CHALMERS

The Impact of Capital Intensity on Private Equity Returns

A Multiple Regression Analysis

Bachelor's Thesis in Industrial Engineering and Management

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Kapitalintensitetens påverkan på avkastningen inom private equity

En multipel regressionsanalys

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Abstract

This study examines how capital intensity in acquired companies influences return on investments (ROI) for private equity firms. The analysis is based on a dataset of 171 European private equity transactions completed between 2000 and 2025. The analysis employs an Ordinary Least Squares (OLS) regression model to test whether target firms' capital intensity levels significantly influence ROI for the private equity firm. Capital intensity is measured as the ratio of net property, plant, and equipment to sales and categorized into low, medium, and high groups. The results demonstrate a statistically significant negative relationship between capital intensity and ROI, with investments in low capital intensity firms yielding higher ROI. Several control variables, including holding period, buy value, and macroeconomic indicators, were included in the model to account for other factors influencing ROI.

The findings contribute to the literature by providing quantitative evidence that capital intensity affect investment performance and offer practical insights for investment strategy development.

Keywords: Capital Intensity, ROI, multiple Regression, Private equity, LBO, Investment Strategies

Sammandrag

Denna studie undersöker hur kapitalintensiteten i uppköpta bolag för private equity företag påverkar avkastningen på investeringar (ROI). Detta undersöks genom ett dataset bestående av 171 europeiska private equity transaktioner mellan 2000 och 2025. Rapporten bygger på en OLS regressionsmodell för att testa om kapitalintensiteten hos de uppköpta bolagen signifikant påverkar ROI för private equity firman. Kapitalintensitet i studien mäts som förhållandet mellan nettoanläggningstillgångar och omsättning, och delas in i tre grupper: låg, medel och hög. Resultatet visar på ett statistiskt signifikant negativt samband mellan kapitalintensitet och ROI, där investeringar i företag med låg kapitalintensitet genererar högre avkastning. Flera kontrollvariabler, såsom innehavsperiod, köpeskilling och makroekonomiska faktorer, har inkluderats för att ta hänsyn till att andra faktorer påverkar avkastningen.

Studien bidrar till forskningen genom att ge kvantitativt bevis för sambandet mellan kapitalintensitet och avkastning inom private equity, samt erbjuder praktiska insikter för utvecklingen av investeringsstrategier.

Keywords: Kapitalintensitet, ROI, multipel regression, private equity, LBO, investeringsstrategier

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Inez Antmar, Gothenburg, May 2025
Oscar Gustavsson, Gothenburg, May 2025
Simon Sand Uhlén, Gothenburg, May 2025

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1 Introduction

Private equity is a segment within corporate finance that provides professionally managed capital to firms and plays a critical role in funding growth and innovation across the economy (Prowse, 1998). Private equity firms are widely recognized for achieving strong returns, through acquiring and restructuring businesses before exiting at a profit (Kaplan & Strömberg, 2009). An important aspect of private equity investment strategy is the type of industry targeted, as different industries present different risks, opportunities, and potential for returns. One key differentiator across industries is capital intensity, which may have implications for the returns that private equity investors are able to realize. Capital-intensive industries are defined by their heavy reliance on physical assets such as machinery, infrastructure, or real estate assets that demand continuous investment in maintenance, upgrades, and expansion (Komonen et al., 2006). This study seeks to examine the impact of capital intensity on return on investment (ROI), with the goal of informing and optimizing private equity investment strategies.

While the impact of capital intensity on private equity returns remains underexplored, certain industry patterns suggest it may be a relevant factor. According to Rousseau and Caruso (2015) sectors characterized by high capital intensity like steel, cement, paper, and aluminum, have historically delivered low returns due to chronic overcapacity and downward price pressure. These sectors have reported a median return on capital employed of only 5.4% over the past quarter century, underscoring the structural profitability challenges they face.

Despite these challenges, high capital intensity industries are not necessarily unprofitable. They require disciplined, long-term asset management strategies and capital allocation aligned with sustainable business goals (Komonen et al., 2006). These long-term considerations, stand in contrast to the short- to medium term investment horizon typically employed by private equity firms. The private equity business model generally seeks immediate improvements in operational efficiency and stable free cash flows to service debt and maximize returns. This makes capital intensive firms less attractive targets, due to their ongoing reinvestment requirements (Street of Walls, 2013).

This preference is reflected in valuation dynamics. Firms with low maintenance capital expenditures offer greater financial flexibility, enabling management to prioritize strategic growth and shareholder returns over continuous infrastructure invest-

ment (Street of Walls, 2013). In contrast, high capital intensity firms limit financial flexibility and expose investors to greater financial and operational risks, particularly in private equity deals, which typically involve 60% to 90% debt financing (Kaplan & Strömberg, 2009; Street of Walls, 2013).

While high capital intensity firms may be less suited to the highly leveraged deal structures commonly used by private equity firms, empirical research exploring the quantitative impact of capital intensity on ROI remains underexplored. To the best of this study's knowledge, no prior research has directly compared ROI between high and low capital intensity firms within private equity.

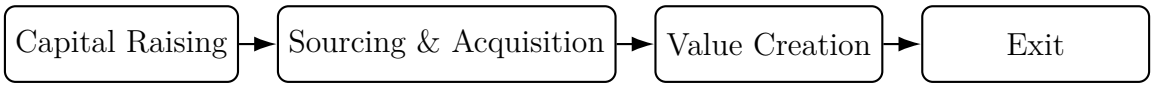
Addressing this gap offers valuable insight and contributes to a broader understanding of the field. The results provide a quantitative basis for better understanding the connection between capital intensity and ROI for private equity firms.

1.1 Theoretical Framework

1.1.1 Private Equity Process

Private equity firms are investment entities that focus on acquiring, managing, and eventually exiting companies with the objective of delivering strong returns to their investors[1]. They secure funding by establishing funds, which generally operate over a period of approximately ten years. This capital is then deployed to purchase businesses, frequently using leveraged buyouts (LBOs), where a large share of the acquisition cost is covered by borrowed capital (Kaplan & Strömberg, 2009).

Private equity firms often acquire a controlling stake in a business and implement financial and managerial controls. They may appoint new management, install detailed reporting requirements, and enforce contractual obligations through board representation and loan covenants (Wood & Wright, 2009). A typical private equity process is illustrated below[2].



[1]For readers of this study, a detailed understanding of every aspect of the private equity process is not necessary. However, knowledge with the key actors and the main steps involved will improve clarity and understanding of the terms and concepts used in the study.

[2]Authors' own design

1.1.2 Return on Investment

Return on investments (ROI) is one of the most used management indicators for measuring companies profit and performance. It is commonly used to compare companies, both of varying sizes and across different industries (Friedlob & Plewa, 1996).

ROI is a tool for both economic and strategic analysis, especially in the context of investment decisions. When properly applied, it provides a clear and structured way to evaluate the profitability of an investment (Erdogmus et al., 2004).

ROI is defined as the profit divided by the cost of the investment, meaning the investment itself (Friedlob & Plewa, 1996):

$$\text{ROI} = \frac{\text{Profit}}{\text{Investment}} \tag{1.1}$$

The concept serves as a foundation for understanding how resources are best allocated. For ROI to be meaningful in serious economic decisions, it must be considered alongside time and risk (Erdogmus et al., 2004).

ROI is a decision-making framework which includes business strategy, valuation and cost-benefit analysis. Strategic use of ROI can help organizations, as private equity firms, prioritize investments that align with long-term goals, and is therefore a good key performance indicator when evaluating an investment (Erdogmus et al., 2004).

1.1.3 Capital Intensity

Capital intensity refers to the level of physical or tangible assets, such as property plant and equipment (PPE) needed to produce a unit of sales revenue (Elmasr, 2007). Net property plant and equipment (NPPE) are defined as PPE subtracted with the accumulated depreciation expenses. The defined formula for calculating the capital intensity is defined as:

$$\text{Capital Intensity} = \frac{\text{NPPE}}{\text{Total Revenue}} \tag{1.2}$$

Firms with higher capital intensity depend on physical assets for their competitive advantage. These companies are more exposed to replication by competitors, leading to overcapacity, pricing pressure, and ultimately lower returns on capital. In contrast, low capital intensity firms often rely on intangible assets like brands,

patents, and distribution networks. These businesses tend to achieve higher and more sustainable returns on invested capital, as their assets are harder to replicate and often provide stronger pricing power. The lower capital requirements and higher margins of low capital intensity firms support greater shareholder wealth creation (Elmasr, 2007).

1.1.4 Leveraged Buyouts

In a leveraged buyout (LBO) a private equity firm acquires a company by using a capital structure composed of a relatively small proportion of equity and a large proportion of external debt, typically financing 60–90% of the purchase price with borrowed funds. The remaining 10–40% is covered by equity from the private equity fund and contributions from the management team of the acquired company (Kaplan & Strömberg, 2009).

The rationale for this structure lies in the discipline imposed by leverage. High levels of debt create fixed interest and principal payments, forcing managers to focus on cash flow generation and operational efficiency (Kaplan & Strömberg, 2009).

1.1.5 Valuation and Due Diligence in Private Equity

Private equity firms rely on structured and comprehensive due diligence processes when evaluating potential acquisitions. The due diligence process is typically divided into several categories, each addressing different dimensions of a company's operations and performance. Commercial due diligence is the most critical component, assessing the target's market position, customer base, industry dynamics, and long-term growth potential. Financial due diligence focuses on verifying the accuracy of financial reporting and evaluating historical earnings quality, cash flows, and working capital. Operational due diligence evaluates the company's internal processes, supply chains, and organizational capabilities. Legal and tax due diligence ensures that no material liabilities or compliance risks are overlooked. By combining these perspectives, private equity firms are better equipped to build a robust investment thesis and avoid overpaying for companies with hidden structural weaknesses (EQT Group, 2025a).

1.2 Litterature Review

1.2.1 Capital Intensity and Private Equity Preferences

According to Cuny and Talmor (2007) high capital intensity implies a larger proportion of value tied up in fixed assets, which increases the capital commitment required for a successful turnaround. Private equity investors operate under a higher effective cost of capital compared to long-term owners due to limited fund lifetimes and the opportunity cost of capital. Firms that require significant reinvestments in physical assets become less attractive as buyout targets, as the expected payoff from operational improvements is discounted more heavily (Cuny & Talmor, 2007).

The theoretical model from Cuny and Talmor (2007) shows that the private equity route is most favorable in situations where the firm's value can be unlocked through operational changes rather than heavy capital expenditures, making low capital intensity companies more likely to generate higher returns.

1.2.2 Holding Period's Effect on ROI

Findings in the literature point to the importance of holding period as a determinant of private equity returns. Joenvaara et al. (2022) notes that much of the value creation in LBOs occurs early in the investment lifecycle, typically through operational improvements, financial restructuring, and strategic repositioning. While the average holding period is 5.8 years, the study highlights that timely exits are crucial for realizing returns, especially when favorable market conditions can be leveraged. This shows that there is an optimal window for divestment, long enough to implement key changes, but not long enough that diminishing returns or market changes erode the value of the investment.

1.2.3 Skill-Based Drivers of High Performing Deals

Thaker (2014) finds that being large and experienced can lead to better returns when combined with strong firm-specific skills. The study analyzed over 11 000 global private equity transactions and shows that the majority of the highest-return, shortest-duration deals were completed by a small group of large and mature private equity firms. Only 11% of firms accounted for 70% of top-quartile transactions, and most of these belonged to the 50 largest private equity firms globally. Furthermore, Thaker (2014) discuss that these firms often benefit from advantages such as better deal flow, stronger networks, operational expertise, and economies of scale, which in

turn reinforce their ability to execute high-performing deals.

Cavagnaro et al. (2018) arrive at a similar conclusion, suggesting that skill-based factors play a role in shaping private equity returns. They find that variation in fund performance is largely attributable to the capabilities of the firm, particularly its skill in sourcing attractive deals and creating value post-acquisition. Their study highlights that private equity is not a matter of accessing capital or timing markets, but rather depends on the investment team's ability to grow portfolio companies. The findings of Thaker (2014) and Cavagnaro et al. (2018) underline that private equity is a skill-driven industry, where a small group of highly capable firms dominate outcomes due to their expertise.

1.2.4 Firm Size and Return Potential in Private Equity

Fama and French (1992) found that smaller companies tend to generate higher returns than larger ones in the stock market, a pattern not fully explained by traditional risk models at the time. They argued that this size effect is driven by the higher risks associated with small firms, such as earnings volatility or financial constraints. For private equity investors, this suggests that targeting smaller companies could lead to higher potential returns, but also involves accepting greater exposure to these underlying risks.

