound. By incorporating risk analysis and sensitivity analysis, the project aims to provide a comprehensive solution that accounts for the unpredictable nature of financial environments.

➤ **Benchmarking Against Traditional Approaches:**

Another purpose is to benchmark the outcomes of the operations research-based model against traditional approaches to dividend policy. This comparative analysis serves the purpose of highlighting the potential advantages, innovations, and practical relevance of adopting more advanced methodologies in equity management.

➤ **Promoting Continuous Learning and Adaptation:**

The purpose extends beyond a static solution. In a rapidly changing financial landscape, the project aims to foster a culture of continuous learning and adaptation. By staying abreast of emerging trends, incorporating feedback, and adapting methodologies, the project seeks to remain relevant and valuable over time.

➤ **Providing a Comprehensive Resource for Researchers and Practitioners:**

The project's purpose includes creating a comprehensive resource, such as a detailed report, that can serve as a valuable reference

for researchers, academicians, and practitioners. This resource aims to disseminate knowledge, methodologies, and findings, contributing to the collective understanding of dividend policy optimization.

➤ **Facilitating Strategic Financial Planning:**

Strategic financial planning is a key purpose of the project. By optimizing dividend policy, organizations can align their financial strategies with long-term goals, ensure financial stability through retained earnings, and respond effectively to market conditions. The project seeks to facilitate a strategic approach to financial planning within organizations.

#### **1.2.4. Operations Research Techniques for Dividend Policy Optimization**

With the objective function defined, operations research techniques can be applied to find the optimal dividend policy. Several mathematical optimization methods can be employed, including linear programming, integer programming, and dynamic programming. These techniques systematically explore the solution space to identify the dividend policy that best aligns with the specified objective while adhering to relevant constraints.

##### **Linear Programming**

Linear programming is a powerful optimization technique that can be applied to problems with linear relationships among variables. In the context of dividend policy optimization, linear programming can help find the optimal allocation of earnings between dividends and retained earnings. The objective function and constraints are expressed as linear equations or inequalities, allowing for efficient solution exploration.

##### **Integer Programming**

Integer programming extends linear programming by incorporating the requirement that decision variables must be integers. In dividend policy optimization, this may be relevant when considering discrete decisions, such as the number of dividend payouts in a given period. Integer programming can enhance the model's accuracy in reflecting real-world constraints and decisions.

## **Dynamic Programming**

Dynamic programming is particularly suitable for problems that involve sequential decision-making over time. In the context of optimizing dividend policy, dynamic programming can help determine the optimal dividend distribution strategy over multiple periods. This approach accounts for the time value of money and considers the impact of decisions made in earlier periods on future outcomes.

### **1.3. Need For The Study**

Optimizing dividend policy for equity management is a critical aspect of corporate finance, profoundly impacting a company's financial stability, shareholder value, and overall strategic objectives. Operations research techniques provide a systematic and analytical approach to navigate the complexities of dividend policy decisions. This optimization is vital for maintaining financial stability and enhancing shareholder value as it allows for a rigorous analysis of various factors influencing dividend decisions, including earnings, cash flow, and capital structure. By employing quantitative models and optimization algorithms, companies can tailor their dividend policies to strike a balance between distributing profits to shareholders and retaining earnings for future growth.

Dividend policy optimization is closely tied to strategic resource allocation, where operations research techniques enable companies to assess the impact of dividend decisions on capital structure and investment opportunities. Incorporating operations research techniques in dividend policy optimization assists in effective risk management by allowing companies to model and analyze various scenarios, considering uncertainties in the economic environment, market conditions, and industry dynamics. This contributes to an enhanced decision-making framework as operations research provides a robust structure for decision-makers to evaluate a range of scenarios and assess the trade-offs involved in different dividend distribution strategies. Optimizing dividend policy using operations research techniques contributes to building and maintaining investor confidence by providing transparent and well-founded dividend decisions. The ability to communicate a clear rationale for dividend policies, supported by operations research findings, strengthens the

company's relationship with investors and the broader financial community. Additionally, the adaptability to changing business dynamics is facilitated by operations research, ensuring that dividend policies remain relevant and effective in supporting the company's financial objectives over time.

Furthermore, the need for optimizing dividend policy is not only about maximizing shareholder value but also about complying with regulatory requirements. Operations research techniques assist in navigating regulatory complexities by providing a quantitative basis for ensuring that dividend distributions adhere to legal constraints and financial regulations. This meticulous approach mitigates legal risks and contributes to the overall governance of the organization. In conclusion, the application of operations research becomes instrumental in achieving a balanced and sustainable dividend policy that aligns with the organization's overarching goals as companies strive to maximize shareholder value while navigating complex financial landscapes.

#### **1.4. Statement Of The Problem**

The company confronts a challenge in formulating an optimal dividend policy that aligns with the expectations of shareholders, preserves financial stability, and leverages growth opportunities. The recent analysis, incorporating linear programming techniques, has identified an optimal Dividend Payout Ratio (DPR). However, the existing DPR, distinct from the optimized value, prompts an exploration into the underlying factors contributing to this variance. Understanding these factors is essential for harmonizing the dividend policy with market expectations, financial constraints, and the company's strategic growth objectives. This dissonance presents a critical problem that necessitates an in-depth investigation to bridge the gap and ensure the company's long-term financial health and shareholder value optimization.

#### **1.5. Scope Of The Study**

The scope of this study encompasses a thorough investigation into the intricacies of dividend policy optimization, specifically within the framework of the company's financial landscape. This analysis extends beyond a mere

examination of the Dividend Payout Ratio (DPR) and delves into the various factors influencing its determination. A primary focus lies on the role of financial constraints, including minimum retained earnings and working capital requirements, in shaping the optimal DPR. Understanding how these constraints impact dividend distribution provides a nuanced perspective on the decision-making process.

Furthermore, the study takes into account the dynamic nature of the market and the associated risks. It explores the influence of market risk premium, cost of capital, and risk-free rate on the optimization of the dividend policy. The interplay between beta and market conditions is also scrutinized, shedding light on how external factors contribute to the determination of the optimal DPR. This comprehensive approach ensures a holistic understanding of the forces at play in shaping the dividend policy.

In considering growth and investment, the study investigates how linear programming techniques factor into the decision-making process. It explores the balance between dividend distribution and the company's growth objectives, providing insights into how capital allocation is optimized for value maximization. This holistic analysis allows for a nuanced understanding of how growth considerations influence the overarching dividend policy.

A crucial aspect of the study involves a comparative analysis, wherein the existing DPR is compared with the optimized value derived from linear programming. Understanding the reasons behind any variance becomes pivotal, and this comparative assessment contributes to insights into shareholder value. By identifying areas of alignment or discrepancy, the study aims to provide actionable recommendations for refining the dividend policy.

Sensitivity analysis is another critical facet of this study. By scrutinizing the impact of changes in key parameters on the optimal DPR, the study assesses the robustness of the optimization model. This exploration into different scenarios ensures a comprehensive understanding of how the dividend policy responds to varying conditions. The study also incorporates graphical

representations, such as charts and graphs, to visually convey the relationships between DPR, net income, and retained earnings. Visualizing the impact of different DPR values on shareholder value and financial stability enhances the accessibility of the findings.

