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"Reassessing the Fundamental Determinants of Stock Returns: A Panel Data Analysis of NYSE Firms (2013–2023) Incorporating Profitability, Leverage, Firm Size, and Market Dynamics"

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Abstract

This study examines the primary determinants of stock returns for companies listed on the New York Stock Exchange (NYSE) from 2013 to 2023, emphasising the influences of leverage, profitability, business size, and market-wide fluctuations. Utilising a panel dataset of 330 enterprises across various industries, this study applies fixed effects panel regression models to address unobserved heterogeneity at the firm, time-based, and industry levels. Key financial indicators—such as total debt-to-equity (leverage), return on equity (ROE), and total assets (serving as a proxy for firm size)—are adjusted to reduce skewness and outliers using winsorization and logarithmic transformation. The market return is utilised as a control variable to separate systematic effects.

The findings demonstrate a positive and significant correlation of stock return between profitability (ROE) and market return, indicating that more efficient and higher-performing enterprises generate greater investor returns. The size of a firm exhibits a negative correlation with returns, consistent with the "size effect" identified in previous studies. Nevertheless, leverage does not demonstrate a uniform or substantial correlation with returns across all models. A robustness check that excludes financial firms verifies the overall stability of these linkages.

The results endorse multifactor asset pricing theories, emphasising the significance of firm-specific fundamentals in elucidating return variability beyond market risk. Diagnostic tests verify the existence of heteroskedasticity, which is mitigated by employing robust standard errors clustered at the firm level. Multicollinearity is minimal among the variables. This research enhances existing models by incorporating firm, period, and industry fixed effects, providing a more refined comprehension of return determinants in a dynamic market context.

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1.0 Introduction

The factors influencing stock returns are among the most extensively studied, yet continually contested, subjects in financial economics. Historically, stock price dynamics have been represented by equilibrium models like the Capital Asset Pricing Model (CAPM), which posits that systematic market risk (beta) is the principal determinant of return fluctuations among assets (Sharpe, 1964; Lintner, 1965). A flourishing portion of empirical evidence has consistently contested the adequacy of single-factor models by illustrating that firm-specific characteristics, or "anomalies," including profitability, leverage, book-to-market ratios, and firm size, possess substantial explanatory power beyond market beta (Fama & French, 1992; Jegadeesh & Titman, 1993).

Inspired by these discoveries, asset pricing research has increasingly transitioned to multi-factor models that include basic variables to more effectively elucidate cross-sectional variations in returns. The Fama-French three-factor and five-factor models are among the most influential, incorporating profitability and investment as significant enhancements to size and value impacts (Fama & French, 2015). Nevertheless, numerous enquiries remain unresolved: Do these partnerships last throughout time? Are they consistent across industries, especially in a time of changing financial frameworks, technological advancement, and increased market volatility? The methodology specifically examines the impact of profitability (represented by return on equity), leverage (total debt-to-equity ratio), and business size (assessed by total assets) on monthly stock returns, while accounting for overall market fluctuations.

The impetus for this investigation is dual. Initially, there exists an academic necessity to reassess the empirical validity of essential return predictors in contemporary time frames, particularly considering post-crisis monetary policy alterations, heightened investor emphasis on financial stability, and evolving capital structures (Campbell et al., 2009; Novy-Marx, 2013). Secondly, from a pragmatic perspective, asset managers and institutional investors continue to seek measurable, dependable indicators to guide asset allocation strategies and risk-adjusted return anticipations. Reassessing these linkages with updated panel data facilitates more prompt and policy-relevant conclusions.

This paper recognizes sector heterogeneity by incorporating a robustness test that omits financial enterprises, which frequently adhere to different accounting standards and regulatory frameworks. This omission aligns with previous studies, which indicates that their capital structures and risk-return profiles are not directly comparable to those of other sectors (Billett, Flannery, & Garfinkel, 2006). This research enhances empirical asset pricing by re-examining conventional firm-level predictors within a robust panel framework, providing new evidence on the relationship between important financial measures and market performance in the contemporary NYSE context.

This study presents multiple novel additions to the literature on stock return predictability. Initially, it used a freshly assembled imbalanced panel data-set consisting of 330 NYSE-listed companies from 2013 to 2023, providing a contemporary perspective on post-crisis financial dynamics that numerous previous research have overlooked. Secondly, the research employs a three-way fixed effects method (firm, year, and industry), which improves upon conventional two-way specifications, to more accurately isolate the impacts of company-specific fundamentals by considering unobserved industry-level variability. Third, the study does a robustness check by omitting financial firms, which are governed by distinct regulatory and accounting norms, to determine if their inclusion substantially skews overall industry patterns. Collectively, these methodological enhancements yield a more comprehensive and dependable evaluation of the relationship between critical firm-level factors—namely profitability, size, and leverage—and stock returns in the current U.S. equity market.

1.1 Research questions and hypotheses

Comprehending the factors that influence stock returns is both a theoretical issue for financial economists and a practical requirement for institutional investors, portfolio managers, and legislators. Although traditional asset pricing literature primarily attributes return variation to systematic risk factors, recent studies increasingly emphasize the significance of firm-level characteristics, including profitability, capital structure, and firm size, in elucidating return behaviour (Fama & French, 2015; Novy-Marx, 2013).

This study re-examines the explanatory capacity of fundamental indicators to assess if these firm-specific characteristics retain explanatory significance in contemporary equity markets, particularly considering larger market dynamics and firm heterogeneity.

Research Question: **To what degree do company-specific fundamentals—specifically profitability, leverage, and firm size—alongside market return, account for the fluctuations in monthly stock returns of NYSE-listed companies from 2013 to 2023?**

Hypotheses:

H1: Leverage is negatively associated with stock returns.

H2: Profitability is positively associated with stock returns.

H3: Firm size is negatively associated with stock returns.

H4: Market return is positively associated with stock returns.

Robustness Check:

To augment the reliability of the findings, a supplementary robustness study is performed by re-estimating the model without financial firms. These companies, generally subject to varying regulatory frameworks and capital configurations, exhibit distinct behaviors regarding leverage and profitability metrics (Billett et al., 2006). This exclusion facilitates the assessment of relationship stability across various industrial sectors and guarantees that outcomes are not unduly influenced by the financial sector.

1.2 Scope and Significance of the study

This study's scope is established by its time range and analytical framework. This study examines the correlation between firm-specific financial indicators and monthly stock returns utilizing a balanced panel of NYSE-listed companies observed over an 11-year span from 2013 to 2023. This period encompasses a varied economic landscape characterized by recovery from the global financial crisis, historically low interest rates, pandemic-related volatility, and substantial changes in corporate financial conduct, rendering it an intriguing interval for reassessing fundamental return determinants (Campbell, Polk, & Vuolteenaho, 2009; Fama & French, 2015).

The empirical emphasis is on four fundamental variables: leverage, profitability, company size, and market return. These were chosen based on strong theoretical underpinnings and a persistent presence in the literature regarding asset pricing anomalies and fundamental analysis (Novy-Marx, 2013; Bhandari, 1988; Fama & French, 1992). The study encompasses a substantial and varied sample of U.S. enterprises from multiple industries, hence augmenting the applicability of its findings within established capital markets.

To maintain comparability and model integrity, two variables initially contemplated — the book-to-market ratio and total sales — were ultimately omitted from the final analysis. The book-to-market ratio was eliminated due to multicollinearity issues and its diminishing significance in specific sectors, especially in contemporary asset-light businesses where intangible assets prevail (Asness et al., 2015). Total sales were eliminated because statistical diagnostics indicated a high correlation with total assets, presenting hazards of multicollinearity and redundancy in measuring company size impacts. These judgments align with optimal econometric techniques in variable selection and specification (Wooldridge, 2010).

The study methodologically enhances the literature by utilizing panel data approaches, enabling the control of unobserved firm-specific heterogeneity. The incorporation of firm, period, and industry fixed effects mitigates potential biases stemming from missing variables and structural disparities among enterprises and economic cycles (Baltagi, 2008). A robustness test is performed to evaluate the durability of relationships considering sector-specific characteristics, as financial organizations frequently operate under unique regulatory frameworks and accounting standards (Billett, Flannery, & Garfinkel, 2006).

This research holds considerable practical and theoretical value. For academics, it re-examines established return predictors within the framework of a contemporary, turbulent decade employing refined empirical methodologies. It provides investors and asset managers with evidence-based insights into the predictive significance of fundamentals in equity portfolio construction and firm-level risk management. Policymakers and analysts may also gain from the study's capacity to differentiate between structural and temporary influences on stock performance, particularly during periods of economic upheaval.

This thesis contributes to the ongoing discourse over the validity of classic financial indicators in elucidating return patterns in modern equity markets. The findings seek to enhance comprehension of essential factors across industries and facilitate more sophisticated investment decision-making.

2.0 Literature Review

2.1 Theoretical Background: CAPM, Fama-French Models, and Anomalies

The examination of stock return dynamics is grounded in asset pricing theory, wherein fundamental models aim to elucidate the relationship between risk and expected return. The

Capital Asset Pricing Model (CAPM), formulated by Sharpe (1964), Lintner (1965), and Mossin (1966), is among the first and most significant frameworks. The Capital Asset Pricing Model (CAPM) asserts that an asset's anticipated return is directly proportional to its sensitivity to market risk, denoted by its beta coefficient. The approach implies that all idiosyncratic or firm-specific risks may be diversified, thereby having no impact on predicted returns.

Although the CAPM offers a sophisticated and concise framework, significant empirical analysis has uncovered numerous systematic deviations from its predictions, generally known as asset pricing anomalies. Notable phenomena include the size effect (smaller companies yielding superior returns), the value effect (stocks with elevated book-to-market ratios surpassing growth stocks), and momentum (previously successful stocks maintaining strong performance). These anomalies suggest that elements beyond market beta substantially influence return variability (Banz, 1981; Jegadeesh & Titman, 1993).

To address these empirical deficiencies, Fama and French (1992, 1993) introduced the three-factor model, which enhances CAPM by incorporating:

- Size (SMB - Small Minus Big): Measuring the return disparity between small-cap and large-cap equities.
- Value (HML - High Minus Low): Indicating the return differential between high and low book-to-market equities.
- Market Risk (MKT): The conventional CAPM beta coefficient.

