An Empirical Study of NASDAQ Composite based on the Asset Pricing Models

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Abstract. The Fama and French five-factor model (FF5 model) has been widely used in finance to explain the returns of stocks. This model posits that stock returns can be explained by five factors: market beta, size, value, profitability and investment pattern. Despite its wide use, there has been limited empirical research on whether FF5 model is the superior in the context of the NASDAQ composite index (IXIC). This paper aims to fill this gap by conducting empirical research on the validity of the FF5 model compared with other asset pricing models. The study uses seventy-five stocks listed on the NASDAQ composite from January 2002 to December 2021 to test the validity of the FF5 model. The data was analyzed using regression analysis, with stock returns as the dependent variable and the five factors as the independent variables. The results of the study provide evidence for the validity of the FF5 model compared with other asset pricing models. It suggests that the FF5 model can explain stocks on the NASDAQ composite and it is superior compared with other asset pricing models. Result also indicated that the market beta, size, value, profitability and investment factors can have significant impact to stock returns. Thus, results suggests that the FF5 model can be used to effectively predict rate of return of stocks on the NASDAQ composite.

Keywords: Empirical analysis; asset pricing model; NASDAQ composite.

1. Introduction

The Five-Factors model introduced by Fama and French in 2015 has attracted tremendously amount of attention from the field of asset pricing [1]. This model suggests that asset returns can be explained by the market, size, value, profitability and investment pattern and it offers stronger ability to explain return of assets compared to the three factors model and the Capital Asset Pricing Model (CAPM) [2]. However, despite its popularity, these remains a lack of consensus on the validity of the model in explaining stock returns [3]. Specifically, study has shown that the FF5 model is not valid in estimating stock in the Japanese market [4]. Market efficiency also plays a role as studies have found that stock returns unexplained as this model fails to explain momentum effect in New Zealand [5]. This paper will be examining the validity of the FF5 model on assets in the NASDAQ composites.

The NASDAQ Composite have posted many studies as it is an important benchmark for the U.S stock market, specifically, the technology sector, innovation and investment performance. The NASDAQ Composite includes many well-known technology firms such as Amazon, Apple and Microsoft. Moreover, the NASDAQ Composite is weighted by market capitalization, which meaning that larger companies have higher impact on the index performance. Therefore, I have decided to include 75 firms with the highest market capitalization that are listed on the NASDAQ Composite as they have greater influence. Given that technological companies play a big role in modern economy and innovation, their success have a substantial impact on the financial market and it is crucial to investigate the applicability of the FF5 model to these companies [6]. Investors, as well as legislators and regulators who must make choices regarding financial markets and must have a solid understanding of the variable that have impact on the returns of tech companies. For individuals seeking to invest in technology companies or comprehend their financial performance. FF5 model offers helpful insights if it were determined to be a reliable instrument for explaining the returns of IT and tech firms. Alternate models might be required to provide a better understanding of the returns of these companies, however, if model is proved to be inadequate in its relevance to these firms.

Past studies on the validity of the FF5 model failed to consider many key behaviors and characteristics of firms listed in the NASDAQ composite. The capacity to create and launch new goods and services may have a substantial influence on the returns for tech0firms, which rely on innovation to spur growth and boost profitability. Network effect, where a company's value rises as more individuals utilize its products or services, are advantageous to many tech firms. Tech firms also have the ability to expand their businesses fast and effectively, resulting in considerable increase in sales and profitability. The IT sector is competitive, businesses that consistently outperform their rivals in innovation, efficiency and customer satisfaction are more likely to see bigger returns. Regulations that apply to technology firms on a national and international level can significantly affect their financial results. The returns of technology firms are also influenced by the national economy, monetary policy and other macroeconomic factors.

The performance of conventional asset pricing models, including the capital asset pricing mode, the FF3 model, and the FF5 model, is generally compared in this study. The findings indicate that the market, size, value, profitability, and investment determinants have only a tenuous relationship with the returns of companies listed on the NASDAQ Composite. Additionally, research has shown that the FF5 model is better than conventional models.

