T.C.
İSTANBUL KÜLTÜR UNIVERSITY
INSTITUTE OF GRADUATE STUDIES

A FINANCIAL OVERVIEW IN REAL ESTATE SECTOR IN TURKEY: OPTIMIZATION OF THE LEVERAGE IN REAL ESTATE DEVELOPMENT

Master Of Science Thesis

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Program: International Economics and Finance

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JUNE 2024

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ÖZET

TÜRKİYE'DE GAYRİMENKUL SEKTÖRÜNDE FİNANSAL GENEL BAKIŞ: GAYRİMENKUL GELİŞTİRMEDE KALDIRAÇ OPTİMİZASYONU

Saad ALNEHLAWI

Bu tez, İstanbul Bahçeşehir'de bir konut gayrimenkul geliştirme projesinin finansal fizibilitesini araştırmaktadır. Proje, 10.497,23 metrekarelik bir arsada 45.633 metrekare inşaat alanına sahip bir konut kompleksinin geliştirilmesini içermektedir.

Ana araştırma sorusu (RQ), "Farklı faiz oranı senaryoları altında, projenin karlılığını ve finansal performansını maksimize eden optimal finansal kaldıraç oranı nedir?" Bu çalışma, öz sermaye ve borç finansmanı kombinasyonlarını inceleyerek, bunların Net Bugünkü Değer (NPV), İç Verim Oranı (IRR) ve Yatırım Getirisi (ROI) üzerindeki etkilerini analiz etmektedir. Metodoloji, gelir projeksiyonları, maliyet yapıları ve nakit akışı analizini içeren bir finansal modelden oluşmaktadır. Optimal kaldıraç oranını belirlemek için %10, %7, %5 ve %2 faiz oranı senaryoları değerlendirilmiştir. Bulgular, yatırımcılar ve geliştiriciler için projenin uygulanabilirliğini ve karlılığını artıran stratejileri vurgulayarak değerli içgörüler sunmaktadır.

Anahtar Kelimeler: Finansal Kaldıraç, Gayrimenkul Geliştirme, IRR, ROI, Stratejik Finansman

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Institute	**: Institute of Graduate Studies**
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ABSTRACT

A FINANCIAL OVERVIEW IN REAL ESTATE SECTOR IN TURKEY: OPTIMIZATION OF THE LEVERAGE IN REAL ESTATE DEVELOPMENT

Saad ALNEHLAWI

This thesis explores the financial feasibility of a residential real estate development project in Bahçeşehir, Istanbul. The project involves developing a residential complex on a 10,497.23 square meter plot with a construction area of 45,633 square meters.

The primary research question (RQ) is: "What is the optimal financial leverage ratio that maximizes the project's profitability and financial performance under varying interest rate scenarios?" This study examines different equity and debt financing combinations, analyzing their impact on Net Present Value (NPV), Internal Rate of Return (IRR), and Return on Investment (ROI).

The methodology includes a financial model with revenue projections, cost structures, and cash flow analysis, evaluating interest rate scenarios of 10%, 7%, 5%, and 2% to determine the optimal leverage ratio. The findings provide valuable insights for investors and developers, highlighting strategies to enhance project viability and profitability through effective leverage optimization.

Keywords: Financial Leverage, Real Estate Development, IRR, ROI, Strategic Financing

1. INTRODUCTION

Real estate development constitutes a critical component of urban development and economic growth, encompassing a multifaceted process involving land acquisition, project planning, construction, and property management. Real estate development projects range from residential, commercial, and industrial to mixed-use developments, each with its unique set of challenges and opportunities. Stakeholders, including developers, investors, lenders, and policymakers, engage in the creation, improvement, and transformation of real property assets to meet the demands of end-users and investors

Leverage, or the use of borrowed capital to increase the potential return on investment, is a fundamental concept in real estate finance. While leverage can amplify returns, it also magnifies risks, making it essential for developers and investors to optimize their leverage ratios to balance risk and reward effectively. The challenge lies in determining the optimal leverage ratio that maximizes financial performance metrics such as Internal Rate of Return (IRR) and Return on Investment (ROI) under varying interest rate scenarios.

. In Turkey, the real estate market is one of the most dynamic sectors, benefiting from the country's strategic location, growing population, and robust economic growth. Istanbul, as Turkey's economic hub, has seen significant development activities, particularly in residential real estate. The Bahçeşehir area, known for its strategic location and excellent infrastructure, represents an attractive investment opportunity for real estate developers.

The primary objective of this study is to analyse the financial feasibility of a residential real estate development project in Bahçeşehir, Istanbul, by optimizing the financial leverage ratio. The study aims to construct a detailed financial model for the real estate development project, evaluate the project's financial performance under different leverage ratios and interest rate scenarios, identify the optimal leverage ratio

that maximizes IRR and ROI, and provide strategic recommendations for investors and developers based on the analysis.

This study provides valuable insights into the optimization of financial leverage in real estate development projects, contributing to the broader understanding of real estate finance. By identifying the optimal leverage ratio under different interest rate scenarios, the study offers practical guidance for developers and investors, enabling them to make informed financing decisions that enhance project profitability and sustainability.

The thesis is structured as follows: in the first chapter, the introduction provides the background, problem statement, objectives, significance, and structure of the study. In the second chapter, the literature review covers existing literature on financial leverage, real estate finance, and related topics. In the fourth chapter, the methodology describes the research design, case study determination, financial model construction, and optimization process. The fifth chapter presents the case study details, financial model implementation, analysis of results under different scenarios, and comparison of the financial performance of different leverage ratios, providing key insights. Finally, in the sixth chapter the conclusion summarizes the findings, discusses the implications, and offers recommendations for future research.

1.1. Overview of the Real Estate Development

Real estate development constitutes a critical component of urban development and economic growth (Linneman, 2016; Baum & Crosby, 2008; Brinkley, 2019). It encompasses a multifaceted process involving land acquisition, project planning, construction, and property management (Linneman, 2016). Real estate development projects range from residential, commercial, industrial to mixed-use developments, each with its unique set of challenges and opportunities (McDonald, 2007; Clayton, 2009). In real estate development, stakeholders engage in the creation, improvement, and transformation of real property assets to meet the demands of end-users and investors (Linneman, 2016; Baum & Crosby, 2008).

Developers play a central role in identifying market opportunities, acquiring land parcels, securing financing, and overseeing project execution (Brinkley, 2019). Additionally, they collaborate with architects, engineers, contractors, and local authorities to bring development projects to fruition (McDonald, 2007).

Real estate development projects are driven by various factors, including demographic trends, economic conditions, regulatory policies, and technological advancements (Clayton, 2009; Baum & Crosby, 2008). Developers must conduct thorough market research and feasibility studies to assess the viability of their projects and mitigate potential risks (Brinkley, 2019).

Understanding the fundamentals of real estate development is essential for stakeholders involved in the industry, including developers, investors, lenders, and policymakers (Linneman, 2016; Baum & Crosby, 2008; Brinkley, 2019). By gaining insights into the dynamics of real estate development, stakeholders can make informed decisions regarding project feasibility, market positioning, and risk management (McMahan & Seiler, 2015; Longo & Hartzell, 2009).

Although real estate development represents a dynamic and multifaceted process that drives urban growth and transformation (Linneman, 2016; Baum & Crosby, 2008), by navigating the complexities of development projects, stakeholders can contribute to the creation of vibrant and sustainable built environments (McDonald, 2007; Clayton, 2009).

1.2. Real Estate Development in Turkey

Turkey's real estate market is one of the most dynamic in Europe, benefiting from its strategic location and a growing population of about 85 million people. Positioned at the crossroads of Europe, the Middle East, and Asia, Turkey offers lucrative opportunities for developers (Investment Office of the Presidency of Turkey, 2023). As shown in Figure 1, in recent years, Turkey has seen significant foreign direct investment (FDI) in its real estate sector. For instance, in 2021, FDI in Turkey reached USD 13.3 billion, with real estate investments accounting for a substantial portion.

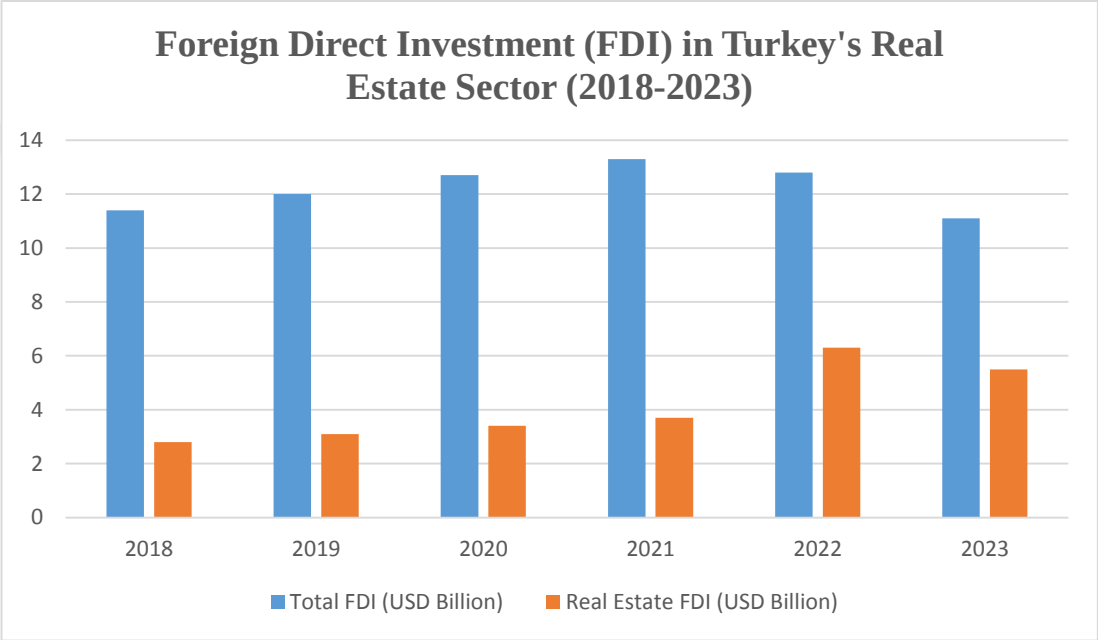

Figure 1 Foreign Direct Investment (FDI) in Turkey's Real Estate Sector (2018-2023)
Source: Investment Office of the Presidency of Turkey, 2023)

Major projects such as Marmaray, Yavuz Sultan Selim Bridge, Eurasia Tunnel, and Istanbul Airport are key components of Turkey's urban renewal strategy, aimed at modernizing infrastructure and boosting economic growth (Central Bank of the Republic of Turkey, 2023).

Furthermore, the Turkish property market has experienced robust activity, as shown in Figure 2, over 1.2 million homes sold in 2021. Notably, a significant number of these transactions were made by foreign buyers, particularly in Istanbul. Legislative changes easing citizenship requirements for foreign investors and various promotional campaigns have further stimulated the residential real estate market (Investment Office of the Presidency of Turkey, 2023; Mordor Intelligence, 2023).

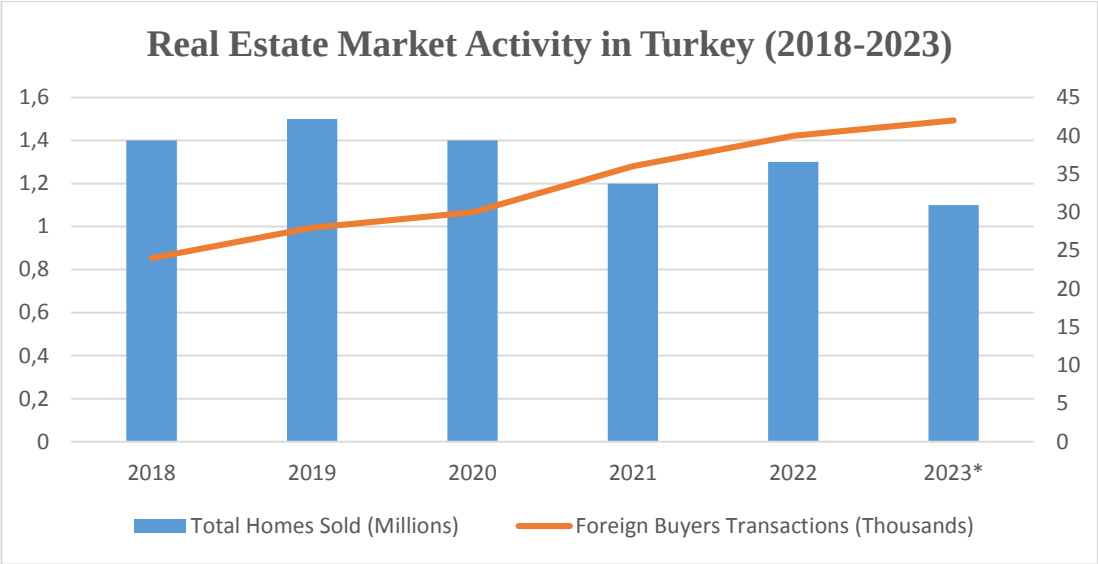

Figure 2 Real Estate Market Activity in Turkey (2018-2023)
Source: Investment Office of the Presidency of Turkey, 2023; Mordor Intelligence, 2023).

Additionally, Istanbul, Turkey's economic hub, has a thriving commercial real estate market. By the end of 2021, the city's Grade A office space exceeded 5.8 million square meters (2023; Central Bank of the Republic of Turkey, 2023). Consequently, the Turkish real estate market is expected to reach a value of USD 7.81 trillion by 2024, with the residential segment showing the most growth.