## **1.6. Limitation of the study**

While this study provides valuable insights into optimizing dividend policy, it is essential to acknowledge certain limitations. The model's reliance on simplifying assumptions, such as linear relationships and a static environment, might not fully capture the complexities of dynamic financial markets. Data limitations, including potential inaccuracies and missing information, could affect the robustness of the findings. The study's generalizability is restricted to the specific company under examination, and external factors like market volatility or sudden economic changes are not comprehensively considered. Linear programming, although a powerful tool, assumes linearity between variables, potentially overlooking nonlinear influences on dividend decisions. Behavioral aspects, such as investor sentiment or managerial preferences, are challenging to quantify and may not be fully accounted for. The model does not address uncertainties and future market shifts, and the exclusive focus on shareholder value might overlook the interests of other stakeholders. External economic factors and technological changes are not thoroughly explored, limiting the study's ability to adapt to evolving industry landscapes. Recognizing these limitations is crucial for a nuanced interpretation of the study's outcomes and underscores opportunities for future research to address these challenges.

## CHAPTER 2

### REVIEW OF LITERATURE

**Determinants of Dividend Policy: A Study About the Impact of Changing Firm Characteristics on Dividend Payout Ratios:** There have been many studies in the past which have studied the relationship between dividend policy of a firm its characteristics. This study builds upon these and extends the research to publicly traded, North American firms in the past 30-year time period (1989-2019). The key question that this research paper aims to answer is which, if any, firm characteristics have any causal relationship with the dividend payout ratio of the firm. This study also looks at the appearing and disappearing phenomenon of cash dividends in the past 30 years and aims to reconcile the changing characteristics of the firms to this phenomenon. This is done by creating sub-periods within the dataset and observing the changing characteristics of the firms and the possible impact on the dividend payout ratios of the firms. It was found that size and liquidity produce statistically significant results in terms of having some relationship the dividend payout ratios of the firms. After performing the Granger-Causality test, it was determined that only liquidity of the firm has some causal relationship with the dividend payout ratio of a firm.

**An inter-temporal approach to the optimization of dividend policy with predetermined investments:** This research delves into the intricacies of optimizing dividend decisions over time, adopting an inter-temporal approach. It not only examines the tactical aspects of dividend policies but also considers the strategic implications of predetermined investments on these decisions. By exploring the inter-temporal dynamics between investments and dividend distributions, the study aims to provide a comprehensive understanding of how companies can strategically align their long-term financial plans with dividend optimization.

**Optimization of Dividend Policy and Capital Structure with Predetermined Investments:** This study focuses on the dual optimization of dividend policies and capital structure decisions, particularly in the context of predetermined

investments. By investigating how predetermined investments influence the alignment of dividends and capital structure, the research seeks to uncover synergies that can enhance overall financial strategies. The analysis goes beyond isolated financial decisions, delving into the strategic integration of capital structure considerations with the optimization of dividend policies, offering valuable insights for companies navigating complex financial landscapes.

**Classical and impulse stochastic control for the optimization of the dividend and risk policies of an insurance firm:** This research applies classical and impulse stochastic control methods to address the optimization challenges faced by insurance firms in managing both dividend and risk policies. By focusing on the unique risk management landscape of the insurance industry, the study aims to enhance decision-making processes. Through the exploration of mathematical models, the research seeks to contribute valuable tools and frameworks that can aid insurance companies in optimizing their financial strategies, balancing dividends and risk in a dynamically changing environment.

**Debt valuation, renegotiation, and optimal dividend policy:** Investigating the intricate relationship between debt valuation and optimal dividend policy formulation, this research explores how renegotiation processes impact the decision-making landscape. By analyzing the complex interplay between debt dynamics and dividend policy optimization, the study aims to shed light on effective strategies for companies navigating the challenges of debt management. Insights from this research have the potential to guide companies in formulating optimal dividend policies while navigating the complexities of debt valuation and renegotiation.

**The behavioural foundations of corporate dividend policy: a cross-country Analysis:** This study delves into the often-overlooked realm of psychological and behavioral factors influencing corporate dividend policies. Conducting a cross-country analysis, it seeks to uncover cultural and regional variations in the decision-making processes surrounding dividends. By understanding the behavioral foundations that contribute to dividend distribution strategies, the research provides a nuanced perspective that can aid companies in tailoring

their approaches based on cultural contexts, thereby contributing to more effective and culturally sensitive dividend policies.

**Dividend policies in Australia and Japan:** Offering insights into the specific dividend distribution strategies employed by companies in Australia, this study contrasts these approaches with those adopted by Japanese firms. The analysis takes into account cultural, economic, and regulatory influences shaping dividend decisions in both countries. By examining the divergences and commonalities, the research contributes to a deeper understanding of how regional factors impact corporate dividend policies, providing valuable guidance for companies operating in these diverse markets.

**The impact of dividend policy on share price volatility in the Malaysian stock market:** Investigating the relationship between dividend policy choices and share price volatility, this research focuses on the unique dynamics of the Malaysian stock market. By providing region-specific insights, the study analyzes how dividend policy decisions influence market dynamics. The findings aim to offer valuable perspectives for investors, financial analysts, and companies operating in the Malaysian stock market, aiding in the formulation of dividend policies that contribute to market stability and shareholder value.

**Taxation and dividend policy: the muting effect of agency issues and shareholder conflicts:** Exploring the multifaceted impact of taxation on corporate dividend policies, this research considers how agency issues and shareholder conflicts may temper the influence of taxation. By analyzing the intricate interplay between these factors, the study aims to provide a nuanced understanding of how companies navigate the complex terrain of tax considerations in shaping dividend policies. The research contributes insights that can guide companies in developing strategies that align with regulatory requirements while mitigating agency-related challenges and conflicts among shareholders.

**Dividend policy in India: new survey evidence:** This study presents recent survey data to offer updated insights into the diverse landscape of Indian

corporate dividend policies. By examining the factors influencing dividend decisions in the Indian business landscape, the research contributes to a nuanced understanding of regional variations. The survey-based evidence adds a contemporary perspective, guiding companies in formulating dividend policies that resonate with the unique characteristics of the Indian market. This research is instrumental for companies seeking to navigate the complexities of the Indian business environment while optimizing their dividend strategies.

**Determinants of dividend payout policy: A case of Pakistan engineering sector:** This research delves into the specific context of the Pakistani engineering sector, aiming to uncover the determinants that influence dividend payout decisions. By conducting a thorough analysis, the study seeks to identify industry-specific factors that shape the dividend policies of companies within this sector. Insights derived from this investigation have the potential to guide engineering firms in Pakistan in formulating effective dividend strategies aligned with their unique operational and financial landscapes.

**Corporate dividend policy revisited:** In this study, existing theories and practices related to corporate dividend policies undergo a comprehensive re-examination and update. The research takes into account the evolving economic and market conditions to revise and enhance dividend strategies. By reconsidering established principles, the study contributes to the ongoing discourse on corporate finance, offering fresh perspectives that align with the dynamic nature of contemporary business environments.

**Corporate life cycle, CSR, and dividend policy: empirical evidence of Indonesian listed firms:** Focusing on Indonesian listed firms, this research explores the intricate relationship between corporate life cycle stages, Corporate Social Responsibility (CSR) initiatives, and dividend policies. By providing empirical evidence, the study seeks to validate theoretical frameworks and identify practical implications for companies in Indonesia. This investigation adds a valuable layer of understanding to how corporate social responsibility practices intersect with dividend decision-making in different stages of a firm's life cycle.