2. Literature Review

Financial models are important in explaining stock returns because they have the ability to anticipate future stock returns based on historical data and other pertinent information. This predictive capability is vital for risk management and investment choices. Models also assist us in comprehending the fundamental factors that affect stock returns, including macroeconomic trends, company-specific data, and market system risk, allowing us to more accurately evaluate the possible risk and return of an investment. Additionally, models offer a framework for analyzing various investing methods, helping investors make rational decisions and spotting possible risks and opportunities in the stock market. When working with customers or investors who might not have a thorough grasp of the stock market, models can assist us communicate our understanding of stock returns in a succinct way.

CAPM is a popular financial model that illustrates the connection between risk and anticipated return in the stock market. This means that it is impossible to consistently generate abnormal returns using information that is available to the public since it is assumed that financial markets are efficient and that stock prices represent all available information. The CAPM also makes the assumption that systematic risk, which is the inherent risk in the market as a whole and is reflected in market returns like the return on a broad market index like the S&P 500, has impact on stock returns. According to CAPM, a stock's predicted return is a function of its sensitivity to market risk, as reflected by the market return, and can be described by a single factor, the market return. According to this model, risk and anticipated return are positively correlated, with a stock's expected return increasing with risk. The security market line represents this connection. Even risk-averse investors must undertake some systematic risks in order to get a good return since CAPM also assumes that there are no riskless assets and that all investments include some level of risk [7]. Criticisms that the model oversimplifies the connection between risk and expected return and ignores additional elements, it is still a significant tool for financial analysts and investors [7].

On the other hand, FF3 model expands upon the CAPM by adding more variables to account for the distribution of stock returns. By including the size component and the value factor, this model says it can explain stock returns more nicely than the CAPM. The value factor compares the return of value stocks to growth stocks, while the size factor compares the return of small-cap companies to large-cap stocks. Extensive empirical data that supports the FF3 model demonstrates that the size and value factors have been consistently associated with better returns over long periods, supporting the claim that these variables are meaningfully involved in explaining stock returns. The model asserts that the size and value factors have distinct risk-return trade-offs compared to the market component

and predicts a positive link between risk and expected return, much like the CAPM. This can make it easier to comprehend how stock returns vary. The FF3 model has significant implications for investors since it contends that exposure to the size and value factors may be profitable and that these variables can be crucial in creating an effective portfolio. Compared to the CAPM, the FF3 model offers a more thorough explanation of stock returns and actual data backing up its assertions [8]. Despite of the wide use of the FF3 model, portfolio overlapping bias exist. The overlapping bias refers to the potential bias that arises in the standard approach of the three-factor model, there may be overlapping between the test portfolios and the factor portfolio and study suggested that overlapping bias was significant [9].

FF5 model is an enhanced financial model that builds upon the FF3 model by adding two extra elements, profitability and investment, to explain the cross-section of stock returns more effectively. The model contends that it explains stock returns more thoroughly than the FF3 model, and empirical data supporting this assertion indicates that the profitability and investment components significantly influence stock returns. The Five-Factor model predicts a favorable link between risk and expected return and contends that portfolio efficiency may be increased by exposure to the profitability and investment components. The methodology has significant ramifications for investors building effective portfolios [1]. However, there is lack of consensus of the validity of the FF5 model within different industries and around the international financial markets [4, 5]. This study aims to address these research gaps by examining the validity of the Fama-French Five-Factors on firms listed on the NASDAQ Composite.

3. Research Methods

3.1. Data Collection

This paper selected monthly data from Yahoo Finance, the adjusted closed price was used to calculate monthly return. This paper selected seventy-five firms with the highest market capitalization. This data-gathering method aims to gather the information required to evaluate the FF5 model's applicability to the chosen businesses. This model suggests five variables influencing stock returns: market, size, value, profitability, and investment. We can assess whether these five criteria are critical in explaining stock returns in the NASDAQ Composite by evaluating the model's applicability to the chosen businesses. Data-gathering is essential to guarantee that the analysis is founded on correct and complete data. This ensures that the study is free from biases or inaccuracies and that the results accurately represent the effectiveness of the NASDAQ Composite. The outcomes of this research can offer insightful information about the variables that affect stock returns and can be used to assess how well the NASDAQ Composite values stocks.