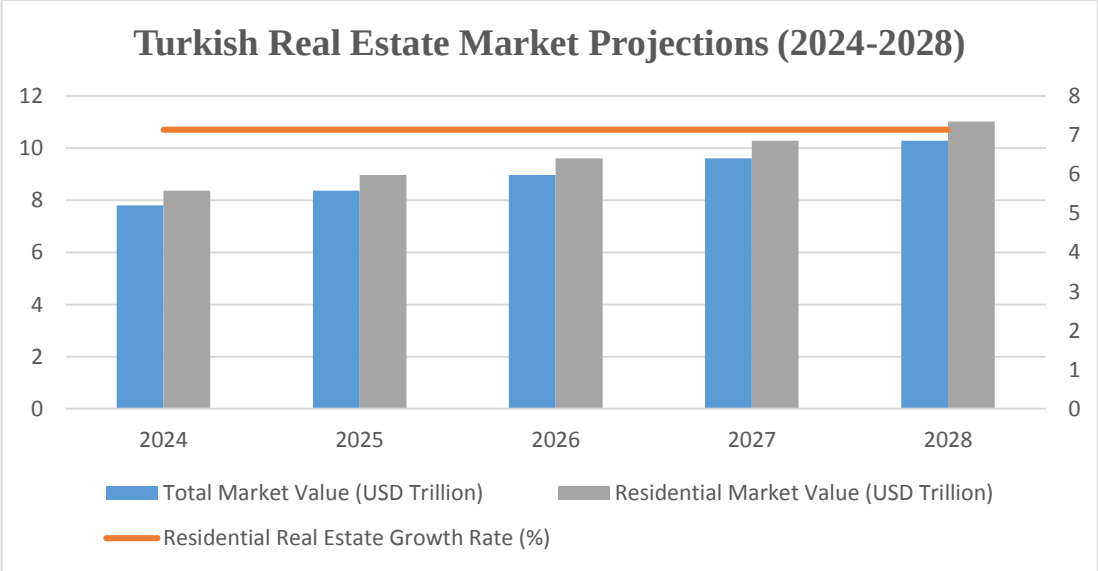

Figure 3 Turkish Real Estate Market Projections (2024-2028)
Source: Central Bank of the Republic of Turkey, 2023

Residential real estate is projected to grow at an annual rate of 7.14% from 2024 to 2028, reaching USD 10.29 trillion by 2028 as shown in Figure 3. (Statista, 2023; Central Bank of the Republic of Turkey, 2023).

1.3. Fundamentals of Leverage and Financial Leverage

Leverage, a fundamental concept in real estate finance, involves utilizing borrowed capital to amplify potential returns on investment. It empowers investors to control larger assets than they could with their own funds alone, thereby magnifying both profits and risks associated with investments (McDonald, 2007; Clayton, 2009; Geltner et al., 2007).

Drawing insights from various scholarly works and empirical studies, the following types of leverage are pertinent to real estate:

Financial leverage, explored in studies such as McDonald's (2007) analysis of optimal leverage in real estate investment, entails utilizing borrowed funds, such as mortgages and loans, to finance real estate acquisitions. It enables investors to leverage their capital and increase the size of their investment portfolios.

Operating leverage, as Clayton (2009) delves into, involves utilizing fixed operating costs, like property management expenses and taxes, to enhance profitability. It can magnify returns during periods of growth but also exacerbate losses in downturns.

Market leverage, discussed by Geltner et al. (2007), involves leveraging market conditions to enhance investment outcomes. This may entail timing property acquisitions to coincide with market cycles or capitalizing on favourable financing terms available during specific economic conditions.

1.3.1. Financial Leverage

The nuances of financial leverage, gleaned from empirical research and theoretical frameworks, include the following:

The Loan-to-Value Ratio (LTV), explored in studies such as Cannaday and Yang (1996), represents the proportion of a property's value financed through debt, where higher LTV ratios indicate greater leverage and risk exposure.

The Debt Service Coverage Ratio (DSCR), examined in research by Alcock et al. (2014), assesses a property's ability to cover its debt obligations with net operating income, with lenders requiring a minimum DSCR to ensure loan repayment.

Insights from Baum and Crosby (2008) underscore the significance of interest rates and loan terms in financial leverage, highlighting that fixed-rate mortgages offer stability, while adjustable-rate mortgages carry interest rate risk.

Effective risk management, as highlighted in various sources including Longo and Hartzell (2009), is essential when employing financial leverage; investors must evaluate potential risks, such as interest rate fluctuations and market volatility, and implement strategies to mitigate these risks.

1.3.2. Leverage in Real Estate Development

Real estate development often relies on various forms of leverage to fund projects and maximize returns. This section examines three primary types of leverage – debt financing, equity financing, and mezzanine financing – discussing their advantages, disadvantages, and implications for project feasibility and risk management.

1.3.2.1. Debt Financing

Debt financing involves borrowing funds from lenders, such as banks or financial institutions, with the promise of repayment plus interest over time. Key characteristics and considerations include the leverage multiplier, where debt allows developers to amplify their investment by using borrowed capital, thereby increasing project size and potential returns. Additionally, debt financing offers tax benefits, as interest payments on debt may be tax-deductible, providing potential tax advantages for developers. Furthermore, it helps in the preservation of equity, allowing developers to retain equity capital for other projects or investment opportunities (McDonald, 2007; Geltner et al., 2007; Alcock et al., 2014).

However, debt financing also entails regular interest payments, which can increase financial obligations and affect project cash flow. The risk of default is significant, as failure to meet debt obligations can result in the loss of collateral and damage to the developer's creditworthiness. High levels of debt also magnify risks associated with market fluctuations, interest rate changes, and project delays (McDonald, 2007).

Therefore, developers must conduct thorough feasibility analyses to assess the project's ability to generate sufficient cash flow to cover debt service obligations. Effective risk management strategies, such as stress testing cash flow projections and maintaining adequate liquidity reserves, are essential to mitigate leverage-related risks (Geltner et al., 2007).

1.3.2.2. Equity Financing

Equity financing involves raising capital by selling ownership stakes in the project to investors, such as individuals, institutional investors, or real estate investment trusts (REITs). This form of financing does not entail debt repayment obligations, providing greater flexibility in project cash flow management. Investors share in both the risks and rewards of the project, aligning their interests with the success of the development. Equity financing also provides long-term capital, as equity investors may provide patient capital, allowing developers to pursue long-term value creation strategies (Linneman, 2016; Brinkley, 2019; Geltner et al., 2007).

However, selling equity stakes dilutes the developer's ownership interest in the project, potentially reducing control and decision-making authority. Additionally, equity financing often carries a higher cost of capital compared to debt, as investors expect higher returns to compensate for increased risk. Equity investors may also demand a share of project profits, limiting the developer's upside potential (Brinkley, 2019).

Managing investor relations effectively is crucial, as developers must provide transparency and regular communication to maintain trust and confidence. Lastly, equity financing allows developers to share project risks with investors, reducing individual exposure to unforeseen challenges (Geltner et al., 2007).

1.3.2.3. Mezzanine Financing

Mezzanine financing represents a hybrid form of financing that combines elements of debt and equity. Mezzanine lenders provide capital that ranks between senior debt and equity in the capital structure. Advantages of mezzanine financing include higher leverage, as it allows developers to leverage their equity investment further, typically offering higher loan-to-value ratios than senior lenders. Mezzanine

financing also offers flexible terms, such as deferred interest payments or equity kickers, and enhanced returns, as lenders often participate in project upside through profit-sharing arrangements, thereby enhancing potential returns for developers (McMahan & Seiler, 2015; McDonald, 2007; Clayton, 2009).

However, mezzanine financing typically carries higher interest rates and fees compared to senior debt, increasing overall project costs. Mezzanine lenders also hold a subordinate position to senior debt in the capital structure, increasing their risk exposure in the event of default. Additionally, mezzanine financing transactions can be complex and require careful structuring to align the interests of all parties involved (McMahan & Seiler, 2015).

Developers must possess expertise in structuring mezzanine financing transactions to optimize terms and minimize risks. Mezzanine lenders often require additional risk mitigation measures, such as personal guarantees or collateral pledges, to protect their investment (Clayton, 2009).

Understanding the different types of leverage in real estate development is crucial for developers to make informed financing decisions. By weighing the advantages, disadvantages, and implications of debt financing, equity financing, and mezzanine financing, developers can optimize their capital structure, manage project risks effectively, and maximize investment returns.

1.3.3. Leverage in Usage and limitations.

1.3.3.1. Factors Influencing Leverage Decisions

Real estate developers and investors consider several factors when deciding on leverage utilization to optimize capital structure and enhance project returns. Market conditions directly impact financing options and terms available to developers. For instance, during economic downturns, lenders might tighten credit standards, making it more challenging to secure debt financing (Geltner et al., 2007). Conversely, in booming markets, favourable conditions may encourage higher leverage utilization to capitalize on growth opportunities (Baum & Crosby, 2008). Regulatory policies, such as interest rate regulations and zoning laws, significantly influence leverage decisions in real estate development. Changes in regulatory frameworks, like tax policies or lending regulations, can impact the cost of capital and overall project feasibility (Linneman, 2016). Developers must stay abreast of regulatory changes to adapt their leverage strategies accordingly.

Risk tolerance varies among developers and investors, shaping their leverage decisions. While some may prefer conservative leverage ratios to mitigate risk exposure, others may opt for aggressive leveraging to amplify returns (McMahan & Seiler, 2015). Factors such as project scale, market volatility, and asset liquidity influence risk appetite and, consequently, leverage choices. The type and quality of the underlying assets significantly impact leverage decisions. High-quality assets with stable cash flows and low volatility may support higher leverage ratios, as they offer greater collateral value and reduced default risk (Longo & Hartzell, 2009). Conversely, projects with uncertain cash flows or distressed assets may warrant conservative leverage approaches to mitigate potential losses (Esakin & Lindeman, 2006).

The preferences and objectives of project stakeholders, including equity investors and lenders, influence leverage decisions. Equity investors seeking higher returns may advocate for aggressive leveraging to magnify equity yields (Geltner et al., 2007). Conversely, lenders prioritize debt service coverage and loan-to-value ratios, impacting the maximum leverage thresholds acceptable for financing (Cannaday & Yang, 1996). The broader economic outlook, encompassing factors such as GDP growth, inflation rates, and employment trends, informs leverage decisions in

real estate development. Positive economic indicators may instil confidence in lenders and investors, facilitating access to favourable financing terms (McDonald, 2007). Conversely, economic uncertainty may prompt conservative leveraging to safeguard against downturns (Giacomini & Ling, 2015).

Leverage decisions in real estate development are multifaceted, influenced by market conditions, regulatory environments, risk appetite, and asset quality. Developers and investors must conduct comprehensive analyses to formulate optimal leverage strategies that align with project objectives and mitigate risks.

1.3.3.2. Limitations of Increased Leverage in Real Estate Development

While leverage can be a valuable tool for enhancing returns and amplifying investment opportunities, there are instances where excessive leveraging may not translate into improved project feasibility. It is essential for developers and investors to recognize these limitations and exercise prudence in leveraging decisions to avoid potential pitfalls. One of the primary limitations of excessive leverage is the potential erosion of cash flow coverage ratios. Higher debt obligations, coupled with variable market conditions or unexpected expenses, may strain project cash flows, leading to difficulties in servicing debt payments (Clayton, 2009). Inadequate cash flow coverage can jeopardize project sustainability and increase the risk of default, especially during economic downturns or periods of market volatility.

Elevated leverage levels heighten financial vulnerability, particularly in the face of adverse market conditions or unexpected events. Projects heavily reliant on debt financing may encounter challenges in refinancing existing debt or securing additional financing during periods of economic turmoil (Alcock et al., 2014). Excessive leverage amplifies the impact of market fluctuations on project returns, exposing investors to heightened financial risks and potential capital losses. Excessive leverage can also constrain project flexibility and agility, limiting the ability to adapt to changing market dynamics or capitalize on emerging opportunities. Projects burdened with high debt loads may face restrictions on additional borrowing or capital allocation decisions, hindering strategic initiatives such as expansion or diversification (Dwiantari & Artini, 2020). Moreover, rigid debt covenants or collateral requirements imposed by lenders

may impede operational flexibility, constraining management's ability to navigate challenging environments effectively.

Highly leveraged projects may have limited options for risk mitigation, especially in downturn scenarios or adverse market conditions. With little room for manoeuvring, developers and investors may find themselves unable to implement effective risk management strategies or buffer against unforeseen challenges (Haughwout et al., 2011). In the absence of adequate risk mitigation measures, projects reliant on excessive leverage may be more susceptible to financial distress or default, exacerbating investor losses and undermining project viability. While leverage can enhance investment returns and facilitate project growth, it is essential to recognize its limitations and exercise caution in leveraging decisions. Excessive leverage can diminish cash flow coverage, increase financial vulnerability, impede flexibility, and limit risk mitigation options, potentially undermining project feasibility and sustainability. Developers and investors must strike a balance between leveraging for growth and preserving financial resilience to navigate the complexities of the real estate market effectively.

2. LITERATURE REVIEW

Financial and operational leverage are critical in real estate investment. Financial leverage involves using debt to finance investments, which can enhance returns if borrowing costs are lower than the returns on investment. However, it also increases the potential for losses, necessitating a balanced approach (Linneman, 2016).

The concept of the debt-to-equity ratio is pivotal in understanding how financial leverage can amplify both gains and risks, emphasizing the need for careful analysis (Clauretie and Sirmans, 2011).

In commercial real estate, leveraging can enhance the return on equity by borrowing at lower interest rates than the property's expected return, but high leverage poses significant risks in volatile markets (Geltner, Miller, Clayton, and Eichholtz, 2007).

In the context of portfolio management, leveraging can be optimized to enhance performance if properly diversified to mitigate risks. Moderate leverage can significantly improve portfolio returns without substantially increasing risk (Pagliari, Peiser, and Carpenter, 2006).

Contemporary leveraging strategies, including debt and equity financing, impact cash flow and risk management. Innovative leveraging techniques arising from technological advancements and regulatory changes offer significant advantages in flexibility and cost-efficiency (Bender and Stein, 2015).