1.2.5 Macroeconomic Conditions and Private Equity Performance

Private equity performance is closely tied to the broader macroeconomic environment. Factors such as GDP growth, interest rates, inflation, and credit conditions all play a role in shaping investment outcomes and fund returns.

1.2.5.1 General Macroeconomic Climate

Both Aigner et al. (2008) and Eissler and Wang (2025) highlight that strong macroeconomic growth provides a favorable environment for value creation and successful exits. In a study of Eissler and Wang (2025) they cover the U.S. private equity market from 1985 to 2023 and finds that the overall strength of the economy is one of the most important drivers of private equity returns. Average GDP growth in the target region over the life of a fund has a positive effect on performance (Aigner et al., 2008).

Periods of strong economic growth, regardless of the interest rate level, tend to align with stronger private equity performance. Favorable macroeconomic conditions

support portfolio company expansion, improve exit markets, and stimulate deal activity. During periods of weak economic growth, even low interest rates have limited effect if growth prospects and exit opportunities are weak (Eissler & Wang, 2025).

1.2.5.2 Interest Rates and Their Effects on Private Equity Deals

Rising interest rates have had a significant impact on private equity activity. Following a long period of low rates that enabled cheap debt financing and supported favorable valuations, central banks sharply increased rates in response to high inflation. Between March 2022 and July 2023, the U.S. base rate rose from 0.25% to 5.5%, marking a substantial shift in the cost of capital (EQT Group, 2025b).

According to EQT (2025), global deal values declined by 60% compared to the 2021 peak, while exit values fell by 66% and fund closings dropped by over 50%. Higher interest rates increased financing costs, reduced the feasibility of debt-driven transactions, and placed downward pressure on valuations and returns.

This macroeconomic shift directly affects ROI and deal structure. With debt now more expensive, the cost of capital increases, which in turn lowers returns. The sensitivity of private equity deals to interest rate fluctuations has become more pronounced in periods of economic uncertainty. For these reasons interest rate is a key macroeconomic factor that influences both deal making behavior and expected returns (EQT Group, 2025b).

Furthermore, Axelson et al. (2013) show that private equity firms tend to use higher levels of leverage and pay higher transaction multiples when debt is inexpensive. Their findings indicate that greater deal leverage is linked to lower fund-level returns. This suggests that the availability of cheap credit encourage overpayment, which in turn can negatively affect long-term performance.

1.2.6 Sector Focus of Private Equity Firms

Private equity firms tend to concentrate their investments in industries that demonstrate long-term structural growth, high scalability, and opportunities for transformation. Common target sectors include healthcare, technology, business services, industrial technology, and financial services. These industries are often closely aligned with global macro trends such as digitalization, demographic shifts, sustainability, and increasing demand for technological integration (EQT, 2023; Nordic Capital, 2023).

Within the healthcare sector private equity firms invest in multiple areas for ex-

ample medical technology. These investments are supported by stable long-term demand and offer opportunities for operational improvement and expansion, particularly in regulated or under served markets. Technology and software are central to many private equity portfolios due to characteristics such recurring revenue models, and potential for rapid scaling. The investments are commonly pursued for their high margins and strategic importance in modern business infrastructure (EQT, 2023; Nordic Capital, 2023).

Business services, especially those providing mission critical outsourcing or technical expertise, are also a target. These firms operate in fragmented markets, making them attractive for consolidation and operational efficiency initiatives. In the area of industrial technology, private equity firms focus on companies that can deliver stable cash flows and benefit from modernization strategies (EQT, 2023; Nordic Capital, 2023).

Financial services, including insurance and fintech platforms, are further areas of interest due to their rapid digital transformation, regulatory evolution, and the rise of new financial delivery models (Nordic Capital, 2023).

1.3 Purpose

The purpose of this study is to identify how the ROI for private equity firms are affected by the capital intensity of acquired companies. The study aims to provide quantitative insights that can serve as a foundation for future research on optimizing and developing investment strategies for private equity firms.

1.4 Research Question and Null Hypothesis

Research Question:

- How does the capital intensity of acquired companies affect the ROI for private equity firms?

This is tested through contradiction with the following hypotheses:

- **Null Hypothesis ($\mathbf{H}_0$)**: There is no statistically significant difference in ROI between investments in high capital intensity firms and low capital intensity firms.
- **Alternative Hypothesis ($\mathbf{H}_a$)**: Private equity firms achieve significantly higher ROI when investing in low capital intensity firms.

2 Data

This chapter provides a comprehensive overview of the data collection process. The study is based on a dataset comprising 171 observations gathered from multiple sources. The section also addresses the limitations and adjustments that have influenced the construction of the final dataset.

2.1 Data Collection

The primary data collection for this study was conducted using S&P Capital IQ (S&P Global Market Intelligence, 2025a) and S&P Capital IQ Pro (S&P Global Market Intelligence, 2025b). The study is based on a dataset composed of observed transactions in which private equity firm acquired a whole company and then later sold off to new owners. For each observation, the acquisition value, exit value, acquisition date, and exit date were recorded. The initial data collection was limited according to the following criteria:

- **Time period**: The dataset includes only completed transactions from Jan 2000 to Feb 2025.
- **Geographic scope**: The dataset are limited to companies headquartered in Europe.
- **Transaction type**: This study only includes LBO transactions, where a private equity firm acquires the entirety of a target company.

Table 2.1: Sample Selection Steps

Selection Step	Number of Observations
Initial data selection	4 728
With both buy and sell values matched	409
With complete financial company data	171

Source: S&P Global Market Intelligence (2025a)

As shown in Table 2.1 the sample initilly consisted of 4 728 observations of transactions in Europe between 2000 and 2025 with a documented transaction value. Matching firm names, acquisition and exit dates, as well as buyer and seller information, resulted in 409 observations with both entry and exit values. After incorporating form-specific financial data at the time of the acquisition, the final dataset was further narrowed down to 171 observations.

The final dataset of 171 observations includes transaction details, firm-level variables at the time of the acquisition, dummy variables capturing major economic events, and external macroeconomic factors. See Appendix A for the complete list of columns included in the dataset.

To ensure that the final dataset of 171 observations represent the original dataset of 4 728 observations, three comparisons between the initial dataset and the final dataset were conducted. These comparisons looked at whether there were differences in the country distribution (see Appendix B), year-by-year distribution (see Appendix C), and between average transaction value (see Appendix D).

2.2 Data Processing & Data Cleaning

Data processing was carried out mainly in Excel, while data cleaning and the integration of multiple files was performed using Python.

To efficiently collect firm-level specific variables S&P Capital IQ Excel plug-in was utilized, enabling automated extraction of data from the S&P Capital IQ database.

Python was primarily used for cleaning and merging files, enabling fast and efficient handling of large volumes of data. To ensure data quality and minimize the risk of errors, multiple spot checks were performed.

2.3 Industry Classification

Each observation in the dataset is assigned an industry classification according to the S&P Dow Jones Indices (2025), indicating the sector in which the target or the issuer company operates. The dataset includes the following industries: Automobiles / Aerospace / Defense, Communication Services, Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Information Technology, Materials and Utilities. The dataset consists of companies from these 11 industries, with the highest representation from Industrials and the lowest from Energy.

2.4 Firm Specific Control Variables

The firm-specific control variables were obtained from S&P Capital IQ, based on each company's annual report for the fiscal year preceding the transaction. This approach was chosen to ensure that the data reflects the company's original financial

condition, unaffected by any changes introduced by the buyout itself. The variables included in the dataset are presented in Table 2.2 below.

Table 2.2: Firm-Specific Financial Control Variables

Variable	Description
Total Revenue	Total sales generated by the company during the fiscal year
Total Assets	The sum of all assets owned by the company
EBITDA	Earnings before interest, taxes, depreciation, and amortization
Net Income	The company's total profit after all expenses and taxes
Total Debt	The sum of both short- and long-term liabilities
Total Equity	The value of shareholders' equity
Net PP&E	Net value of plant, property, and equipment assets

Source: S&P Global Market Intelligence (2025a)

The purpose of including these variables is to control for the firm's financial starting position. According to Palepu and Healy (2013) financial statements serve as a foundation for assessing a company's performance, profitability, capital structure, and overall financial health.

To ensure that the data are representative, observations with three or more missing control variables were excluded from the dataset. In cases with at most two missing values, linear interpolation was applied to complete the data. Linear interpolation is further discussed in Section 2.9.2.

Table 2.3: Missing Values for Firm-Specific Control Variables

Control Variable	Missing Values
Total Revenue	10
Total Assets	1
EBITDA	17
Net Income	5
Total Debt	1
Total Equity	3
Net Plant, Property, Equipment	13

Source: Authors' own calculation

Table 2.3 presents the number of missing values for each financial control variable after the exclusion of observations with three or more missing entries. 151 observations had complete financial data, for which interpolation was not required. As shown in Table 2.3, data availability varies across variables.

2.5 Macroeconomic Variables

Three macroeconomic variables have been included in the dataset, see Table 2.4. The macroeconomic variables, inflation, GDP growth, and interest rate, were obtained from the European Central Bank (2025a, 2025b, 2025c). Inflation and GDP growth reflect economic developments across the European region, while the interest rate refers to the key policy rate of the ECB.

Table 2.4: Macroeconomic Control Variables

Control Variable	Definition
Inflation	Percentage change in HICP[1] compared to the same month the previous year
GDP Growth	Real GDP growth rate compared to the previous quarter
Interest Rate	Daily policy rate set by the European Central Bank

Source: European Central Bank (2025a, 2025b, 2025c)
[1]Harmonised Index of Consumer Prices

The ECB's policy rate was selected as a representative indicator of the European interest rate environment, despite the fact that not all countries in the dataset use the euro. While national interest rates may vary, they tend to follow similar trends (Schiffler, 2025), making the ECB rate a suitable proxy for the region's overall financial climate. Inflation and GDP growth were also included to reflect broader macroeconomic conditions, based on monthly price index and quarterly real GDP data (Mitchell et al., 2005). For all three variables, interest rate, inflation, and GDP growth, the dataset contains values at the time of acquisition and exit, as well as the average over the holding period.

2.6 MSCI Europe Index

The dataset also contains a stock index, the MSCI Europe Index. The MSCI Europe Index is an equity index representing the performance of large and mid-cap listed companies in 15 developed European countries (MSCI Inc., 2025). The index is used as a control variable to represent the general market situation. The historical data were obtained from Curvo (2025).

2.7 Dummy Variables

Three binary dummy variables have been included in the dataset and are presented in Table 2.5 below.

Table 2.5: Binary Dummy Variables Included in the Dataset

Dummy Variable	Explanation
Sell Post Covid	Indicates whether the exit occurred after 2020 (1 = Yes, 0 = No)
Buy during financial crisis (2008–2012)	Indicates whether the acquisition occurred during the global financial crisis of 2008–2012 (1 = Yes, 0 = No)
Sell during financial crisis (2008–2012)	Indicates whether the exit occurred during the global financial crisis of 2008–2012 (1 = Yes, 0 = No)

Source: Authors' own definitions

As shown in Table 2.5 the dataset includes only a dummy variable if an exit was conducted after 2020, and not for acquisitions post-2020. This decision is based on the fact that only one observation in the dataset has an acquisition date after 2020.

The time period 2008 to 2012 has been selected to define the financial crisis in this study, in accordance with Shala et al. (2013). Shala et al. (2013) describes this period as a continuous phase of financial and macroeconomic instability in both the United States and Europe. The crisis began with the collapse of the American banking system in 2008 and extended into the European sovereign debt crisis, with effects persisting until 2012.

2.8 Correlation between Variables

To identify potential multicollinearity and guide variable selection, a correlation matrix was produced for key macroeconomic, financial, and firm-level variables. The full pairwise Pearson correlation heatmap is presented in Appendix E.

Given the decision to include average inflation rate, it becomes important to avoid including other macro variables that are highly correlated with it. The average inflation rate and average interest rate during the holding period are strongly correlated ($p = 0.70$). To reduce multicollinearity and maintain interpretability, average interest rate will therefore be excluded. Instead the more time-specific variables interest rate at buy date and sell date will be considered, as they capture monetary conditions at critical decision points.

Furthermore, we examined the correlation matrix to identify and avoid multicollinearity between variables. Based on this, we carried out an iterative model specification process, testing different combinations of variables to assess their individual and joint effects.

2.9 General Adjustments

The following section describes the general adjustments applied to the final dataset.

2.9.1 Winsorization

Extreme outliers can skew the results and compromise the validity of the regression analysis by leading to a non-representative sample (Daszykowski et al., 2007). A well-established approach in financial research is the use of winsorization (Adams et al., 2018). Winsorization is a technique that replaces extreme values in a dataset with values at specified percentiles, thereby reducing the influence of outliers while preserving the overall structure of the data.