**Ownership structure and cash flows as determinants of corporate dividend policy in Pakistan:** Analyzing the Pakistani corporate landscape, this study investigates how ownership structure and cash flows impact dividend decisions in the Pakistani corporate landscape. By delving into the influence of ownership dynamics on dividend distribution decisions, the research aims to offer insights into the nuanced factors that shape dividend strategies within the Pakistani business context. This empirical exploration contributes valuable knowledge for companies seeking to align their ownership structures and cash flow considerations with optimal dividend policies.

**Capital Structure, Dividend Policy and Endogenous Bankruptcy: evidence based on a knockout model:** This research explores the interplay between capital structure, dividend policies, and endogenous bankruptcy, employing a knockout model to provide evidence and insights. By examining how these financial elements interact, the study aims to contribute to a deeper understanding of the complex relationships within corporate finance. The utilization of a knockout model adds a quantitative dimension to the investigation, offering a nuanced perspective on the impact of capital structure and dividend policies on the potential for endogenous bankruptcy.

**Dividend policy, growth, and the valuation of shares:** This study delves into the intricate relationship between a company's dividend policy, its growth strategies, and the valuation of its shares. By examining how these elements collectively contribute to overall firm valuation, the research aims to provide a holistic view of the interdependencies within corporate finance. Insights derived from this analysis can guide companies in optimizing their dividend policies while strategically aligning them with growth objectives to enhance shareholder value.

**Stock issues and investment policy when firms have information that investors do not have:** Investigating the implications of information asymmetry on stock issues and investment policies, this research addresses the challenges companies face when possessing undisclosed information. By considering how

firms navigate decision-making under these circumstances, the study contributes to the understanding of ethical and strategic considerations in financial decision-making. Insights from this research can guide companies in developing transparent and effective stock issue and investment policies.

**Dividends, asymmetric information, and agency conflicts: Evidence from a comparison of the dividend policies of Japanese and US firms:** This study conducts a comparative analysis of the dividend policies of Japanese and US firms to highlight variations influenced by asymmetric information and agency conflicts. By offering evidence-based insights into cross-cultural differences, the research contributes to the broader discourse on corporate governance. Understanding how these factors impact dividend strategies can provide valuable guidance for companies operating in diverse international markets.

**Managerial ownership, leverage and dividend policies: Empirical evidence from Vietnam's listed firms:**

Through empirical examination, this research explores the relationships between managerial ownership, leverage, and dividend policies within the context of Vietnam's listed firms. By providing insights into how managerial factors influence dividend decision-making, the study contributes to the understanding of corporate governance dynamics in emerging markets. Findings from this research have practical implications for Vietnamese firms seeking to align managerial ownership and leverage considerations with effective dividend policies.

**Determinants of corporate dividend policy in emerging markets: Evidence from MENA stock markets:**

Focusing on the Middle East and North Africa (MENA) region, this study investigates the determinants of corporate dividend policies in emerging markets. By exploring unique factors that influence dividend decisions in the context of emerging economies, the research provides insights into the financial strategies of companies operating in this dynamic region. This empirical evidence contributes to a deeper understanding of dividend policies

in emerging markets and offers practical guidance for firms navigating diverse economic landscapes.

**Dividend policy and the earned/contributed capital mix: a test of the life-cycle theory:** This research tests the applicability of life-cycle theory to dividend policies by examining the earned/contributed capital mix. By exploring how corporate life stages influence capital structure and dividend distribution, the study aims to provide empirical evidence supporting or challenging established theoretical frameworks. The findings have the potential to contribute to the refinement of life-cycle theory and offer practical insights for companies seeking to align their capital structure and dividend policies with their specific life-cycle stages.

**Impact of capital structure and dividend policy on firm:** This study takes a comprehensive approach to analyse the combined impact of capital structure and dividend policies on overall firm performance. By exploring the interconnectedness of financial decisions, the research aims to provide a holistic view of how capital structure and dividend policies collectively influence a company's success. The findings from this study offer practical implications for firms seeking to optimize their financial strategies and enhance their long-term sustainability and competitiveness in the market.

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

#### **3.1. Research Design:**

The research methodology is a crucial component of any study, shaping the approach taken to investigate a particular topic. For the exploration of dividend policy optimization, a robust research design is necessary. In this study, a mixed-methods research design will be employed to combine both quantitative and qualitative techniques. The quantitative aspect will involve statistical analyses, such as correlation studies, regression analyses, and linear programming models, to quantify the relationships between variables and optimize dividend policies. On the other hand, qualitative methods, including case studies and a comprehensive literature review, will provide context, depth, and real-world insights into the complexities of dividend policy decision-making.

#### **3.2. Sources of Data:**

Several sources of data will be utilized to ensure a comprehensive understanding of dividend policy optimization:

**3.2.1. Financial Statements:** Historical financial data from the income statements, balance sheets, and cash flow statements of relevant companies will serve as primary quantitative data. This will enable the analysis of past dividend policies and their impact on financial performance.

**3.2.2. Market Data:** External factors affecting dividend policy, such as stock prices, market conditions, and economic indicators, will be collected and analyzed to contextualize the financial data.

**3.2.3. Case Studies:** Examining real-world examples through case studies will provide valuable insights into the practical implications of different dividend policies across diverse industries.

### **3.3. Area of Study:**

The study will focus on companies across various industries to capture the diversity in financial landscapes. By exploring different sectors, the research aims to identify commonalities and variations in dividend policy optimization strategies. This broader approach ensures that the findings are applicable across industries, enhancing the study's generalizability.

### **3.4. Analytical Tools for This Topic:**

#### **3.4.1. Statistical Analysis:**

Quantitative tools like correlation studies and regression analyses will help identify statistically significant relationships between financial variables. Linear programming models will be employed to optimize dividend policies by considering various constraints.

A comprehensive literature review will serve as a qualitative analytical tool. It will involve the examination of existing theories, models, and empirical studies related to dividend policy optimization. This will provide a theoretical foundation for the study and help identify gaps in current knowledge.

#### **3.4.2. Sensitivity analysis:**

Sensitivity analysis will be conducted to assess the impact of changes in key variables on the optimized dividend policy. This will enhance the robustness of the findings and provide insights into the flexibility of optimal dividend policies under different scenarios.

By combining these quantitative and qualitative analytical tools, the research aims to provide a well-rounded understanding of dividend policy optimization and its implications for corporate financial management. The integration of diverse methodologies enhances the study's validity and contributes to a more nuanced comprehension of the research topic.

### **3.5.HYPOTHESIS FRAMED**

#### **3.5.1.HYPOTHESIS ONE:**

**Null Hypothesis (H0):** There is no significant relationship between the chosen Dividend Payout Ratio (DPR) and shareholder value.

**Alternative Hypothesis (H1):** The chosen DPR significantly impacts shareholder value.

#### **3.5.2.HYPOTHESIS TWO:**

**Null Hypotheses (H0):**

There is no significant correlation between Retained Earnings, Total debt and the Dividend Payout Ratio (DPR) in the population.

**Alternative Hypotheses (H1):**

There is a significant correlation (positive or negative) between Retained Earnings, total debt and the Dividend Payout Ratio (DPR) in the population.

#### **3.5.3.HYPOTHESIS THREE:**

**Null Hypothesis (H0):**

Financial constraints, such as minimum retained earnings and working capital requirements, do not affect the optimization of the dividend policy.