Their model demonstrated enhanced explanatory capability compared to CAPM, especially in explaining the cross-section of U.S. stock returns. Nonetheless, the existence of enduring residual anomalies — including profitability and investment trends — prompted additional advancements. Fama and French (2015) proposed a five-factor model by incorporating:

- Profitability (RMW - Robust Minus Weak): Firms with greater profitability generally achieve superior returns.
- Investment (CMA – Conservative Minus Aggressive): Conservative investment firms surpass their aggressive counterparts in performance.

The five-factor approach markedly diminished the alpha (unexplained return) across various portfolios, especially those categorized by profitability and investment intensity. However,

considerable criticism emerged, particularly about the model's constrained capacity to account for the momentum anomaly (Barber & Lyon, 1997; Hou, Xue, & Zhang, 2015).

Simultaneously, other researchers provided alternate models and explanatory variables. Novy-Marx (2013) illustrated the gross profitability premium, contending that profitability serves as a return predictor as potent as value. Bhandari (1988) demonstrated that leverage, quantified by the debt-to-equity ratio, is positively correlated with expected returns, indicating that increased financial risk may yield compensation through elevated return expectations.

These anomalies collectively challenge the adequacy of single-factor models and have initiated a new research trajectory that prioritizes business fundamentals — including leverage, profitability, size, and value — as essential determinants of asset price. Contemporary asset pricing theory increasingly perceives return behaviour as a multidimensional consequence of risk exposure, financial stability, and market conditions (Cochrane, 2011).

This study utilizes a panel data methodology to reevaluate the influence of fundamental factors on the stock returns of corporations listed on the NYSE. It aims to ascertain if these firm-specific traits retain their explanatory significance in the decade after the global financial crisis and during a phase of changing financial architecture.

2.2 Empirical Evidence on Fundamental Drivers of Stock Returns

2.2.1 Leverage and Stock Returns

Financial leverage, typically assessed through the debt-to-equity ratio, has been thoroughly investigated in asset pricing literature for its dual function of amplifying returns and heightening financial risk. Bhandari (1988) was one of the pioneers in empirically demonstrating that firms with elevated leverage typically achieved greater projected returns, possibly as a risk premium for assuming financial distress risk. Subsequent research, including Fama and French (1992), presented a more nuanced perspective, indicating that although leverage is positively connected with expected returns, this association is frequently overshadowed by other variables like as size and book-to-market equity.

Additional study underscores the context-dependent characteristics of this effect. Öztürk and Yılmaz (2015) identified a substantial negative correlation between leverage and stock returns in Turkish markets, confirming that over-leveraged enterprises indicate poor financial

health. In emerging economies, leverage has been associated with both volatility and market undervaluation (Ullah & Shah, 2014). Considering these varied results, the association between leverage and returns continues to be a promising subject for empirical reassessment, especially for U.S. corporations following the financial crisis.

This work analyses leverage in its log-transformed and winsorized forms to diminish skewness and alleviate the influence of extreme outliers, so providing a more accurate assessment of its genuine predictive capability.

2.2.2 Profitability and Stock Returns

Profitability is a significant predictor of stock returns in modern financial literature. Novy-Marx (2013) discovered that gross profitability, when adjusted for total assets, forecasts return with equal efficacy as value. Fama and French (2015) subsequently integrated profitability into their five-factor model, demonstrating that firms with elevated operating profitability typically yield consistently stronger returns.

This information contradicts conventional valuation principles that prioritized price multiples and book value. The profitability premium is regarded as remuneration for companies' capacity to produce internal capital and maintain long-term growth, despite market fluctuations. Furthermore, profitability exhibits significant stability over time, rendering it a dependable metric for long-term investment (Hou et al., 2015).

This thesis utilizes return on equity (ROE) as a surrogate for profitability, a prevalent and straightforward metric that reflects net income in relation to shareholders' equity. This selection is particularly appropriate considering the availability of net income and equity data for all enterprises in the data-set.

2.2.3 Firm Size and Stock Returns

The inverse correlation between business size and stock returns, referred to as the size effect, was initially identified by Banz (1981) and subsequently formalized by Fama and French (1993) in their three-factor model. Smaller enterprises frequently surpass larger firms on a risk-adjusted basis owing to information asymmetry, restricted analyst coverage, and enhanced growth potential.

The enduring nature of the size effect has been contested in recent decades. Certain studies contend that the oddity has lessened over time, particularly in extensive, well-established

markets (Amihud, 2002). Nevertheless, numerous individuals nevertheless perceive size as pertinent when accounting for additional variables like as profitability and investment.

This study employs total assets as an indicator of firm size. Following an assessment for multicollinearity, total sales was eliminated due to its significant association with assets. This methodology conforms to established norms in contemporary panel research (Pandey, 2001; Menike et al., 2015), facilitating a more transparent interpretation of size effects concerning leverage and profitability.

2.2.4 Market Return as a Control Variable

This study primarily examines firm-specific characteristics while incorporating market return as a control variable to account for systematic fluctuations in the equity market. This inclusion is based on the Capital Asset Pricing Model (CAPM) (Sharpe, 1964; Lintner, 1965), which asserts that all asset returns are partially influenced by market-wide variations.

Fama and French (1993) and subsequent research established that although market return alone cannot fully elucidate cross-sectional return disparities, it continues to be a statistically relevant element of stock return dynamics. Incorporating this variable accounts for macroeconomic shocks, investor sentiment fluctuations, and systemic liquidity constraints that may otherwise obscure the correlation between firm fundamentals and returns.

To rectify distributional anomalies in the data-set, market return is incorporated in its log-transformed and winsorized format.

2.2.5 Analysis of Sector Effects (Exclusion of Financial Firms)

A significant factor in return predictability is industry variation, especially with the inclusion or exclusion of financial institutions. Financial institutions such as banks and insurance companies function under distinct capital and regulatory frameworks. Their accounting frameworks, such as the classification of deposits as liabilities, and the associated risk-return trade-offs, significantly diverge from those of industrial or service enterprises (Billett et al., 2006; Barber & Lyon, 1997).

Consequently, numerous empirical research either omit financial firms from the beginning or do robustness tests both with and without their inclusion. This research uses the latter methodology. Followed by executing the primary panel regression on the complete data-set, a secondary model is constructed, omitting firms categorized under industry code 6

(financial). This enables the assessment of sector wise sensitivity in the findings and ascertains the adaptability of correlations across various company types.

2.3 Gaps in Literature and Justification for the Study

Notwithstanding the wealth of research on stock return predictability, significant gaps persist that warrant additional empirical investigation. Primarily, a significant portion of the foundational research concerning asset pricing anomalies — encompassing investigations into size, value, profitability, and leverage — relies on historical datasets from the 1960s to the early 2000s (Fama & French, 1992, 1993; Bhandari, 1988; Jegadeesh & Titman, 1993). Considering the significant structural and technological transformations in global markets over the past decade, it is imperative to reevaluate these linkages utilizing contemporary data that accurately represents current company conduct, investor opinion, and regulatory environments.

Secondly, although numerous studies corroborate the Fama-French five-factor model, very limited research has examined its applicability solely to NYSE-listed companies during the post-financial crisis period (2013–2023). This time-frame encompasses various market phases — such as exceptionally low interest rates, the COVID-19 pandemic, inflationary shocks, and heightened corporate leverage — all of which may have altered the correlation between firm fundamentals and stock performance (Campbell et al., 2008; Cochrane, 2011). Therefore, there is an increasing necessity to reassess traditional indicators such as leverage and profitability in light of these new market situations.

Third, although profitability has garnered interest as a predictor of returns (Novy-Marx, 2013; Fama & French, 2015), research frequently employs various profitability proxies (e.g., gross profit, net income, ROA), and there is ongoing contention on which is the most effective across different industries. Application of ROE, bolstered by the data-set and contemporary research, elucidates this methodological contradiction. Likewise, while business size is a critical element in asset pricing, several research utilize market capitalization; this study, however, adopts total assets, providing an alternative viewpoint based on accounting principles.

Fourth, sector sensitivity is frequently inadequately examined in panel research. Financial institutions are often entirely excluded due to their distinct regulatory characteristics (Billett et al., 2006; Barber & Lyon, 1997). Nevertheless, this exclusion is seldom subjected to explicit examination. This study solves a methodological gap by performing a robustness test

that contrasts results with and without financial businesses, thereby contributing to the expanding literature on sector-adjusted asset pricing models.

Many current research utilize cross-sectional or time-series data, which may neglect unobserved variation among enterprises. This study employs panel data methodologies with fixed effects for firms, time, and industry, offering a robust estimate framework that reduces omitted variable bias and accounts for dynamic behaviour across time (Baltagi, 2008; Wooldridge, 2010).

Collectively, these limitations underscore the significance and novelty of the research. This work utilizes a recent 11-year panel of NYSE corporations, employs advanced econometric methods, and reevaluates traditional predictors in current contexts, thereby offering novel insights to the theoretical and empirical discussions in asset pricing.

3.0 Methodology

3.1 Data Sources and Sample Description

This study use a data-set of 330 publicly traded companies from the New York Stock Exchange (NYSE), covering the period from January 2013 to December 2023. This 11-year period enables the analysis to encompass various market conditions, including post-crisis recovery, the COVID-19 epidemic, and recent monetary policy tightening, all pertinent to the changing dynamics of stock return behaviour. The sample was designed to guarantee comprehensive industry representation and temporal depth while preserving data consistency across essential financial variables. Companies were chosen based on the availability of necessary financial measures (e.g., total assets, debt-to-equity ratio, return on equity, market returns, and stock returns) and their continuous listing status during the study period.

The firm selection was performed manually, incorporating companies from various sector groups, market capitalization, and operational sizes to increase heterogeneity and guarantee a comprehensive representation of the NYSE. Manual selection was essential to verify the completeness and usefulness of data for each organization, particularly as automated filters frequently incorporate illiquid stocks or entities without financial disclosures. This intentional filtering method is prevalent in panel-based finance research (Baltagi, 2008; Wooldridge, 2010) and enhances the internal validity of the empirical study. Most firms provided a complete 11 years of observations (2013–2023), whereas a subset contributed fewer years due to late listings or restricted data availability. This leads to a unbalanced panel,

a frequent occurrence in financial research that does not undermine the validity of panel estimate, particularly when suitable econometric methods are utilized (Hsiao, 2003; Baltagi, 2008).