ROI values below the 1st percentile and above the 99th percentile were replaced with the respective percentile values. This process was applied to reduce impact of extreme outliers and ensuring that the analysis remains robust without removing any observations (Adams et al., 2018). Appendix F shows a summary of descriptive statistics for ROI, both before and after winsorization.

2.9.2 Missing data

One common approach to handling missing data is to remove all observations that contain missing values. However, this approach can substantially reduce the sample size and, in turn, weaken the statistical power of the analysis. An alternative method is to apply linear interpolation, which offers a simple yet effective way to estimate missing values. According to Blu and Unser (2004) standard linear interpolation performs well in practical applications and is suitable for addressing missing data in quantitative analyses.

In this study linear interpolation was used to approximate missing values by assuming that the change between two known data points can be approximated by a straight line. This technique was applied to firm-specific control variables in order to maximize the use of available observations.

2.9.3 Logarithmic transformation

A well-established strategy in statistical analysis for handling skewed data is the use of logarithmic transformation. This approach is effective when variables illustrate positive skewness (i.e., right-skewed data), which is common for financial and economic measures (Lütkepohl & Xu, 2009). Logarithmic transformation reduces skewness, produces a more normal distribution, and thereby improves the suitability of the data for methods such as regression analysis or t-tests (West, 2021).

West (2021) emphasizes that logarithmic transformation not only reduces skewness but also help stabilize variance and reduce the influence of outliers. Although a logarithmic transformation does not always result in perfectly normal data, it provides a more robust foundation for statistical inference than working with untransformed data.

In this study both the Buy Value and Capital Intensity are logarithmically transformed prior to inclusion in the regression model. The decision to apply logarithmic transformation is supported by the histograms presented in Appendix G and Figure 3.1 which show that the distribution becomes less skewed after the transformation.

3 Method

This chapter outlines the methodological approach used in this study. The analysis is based on secondary data and applies an Ordinary Least Squares (OLS) regression to examine whether a firm's capital intensity influences ROI for private equity firms. Given the use of numerical data and statistical modeling, this is a quantitative study.

3.1 OLS Regression

This study explores the relationship between ROI and levels of capital intensity. The analysis is conducted using cross sectional OLS regressions to assess how ROI varies across these categories. OLS regression is a statistical method used to estimate the relationship between a dependent variable and one or more independent variables (Flom & Strauss, 2003). The general form of the OLS equation is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k + \epsilon \tag{3.1}$$

For a more detailed explanation of OLS regression see Flom and Strauss (2003).

ROI is used as the dependent variable in the analysis, while capital intensity, originally a continuous variable, is transformed into a categorical variable by dividing the sample into three equally sized groups (tertiles), representing low, medium, and high capital intensity. This method of discretizing continuous variables is commonly used in financial and empirical research. This approach simplifies interpretation and allows for detection of non-linear relationships (Fama & French, 1992).

3.1.1 Equation

Equation 3.2 outlines the multiple linear regression model used to examine the determinants of ROI.

$$\begin{aligned} ROI_i = \beta_0 &+ \beta_1 Capital\ Intensity:\ High_i + \beta_2 Capital\ Intensity:\ Medium_i \\ &+ \beta_3 Holding\ Period_i + \beta_4 Interest\ Buy\ Date_i + \beta_5 EBITDA_i \\ &+ \beta_6 GDP\ Growth\ Sell_i + \beta_7 GDP\ Growth\ Sell_i \\ &+ \beta_8 Avg\ Inflation\ HP_i + \beta_9 \log(Buy\ Value_i) + \beta_{10} Sell\ FC_i \\ &+ \beta_{11} Buy\ FC_i + \beta_{12} Sell\ Post\ Covid_i \end{aligned} \tag{3.2}$$

3.2 Variables in the Model

The variables used in the model are presented in Table 3.1 below.

Table 3.1: Summary of Variables

Variable Name	Description
Dependent Variable	
ROI	Return on Investment, calculated as the total return over the holding period
Variable of Interest	
Capital Intensity	Categorical variable indicating capital intensity level (Low, Medium, High), based on the natural log value of NPPE to Revenue ratio. Represented by dummy variables in the regression analysis
Control Variables	
Holding Period	Number of years the investment was held
Interest Buy Date	Interest rate at the time of acquisition
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization at acquisition
GDP Growth Sell	GDP growth rate of Europe at the time of exit
MSCI Europe	MSCI Europe percentage growth during holding period
Avg Inflation HP	Average inflation rate across the holding period
Buy Value	Logarithm of the deal value in million USD
Sell FC	Dummy variable equal one if the investment was sold during the 2008–2012 financial crisis
Buy FC	Dummy variable equal one if the investment was bought during the 2008–2012 financial crisis
Sell Post Covid	Dummy variable equal one if the investment was sold post Covid onset

Source: Authors' own definitions

3.2.1 Return Measurement

The focus of this study is to investigate whether capital intensity is associated with systematic differences in firm performance, as measured by ROI. ROI serves as an indicator of financial performance across these categories, allowing for an evaluation of how varying levels of capital intensity relate to firms' ability to generate returns.

T-tests with robust standard errors are employed to statistically test whether the ROI within each capital intensity group differs significantly from the others. Each group is compared to the low capital intensity group, which serves as the reference category. These tests compare the mean ROI of each group to assess whether observed differences are statistically significant. The t-tests are parametric and assume that the underlying distribution of ROI is normal.

3.2.2 Variables of Interest

To analyze differences in capital intensity, the original capital intensity variable was transformed using the natural logarithm. This transformation was applied to address the strong positive skewness observed in the original distribution in Figure 3.1.

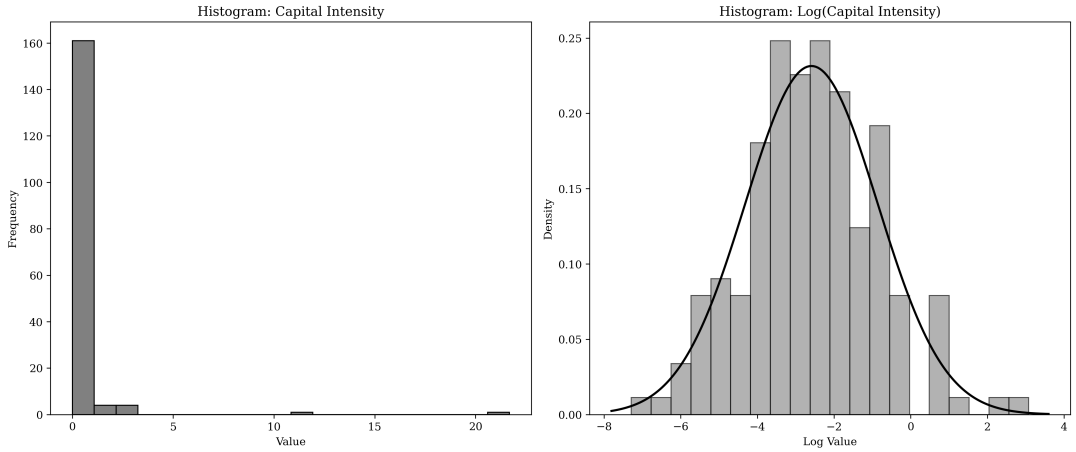


Figure 3.1: Histograms of Capital Intensity and Log-Transformed Capital Intensity
Source: Authors' own calculation

The resulting log-values produced a distribution that more closely approximates a normal distribution seen in the right side of Figure 3.1, making the data more appropriate for statistical analysis.

Based on the log-values, three categories: low, medium, and high were constructed using percentile cut-offs. Firms below the 33rd percentile are classified as low capital intensity, those between the 33rd and 66th percentiles as medium, and

those above the 66th percentile as high. This method allows for a relative comparison of firms' capital intensity across the sample (Altman & Bland, 1994).

3.2.3 Control Variables

Several control variables have been included in the analysis to strengthen causal inferences by ruling out alternative explanations and to reduce omitted variable bias (Li, 2021). This is important because the relationship being studied may not be fully explained by the main variable alone. By adding control variables, the analysis can provide a more complete picture of the different factors that may influence the results. The variables and their potential effects are described in the following sections.

3.2.3.1 Holding Period

Holding period is included as a control variable to account for variations in expected returns across different investment horizons. According to Lyle and Wang (2015), the expected returns converge to their long-term average as the holding period increases, indicating that the investment horizon may influence the magnitude and dynamics of the return.

3.2.3.2 Interest Buy Date

The article by Hyde (2007) suggests that stock returns are influenced by interest rate risk, and therefore is this factor included as a control variable in the model. Interest rate levels at the time of acquisition are taken into account, as private equity transactions are typically highly leveraged and particularly sensitive to financing costs (Kaplan & Strömberg, 2009).

3.2.3.3 EBITDA

EBITDA reflects a company's earnings from core operations, excluding the effects of financing, taxes, and non-cash items. This makes it a useful measure of the company's underlying business performance, independent of its current capital structure, which is likely to change under new ownership in a private equity transaction.

3.2.3.4 GDP Growth Sell

GDP growth is included as a control variable to account for the influence of macroeconomic conditions on equity returns. As highlighted by Schroders Investment Man-

agement (2013), changes in expected economic growth are significantly correlated with market performance.

3.2.3.5 MSCI Europe

The MSCI Europe index is included as a variable to account for general market movements that can influence firm-level returns independently of the explanatory variables of interest. It gives a broad benchmark of European equity performance. Specifically, the MSCI Europe variable reflects the growth over the holding period, calculated as the difference in index value at the time of the purchase and the time of sale divided by its value at the time of purchase.

3.2.3.6 Avg Inflation HP

Average inflation over the holding period is included as a control variable to account for the general price environment during ownership. While growth rates in the model are measured on a quarterly basis, the inflation variable serves as an aggregated annual indicator for macroeconomic stability. Given the low correlation between inflation and other growth variables, it provides additional value without introducing multicollinearity.

3.2.3.7 Buy Value

The buy value is included in the model to account for firm size at the time of the acquisition. A higher buy value indicates greater difficulty in achieving high ROI, since larger firms often exhibit lower relative growth potential (Friedlob & Plewa, 1996). The choice to apply a logarithmic transformation is supported by the histograms in Appendix G which illustrate that the distribution becomes less skewed and more normal distributed.

3.2.3.8 Sell FC & Buy FC

Buy FC and Sell FC are included as dummy variables to account for the potential impact of the Global Financial Crisis. As discussed by Eissler and Wang (2025), the relationship between private equity returns and macroeconomic factors shifted significantly after the crisis, suggesting that transactions made or exited during this time may be systematically affected.

3.2.3.9 Sell Post Covid

Similar to the financial crisis period, key financial growth indicators such as GDP growth declined during the COVID-19 period, indicating the presence of broader macroeconomic effects. To account for these, the variable Sell Post Covid is included as a variable in the model.

3.2.4 OLS Regression Accuracy

To ensure reliable results from an OLS regression, key assumptions must be tested, namely; absence of multicollinearity, homoscedasticity, and normally distributed error terms. Violations of these can lead to biased estimates and invalid conclusions (Sallis et al., 2021). This section will assess these assumptions to verify the robustness of the regression model used.

3.2.4.1 Multicollinarity

Multicollinearity occurs when independent variables in a regression model are highly correlated. This can make it difficult to isolate the individual effect of each variable on the dependent variable. To asses whether multicollinarity is present, two commonly used diagnostic tools are the correlation matrix and the Variance Inflation Factor (VIF) (Sallis et al., 2021). According to Sallis et al. (2021), absolute correlation coefficients greater than 0.9 or VIF values exceeding 10 are considered signs of problematic multicollinearity. This study applies both methods, and the result are as follows:

(i) The correlation matrix in Appendix H shows that the highest absolute pairwise correlation is 0.33, which is well below the commonly used threshold of 0.9.

(ii) The highest VIF value was 2.13, which is well below the commonly accepted threshold of 10. A complete overview of the VIF values is provided in Appendix I.

These results indicate that each predictor can be interpreted independently, without concerns related to multicollinearity.

3.2.4.2 Homoscedasticity

Homoscedasticity refers to the assumption that the variance of the error terms remains constant across all levels of the predicted values. If this assumption is violated, standard errors may become unreliable, leading to incorrect inference, even though the OLS estimator remains unbiased (Sallis et al., 2021). According to Sallis et al. (2021), homoscedasticity can be assessed visually using residual plots. For a more

robust evaluation, the Breusch–Pagan test is applied. The Breusch–Pagan test assesses the null hypothesis of homoscedasticity (Breusch & Pagan, 1979). This study applies both methods, and the results are as follows:

(i) A residuals-versus-fitted plot presented in Appendix J reveals a curved pattern in the residuals, suggesting that the model may not fully capture the underlying data structure. Despite this, the spread of residuals remains relatively constant across the fitted values, indicating no strong evidence of heteroskedasticity.