Leveraging strategies must align with a project's risk profile and expected returns. Debt financing is often used for large-scale projects, while equity financing helps mitigate financial risks. A balanced approach generally yields the best results (Linneman, 2016).

Macroeconomic factors such as interest rates and economic cycles significantly impact leveraging decisions, requiring developers to adapt their strategies to changing market conditions to maximize returns and minimize risks (McMahan and Seiler, 2015).

Leveraging during favourable market conditions can enhance returns, but poor timing can lead to substantial losses, highlighting the importance of understanding market cycles and timing leveraging decisions appropriately (Geltner, Miller, Clayton, and Eichholtz, 2007).

Practical aspects of leveraging in real estate investments include enhancing returns through financial leverage, but also involve increased financial risk and the potential for overleveraging, which can lead to financial distress.

Careful management of leverage is essential to avoid insolvency during market downturns (Esakin and Lindeman, 2006). The impact of leveraging decisions on investment performance is significant, with conservative leveraging practices being crucial to protect investors from significant losses in unstable markets (Baum and Crosby, 2008).

Joint leverage and maturity choices in real estate firms, particularly within REIT structures, are shaped by regulatory frameworks, with optimal leveraging practices balancing risk and return to ensure financial stability (Alcock, Steiner, and Tan, 2014).

3. METHODOLOGY

Outlining the methodology used to achieve the objectives of this thesis. Beginning with the determination of the case study, followed by a detailed analysis of different leverage ratios. The methodology includes examining the impact of varying interest rates on the financial performance of a real estate development project. The steps involve implementing various financial scenarios for the project, analyzing the outcomes, and comparing the results to identify the optimal leveraging strategy.

3.1. Determining the Case Study

In this initial step, the case study for the real estate development project is determined, and key assumptions are established. The selection process involves identifying a suitable project that aligns with the objectives of the study, considering factors such as location, type, size, and availability of relevant data for analysis. Assumptions regarding the project details, including the location, type of development (residential, commercial, mixed-use), number of units, construction area, sellable area, types of units (e.g., 1-bedroom, 2-bedroom), land area, and any other pertinent project details, are defined at this stage. These assumptions serve as the foundation for subsequent analysis and modelling of the real estate development project.

3.2. Financial Model

3.2.1. Revenue model

In this stage, a revenue model for the real estate development project is established based on various factors, including assumptions about the meter price, sales capability, and sales seasons of similar projects in the area. A forecast of unit sales per month is generated for each unit type based on market analysis and historical data, considering factors such as demand trends, market conditions, and seasonality. This sales forecast enables the projection of revenue cash flows for the upcoming months, providing insight into the expected income generated by the project over time. By integrating market insights and sales projections, the revenue model serves as a crucial component in the financial analysis of the real estate development project.

3.2.2. Cost Structure

In this phase, the cost structure of the real estate development project is outlined, encompassing various elements such as land value or cost, construction cost, and other associated expenses including marketing costs. Assumptions regarding the land value or cost are made based on market analysis, location factors, and negotiations with landowners or sellers. Similarly, construction costs are estimated considering factors such as material prices, labour costs, and project scale. Additionally, other costs such as marketing expenses for promoting the project and attracting potential buyers are factored into the cost structure.

Furthermore, a time schedule for the construction process is developed, outlining key milestones and timelines for different phases of the project. Payments related to land acquisition, construction activities, and other expenses are projected over the duration of the construction period. These projected costs are then incorporated into the cash flow table, aligning with the revenue model to provide a comprehensive overview of the financial aspects of the real estate development project.

3.2.3. Identifying Financial Sources

In this step, funding sources for the real estate development project are identified, focusing primarily on bank credit or owner's equity. Available funds are assessed, considering personal investments or potential loans from financial institutions. Research is conducted to explore debt financing options, assessing terms like interest rates and repayment schedules. Similarly, opportunities for equity financing are considered, including partnerships or private equity investors. The aim is to optimize the funding structure by determining the appropriate mix of equity and debt financing to maximize returns while considering financial ratios. This involves evaluating leverage ratios, cost of capital, and other financial metrics to secure the necessary capital for development.

3.2.4. Cash Flow

Once the cost structure of the real estate development project has been established, the next step involves creating a comprehensive cash flow table to track the inflow and outflow of funds throughout the project lifecycle. The cash flow table serves as a crucial financial tool for monitoring and managing project finances, facilitating decision-making and risk assessment.

The cash flow table is constructed by integrating various financial elements, including projected revenues, expenses, and funding sources over a predefined period, typically spanning the duration of the project. Revenue projections are derived from the revenue model, which forecasts sales of residential units based on market analysis, demand trends, and other relevant factors. These revenue projections are segmented by unit type and sales seasonality, providing a detailed breakdown of expected income streams.

On the expense side, construction costs, land acquisition expenses, marketing expenditures, and other operational costs are incorporated into the cash flow table. These costs are allocated to specific time periods based on the project timeline and construction schedule, accounting for payment milestones, material procurement, labour expenses, and other relevant factors.

Additionally, funding sources such as equity investments, debt financing, and mezzanine financing are included in the cash flow table, detailing the timing and magnitude of cash inflows from each source. This allows for a comprehensive analysis of project financing, ensuring adequate liquidity to support construction activities and operational expenses.

By synthesizing revenue projections, expense estimates, and funding sources into a unified cash flow table, stakeholders gain valuable insights into the financial dynamics of the real estate development project. This enables informed decision-making, risk mitigation, and strategic planning throughout the project lifecycle, ultimately contributing to its successful execution and profitability.

3.3. Optimizing the Leverage Ratio for Different Interest Rates

In this section, the optimization of the leverage ratio for varying interest rates is explored to determine the optimal financial structure for the real estate development project. This involves analyzing different combinations of equity and debt financing under multiple interest rate scenarios to identify the leverage ratio that maximizes the project's financial performance.

3.3.1. Interest Rate Scenarios

The first step in optimizing the leverage ratio involves defining different interest rate scenarios. These scenarios represent possible variations in the cost of debt financing that the project might encounter. For this analysis, interest rates such as 2%, 5%, 7%, and 10% are selected to represent a range of potential market conditions. These rates are chosen based on historical data, market forecasts, and economic indicators relevant to the real estate sector.

3.3.2. Leverage Ratio Combinations

For each interest rate scenario, various leverage ratios are tested to understand their impact on the project's financial performance. Leverage ratios represent the proportion of debt to equity used in financing the project. The initial analysis includes a broad range of ratios, from 10% debt (90% equity) to 100% debt, specifically:

- 10% Debt, 90% Equity
- 20% Debt, 80% Equity
- 30% Debt, 70% Equity
- 40% Debt, 60% Equity
- 50% Debt, 50% Equity
- 60% Debt, 40% Equity
- 70% Debt, 30% Equity
- 80% Debt, 20% Equity
- 90% Debt, 10% Equity
- 100% Debt, 0% Equity

3.3.3. Financial Performance Metrics

The financial performance of the project under each leverage ratio and interest rate combination is evaluated using key financial metrics, such as Return on Investment (ROI), Net Present Value (NPV), and Internal Rate of Return (IRR). These metrics provide insights into the profitability, viability, and risk associated with each financing structure.

Return on Investment (ROI): Measures the gain or loss generated relative to the amount of money invested. The formula for ROI is:

$$\text{ROI} = \frac{\text{Net Profit}}{\text{Total Investment}} \times 100$$

Where:

- Net Profit = Total Revenues - Total Costs
- Total Investment = Equity + Debt

Net Present Value (NPV): Calculates the difference between the present value of cash inflows and outflows over the project's lifespan. The formula for NPV is:

$$\text{NPV} = \sum_{t=0}^{N} \frac{C_t}{(1+r)^t}$$

Where:

- *Ct* = Net cash inflow during the period t
- r = Discount rate (interest rate)
- t = Time period
- N = Total number of periods

Internal Rate of Return (IRR): Represents the discount rate that makes the net present value of all cash flows equal to zero. The formula for IRR is the rate (r) that satisfies:

$$0 = \sum_{t=0}^{N} \frac{C_t}{(1+IRR)^t}$$

Where:

- *Ct* = Net cash inflow during the period t
- t = Time period
- N = Total number of periods

3.3.4. Simulation and Analysis

For each interest rate scenario, the following steps are conducted:

1. **Initial Analysis:** Revenue and expense projections are created using the revenue model and cost structure. A cash flow model is constructed for each combination of leverage ratios.
2. **Performance Calculation:** Calculate ROI, NPV, and IRR for each leverage ratio under each interest rate scenario.
3. **Range Identification:** Identify the range of leverage ratios that yield the highest financial performance metrics.

3.3.5. Optimal Leverage Ratio Determination

Based on the detailed analysis, the optimal leverage ratio for each interest rate scenario is determined. This involves identifying the ratio that provides the highest ROI, NPV, and IRR while ensuring manageable risk levels. The findings are summarized to present a clear picture of how different financing structures impact the project's financial outcomes under varying interest rate conditions.

In summary, this section of the methodology provides a systematic approach to optimizing the leverage ratio for the real estate development project under different interest rates. By rigorously analyzing various financing structures and their impact on financial performance metrics, the study aims to identify the most effective leverage ratio that maximizes returns and ensures the project's financial success.

3.4. Financial Ratios Results and Graphs

This section presents the findings from the financial analysis conducted in the previous steps, showcasing the results of ROI, NPV, and IRR calculations for each leverage ratio under different interest rate scenarios. The results are visualized using graphs to facilitate comparison and highlight the optimal leverage ratios.

3.4.1. Results for Interest Rate Scenarios

For each interest rate scenario (2%, 5%, 7%, and 10%), the financial ratios (ROI, NPV, and IRR) are calculated across the range of leverage ratios (10% to 100% debt). The detailed results are tabulated to provide a clear view of how each leverage ratio impacts the financial performance of the project.

2% Interest Rate Scenario

- ROI for leverage ratios from 10% to 100% debt
- NPV for leverage ratios from 10% to 100% debt
- IRR for leverage ratios from 10% to 100% debt

5% Interest Rate Scenario

- ROI for leverage ratios from 10% to 100% debt
- NPV for leverage ratios from 10% to 100% debt
- IRR for leverage ratios from 10% to 100% debt

7% Interest Rate Scenario

- ROI for leverage ratios from 10% to 100% debt
- NPV for leverage ratios from 10% to 100% debt
- IRR for leverage ratios from 10% to 100% debt

10% Interest Rate Scenario

- ROI for leverage ratios from 10% to 100% debt
- NPV for leverage ratios from 10% to 100% debt
- IRR for leverage ratios from 10% to 100% debt

3.4.2. Graphical Representation

Graphs are used to visualize the relationship between leverage ratios and financial performance metrics for each interest rate scenario. These graphs help in identifying the trends and optimal points where financial performance is maximized.

ROI vs. Leverage Ratio:

Plot ROI against leverage ratios for each interest rate scenario.

NPV vs. Leverage Ratio:

Plot NPV against leverage ratios for each interest rate scenario.

IRR vs. Leverage Ratio:

Plot IRR against leverage ratios for each interest rate scenario.

3.4.3. Analysis of Results

Analyzing the graphs to identify the leverage ratios that maximize ROI, NPV, and IRR for each interest rate scenario. Discuss the trends observed and the implications for the real estate development project.

Optimal Leverage Ratio for 2% Interest Rate:

Identify and discuss the leverage ratio that provides the highest financial performance.

Optimal Leverage Ratio for 5% Interest Rate:

Identify and discuss the leverage ratio that provides the highest financial performance.

Optimal Leverage Ratio for 7% Interest Rate:

Identify and discuss the leverage ratio that provides the highest financial performance.

Optimal Leverage Ratio for 10% Interest Rate:

Identify and discuss the leverage ratio that provides the highest financial performance.

3.5. Comparison

This section synthesizes the findings from the financial analysis and provides a comparative overview of the optimal leverage ratios under different interest rate scenarios. The conclusions drawn from this comparison offer insights into the most favourable financing structure for the real estate development project.

The optimal leverage ratios identified for each interest rate scenario are compared in terms of maximizing IRR and in terms of maximizing ROI, to highlight patterns and consistencies. This comparison provides a clear understanding of how varying interest rates influence the ideal financing structure for the project.

Comparison Table:

For both maximizing ROI and IRR, a table summarizing the optimal leverage ratios and its corresponding financial metric ratios for interest rates of 2%, 5%, 7%, and 10% where provided.

The table designed presents the leverage ratios that maximize financial performance in terms of ROI and IRR under different interest rates.

Comparison Graphs:

Graphs visually represent the optimal leverage ratios across different interest rates for maximizing ROI and for maximizing IRR. This visual aid provides a clear illustration of how leverage ratios adjust in response to changing interest rates.

4. IMPLEMENTATION AND RESULTS

4.1. Case Study

4.1.1. Project Location and Context

The case study focuses on a residential real estate development project situated in Bahçeşehir, Istanbul. Bahçeşehir is a rapidly developing area known for its strategic location, excellent infrastructure, and high demand for residential properties. The neighbourhood's proximity to major highways such as the TEM and E-5, key business districts like Levent and Maslak, and prominent educational institutions, including several universities and international schools, makes it an attractive destination for potential homebuyers and investors. Additionally, Bahçeşehir is part of the larger Başakşehir district, which has seen significant government investment in infrastructure, including the Başakşehir City Hospital and the Istanbul Canal project.

Bahçeşehir, often referred to as the "City of Gardens," is known for its extensive green spaces and modern urban planning. It is home to Turkey's largest artificial lake, Bahçeşehir Golet, which spans an area of 300,000 square meters and is surrounded by a variety of social amenities such as restaurants, cafes, and recreational facilities. These features not only enhance the quality of life for residents but also increase the appeal of the area for potential buyers and investors (Istanbul Real Estate, 2023).