The inclusion of enterprises with abbreviated data histories was a strategic decision to enhance cross-sectional diversity and augment the applicability of the findings across firm types. It mirrors actual market dynamics, as corporations enter or depart public markets at varying intervals. The panel models employed in this investigation, such as fixed effects with robust standard errors, are adept at managing unbalanced structures without causing estimation bias (Wooldridge, 2010).

The data-set integrates firm-level accounting metrics reported annually with stock price data collected monthly. In this research, monthly stock returns are the dependent variable, whereas firm-specific factors (e.g., ROE, leverage, total assets) are assessed annually. Monthly stock returns offer enhanced detail and more accurately reflect short-term market fluctuations, whilst annual company fundamentals represent long-term financial attributes that affect returns over the subsequent year—rendering this combination both legitimate and broadly accepted in case of empirical finance research. This methodology is prevalent in asset pricing literature (Fama & French, 1992; Novy-Marx, 2013) and facilitates the evaluation of the impact of business fundamentals on future return patterns. The market return, utilized as a measure for systematic risk, is incorporated on a monthly basis to line accurately with the return series, hence providing consistency in reflecting market-wide impacts on individual stocks.

Firm-specific financial data—including net income, total assets, debt-to-equity ratio, sales, and return on equity—was obtained from FactSet and corroborated with firm-level reports to ensure completeness of the directory. Monthly stock prices were sourced from the FactSet database, while market returns were acquired from the Kenneth R. French Data Library, which offers highly recognized, peer-reviewed financial statistics utilized in academic research.

Following data cleaning, the elimination of firms with missing variables, and the verification of panel structure integrity, 2,793 full firm-year observations were preserved for empirical estimate. A categorical variable denoting industrial sector was incorporated to facilitate industry fixed effects. This curated data-set enables rigorous panel data estimation by balancing data coverage with quality and supports various forms of fixed-effects modeling—

such as firm, year, and industry controls—crucial for capturing unobserved heterogeneity in financial behaviour (Hsiao, 2003; Greene, 2012).

3.2 Model Specification and tests

3.2.1 Regression model

Baseline Model Structure; The core regression model

$$Stock\ Return_{it} = \beta 0 \quad + \beta 1 \quad (Net\ Income_{it}) + \beta 2 \quad (ROE_{it}) + \beta 3 \quad (Leverage_{it}) + \beta 4 \quad (Total\ Assets_{it}) + \beta 5 \quad (Market\ Return_{it}) + u_{it}$$

($Stock\ Return_{it}$ = stock return for firm i at time t; $Net\ Income_{it}$ = net income for firm i at time t; ROE_{it} = return on equity for firm i at time t; $Leverage_{it}$ = leverage ratio for firm i at time t; $Total\ Assets_{it}$ = total assets of firm i at time t; $Market\ Return_{it}$ represents the market return at time t; β0 is the intercept term; β1,β2,β3,β4,β5 are the coefficients to be estimated; u_{it} is the error term for firm i at time t.)

This study utilizes panel data regression models to analyse the influence of firm-level fundamentals on stock returns, incorporating both cross-sectional and time-series aspects of the data-set. Panel data methodologies are particularly appropriate in this scenario since they account for unobserved variation among enterprises and facilitate more efficient estimation through repeated temporal observations (Baltagi, 2008; Wooldridge, 2010). The dependent variable, stock return, is quantified on a monthly basis, but firm-level fundamentals are assessed annually.

To guarantee robustness and identify the most suitable estimator, multiple model specifications were evaluated:

3.2.2 Fixed Effects Model

$$Stock\ Return_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it}$$

($Stock\ Return_{it}$ = stock return for firm i at time t; α_i = firm-specific intercept that capture unobserved heterogeneity across firms; β = vector of coefficients for the explanatory variables; X_{it} = vector of explanatory variables for firm i at time t; ε_{it} = error term for firm i at time t.)

The Fixed Effects model accounts for firm-specific features that remain constant over time and may correlate with the regressors. This estimator was used as the principal model to account for time-invariant heterogeneity among firms—such as variations in corporate strategy, risk tolerance, or management quality—that are likely to correlate with explanatory variables like leverage or profitability. The selection of fixed effects (FE) over random effects (RE) was statistically substantiated by the Hausman test, which indicated that the

assumptions necessary for the consistency of RE were breached, thus affirming the appropriateness of FE (Hausman, 1978).

3.2.3 Two-Way Fixed Effects Model

$$Stock\ Return_{it} = \alpha_i + \lambda_t + \beta X_{it} + \varepsilon_{it}$$

($Stock\ Return_{it}$ = stock return for firm i at time t; α_i = firm-specific intercept that capture unobserved heterogeneity across firms; λ_t = time specific effect to capture unobserved factors affecting all the firm at time t; β = vector of coefficients for the explanatory variables; X_{it} = vector of explanatory variables for firm i at time t; ε_{it} = error term for firm i at time t.)

To enhance model robustness, a two-way fixed effects specification was estimated, incorporating year fixed effects to address time-specific shocks (e.g., macroeconomic policy changes, financial crises) that may uniformly affect all companies (Wooldridge, 2010).

3.2.4 Three-Way Fixed Effects Model (Firm, Time, Industry)

$$Stock\ Return_{it} = \alpha_i + \lambda_t + \delta_j + \beta X_{it} + \varepsilon_{it}$$

($Stock\ Return_{it}$ = stock return for firm i at time t; α_i = firm-specific intercept that capture unobserved heterogeneity across firms; λ_t = time specific effect to capture unobserved factors affecting all the firm at time t; δ_j = industry fixed effect for firm i in sector j; β = vector of coefficients for the explanatory variables; X_{it} = vector of explanatory variables for firm i at time t; ε_{it} = error term for firm i at time t.)

A Three-Way Fixed Effects model was utilized to enhance the control for unobserved heterogeneity. It encompasses fixed impacts for firms, years, and industries. This framework is especially beneficial when industry-specific factors—such as regulatory restrictions, capital intensity, or competitive dynamics—are anticipated to affect stock returns in conjunction with company and macroeconomic variables. This specification enhances causal inference by eliminating confounding effects at three tiers; Firm: such as strategy, leadership; Time: economic cycles and; Industry: for instance sectoral profitability or risk standards

3.2.5 Random Effects Model

$$Stock\ Return_{it} = \alpha_i + \beta X_{it} + u_i + \varepsilon_{it}$$

($Stock\ Return_{it}$ = stock return for firm i at time t; α_i = firm-specific intercept that capture unobserved heterogeneity across firms; β = vector of coefficients for the explanatory variables; X_{it} = vector of explanatory variables for firm i at time t; u_i = firm-specific random effects; ε_{it} = error term for firm i at time t.)

The Random Effects model posits that firm-specific effects αi are uncorrelated with the explanatory factors. This method is more efficient than FE if this assumption is valid, as it permits the incorporation of time-invariant variables. The Hausman test, however, refuted this

assumption in favour of fixed effects, establishing that the RE estimator would be biassed in this scenario.

3.2.6 Other statistical models and tests

Robust Standard Errors with Heteroskedasticity

All models are estimated using robust standard errors (Arellano/White-type) to address potential heteroskedasticity and serial correlation in the panel data. The Breusch-Pagan test validated the existence of heteroskedasticity, warranting this modification.

Alternative Model: Excluding Financial Firms

A second fixed effects model was calculated to assess the sensitivity of the results to sectoral variations by removing financial enterprises (designated under industry code 6). Financial institutions frequently adhere to specific accounting and regulatory standards, and their incorporation may skew assessments of leverage and profitability impacts.

Multicollinearity

The study evaluated potential multicollinearity among explanatory factors by analysing Variance Inflation Factors (VIF) within a linear framework. All VIF values were much below the standard threshold of 10, suggesting that multicollinearity was not a substantial issue. During the initial phase of variable selection, a significant correlation was seen between total sales and total assets. To prevent distortion of coefficient estimates and exaggerated standard errors, total sales was omitted from the final model, while total assets was retained as the proxy for business size due to its greater accounting significance.

Heteroskedasticity

The Breusch-Pagan test for heteroskedasticity was employed to assess the constancy of residual variance across observations. The test revealed heteroskedasticity, contravening the classical linear model's assumption of homoskedastic errors. The study utilised robust standard errors (White-type HC1) across all model specifications to tackle this issue. This modification guarantees that the statistical conclusions — such as t-tests and confidence intervals — retain their validity despite the existence of heteroskedasticity, as advised by Arellano (1987) and Wooldridge (2010).

4.0 Empirical Analysis

4.1 Variables Analysis

4.1.1 Descriptive Statistics

Descriptive statistics offer a summary of the central tendencies, variability, and distributional attributes of the principal variables employed in the empirical analysis. The summary statistics presented below illustrate the distribution of the refined and modified variables.