(ii) The Breusch–Pagan test indicates a violation of the homoscedasticity assumption. Detailed results are presented in Appendix K.

These results provide statistical evidence of heteroskedasticity, indicating that standard errors may not be reliable in this model. To address this issue, the model adopts heteroskedasticity-robust standard errors. This adjustment ensures that statistical inference remains valid despite the non-constant variance in the residuals, thereby enhancing the reliability of coefficient estimates and hypothesis testing.

3.2.4.3 Normality of Residuals

Another important assumption in linear regression is the normal distribution of residuals (Sallis et al., 2021). The normality of the residuals is evaluated using the following methods:

(i) **Q-Q Plot:** Appendix L presents the Q-Q plot used to assess the normality of residuals. The points should align closely with the 45-degree reference line. In this case the plot shows clear deviations in the upper tail, indicating non-normality in the residuals.

(ii) **Jarque-Bera Test:** The Jarque–Bera test is used to formally assess normality (Jarque & Bera, 1987). The results yield a JB statistic of 208.64 with a p-value of 0.0000, clearly rejecting the null hypothesis of normally distributed residuals.

The histogram of residuals presented in Appendix M shows a right-skewed distribution. This further supports the result from the Q–Q plot and the Jarque–Bera test. According to Lumley et al. (2002) the central limit theorem provides robustness in large samples, allowing t-tests and linear regression to remain valid despite deviations from normality. Substantial deviations, especially when combined with issues like heteroskedasticity, still compromise the reliability of p-values and confidence intervals.

These results must be interpreted in conjunction with the earlier findings of heteroskedasticity. Raissi (2018) indicates that heteroskedasticity can bias standard

normality tests, resulting in false rejections. To address both heteroskedasticity and non-normailty the regression analysis is supplemented with a bootstrapped OLS procedure using 1 000 replications (Efron & Tibshirani, 1993), as presented in Appendix F.4, providing more reliable inference.

4 Result

This chapter presents the empirical results of the study. It begins with an overview of the descriptive statistics for the dependent and independent variables followed by the results from the OLS regression.

4.1 Descriptive Statistics

In this section the descriptive statistics are presented. Winsorization is not applied to the data presented in this section.

Table 4.1: Summary Statistics of Dependent and Control Variables

Variable	obs	mean	std	min	25%	50%	75%	max
ROI	171	1.76	3.55	-0.96	0.28	0.99	2.17	37.96
Holding Period[1]	171	5.24	2.90	0.80	3.01	4.82	6.73	15.96
Interest Buy Date	171	0.02	0.01	0.00	0.01	0.02	0.04	0.05
EBITDA[2]	171	32.61	111.31	-110.45	2.59	8.98	24.10	1303.47
GDP Growth Sell	171	0.01	0.02	-0.14	0.01	0.02	0.02	0.06
Avg Inflation HP	171	0.02	0.01	0.00	0.01	0.02	0.02	0.05
Buy Value[2]	171	281.75	518.68	0.18	46.40	93.94	334.25	3350.28
MSCI Europe	171	0.29	0.39	-0.3	0.01	0.22	0.5	1.79
Sell FC	52	0.30	0.46	0.00	0.00	0.00	1.00	1.00
Buy FC	49	0.27	0.44	0.00	0.00	0.00	1.00	1.00
Sell Post Covid	9	0.05	0.22	0.00	0.00	0.00	0.00	1.00

[1] in years, [2] in million USD

Source: Authors' own calculation

Table 4.1 provides summary statistics for the dependent and independent variables used in the regression analysis. Table 4.1 shows the number of observations, mean, standard deviation, minimum, maximum, and selected percentiles (25%, 50%, 75%) for each variable. Looking at ROI, it can be observed that the mean (1.76) is almost double the median (0.99), indicating the presence of a few observations with very high ROI values.

4.1.1 Descriptive Statistics Between The Three Groups

The following three sections presents descriptive statistics between the three capital intensity groups.

4.1.1.1 ROI by Capital Intensity

Table 4.2 presents the summary statistics of ROI categorized by capital intensity levels (Low, Medium, High).

Table 4.2: Summary Statistics of ROI by Capital Intensity

Capital Intensity	obs	mean	std	min	25%	50%	75%	max	Interval[1]
Low	57	2.95	5.66	-0.91	0.50	1.32	2.32	37.96	0.0007 – 0.0353
Medium	57	1.05	1.32	-0.96	0.11	0.80	2.00	4.92	0.0354 – 0.1508
High	57	1.27	1.52	-0.79	0.15	0.98	1.98	5.97	0.1528 – 21.6831

[1]The interval for each category is based on the NPPE/Total Revenue ratio
Source: Authors' own calculations

Across all three categories, the mean ROI is higher than the median (50th percentile), suggesting the presence of higher values (positive skewness) in the distributions. For example, the mean ROI for the Low capital intensity group is 2.95, while the median is 1.32. The maximum ROI also varies notably, with Low reaching 37.96, while Medium and High have substantially lower maxima at 4.92 and 5.97.

Additionally the standard deviation is highest in the Low capital intensity group (5.66), indicating a much greater spread in ROI values compared to Medium (1.32) and High (1.52).

The interval values in Table 4.2 show how firms are distributed based on their capital intensity. Companies categorized as Low have a capital intensity ratio between 0.0007 and 0.0353, Medium firms range from 0.0354 to 0.1508, and High capital intensity firms range from 0.1528 to 21.6831. The wide span of the High category indicates a greater diversity in capital-intensive firms compared to the narrower ranges of the Low and Medium groups.

4.1.1.2 Buy Value by Capital Intensity

Table 4.3 presents the summary statistics of Buy Value by capital intensity level.

Table 4.3: Summary Statistics of Buy Value by Capital Intensity

Capital Intensity	obs	mean	std	min	25%	50%	75%	max
Low	57	127.15	232.97	0.18	22.11	50.03	120.54	1551.36
Medium	57	392.64	732.09	6.58	52.69	110.13	381.83	3350.28
High	57	325.45	433.21	17.00	62.81	167.43	420.73	2668.25

Note: Buy Value in million USD
Source: Authors' own calculation

The Low capital intensity group has the lowest mean and median Buy Value, at 127.15 and 50.03 respectively, indicating that firms with lower capital intensity tend to engage in smaller transactions. This group also has a relatively low standard deviation of 232.97, suggesting more consistent deal sizes.

In contrast the Medium capital intensity group exhibits the highest mean Buy Value of 392.64, yet its median is only 110.13, lower than that of the High group which is 167.43. This indicates a right skewed distribution, driven by a few large deals. This is further reflected in the maximum Buy Value of 3350.28 for the Medium group, the highest across all categories, compared to 2668.25 for the High group.

The High capital intensity group has a lower mean of 325.45 than that of Medium but a higher median, suggesting a more balanced distribution of deal sizes without outliers dominating the average. The minimum values also show that Low capital intensity firms can be involved in very small deals, with a minimum of just 0.18, compared to 6.58 and 17.00 for the Medium and High categories.

4.1.1.3 Selected Control Variables Statistics Between The Groups

Table 4.4 provides a descriptive snapshot of how key variables differ by capital intensity. It presents the median values of selected control variables across the three levels of capital intensity (Low, Medium, High).

Table 4.4: Median Values of Selected Control Variables by Capital Intensity

Capital Intensity	Holding Period[1]	EBITDA[2]	Sell FC[3]	Buy FC[3]	Sell Post Covid[3]
Low	4.13	5.96	16	20	4
Medium	5.26	9.41	18	16	2
High	5.03	15.60	18	10	3

Note: All values represent medians. [1] in years, [2] in million USD, [3] number of deals in each category
Source: Authors' own calculation

The median holding period is fairly consistent across groups, with slightly longer durations observed for the Medium at 5.26 years and High at 5.03 years groups compared to Low at 4.13 years. EBITDA increases steadily with capital intensity. The High capital intensity group shows the highest medians, with 15.60 million USD for EBITDA while Low has 5.96 million USD and Medium 9.41 million USD.

The number of deals sold during the financial crisis (Sell FC) is fairly consistent across the different groups, with 16, 18, and 18 deals for Low, Medium, and High. In contrast the number of deals bought during the financial crisis (Buy FC) decreases from 20 in the Low group to 16 in the Medium group and 10 in the High group.

There are more sales than purchases of high capital intensity targets during the financial crisis. Finally, post Covid deal activity is low across all groups, with only 4, 2, and 3 observations recorded for Low, Medium, and High.

4.1.2 ROI and Capital Intensity by Industry

Figure 4.1 displays the median ROI and median capital intensity for the different industries in the dataset, with each bubble representing a unique industry and the size of the bubble indicating the number of observations. The dashed horizontal and vertical lines represent the overall median ROI and capital intensity, dividing the plot into four quadrants.

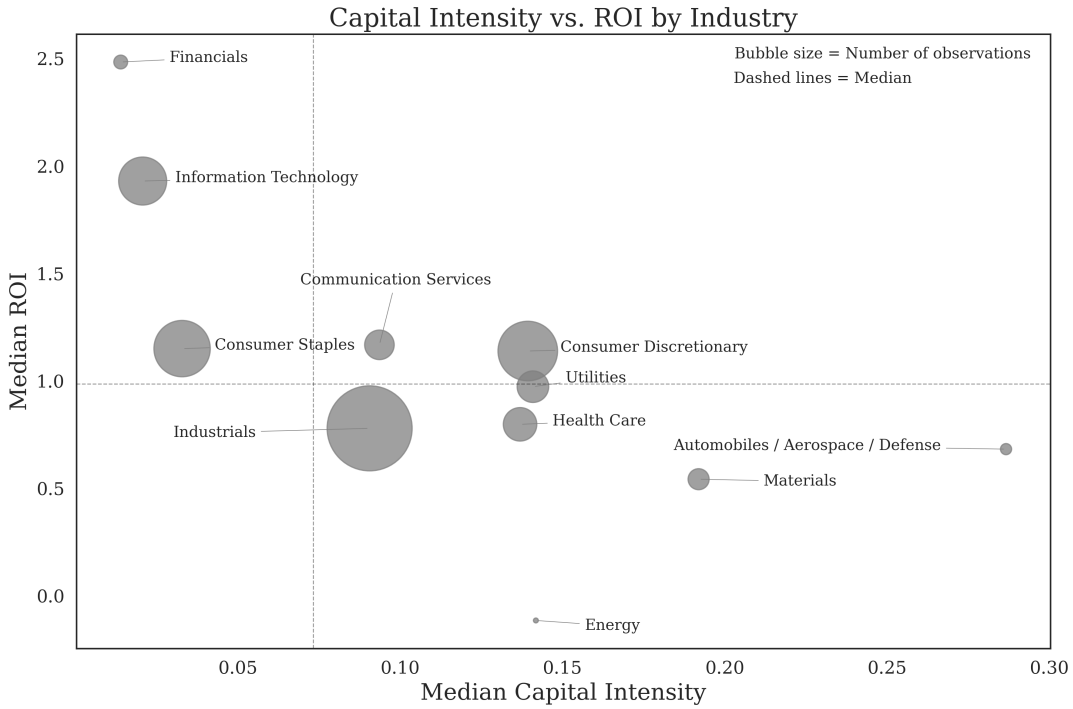


Figure 4.1: Capital Intensity and Median ROI per industry

Source: Authors' own calculation

Industries such as Information Technology, Financials, and Consumer Staples are positioned in the upper-left quadrant, indicating a combination of high ROI and low capital intensity. The lower-right quadrant, characterized by low ROI and high capital intensity, includes industries such as Energy, Healthcare, Automobiles / Aerospace / Defense, and Materials. Notably, the Energy industry is based on only one observation, while Automobiles / Aerospace / Defense includes three observations, and Financials is represented by four. The lower-left quadrant, reflecting both low ROI and low capital intensity, does not include any industries. Commu-

nications Services and Industrials are positioned near the center of the chart, close to the overall median values. Consumer Discretionary and Utilities appear in the lower-central of the upper-right quadrant.

4.1.3 Deal Distribution by Country

Figure 4.2 illustrates the distribution of deals by country.