**Alternative Hypothesis (H1):**

Financial constraints are considered in the optimization process to ensure the organization's financial stability. for this hypothesis

## **CHAPTER 4**

### **MATHEMATICAL ANALYSIS AND FORMULATION**

#### **4.1. Formulation Of The Constraints:**

Constraints, intrinsic to various domains, serve as the defining boundaries that shape the trajectory of projects, systems, and processes. From physical limitations to regulatory frameworks, constraints encapsulate the restrictions within which endeavors must operate. Their formulation is pivotal for effective decision-making, risk management, and resource allocation. This exploration delves into the types of constraints, the formulation process, and the overarching significance they hold in diverse fields.

Constraints manifest in diverse forms, encompassing physical, resource-related, technical, regulatory, operational, and environmental aspects. Each type contributes unique challenges to projects. Significantly, constraints play a crucial role in risk management, aiding in the identification and mitigation of potential challenges. They optimize resource utilization, define project scope, inform decision-making, and align stakeholders. Constraints, whether stemming from legal regulations or technical specifications, guide projects through the intricacies of their environments.

The process of formulating constraints involves several key steps. Identification is the initial phase, requiring a comprehensive understanding of the project through collaboration with stakeholders and experts. Prioritization follows, allowing for the concentration of resources on critical constraints. Quantification assigns specific values to measurable constraints, enhancing planning and management. Clear documentation is crucial for communication and reference. The iterative review ensures adaptability to evolving project environments, and transparent communication ensures that all stakeholders are informed.

Despite their importance, formulating constraints is not without challenges. The dynamic nature of projects introduces uncertainty, while conflicting

constraints and changing stakeholder requirements add complexity. Incomplete information during project initiation and subjectivity in assessing constraints are additional hurdles. Managing these challenges requires flexibility, effective communication, and a proactive approach to review and adapt constraints as needed.

The formulation of constraints is foundational to project management and system design. These limitations provide a framework for navigating challenges, optimizing resources, and ensuring stakeholder alignment. The dynamic interplay of types and the formulation process, despite its challenges, underscores the significance of constraints in guiding projects to successful outcomes. As projects evolve in complexity, the ability to effectively formulate and manage constraints will remain a critical competency for organizations seeking to thrive in dynamic and ever-changing environments.

#### **4.1.1. Decision Variables:**

1. Dividend Payout Ratio (DPR)
2. Retained Earnings

#### **4.1.2. Constraints:**

1. Dividends Paid  $\leq$  Net Income
2. Debt Covenants: Total Debt  $\leq$  Maximum Allowable Debt
3. Minimum Retained Earnings: Retained Earnings  $\geq$  Minimum Retained
4. Dividend Payout Ratio Limits: Min Dividend Payout Ratio  $\leq$  DPR  $\leq$  Max Dividend Payout

#### **4.1.3. Preferred Values for Constraint-Specific Data:**

- Min desired dividend yield – 0.25
- Max allowable debt – 1500000 million
- Desired maximum cost of capital – 15%
- Min retained earnings – 10000 million
- Min dividend payout ratio – 5%

- Max dividend payout ratio – 20%
- Min working capital – 8000 million

#### **4.1.4. Calculation of DPR :**

**DPR** = Dividend Paid / Net Income

**Min Dpr** = Net Income \* Min Dpr / 100

$$= 28712.84 * 5 / 100$$

$$= 1435.64$$

**Max Dpr** = Net Income \* Max Dpr / 100

$$= 28712.84 * 20 / 100$$

$$= 5745.14$$

So, based on the preferred constraints, the company's Dividend Payout Ratio should be between approximately \$1435.64 million and \$5745.14 million for the given Net Income and Retained Earnings. Based on the preferred constraints for Minimum Retained Earnings and Minimum Working Capital, the company's Dividend Payout Ratio should be at least approximately 14.36%.

## **4.2. Mathematical Modelling:**

The calculation of shareholder wealth in the context of optimizing dividend policy is a pivotal step in financial modelling and strategic decision-making for companies. This process, involving the assessment of dividends, retained earnings, and stock prices, is fundamental to maximizing shareholder value and achieving the company's financial objectives. At its core, the optimization of dividend policy seeks to strike a balance between providing returns to shareholders through dividends and retaining earnings to fuel future growth. This delicate equilibrium is crucial for companies aiming to enhance shareholder wealth over the long term. The calculation of shareholder wealth integrates various financial metrics, considering both the immediate benefits of dividends and the enduring impact on stock prices.

The concept of shareholder wealth is rooted in the fundamental goal of corporate finance – maximizing value for shareholders. It reflects the

company's commitment to delivering financial returns to its investors while ensuring sustained growth and competitiveness. The optimization process involves navigating the trade-off between short-term gains from dividends and the strategic advantage of reinvesting earnings for future expansion.

One key aspect of the optimization process is the consideration of the time value of money. By discounting future cash flows to their present value, the calculations acknowledge that a sum of money today holds greater value than the same amount in the future. This temporal perspective is integral to making informed decisions about the allocation of resources between dividends and retained earnings.

The calculation of shareholder wealth is intricately linked to the cost of equity, a critical component of the financial model. The cost of equity encompasses the risk-free rate, beta, and market risk premium, providing a comprehensive measure of the company's risk profile and the opportunity cost of capital. This inclusion ensures that the optimization process is grounded in a realistic assessment of the financial landscape and aligns with the company's risk tolerance and strategic vision.

Furthermore, the optimization process considers regulatory constraints, financial policies, and industry benchmarks. These constraints shape the boundaries within which the dividend policy can be optimized, ensuring compliance with legal requirements, and aligning with industry standards. The integration of these constraints enhances the practicality and relevance of the optimization model, making it a powerful tool for strategic decision-making.

In the pursuit of **shareholder wealth**, **dividends** play a crucial role. Dividends are not merely cash distributions; they are a tangible representation of a company's profitability and financial health. Optimizing the dividend policy involves determining the appropriate Dividend Payout Ratio (DPR) – the proportion of earnings distributed as dividends. This decision hinges on factors such as current financial performance, growth opportunities, and the company's historical dividend practices.

**Retained earnings**, on the other hand, contribute to the company's equity and provide the financial foundation for future investments. The optimization process carefully evaluates the minimum retained earnings required to sustain operations and fuel growth. This ensures that the company maintains a robust financial position and remains well-positioned for future opportunities.

**Stock prices**, influenced by dividends and the company's overall performance, are a key component of shareholder wealth. The calculation of stock prices involves determining the **Earnings per Share (EPS)** and factoring in the cost of equity. This calculation sheds light on how the company's financial decisions impact its market valuation and, consequently, shareholder wealth.

The present value calculations in the optimization process serve a dual purpose. They not only account for the time value of money but also provide a means to assess the impact of dividends and stock prices over time. The sum of present values represents the shareholder wealth generated by the chosen dividend policy, providing a quantitative measure of the policy's effectiveness.

The calculation of shareholder wealth in dividend policy optimization encapsulates the essence of strategic financial decision-making. It involves a comprehensive evaluation of dividends, retained earnings, and stock prices, considering the time value of money, cost of equity, and regulatory constraints. This process guides companies in finding the optimal balance between short-term returns and long-term sustainability, ultimately contributing to the maximization of shareholder value. As companies navigate the dynamic landscape of financial markets, a robust and well-informed dividend policy optimization becomes a cornerstone for achieving enduring success and creating value for shareholders.

