Low Risk Anomaly and Coskewness: Evidence from Europe

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Abstract. Empirical findings that less risky stocks consistently outperform the riskier ones have motivated a great number of studies on the low risk anomaly. This paper aims to explain it away by controlling for coskewness of stock returns with the market return on the European stock market represented by constituents of the S&P 350 Index. Stocks are double sorted on coskewness and beta volatility into 2x5 quintile portfolios, and their excess returns are subsequently regressed on the Fama-French three and five factor models separately for both coskewness categories. In the low coskewness category, a persistent, highly significant low risk anomaly is identified. As the coskewness increases, the low risk anomaly dramatically decreases and loses statistical significance. As a result, in the high coskewness category, less risky portfolios no longer consistently outperform the riskier ones. Results demonstrate that accounting for coskewness in the model remarkably decreases the profitability of low risk and betting-against-beta strategies in European data.

Keywords: low risk anomaly, coskewness, portfolio

JEL classification: *G11, G12*

1 Introduction

High risk, high return, that is how the equity market is supposed to operate according to the risk- return tradeoff principle. As specified by the traditional Capital Asset Pricing Model (CAPM) created by Sharpe (1964), investors should be rewarded for facing risk by earning a higher expected return. However, it is well known by now that the CAPM is not considered the reliable model it has been deemed for decades. Number of studies suggest that return and risk within equity markets show no correlation, or if they do, they are negatively correlated. Rosenberg, Reid, and Lanstein (1985) and Bhandari (1988) reveal that CAPM betas only have little or no informative power for the cross- section of average returns, when implemented alone. Furthermore, Jensen, Black, and Scholes (1972), Fama and MacBeth (1973) show that the relationship between average return and market beta is flat, or even negative in some cases.

This astonishing contradiction appears to be true, persistent and not varying largely with differences in markets and methodological choices. More recently, an extensive body of academic research has highlighted that the negative risk- return relationship is observable within asset classes (for example equity class) if not across them. This phenomenon called low risk anomaly. According to Joshipura and Jushipura (2015), the principal hypothesis is that a portfolio comprised of low risk stocks outperforms its high volatility equivalent over a period of full market cycle.

Ever since the honored article of Ang et al. (2006) confirmed a negative relation between the level of volatility and the cross- section of U.S. stock market returns, the existence of the low risk anomaly has been profoundly discussed, and many reasons justifying its existence have been analyzed. Even though it is troublesome to explain its presence and persistence using traditional finance theory and models, there are some reasonable explanations, which provide meaningful clarifications on the profitability of low risk investment strategies. So far there are two sets of explanations. The first one aims to offer evidence of low risk anomaly utilizing behavioral reasoning, while the collection of economic justifications attempts to explain it away.

On the account of behavioral explanations, the majority of them reached a conclusion that investors underestimate low risk stocks. Blitz and Vliet (2007) provide a mental accounting interpretation. Although investors can make rational risk- averse decisions for asset allocation choices, with regard to security selection within the asset class, they exhibit risk- seeking tendencies, and show strong preference for high volatility investments. Barber and Odean (2008) also demonstrate that investors exhibit preference for volatile, attention- grabbing stocks. Another explanation lies in overconfidence. Falkenstein (2009) discloses that a lot of people are convinced that they are capable of picking stocks successfully. In turn, investors may be biased toward higher risk. Overweighting risky stocks with aim of generating return premia indeed negates the effect via their collective action, giving rise to the low risk anomaly.

The stream of economic reasoning proposes several clarifications on the low risk anomaly as well. Baker, Bradley, and Wurgler (2011) attribute its presence to the reality of institutional investors usually striving to surpass a chosen benchmark. Since pursuing riskier stocks is a simpler way of doing so, investments in low risk stocks are discouraged. Contrarily, Hong and Sraer (2012) show that returns to trading low risk anomalies lie in high risk stocks being more prone to speculative overpricing. Short selling constraints prevent arbitrageurs from correcting the overblown prices of high beta stocks promptly, which then gives rise to their underperformance. Ultimately, Schneider, Wagner, and Zechner (2020) express that low risk anomalies can be justified by the equity returns skewness, which is repeatedly neglected by standard measures of risk. Their U.S. specific findings demonstrate that anomalous empirical patterns do not constitute asset pricing puzzles if coskewness of equity returns with the market is considered. This incites an immediate follow-up question: Does coskewness reduce the low risk anomaly in other equity markets too?

