

Cross-Sectional Long-Short Strategies on the S&P 500: Signals, Weighting, and Costs

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Abstract. The paper explores a basic long-short equity strategy on the S&P 500 securities. The central issue is how effective are the past-return signals over the volatility-based ones considering the transaction costs. There were 503 S&P 500 stocks and the monthly closing prices were gathered starting December 1999 to July 2026. Five signals of ranking are discussed, which are one-month return, six-month return, twelve-month return, return-volatility and volatility-scaled momentum. Each of the signals is implemented using two portfolio rules, decile portfolio and rank weighted portfolio. Monthly rebalancing is done at a one-way transaction cost of 25 basis points. The findings indicate that return volatility is the most important signal in this sample. Volatility decile strategy has the highest net annualized return, and rank-weighted volatility strategy has the least turnover and minimum drawdown. If costs are taken into account, the strategies based on past-returns do not work. This strategy, in terms of volatility, has a relatively large beta as well indicating that some portion of its return can be explained by the market exposure. This should be factored in when evaluating the performance of the strategy.

Keywords: cross-sectional strategies, long-short portfolio, return volatility, transaction costs, S&P 500

1. Introduction

Cross-sectional methods are frequently used in quantitative investing. The simple concept is to order stocks by a signal, buy the stocks with stronger signals and short the stocks with weaker signals. This setup can be used to test whether a signal can distinguish between stocks without relying only on market direction. Momentum based on past returns is one of the most famous signals in the literature [1]. Studies based on factors also indicate that stock returns may be associated with shared characteristics and risk factors.

The gross return cannot be the sole indicator. On a practical level, monthly rebalancing may increase turnover and trading expenses might decrease actual performance [2, 3]. The problem is also addressed in the literature on anomalies and implementation costs [4, 5]. Dollar-neutral portfolio may still have the exposure to market risk when the long and short are unequal in terms of beta exposure [3]. Due to this, the report provides information on gross return, net return, turnover, drawdown, and beta.

This paper compares return-based and volatility-based signals in the S&P 500 universe. The main question is which signal gives a better long-short portfolio when transaction costs are considered. The analysis also compares a decile rule and a rank-weighted rule to see how portfolio construction changes the result.

The most important finding is that ranking based on volatility outperforms ranking based on past-returns in the given sample, however, the optimal strategy remains exposed to the market. It implies that both the choice of signals and implementation costs are relevant.

2. Literature review

The concept of momentum is widespread in predicting stock returns. It implies that the assets with high previous returns might remain successful during the certain period. The study of Jegadeesh and Titman is one of the classical works on this subject and demonstrates that winners are likely to outperform losers over medium-term periods [1]. Momentum is also another factor that Carhart considers in his discussion of mutual fund performance [6]. On this basis, the analysis examines one-month, six-month and twelve-month return signals.

The previous return is not the only possible signal. Volatility can also be informative as it represents the extent to which a stock moves over a certain period of time. Previous studies indicate that there exists a relationship between volatility and expected returns across stocks [7]. If the stock has high volatility, then the return change is large, whereas, if the stock has a low volatility, then the return change is more gradual. The analysis contains a volatility return to determine if the present signal associated with risk would perform better in ranking the stocks than the historical returns. Volatility-scaled momentum is also considered as it consists of both return and volatility in one signal.

The construction of a portfolio can also influence the ultimate outcome. In a decile portfolio there are just two groups of stocks (top and bottom), which makes it more focused. This might be useful to the returns in case of a strong signal, yet it can increase the turnover and the risk. Rank-weighted portfolios give more weights to more stocks depending on their ranks. The approach is typically less concentrated and might have lower turnover. Portfolio weighting matters as various weighting formulas can produce different risk and return outcomes [8]. Due to this reason, the two portfolio approaches are compared in this paper.

The transaction costs matter since the portfolios are rebalanced on a monthly basis. The cost may decrease a significant portion of the return when a strategy trades excessively. Trading costs and their impact on investment performance are discussed by Frazzini, Israel, and Moskowitz [2]. Novy-Marx and Velikov also demonstrate that trading costs may alter the appearance of profitable anomalies in reality [5]. Market exposure is also taken into account. Equal long and short notional in a long-short portfolio do not necessarily imply zero market risk. As beta is most often employed as a quantification of market risk in the asset pricing literature [3], the analysis reports beta related to SPY.

