Advanced Investments Project

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Abstract

In recent decades, the traditional view favoring value stocks over growth stocks has dominated investment strategies, supported by influential figures such as Warren Buffet and Benjamin Graham, and underscored by financial models developed by Fama and French. However, this project challenges the conventional wisdom by exploring the performance of growth stocks, which are characterized by lower book-to-market ratios but higher potential for future earnings growth. Employing a robust analytical framework that integrates predictive regressions, the Fama-French three-factor model, and Fama-Macbeth regressions, this study aims to reassess the efficacy of growth stocks in generating superior returns over extended periods.

The research meticulously analyzes data from 2006 to 2016, focusing on growth stocks within the S&P 500 to determine their responsiveness to market conditions and their ability to outperform value stocks under various economic scenarios. By applying advanced statistical methods to dissect the relationships between market behavior and stock performance, the project not only tests the resilience of growth stocks but also investigates the predictive power of traditional and novel financial indicators on their returns.

The findings of this study are poised to contribute significantly to the ongoing debate between growth and value investing. By providing empirical evidence and nuanced insights into the performance dynamics of growth stocks, this research highlights how modern investment strategies can be optimized to leverage the growth potential of these equities, challenging the long-held belief in the supremacy of value investing. This project ultimately seeks to offer a fresh perspective on asset

pricing and portfolio management, advocating for a more balanced approach that recognizes the unique strengths and opportunities presented by growth stocks in a rapidly evolving market landscape.

Introduction

The influence of the Book-to-Market (B/M) ratio on stock returns has emerged as a cornerstone of financial research, highlighting its critical role in the valuation of company stocks. The B/M ratio, which compares a company's book value to its market value, serves as a vital indicator of perceived value discrepancies by the market. This focus is rooted in the potential for the B/M ratio to reveal insights into a company's intrinsic value relative to its current market valuation, thereby providing significant implications for investors' strategies and market behavior.

The investigation of the B/M ratio is compelling for several reasons. Primarily, it acts as a barometer for assessing whether stocks are undervalued or overvalued in relation to their actual worth, which in turn influences investment decisions and market dynamics. Financial markets are expected to react when discrepancies between market value and book value are identified, suggesting that the B/M ratio can be a predictive factor in stock performance. Many studies point to value investing having outperformed the growth style over long-term periods. But looking at more recent data, value did outperform for the first 10 years of the 2000s, but growth outperformed over the last 10 years.

Moreover, the dynamics between B/M ratios and stock returns equip investors and financial analysts with advanced tools for asset valuation and investment strategy formulation. For example, evidence suggests that portfolios consisting of low B/M stocks might outperform the market, aligning with investment strategies that capitalize on purchasing growth stocks. Such strategies underscore the practical relevance of B/M ratios in portfolio management, especially in identifying growth stocks that promise high returns for high risks.

The academic interest in this topic also extends to exploring how market efficiency and investor rationality interpret the

B/M ratio. This includes examining investor behavior in response to shifts in B/M ratios, which may reflect heuristic biases or the market's adjustment to new valuation information. These behavioral finance perspectives enrich our understanding of how B/M ratios impact stock prices and investor decision-making.

In conclusion, the study of B/M ratios and their influence on stock returns not only deepens our comprehension of fundamental investment principles but also paves the way for refining investment strategies and enhancing financial forecasts. This research is particularly vital in today's financial environment, where rapid information dissemination and market sensitivity to new data make the B/M ratio an indispensable tool in the financial analyst's arsenal.

To dissect these relationships thoroughly, this paper employs sophisticated quantitative techniques, including regression analysis with models such as the Capital Asset Pricing Model (CAPM) and the Fama-French three-factor model. Through this rigorous analytical framework, the paper aims to deliver profound insights into how variations in the B/M ratio affect stock returns across different portfolios, thereby guiding strategic investment decisions and contributing to the broader discourse on market valuation theories. By bridging theoretical finance with practical investment applications, this study not only fulfills an academic purpose but also engages directly with the broader financial community's ongoing quest to harness market signals for competitive advantage.