With the aim of evaluating the impact of equity returns' coskewness on the magnitude of the low risk anomaly outside the U.S., the attention of this study is shifted to European markets represented by the constituents of S&P Europe 350 Index. In order to compare the existence and the magnitude of the low risk anomaly across different coskewness levels, double sorted 2x5 stock portfolios are assembled. At first, each stock is assigned to either high or low coskewness category based on its coskewness with market return. Subsequently, stocks in both categories are split into equally weighted quintile portfolios depending on their beta volatility estimated in the CAPM. The difference portfolio[1] specified as the difference of the lowest and the highest quintile portfolio is created too. Finally, the low risk anomaly is tested for each portfolio in each coskewness category separately using Fama-French three factor (FF-3) and Fama-French five factor (FF-5) model.

Results demonstrate that accounting for coskewness in the model remarkably decreases the profitability of low risk and betting-against-beta strategies in European data. As the coskewness becomes substantially less negative, the excess returns in such strategies decline, which confirms results of Schneider, Wagner and Zechner (2020). Results obtained for the low coskewness category confirm the existence of the low risk anomaly in the cross section of European stocks. The long-short portfolio is found to yield a positive average monthly return, and its alpha is discovered to be highly statistically significant for both models. In the high coskewness category, all estimated alphas are lower than in the previous category. None of the excess returns for the Q1-Q5 portfolio have been proved statistically different from zero, implying that the less risky portfolios no longer outperform the riskier ones. These results confirm the shrinkage, or even disappearance of the low risk anomaly in high coskewness category.

The structure of the remainder of this paper is as follows. The second section is focused on the presentation of data used in the empirical analysis and the description of methodology. Next section interprets the obtained results on the comparison of presence and magnitude of the low risk anomaly for all quintile portfolios across both coskewness categories. The final section summarizes the main findings and offers conclusion.

2 Data and methodology

The empirical analysis is conducted on the monthly stock prices of the constituents of S&P Europe 350 Index retrieved from the Thomson Reuters Eikon terminal. S&P Europe 350 is a leading equity index comprised of 350 blue- chip companies and is one of seven headline indices[2] that are included in the S&P Global 1200. With intention of measuring the market performance of large capitalization companies trading on the 16

[1] Throughout the whole of this paper the terms Q1-Q5, difference portfolio, and long- short portfolio are used interchangeably.

[2] The remaining 6 indices are S&P 500, S&P Asia 50, S&P/ASX 50 Index, S&P/TOPIX 150, S&P Latin America 40 and S&P/TSX 60.

major developed European markets[3], it is float-adjusted and market capitalization weighted, while including both common and preferred shares. The obtained sample ranges from January 2010 to February 2020 in order for results not to be biased by the financial crisis of 2007-2009 and the later Covid-19 crisis. Apart from the stock price data, the monthly Fama- French three and five factor European time series are fetched for the same period from the Kenneth French Data Library.

So as to prepare the data for the subsequent analysis, the application of extensive filtering methods is administered. All companies with missing data in the researched period are excluded from the study, which leads to the notable reduction of the sample size to 267 companies.

For the purpose of analyzing, contrasting and comparing the presence and the extent of the low risk anomaly across different coskewness and riskiness levels, double sorted 2x5 stock portfolios are constructed. In the first place, every stock is assigned to either high or low coskewness category based on the coskewness of its return with market return. As a next step, stocks in both categories are split into equally weighted quintile portfolios based on their beta volatility determined by the CAPM, which is a measure chosen to assess the riskiness of individual stocks. The difference portfolio Q1-Q5 is constructed as well. Ultimately, the existence and magnitude of the low risk anomaly is tested for each portfolio in each coskewness category separately using FF-3 and FF-5 model. The low risk anomaly is defined as an identified positive difference in estimated excess returns of the least and most risky portfolio.

