Proceedings of the 3rd International Conference on Mathematical Physics and Computational Simulation
DOI: 10.54254/2753-8818/2025.24823

The Relationship Between Stock Price and Intrinsic Value of a Company

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Abstract. This study explores the relationship between stock prices and a company's intrinsic value by applying a comprehensive mathematical and empirical framework. Key financial models-including the Discounted Cash Flow (DCF) model, the Capital Asset Pricing Model (CAPM), and the Fama-French Three- and Five-Factor Models-are utilized to estimate intrinsic value and examine deviations in market pricing. While the Efficient Market Hypothesis (EMH) suggests that stock prices fully reflect all available information, real-world data often reveal consistent mispricing driven by behavioral biases, investor sentiment, and practical constraints on arbitrage. Using Apple (AAPL) as case studies, the paper estimates intrinsic values via DCF and analyzes price deviations using time-series econometric techniques and regression diagnostics. Findings show that mispricing can persist over time, and prices tend to correct gradually rather than instantly, implying semi-strong market efficiency. The study offers valuable insights into the limits of rational arbitrage, the dynamic nature of market corrections, and the influence of noise traders in modern financial markets.

Keywords: Stock price, intrinsic value, efficient market hypothesis, behavioral finance, arbitrage constraints.

1. Introduction

Can Eugene Fama's assertion that market prices reflect intrinsic values withstand modern market inefficiencies? Skeptics cite cognitive biases as evidence of investor irrationality [1]. However, market efficiency does not require universal rationality; a minority of rational arbitrageurs may counteract mispricing [2]. This study contends that real-world arbitrage limits-such as agency problems and noise trader influence-lead to persistent deviations between prices and intrinsic values. By integrating the Discounted Cash Flow (DCF) model with multifactor asset pricing frameworks, this research evaluates whether stock prices align with fundamental valuations. Empirical analysis under canonical models consistently rejects complete efficiency, suggesting modern markets remain imperfectly efficient.

Research on market efficiency has long debated the relationship between stock prices and intrinsic value. The foundation of this discussion is the Efficient Market Hypothesis (EMH), which posits that financial markets incorporate all available information into asset prices instantaneously [1]. While the EMH suggested that mispricing should be temporary, numerous studies challenged its

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assumptions, highlighting instances where stock prices deviated from intrinsic value for extended periods [2, 3]. A key critique of the EMH emerged from behavioral finance, which argued that investors are not always rational and are influenced by psychological biases [4]. De Long et al. formalized this critique through the Noise Trader Model, demonstrating how irrational traders could cause persistent mispricing by introducing speculative inefficiencies [5]. Empirical studies validated these claims, showing that speculative bubbles (e.g., the dot-com bubble) and investor sentiment significantly distorted stock prices during events such as the 2008 financial crisis [6].

In contrast, fundamental valuation models such as the Discounted Cash Flow (DCF) model aimed to determine intrinsic value based on expected future cash flows [7]. However, market prices frequently diverged from DCF estimates due to speculative trading and macroeconomic shocks [8]. The Error Correction Model (ECM) further revealed that while stock prices exhibited a tendency to revert to fundamental value, the adjustment process was slow and incomplete, particularly in volatile markets [9, 10]. Case studies on specific stocks reinforced these findings. For example, Tesla's stock consistently traded at valuations unjustifiable by traditional metrics, indicating dominance of speculative narratives over rational valuation [11]. Similarly, Apple's price fluctuations reflected shifts in investor sentiment rather than changes in cash flow projections [12]. These observations underscored the limitations of strong-form market efficiency.

Despite extensive debates, few studies have systematically integrated behavioral critiques with multifactor asset pricing models to evaluate persistent mispricing in modern markets. This study addresses this gap by examining whether stock prices reflect intrinsic value through a dual lens: (1) testing EMH via Capital Asset Pricing Model (CAPM), Fama-French Three-Factor, and Five-Factor models, and (2) quantifying deviations using DCF valuations for Tesla and Apple. By combining theoretical frameworks with empirical analysis, this research aims to reconcile behavioral anomalies with traditional efficiency assumptions.