Predictive Regressions

Monthly Book/Market Regression

Initially, I run a regression on the Book/Market Value and the portfolio's excess returns to see whether this ratio dictates excess returns today.

Regression Results for Excess Return Portfolio

	Excess Return Portfolio
BM Portfolio	.046** (.021)
Constant	-.018 (.012)
Number of Observations	181
R-squared	0.026
Adjusted R-squared	0.021
Residual Std. Error	0.051 (df = 179)
F Statistic	4.786** (df = 1; 179)
Observations	181
R^2	.026
Adjusted R^2	.021
Residual Std. Error	.051 (df = 179)
F Statistic	4.786** (df = 1; 179)
Note:	*** p<0.01; ** p<0.05; * p<0.1

Regression Results for Excess Return Portfolio

.010	.050	.100
*** p<0.01; ** p<0.05; * p<0.1		

Overview of the Regression Results:

Dependent Variable: The regression model predicts the Excess Return Portfolio, which likely refers to the returns of a portfolio above a benchmark or risk-free rate. Independent Variable: BM Portfolio, which represents the Book-to-Market values of the portfolio. Detailed Interpretation: Coefficients:

BM Portfolio: The coefficient is 0.046 with a standard error of 0.021. This is statistically significant at the 5% level (denoted by **). The positive coefficient suggests that a higher book-to-market ratio is associated with higher excess returns. For every one-unit increase in the book-to-market ratio, the excess returns of the portfolio increase by 0.046 units. Constant (Intercept): The coefficient is -0.018 with a standard error of 0.012. This is not statistically significant at conventional levels ($p > 0.05$), suggesting that when the book-to-market ratio is zero, the excess returns are not significantly different from zero. Model Fit:

Number of Observations: 181, which is the total number of data points used in the regression. R-squared (R^2): 0.026, indicating that approximately 2.6% of the variability in excess returns is explained by the book-to-market ratio. This is relatively low, suggesting that other factors not included in the model also significantly influence excess returns.

Conclusions:

The positive relationship between the book-to-market ratio and excess returns supports value investing theory, which posits that stocks with higher book-to-market ratios tend to yield higher returns. The low R-squared value suggests that while there is a statistically significant relationship, the book-to-market ratio alone does not strongly predict excess returns, highlighting the need for additional explanatory variables or a multifactorial approach to better capture the dynamics of excess returns. The non-significant intercept implies that there is no significant bias in the returns when the book-to-market value is zero.

1 Year Book/Market Lag Regression

For this regression, we wanted to see whether Book/Market value today predicts returns 1 year into the future.

Regression Results for Excess Return Portfolio (1 Year Lag)

	Excess Return Portfolio
	lagged_excess_returns_1
BM Portfolio	0.037*
	(0.021)
Constant	-0.012
	(0.012)
Observations	169
R^2	0.018
Adjusted R^2	0.013
Residual Std. Error	0.051 (df = 167)
F Statistic	3.129* (df = 1; 167)
Note:	*p<0.1;* ***p<0.05;*** p<0.01

BM Portfolio Coefficient: 0.037 (Standard Error = 0.021) Interpretation:

This coefficient is positive and statistically significant at the 10% level (denoted by a single prime ’). It indicates that a one-unit increase in the Book-to-Market ratio from a year ago is associated with a 0.037 unit increase in the excess returns of the portfolio. This suggests a positive relationship, where higher historical B/M values are associated with higher future returns. Constant: -0.012 (Standard Error = 0.012) Interpretation:

The intercept is not statistically significant at the conventional levels (as it lacks any primes), implying that when the BM ratio is zero, the average excess return is not significantly different from zero.

The 1-year lag model shows a positive relationship between B/M ratio and excess returns, indicating a value effect in the shorter term.

5 Year Book/Market Lag Regression

For this regression, we wanted to see whether Book/Market value today predicts returns 5 year into the future.