3.2. Asset Pricing Model

This study will examine three financial models to compare the validity of these models. A popular financial theory, CAPM offers a model for calculating the anticipated return on an asset, such as a stock. It is used to price financial items, such as stocks and bonds, and to assist investors in making well-informed investment decisions. The fundamental tenet of the CAPM is that an asset's expected return is inversely correlated with its systemic risk or risk across the board in the market. The formula below can be used to represent the CAPM:

$$\mathrm{E(R)} = R_f + \beta * (\mathrm{E}(R_m) - R_f) \quad (1)$$

Where E(R) represents the asset's anticipated return The risk-free rate of return, or R_f, is the yield on a Treasury bond. The asset's beta quantifies its systematic risk in relation to the market. E(R_m) represents the market's anticipated return. The beta coefficient calculates an asset's volatility in relation to the market. A beta of 1 indicates that the asset is anticipated to experience the same level

of volatility as the market. In contrast, a beta of less than 1 indicates that the asset is expected to experience higher levels of market volatility [2].

CAPM, put forth by Eugene Fama and Kenneth French in 1993, is expanded upon in the FF3 model. According to the model, market risk, size risk, and value risk can all be used to account for the expected return of a stock. These variables are meant to account for both general risks that apply to all stocks on the market as well as specific risks related to a particular stock. The expected return of a stock can be expressed as follows:

$$\mathrm{E}(R_i) = R_f + \beta_1 * \mathrm{MKT} + \beta_2 * \mathrm{SMB} + \beta_3 * \mathrm{HML} \quad (2)$$

Where $\mathrm{E}(R_i)$ is the expected return of stock I, $R_f$is the risk-free rate of return β_1 is the market beta of stock I, β_2 is the SMB factor, and β_3 is the value factor [8]. FF3 model is expanded into the FF5 model, which adds two new variables to account for returns on a portfolio or asset. According to the model, five elements can be used to explain a security's projected return: size, value, profitability, and investment. The market premium in the model represents market risk. The calculation looks like this:

$$R_i = \alpha + \beta_1 * \mathrm{Rm} + \beta_2 * \mathrm{SMB} + \beta_3 * \mathrm{HML} + \beta_4 * \mathrm{RMW} + \beta_5 * \mathrm{CMA} + \varepsilon_i \quad (3)$$

Where R_i is the expected return on security, alpha is the intercept, or the expected return when all factors are equal to zero, Beta1, 2, 3, 4, 5 are exposure of security to market, size, value, profitability and investment factors respectively [1].

4. Empirical Results

In this study, we compare these three models to see how well they can account for the returns of a sample of companies included on the NASDAQ Composite Index. This study used the average monthly return from January 2002 to December 2021 of the 75 stocks listed on the NASDAQ Composite with the highest market capitalization to compare the validity of the three asset pricing models by utilizing regression analysis where the monthly asset return was used as Y-variable, market, size, value, profitability and investment factors as X-variable.

FF5 model analyses the following five factors to explain the returns of securities. The market factor, which gauges the performance of the entire market, is computed as the return on a market index less the risk-free rate. The size factor measures how well small firms are compared to large firms and is determined as the return difference between a portfolio of small firms and a portfolio of large firms. The value factor, which measures how well value equities perform compared to growth stocks, is determined as the return difference between a portfolio of value stocks and a portfolio of growth stocks. The profitability factor measures the performance of companies with high operating profitability compared to those with low operating profitability. It is calculated as the return difference between a portfolio of companies with high operating profitability and a portfolio with low operational profitability. The investment factor, which measures how a firm's investment behavior affects its stock returns, is calculated as the return difference between a portfolio of cautious firms with a high investment-to-assets ratio and a portfolio of aggressive firms with a low investment-to-assets ratio. These factors' effectiveness is evaluated based on their capacity to account for the returns of the sample companies [1].