Summary statistics of the key variables for the panel regression

Variable	N	Mean	Std. Dev	Median	Min	Max	Range	Skewness	Kurtosis
Net Income	2793	6.16	1.69	6.35	-2.41	9.26	11.66	-0.98	1.55
Return on Equity	2793	2.75	0.89	2.75	-2.81	5.77	8.59	0.11	2.09
Leverage	2793	3.97	1.29	4.07	0.85	7.31	6.46	-0.18	-0.10
Market Return	2793	0.12	0.15	0.20	-0.23	0.30	0.53	-1.05	0.03
Stock Return	2793	0.00	0.01	0.00	-0.04	0.05	0.09	-0.09	1.08
Total Assets	2793	8.72	1.82	9.06	4.05	11.39	7.34	-0.93	0.17

Table 1: This table reports the results Summary of Descriptive Statistics of the panel data set of 314 firms (observations = 2793). Firm level financial data (Stock prices, Net Income, Return on Equity, Leverage, and Total assets) were collected from FactSet and Market return was collected from Kenneth R. French Data Library. Stock returns were computed as monthly logarithmic returns derived from firm-level adjusted closing prices, consolidated annually to align with the periodicity of accounting variables. Range values show the difference between max . and min., degree of asymmetry shown by skewness, and the the degree of tailedness or peak denoted as kurtosis values. To address the distributional concerns in essential financial ratios, independent variables were subjected to $\log transformation$[1] *and* $winsorization$[2] *at the 1st and 99th percentiles before preparing this chart. This tackled both skewness and the impact of extreme outliers, so ensuring more dependable coefficient estimation and enhanced model fit (Greene, 2012). N is number of observations.*

Net income exhibits a significantly left-skewed distribution (skewness = -0.98), signifying a concentration of enterprises with lower or minimal positive income values. The distribution is rather platykurtic (kurtosis = 1.55), indicating a reduced presence of extreme values during winsorization. The return on equity (ROE) has a fairly symmetric distribution (skewness = 0.11) and substantial kurtosis (2.09). This signifies a well-structured distribution appropriate for regression analysis. Leverage exhibits near symmetry with a slight negative skew (-0.18) and negligible kurtosis (-0.10), suggesting that excessive debt-to-equity ratios were

effectively mitigated through winsorization. The market return exhibits a significant left skewness (-1.05), characteristic of return distributions owing to infrequent yet substantial declines. The kurtosis value of about zero (0.03) indicates a lack of heavy tails.

The dependent variable, stock return, exhibits a mean close to zero and a limited standard deviation, aligning with monthly return patterns. The distribution exhibits a minor negative skew and is light-tailed (kurtosis = 1.08), suggesting that normality is not significantly compromised.

Total assets, serving as a proxy for business size, exhibit left skewness (-0.93) due to the predominance of smaller enterprises in the sample. The slight positive kurtosis (0.17) indicates that the distribution is dense but lacks hefty tails.

4.1.2 Correlation Matrix

A Pearson correlation matrix was created to evaluate potential linear correlations among the variables in the regression study. This assists in identifying collinearity tendencies that may affect the reliability of regression coefficients. The table below displays the pairwise correlations among the principal variables utilised in the model.

Pearson Correlation Matrix of Explanatory Variables

	Stock Return	**Net Income**	**ROE**	**Leverage**	**Total Assets**	**Market Return**
Stock Return	1.00	-0.01	0.11	-0.02	-0.05	0.45
Net Income	-0.01	1.00	0.26	0.00	0.14	-0.03
ROE	0.11	0.26	1.00	0.20	-0.14	-0.01
Leverage	-0.02	0.00	0.20	1.00	0.10	-0.00
Total Assets	-0.05	0.14	-0.04	0.10	1.00	-0.01
Market Return	0.45	-0.03	-0.01	-0.00	-0.01	1.00

Table 2: This matrix displays pairwise Pearson correlations among the explanatory variables employed in the regression models of the panel data set of 314 firms (observations = 2793). Firm level financial data (Stock prices, Net Income, Return on Equity, Leverage, and Total assets) were collected from FactSet and Market return was collected from Kenneth R. French Data Library[3]*. Stock returns were computed as monthly logarithmic returns derived from firm-level adjusted closing prices, consolidated annually to align with the periodicity of accounting variables. All variables are presented in log-transformed and winsorized formats. The matrix is employed to evaluate potential multicollinearity*[4]*. Except between market return and stock return, a ll correlations are below 0.3, indicating satisfactory independence among the regressors.*

The most robust correlation identified is between stock return and market return (r = 0.45), which is anticipated due to the substantial impact of market fluctuations on individual stock returns. Net income and return on equity (ROE) have a moderate correlation (r = 0.26), which is reasonable considering that both serve as indices of profitability. The correlation is insufficient to raise concerns regarding multicollinearity. All other correlations are comparatively modest, with values between -0.10 and +0.20, indicating a little danger of multicollinearity in the model.

Total assets and net income exhibit a weak positive connection (r = 0.14), suggesting that larger enterprises generally generate higher earnings; however, the correlation is insufficiently robust to significantly affect regression findings. The incorporation of ROE, net income, and leverage within the same model is warranted, provided their intercorrelations are maintained at acceptable levels (below 0.3), alleviating worries regarding overlapping effects.

The findings validate that the variables in the regression model exhibit minimal collinearity and can be read independently with a degree of confidence.

4.1.3 Variance Inflation Factor (VIF)

Variance Inflation Factor (VIF) values were computed to further examine the occurrence of multicollinearity among the independent variables.

Variance Inflation Factor (VIF) for further Multicollinearity Assessment

Variable	Variance Inflation Factor
Net Income	1.11
Return on Equity	1.13
Leverage	1.06
Total Assets	1.04
Market Return	1.00

Table 3: VIF measures the extent to which the variance of a coefficient estimate is amplified due to collinearity with other predictors. Variance Inflation Factor Outputs, score of 10 generally signifies substantial multicollinearity, however several studies adopt a more cautious threshold of 5.

All VIF readings are approximately 1 and much below the widely recognised criteria. This signifies that; the resulting model exhibits no substantial multicollinearity among the explanatory variables, each component independently helps to elucidating the variation in

stock returns, and the model estimates remain stable and the standard errors of the coefficients are not exacerbated by linear dependencies among the variables.

These findings validate the suitability of the variable selection and confirm that multicollinearity is not an issue in the analysis. During the initial stages of model development, total sales were excluded due to significant collinearity with total assets, which was preserved as the more theoretically robust indicator of company size.

4.1.4 Heteroskedasticity Test: Breusch-Pagan

The Breusch-Pagan test was employed on the baseline model to assess the constancy of residual variance over observations, which is a fundamental premise of linear regression.

$$BP = 26.66, \text{ degrees of freedom} = 5, \text{ p-value} < 0.001.$$

The p-value is statistically significant, signifying the rejection of the null hypothesis of homoskedasticity[5]. This verifies the existence of heteroskedasticity [6] in the model, which may result in; Skewed standard errors, Deceptive t-tests and p-values, or Weakened efficacy of coefficient estimations.

The study employs robust standard errors (White – type HC1[7]) in all panel regression models to tackle this issue. These resilient estimators guarantee the validity of statistical inference in the presence of heteroskedasticity, as recommended in applied econometric literature (Arellano, 1987; Wooldridge, 2010).

4.2 Regression Results

4.2.1 Fixed Effects Model

The model accounts for roughly 23.1% of the overall variation in stock returns, with an adjusted R-squared a^2 of 13.3%. Although the adjusted R^2 value in the model low, this result is anticipated and aligns with established empirical finance findings. Stock returns are intrinsically volatile and affected by various unanticipated market dynamics, sensations, and external shocks. As a result, even accurately defined models based on firm fundamentals frequently account for only a limited share of return variation, especially when utilizing monthly return data (Campbell et al., 2009).

5 Homoskedasticity refers to the uniformity of residual distribution across all values of the predictor variables. 6 Heteroskedasticity refers to the variation of residuals that fluctuates in accordance with the value of the independent variable. 7 White Type HC1; modify standard errors in the context of heteroskedasticity.

The Effect of Firm Fundamentals on Stock Returns: Results from Panel Regression with Firm Fixed Effects

Variable	Coefficient	Std. Error	t-Value	p-Value	Significance
Net Income	0.00046	0.00038	1.21	0.2248	
Return on Equity	0.00108	0.00036	2.96	0.0031	**
Leverage	-0.00013	0.00019	-0.68	0.4949	
Total Assets	-0.00235	0.00055	-4.26	2.1e−05	***
Market Return	0.02677	0.00102	26.21	< 2e−16	***
Model Fit Statistics					
R-Squared			0.231		
Adjusted R-squared			0.133		
F-statistics			149.04		

*Table 4: This table reports the results of a fixed effects regression using a panel data set of 314 firms (observations = 2793). Firm level financial data (Stock prices, Net Income, Return on Equity, Leverage, and Total assets) were collected from FactSet and Market return was collected from Kenneth R. French Data Library. Stock returns were computed as monthly logarithmic returns derived from firm-level adjusted closing prices, consolidated annually to align with the periodicity of accounting variables. To address the distributional concerns in essential financial ratios, independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. This tackled both skewness and the impact of extreme outliers, so ensuring more dependable coefficient estimation and enhanced model fit (Greene, 2012). To enhance the reliability of the statistical outcomes, standard errors were modified by incorporating clustering at the firm level. The model features firm fixed effects that account for all attributes unique to each corporation. The R-squared value signifies the percentage of variance in stock returns elucidated by the model, whereas the adjusted R-squared modifies this metric based on the quantity of predictors included. The F-statistic evaluates the collective significance of all regressors, indicating if the model offers a superior fit compared to one without predictors. P-values represent the likelihood of witnessing the estimated effects due to random variation; lower numbers indicate more substantial evidence against the null hypothesis. Extremely small p-values (e.g., "< 2e-16") are typical outputs in R, indicating values so negligible that they are virtually zero, signifying profound importance. The ** implies significance at 5% and *** implies significance at 1% level.*

Net income exhibits a positive correlation with stock returns ($\beta = 0.00046$), however this association lacks statistical significance ($p = 0.2248$). This indicates that, after accounting for other variables, net income does not significantly account for the diversity in stock performance among enterprises.

Return on equity (ROE) demonstrates a positive and statistically significant effect on stock returns ($p < 0.01$), suggesting that more successful companies typically have superior stock

performance. This demonstrates the idea that profitability is a principal determinant of equity value.

Leverage, as shown by the debt-to-equity ratio, exhibits a negative coefficient; however, it lacks statistical significance ($p = 0.4949$). This indicates that after accounting for company fixed effects and other factors, leverage does not consistently affect stock returns within the sample.

Total assets, serving as an indicator of business size, exert a negative and significant influence ($p < 0.001$), perhaps indicating size-related return anomalies (i.e., smaller firms yielding higher returns), consistent with prior empirical asset pricing research.

The market return exerts the most robust and statistically significant positive influence on stock return ($p < 0.001$). This verifies that firm-specific stock fluctuations are significantly influenced by general market conditions, a conclusion consistent with fundamental asset pricing theory.