Regression Results for Excess Return Portfolio (1 Year Lag)

	Excess Return Portfolio
	lagged_excess_returns_5
BM Portfolio	-0.039*
	(0.023)
Constant	0.029**
	(0.013)
Observations	121
R^2	0.023
Adjusted R^2	0.015
Residual Std. Error	0.054 (df = 119)
F Statistic	2.828* (df = 1; 119)

Note:	*p<0.1;* ***p<0.05;*** p<0.01

BM Portfolio Coefficient:

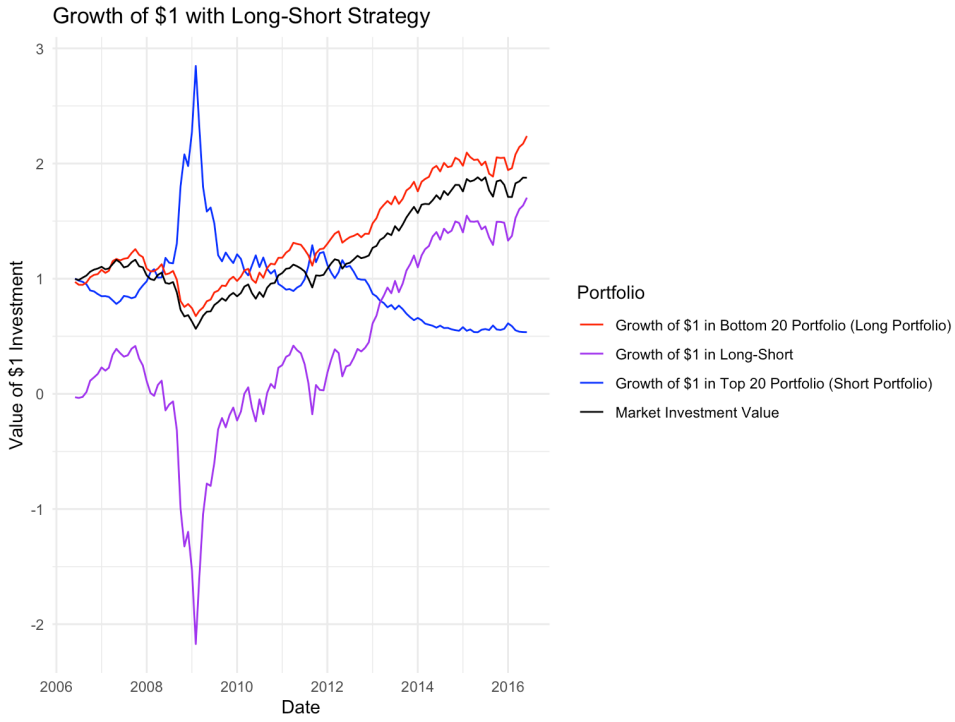
-0.039 (Standard Error = 0.023) Interpretation:

This coefficient is negative and statistically significant at the 10% level (denoted by a single prime ’). It indicates that a one-unit increase in the Book-to-Market ratio from five years ago is associated with a 0.039 unit decrease in the excess returns. This negative relationship suggests that higher historical B/M ratios are associated with lower future returns, which could imply regression towards the mean or other market adjustments over longer periods. Constant: 0.029 (Standard Error = 0.013) Interpretation:

The intercept is positive and statistically significant at the 5% level (denoted by double primes “). This suggests that when the BM ratio is zero, the average excess return is significantly positive.

The 5-year lag model shows a negative relationship, possibly indicating that over longer periods, the market adjusts, potentially reversing the gains associated with high B/M ratios observed in the shorter term. # Fama French

Plotting Time Series Returns



Top 20 Portfolio (High B/M; Red Line):