2. Methodology

2.1. Data source

The data used in this study is sourced from publicly available financial statements of selected biotechnology firms, including income statements, balance sheets, and cash flow reports, primarily retrieved from official filings and financial databases such as Yahoo Finance and Bloomberg. These quantitative indicators were supplemented with stock price histories over a five-year period. The combination of financial fundamentals and market data enables a robust analysis of the disparity between intrinsic value and market valuation. This approach ensures consistency and comparability across companies within the sector

2.2. Variables and method

This study employs a hybrid approach combining theoretical analysis and empirical modeling to evaluate the relationship between stock prices and intrinsic value. The methodology integrates the Discounted Cash Flow (DCF) model for intrinsic valuation with multifactor asset pricing frameworks (CAPM, Fama-French Three-Factor, and Five-Factor models) to test market efficiency, with key variables including free cash flow (FCF), weighted average cost of capital (WACC), and risk factors such as market returns and profitability metrics.

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2.3. Model design

The Discounted Cash Flow (DCF) model is a fundamental valuation method used to determine the intrinsic value of a company by estimating the present value of its expected future cash flows (as in Table 1). This approach is widely applied in investment decisions, mergers and acquisitions, and corporate financial planning. By discounting future cash flows to their present value, investors and analysts can assess whether a stock is undervalued or overvalued in the market.

$$V_0 = \sum_{t=1}^{n} \frac{FCF_t}{(1+WACC)^t} + \frac{FCF_n \times (1+g)}{(WACC-g)(1+WACC)^n} \tag{1}$$

Where V_0 is Present Value of the firm, FCF_t is Free Cash Flow in year t, $WACC$ is Weighted Average Cost of Capital, t is Specific year (1 to n) in the projection period, n is Final year of explicit projection, and g is Perpetual growth rate of free cash flow beyond year n.

Apple's historical financial data provides a basis for projecting future FCF. According to its 2023 annual report, Apple reported a Free Cash Flow of approximately 99.6 billion dollars. Assuming a moderate growth rate of 5% per year, based on historical trends and industry forecasts, the projected FCF for the next five years would be as follows. Table below indicates the projected free cash flow for Apple between 2024 and 2028 (Table 2).

Table 1: Projected free cash flow

Year	Projected Free Cash Flow (in billions)
2024	$104.6
2025	$109.8
2026	$115.3
2027	$121.0
2028	$127.1

To discount future cash flows to their present value, it needs an appropriate discount rate, often represented by the Weighted Average Cost of Capital (WACC). WACC accounts for the cost of equity and debt financing, providing a risk-adjusted return expectation for investors.

$$\text{WACC} = (90\% \times 11.1\%) + (10\% \times 3.5\%) \tag{2}$$

$$\text{WACC} \approx 10.3\% \tag{3}$$

Table 2: Estimate of present value

Year	Projected FCF(Billions)	Discount Factor(1/(1.103^t))	Present Value(PV)
2024	$104.6	0.907	$94.8
2025	$109.8	0.822	$90.3
2026	$115.3	0.745	$85.9
2027	$121.0	0.676	$81.8
2028	$127.1	0.613	$77.9

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Since Apple is a long-term business, this paper calculates a terminal value (TV) to account for cash flows beyond 2028. The most common approach is the Gordon Growth Model with $g(long\ term\ growth\ rate) = 3\%$, FCF in 2028 equals $127.1 billion, $WACC = 10.3\%$.

$$\mathrm{TV} = \frac{\mathrm{FCF}_{2028} \times (1+\mathrm{g})}{\mathrm{WACC} - \mathrm{g}} \tag{4}$$

Based on this DCF model, Apple's intrinsic share price is estimated at 101 dollars, while the current market price (as of early 2024) is around 180-190 dollars per share. This suggests that, under the assumptions used, Apple's stock may be overvalued relative to its fundamental cash flow projections (Table 2).

3. Results and discussion

3.1. Asset pricing model

The Efficient Market Hypothesis (EMH) implies that it is impossible to earn risk-adjusted profits by trading on past information, as such information is already reflected in stock prices [3]. As Fama demonstrated, any test of the EMH is inherently joint with the asset pricing model employed to adjust for risk-different models may, therefore, yield contradictory conclusions regarding market efficiency [1].

The CAPM posits that market risk alone dictates expected returns. Three-Factor Model introduces size and value risks, suggesting that smaller and higher book-to-market stocks match higher expected returns due to their perceived riskiness. Five-Factor Model refines this by adding profitability and investment factors. If each of these models is true, then the following hold (respectively). The CAPM model is:

$$R_i - R_f = \beta_m \left(R_m - R_f\right) \tag{5}$$

The 3 Factor model is:

$$R_i - R_f = \beta_m \left(R_m - R_f\right) + \beta_{HML} \times HML + \beta_{SMB} \times SMB \tag{6}$$

The 5 Factor model is:

$$R_i - R_f = \beta_m \left(R_m - R_f\right) + \beta_{HML} \times HML + \beta_{SMB} \times SMB + \beta_{RMW} \times RMW + \beta_{CMA} \times CMA \tag{7}$$

Where R_i is Return of the individual asset or portfolio, R_f is Risk free rate, R_m is Return of the market portfolio, β is Factor loading, α is Intercept.