The results substantiate H2 (profitability favourably influences stock returns) and H3 (market-wide effects are substantial), while presenting less compelling evidence for H1 (the impact of leverage is negligible in this specification). The adverse correlation with business size may be regarded as an additional finding necessitating additional examination.

4.2.2 Two-Way Fixed Effects Model

In Table 5 Net income is statistically insignificant ($p = 0.275$), indicating that after accounting for both company and temporal fixed factors, net income alone lacks explanatory power for fluctuations in stock return.

The return on equity (ROE) is positive and slightly significant ($p = 0.052$). This substantiates the idea that profitability may be a significant determinant of returns, but its influence diminishes marginally with the inclusion of time fixed factors.

Leverage is statistically insignificant, exhibiting a minor negative coefficient. This indicates that after controlling for fixed variables, capital structure does not reliably affect monthly stock returns in the sample.

Total assets exhibit a robust negative and significant correlation ($p < 0.001$), emphasising the size effect—where smaller enterprises often yield better returns—even when temporal variables are accounted for.

Firm and Time Effects in Explaining Stock Return Variation

Variable	Coefficient	Std. Error	t-Value	p-Value	Significance
Net Income	0.00041	0.00038	1.09	0.275	
Return on Equity	0.00069	0.00035	1.94	0.052	•
Leverage	-0.00020	0.00018	-1.06	0.289	
Total Assets	-0.00325	0.00065	-5.03	< 0.001	***
Model Fit Statistics					
R-Squared			0.018		
Adjusted R-squared			-0.112		
F-statistics			11.40		

*Table 5: This table reports the regression results of Two-Way Fixed Effects Model. using a panel data set of 314 firms (observations = 2793). Firm level financial data (Stock prices, Net Income, Return on Equity, Leverage, and Total assets) were collected from FactSet and Market return was collected from Kenneth R. French Data Library. Stock returns were computed as monthly logarithmic returns derived from firm-level adjusted closing prices, consolidated annually to align with the periodicity of accounting variables. To address the distributional concerns in essential financial ratios, independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. This tackled both skewness and the impact of extreme outliers, so ensuring more dependable coefficient estimation and enhanced model fit (Greene, 2012). Independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. The standard errors have been adjusted for enhanced reliability by incorporating variations in error patterns across every organisation over time. In controlling for time fixed effects to account for factors such economic recessions and interest rate fluctuations, it is normal practice to cluster at the panel unit level (i.e., firm), as the primary source of potential serial correlation arises from data within firms over time. p-values denote statistical significance.The *** implies significance at 1% level and • implies marginal significance.*

Despite the R-squared being somewhat low (1.8%), does not represent a limitation and corresponds with the literature that regards low R^2 values as common in this type of return regressions. The statistical significance, direction, and consistency of the computed coefficients are crucial, as they reveal enduring links between company characteristics and returns across time. The primary conclusion is that business size is a significant factor. The results indicate that firm-specific fundamentals, particularly size and profitability, significantly contribute to the diversity in returns, even amid market-wide shocks.

4.2.3 Three-Way Fixed Effects Model

The influence of Profitability, Leverage, and Size on Stock Returns Controlling for Industry, Firm, and Time Effects

Variable	Coefficient	Std. Error	t-Value	p-Value	Significance
Net Income	0.00041	0.00038	1.09	0.275	
Return on Equity	0.00069	0.00035	1.94	0.052	•
Leverage	-0.00020	0.00018	-1.06	0.289	
Total Assets	-0.00325	0.00065	-5.03	< 0.001	***
Model Fit Statistics					
R-Squared			0.018		
Adjusted R-squared			-0.112		
F-statistics			11.40		

*Table 6: This table reports the Regression Results of Three-Way Fixed Effects Model using a panel data set of 314 firms (observations = 2793). Firm level financial data (Stock prices, Net Income, Return on Equity, Leverage, and Total assets) were collected from FactSet and Market return was collected from Kenneth R. French Data Library. Stock returns were computed as monthly logarithmic returns derived from firm-level adjusted closing prices, consolidated annually to align with the periodicity of accounting variables. Independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. The *** implies significance at 1% level and • implies marginal significance. This model enhances the robustness of previous regressions by accounting for three dimensions (Firm + Year + Industry) for unobserved factors that remain constant within each firm, year, or industry—such as business strategy, macroeconomic conditions, or sector-wide laws. Standard errors are clustered at the firm level to account for potential correlations of errors within each company over time, hence enhancing the robustness of statistical inference. The R-squared number reflects the extent to which the independent variables account for the variation in stock returns, subsequent to the adjustment for fixed effects. The F-statistic and associated p-value indicate the statistical significance of the whole model.*

Firm fixed effects address constant firm-specific variables (e.g., management style, risk culture), Time fixed effects account for year-specific disturbances (e.g., economic downturns, regulatory changes), and Industry fixed effects account for structural disparities at the sector level (e.g., finance versus technology enterprises).

Net income retains a positive sign but is statistically insignificant, suggesting it lacks substantial explanatory power when industry, temporal, and business heterogeneity are comprehensively accounted for. Return on equity (ROE) is slightly significant (p = 0.052), indicating a slight nevertheless favourable impact of profitability on stock returns. The leverage is negative yet insignificant, indicating no robust correlation with return when all

variables are controlled. Total assets exhibit a substantial negative correlation ($p < 0.001$), reinforcing the notion that smaller enterprises typically provide higher returns.

The R^2 is low (1.8%), which is anticipated for high volatility in monthly stock returns and does not inherently signify a deficient model. The adjusted R^2 is negative, a frequent occurrence in fixed effects models with numerous dummy variables (particularly industry × year), indicating significant consumption of degrees of freedom.

4.2.4 Random Effects Model

Effect of Firm Fundamentals on Stock Returns: Random Effects Estimation

Variable	Coefficient	Std. Error	z-Value	p-Value	Significance
Intercept	-0.00013	0.00104	-0.13	0.898	
Net Income	-0.00012	0.00010	-1.20	0.230	
Return on Equity	0.00128	0.00019	6.90	< 0.001	***
Leverage	-0.00028	0.00012	-2.24	0.025	*
Total Assets	-0.00015	0.00009	-1.76	0.078	•
Market Return	0.02695	0.00100	26.83	< 0.001	***
Model Fit Statistics					
R-Squared			0.218		
Adjusted R-squared			0.217		
Chisq			777.0 (df = 5)		
p-value			< 2.2e−16		

*Table 7: This table reports the Regression Results of Random Effects Model using a panel data set of 314 firms (observations = 2793).The RE model proposes that unobserved firm-specific traits are random and uncorrelated with the explanatory variables, hence facilitating the use of both cross-sectional and time-series data variations. Independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. Each coefficient signifies the anticipated adjustment in stock return linked to a one-unit variation in the respective variable, presuming all other factors remain same. Robust standard errors are employed, and statistical inference relies on $z - values$[8] suitable for Random Effects estimation. A substantial test statistic coupled with a minimal p-value signifies that the model is statistically significant overall. The R-squared quantifies the proportion of variance in stock returns explained by the included variables. Although lower than in many cross-sectional models, moderate R-squared values are characteristic in stock return models owing to significant market volatility and the impact of numerous unobservable variables. The significance codes represent confidence levels: *** signifies strong evidence (99% level), ** indicates moderate evidence (95%), * reflects weak evidence (90%), and • suggests marginal evidence (often around the 10% threshold).*

Here ROE is once more positive and significantly impactful, underscoring its importance as a principal determinant of stock returns. Leverage exhibits a notable negative correlation, indicating that enterprises with elevated debt-to-equity ratios generally have somewhat reduced returns, hence proving H1. Total assets have a slightly significant negative correlation, suggesting a size effect. The market return is robustly positive and statistically

8.The z-values evaluate the distance of the estimated coefficients from zero in terms of standard errors, assisting in the determination of statistical significance of the effects. An elevated absolute z-value indicates more substantial evidence against the null hypothesis of no effect. 9.The Chi-squared statistic assesses whether the collective predictors significantly account for the variability in stock returns.

significant, indicating that systematic market performance is a primary determinant of firm-level returns. Net income and intercept lack significance, indicating less distinctive influence when other variables are considered.

The regression model evaluates whether the collective influence of all explanatory factors (regressors) significantly impacts the dependent variable (such as stock return). If joint significance is affirmed (usually demonstrated by a statistically significant F-statistic or Chi-squared statistic), it signifies that the regressors collectively contribute to explaining the outcome, despite certain individual variables potentially lacking statistical significance independently. The R-squared score of 0.218 and adjusted R-squared of 0.217 signify that the model accounts for approximately 21.7% of the variability in stock returns. The model's overall significance is validated by a $\text{Chi} - \text{squared}^9$ statistic of 777.0 (df = 5) with a p-value below 0.001, indicating the collective significance of the regressors.

4.2.5 Hausman Test

Hausman Test Comparing Fixed and Random Effects Models

Statistics	Value
Chi-squared	18.391
Degrees of freedom	5
p-value	0.0025

Table 8: Hausman Test Summary. The Hausman specification test evaluates the consistency of the random effects estimator. The null hypothesis implies an absence of correlation between firm effects and regressors. Alternative hypothesis H1 implies that Fixed effects model is preferred as correlation exists. A p-value of less than 0.05 signifies a preference for the fixed effects model over the random effects model. Analysis performed on the complete sample (N = 2,793 firm-year observations). A greater Chi-squared value typically signifies a more substantial disparity between the two models, implying that their assumptions yield significantly different outcomes. Degrees of freedom define the distribution employed to evaluate the test statistic.

The Hausman test assesses the suitability of the Random Effects (RE) model in relation to the Fixed Effects (FE) model. It specifically evaluates the null hypothesis that the individual effects are uncorrelated with the regressors, indicating that the random effects model is both consistent and efficient.

Given that the p-value is 0.0025 (significant at the 1% threshold), we reject the null hypothesis, suggesting that the RE model is inconsistent. This indicates that firm-specific effects are associated with explanatory factors, so the Fixed Effects model is favoured.