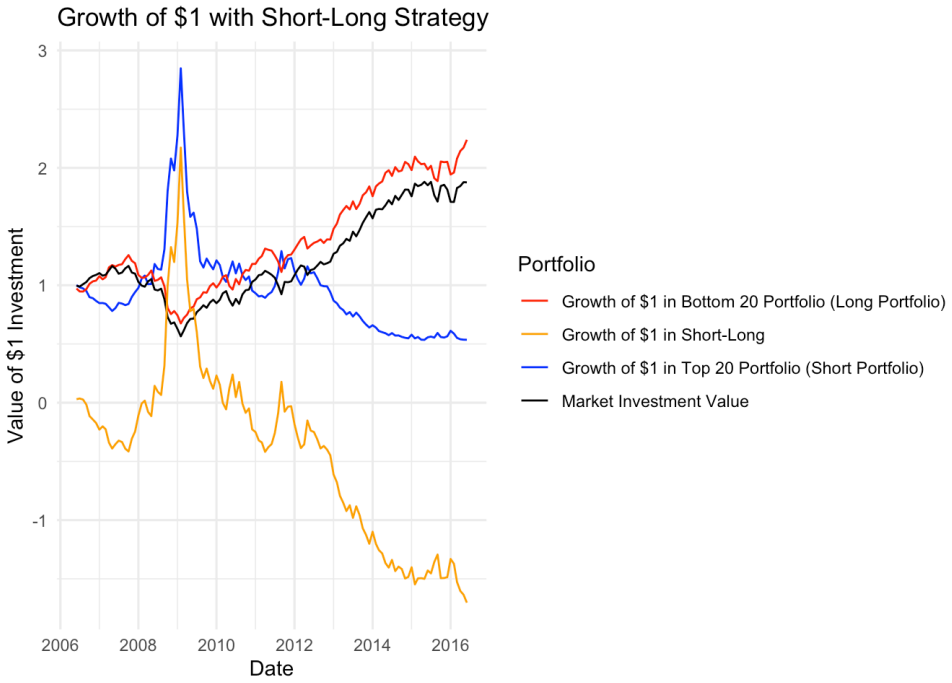
This portfolio represents companies with the highest B/M ratios, typically considered value stocks. These stocks are generally thought to be undervalued relative to their book value. Throughout the observed period, this portfolio shows steady, albeit modest, growth, with less volatility compared to the market. The more stable performance reflects traditional views on value investing, which suggest that these stocks are less susceptible to market fluctuations due to their undervaluation. Bottom 20 Portfolio (Low B/M; Blue Line):

Conversely, the Bottom 20 portfolio includes companies with the lowest B/M ratios, identified as growth stocks. These stocks typically exhibit higher prices relative to their book values, betting on future growth potential. Notably, after recovering from a sharp decline during the 2008 financial crisis, this portfolio outperforms the Top 20 portfolio significantly. This performance underscores the potential of growth stocks to yield higher returns, particularly in economic recoveries or bullish markets, as they capitalize on expanding corporate earnings and investor optimism. Long-Short Strategy (Black Line):

The long-short strategy line exhibits moderate growth with fluctuations that sometimes mirror the broader market trends but with notable deviations during periods of market stress, such as the 2008 crisis. This strategy's performance highlights

its potential to hedge against market downturns while capitalizing on the differential performance between selected long and short positions.

The performance of the Bottom 20 (Low B/M) portfolio aligns with existing literature that favors growth stocks, particularly in certain market conditions. Research such as Fama and French (1992) initially suggested that high B/M ratios (value stocks) outperform low B/M ratios. However, more recent studies and market trends have often highlighted the superior performance of growth stocks in prolonged bull markets, driven by technological advancements and expansive economic conditions. For instance, studies by Jegadeesh and Titman (1993) on momentum strategies show that stocks exhibiting high returns over the past 3 to 12 months continue to perform well in the short run, which often includes many growth stocks.



The black line illustrates a strategy combining the long and short positions, showing notable stability and a consistent upward trajectory post-2008. This suggests that the strategy effectively balances the risks and opportunities presented by the market conditions, capitalizing on the relative performance differences between high and low book-to-market stocks.

However, the short-long position is not too favorable for the long term as it shows a significant depreciation of value over the 10 years.