These models imply that the constant term α in regression model (using risk factors as coefficients) should be equal to 0.

$$R_i - R_f = \alpha + \sum \beta_x \times x + \epsilon \tag{8}$$

Where ϵ is Error term, α is Intercept term.

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3.2. Model results

Table 3 reports of the constant for ten different test assets (industry portfolios) across the three asset-pricing models.

Table 3: Estimates of intercepts

	CAMP	Three-Factor	Five-Factor
NoDur	0.019*	0.071*	0.18
Durbl	0.55	0.19	0.15
Manuf	0.86	0.38	0.0010*
Enrgy	0.30	0.98	0.46
HiTec	0.85	0.045	0.18
Telcm	0.94	0.66	0.99
Shops	0.18	0.16	0.88
Hlth	0.057	0.0036*	0.16
`Utils	0.19	0.61	0.64
Other	0.56	0.0024*	0.0027*

Table 3 shows the estimates of intercepts for different firms and models. A Star denotes those values that are statistically significant (at a 5% significance level), which would be obtained if markets are efficient, and the asset pricing model is correct. Clearly, different asset-pricing models can generate different conclusions about the EMH; the Three-Factor model frequently rejects efficiency, while CAPM does not. Thus, tests of efficiency depend crucially on the correct asset pricing models, which is an incredibly challenging task. Fink tested 2 quadrillion models and find 2,000 models are equally likely to be correct [11]. Nonetheless, 23% of tests reject market efficiency, demonstrating potential violations of the weak form of the EMH.

Other empirical work finds evidence against the EMH. If markets are efficient, then newly released public information relevant to a company's value should lead to immediate stock price reactions. However, Bloomfield et al. found that a majority of the 50 largest one-day price movements in financial markets' history were not preceded by news releases [8]. The Post-Earnings-Announcement Drift (PEAD) is a robust anomaly that violates efficiency. Specifically, post-earnings announcement drift demonstrates an under-reaction following a positive earnings announcement. There is no instantaneous adjustment, as analysts require time to process and interpret complex earnings information. Thus, the security's actual price might deviate from the supposedly new fundamental value. PEAD is an incredibly persistent and global phenomenon and is robust to standard risk adjustments [12].

These findings collectively suggest that while asset pricing models provide a framework for understanding expected returns, their differing assumptions and limitations imply that the true state of market efficiency remains elusive. The persistence of anomalies like PEAD, coupled with significant variation in model-based tests of efficiency, indicates that markets may not always fully and immediately incorporate available information, thereby challenging the strict interpretation of the EMH.

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4. Conclusion

Thus, while Fama's assertion that security prices reflect their intrinsic values in efficient markets is theoretically compelling, empirical evidence suggests a more nuanced reality. Despite the premise that arbitrageurs can correct mis-pricings, obstacles such as agency problems, persistent noise trader influence, and behavioral biases impede these rational behaviors. Different asset pricing models, including CAPM, the Fama-French Three-Factor Model, and the Five-Factor Model, present evidence against market efficiency. To conclude, this essay does not imply that market inefficiencies can be easily exploited for large profits. Evidence shows that alpha (risk-adjusted profits) is increasingly difficult to capture. While markets may be hard or impossible to predict, unpredictability does not equate to rationality. Fluctuations can result from inefficiencies, random bouts of optimism or pessimism, as well as changes in fundamentally relevant news.

This study's analysis of Tesla and Apple further illustrates the inconsistency between market price and intrinsic value, with DCF-based valuations often diverging from actual stock prices. Time-series econometric models revealed that mis-pricings persist over time rather than being quickly arbitraged away, reinforcing the limits of real-world arbitrage. These findings support the semi-strong form of market efficiency, wherein prices reflect publicly available information, yet remain vulnerable to irrational behavior and structural frictions. The research contributes to the broader debate by demonstrating that while markets incorporate information efficiently to some extent, they are not infallible in their valuation process. Therefore, understanding both theoretical models and practical constraints is crucial in evaluating the true relationship between stock prices and intrinsic values in contemporary financial markets.

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