4.2.6 Robust Fixed Effects

Effect of Firm Fundamentals on Stock Returns: Fixed Effects with Robust Standard Errors

Variable	Coefficient	Robust Std. Error	t-Value	p-Value	Significance
Net Income	0.00046	0.00042	1.10	0.271	
Return on Equity	0.00108	0.00038	2.85	0.0045	**
Leverage	-0.00013	0.00018	-0.72	0.475	
Total Assets	-0.00235	0.00050	-4.71	< 0.001	***
Market Return	0.02677	0.00127	21.16	< 0.001	***

*Table 9: This table reports the Robust Fixed effects results summary using a panel data set of 314 firms (observations = 2793). Independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. This table displays the fixed effects regression outcomes, using unobserved firm-specific attributes. Standard errors are modified utilizing the HC1 robust estimator so resilient to heteroskedasticity, clustered at the firm level, and yielding more trustworthy inferences. ***A p-value less than 0.001 indicates Highly significant. The probability that the outcome is linked to random variation is less than 0.1%. Compelling evidence contradicts the null hypothesis. ** A p-value less than 0.01 indicates statistical significance. Somewhat substantial. There is a likelihood of less than 1% that the outcome is random, that's a Strong evidence opposing the null hypothesis.*

ROE is both positive and statistically significant (p = 0.0045), indicating that more profitable companies are likely to achieve greater stock returns. Total assets have a robust, negative, and significant correlation with returns, aligning with the "size effect." The market return is the predominant variable, demonstrating a highly significant and substantial positive effect. Leverage and net income are statistically negligible, indicating minimal direct explanatory power when accounting for fixed factors and robust errors.

4.3 Hypotheses Evaluation

This section provides a systematic assessment of the hypotheses developed earlier in the study, grounded in the outcomes of the fixed effects regression model and the performing robustness checks. Each hypothesis is evaluated based on the statistical significance, direction, and consistency of the pertinent coefficient across models.

H1: Leverage exhibits a negative correlation with stock returns.

The regression results did not prove this theory. In both the complete sample and the non-financial sample models, the coefficient for leverage remained statistically insignificant, with the relationship's direction becoming marginally positive upon the exclusion of financial enterprises. The findings indicate that, after accounting for firm-level fixed variables,

financial leverage (as indicated by the debt-to-equity ratio) does not consistently affect stock returns. This result contradicts previous findings by Bhandari (1988) and Fama and French (1992), which established a negative correlation between leverage and returns, and may be due to evolving capital structures, enhanced risk management procedures, or sectoral diversity.

- Conclusion: H1 is not supported.

H2: Profitability is favourably correlated with stock returns.

The coefficient for ROE was positive and statistically significant across all parameters, including the robustness check that omitted financial businesses. This persistent correlation substantiates that more profitable companies generally provide superior stock returns, corroborating the conclusions of Fama and French (2015) and Novy-Marx (2013), who highlight the predictive significance of profitability in contemporary asset pricing frameworks. The consistency of this outcome across all firm types and historical periods highlights the significance of internal operational efficiency as a value generator in equity markets.

- Conclusion: H2 is supported.

H3: The size of a firm is inversely correlated with stock returns.

The size of the firm, represented by the logarithm of total assets, exhibited a consistently negative and statistically significant coefficient in all models. This affirms the continuation of the "size effect," wherein smaller enterprises yield superior average returns, maybe attributable to enhanced growth potential or increased risk exposure. The outcome aligns with the conclusions of Fama and French (1993), further substantiating the significance of company size in return prediction models.

- Conclusion: H3 is supported.

H4: The market return exhibits a favourable correlation with stock returns.

As anticipated, market return proved to be the most significant and impactful predictor in the model. The coefficient remained continuously substantial and statistically significant across all specifications, indicating that broader market fluctuations are significantly mirrored in individual stock returns. This discovery confirming the essential premises of the Capital

Asset Pricing Model (CAPM) (Sharpe, 1964), validating the significance of systematic risk in expanding return variability.

- Conclusion: H4 is supported.

4.4 Robustness check; Alternative Model

Robustness Check: Fixed Effects Model Excluding Financial Sector Firms

Variable	Estimate	Std. Error	t- Value	p- Value	Significance
Net Income	4.7870e-04	4.1622e-04	1.15	0.25023	
ROE	9.5621e-04	3.8489e-04	2.48	0.01306	*
Leverage	-4.5184e-05	1.9876e-04	-0.23	0.82019	
Total Assets	-2.5915e-03	6.1617e-04	-4.21	2.71e-05	***
Market Return	2.6094e-02	1.1088e-03	23.53	< 2.2e-16	***
Model Fit Statistics					
R^2			0.219		
Adjusted R^2			0.118		
F-statistic			122.90, p- value < 0.001		

*Table 10: This table reports the Regression results of Alternative Fixed Effects Model (Excluding Financial Firms) of a panel data set of 271 firms (observations = 2391). Independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. The model is evaluated applying robust standard errors clustered at the firm level to address potential heteroskedasticity and serial correlation within firms over time. The reported R^2 indicates the extent of within-firm variance clarified by the model. The F-statistic evaluates the collective significance of all regressors. Significance codes denote: *** $p < 0.001$, * $p < 0.05$.*

To enhance the applicability of results, the regression model was re-estimated following the exclusion of financial enterprises due to their unique regulatory frameworks and financial reporting processes (Billett et al., 2006). The comparison between the full-sample model and the restricted-sample model uncovers some significant patterns. The R-squared value marginally declines from 23.1% to 22.1% upon the exclusion of financial enterprises. This indicates that financial enterprises provide only a slight amount of overall explanatory power, possibly due to their distinct responses to market conditions and unique business strategies. (table: check)

The coefficient for return on equity (ROE) consistently exhibited statistical significance and positivism in both models, confirming its reliability as a primary factor influencing stock returns irrespective of industry mix. Although net income remained statistically insignificant in both instances, its coefficient experienced a tiny increase in the restricted model, however it still did not reach conventional significance thresholds. The leverage variable, previously inconsequential in the entire model, became even less pertinent in the non-financial sample, further proving the idea that its explanatory power wanes as firm-specific effects are accounted for.

The inverse correlation between firm size (total assets) and stock returns was maintained and remained statistically significant in both models, reinforcing the evidence for a size effect in equity returns. Likewise, market return remained the most potent and reliable predictor, exhibiting roughly equal coefficients and significance levels across models. This indicates that the omission of financial enterprises did not significantly affect the overall market dynamics impacting stock performance.

The comparison highlights the strength of the principal findings: profitability and market dynamics are the predominant determinants of stock returns, whereas leverage and net income have a weaker and more inconsistent impact. The presence or absence of financial firms has minimal effect on these fundamental links, hence affirming the validity and applicability of the study's findings.

4.5 Testing Nonlinearity and Interaction Effects

In the fixed effects regression model, all explanatory variables were assumed to have linear and additive associations with stock returns. Nonetheless, financial theory and empirical research increasingly indicate that these effects may be nonlinear or contingent upon business characteristics. For example, profitability (ROE) may not exert a uniform marginal influence on returns; there could be declining returns at elevated levels of profitability. The influence of ROE on stock performance may differ based on firm size, indicating a possible interplay between profitability and firm size.

Model 1: Profitability × Firm Size

In Table 11 the interaction value implies minimal explanatory power without significantly enhancing the model. Nonetheless, it illustrates the endeavor to investigate nonlinearities.

Interaction Effects Between Profitability and Firm Size on Stock Returns

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-4.3768e-02	-4.5829e-03	3.0461e-05	4.8844e-03	3.8163e-02

Coefficients:

	Estimate	Std. Error	t-value	Pr(>|t|)	significance
Net Income	0.00047726	0.00038277	1.2469	0.212564	
ROE	0.00271845	0.00121490	2.2376	0.025337	*
Leverage	-0.00012087	0.00018781	-0.6436	0.519925	
Total Assets	-0.00191029	0.00063337	-3.0161	0.002587	**
Market Return	0.02674218	0.00102159	26.1769	<2.2e-16	***
ROE: Total Assets	-0.00019147	0.00013510	-1.4173	0.156534	

Total Sum of Squares: 0.21988, Residual Sum of Squares: 0.16884

R-Squared: 0.23211, Adj. R-Squared: 0.13306

F-statistic: 124.587 on 6 and 2473 DF, p-value: < 2.22e-16

Table 11: This table displays result from fixed effects regression incorporating an interaction term between return on equity and total assets to investigate whether business size influences the effect of profitability on stock returns of a panel data set of 314 firms (observations = 2793). Independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. The standard errors are both resilient and clustered.The total sum of squares and the residual sum of squares indicate the proportion of volatility in stock returns addressed by the model.The reported R^2 indicates the extent of within-firm variance clarified by the model. The F-statistic evaluates the collective significance of all regressors. Significance codes denote as: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Although both ROE and company size were individually significant, the interaction term was statistically insignificant ($p = 0.157$), suggesting that the influence of profitability may decrease with firm size, although this effect is not consistent throughout the sample. Nonetheless, the model's explanatory capacity increased marginally, reinforcing the likelihood of underlying connections that urge further exploration.

Nonlinear Model: Quadratic ROE.

A quadratic factor was incorporated into the model to account for potential nonlinearities in the impact of profitability.

Nonlinear Relationship Between Profitability and Stock Returns: Quadratic ROE Specification

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-4.3603e-02	-4.6638e-03	7.8628e-05	4.8878e-03	3.8039e-02

Coefficients:

	Estimate	Std. Error	t-value	Pr(>|t|)	significance
Net Income	0.00058941	0.00038666	1.5244	0.1275	
ROE	-0.00047951	0.00079635	-0.6021	0.5471	
ROE_sq	0.00030109	0.00013730	2.1930	0.0284	*
Leverage	-0.00016759	0.00018850	-0.8891	0.3740	
Total Assets	-0.00249075	0.00055498	-4.4880	7.518e-06	***
Market Return	0.02684086	0.00102128	26.2816	<2.2e-16	***

Total Sum of Squares:0.21988, Residual Sum of Squares: 0.16865

R-Squared:0.23298, Adj. R-Squared: 0.13404

F-statistic: 125.194 on 6 and 2473 DF, p-value: <2.22e-16

Table 12 : This model includes a squared component for ROE to examine a possible nonlinear (concave or convex) link between profitability and stock returns of a panel data set of 314 firms (observations = 2793). Independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. All controls are incorporated with fixed effects and robust standard errors. The total sum of squares and the residual sum of squares indicate the proportion of volatility in stock returns addressed by the model.The reported R^2 indicates the extent of within-firm variance clarified by the model. The F-statistic evaluates the collective significance of all regressors. Significance codes denote as: *** $p < 0.001$, * $p < 0.05$.