Property prices in Bahçeşehir have been steadily rising, reflecting the area's growing popularity and development. For instance, one-bedroom apartments in Bahçeşehir start at approximately $140,000, while larger units, such as four-bedroom apartments, can reach up to $325,000. Duplex apartments, which offer more space and luxury, are priced even higher, with some five-bedroom units selling for around $495,000 (Housearch Blog, 2023). These rising prices indicate a strong investment potential, as property values are expected to continue increasing in the coming years.

The demand for residential properties in Bahçeşehir is driven by both local and foreign buyers. Foreign investors, particularly from countries such as Russia, the Persian Gulf, and Germany, have shown a keen interest in the area. This interest is partly due to Turkey's relatively affordable housing prices compared to Europe and the attractive investment opportunities in Istanbul's real estate market. Furthermore,

Turkey's citizenship-by-investment program, which grants citizenship to foreign nationals who invest a certain amount in real estate, has significantly boosted foreign demand (Housearch Blog, 2023).

Bahçeşehir's appeal is further enhanced by its comprehensive social infrastructure. The area boasts numerous educational institutions, including Bahçeşehir University and several international schools, which cater to the educational needs of both local and expatriate families. In terms of healthcare, Bahçeşehir is well-served by facilities such as the Bahçeşehir local hospital and the German specialist hospital, ensuring residents have access to high-quality medical care. Additionally, the area is home to a variety of shopping centres, including the Akbati Centre, which features a wide range of Turkish and international brands, as well as dining and entertainment options (Istanbul Real Estate, 2023).

The transportation infrastructure in Bahçeşehir is another major draw for residents and investors. The area is well-connected to the rest of Istanbul through public transportation, including municipal buses and minibuses. Ongoing infrastructure projects, such as the construction of new metro lines, are expected to further improve connectivity. These metro lines will link Bahçeşehir to key areas like Esenyurt, Ispartakule, and Mahmutbey, significantly reducing commute times and enhancing the area's accessibility (Imtilak Real Estate, 2023).

4.1.2. Land and Construction Details

The project involves the development of a residential complex on a plot of land measuring 10,497.23 square meters. The land has been appraised at $1,300 per square meter, resulting in a total land value of $13,646,399. The construction area for the project is planned to be 45,633 square meters, with an estimated construction cost of $650 per square meter, leading to a total construction cost of $29,661,736. These figures are derived from current market rates and have been validated through an analysis of recent transactions and construction projects in the Bahçeşehir area.

4.1.3. Project Scope and Unit Details

The residential development will comprise a total of 200 units, designed to cater to a diverse range of buyers. The unit types and their respective areas include:

4 units of 1+1 type, average of 69.96 square meters, totalling 279.84 square meters.

135 of 2+1 type, average of 139.92 square meters, totalling 18,889.20 square meters.

43 of 3+1 units, average of 174.24 square meters, totalling 7,492.32 square meters.

16 of 4+1 units, average of 196.02 square meters, totalling 3,136.32 square meters.

2 of 5+1 units, average of 210.54 square meters, totalling 421.08 square meters.

The sellable area for the project is calculated at 29,945 square meters, with an anticipated selling price of $1,700 per square meter. This pricing strategy is based on a market analysis of similar projects within Bahçeşehir, ensuring competitive pricing while maximizing revenue. The total projected revenue from the sale of residential units is estimated at $50,906,267.90, resulting in a gross profit of $7,598,132.90.

4.1.4. Construction Timeline and Scheduling

The construction of the project is scheduled to commence in July 2024. The timeline has been meticulously planned to ensure the efficient allocation of resources and timely completion of the project phases. This phased approach will involve initial site preparation and foundational work, and a sequential construction of residential units, allowing for staged sales and revenue generation, ends with the finalization of infrastructure and amenities to enhance the project's overall appeal.

4.1.5. Assumptions and Financial Projections

Several key assumptions underpin the financial analysis and modelling of this project. Firstly, market demand in Bahçeşehir is anticipated to be high due to its strategic location, making it an attractive area for residential projects. Consequently, cost estimates for land acquisition and construction are based on current market rates, ensuring accurate financial projections. Additionally, the pricing strategy for the

residential units is determined through a detailed market analysis, aimed at ensuring competitive pricing while maximizing revenue.

The primary objective of this case study is to analyse the financial feasibility of the real estate development project through the optimization of leverage ratios under various interest rate scenarios. By examining different combinations of equity and debt financing, the study seeks to identify the optimal leverage ratio that maximizes profitability and enhances financial performance. This analysis will provide valuable insights for investors and developers regarding the effective use of leverage in real estate development projects.

By establishing these comprehensive details and assumptions, the foundation is set for the subsequent financial modelling and analysis, which will further explore the project's financial viability and optimization strategies.

4.2. Financial Model

4.2.1. Revenue model

The revenue model for the real estate development project in Bahçeşehir, Istanbul, is a critical element of the financial analysis, providing projections of expected income over the project's duration. This model is constructed based on several key assumptions and market analysis, ensuring a comprehensive and realistic forecast of revenue streams.

To develop the revenue model, several assumptions are made based on market demand, pricing strategy, and sales capacity. Bahçeşehir, known for its strategic location and ongoing development activities, is identified as a high-demand area for residential projects. This assumption is supported by market analysis, which indicates strong demand for housing in the region.

A detailed market analysis is conducted to determine the selling price per square meter. This analysis considers competitive pricing strategies, and market trends to set a price that is both competitive and capable of maximizing revenue. For this project, the selling price is assumed to be $1,700 per square meter, based on market conditions and the desirability of the Bahçeşehir location.

Based on these assumptions and market analysis, a sales forecast is developed to estimate the number of units sold each month. The project comprises 200 residential units of various types, including 1+1, 2+1, 3+1, 4+1, and 5+1 configurations. To simplify the cash flow analysis and focus on the financial leverage factors such as interest rates and leverage ratios, it is assumed that the units will be sold equally over 36 months.

The total sellable area of the project is 29,945 square meters. With the selling price set at $1,700 per square meter, the total projected revenue amounts to approximately $50,906,268. This revenue is distributed evenly over the 36-month sales period, resulting in consistent monthly revenue inflows.

The revenue projections are derived from the sales forecast, providing a detailed monthly breakdown of expected income. Given the total projected revenue of $50,906,268, the monthly revenue is calculated as follows:

$$\text{Monthly Revenue} = \frac{Total\ Revenue}{Sales\ Period\ (months)} = \frac{50{,}906{,}268}{36} \approx 1{,}414{,}063$$

This revenue is distributed over the project duration, reflecting the phased sales approach, and expected market absorption rates. The revenue model includes monthly revenue inflows, allowing for precise tracking and management of cash flow throughout the project lifecycle.

The projected revenues are integrated into the overall cash flow table, providing a comprehensive view of the project's financial health. This integration ensures that all revenue inflows are accounted for in the financial planning, supporting effective resource allocation and financial decision-making.

By synthesizing these revenue projections with the cost structure and funding sources, the revenue model serves as a foundational element of the financial analysis, enabling stakeholders to assess the project's profitability and financial viability comprehensively. This detailed revenue model ensures that the project is financially sound and capable of delivering the anticipated returns on investment.

4.2.2. Cost Structure

The cost structure for the real estate development project in Bahçeşehir, Istanbul, outlines the various financial commitments required to bring the project to fruition. This comprehensive overview includes land acquisition costs, construction costs, and marketing expenses. The structured approach to these costs ensures accurate financial planning and effective cash flow management.

The first major component of the cost structure is the land acquisition cost. The project site in Bahçeşehir covers an area of 10,497.23 square meters, with a land price set at $1,300 per square meter. Therefore, the total land cost is calculated as follows:

Total Land Cost = Land Area * Land Price per Square Meter

$$10{,}497.23\ m^2 * \$1{,}300 = \$13{,}646{,}399$$

This amount is a one-time expense incurred at the beginning of the project.

The construction cost is another significant component of the project's financial requirements. The project involves a total construction area of 45,633 square meters, with a construction cost of $650 per square meter. The total construction cost is calculated as follows:

Total Construction Cost = Construction Area * Cost per Square Meter

$$45{,}633\ m^2 * \$650 = \$29{,}661{,}736$$

The payment schedule for the construction cost is structured with 10% of the total cost paid in the first month, and the remaining 90% spread equally over the following 18 months. This payment plan ensures a manageable cash flow throughout the construction phase.

Marketing expenses are essential for promoting the project and ensuring successful sales. These expenses are set at 3% of the monthly revenue, providing a continuous budget for marketing activities over the 36-month sales period. The monthly marketing expense is calculated based on the projected monthly revenue of approximately $1,414,063:

Monthly Marketing Expense = Monthly Revenue * 3%

$$\$1{,}414{,}063 * 0.03 = \$42{,}422$$

These marketing expenses are consistently applied throughout the 36 months, ensuring sustained promotional efforts to attract buyers.

The cost structure does not include loan expenses at this stage, as these will be addressed in a subsequent section focused on financial leverage scenarios.

4.2.3. Identifying Financial Sources

In the financial structuring of the Bahçeşehir real estate development project, identifying the appropriate financial sources is critical. This involves determining the balance between equity financing and debt financing, which impacts the project's overall financial health, risk profile, and profitability. The primary financial sources considered for this project include the owner’s equity and bank loans.

Owner's equity represents the funds contributed by the project's developers or investors. This source of financing is critical as it signifies the initial capital investment without the obligation of repayment, thereby reducing financial risk. The project's

initial stages, including land acquisition and preliminary construction costs, are likely to be financed through owner's equity to establish a solid financial foundation.

The amount of owner's equity invested in the project directly influences the leverage ratio, which in turn affects the project's risk and return profile. A higher proportion of owner's equity typically results in lower financial risk but may limit potential returns due to the absence of debt leverage.

Debt financing through bank loans is another essential component of the project's financial structure. Bank loans provide the necessary capital for construction and operational expenses, offering the advantage of leveraging equity to potentially enhance returns. However, this comes with the obligation of interest payments and principal repayment, impacting the project's cash flow and financial risk.

For this project, various leverage ratios will be analysed, ranging from 10% to 100% debt financing. Each scenario will be assessed to determine the optimal mix of debt and equity that maximizes the project's financial performance. The interest rates considered for the bank loans are 2%, 5%, 7%, and 10%, reflecting a range of market conditions and borrowing costs.

The loan terms and interest rates are critical factors that influence the project's financial feasibility. Lower interest rates reduce the cost of borrowing, improving cash flow and profitability, while higher interest rates increase financial obligations and risk. The analysis will involve creating detailed cash flow projections for each interest rate and leverage ratio scenario, enabling a comprehensive evaluation of the financial outcomes.

In summary, identifying financial sources for the Bahçeşehir real estate development project involves a careful balance between owner's equity and bank loans. By evaluating different leverage ratios and interest rates, the optimal financial structure will be determined to ensure the project's success and profitability.

4.2.4. Cash Flow

Creating a comprehensive cash flow table is essential for monitoring and managing the financial dynamics of the real estate development project in Bahçeşehir, Istanbul. The cash flow table integrates various financial elements, including projected revenues, expenses, and funding sources over the project lifecycle. This section outlines the details and assumptions used to construct the cash flow table.

The initial step involves determining the land acquisition cost, which is incurred at the beginning of the project (month 0). The land cost is set at $13,646,399.

Construction costs are then calculated based on the total construction area of 45,633 square meters, with an estimated cost of $650 per square meter. The total construction cost amounts to $29,661,736. This cost is distributed over 18 months, with an initial payment of 10% ($2,966,174) in the first month, followed by equal monthly payments of $1,570,327 over the subsequent 17 months.

Revenue projections are derived from the total sellable area of 29,945 square meters, with an estimated selling price of $1,700 per square meter. The sales are assumed to be evenly distributed over 36 months, starting from the commencement of the project. This results in a steady monthly revenue stream, facilitating a straightforward comparison across different financial leverage scenarios.

Marketing expenses are accounted for as a percentage of the monthly revenue, set at 3%, to ensure continuous promotion and sales efforts throughout the project duration. These expenses are included in the cash flow table as they directly impact the net cash inflows.

The cash flow table does not initially include loan expenses, as these will be addressed separately when evaluating different leverage ratios and interest rates. This approach allows for a focused analysis on the impact of financial leverage on project feasibility and profitability.

By incorporating these detailed assumptions and projections, the cash flow table below provides a clear and structured view of the financial performance of the real estate development project, enabling informed decision-making and effective financial management.