Table 1 illustrates the regression of asset pricing factors within the capital market pricing mode, FF3 model and FF5 model with the average monthly return of the 75 stocks listed on the NASDAQ Composite. These models attribute the excess return on particular stocks to a single component or set of variables.

Table 1. Comparison of model performance

Variables	CAPM	FF3	FF5
MKT	1.08546**	0.90335***	0.910815***
	(0.00248)	(0.00119)	(0.00173)
SMB		-0.25618***	-0.18167*
		(0.000133)	(0.015879)
HML		0.12321	0.014747
		(0.1779)	(0.785365)
RMW			0.073772
			(0.360401)
CMA			0.216536**
			(0.11837)

***p < 0.01, ** p < 0.05, * p < 0.1.

From regression results, the CAPM suggests that the market risk successfully explains the return of these firms. However, looking at the three-factor and five-factor models, the value and profitability factors tend to have a weak explanatory power toward these stocks. Due to sample bias, data quality difficulties, shifting market dynamics, and model constraints, the accuracy of the value and profitability components in predicting returns of companies listed on the NASDAQ Composite may be constrained. Many fast-growing technology and internet companies that might need to cleanly fall into the value and profitability categories used in the FF5 model are represented in the NASDAQ Composite. Additionally, the accuracy of the model's calculations depends on the quality of the data utilized. The NASDAQ Composite's and the technology sector's rapid fluctuations may impact how relevant these elements are to understanding stock returns [10]. When using the model to assess particular organizations, it's crucial to consider these constraints and inherent biases.

Table 2. Comparison of model significant alphas

	CAPM	FF3	FF5
Number of Stocks	75	75	75
Significant Alpha	23	18	16

A measure of an investment's excess return concerning its benchmark is called a significant alpha. The importance of an alpha implies that, after correcting for systematic risk, the investment's actual return is different from what would be predicted based on its benchmark, as shown in Table 2. Significant alphas are crucial for determining whether an asset pricing model is viable since they show whether it correctly captures the investment's risk-adjusted returns. Suppose the alpha is determined to be statistically significant. In that case, this indicates that the model may not accurately reflect the investment's returns and that additional variables may be at play.

Put another way, if a model produces high alphas, it means a discrepancy between the investment's actual returns and its predicted returns based on the model. The elements in the model cannot account for that discrepancy. In this situation, the model's reliability may be questioned, and further research may be required to fully comprehend the sources of the returns and the variables influencing the success of the investment. Significant alphas are crucial in determining if an asset pricing model is viable because they show whether the model effectively captures the investment's risk-adjusted returns. They draw attention to any discrepancies between actual returns and predicted returns based on the model. The regression result suggests that the FF5 model has a better performance in the explanatory power of asset return among the selected three asset pricing models on 75 stocks listed on the NASDAQ Composite with the highest market capitalization.

5. Conclusion

As a result of this analysis, FF5 model were more effective at explaining the average returns of the 75 stocks with the most significant market capitalizations listed on the NASDAQ Composite. According to the study, the value and profitability factors had little explanatory power, but the FF5 model nevertheless beat the CAPM and FF3 model. The FF5 model exhibited the least significant alphas among the individual stocks, indicating a better match with the stocks' actual returns. It is significant to emphasize that this study has a number of limitations. For instance, the sample size of 75 equities may not accurately reflect the NASDAQ Composite, and the findings may not apply to other markets. Furthermore, no other investment vehicles or asset classes were taken into account by the study. This study took only stock returns into account. Moreover, FF5 model is still exposed to the overlapping portfolio bias as assets may still overlap with the factor portfolio. Additional investigation might look at the efficacy of the FF5 model using a bigger sample size or a more comprehensive range of assets. It would be intriguing to find out how different industries or market circumstances affect the explanatory power of the value and profitability components. Incorporating more variables or using other models may offer new insights into what influences stock returns.

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