A quadratic model for return on equity (ROE) demonstrated a significant U-shaped correlation with stock returns. Although ROE by itself was not linearly significant, the squared term was positive and statistically significant ($p = 0.028$), suggesting that the impact of profitability on returns amplifies at elevated ROE levels. This indicates the existence of nonlinear investor reactions, wherein only exceptionally profitable enterprises are constantly rewarded by the market.

An additional specification examined the interplay between profitability (ROE) and leverage to determine if the impact of leverage on stock returns is contingent upon a firm's profitability.

Model 2: ROE x Leverage

Interaction Between Profitability and Leverage in Explaining Stock Returns

Variable	Estimate	Significance
Interaction1	+0.000006	Not significant (p = 0.85)
R^2 / Adj. R^2	0.232 / 0.132	
F-statistic	124.16	

Table 13: This model incorporates an interaction between ROE and leverage to investigate if the link between profitability and returns is influenced by a firm's capital structure of a panel data set of 314 firms (observations = 2793). Independent variables were subjected to log transformation and winsorization at the 1st and 99th percentiles. Panel fixed effects and robust clustering standard errors were utilized.

The interaction term was deemed statistically insignificant, suggesting a lack of meaningful evidence that ROE moderates the effect of leverage within the examined sample. Furthermore, the incorporation of this variable did not significantly enhance the model's explanatory capacity, indicating that the association between leverage and stock returns is not dependent on profitability in this scenario.

5.0 Discussion

The fixed effects model, validated by diagnostic testing and robust standard errors, was chosen as the principal specification for inference based on a panel of enterprises from various industries. The analysis of the data emphasises the indicators, magnitudes, and statistical significance of principal independent variables: profitability (ROE), leverage, business size, market return, and net income.

A notable discovery is the robust and statistically significant positive correlation between return on equity (ROE) and stock returns. This outcome substantiates Hypothesis 2 and corresponds with theoretical anticipations and empirical studies (e.g., Fama & French, 2015; Novy-Marx, 2013). An elevated ROE signifies effective management and robust profitability, possibly resulting in increased investor confidence and anticipated future cash flows. This relationship's persistent presence across several model configurations highlights its robustness and affirms that profitability is a fundamental driver of stock performance over the analysed decade.

The size of a firm, shown by log-transformed total assets, exhibits a statistically significant negative correlation with stock returns, so corroborating the well-documented "size effect" in financial markets. Large corporations may encounter diminishing marginal returns or be viewed as less nimble in adapting to market changes, leading to relatively lower returns (Banz, 1981). The discovery indicates that investors may require a greater risk premium

from smaller firms owing to perceived risks and uncertainties, resulting in elevated returns from smaller, potentially more volatile enterprises. This reinforces the idea that size-related factors continue to be pertinent in elucidating return variation, even in contemporary, rigorously regulated capital markets.

The market return, utilised as a control variable, demonstrated the most robust statistical correlation with stock return in all models. This validates its function in identifying systemic risk, in accordance with the premises of the Capital Asset Pricing Model (Sharpe, 1964). The persistent high significance underscores that overarching market dynamics continue to exert considerable influence on individual firm performance, even after accounting for firm-specific characteristics. This further validates its incorporation as an essential variable in multifactor models and aligns with extensive empirical studies, including those by Jegadeesh and Titman (2001), who recognised the simultaneous influence of both macro and micro variables on asset price behaviour.

Contrary to original assumptions, leverage (debt-to-equity ratio) does not exhibit a significant correlation with stock returns in the fixed effects model, but it demonstrated weak relevance in the random effects models. This result indicates that when unobservable firm-specific traits are considered, the explanatory capacity of leverage decreases. The impact of leverage may be nonlinear or influenced by unobserved variables, such risk appetite, industry-specific standards, or macroeconomic factors. The literature presents divergent views on the influence of capital structure (e.g., Bhandari, 1988; Penman et al., 2007), and this finding adds to the discourse by indicating a diminished significance of leverage in contemporary NYSE-listed companies.

Ultimately, net income, although conceptually relevant, exhibited no statistically significant explanatory power in any model. This may result from its strong association with ROE or potential distortion caused by firm size and accounting variability. It was included in the model to consider profitability breadth; however, its insignificance indicates that ROE serves as a more effective proxy for market-relevant profitability in stock valuation.

Collectively, the data confirm that corporate profitability and market dynamics are the most reliable and economically significant determinants of stock returns from 2013 to 2023. The adverse impact of size and the negligible influence of leverage indicate a change in market dynamics relative to previous eras. These results furnish contemporary empirical validation

for multi-factor asset pricing models and present practical ramifications for investors and portfolio managers aiming to develop performance-oriented equity strategies.

6.0 Implications

Theoretical Implications and practical significance for portfolio managers, equity analysts, and business decision-makers of this empirical analysis:

This study advances asset pricing theory by empirically validating the significance of firm-specific fundamentals in describing stock returns, beyond established models such as the Capital Asset Pricing Model (CAPM). Although the Capital Asset Pricing Model (CAPM) argues that market return is the exclusive systematic determinant of expected returns (Sharpe, 1964), this research indicates that firm-specific variables—especially return on equity (ROE) and firm size—exhibit robust and significant correlations with stock performance. This validates the transition to multi-factor models such as those proposed by Fama and French (1993, 2015).

The positive and statistically significant correlation between ROE and stock returns across all model specifications affirms that profitability is a persistent and solid determinant of stock performance, in accordance with Novy-Marx (2013). Investors and analysts may employ ROE as a critical criterion in stock selection strategies, prioritizing companies that exhibit effective internal capital utilization.

Furthermore, the inverse correlation between firm size (assessed by total assets) and returns offers contemporary empirical validation for the established "size effect" (Banz, 1981), indicating that the phenomenon continues to exist in current capital markets. Smaller enterprises, characterized by fewer total assets, demonstrated higher returns, hence enhancing the appeal of small-cap strategies for long-term, risk-tolerant investors.

Notably, leverage and net income were determined to be statistically irrelevant in the majority of models. Although previous research (e.g., Bhandari, 1988) anticipated a positive risk premium linked to increased leverage, our results suggest that leverage may not universally serve as a predictor—especially in regulated, transparent markets such as the NYSE. These findings indicate the conditional significance of leverage and advocate for a reassessment of its function in return prediction. Particularly in mature markets corporate finance managers should prioritize profitability and operational efficiency rather than debt manipulation to boost business worth.

The market return variable consistently demonstrated high significance across all models, underscoring the critical need to observe macroeconomic conditions and market sentiment. Asset managers ought to persist in incorporating market-level indicators into forecasting models in conjunction with firm-level factors.

This study illustrates the efficacy of panel data approaches in enhancing estimation accuracy and mitigating omitted variable bias in asset pricing research by utilizing three-way fixed effects (firm, year, industry) and correcting for unobservable heterogeneity.

7.0 Summary of findings

Profitability (ROE) was identified as a statistically significant and positive factor influencing stock returns in the fixed effects model. This proves the premise that companies yielding elevated returns on equity provide superior stock returns, complementing previous research by Fama and French (2015) and Novy-Marx (2013). Net income, while conceptually associated with company profitability, was not statistically significant in any model. This suggests that ROE is a more significant statistic for investors and analysts when assessing return prospects.

The size of the firm, shown by the logarithm of total assets, exhibited a substantial inverse correlation with stock returns. This validates the existence of a "size effect," wherein larger enterprises often produce lower returns than smaller firms, in accordance with Banz (1981). The market return exhibited the most robust and statistically significant positive correlation with firm-level stock returns across all models. This underscores the significance of systematic risk variables in stock performance and validates its application as a control variable in multi-factor asset pricing models.

Leverage did not exhibit a statistically significant effect on stock returns in the fixed effects or two-way fixed effects models; however, it played a minimal role in the random effects model. This indicates that as unobserved heterogeneity is accounted for, the explanatory capacity of capital structure decreases.

Robustness checks validated the accuracy of the fixed effects specification. The Hausman test rejected the null hypothesis in favour of fixed effects. The Breusch-Pagan test revealed heteroskedasticity, necessitating the application of robust standard errors. Multicollinearity assessments using VIF indicated that all variables were within acceptable limits (VIF < 2). An alternative model that excluded financial enterprises was also estimated, demonstrating

analogous patterns in coefficient signs and significance, thus enhancing the applicability of the results to non-financial sectors.

8.0 Limitations and suggestions for future research

Limitations:

The dataset consists of an imbalanced panel of 330 NYSE businesses monitored from 2013 to 2023. Although imbalanced panels are prevalent in financial research and facilitate the inclusion of additional firms, they also result in certain firms being watched for fewer years. This may introduce minor bias if such firms systematically differ from those with complete 11-year histories.

Despite attempts to guarantee randomness and variety in company selection, the sample was constructed manually. Consequently, selection bias cannot be entirely eliminated. Moreover, financial enterprises were incorporated into the primary model, despite their accounting frameworks differing markedly from those of other sectors. An alternate model omitting financials was projected to mitigate this issue; however, the significant variability of sectors may still impact comparability.

The investigation is confined to NYSE-listed corporations; hence the conclusions may not be applicable to other markets, particularly emerging economies where market dynamics, investor behaviour, and financial disclosure norms vary considerably.

Suggestions for Future Research:

Incorporating inflation, GDP growth, interest rates, or market volatility indexes (e.g., VIX) into the model would enhance the connection between company performance and overarching economic trends, hence augmenting model robustness.

Subsequent study may evaluate the predictive efficacy of ROE in comparison to alternative profitability indicators, such return on assets (ROA) or gross profitability, as demonstrated by Novy-Marx (2013).