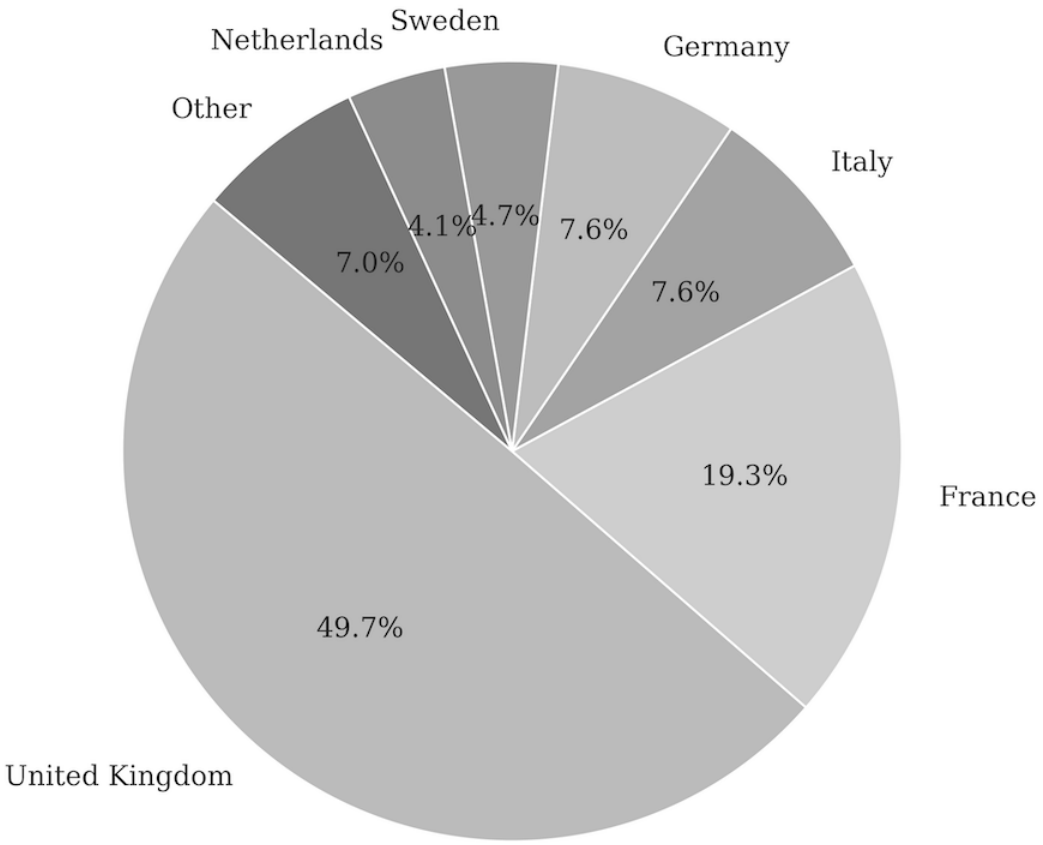


Figure 4.2: Deal Distribution by Country

Note: The "Other" category aggregates countries that each represent less than 3% of the total deals. In total, this includes 6 countries
Source: Authors' own calculation

The United Kingdom accounts for the largest proportion, comprising 49.7% of the total. France follows with 19.3%, while Italy and Germany each represent 7.6%. Sweden and the Netherlands contribute 4.7% and 4.1%, respectively.

4.1.4 Holding Period's Effect on Investment Performance

Figure 4.3 illustrates the relationship between holding period and investment performance, measured in both absolute ROI and AROI[1].

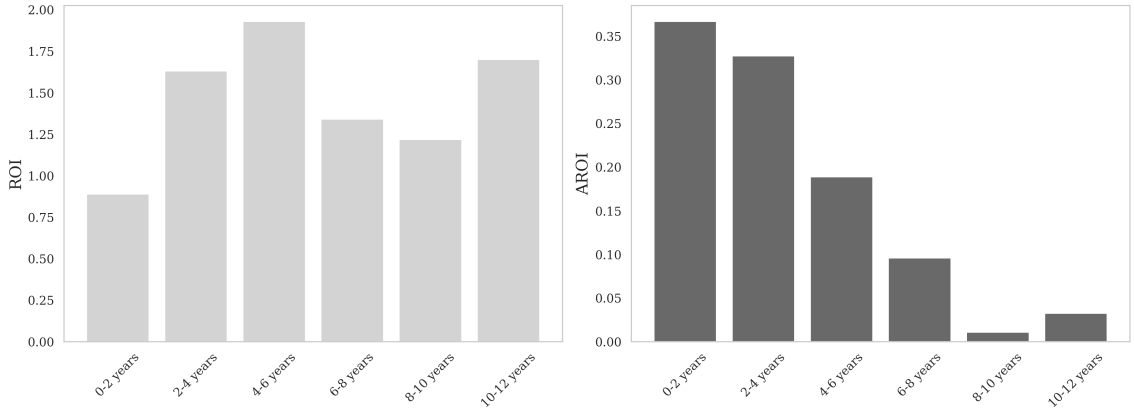


Figure 4.3: ROI and AROI Comparison by Holding Period

Source: Authors' own calculation

The results reveal a clear inverse trend between AROI and holding period duration. Investments held for shorter periods, particularly within the 0–2 and 2–4 year intervals, exhibit the highest average AROI. This suggests that shorter-term deals tend to generate more efficient returns on an annualized basis. Conversely ROI increases with longer holding periods, peaking in the 4–6 year interval. Despite the higher absolute return, AROI in this range decreases significantly, by more than 50% compared to the shortest interval. This highlights the trade-off between absolute and annualized performance.

[1]Annualized Return on Investment (AROI) adjusts the total ROI for the length of the investment period. It is calculated using the formula: $\text{AROI} = (1 + \text{ROI})^{\frac{1}{n}} - 1$, where n is the holding period in years (Damodaran, 2002).

4.2 Regression Analysis

In Table 4.5 the results of the regression analysis are presented.

Table 4.5: OLS Regression Results

Variable	Coefficient	t-statistic	p-value
Constant	3.0208	3.426	0.001***
Holding Period	0.1849	2.388	0.018**
Interest Buy Date	-0.4587	-2.452	0.015**
Sell Post Covid	-1.1719	-1.186	0.237
EBITDA	0.0014	0.888	0.376
Buy Value	-0.4899	-3.848	0.000***
Avg Inflation HP	0.7861	2.075	0.040**
Sell FC	-0.0198	-0.047	0.963
Buy FC	0.0780	0.191	0.849
MSCI Europe	0.5288	0.934	0.352
GDP Growth Sell	0.0373	0.452	0.652
CI_High	-0.9344	-2.089	0.038**
CI_Medium	-1.0975	-2.528	0.012**
Model Summary Statistics			
Adjusted R-squared[1]			0.165
F-statistic			3.794
Observations			171

Notes: * p < 0.1, ** p < 0.05, *** p < 0.01
[1]Financial data often exhibit low R^2 values, as much of the variation tends to be firm-specific rather than explained by common market factors (Morck et al., 2013)
Source: Authors' own calculation

4.2.1 Variables of Interest

The regression results show a statistically significant negative association between capital intensity and ROI. As shown in Table 4.5, both CI_High and CI_Medium are negatively related to the dependent variable, with coefficients of –0.9344 (p = 0.038) and –1.0975 (p = 0.012). These findings indicate that, compared to the reference group (Low capital intensity), firms classified as having Medium or High capital intensity yield a lower ROI. Holding all else constant, investing in a High capital intensity firm is associated with a 0.93 percentage point lower ROI, while medium capital intensity is linked to a 1.10 percentage point lower ROI. The effects are statistically significant at the 5% level confirming the alternative hypothesis that investments in Low capital intensity firms yield a higher ROI.

4.2.2 Control Variables

The regression results indicate that several control variables are statistically significant in explaining variation in ROI. Holding Period has a positive coefficient of 0.1849 (p = 0.018), indicating that a longer holding period is associated with higher ROI. This means that, on average, each additional year a firm is held increases ROI by approximately 0.18 percentage points, holding all else constant. Avg Inflation HP also exhibits a positive and statistically significant relationship with a coefficient of 0.7861 (p = 0.040). This indicates that higher average inflation during the holding period corresponds to greater ROI.

Buy Value, a proxy for transaction size, has a significant negative coefficient of –0.4899 (p = 0.000), implying that larger deals yield lower returns. Interest Buy Date is also statistically significant with a negative coefficient of –0.4587 (p = 0.015), indicating that higher interest rates at the time of investment are associated with lower ROI.

In contrast, other control variables such as EBITDA (coefficient = 0.0014, p = 0.376), Sell Post Covid (coefficient = –1.1719, p = 0.237), Sell FC (coefficient = –0.0198, p = 0.963), Buy FC (coefficient = 0.0780, p = 0.849), MSCI Europe (coefficient = 0.5288, p = 0.352) and GDP Growth Sell (coefficient = 0.0373, p = 0.654) do not show statistically significant associations with ROI.

5 Analysis

This chapter presents the main empirical findings and interprets them in the context of the study's hypotheses and theoretical framework.

5.1 Lower Capital Intensity Leads to Higher Returns

The regression results show that firms with low capital intensity are associated with significantly higher ROI compared to both medium and high capital intensity firms. This provides evidence to reject the null hypothesis in favor of the alternative hypothesis, suggesting that capital intensity does influence ROI for private equity firms.

This finding confirms the theoretical perspectives of Cuny and Talmor (2007), who argue that private equity strategies are most effective in environments where value can be unlocked through operational improvements, such as cost reductions, process efficiencies, or strategic repositioning, rather than through large-scale capital investments. Their model suggests that firms requiring heavy capital expenditures are less attractive targets, as the returns from these investments are slower to materialize and less compatible with the relatively short fund lifecycles and higher opportunity costs that private equity investors face. Similarly, the results are in line with Komonen et al. (2006), who highlights that capital-intensive industries are characterized by continuous reinvestment needs and long-term asset management strategies. These structural characteristics limit financial flexibility and reduce free cash flow, restricting a firm's ability to service debt and distribute returns within typical private equity timeframes. Supporting this, Table 4.4 show that both high and medium capital intensity firms are associated with longer average holding periods (5.03 and 5.26 years, respectively) compared to low capital intensity firms (4.13 years). These findings reinforce the view that capital intensity shapes not only return outcomes but also the timeline and feasibility of private equity investment strategies.

The relationship between capital intensity and ROI varies across industries, as illustrated in Figure 4.1. For instance Consumer Discretionary appears in the higher range of capital intensity among the industries but still delivers a ROI above the overall median across all industries. Similarly Communication Services, despite be-

ing moderately capital-intensive, also has strong ROI. In contrast Consumer Staples, a low capital intensity industry, displays nearly the same median ROI as Consumer Discretionary.

These patterns suggest that while capital intensity plays a role, other factors such as industry-specific characteristics also influence ROI. This view is supported by EQT Group (2025a), who emphasize that commercial due diligence is the most critical element in assessing the potential in a target company. This process includes an evaluation of the target's market position, competitive landscape, and long-term growth potential.

An interesting pattern emerges when examining the effect of capital intensity on ROI. The difference in ROI between low and medium capital intensity firms is greater than the difference between low and high capital intensity firms. While both effects are statistically significant, the coefficient for medium (-1.0838) is larger in absolute value than that for high (-0.8857). This result is somewhat unexpected, as one might assume that firms with the highest capital intensity would show the greatest difference in ROI compared to low capital intensity firms.

One possible explanation relates to the nature of the firms pursuing these deals. As shown in Table 4.3, high capital intensity firms have the highest median buy value, implying that acquiring these companies requires significantly more capital upfront. According to Thaker (2014), the majority of high-return private equity transactions are undertaken by the world's largest and most experienced firms. These firms not only possess the highest levels of skill and experience, but also the greatest access to capital, enabling them to pursue high-capital deals. Cavagnaro et al. (2018) further supports this by emphasizing that private equity is a skill-driven industry, which makes it possible only for these top-tier firms to successfully pursue and manage such capital-intensive investments.

This suggests that high capital intensity firms yield better ROI than medium capital intensity firms not because they are inherently more attractive targets, but because only the largest and most experienced firms are able to pursue them. In contrast, medium capital intensity firms are more accessible to a broader range of private equity firms, including those with less experience and fewer resources, which may contribute to the lower average ROI observed for these investments.

5.2 Significant Control Variables

5.2.1 Holding Period Effects on ROI

The OLS regression is displayed in Table 4.5 which show that the holding period has a statistically significant and positive effect on ROI at the 5% level, indicating that on average, longer holding periods are associated with higher ROI. The holding period is a critical determinant of private equity performance, as it reflects both the duration available for implementing value creation strategies and the efficiency with which returns are realized. As noted by Erdogmus et al. (2004), ROI must be interpreted in conjunction with time and risk to fully capture the economic value of an investment.