Methodology regarding coskewness estimation, beta volatility and Fama-French modes is addressed in this section.

2.1 Coskewness

In the field of statistics, coskewness serves to measure to what extent two random variables change together. If applied in finance it can be utilized to assess security and portfolio risk. Investors favor positive coskewness, as it suggests a higher likelihood that two assets in the same portfolio are going to yield extreme positive returns in excess of market returns simultaneously. In case return distributions of the two chosen assets feature negative coskewness, it implies that both assets have a higher probability of underperforming the market synchronously.

Stocks' coskewness with market return is determined by the first moment or the population mean (μ_m), market return (R_m) and historical stock returns (R_i). It is calculated using standard moment estimators as follows:

$$Coskew_{i,m} = \frac{\mathrm{cov}(R_i, (R_m - \mu_m)^2)}{E[(R_m - \mu_m)]^3} \tag{1}$$

As a second step, the median coskewness is calculated and stocks are divided into two groups: high coskewness with market return, and low coskewnness with market return.

[3] The constituents of S&P 350 Index must be domiciled in Italy, Sweden, Denmark, Finland, Belgium, the Netherlands, Spain, Ireland, Austria, Greece, United Kingdom, Portugal, Norway, or Luxembourg.

Subsequently, each coskewness group is split into equally weighted quintile portfolios according to the beta volatility of stock returns.

2.2 Beta volatility

The ongoing discussion about the relation between beta and realized return in the academia validates the usability of beta as a measure of the volatility of a security or portfolio in comparison to the market. In this paper, beta for the time series of each stock is estimated from regressions of stock returns on market excess returns (MKT) using the CAPM defined as:

$$E(R_i) - R_f = \alpha + \beta_i^{TS} MKT \quad (2)$$

The estimated beta for the time series of a stock i (β_i^{TS}) is given by:

$$\beta_i^{TS} = \rho \frac{\delta_i}{\delta_m} \quad (3)$$

Where δ_i and δ_m are estimated standard deviations for the stock i and the market with their correlation being represented by ρ.

In the interest of reducing the influence of outliers, the methodology of Vasicek (1973) is followed, shrinking the time series estimate of β_i^{TS} towards the cross- sectional mean β^{XS} using the shrinkage factor ω_i:

$$\beta_i = \omega_i \beta_i^{TS} + (1 - \omega_i)\beta^{XS} \quad (4)$$

In favor of simplicity, rather than employing time varying shrinkage factors as in the model of Vasicek (1973), the approach of Frazzini and Pedersen (2014) is pursued, setting $\omega_i = 0.6$ and $\beta^{XS} = 1$ for all periods and across all stocks. The selection of the shrinkage factor does not influence the manner in which individual securities are assigned into portfolios, since the common shrinkage does not alter the ranks of the security betas. Based on the estimated and shrunk betas, stocks are divided into equally weighted quintile portfolios, and employed in FF-3 and FF-5 models.

2.3 Fama-French models

Fama-French asset pricing models were proposed to clarify many inconsistencies in the CAPM. Banz (1981) discovers a size effect by observing that average returns of small are too big relative to their beta estimates, and vice versa for larger stocks. Furthermore, Basu (1983) shows that earnings- to -price ratio has explanatory power on the cross-section of average returns. Next discrepancy is the positive relationship between stocks' average returns and firm's book- to- market ratio, which is reported by Rosenberg, Reid, and Lanstein (1985). Finally, Bhandari (1988) documents that leverage facilitates the explanation of the cross- section of average stock returns, when tested alongside size and market beta.

Fama and French (1992) assert that all existing inconsistencies are only different variations of stock prices scaling. As a result, they commence the evaluation of the combined roles of market beta, size, and book- to- market equity, earnings- to- price and leverage in the cross- section of stock returns. Their conclusions fail to present support of the CAPM as no positive relationship of average stock returns and market betas is found.

Biulding on their 1992 findings, Fama and French (1993) introduce the FF-3 model for stock returns given by the following equation:

$$E(R_i) - R_f = \alpha + \beta_1 MKT + \beta_2 SMB + \beta_3 HML \quad (5)$$

Where β_{123} denote factor coefficients with the three factors being: the market portfolio (MKT), the size (SMB) and the book- to- market- equity factor (HML). SMB stands for the difference in average returns between small and big stock portfolios, while HML symbolizes the difference between the average returns of high book- to market and low book- to- market firms' portfolios.