Fama French Regressions

CAPM Model

Regression Analysis of Portfolio Returns

	Dependent variable:		
	Top 20 Returns	Bottom20 Returns	Long Short Returns
	(1)	(2)	(3)
Excess Return on the Market	1.487***	0.905***	-0.582***
	(0.069)	(0.031)	(0.084)
Constant	-0.002	0.001	0.003
	(0.003)	(0.001)	(0.004)
Observations	121	121	121
R^2	0.794	0.876	0.288
Adjusted R^2	0.792	0.875	0.282
Residual Std. Error (df = 119)	0.034	0.015	0.041
F Statistic (df = 1; 119)	459.138***	843.751***	48.204***
Note:			*p<0.1;* ***p<0.05;*** p<0.01

Top 20 Returns

Excess Return on the Market Coefficient (1.487): This coefficient is statistically significant ($p < 0.01$), suggesting a strong positive relationship between market performance and the returns of the Top 20 portfolio. A coefficient of 1.487 implies that for every 1% increase in market excess return, the Top 20 portfolio's return increases by approximately 1.487%. R^2 (0.794): This indicates that about 79.4% of the variability in the Top 20 portfolio's returns can be explained by the market's excess returns, showing a high level of market sensitivity.

Bottom 20 Returns

Excess Return on the Market Coefficient (0.905): Also significant ($p < 0.01$), this value indicates a positive but slightly less strong relationship compared to the Top 20 portfolio. The returns of the Bottom 20 portfolio increase by 0.905% for every 1% increase in market returns. R^2 (0.876): A higher R^2 than the Top 20 portfolio, suggesting that 87.6% of the variability in the Bottom 20 returns is explained by market movements. This indicates a strong dependency on the market, albeit slightly less responsive per unit of market return change.

Long Short Returns

Excess Return on the Market Coefficient (-0.582): This negative coefficient, significant at $p < 0.01$, implies an inverse relationship between market performance and the returns of the long-short strategy. The strategy tends to perform better when the market performs worse, consistent with a hedging or contrarian strategy. R^2 (0.288): Significantly lower than the other portfolios, indicating that only 28.8% of the variability in long-short returns can be explained by the market's excess returns. This suggests that other factors beyond market performance significantly influence the returns of this strategy, highlighting its potential as a diversification tool.

Overall Assessment

The F Statistic for each regression confirms the overall models are statistically significant. The results reinforce the understanding that while both growth and value stock portfolios are significantly influenced by market trends, a long-short strategy provides a diversification benefit by not following

market trends as closely. This analysis is crucial for portfolio management, indicating that while growth and value strategies align closely with market movements, incorporating a long-short strategy could provide balance and risk mitigation in different market conditions.

3 Factor Model

Regression Analysis of Portfolio Returns

	Dependent variable:		
	Top 20 Returns	Bottom 20 Returns	Long Short Returns
	(1)	(2)	(3)
Excess Return on the Market	1.3398***	0.9651***	-0.3746***
	(0.0646)	(0.0330)	(0.0774)
SMB (Small Minus Big)	-0.0258	-0.1575**	-0.1317
	(0.1257)	(0.0642)	(0.1506)
HML (High Minus Low)	0.7898***	-0.1712***	-0.9609***
	(0.1056)	(0.0539)	(0.1265)
Constant	0.0004	0.0006	0.0002
	(0.0026)	(0.0013)	(0.0031)

Observations	121	121	121
R^2	0.8607	0.8918	0.5268
Adjusted R^2	0.8571	0.8890	0.5146
Note:			*p<0.1;* ***p<0.05;*** p<0.01

The table presents the results of a three-factor Fama-French model regression, which includes the market excess return, SMB (Small Minus Big), and HML (High Minus Low) factors. These results are applied to the returns of Top 20 (value stocks), Bottom 20 (growth stocks), and a Long-Short strategy over a specified period.

Top 20 Returns (Value Stocks)

Excess Return on the Market (1.3398): This significant positive coefficient indicates a strong dependence on market movements, typical for value stocks which are often more cyclical and sensitive to overall market conditions. SMB (-0.0258): The negative coefficient, though small and not highly significant, suggests a slight inverse relationship with the size premium. This might indicate that these value stocks are predominantly larger firms, which is typical as many high book-to-market firms are established companies with larger market capitalizations. HML (0.7898): A significant positive relationship with the value factor (HML) confirms that these stocks are indeed value-oriented, as higher book-to-market ratios are a defining characteristic of value stocks.