Table 1 Cash Flow Table

Month	Land Purchase	Construction Costs	Marketing Expenses	Revenue	Net Cash Flow
0	(13,646,399.00)	-	-	-	(13,646,399.00)
1		(2,966,173.60)	(42,421.89)	1,414,063.00	(1,594,532.49)
2		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
3		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
4		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
5		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
6		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
7		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
8		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
9		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
10		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
11		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
12		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
13		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
14		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
15		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
16		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
17		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
18		(1,570,327.20)	(42,421.89)	1,414,063.00	(198,686.09)
19			(42,421.89)	1,414,063.00	1,371,641.11
20			(42,421.89)	1,414,063.00	1,371,641.11
21			(42,421.89)	1,414,063.00	1,371,641.11
22			(42,421.89)	1,414,063.00	1,371,641.11
23			(42,421.89)	1,414,063.00	1,371,641.11
24			(42,421.89)	1,414,063.00	1,371,641.11
25			(42,421.89)	1,414,063.00	1,371,641.11
26			(42,421.89)	1,414,063.00	1,371,641.11
27			(42,421.89)	1,414,063.00	1,371,641.11
28			(42,421.89)	1,414,063.00	1,371,641.11
29			(42,421.89)	1,414,063.00	1,371,641.11
30			(42,421.89)	1,414,063.00	1,371,641.11
31			(42,421.89)	1,414,063.00	1,371,641.11
32			(42,421.89)	1,414,063.00	1,371,641.11
33			(42,421.89)	1,414,063.00	1,371,641.11
34			(42,421.89)	1,414,063.00	1,371,641.11
35			(42,421.89)	1,414,063.00	1,371,641.11
36			(42,421.89)	1,414,063.00	1,371,641.11

4.3. Optimizing the Leverage Ratio for Different Interest Rates

4.3.1. Analysis of Scenario 1: 10% Interest Rate

For the 10% interest rate scenario, a discount rate of 10% was applied to the project's cash flow analysis. The objective was to assess the financial performance of the real estate development project under different leverage ratios, ranging from 0% to 100% bank loan financing. The following table summarizes the financial results for each leverage alternative:

Table 2 10% Interest Scenario Financial Analysis

Bank Loan	Bank Loan	NPV	ROI	IRR	Payback Period	Project Capital	Financial Leverage Ratio
100%	$18,618,595	$1,177,025	7.479%	19.878%	33	$32,264,994	57.70%
90%	$16,756,735	$1,192,412	8.214%	18.472%	32	$30,403,134	55.11%
80%	$14,894,876	$1,207,799	8.949%	17.463%	32	$28,541,275	52.19%
70%	$13,033,016	$1,223,187	9.684%	16.702%	32	$26,679,415	48.85%
60%	$11,171,157	$1,238,574	10.203%	16.107%	32	$25,106,907	44.49%
50%	$9,309,297	$1,253,961	10.343%	15.628%	32	$24,025,522	38.75%
40%	$7,447,438	$1,269,348	10.470%	15.234%	32	$22,944,136	32.46%
30%	$5,585,578	$1,284,736	10.584%	14.904%	32	$21,862,751	25.54%
20%	$3,723,719	$1,300,123	10.688%	14.623%	32	$20,781,365	17.92%
10%	$1,861,859	$1,315,510	10.782%	14.382%	32	$19,699,980	9.45%
0%	$0	$1,330,897	10.869%	14.172%	32	$18,618,595	0%

The financial leverage ratio (total debt to total capital) changes with varying proportions of bank loans as the graph below demonstrates. as represented in Figure 5

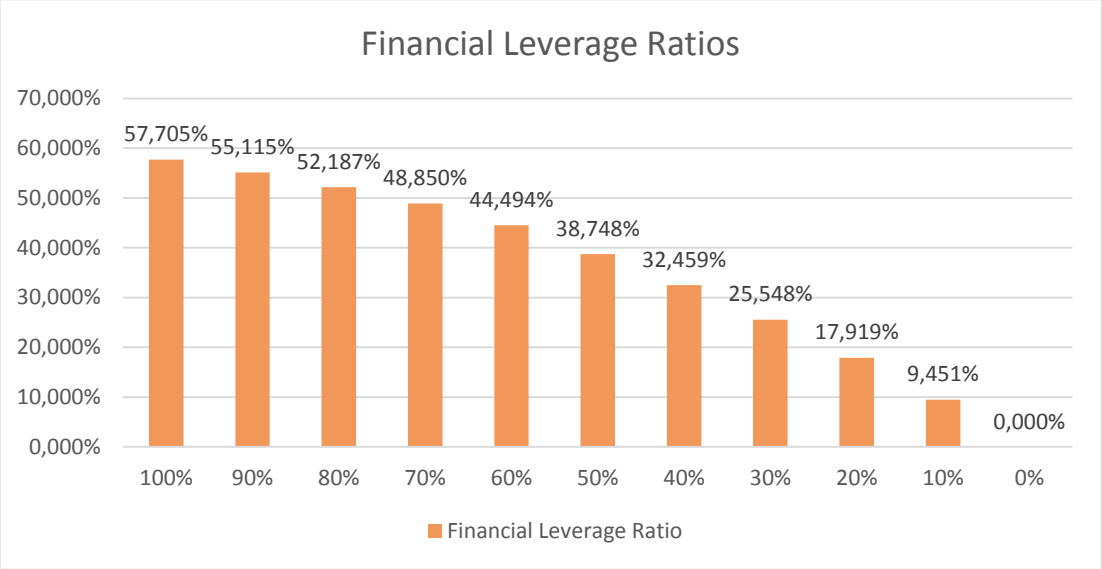

Figure 4 10% Scenario Financial Leverage Ratios

At 100% bank loan, the financial leverage ratio is 57.705%, representing the highest proportion of debt financing. As the reliance on bank loans decreases, the financial leverage ratio gradually declines, reaching 0% when no bank loan is used.

At 0% bank loan (0% financial leverage), the Net Present Value (NPV) is $1,330,897, and at 100% bank loan (57.70% financial leverage), the NPV is $1,177,025, with the maximum NPV reaching $1,330,897 at 0% bank loan.

The Return on Investment (ROI) starts at 10.869% with 0% bank loan (0% financial leverage) and rises to 7.479% with 100% bank loan (57.70% financial leverage), peaking at 10.869% at 0% bank loan (0% financial leverage).

The Internal Rate of Return (IRR) begins at 14.172% with no bank loan (0% financial leverage) and significantly increases to 19.878% at full bank loan (57.70% financial leverage), maintaining its highest value of 19.878% at 100% bank loan.

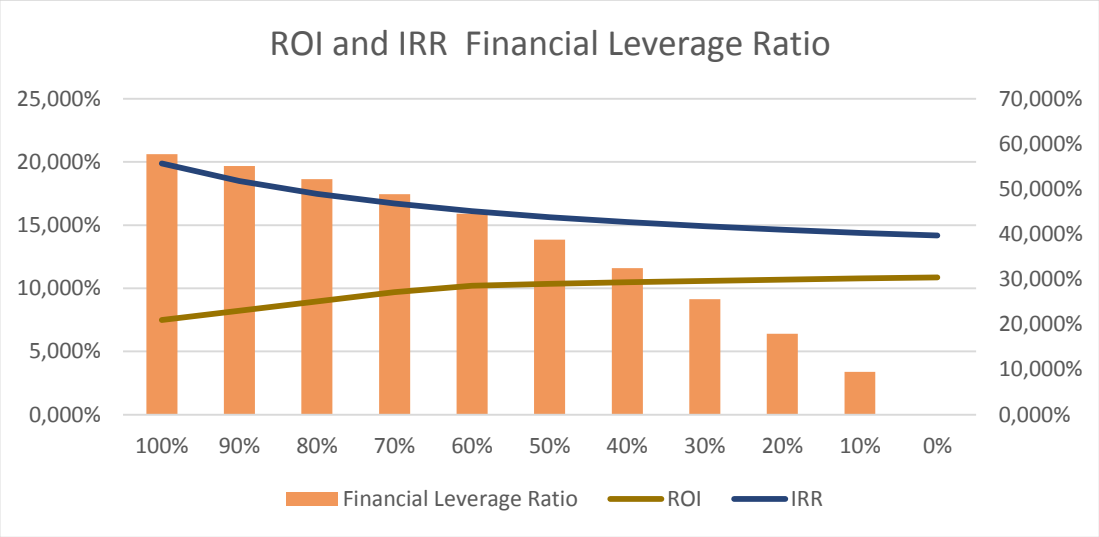

Figure 5 10% Scenario ROI and IRR Results Regarding the Financial Leverage Ratio

The payback period is consistently 32 months across most leverage ratios, except at 100% bank loan where it extends to 33 months.

Total Project Capital is $18,618,595 at 0% bank loan (0% financial leverage) and $32,264,994 at 100% bank loan (57.70% financial leverage), with the maximum project capital being $32,264,994 at full loan.

These values highlight the optimal points for each financial ratio, showing how the project's financial performance changes with varying levels of leverage.

4.3.2. Analysis of Scenario 2: 7% Interest Rate

For the 7% interest rate scenario, a discount rate of 7% was applied to the project's cash flow analysis. The objective was to assess the financial performance of the real estate development project under different leverage ratios, ranging from 0% to 100% bank loan financing. The following table summarizes the financial results for each leverage alternative as the initial range of bank loan analysed.

Table 3 7% Interest Scenario Financial Analysis

Bank Loan	Bank Loan	NPV	ROI	IRR	Payback Period	Project Capital	Financial Leverage Ratio
100%	18,618,595	2,507,266	9.75%	27.0%	31	32,264,994	57.7%
90%	16,756,736	2,518,002	10.26%	24.0%	32	30,403,135	55.1%
80%	14,894,876	2,528,737	10.77%	21.0%	32	28,541,275	52.2%
70%	13,033,017	2,539,472	11.28%	20.0%	32	26,679,416	48.9%
60%	11,171,157	2,550,207	11.78%	18.0%	32	24,827,387	45.0%
50%	9,309,298	2,560,943	11.58%	17.0%	32	23,792,589	39.1%
40%	7,447,438	2,571,678	11.41%	16.0%	32	22,757,790	32.7%
30%	5,585,579	2,582,413	11.25%	16.0%	32	21,722,991	25.7%
20%	3,723,719	2,593,148	11.11%	15.0%	32	20,688,192	18.0%
10%	1,861,860	2,603,883	10.99%	15.0%	32	19,653,394	9.5%
0%	0	2,614,619	10.87%	14.0%	32	18,618,595	0.0%

The financial leverage ratio (total debt to total capital) changes with varying proportions of bank loans as shown in Figure 7.

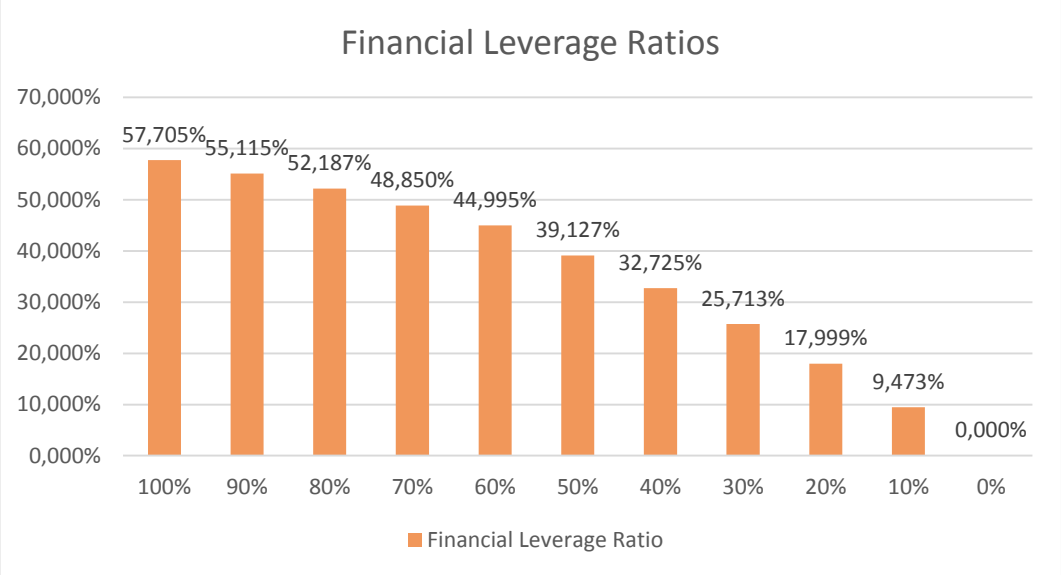

Figure 6 7% Scenario Financial Leverage Ratios

At 100% bank loan, the financial leverage ratio is 57.705%, representing the highest proportion of debt financing. As the reliance on bank loans decreases, the financial leverage ratio gradually declines, reaching 0% when no bank loan is used.

At 0% bank loan (0.0% financial leverage), the Net Present Value (NPV) is $2,614,619, and at 100% bank loan (57.7% financial leverage), the NPV is $2,507,266, with the maximum NPV reaching $2,614,619 at 0% bank loan.

The Return on Investment (ROI) starts at 10.87% with 0% bank loan (0.0% financial leverage) and rises to 9.75% with 100% bank loan (57.7% financial leverage), peaking at 11.78% at 60% bank loan (45.0% financial leverage).

For the Internal Rate of Return (IRR), it begins at 14% with no bank loan (0.0% financial leverage) and significantly increases to 27% at full bank loan (57.7% financial leverage), maintaining its highest value of 27% at 100% bank loan.

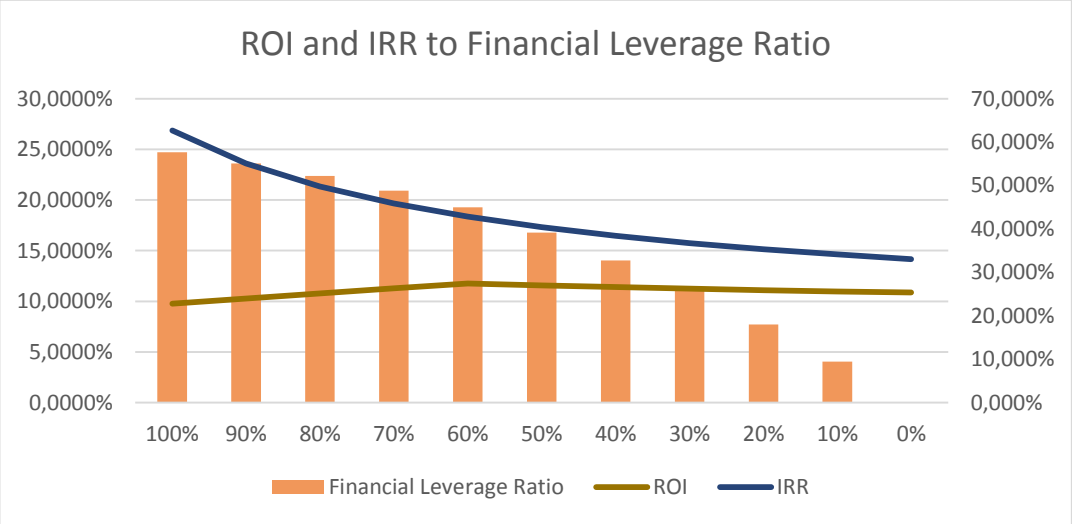

Figure 7 7% Scenario ROI and IRR Results Regarding the Financial Leverage Ratio

The payback period is 32 months at 0% bank loan, with the shortest payback period of 31 months occurring at full bank loan.