Including two additional factors called operating profitability (RMW) and investment (CMA), a five-factor model is published in Fama and French (2015, defined as:

$$E(R_i) - R_f = \alpha + \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA \quad (6)$$

Which is shown to describe the cross- section of returns even more accurately than the FF-3. To put in another way, by controlling for additional factors, the abnormal returns of the model are diminished, as low volatility stocks are affiliated with firms characterized with comparably strong operating profitability and a conservative investment approach. The FF-5 model, nevertheless, does not succeed in completely capturing average returns, as the low risk anomaly is still recognized.

3 Results and discussion

For stocks in both coskewness categories, the same methodology is applied for sample period from January, 2010 to February, 2020. Equally weighted quintile portfolios are formed by sorting stocks based on their beta volatility determined by the CAPM. The portfolio with the highest (lowest) beta volatility is denoted Q5 (Q1) and buying Q1 and selling Q5 yields the long-short portfolio[4] denoted Q1-Q5. Excess return denoted alpha is estimated for each portfolio when accounting for the systematic risk given by FF-5 or FF-3.

3.1 Low coskewness

The low coskewness category is characterized by significantly negative coskewness with market return. The midpoint of a frequency distribution of observed values, i.e., median is -0.58, meaning that the market and low coskewness portfolios are likely to underperform at the same time.

The summary of results is reported in Table 1. For the vast majority of quintile portfolios, a clear pattern of mean return decreasing, and standard deviation increasing is apparent, when moving towards riskier portfolios. The pattern is also confirmed in the long-short portfolio, which generates a positive average return of 0.16% per month. Such outperformance of less risky portfolios provides a first indication of the existence of the low risk anomaly.

[4] Also called betting-against-beta, or betting-against-volatility in Frazzini and Pedersen (2014) and Schneider, Wagner and Zechner (2020).

Another piece of evidence in favor of its presence is obtained when controlling for systematic risk factors in FF-3 and FF-5 models. Alphas generated by both models are identified to be noticeably higher in less volatile portfolios. As a matter of fact, only two least risky long portfolios demonstrate statistically significant alphas at 1% level. Since estimated alphas for riskier portfolios are not statistically significant, the actual outperformance of less risky portfolios may be even higher.

Table 1. Portfolios formed of low coskewness stocks. Robust t-statistics is presented in square brackets. The symbol "*" implies significance at 1% level.

Portfolio	Mean return	St. deviation	FF-5 Alpha	FF-3 Alpha
Q1	0.3185	1.3058	0.3199 * [2.492]	0.2956 * [2.423]
Q2	0.3110	1.3271	0.3049 * [−2.332]	0.2739 * [2.204]
Q3	0.2173	1.2575	0.2015 [1.644]	0.1859 [1.591]
Q4	0.1019	1.4954	0.0825 [0.578]	0.0544 [0.397]
Q5	0.1585	1.7660	0.1265 [0.757]	0.1003 [0.630]
Q1-Q5	0.1600	1.0241	0.1913 * [2.158]	0.1932 * [2.296]

Focusing on the difference portfolio, the Q1-Q5 portfolio yields a statistically significant positive alpha for both models, which further validates the presence of the low risk anomaly in low coskewness stocks. Results also demonstrate the decrease of excess returns for the long-short portfolios when controlling for two additional risk factors in FF-5 model compared to the FF-3 model. This confirms the findings of Fama and French (2015), who illustrate that the inclusion of supplementary factors leads to the reduction of the low risk anomaly.

3.2 High coskewness

The median coskewness of stocks in the high coskewness category is -0.20, which is a 65% increase compared to the previous category. Main results are presented in Table 2. Overall, in the high coskewness category, mean portfolio returns are lower than in portfolios exhibiting low coskewness with market return. There is no observable trend, as mean returns are alternately increasing and decreasing, as well as standard deviations. The decrease in mean portfolio returns is notable in the Q1-Q5 portfolio too, where the positive average return falls to 0.4% per month.