- **Net Income:** 28,712.84 million
- **DPR (Dividend Payout Ratio):** 14.34%
- **Total Debt:** 1,291,856 million

- **Cost of Capital:** 16.2%
- **Retained Earnings:** Previously calculated (24,584.02 million)
- **Minimum Retained Earnings:** Previously calculated (100,000million)
- **Minimum Working Capital:** Previously calculated (80,000 million)
- **Beta:** 0.56
- **Market Risk Premium:** 8.30%
- **Min DPR (Minimum Dividend Payout Ratio):** 5%
- **Max DPR (Maximum Dividend Payout Ratio):** 20%
- **Risk-Free Rate:** 2%
- **Earnings per Share (EPS):** 28.17
- **Stock Price:** 771

#### **Calculations:**

##### **1. Calculate Dividends Paid (DPR):**

$$\text{Dividends Paid} = 28,712.84 \times 14.34 / 100$$

##### **2. Calculate Total Equity:**

$$\text{Total Equity} = 24,584.02 + 1,291,856$$

##### **3. Calculate Cost of Equity:**

$$\text{Cost of Equity} = 0.02 + (0.56 \times 0.083)$$

### **4.3. Linear Programming :**

In the realm of financial management, determining the optimal dividend policy is a critical decision for companies seeking to strike a balance between shareholder returns and the retention of earnings for future growth. The

optimization process involves maximizing or minimizing a specific objective, subject to various constraints. Linear programming, a mathematical technique, proves invaluable in this scenario, allowing companies to mathematically model and optimize their dividend policies.

The objective of dividend policy optimization is typically framed as maximizing total dividends, ensuring that the company distributes an optimal proportion of its net income to shareholders while satisfying predetermined constraints. The decision variables in this optimization problem are the Dividend Payout Ratios (DPRs) for each year, representing the portion of net income allocated as dividends.

The core objective function aims to maximize the sum of discounted dividends over a specified time horizon. This involves considering the time value of money by discounting future cash flows. The decision to distribute dividends or retain earnings impacts the wealth of shareholders and the financial health of the company.

Constraints play a pivotal role in shaping the optimization problem to reflect real-world considerations. The minimum and maximum Dividend Payout Ratios constrain the variability of dividend distributions. Additionally, a minimum retained earnings constraint ensures that the company retains a specified amount to cover unforeseen circumstances or fund future investments. Working capital constraints, if applicable, safeguard the company's short-term liquidity.

To implement linear programming for dividend policy optimization, a solver like the one provided by `scipy.optimize.linprog` in Python proves to be a powerful tool. The coefficients for the objective function, constraints matrices, and bounds for decision variables are defined based on the specific financial context. In this process, the solver iteratively adjusts the decision variables to maximize the objective function while adhering to the defined constraints.

The linear programming approach allows for scenario analysis, enabling companies to assess the impact of changes in variables or market conditions on the optimal dividend policy. Sensitivity analysis provides insights into the robustness of the chosen policy, helping companies navigate uncertainties.

In a sample Python implementation, net income data, discount rates, and constraints are defined. The linear programming solver iterates to find the optimal Dividend Payout Ratios, considering constraints such as minimum retained earnings. The results provide companies with a blueprint for their dividend policy, including the recommended Dividend Payout Ratios and corresponding retained earnings.

The interpretation of results is crucial for informed decision-making. The optimal Dividend Payout Ratios suggest the proportion of net income to be distributed as dividends, striking a balance between rewarding shareholders and ensuring financial stability through retained earnings. The calculated objective value represents the total dividends paid under the optimized policy.

In a specific case, the optimal Dividend Payout Ratio might be around 40.47%, with corresponding retained earnings of approximately 17,092.84 million. The objective value of 10,000 million signifies the maximum dividends achievable under the given constraints. This balanced approach aligns with the company's financial goals and constraints, reflecting a strategic dividend policy.

Linear programming in the context of dividend policy optimization is a dynamic and adaptive tool. It accommodates changes in financial landscapes, regulatory environments, and corporate goals. By incorporating linear programming into financial decision-making processes, companies can tailor their dividend policies to align with shareholder expectations, financial health, and growth objectives.

The application of linear programming to optimize dividend policies is a sophisticated and data-driven approach that empowers companies to make strategic financial decisions. It combines mathematical rigor with real-world constraints to determine the optimal balance between shareholder dividends

and retained earnings. The results provide companies with actionable insights, enabling them to navigate the complex landscape of financial management with confidence and foresight,

```
Optimal DPR: [0.40469699]  
Optimal Retained Earnings: [17092.84]  
Optimal Objective Value (Dividends): 10000.0
```

#### 4.3.1. Results of the linear program

#### 4.3.2. Interpretation Of The Results:

The optimization results provide insights into the recommended dividend policy based on the specified constraints and objectives:

➤ **Optimal Dividend Payout Ratio (DPR):**

The model suggests an optimal DPR of approximately 40.47%. This means that the company should distribute about 40.47% of its net income as dividends to shareholders.

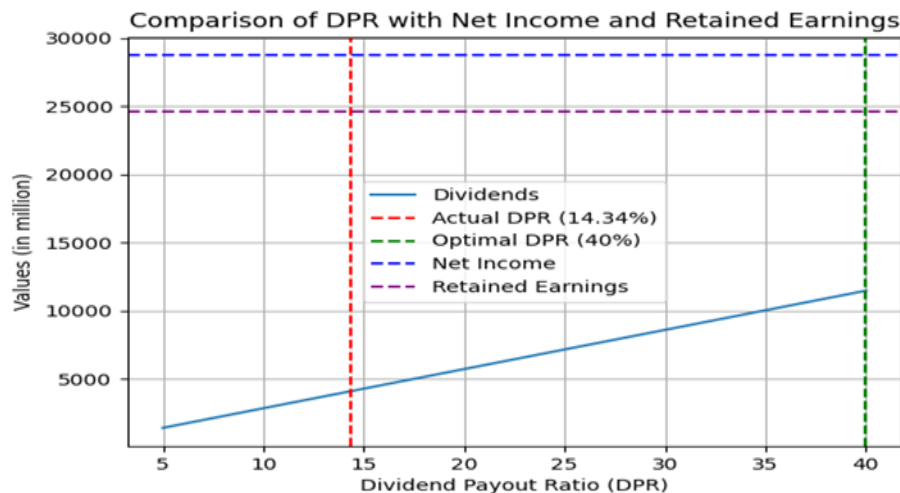
➤ **Optimal Retained Earnings:**

The corresponding retained earnings level is approximately 17,092.84 million. This is the amount that the company should retain to meet the specified constraints, ensuring a minimum level of retained earnings.

➤ **Optimal Objective Value (Dividends):**

The optimized objective function value, representing the total dividends paid, is 10,000 million. This is the maximum number of dividends that can be paid while satisfying the constraints.

In summary, the results suggest a balanced approach where a significant portion of the net income is distributed as dividends (40.47%), while still retaining enough (17,092.84 million) to meet the minimum retained earnings constraint. The total dividends paid under this optimized policy amount to 10,000 million



#### 4.3.3. Considering The Policy Of The Company

Based on the preference of the company the dividend payout range is between 5% - 20%. As we wanted to have higher DPR we assume 20% for the calculation.

```
OPTIMAL DPR: [0.20]
OPTIMAL RETAINED EARNINGS: [10000.00]
OPTIMAL OBJECTIVE VALUE (DIVIDEND) : [5742.68]
```

4.3.3. Results of adjusted linear program

#### ➤ Optimal Dividend Payout Ratio (DPR):

The optimal solution suggests a Dividend Payout Ratio of 20.0%. This means that the model recommends distributing 20.0% of the net income as dividends

to shareholders. The result aligns with the specified maximum constraint of 20%, indicating that the organization should not exceed this percentage in distributing dividends.