While longer holding periods result in higher absolute ROI, they do not necessarily translate into superior annualized returns as shown in Figure 4.3. A reason for this could be that once core improvements are made, additional time can yield diminishing marginal gains relative to the duration of the investment. As shown in Figure 4.3, shorter holding periods (0–2 and 2–4 years) are associated with the highest AROI values, supporting the findings of Thaker (2014), who highlight that highly skilled private equity firms are often able to execute changes quickly and achieve strong returns in a short period.

On the other hand, absolute ROI tends to peak in the 4–6 year range according to Figure 4.3, which indicates that this may represent an optimal balance between time and return. This aligns with Joenvaara et al. (2022) who states that the average holding period for private equity firms is around 5.8 years. The figure also shows that longer holding periods beyond 6 years are not consistently associated with superior outcomes, neither in terms of ROI nor AROI. This suggests that extended timelines do not guarantee higher returns and may reflect challenges in executing an exit. After all, as part of the private equity process, one might consider whether the value creation eventually reaches a ceiling. Once key improvements have been implemented, there may simply be little left to optimize. These findings align with the conclusions of Joenvaara et al. (2022), who emphasize that much of the value creation in leveraged buyouts occurs early in the investment lifecycle. Their study highlights the importance of timely exits and suggests that there is a limited window in which returns can be maximized before diminishing marginal gains or external factors reduce value. This supports the interpretation that the 4–6 year range may represent a strategic sweet spot for maximizing absolute ROI, while the higher AROI observed in shorter holding periods reflects the effectiveness of skilled firms executing

value creation rapidly.

Taken together, the findings suggest that while private equity firms must allow enough time for operational improvements, the most efficient and highest performing deals tend to occur within a holding period of 2 to 6 years.

5.2.2 Interest Rate and ROI

The OLS regression outcomes are displayed in Table 4.5, which indicate a statistically significant negative impact of interest rates at the time of acquisition on ROI at the 5% level.

Although Axelson et al. (2013) emphasize that lower interest rates tend to lead to higher transaction multiples and overpayment, causing weaker returns in the long run, the results indicate that high interest rates at the time of acquisition cause adverse effects on ROI. In line with this EQT Group (2025b) provides further context, showing that as interest rates increased significantly between March 2022 and July 2023, global deal values declined by 60% and exit values fell by 66%. Taken together, these findings underscore the importance of interest rates as a key macroeconomic factor influencing both deal activity and investment outcomes in private equity.

5.2.3 Buy Value's Effect on ROI

The OLS regression results in Table 4.5 show that Buy Value has a statistically significant negative relationship with ROI at the 5% level, indicating that larger acquisition sizes are associated with lower ROI. This result aligns with the findings of Fama and French (1992), who observed that smaller companies tend to outperform larger ones in the stock market.

Furthermore, the finding is consistent with the argument presented by Friedlob and Plewa (1996), who note that larger firms typically exhibit lower relative growth potential. As such, the negative association between Buy Value and ROI may also reflect the inherent challenges in generating outsized returns from large-scale investments, where opportunities for rapid operational improvements or scaling efficiencies are often more constrained.

This pattern is also evident in the descriptive statistics. Table 4.3 shows that the low capital intensity group has the lowest median buy value. At the same time, Table 4.2 reports that the low group achieves the highest median but also the highest standard deviation of ROI between the three groups, indicating greater variability in ROI. This higher dispersion reflects elevated risk, consistent with Fama and French

(1992) argument that smaller firms carry more uncertainty but also higher returns compared to larger firms.

5.2.4 Average Inflation Rate Effect on ROI

The OLS displayed in Table 4.5 show a positive and statistically significant relationship with ROI, indicating that investments held during more inflationary periods tended to yield slightly higher returns. A possible explanation is that nominal revenue growth or price adjustments may have supported company performance under such conditions. However, as inflation is not a central focus of the analysis, the result is primarily interpreted as supporting the model's control structure rather than representing a key driver of ROI.

5.3 Non-Significant Control Variables

5.3.1 Sell Post Covid

The regression results show that the variable Sell Post Covid has a negative coefficient of -1.1719, but it is statistically insignificant (p = 0.237), indicating no meaningful effect on ROI. Several caveats must be considered when interpreting this result. First, the number of observations (9) in the post Covid period is relatively limited, which restricts the statistical power of the analysis. Second, isolating the effect of COVID-19 on private equity returns is difficult, as the pandemic was followed by a series of major geopolitical and macroeconomic shocks, including the outbreak of the Russia–Ukraine war in 2022 and the conflict in Gaza. These overlapping crises likely influenced global investment dynamics, making it challenging to isolate the effects of the pandemic to changes in ROI. Moreover, the year 2021 was exceptionally strong for public equity markets, which further makes it difficult to isolate the effect of COVID-19 on ROI on private equity investments (Curvo, 2025). Compounding these issues is the fact that many private equity investments made during or after the pandemic have not yet reached their exit phase, limiting available data on realized returns. As such, the post Covid market remains volatile and uncertain, and the long-term impact on private equity returns is still unfolding.

5.3.2 EBITDA

The regression results show that the variable EBITDA has a positive coefficient of 0.0014, but it is statistically insignificant (p = 0.376), indicating no meaningful

linear relationship between EBITDA levels at the time of acquisition and ROI. This result might seem unexpected at first glance, as a higher EBITDA generally reflects stronger operational performance, independent of a firm's capital structure. From this perspective, one would expect firms with higher EBITDA to deliver better returns.

Financial metrics like EBITDA provide a snapshot of current performance, but private equity firms typically base their investment decisions on a company's future growth potential, as identified through the commercial due diligence process. According to EQT Group (2025a), commercial due diligence plays a critical role in valuing a company by assessing market positioning, customer dynamics, and long-term growth prospects. This suggests that a low EBITDA at acquisition is not necessarily a barrier to investment, particularly if the firm is expected to scale significantly over the holding period. Conversely, if a company already has a very high EBITDA at entry, the scope for further operational improvements may be limited. This may indicate that private equity firms prefer to acquire companies with greater EBITDA improvement potential, where value creation opportunities are greater.

It is therefore reasonable to assume that ROI in private equity deals may be more closely related to future EBITDA development rather than static figures at entry.

5.3.3 Sell & Buy Financial Crisis

Both Sell FC and Buy FC refer to whether the transaction occurred during the financial crisis period, and their p-values (0.963 and 0.849 respectively) indicate that they are not statistically significant. The coefficient for Buy FC is positive (0.0780), while Sell FC is negative (-0.0198), though both are close to zero. Despite their lack of statistical significance, the direction of the coefficients aligns with an economically intuitive narrative. Acquisitions during the financial crisis (Buy FC) may have capitalized on temporarily depressed valuations and market dislocation, allowing private equity firms to purchase assets at favorable prices with substantial upside potential. Conversely, exits during the crisis (Sell FC) may have been driven by liquidity constraints or unfavorable market conditions, likely resulting in lower exit valuations and weaker ROI outcomes.

This interpretation is further supported by Table 2.2, which shows that there were over 17% more exits than entries recorded during the financial crisis period, suggesting that a number of firms were sold despite potentially poor timing. As emphasized by Joenvaara et al. (2022), who finds that timely exits are essential for realizing strong returns. In this context, the negative coefficient on Sell FC may reflect the downside of being forced to exit amid crisis conditions, while the positive

Buy FC coefficient supports the idea that acquisitions made during downturns, when valuations are low can set the stage for stronger returns.

5.3.4 MSCI Europe and GDP Growth Sell

The coefficients for MSCI Europe and GDP Growth at Sell are 0.5288 and 0.0373, respectively, though neither is statistically significant (p-values of 0.352 and 0.652). Despite the lack of significance, the direction and magnitude of the effects are notable. The MSCI Europe growth during the holding period shows a relatively high coefficient, which is reasonable since the index serves as a proxy for how the market values companies. Similarly the positive coefficient for GDP growth at the time of exit makes sense. A stronger macroeconomic environment generally reflects healthier economic conditions, which can lead to higher company valuations at the time of exit as investors are more willing to pay premiums in favorable market climates.

These results align broadly with findings from the literature. Eissler and Wang (2025) argue that macroeconomic strength, especially in the exit phase, is among the most critical drivers of private equity returns. Similarly Aigner et al. (2008) highlight that private equity performance tends to improve in periods of general economic growth.

5.4 Insights from the Industry

We had the opportunity to speak with Simon Tillmo, Managing Director at EQT Partners, which is ranked as the third largest private equity firm globally according to Private Equity International (2024). He provided valuable reflections on the findings. Tillmo shared that high capital intensity firms could also be attractive investments in the right context, particularly when they benefit from high barriers to entry or generate stable cash flows. These characteristics can reduce the overall investment risk and help support debt repayments, which may make such firms appealing despite their higher capital requirements. This is particularly relevant in leveraged buyouts, where transactions are often financed with a high proportion of debt, making stable cash flows an important factor for ensuring financial sustainability. This is an aspect that the analysis does not fully account for, as it does not explicitly consider differences in investment risk. Tillmo also mentions that fixed assets can be used to increase the leverage of the deal, making it easier to obtain higher levels of financing compared to firms that do not possess such collateral. However, while some high capital intensity firms benefit from stable cash flows, these are generally lower due to the ongoing need for reinvestments in the asset base.

Tillmo also pointed to the difference between two common investment cases in private equity, growth and value, and how these relate to capital intensity. High capital intensity firms often require a different type of value creation, with more focus on efficiency and stability, which is more typical of value cases. In contrast, low capital intensity firms are generally more scalable and often associated with growth cases[1].

Tillmo also noted how value creation in private equity has evolved over time. Earlier strategies often relied more on financial leverage, while today there is a stronger focus on operational improvements and driving growth. This development supports the idea that low capital intensity firms may be more aligned with how private equity firms create value today.

5.5 Sources of Errors

Despite the robustness of the methodology, several limitations should be acknowledged. The final sample includes only 171 observations out of a possible 4 728 transactions identified in Europe over the last 25 years. This represents approximately 3.6% of the total observations, indicating that the dataset used in the regression analysis is a relatively small subset of the broader private equity market.

The composition of the dataset should also be considered when interpreting the results. As illustrated in Appendix B, the country distribution in the main dataset is fairly balanced, with the United Kingdom, France, Germany, and Italy together accounting for the majority of the observations. This is broadly in line with the larger dataset, although some smaller markets are underrepresented or missing entirely.

In addition to country representation, differences in transaction year distribution may introduce bias. As shown in Appendix C, the final dataset overrepresents certain time periods compared to the full sample, particularly around peak activity years such as 2007 and 2010. This could affect results if deal characteristics systematically vary across time.

Moreover, Appendix D shows that the average transaction size in the final dataset is slightly smaller than in the initial dataset, with a difference of 7.9%. This suggests a mild selection effect where larger deals may be underrepresented, potentially influencing observed return or structure patterns.

Another limitation stems from the use of interpolation techniques for certain

[1] A value case typically involves improving an existing business through operational changes or restructuring, often in firms with established assets and predictable cash flows. A growth case focuses on expanding a business in a growing market, where the aim is to scale operations quickly rather than restructure existing ones (Hammer et al., 2022).

variables. While necessary to deal with missing data, interpolation inevitably introduces some degree of approximation and may deviate from actual values. This can affect the precision of the estimates, particularly in time series components such as macroeconomic indicators.

The construction of the capital intensity variable may also introduce uncertainty. Capital intensity can appear artificially high in some cases, especially for younger companies that are common targets in private equity transactions. These firms often have relatively low or even negligible revenues in the early stages of ownership, while still holding tangible fixed assets on their balance sheets. As a result, the ratio of Net Property, Plant, and Equipment (NPPE) to revenue may be inflated, potentially overstating the firm's structural capital intensity and distorting comparisons across more mature firms.

Although the regression results demonstrate statistically significant effects for several explanatory variables, the adjusted R-squared remains low. While this is not uncommon in financial and economic research involving heterogeneous firm-level data (Morck et al., 2013), it raises the possibility that other important explanatory variables are missing from the model.

These factors should be considered when interpreting the findings and assessing the broader applicability of the results.

5.6 Further Research

This study has grouped capital intensity into three broad categories (Low, Medium, High). Future research could explore alternative ways of defining capital intensity. For example using continuous measures or quartiles, and test for non-linear effects or interaction terms between capital intensity and industry classification.

This study focuses on the relationship between capital intensity and ROI for private equity firms by categorizing firms into low, medium, and high capital intensity. This approach provides insights into how capital structure relates to ROI, it does not fully account for the industry specific characteristics that may influence these outcomes. As shown in the results, some industries deviate from the general pattern, suggesting that sector-specific factors could affect the relationship between capital intensity and ROI.

Another suggestion for future research is to examine the role of operational strategies and value creation plans in capital intensive versus non-capital intensive firms. This could include qualitative case studies of how private equity firms approach operational improvements across different sectors.