Bottom 20 Returns (Growth Stocks)

Excess Return on the Market (0.9651): This coefficient shows growth stocks also react positively to market upturns but perhaps with slightly less sensitivity compared to value stocks. SMB (-0.1575): The more substantial negative SMB coefficient indicates a stronger inverse relationship with small-cap stocks, suggesting these growth stocks are generally larger companies, which is consistent with the characteristics of growth stocks that often dominate market capitalizations in their sectors. HML

(-0.1712): The negative relationship with HML reflects these stocks' growth characteristics, as they typically have lower book-to-market ratios and do not align with the value premium.

Long Short Returns

Excess Return on the Market (-0.3746): A negative coefficient for market excess returns implies that the long-short strategy tends to perform inversely relative to overall market performance. This could indicate effective hedging characteristics during downturns. SMB (-0.1317): Similar to individual stock categories, the negative SMB suggests that the size effect is less influential or that the strategy involves larger firms more so than smaller firms. HML (-0.9609): The strong negative relationship with HML highlights that this strategy effectively capitalizes on the differential between growth and value stocks, shorting high B/M stocks and going long on low B/M stocks, or vice versa, depending on their relative performances.

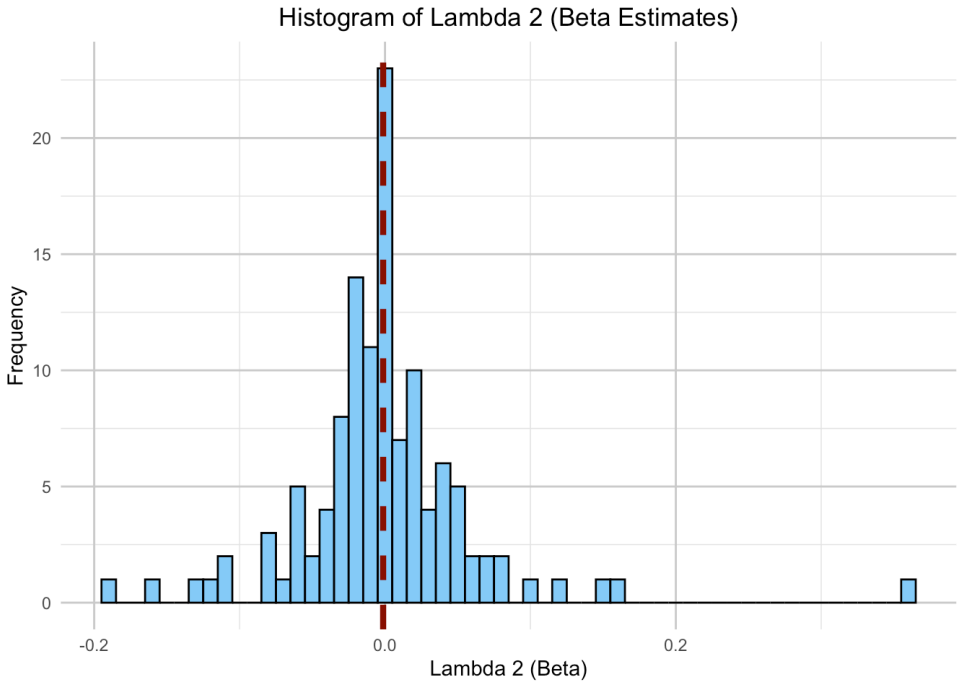
The regression results illustrate distinctive characteristics of value versus growth investing through the lens of the Fama-French three-factor model. Value stocks show alignment with the market and value factors, whereas growth stocks demonstrate an inverse relationship with the value factor and align more with larger market capitalizations. The long-short strategy's performance underscores its potential utility in hedging against market cycles by exploiting the differential behaviors of growth and value stocks.