Ultimately, doing this study in additional developed and emerging stock markets may ascertain the applicability of the findings and express fundamental disparities among markets.

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10.0 Appendix

Appendix 1: Variable Definitions and Measurement

This study examines the influence of firm-specific fundamentals and market variables on monthly stock returns. The variables used in the final empirical model are chosen based on their theoretical relevance, empirical significance in previous studies, and data availability throughout the sample period.

The definitions, measurement category, and anticipated theoretical indicators of the variables

Variable	Category	Definition	Measurement
Stock Return	Dependent Variable	The monthly stock return is determined by the percentage change in the firm's adjusted closing price from one month to the subsequent month. Prices are obtained from FactSet.	This variable indicates the firm's actual market performance over time and functions as the dependant variable in all regression models
Leverage	Independent Varible	Defined as the overall debt-to-equity ratio, this variable encapsulates the firm's financial structure and risk profile.	According to Bhandari (1988), it is anticipated to affect returns depending on how investors assess financial risk. The variable is winsorized at the 1st and 99th percentiles due to skewness and subsequently log-transformed to create log_leverage.
Return On Equity (ROE) as Profitability	Independent Varible	Defined as return on equity (ROE), computed by dividing net income by shareholders' equity.	This is a commonly utilized metric for assessing managerial efficiency and internal capital productivity (Fama & French, 2015). The variable undergoes winsorization and log transformation to mitigate outliers and non-normality, yielding log_roe.
Total Assets as Firm Size	Independent Varible	Firm size is indicated by total assets, reflecting the magnitude of operations. While other studies frequently utilize market capitalisation (Banz, 1981),	Following an assessment for multicollinearity, total sales was omitted due to its significant association with assets. The size variable is converted to log_total_assets

		total assets offer a balance-sheet-based, accounting-derived metric.	following winsorization to achieve distributional normalcy.
Market Return	Control Varible	A control variable denoting the monthly return of a comprehensive market index, obtained from the Kenneth R. French Data Library.	This considers systematic market fluctuations according to CAPM and multi-factor models (Sharpe, 1964; Fama & French, 1993). The variable undergoes log transformation subsequent to winsorization.
Net Income	Independent variable	After accounting all the expenses the amount remaining from total revenues.	Although net income was utilized to calculate ROE and examined in preliminary modelling, it was excluded as an independent predictor due to its inferior performance and conceptual redundancy. ROE functions as a standardized and comparative indicator of profitability.
Book-to-Market Ratio (BM)	Excluded variable	The book-to-market ratio, defined as the proportion of a firm's book value of equity to its market value of equity, has traditionally been pivotal in elucidating stock returns (Fama and French, 1992; 1993).	Nonetheless, despite its theoretical allure and historical significance, the BM ratio was omitted from the final model of this study due to Multicollinearity with other variables in the model, notably with firm size (total assets) and leverage.
Total Sales	Excluded variable	Used as key performance indicator for tracking total revenue generated from sales of products or services.	Excluded from the final model due to its significant Multicollinearity with total assets, which posed a risk of inflating standard errors and complicating interpretation.

Appendix 2:

List of all the Industry category and Number of firms of each RBICS category of the unbalanced panel data set

RBICS Economy	Number of firms	Industry Code	RBICS Economy	Number of firms	Industry Code
Non-Energy Materials	80	01	Utilities	18	07
Industrials	50	02	Consumer Non-Cyclicals	34	08
Healthcare	37	03	Consumer Services	22	09
Technology	27	04	Energy	19	10
Business Services	18	05	Consumer Cyclicals	21	11
Finance	45	06	Telecommunication	1	12

Table: List of Industry category and the number of firms under each category collected from FactSet.

Appendix 3:

Distribution of Stock Returns by Industry Code in Unbalanced Panel Dataset of 314 NYSE-listed public firms

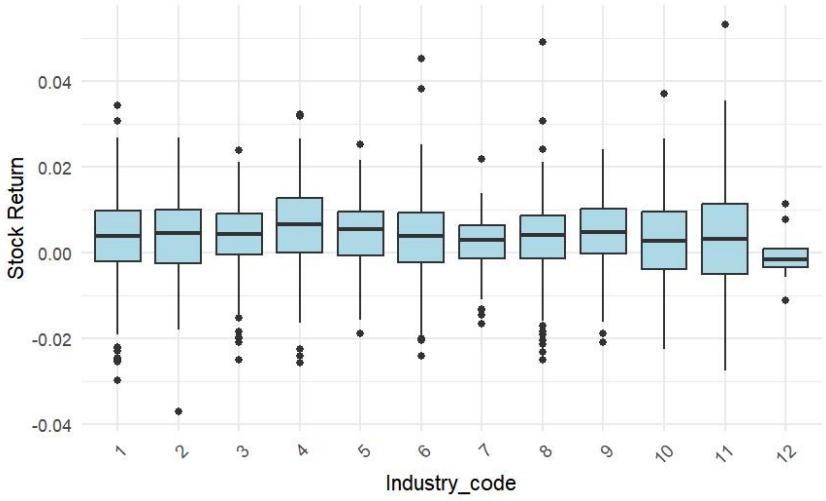

Figure 1: This boxplot illustrates the distribution of stock returns over 12 distinct industry codes from an unbalanced panel data-set, characterized by varying observation counts per industry. Each box illustrates the median, interquartile range (IQR), and outliers of stock returns within a specific industry. The majority of industries exhibit median returns close to zero, reflecting comparable central tendencies, although certain sectors (e.g., codes 10 and 11) display broader interquartile ranges, indicating increased volatility. The existence of outliers in almost all sectors indicates irregular extreme returns.

Appendix 4:

Relation Between Stock Return and Return on Equity (ROE): Scatterplot with Linear Regression from Unbalanced Panel Data

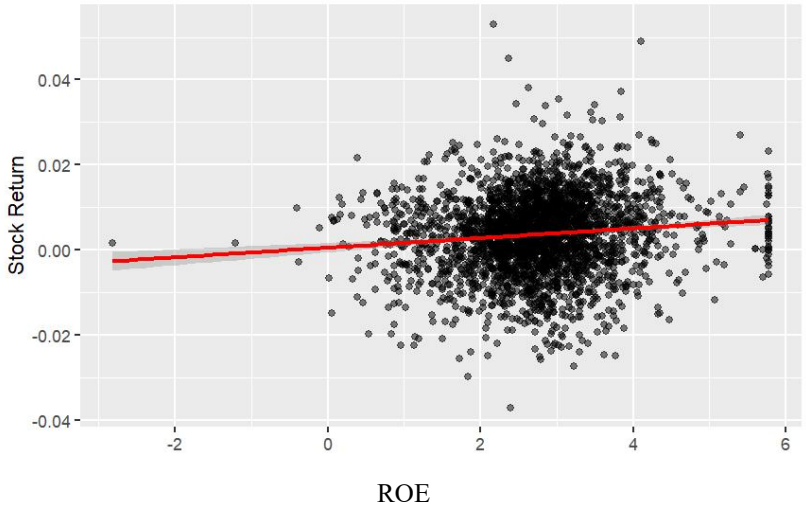

Figure 2: This scatterplot exhibits the relation between Return on Equity (ROE) and stock returns, utilizing data from an imbalanced panel data-set. Each point denotes a firm-period observation, with stock return shown on the y-axis and ROE on the x-axis. The red line represents a linear regression fit, demonstrating a modest positive correlation between ROE and stock returns. Although most data points are concentrated at the origin, indicating that most firms exhibit moderate ROE and stock returns close to zero, the linear trend suggests that, on average, firms with elevated ROE tend to achieve slightly larger stock returns. Nonetheless, the broad dispersion and the shallow slope indicate that ROE solely accounts for a minor portion of the variability in stock returns.

Appendix 5:

Firm Size and Stock Returns: Scatterplot with Linear Regression from the Unbalanced Panel Dataset

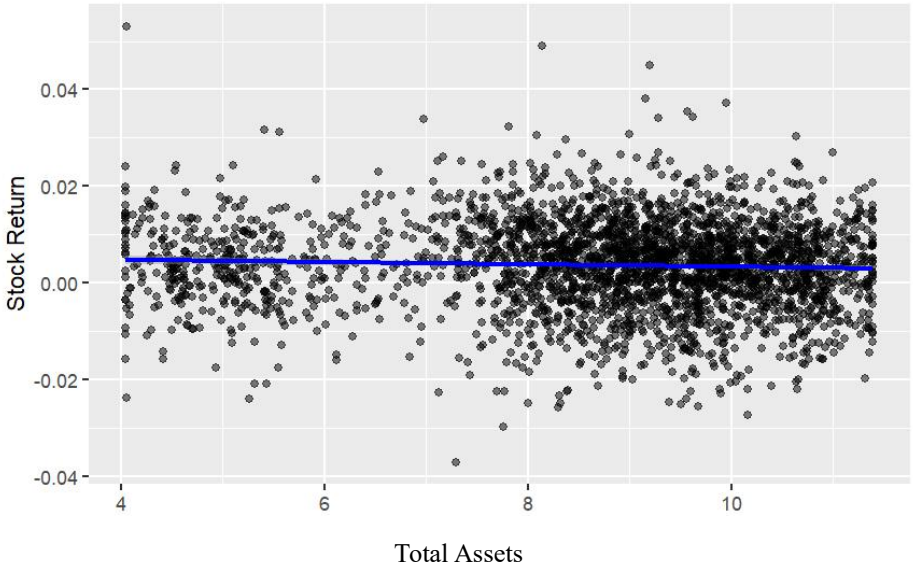

Figure 3: This scatterplot analyzes the correlation between firm size (log-transformed, on the x-axis) and stock returns (on the y-axis) leveraging data from an unbalanced panel. Each dot signifies a firm's observation for a designated time interval. The blue line represents a linear regression fit, with a marginal negative slope. This is a tenuous inverse correlation, wherein

larger firms typically demonstrate somewhat diminished average stock returns. The dispersion of data points and the line's flatness suggest that business size possesses minimal explanatory power regarding stock return variation in this data-set. The clustering of points within size values of 7 to 10 indicates a greater density of mid- to large-sized enterprises in the sample.