Total Project Capital is $18,618,595 at 0% bank loan (0.0% financial leverage) and $32,264,994 at 100% bank loan (57.7% financial leverage), with the maximum project capital being $32,264,994 at full bank loan.

These values indicate the optimal points for each financial ratio, showing how the project's financial performance varies with different levels of leverage.

4.3.3. Analysis of Scenario 3: 5% Interest Rate

For the 5% interest rate scenario, a discount rate of 5% was applied to the project's cash flow analysis. The objective was to assess the financial performance of the real estate development project under different leverage ratios, ranging from 0% to 100% bank loan financing. The following table summarizes the financial results for each leverage alternative:

Table 4 5% Interest Scenario Financial Analysis

Bank Loan	Bank Loan	NPV	ROI	IRR	Payback Period	Project Capital	Financial Leverage Ratio
100%	$18,618,595	$3,460,198	11.24%	32%	31	$32,264,994	57.7%
90%	$16,756,736	$3,467,891	11.60%	27%	31	$30,403,135	55.1%
80%	$14,894,876	$3,475,585	11.96%	24%	31	$28,541,275	52.2%
70%	$13,033,017	$3,483,278	12.32%	22%	31	$26,679,416	48.9%
60%	$11,171,157	$3,490,972	12.67%	20%	31	$24,817,556	45.0%
50%	$9,309,298	$3,498,665	12.41%	18%	32	$23,640,739	39.4%
40%	$7,447,438	$3,506,359	12.03%	17%	32	$22,636,310	32.9%
30%	$5,585,579	$3,514,052	11.70%	16%	32	$21,631,881	25.8%
20%	$3,723,719	$3,521,746	11.39%	15%	32	$20,627,453	18.1%
10%	$1,861,860	$3,529,439	11.12%	15%	32	$19,623,024	9.5%
0%	$0	$3,537,133	10.87%	14%	32	$18,618,595	0.0%

The financial leverage ratio (total debt to total capital) changes with varying proportions of bank loans as represented by Figure 9.

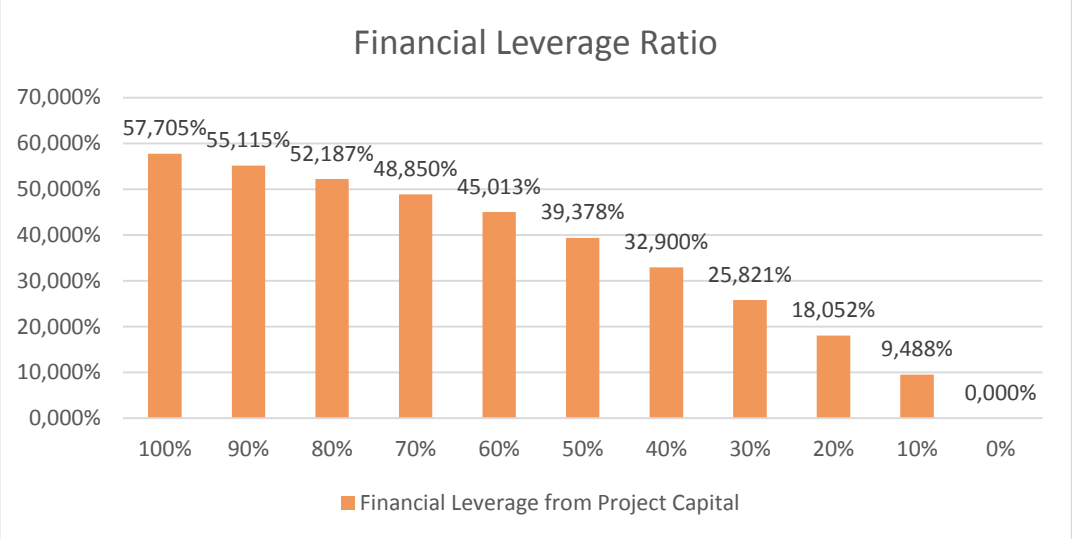

Figure 8 5% Scenario Financial Leverage Ratios

At 100% bank loan, the financial leverage ratio is 57.705%, representing the highest proportion of debt financing. As the reliance on bank loans decreases, the financial leverage ratio gradually declines, reaching 0% when no bank loan is used.

At 0% bank loan (0.0% financial leverage), the Net Present Value (NPV) is $3,537,133, and at 100% bank loan (57.7% financial leverage), the NPV is $3,460,198, with the maximum NPV reaching $3,537,133 at 0% bank loan.

The Return on Investment (ROI) starts at 10.87% with 0% bank loan (0.0% financial leverage) and rises to 11.24% with 100% bank loan (57.7% financial leverage), peaking at 12.67% at 60% bank loan (45.0% financial leverage).

For the Internal Rate of Return (IRR), it begins at 14% with no bank loan (0.0% financial leverage) and significantly increases to 32% at full bank loan (57.7% financial leverage), maintaining its highest value of 32% at 100% bank loan.

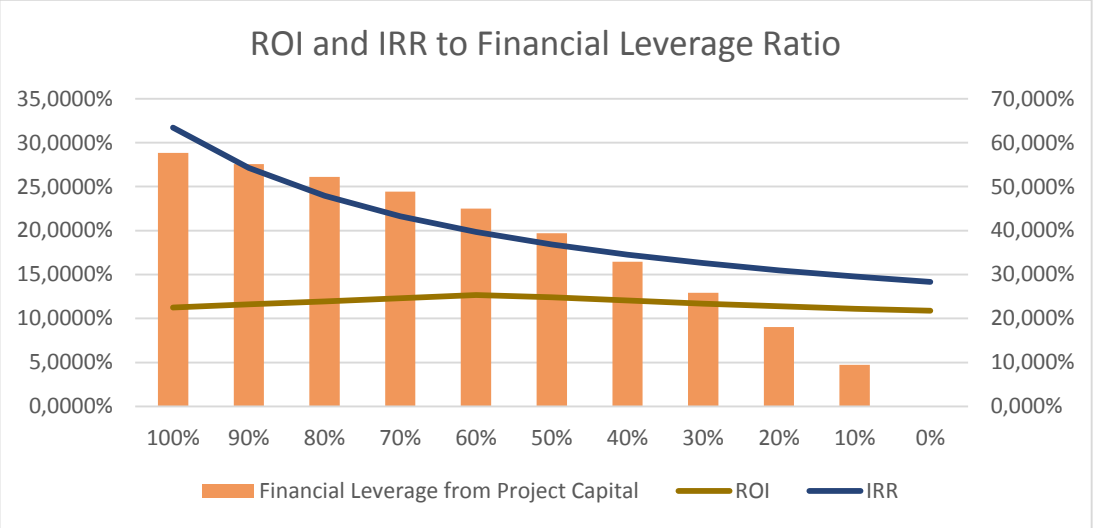

Figure 9 5% Scenario ROI and IRR Results Regarding the Financial Leverage Ratio

The payback period is 32 months at 0% bank loan, with the shortest payback period of 31 months occurring at full bank loan.

Total Project Capital is $18,618,595 at 0% bank loan, with the maximum project capital being $32,264,994 at full bank loan (57.7% financial leverage).

These values indicate the optimal points for each financial ratio, showing how the project's financial performance varies with different levels of leverage.

4.3.4. Analysis of Scenario 4: 2% Interest Rate

In the scenario of 2% interest rate, a discount rate of 2% was applied to the project's cash flow analysis. The financial performance was assessed under different leverage ratios, ranging from 0% to 100% bank loan financing. The summarized financial results for each leverage alternative are as follows:

Table 5 2% Interest Scenario Financial Analysis

Bank Loan	Bank Loan	NPV	ROI	IRR	Payback Period	Project Capital	Financial Leverage Ratio
100%	18,618,595	4,985,697	13.41%	39%	30	32,264,994	57.71%
90%	16,756,736	4,988,790	13.55%	32%	30	30,403,135	55.12%
80%	14,894,876	4,991,883	13.70%	28%	31	28,541,275	52.19%
70%	13,033,017	4,994,976	13.84%	25%	31	26,679,416	48.85%
60%	11,171,157	4,998,068	13.98%	22%	31	24,817,556	45.01%
50%	9,309,298	5,001,161	13.66%	20%	31	23,418,156	39.75%
40%	7,447,438	5,004,254	12.97%	18%	31	22,458,244	33.16%
30%	5,585,579	5,007,347	12.35%	17%	32	21,498,332	25.98%
20%	3,723,719	5,010,440	11.81%	16%	32	20,538,420	18.13%
10%	1,861,860	5,013,532	11.31%	15%	32	19,578,507	9.51%
0%	0	5,016,625	10.87%	14%	32	18,618,595	0.00%

The financial leverage ratio (total debt to total capital) changes with varying proportions of bank loans as represented by Figure 11.

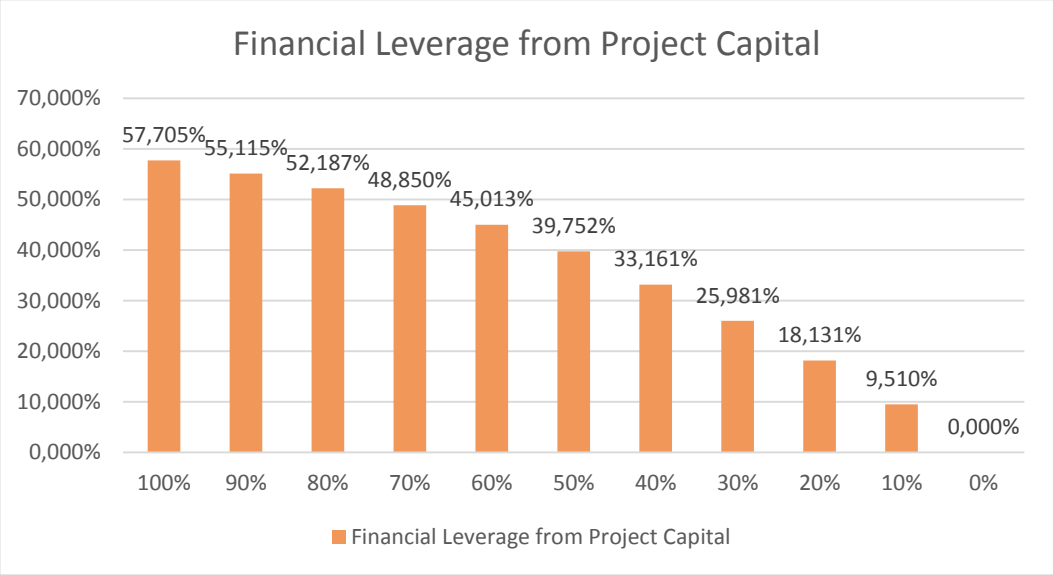

Figure 10 2% Scenario Financial Leverage Ratios

At 100% bank loan, the financial leverage ratio is 57.705%, representing the highest proportion of debt financing. As the reliance on bank loans decreases, the financial leverage ratio gradually declines, reaching 0% when no bank loan is used.

At 0% bank loan (0% financial leverage), the Net Present Value (NPV) is $5,016,625.17, and at 100% bank loan (57.705% financial leverage), the NPV is $4,985,697.36, with the maximum NPV reaching $5,016,625.17 at 0% bank loan.

The Return on Investment (ROI) starts at 10.8690% with 0% bank loan (0% financial leverage) and rises to 13.4133% with 100% bank loan (57.705% financial leverage), peaking at 13.9796% at 60% bank loan (45.013% financial leverage).

For the Internal Rate of Return (IRR), it begins at 14% with no bank loan (0% financial leverage) and significantly increases to 39% at full bank loan (57.705% financial leverage), maintaining its highest value of 39% at 100% loan.

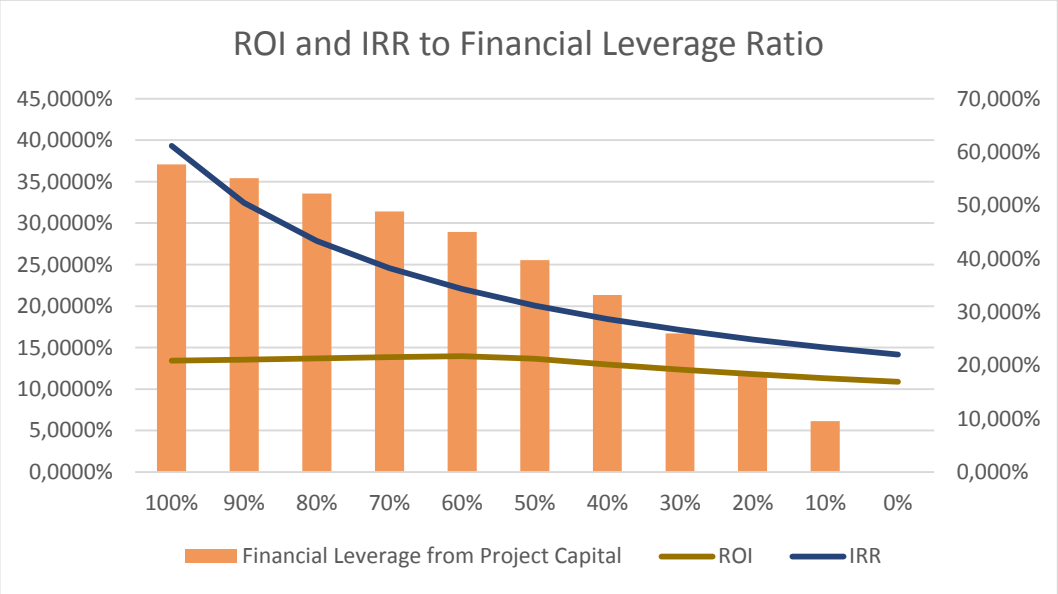

Figure 11 2% Scenario ROI and IRR Results Regarding the Financial Leverage Ratio

The payback period is 32 months at 0% bank loan with the shortest payback period of 30 months occurring at full bank loan.