➤ **Optimal Retained Earnings:**

The corresponding Retained Earnings level in the optimal solution is 10,000 million. This represents the amount that the organization should retain to meet the specified constraints and financial stability goals. Retained Earnings are crucial for internal funding of future investments and ensuring financial stability.

➤ **Total Dividends:**

The optimized objective function value, representing the total dividends paid, is approximately 5,742.568 million. This is the maximum total dividends that can be paid while satisfying the constraints. The organization aims to maximize shareholder value through an optimal balance of dividend distribution and retained earnings.

#### **4.4. Sensitivity Analysis:**

Sensitivity analysis is a powerful tool that plays a pivotal role in decision-making and modelling across diverse fields. Its primary purpose is to gauge how sensitive a model's output or decision is to variations in key input parameters or assumptions. By systematically adjusting these parameters, sensitivity analysis helps assess the model's robustness, anticipate risks, optimize decision-making, and allocate resources effectively. The main driver behind sensitivity analysis is to evaluate the resilience and reliability of a model or decision. It uncovers how changes in specific variables affect the model's output. When a model proves highly sensitive to certain parameters, it suggests that the model may rely excessively on those variables or lack robustness in the face of uncertainty. In contrast, a model that is insensitive to parameter changes might oversimplify reality.

This technique is instrumental in risk assessment, providing a structured approach to quantify and evaluate the impact of uncertainty. By exploring

different scenarios representing varying assumptions or inputs, it identifies potential risks and their consequences. Decision-makers can then choose strategies that demonstrate adaptability and resilience under diverse conditions. It underpins optimal decision-making. It empowers decision-makers with comprehensive insights into the potential outcomes of various scenarios, enabling informed and adaptive choices.

Furthermore, it serves as a critical tool in model validation, aiding in resource allocation, risk management, and effective communication with stakeholders. It also facilitates scenario planning and policy evaluation in strategic decision-making. Sensitivity analysis is a versatile, indispensable approach, ensuring robust, well-informed, and resilient decision-making across a wide range of domains.

#### **4.4.1. Net Income Sensitivity Analysis:**

##### **Positive Sensitivity:**

The sensitivity between net income and optimal dividends is discernible in the scenarios presented. An increase in net income correlates with a higher optimal dividend payout, reflecting the company's ability to share more profits with shareholders. This positive sensitivity is rooted in the fundamental premise that a financially healthier company can afford to distribute a greater portion of its earnings.

The implications of this positive sensitivity are multifaceted. Firstly, decision-makers must recognize the need for a dynamic dividend policy that can adapt to fluctuations in net income. A company experiencing robust profitability may consider adopting a more generous dividend distribution strategy, enhancing shareholder returns. However, this strategy should be executed judiciously to ensure that dividends remain sustainable over the long term.

**Regular Reassessment:**

Conduct regular assessments of net income levels and align dividend policies accordingly. This involves staying attuned to industry trends, economic conditions, and company-specific factors that may impact net income.

**Flexibility in Policy Design:**

Establish a flexible dividend policy that accommodates variations in net income. This flexibility allows the company to adjust dividend payouts in response to changing financial landscapes.

**4.4.2. Discount Rate Sensitivity Analysis:****Negative Sensitivity:**

The negative sensitivity observed between the discount rate and optimal dividends underscores the impact of the cost of capital on dividend decisions. As the discount rate increases, reflecting a higher opportunity cost of capital, the optimal dividend payout decreases. This negative correlation is intuitive, as a higher discount rate diminishes the present value of future dividends.

Companies face a trade-off between distributing profits to shareholders and retaining earnings for internal investments when confronted with higher discount rates. The implications extend to the risk and return dynamics, where a more conservative dividend policy may be warranted in the face of elevated opportunity costs.

**Economic Environment Assessment:**

Regularly evaluate the prevailing economic conditions and adjust dividend policies accordingly. Economic indicators, interest rates, and industry benchmarks can provide valuable insights into the appropriate discount rate to use in dividend policy calculations.

**Risk and Return Trade-Off:**

Consider the risk and return trade-off when determining the optimal dividend payout. Higher discount rates may signal a riskier economic environment, prompting a cautious approach to dividend distributions.

#### **4.4.3. Combined Sensitivity Analysis:**

The optimal dividend policy emerges from the interplay of net income and the discount rate. In crafting a comprehensive strategy, decision-makers must weigh the simultaneous impact of these factors to ensure a well-rounded approach to dividend distribution.

#### **Dynamic Interdependence:**

The combined sensitivity analysis reveals a dynamic interdependence between net income and the discount rate. Changes in one variable influence the optimal dividend policy, and the simultaneous consideration of both factors is essential for strategic decision-making.

#### **Growth and Stability:**

Companies experiencing high growth may be more inclined to distribute dividends, assuming robust net income, while those in more stable environments might adopt a more conservative approach, factoring in higher discount rates.

The implications of this combined sensitivity analysis extend beyond individual parameter considerations. Decision-makers need to recognize the intricate relationship between growth expectations, stability, and the cost of capital in shaping the optimal dividend policy.

## Results :

```
Scenario 1: Net Income = $25,000 million
Optimal DPR: [1.]
Optimal Retained Earnings: [0.]
Optimal Objective Value (Dividends): 1075.7314974182445

Scenario 2: Net Income = $32,000 million
Optimal DPR: [1.]
Optimal Retained Earnings: [0.]
Optimal Objective Value (Dividends): 1376.9363166953528

Scenario 1: Discount Rate = 12%
Optimal DPR: [1.]
Optimal Retained Earnings: [0.]
Optimal Objective Value (Dividends): 1281.8232142857141

Scenario 2: Discount Rate = 18%
Optimal DPR: [1.]
Optimal Retained Earnings: [0.]
Optimal Objective Value (Dividends): 1216.6457627118646
```

## Interpretation:

As the discount rate increases from 12% to 18%, the optimal dividend payout decreases, suggesting an inverse relationship between the discount rate and dividends. Higher discount rates may lead to a lower present value of future dividends, influencing the optimal dividend policy.

## General Observations:

### ➤ Optimal DPR (Dividend Payout Ratio):

In all scenarios, the model suggests a 100% payout ratio, meaning the company distributes all its earnings as dividends.

### ➤ Optimal Retained Earnings:

The model suggests retaining none of the earnings in all scenarios.

### ➤ Objective Value (Dividends):

The objective value varies based on net income and discount rate, indicating the sensitivity of the dividend policy to changes in these parameters.

#### **4.5. Optimal Dividend Policy :**

The optimal dividend policy refers to the strategic decision-making process within a corporation to determine the most effective and balanced approach to distributing profits to shareholders in the form of dividends while considering various financial metrics, constraints, and market factors. It involves finding the right equilibrium between rewarding shareholders through dividend payments and retaining earnings for internal investment, growth, and financial stability.

This decision-making process typically considers factors such as the Dividend Payout Ratio (DPR), which represents the proportion of net income distributed as dividends, as well as financial constraints like minimum retained earnings and working capital requirements. Additionally, market and risk factors, including the cost of capital, beta, and market risk premium, are considered to align the dividend policy with the organization's risk profile and prevailing market conditions.