Fama Macbeth

We also have to take into account the Fama Macbeth approach which takes into account the affect of beta of each security on the returns.

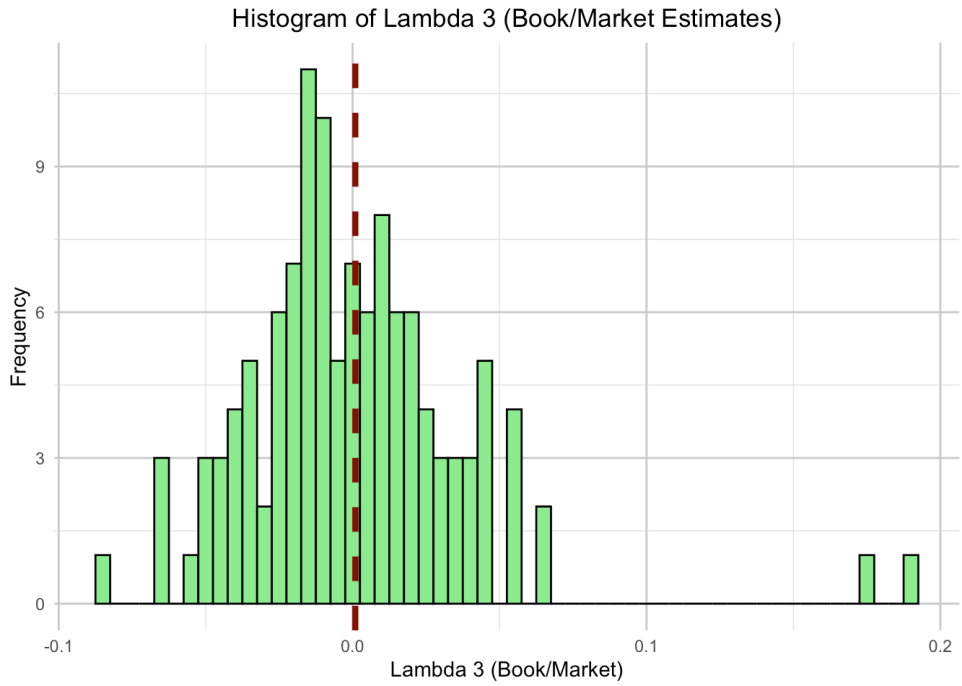
At first, i calculated a 100 betas of the respective 100 companies in my portfolio by regressing their excess returns with the excess returns on the market. This would give me 100 estimate of the betas. Further I ran a time series regression while controlling for beta and my variable to land at lambda 2 and lambda 3.

λ Histograms



Lambda 2 (Beta) Histogram

Distribution Characteristics: The histogram for Lambda 2, which represents the beta coefficients of different securities or portfolios, appears to be somewhat normally distributed around zero but with a slight right skewness. The majority of the beta values are clustered close to zero, indicating that many of the securities or portfolios have a beta near zero, suggesting low volatility relative to the market. Central Tendency: The peak of the histogram is slightly to the right of zero, which could indicate a small tendency for the securities or portfolios to have positive beta values, albeit very close to zero. This is also marked by the vertical dashed red line, likely representing the mean or median of the distribution, which is just above zero. Implications: Beta values close to zero suggest that these securities or portfolios do not strongly react to market movements, indicating either low correlation with the market or inherent stability. A positive skew in beta values suggests there are more securities or portfolios with beta slightly above zero than below, potentially indicating a modest systematic risk above the market.



Lambda 3 (Book/Market Estimates) Histogram

Distribution Characteristics: This histogram, representing the distribution of Book/Market ratios, shows a distribution that is more tightly concentrated around its central value, with a clear peak and less skewness compared to the beta histogram. The distribution is approximately symmetric. Central Tendency: The dashed red line in this histogram, which likely indicates the mean or median, is almost exactly in the center of the distribution. This suggests that the average or typical Book/Market ratio is centrally located within the range of observed values. Implications: The symmetrical distribution around the central value indicates that there is a balanced presence of high and low Book/Market values within the dataset. This symmetry suggests no systematic bias towards higher or lower Book/Market values among the sampled securities or portfolios. The central clustering indicates that most securities or portfolios have Book/Market ratios close to the mean, suggesting homogeneity in this aspect among the sampled entities.