Total Project Capital is $18,618,595.07 at 0% bank loan (0% financial leverage), with the maximum project capital being $32,264,994.07 at full bank loan.

These values indicate the optimal points for each financial ratio, showing how the project's financial performance varies with different levels of leverage.

4.4. Comparison

4.4.1. Optimum Financial Leverage maximizing for IRR.

The table compares the financial outcomes of different interest rate scenarios with the objective of maximizing the IRR ratio. The scenarios considered are interest rates of 10%, 7%, 5%, and 2%. Each scenario is analysed in terms of the highest IRR achieved, the corresponding financial leverage ratio, ROI, NPV, and payback period.

Interest Rate Scenarios	10%	7%	5%	2%
OPTIMUM IRR	19.88%	26.87%	32%	39%
% Bank Loan	100%	100%	100%	100%
% Financial Leverage	57.705%	57.705%	57.705%	57.705%
ROI	7.48%	9.75%	11.24%	13.41%
NPV	$ 1,177,025	$ 2,507,266	$ 3,460,197	$ 4,985,697
PAYBACK PERIOD	33	31	31	30

The relationship between the maximum IRR and the corresponding optimum financial leverage ratio across different interest rate scenarios is illustrated in Figure 13.

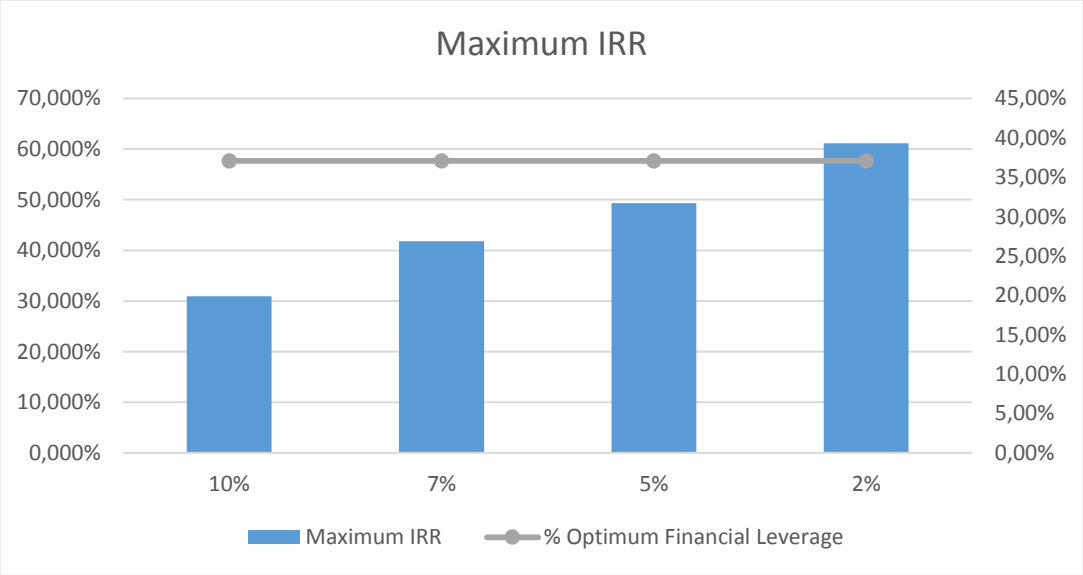

Figure 12 Maximum IRR and Its Corresponding Leverage Ratio Across Different Interest Rate Scenarios

As the interest rate decreases, the maximum IRR increases significantly. At a 10% interest rate, the maximum IRR is 19.88%, while at a 2% interest rate, it reaches 39%.

IRR is increased by of 35% between 10% and 7% scenario, and by 18% between 7% and 5% scenario, and by 24% increase between 5% and 2% scenario. With total of 98% between the 10% and 2% scenario.

This substantial increase in IRR at lower interest rates highlights the enhanced profitability of the project under favourable borrowing conditions.

The optimum financial leverage ratio remains constant at 57.705% for all scenarios (maximum bank loan), indicating that the optimum proportion of debt financing relative to total capital does not change in the objective of maximum IRR.

The NPV in maximum IRR in Figure 14 shows a positive correlation between the decreasing interest rates and the increasing NPV values.

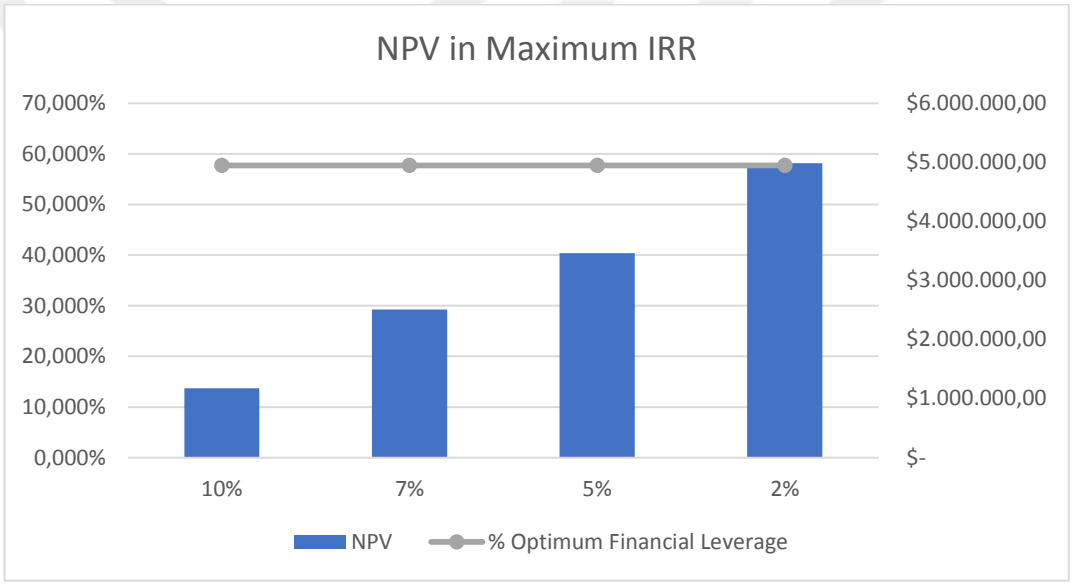

Figure 13 NPV Values corresponding to the Maximum IRR Across the Scenarios

At a 10% interest rate, the NPV is $1,177,025.28, which rises to $4,985,697.36 at a 2% interest rate. This trend suggests that lower interest rates lead to higher net present values, reflecting greater profitability and cash flows over the project's life.

The NPV value is increased by 113% between 10% and 7% scenario, and by 38% between 7% and 5% scenario, and by 44% increase between 5% and 2% scenario. With a total increase by 324% between the 10% scenario and 2% scenario.

Also, the ROI graph in Figure 15 demonstrates a gradual increase in ROI as the interest rate decreases.

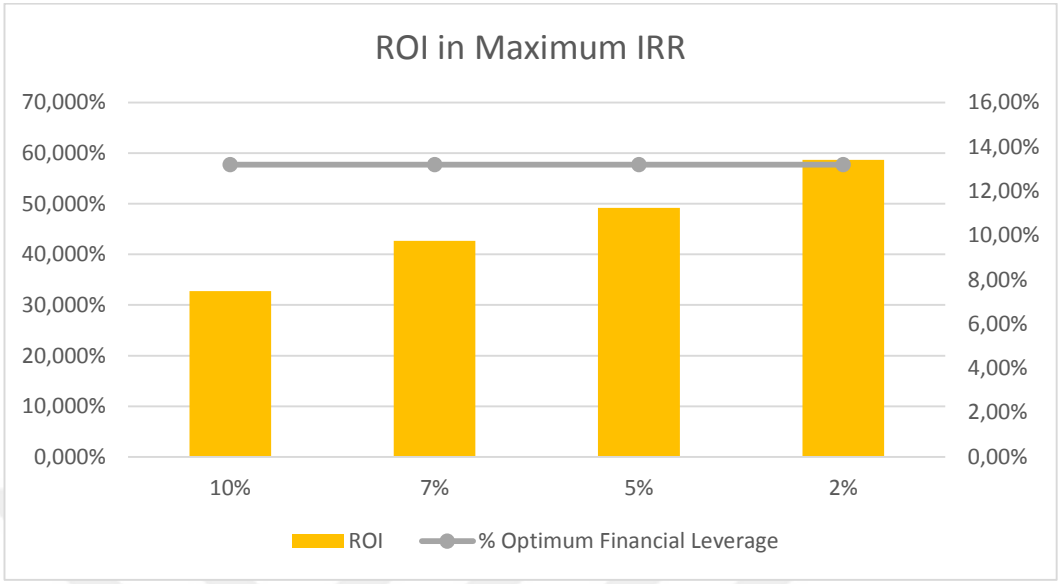

Figure 14 ROI Values corresponding to the Maximum IRR Across the Scenarios

At a 10% interest rate, the ROI is 7.48%, while at a 2% interest rate, it reaches 13.41%. This upward trend signifies that lower interest rates enhance the overall profitability from the owner's perspective.

The ROI value is increased by 30% between 10% and 7% scenario, and by 15% between 7% and 5% scenario, and by 19% increase between 5% and 2% scenario. With a total increase by 79% between the 10% scenario and 2% scenario.

On the other hand, the payback period graph in Figure 16 highlights the impact of interest rates on the time required to recover the initial investment.

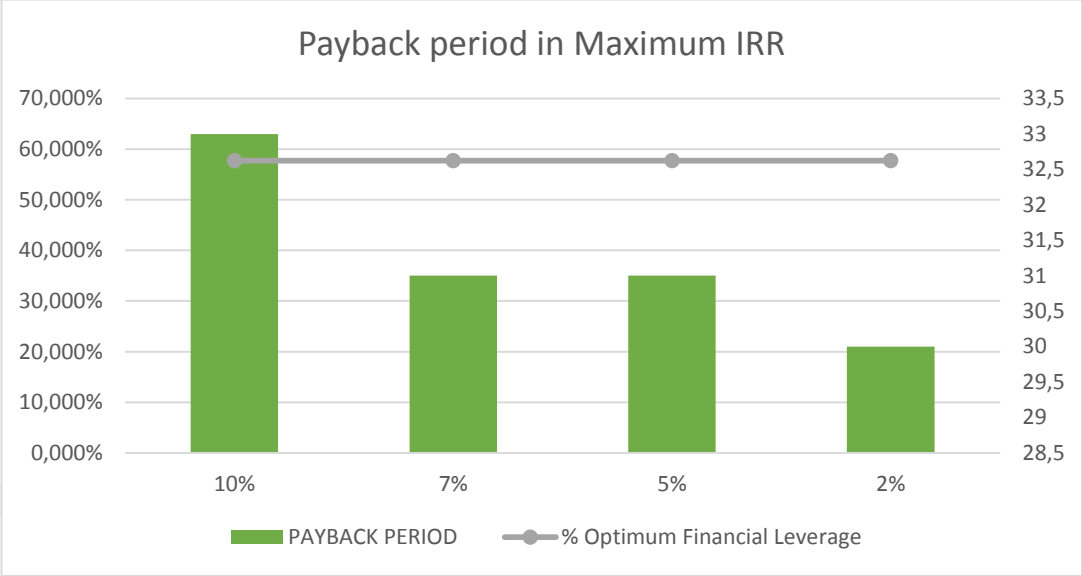

Figure 15 Payback Period Values corresponding to the Maximum IRR Across the Scenarios

At a 10% interest rate, the payback period is 33 months, whereas, at a 2% interest rate, it shortens to 30 months.

This decrease in the payback period with lower interest rates indicates faster recovery of the investment, improving the project's liquidity and reducing financial risk. The consistent financial leverage ratio of 57.705% ensures that the observed changes in the payback period are due to the varying interest rates and not alterations in the financial leverage structure.

These analyses collectively demonstrate that lower interest rates significantly enhance the project's IRR, while its corresponding financial performance such as NPV, ROI, and payback period behave in different ways in different scenarios under the optimum leverage in correspondence to the maximum IRR. While the IRR increased by 98% between the interest rate scenarios 10% to 2%, ROI increased by 79% (the less affected), and NPV by 324% (the most affected).

4.4.2. Optimum Financial Leverage maximizing for IRR.

The table compares the financial outcomes of different interest rate scenarios with the objective of maximizing the ROI ratio. The scenarios considered are interest rates of 10%, 7%, 5%, and 2%. Each scenario is analysed in terms of the highest ROI achieved, the corresponding financial leverage ratio, IRR, NPV, and payback period.

Interest Rate Scenarios	10%	7%	5%	2%
OPTIMUM ROI	10.87%	11.78%	12.67%	13.98%
% Bank Loan	0.000%	60.000%	60.000%	60.000%
% Financial Leverage	0.000%	44.995%	45.013%	45.013%
IRR	14.172%	18.358%	19.844%	22.050%
NPV	$ 1,330,897	$ 2,550,207	$ 3,490,971	$ 4,998,068
PAYBACK PERIOD	32	32	31	31

The relationship between the maximum ROI and the corresponding optimum financial leverage ratio across different interest rate scenarios is illustrated in the graph in Figure 17.