An interesting extension for future research would be to analyze EBITDA growth from acquisition to exit as a predictor of ROI, which may better capture the impact of value creation over time.

6 Conclusion

This study set out to examine how the capital intensity of acquired companies affects the ROI for private equity firms. The empirical results provide robust evidence that capital intensity is a statistically significant determinant of ROI, thereby allowing us to reject the null hypothesis. Firms with lower capital intensity consistently outperform those with medium and high capital intensity in terms of ROI, indicating that capital intensity is not merely a background characteristic, but an important variable influencing investment outcomes in the private equity space.

This finding aligns with existing theory suggesting that private equity firms prefer companies where value can be unlocked through operational improvements rather than through heavy reinvestment in fixed assets. High capital intensity firms typically require ongoing funding for maintenance and upgrades, which constrains financial flexibility and limits the speed with which returns can be realized. Additionally, the finding that medium capital intensity firms underperform relative to both low and high categories suggests a possible structural disadvantage. These firms may lack both the scalability of low capital intensity businesses and the stability or strategic appeal of high capital intensity firms that are typically targeted by the most experienced and well-capitalized private equity investors.

Importantly, insights from the industry provide a complementary perspective. As noted by Simon Tillmo, Managing Director at EQT Partners, high capital intensity firms can still be attractive under certain conditions. When such companies benefit from high barriers to entry or generate stable cash flows, they may reduce overall investment risk and support debt repayments. This is particularly relevant in leveraged buyouts, where predictable cash flows can enhance financial sustainability. Fixed assets may also be used as collateral to secure higher levels of leverage. While these aspects are not explicitly captured in the analysis, they highlight contextual factors that may make high capital intensity firms viable investments, particularly for large and experienced private equity players.

While several control variables, such as holding period, buy value, and inflation, also contributed to explaining ROI, the adjusted R-squared remains modest. This reflects the complexity of return generation in private equity and suggests that other factors, including operational strategies, market timing, and management quality, may also significantly influence outcomes.

The study is subject to certain limitations, including a relatively small sample size

and potential selection bias due to data availability. Moreover, the categorization of capital intensity, while useful for interpretability, may oversimplify a more complex and continuous relationship. Differences in industry dynamics and the strategic positioning of each firm are also not fully accounted for in the model.

Future research could build on these findings by exploring capital intensity as a continuous variable and investigating how it interacts with industry characteristics or specific value creation strategies. Analyzing EBITDA growth over the holding period, or incorporating qualitative assessments of operational improvements, could also yield deeper insights into the mechanisms behind ROI variation in private equity.

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Appendix

A List of Variables Used in the Dataset

Table A.1: Variable Names Included in the Dataset

Variable Name
Target or Issuer
Country/Region
Industry
Buy date
Sell date
Holding Period (Years)
Buy value ($M)
Sell value ($M)
Profit ($M)
ROI
AROI
Post Covid
Buy during financial crisis (2008-2012)
Sell during financial crisis (2008-2012)
MSCI index buy date
MSCI index sell date
MSCI index growth
Interest rate at buy date
Interest rate at sell date
Avg interest rate during holding period
GDP Growth at buy date
GDP Growth at sell date
Avg GDP Growth during holding period
Inflation rate at buy date
Inflation rate at sell date
Avg inflation rate during holding period
Total Revenue
EBITDA
Total Assets
Net Income
Total Debt
Total Equity
NPPE
Capital intensity (NPPE/Total Rev)
Log(Capital Intensity)
Categorical Variables (NPPE/Total Rev)

B Country Distribution Between Initial and Final Dataset

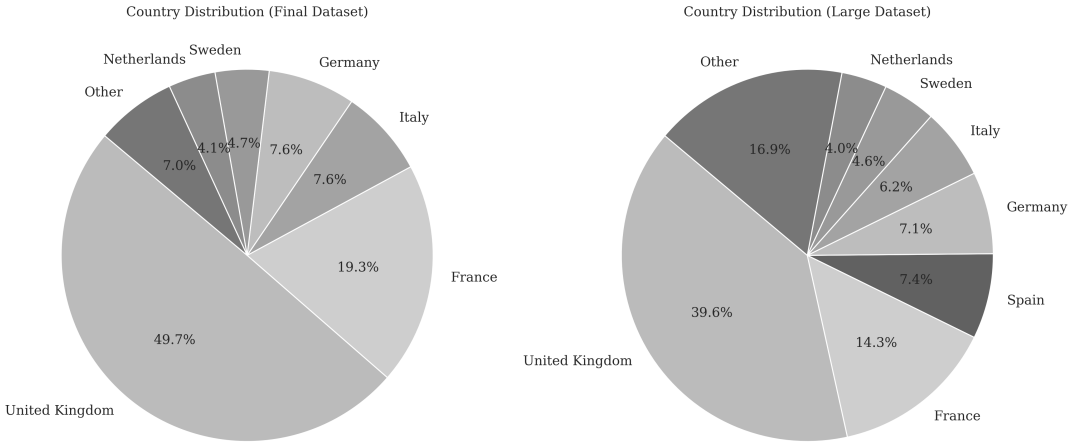

Figure B.1: Country distribution of transactions in the final (left) and large (right) datasets. Countries representing less than 3.0% of the total were grouped into "Other".

C Transaction Distribution Between Initial and Final Dataset

Figure C.2: Yearly distribution of transactions in the final (dark gray) and large (light gray) datasets. The figure shows how deal activity varies across time in both samples.

D Average Transaction Size by Dataset

Table D.2: Comparison of average transaction size and sample size between the large and final dataset.

Dataset	Avg. Size (MUSD)	Observations	Diff. (%)
Large Dataset	306.21	4726	–
Final Dataset	281.75	171	-7.97%

Source: Authors' own calculation

E Correlation matrix

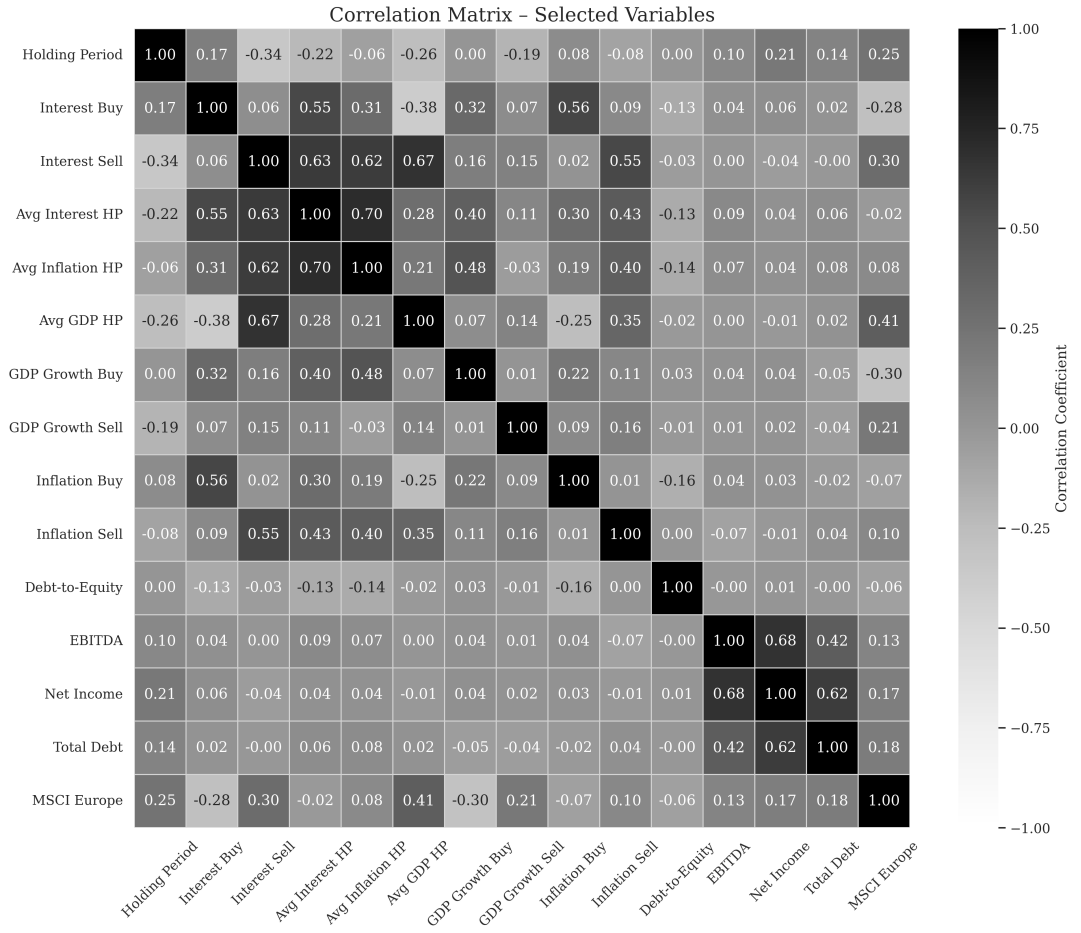

Figure E.3: Correlation Matrix – Selected Variables

F Winsorization

Table F.3: Summary Statistics of ROI Before and After Winsorization

Variable	Count	Mean	Std	Min	25%	50%	Max
ROI	171	1.76	3.55	-0.96	0.28	0.99	37.96
ROI (w)[1]	171	1.61	2.38	-0.91	0.28	0.99	13.25

[1] Winsorized at the 1st and 99th percentiles.
Source: Authors' Own Calculation

Table F.4: Bootstrapped Regression Results (1000 Replications)

Variable	Coefficient	t-statistic	p-value
Constant	3.0721	3.27	0.001***
Holding Period	0.1835	1.67	0.096*
Interest Buy Date	-0.4666	-2.36	0.019**
Sell Post Covid	-1.0948	-0.80	0.427
EBITDA	0.0032	0.88	0.379
Buy Value	-0.5190	-3.16	0.002***
Avg Inflation HP	0.8322	2.11	0.036**
Sell FC	-0.0289	-0.08	0.936
Buy FC	0.1158	0.28	0.779
MSCI Europe	0.4264	0.87	0.386
GDP Growth Sell	0.0427	0.52	0.601
CI_High	-0.9052	-2.08	0.039**
CI_Medium	-1.1216	-2.52	0.013**
Model Summary Statistics			
Adjusted R-squared			– (Bootstrapped)
F-statistic			– (Not applicable)
Observations			171

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Source: Authors' Own Calculation