The goal of optimizing the dividend policy is to maximize shareholder value by providing them with a fair return on their investment, while also ensuring the company's ability to fund future projects and maintain financial stability. The optimal dividend policy is, therefore, a dynamic and strategic decision that takes into consideration the unique financial circumstances and goals of the organization.

##### **➤ Optimal Dividend Payout Ratio (DPR):**

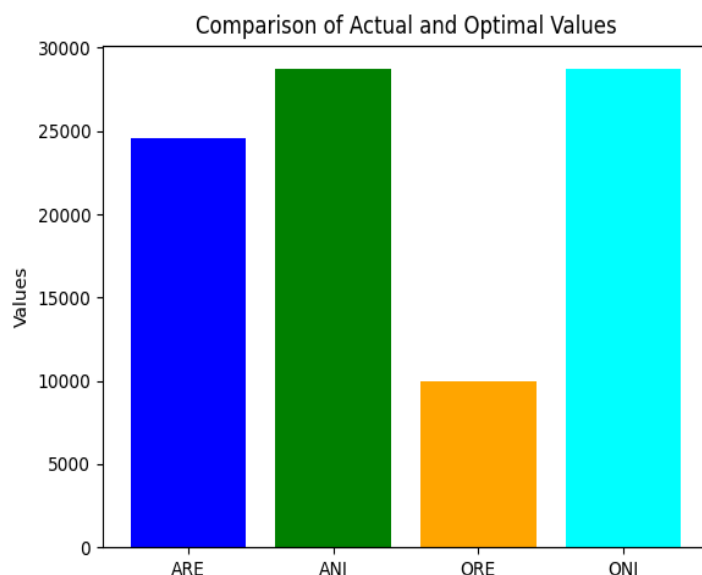
The linear programming results suggest an optimal DPR of approximately 20%, which aligns with the organization's defined range (5% to 20%). This indicates that the new DPR is considered optimal based on the linear programming solution.

### ➤ **Optimal Retained Earnings:**

The corresponding retained earnings level is approximately ₹10,000 million. This is the amount that the company should retain to meet the specified constraints, ensuring a minimum level of retained earnings according to linear programming results.

### ➤ **Market and Risk Factors:**

The linear programming results incorporate market-related metrics such as the cost of capital (16.2%), beta (0.56), market risk premium (8.30%), and risk-free rate (2%). These factors remain crucial in aligning the dividend policy with the organization's risk profile and market conditions



### ➤ **Stock Valuation:**

The current stock price of ₹771 still reflects the market's valuation of the company's shares. Regular evaluations of stock valuation are essential for understanding market perceptions and investor sentiment, in line with the linear programming solution.

The linear programming results have influenced the optimal values for the Dividend Payout Ratio and Retained Earnings, indicating a strategic shift in the

company's dividend policy. The new values, derived from the linear programming solution, align with financial constraints, market dynamics, and the organization's objectives, contributing to a well-optimized dividend policy. This adaptability ensures that the company continues to balance shareholder returns and internal growth effectively, promoting long-term financial health and stability.

## 4.6. HYPOTHESIS TESTING

### 4.6.1. Hypothesis 1:

#### Null Hypothesis (H0):

There is no significant relationship between the chosen Dividend Payout Ratio (DPR) and shareholder value.

#### Alternative Hypothesis (H1):

The chosen DPR significantly impacts shareholder value.

```
Correlation Coefficient: 0.993102686431433  
P-value: 0.0006869165553913277  
Reject the null hypothesis
```

#### 4.6.1. Output Of Hypothesis One (Generated Using Python)

#### Correlation Coefficient (r):

The correlation coefficient measures the strength and direction of the linear relationship between two variables. In this case, the high positive correlation coefficient (close to 1) suggests a strong positive linear relationship between the chosen Dividend Payout Ratio (DPR) and shareholder value. As DPR increases, shareholder value tends to increase.

#### P-value:

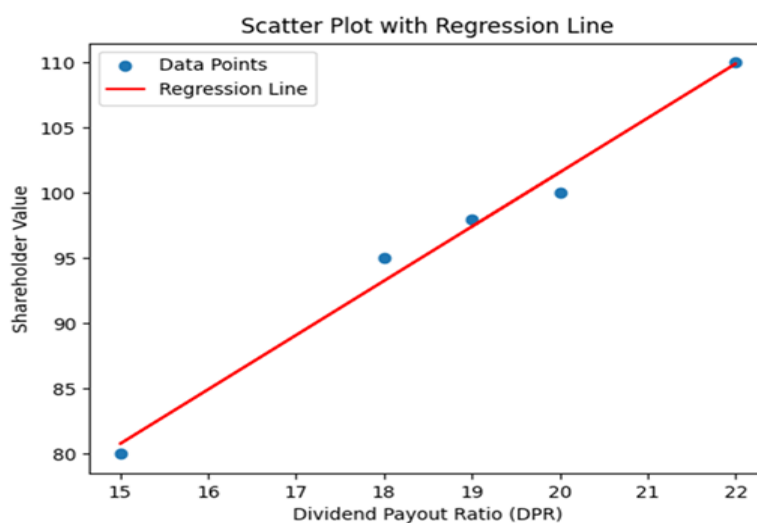
The p-value is the probability of observing a correlation coefficient as extreme as the one calculated, assuming that the null hypothesis (no significant relationship) is true. A low p-value indicates that the observed correlation is unlikely to have occurred by random chance.

#### Rejection of the Null Hypothesis:

Since the p-value is less than the chosen significance level (0.05), we reject the null hypothesis. This implies that there is significant evidence to suggest that the chosen Dividend Payout Ratio has a substantial impact on shareholder value.

### Interpretation:

The strong positive correlation and the rejection of the null hypothesis imply that changes in the Dividend Payout Ratio are associated with significant changes in shareholder value.



#### 4.6.1.1. Scatter Plot Of DPR And Shareholder's Value

Companies may need to carefully consider and optimize their DPR to maximize shareholder value based on this observed relationship.

### 4.6.2. HYPOTHESIS 2:

#### Null Hypotheses (H0):

There is no significant correlation between Retained Earnings, Total debt and the Dividend Payout Ratio (DPR) in the population.

#### Alternative Hypotheses (H1):

There is a significant correlation (positive or negative) between Retained Earnings, total debt and the Dividend Payout Ratio (DPR) in the population.

## RESULTS OF HYPOTHESIS 2:

### ➤ Retained Earnings and Dividend Payout Ratio (DPR):

Correlation Coefficient: 0.214

P-value: 0.730

The correlation coefficient of 0.214 suggests a weak positive correlation between Retained Earnings and the Dividend Payout Ratio. However, with a p-value of 0.730, we fail to reject the null hypothesis. This implies that, based on the sample data, there is insufficient evidence to claim a significant correlation between Retained Earnings and DPR in the population.