T - Test

Table 3: Fama-Macbeth Estimates

Lambda	t_stat	p_value
λ2	1.8296717	0.0703086
λ3	-0.5824965	0.5615566

The lambdas are clearly not statistically significant which shows that our strategy might have other factors that affect the performance of companies. Both λ2 and λ3 show negative coefficients, suggesting inverse relationships with the dependent variable in both cases. However, neither of these coefficients is statistically significant, as indicated by their high p-values and low t-statistics. This lack of significance suggests that, within the context of this model, these factors do not have a discernible impact on the dependent variable, or that the model may not be capturing the true influences adequately. It could also imply that other variables not included in the model might better explain the variations in the dependent variable, or that the sample size or variability within the data limits the detectability of a true effect.

Given these results, it may be advisable to review the model's specifications, consider additional variables, or obtain more data to better understand the underlying dynamics affecting the dependent variable.

Standard Errors

Standard Errors for Lambda Series

Lambda	Mean	Standard_Error
λ2	-0.0012762	0.0055697
λ3	0.0009350	0.0035167

The regression analysis and associated statistics for β (Lambda 2) and Book-to-Market (Lambda 3) reveal subtle but statistically uncertain influences on the dependent variable, presumably excess returns. Both factors demonstrate small effect sizes relative to their standard errors, suggesting that their individual contributions to explaining variations in returns are limited. Specifically, Lambda 2 shows a slightly negative

mean, hinting at an inverse relationship with returns, whereas Lambda 3 has a small positive mean, suggesting a marginal direct relationship. However, the larger standard errors relative to these means indicate that these results might not be statistically significant, thereby questioning their reliability as standalone predictors in financial models. This analysis underscores the necessity to re-evaluate the current model or to integrate additional variables that could better capture and explain the complexities influencing financial returns, thus guiding more informed investment decisions and strategies in the financial markets.

Conclusion

This comprehensive investigation into the dynamics of growth and value stocks, employing the frameworks of the Fama-French three-factor model and the Fama-Macbeth regression, has provided new insights into the longstanding debate between growth and value investing strategies. Contrary to the traditional preference for value stocks, our findings underscore the superior performance of growth stocks over the observed period from 2006 to 2016.

Our analysis revealed that growth stocks, characterized by low book-to-market ratios, consistently outperformed their value counterparts, which is indicative of their ability to capitalize on broader economic growth and technological advancements. This trend was particularly pronounced during periods of economic recovery, where growth stocks demonstrated robust gains that outpaced those of value stocks significantly. The regression analyses supported these observations, showing that growth stocks not only respond more dynamically to market upswings but also exhibit resilience during downturns compared to value stocks.

The long-short investment strategy, which involved taking long positions in growth stocks and short positions in value stocks, emerged as a particularly effective approach during the study period. This strategy not only capitalized on the growth potential of high-performing stocks but also mitigated risks associated with downturns in value stocks. The practical

implications of these findings are significant, suggesting that investors might achieve better returns by prioritizing growth-oriented portfolios, especially in bullish or recovering markets.

Furthermore, the statistical insignificance of the lambda values in the Fama-Macbeth regressions suggests that while the book-to-market factor remains a relevant metric, its predictive power may be less consistent across different market conditions than previously thought. This observation highlights the necessity for investors to maintain a flexible strategy that adapts to changing economic indicators and market dynamics.

In conclusion, this study not only challenges the traditional bias towards value investing but also enhances our understanding of the conditions under which growth stocks can be expected to outperform. The evidence suggests that integrating a preference for growth stocks into investment strategies could be more advantageous, particularly in an era characterized by rapid technological change and economic expansion. Future research might expand upon these findings by exploring additional factors that influence the performance disparity between growth and value stocks, further refining investment approaches in the evolving financial landscape.