G Histograms: Buy value

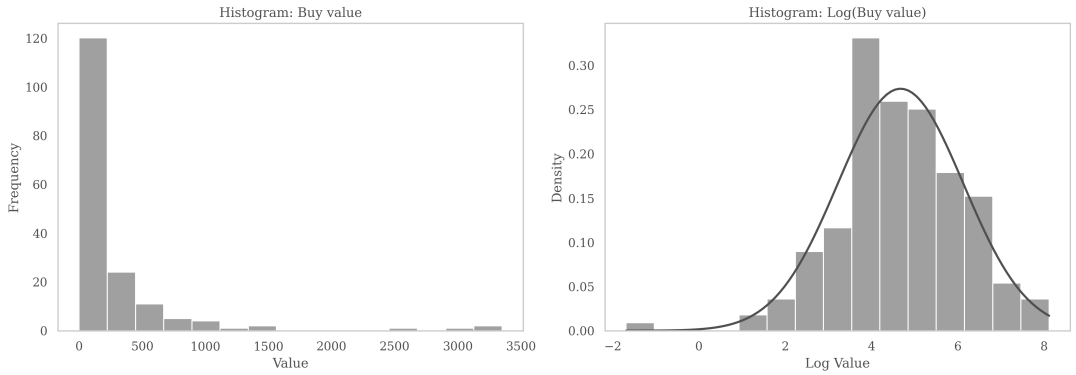

Figure G.4: Histograms of Buy value and Log-Transformed Buy value

H Correlation Matrix - Control Variables

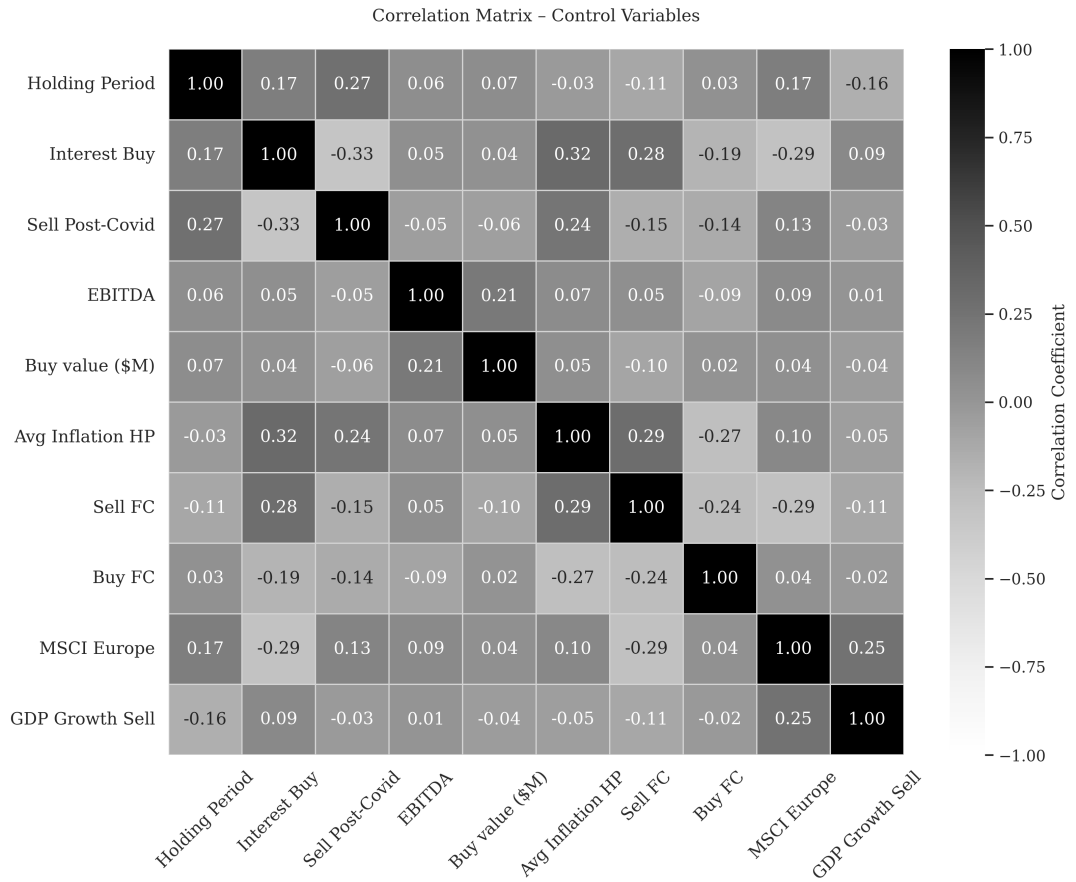

Figure H.5: Correlation Matrix – Control Variables

I Variance Inflation Factor

Table I.5: Variance Inflation Factor (VIF) for Regression Variables

Variable	**VIF**
Constant	28.17
Holding Period	1.82
Interest Buy Date	2.13
Sell Post Covid	1.76
EBITDA	1.09
Buy Value	1.25
Avg Inflation HP	1.75
Sell FC	1.38
Buy FC	1.19
MSCI Europe	1.73
GDP Growth Sell	1.32
CI_High	1.61
CI_Medium	1.52

Source: Authors' Own Calculation

J Residuals vs Fitted

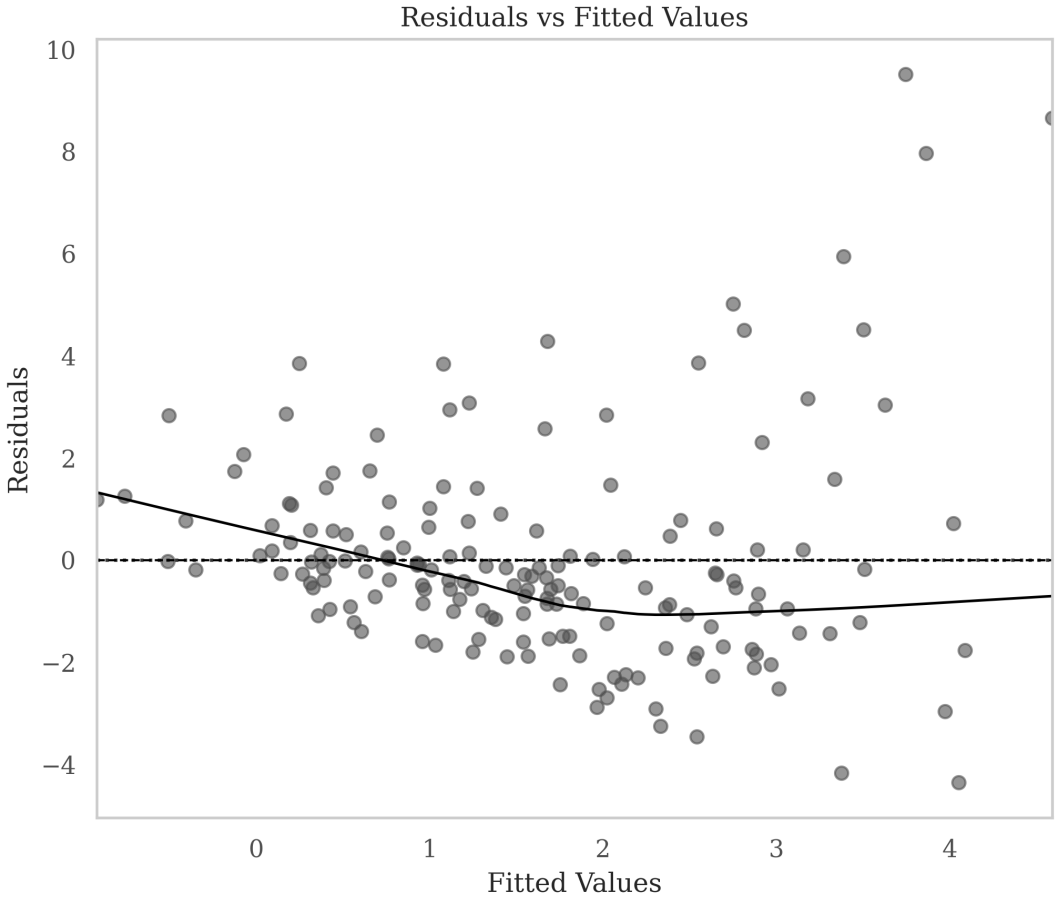

Figure J.6: Residuals vs Fitted Values

K Breusch-Pagan Test

Table K.6: Breusch-Pagan Test for Heteroskedasticity

Statistic	**Value**
LM Statistic	35.39
LM p-value	0.00041
F-statistic	3.44
F p-value	0.00017

Source: Authors' Own Calculation

L Q-Q Plot - Residuals

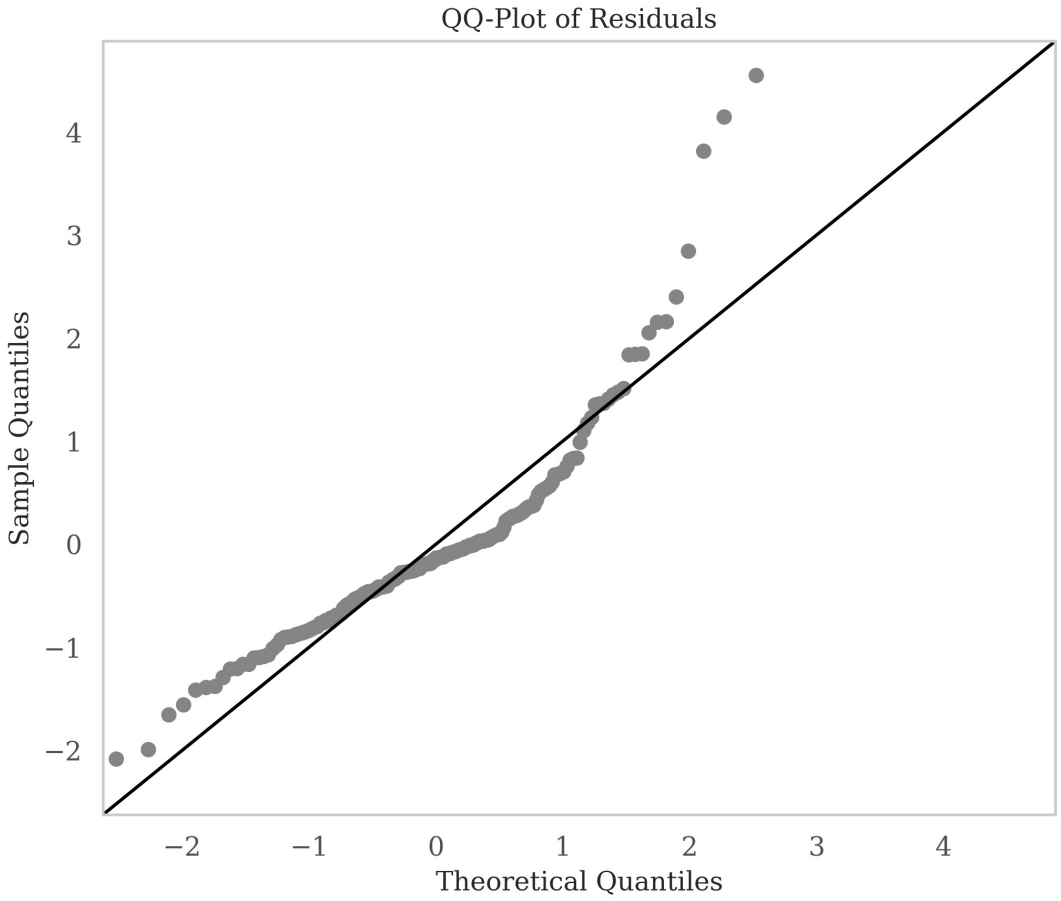

Figure L.7: Q-Q Plot of Residuals

M Histogram of Residuals

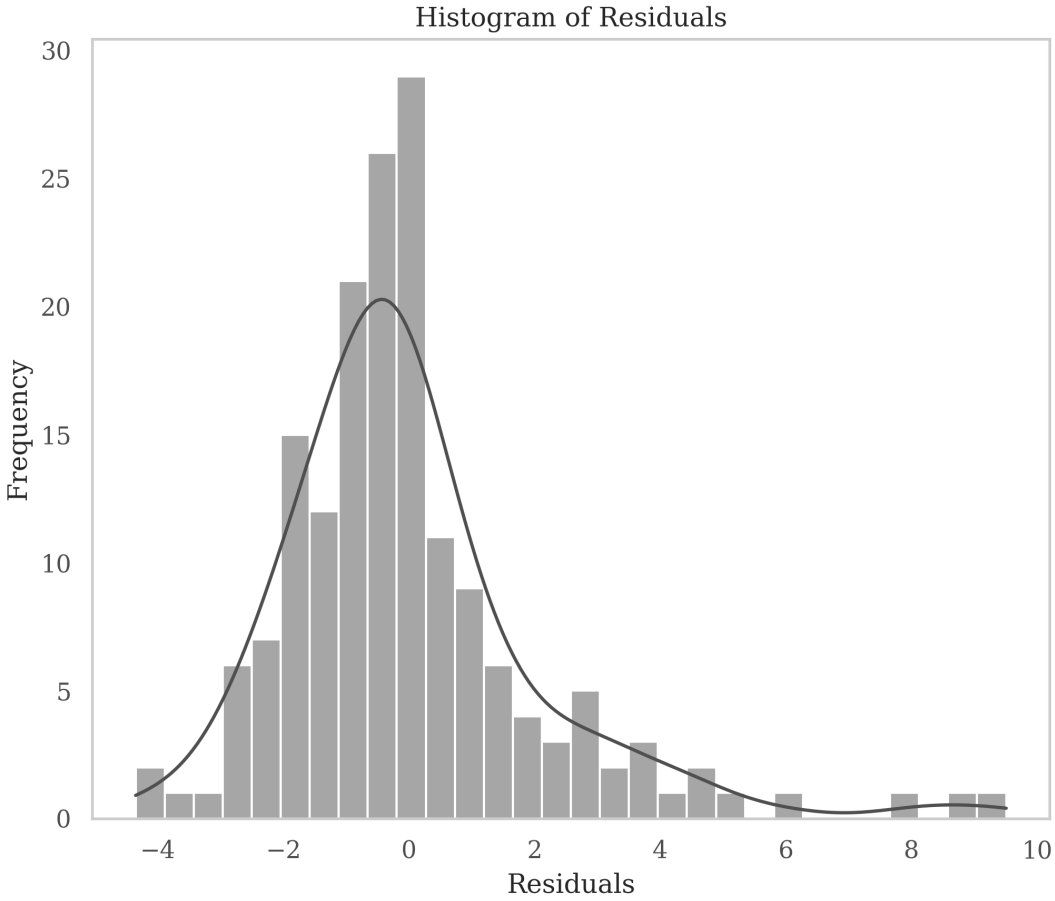

Figure M.8: Histogram of Residuals

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