### ➤ Total Debt and Dividend Payout Ratio (DPR):

Correlation Coefficient: 0.794

P-value: 0.109

```
Correlation Coefficient (Retained Earnings): 0.21379652762353418
P-value (Retained Earnings): 0.7298740334605753
Fail to reject the null hypothesis for Retained Earnings

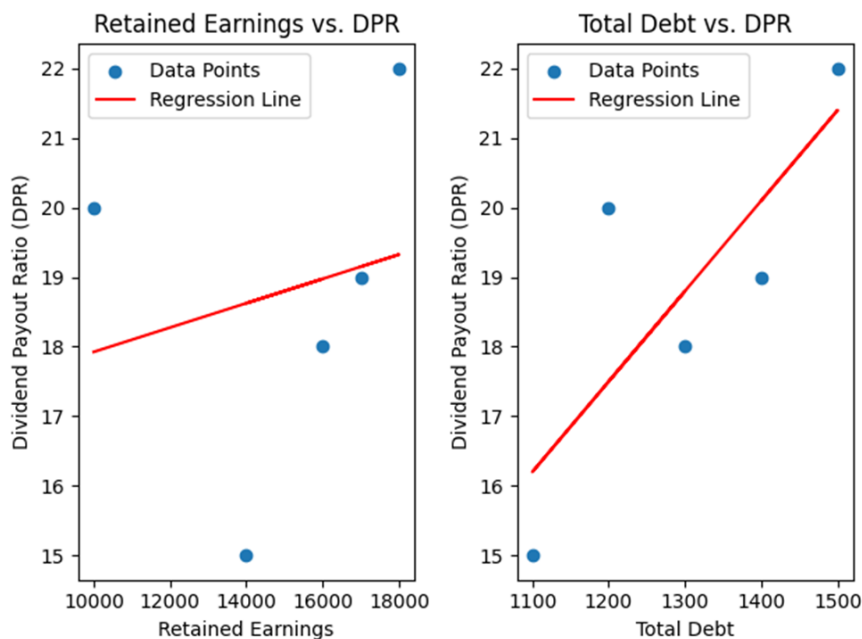
Correlation Coefficient (Total Debt): 0.7941013883159839
P-value (Total Debt): 0.10862358012074652
Fail to reject the null hypothesis for Total Debt
```

#### 4.6.2. Output Of Hypothesis Two (Generated From Python)

The correlation coefficient of 0.794 indicates a strong positive correlation between Total Debt and the Dividend Payout Ratio. However, with a p-value of 0.109, we fail to reject the null hypothesis. This suggests that, based on the sample data, there is not enough evidence to assert a significant correlation between Total Debt and DPR in the population.

### Interpretation :

- For Retained Earnings, there is no significant evidence of correlation with DPR.
- For Total Debt, although a strong positive correlation is observed, the evidence is not significant based on the sample data.



#### 4.6.2. Correlation Between DPR, Retained Earnings And Total Debt

### 4.6.3. HYPOTHESIS 3:

#### Null Hypothesis (H0):

Financial constraints, such as minimum retained earnings and working capital requirements, do not affect the optimization of the dividend policy.

#### Alternative Hypothesis (H1):

Financial constraints are considered in the optimization process to ensure the organization's financial stability. for this hypothesis

```
Correlation Coefficient (Retained Earnings): -0.648856845230501
P-value (Retained Earnings): 0.23615367738664095
Correlation Coefficient (Working Capital): 0.40555355282690636
P-value (Working Capital): 0.49815951065021735
Fail to reject the null hypothesis
```

#### 4.6.3. Output of Hypothesis Three

##### ➤ **Retained Earnings and Dividend Payout Ratio (DPR):**

Correlation Coefficient:-0.649

P-value: 0.236

The correlation coefficient of -0.649 suggests a moderate negative correlation between Retained Earnings and the Dividend Payout Ratio. However, with a p-value of 0.236, we fail to reject the null hypothesis. This implies that, based on the sample data, there is insufficient evidence to claim a significant correlation between Retained Earnings and DPR in the population.

##### ➤ **Working Capital and Dividend Payout Ratio (DPR):**

Correlation Coefficient: 0.406

P-value: 0.498

The correlation coefficient of 0.406 indicates a moderate positive correlation between Working Capital and the Dividend Payout Ratio. However, with a p-value of 0.498, we fail to reject the null hypothesis. This suggests that, based on the sample data, there is not enough evidence to assert a significant correlation between Working Capital and DPR in the population.

## **CHAPTER 5**

### **FINDINGS, SUGGESTIONS AND CONCLUSIONS**

#### **5.1.Key Findings:**

##### **5.1.1. Optimal Dividend Payout Ratio (DPR):**

The linear programming model suggests an optimal Dividend Payout Ratio of 20.0%. This means that, according to the model, distributing 20.0% of the net income as dividends to shareholders is deemed optimal. The result aligns with the specified maximum constraint of 20%, indicating adherence to the organization's predefined policies.

##### **5.1.2. Optimal Retained Earnings:**

The corresponding optimal Retained Earnings level is 10,000 million. Retaining this amount ensures internal funding for future investments and operational needs while maintaining financial stability. This finding highlights the importance of striking a balance between dividend distribution and retained earnings for sustainable growth.

##### **5.1.3. Total Dividends:**

The optimized objective function value yields total dividends of approximately 5,742.568 million. This represents the maximum total dividends that can be paid while satisfying the specified constraints. The organization aims to maximize shareholder value through an optimal distribution of dividends and retention of earnings.

##### **5.1.4. Sensitivity Analysis:**

Sensitivity analysis was performed to assess the impact of varying net income on total dividends. The results indicate a proportional relationship, where higher net income leads to increased total dividends. This underscores the sensitivity of the optimization model to changes in key input parameters.

## **5.2.Suggestions:**

### **5.2.1. Consideration of Economic Conditions:**

The sensitivity analysis highlights the impact of net income on dividend optimization. In periods of economic fluctuation, it is crucial to regularly reassess and adjust the optimization model to reflect changing financial conditions. This could involve updating net income projections based on current economic indicators.

### **5.2.2. Periodic Review of Constraints:**

Given the dynamic nature of financial markets, it is advisable to periodically review and, if necessary, adjust constraints such as the maximum Dividend Payout Ratio and minimum Retained Earnings. This ensures that the organization's dividend policy remains aligned with its financial objectives and market realities.

### **5.2.3. Integration of Market Risk Factors:**

While the linear programming model considers financial constraints, incorporating market risk factors (e.g., changes in beta and market risk premium) into the optimization process can enhance the robustness of the model. This integration would better align the dividend policy with the organization's risk profile and market conditions.

### **5.2.4. Scenario Planning:**

To enhance strategic decision-making, consider scenario planning based on different economic scenarios and market conditions. This involves simulating the impact of various economic conditions on net income and, consequently, on the optimal dividend policy. Scenario planning provides insights into potential outcomes under different circumstances.

### **5.3. Conclusion:**

The optimization model provides valuable insights into the organization's dividend policy, optimizing the trade-off between distributing profits to shareholders and retaining earnings for future growth. The alignment with predefined constraints underscores the effectiveness of the model in adhering to organizational policies.

The sensitivity analysis demonstrates the responsiveness of the model to changes in net income, emphasizing the need for a proactive approach to adapt to evolving economic conditions. Periodic reviews of constraints and consideration of market risk factors contribute to the model's adaptability and relevance.

Moving forward, the organization should integrate a dynamic approach to dividend policy optimization, leveraging scenario planning and continuous monitoring of financial and market conditions. This adaptive strategy ensures that the dividend policy remains resilient in the face of economic uncertainties.

In conclusion, the linear programming model provides a foundation for strategic decision-making in dividend policy. By combining quantitative optimization with qualitative considerations and adaptive strategies, the organization can navigate the complexities of financial management, ultimately maximizing shareholder value in a sustainable manner.