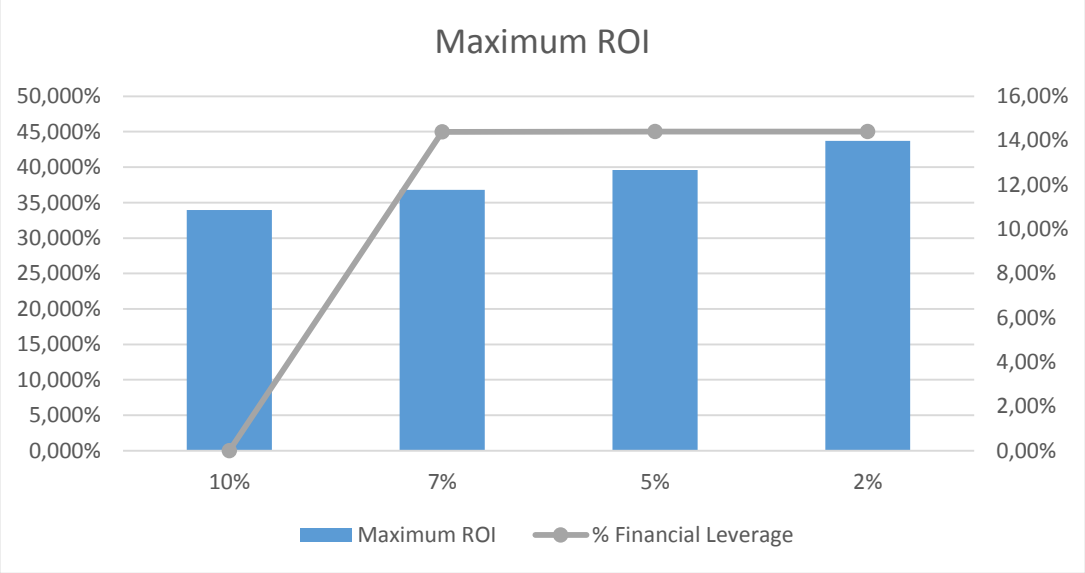

Figure 16 Maximum ROI and Its Corresponding Leverage Ratio Across Different Interest Rate Scenarios

As the interest rate decreases, the maximum ROI increases significantly. At a 10% interest rate, the maximum ROI is 10.869%, while at a 2% interest rate, it reaches 13.9796%. The financial leverage ratio varies, indicating that the increased ROI is primarily driven by favorable borrowing conditions and the appropriate mix of debt and equity.

The optimum financial leverage ratio varies with the interest rates, starting from 0% at a 10% interest rate to 39.752% at a 2% interest rate, while it's showing similar ratio of 45.013% of leverage in both 7% and 5% scenarios.

The NPV in optimum leverage maximizing ROI graph in Figure 18, shows a positive correlation between the decreasing interest rates and the increasing NPV values.

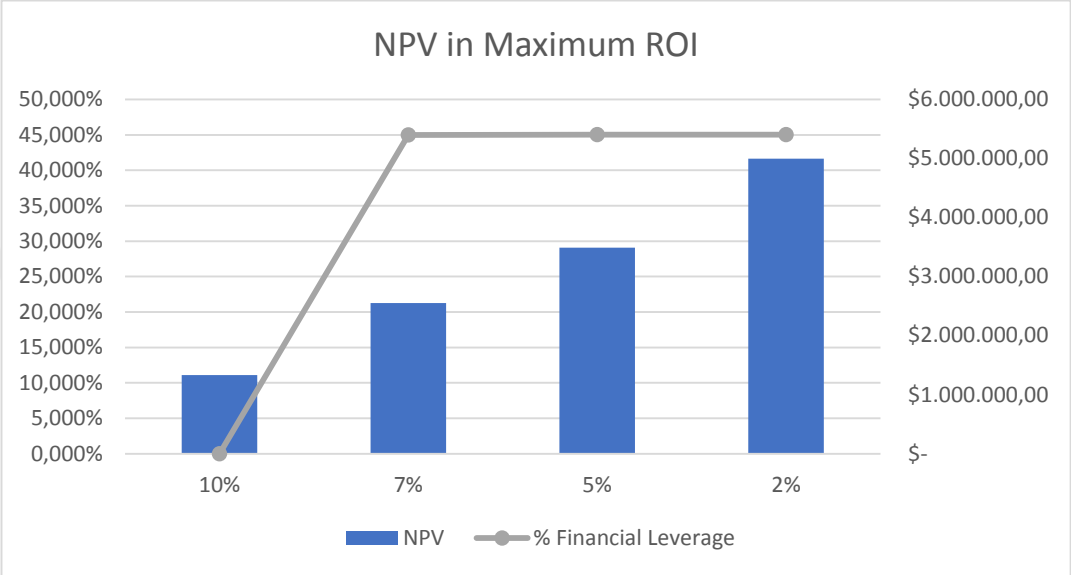

Figure 17 NPV Values corresponding to the Maximum ROI Across the Scenarios

At a 10% interest rate, the NPV is $1,330,897.96, which rises to $5,004,254.05 at a 2% interest rate. This trend suggests that lower interest rates lead to higher net present values, reflecting greater profitability and cash flows over the project's life.

The NPV value is increased by 30% between 10% and 7% scenario, and by 8% between 7% and 5% scenario, and by 11% increase between 5% and 2% scenario. With a total increase by 56% between the 10% scenario and 2% scenario.

Also, the IRR graph shown in Figure 18 demonstrates a gradual increase in IRR as the interest rate decreases.

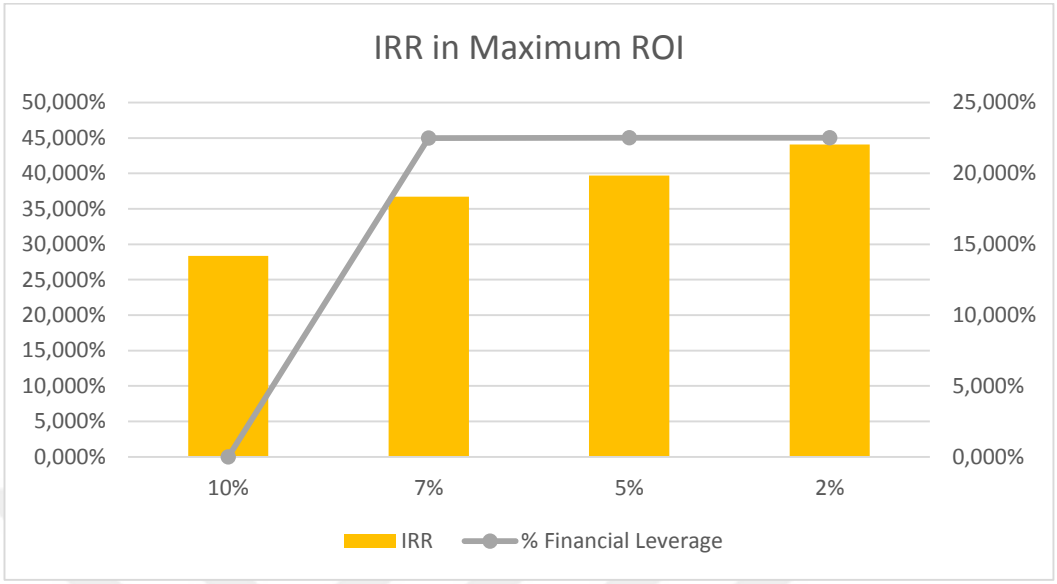

Figure 18 IRR Values corresponding to the Maximum ROI Across the Scenarios

At a 10% interest rate, the IRR is 14.172%, while at a 2% interest rate, it reaches 22%. This upward trend signifies that lower interest rates enhance the overall profitability from the owner's perspective.

The IRR value is increased by 30% between 10% and 7% scenario, and by 8% between 7% and 5% scenario, and by 1% increase between 5% and 2% scenario. With a total increase by 56% between the 10% scenario and 2% scenario.

The payback period graph in Figure 19 highlights the impact of interest rates to recover the initial investment under the optimum leverage maximizing ROI.

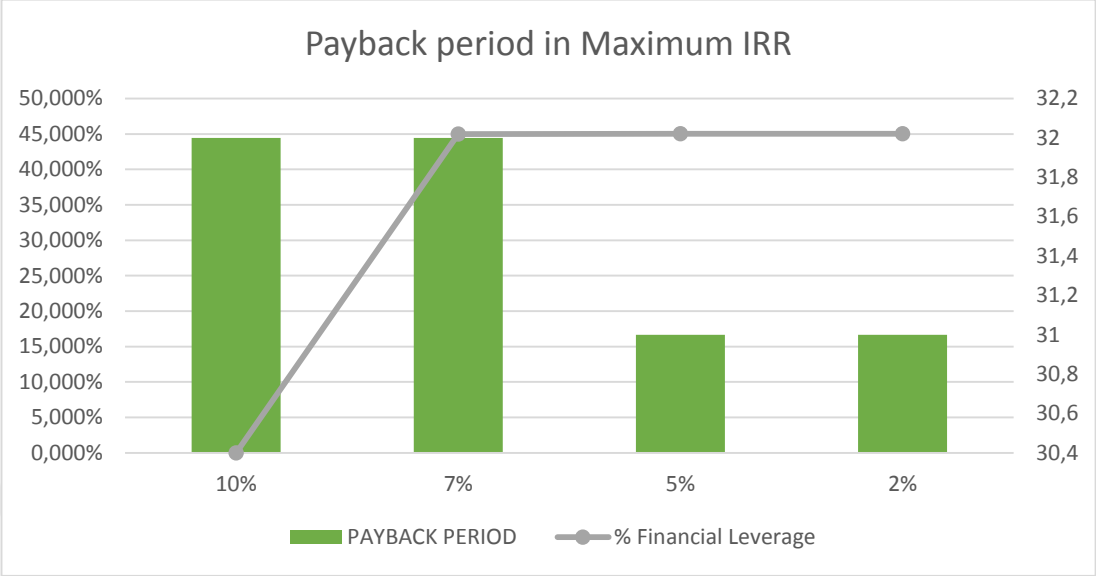

Figure 19 Payback Period Values corresponding to the Maximum ROI Across the Scenarios

At a 10% interest rate, the payback period is 32 months, whereas, at a 2% interest rate, it shortens to 31 months. This decrease in the payback period with lower interest rates indicates faster recovery of the investment, improving the project's liquidity and reducing financial risk. The financial leverage ratio is adjusted accordingly to achieve the maximum ROI in each scenario.

These analyses collectively demonstrate that lower interest rates significantly enhance the project's ROI, while its corresponding financial performance, such as NPV, IRR, and payback period, behave in diverse ways in different scenarios under the optimum leverage in correspondence to the maximum ROI. While the ROI increased by 29% between the interest rate scenarios 10% to 2%, IRR increased by 55%, and NPV by 276%.

In summary of the optimization of both cases, Maximizing IRR favours high financial leverage (100% bank loan, 57.705% leverage ratio) consistently across all scenarios, indicating a preference for debt financing.

In contrast, maximizing ROI involves a varying financial leverage ratio, favouring a balanced mix of debt and equity, especially at lower interest rates.

Lower interest rates enhance both IRR and ROI, but the impact is more pronounced for IRR.

The NPV increases significantly in both scenarios as interest rates decrease, reflecting higher project profitability. And the payback period decreases under lower interest rates, indicating faster recovery of the initial investment.

Overall, the choice between optimizing for IRR or ROI depends on the project's financing strategy and the desired balance between debt and equity. Optimizing for IRR favours higher leverage and higher returns but may involve greater risk. Optimizing for ROI provides a balanced approach, enhancing profitability while managing financial risk effectively.

5. CONCLUSION

The research addresses a critical gap in the real estate investment literature by focusing on the optimization of financial leverage specifically for residential real estate development projects. The study provides a robust analytical framework that real estate developers and investors can use to determine optimal leverage strategies under varying market conditions. By integrating different interest rate scenarios, this research offers a comprehensive understanding of how financial performance metrics are influenced by leverage decisions, contributing to more informed and strategic investment planning.

A detailed comparison was made between various leverage ratios across different interest rates (2%, 5%, 7%, and 10%). The analysis revealed that higher leverage ratios generally maximize IRR, with the highest IRR achieved at 100% debt financing across all interest rate scenarios. In contrast, the optimal ROI varied with interest rates, indicating that a balanced approach to leverage was more effective in certain conditions. For example, at lower interest rates, a higher leverage ratio was beneficial, while at higher interest rates, a more conservative leverage approach was advisable.

The study highlighted the significant impact of interest rate variations on financial performance, underscoring the importance of strategic financing decisions. These findings provide valuable guidance for real estate developers and investors, enabling them to make informed decisions that enhance project profitability and sustainability.

The primary contributions of this study include a comprehensive analysis of how different leverage ratios impact financial performance metrics such as IRR and ROI under varying interest rates. The findings offer practical guidance for developers and investors, providing actionable insights into how to adjust leverage strategies based on current market conditions to enhance the profitability and sustainability of real estate projects. Additionally, the methodology and findings serve as a foundation for further exploration into financial leverage optimization in different types of real estate projects and under various economic conditions.

Despite its contributions, this study has several limitations. The research is limited to residential real estate development projects, and future studies should explore the applicability of these findings to commercial and mixed-use developments to validate and extend the results. The study assumes static economic conditions and interest rates during the analysis period, so future research should consider broader economic fluctuations and their impact on leverage optimization. This study also did not incorporate sustainability metrics into the analysis, and future research should evaluate the long-term viability of real estate projects under various leverage scenarios by including sustainability considerations.

Considering these limitations, several recommendations for future studies are proposed. Future research should explore the impact of broader economic conditions and market fluctuations on leverage optimization in real estate. Additionally, applying the methodology to different types of real estate projects, including commercial and mixed-use developments, would be beneficial to further validate the findings. Lastly, incorporating sustainability metrics to evaluate the long-term viability of real estate projects under various leverage scenarios should be considered in future studies.

In conclusion, the study contributes to the broader understanding of financial leverage in real estate development, offering a robust framework for optimizing leverage to enhance financial performance. By applying the insights gained from this research, developers and investors can improve their financial strategies, ensuring sustainable and profitable real estate investments.

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