Controlling for systematic risk factors in FF-5 and FF-3 model, all long portfolios demonstrate statistically significant excess returns on at least 5% level. Their closer inspection suggests a substantial decrease in the magnitude of the low risk anomaly. Not only are all alphas lower than in the low coskewess category, but also the pattern of an outperformance of less risky portfolio is diminished, with exception of the least and most risky portfolio.

Table 2. Portfolios formed of high coskewness stocks. Robust t-statistics is presented in square brackets. The symbol "*" implies significance at 1% level and "." indicates significance at 5% level.

Portfolio	Mean return	St. deviation	FF-5 Alpha	FF-3 Alpha
Q1	0.2294	0.9536	0.2209 * [2.350]	0.2066 * [2.316]
Q2	0.2597	1.0375	0.2493 * [2.442]	0.2333 * [2.411]
Q3	0.1794	0.9332	0.1826 * [2.002]	0.1617 . [1.811]
Q4	0.2374	0.9882	0.2272 * [2.379]	0.2059 * [2.256]
Q5	0.1914	0.9177	0.1750. [1.962]	0.1656 . [1.939]
Q1-Q5	0.0380	0.4013	0.0438 [1.105]	0.0388 [1.016]

The difference portfolio also demonstrates the shrinkage of the low risk anomaly. Although positive, alphas generated by both Fama- French models are considerably lower than for stocks exhibiting low coskewness with market return. Neither of the two alphas for the Q1-Q5 portfolio has been found statistically different from zero, meaning that the least risky portfolio no longer outperforms the riskiest one. These finding further supports the decline, or even vanishing of the low risk anomaly in high coskewness category.

The aforementioned findings in are in accordance with the research of Schneider, Wagner, and Zechner (2020). Controlling for coskewness in the model eliminates the benefit of betting-against-beta strategies. After the coskewness is considered, such strategies do not render statistically significant excess returns and low risk anomalies disappear.

4 Conclusion

The low risk anomaly has sparked a lot of interest in the recent years due to its puzzling nature conflicting the traditional finance theory. Schneider, Wagner and Zechner (2020) demonstrate on the wide range of U.S. data that it can be fully eliminated, when controlling for stock's downside risk represented by coskewness.

The present paper aims to investigate the role of coskewness in the low risk anomaly of the European stocks, which are constituents of S&P 350 Index. With that objective in mind, double sorted 2x5 stock portfolios are assembled. At first, stocks are assigned to either high or low coskewness category. Afterwards, both categories are divided into equally weighted quintile portfolios conditional on their beta volatility estimated by the

CAPM, and the difference portfolio. Finally, the low risk anomaly is assessed for each portfolio in each coskewness category using FF-3 and FF-5 model.

Results obtained for the low coskewness category confirm the existence of the low risk anomaly in the cross section of European stocks. Alphas estimated by both FF-3 and FF-5 models is only significant in two least risky portfolios, and much higher in less volatile portfolios, compared to riskier portfolios. The long- short portfolio yields a positive average monthly return. On the top of that, its alpha is found to be highly statistically significant for both models, which further validates the presence of the low risk anomaly in low coskewness stocks.

In the high coskewness category, the median coskewness of stock return with market return is 65% lower than in the previous category. Although all long portfolios demonstrate statistically significant excess returns in FF-3 and FF-5 models, their analysis signals a sizeable decrease in the low risk anomaly. All estimated alphas are lower than in the low coskewess category. The difference portfolio also demonstrates the reduction in the size of the low risk anomaly. Although positive, alphas generated by both Fama- French models are substantially lower. In addition, neither of the excess returns for the Q1-Q5 portfolio has been proved statistically different from zero, implying that the less risky portfolios no longer outperform the riskier ones. These results further validate the shrinkage, or even disappearance of the low risk anomaly as the stocks' coskewness with the market increases.

Altogether, findings are in line with existing research and provide their further extensions. Results demonstrate that accounting for coskewness in the model remarkably decreases the profitability of low risk and betting-against-beta strategies in European data. As the coskewness becomes substantially less negative, the excess returns in such strategies decline.

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