3. Data and methodology

The paper takes monthly closing prices of 503 S&P 500 stocks over December 1999-July 2026. The month-end prices are used to compute monthly returns, and the portfolios are rebalanced on a monthly basis. In order not to suffer look-ahead bias, all the signals are created in month t and the portfolio return is evaluated in month $t+1$. The market reference is SPY whenever beta is estimated.

There are five signals that are considered. The first three are past-return signals: one-month return, six-month return, and twelve-month return. These signals represent the amount by which the stock has risen or fallen in recent weeks. The fourth signal is return volatility, which is obtained by taking the standard deviation of the last twelve-monthly returns. The fifth signal is volatility-scaled momentum, which is measured as the twelve-month return divided by the return volatility.

In every month, the stocks are sorted in a descending order according to the chosen indicator. There are two portfolio strategies. In the decile approach, the bottom 10 percent of the ranks is shorted and the top 10 percent is bought. It provides a higher value to the most powerful group of signals. The rank-weighted approach uses all ranks with the weights and thus there is inclusion of more stocks and the changes in their positions are also smoother.

Every single portfolio is a dollar-neutral long-short portfolio. The notional value on both long and short sides is equal, which means that there is no net exposure and total exposure is 200 percent of capital. Monthly turnover has a one-way trading cost of 25 basis points. Because a dollar-neutral portfolio may still be exposed to the market, beta relative to SPY is provided per strategy.

4. Results

The key takeaway is that the volatility-based ranking outperforms the past-return ranking in this sample. All the ten strategies have the highest gross and net returns in the volatility decile portfolio. Its gross annualized return stands at 26.1% and its net annualized return stands at 23.3% when a one-way transaction cost of 25 basis points is charged. It is also the portfolio with the highest Sharpe ratio which is 0.93. Rank-weighted volatility portfolio has less return, however, it is more stable. Its net annualized return is 12.4, with a Sharpe ratio of 0.85 and a maximum drawdown of -28 percent. This finding is also connected to the assumption that volatility can be a meaningful property of stocks [7].

Strategy of past returns are not effective. The worst of them all is the one-month return strategy as it trades too frequently. Its turnover is 351 percent monthly and its net annualized return is negative (8.6%) with trading fees. Twelve-month return strategy is superior compared to one-month strategy, but far inferior to volatility strategy. Typically, the group of past-returns is not effective after considering costs.

Turnover is one of the reasons behind this difference. Strategies with high turnover have higher losses after transaction costs. There are some strategies which seem good until the costs are considered, and when the trading costs are introduced the outcome will significantly change. It is in line with the concept that implementation costs may impact factor strategies significantly [2, 5]. Volatility strategies are not impacted as much as the turnover is lower.

Beta is also important. The most effective volatility decile has a beta of 1.17 and so some of its returns are due to market exposure. Following beta hedging, its annualized return drops by 26.1% to 11.9%. It indicates that the strategy remains beneficial, but the gain is no longer based on stock selection alone.

On average, volatility provides a more efficient signal compared to the previous return in this sample. The decile version has greater return at the expense of superior risk control by the rank-weighted version. Both the choice of signal and the construction of portfolios are important.

5. Discussion

The findings indicate that return volatility is a stronger indicator compared to past return in the given sample. One of them is that volatility is less volatile on a monthly basis. One particular stock

that is very volatile in one month tends to remain highly volatile in the subsequent month. Since this is the case, the volatility signal will be slower to change than the return signal, so the portfolio will not have to trade as frequently. It is important because with less turnover, the strategy can retain more of its gross return once transaction costs are factored in. The result is not the typical momentum tale, however it fits into the larger literature on factor investing [9].

Strategies based on past returns are also weaker but due to another reason. Their signals are changing faster and hence the portfolios should be rebalanced at higher frequencies. It is more costly to trade them. The turnover with the one-month strategy is so large that it becomes negative. This means that even though a signal may appear to be good prior to costs, it can still fail when implemented. Trading expenses play a direct role in the outcome of this project.

It is also evident that there is a distinction between the decile and rank-weighted portfolios. Decile version typically provides better returns, but it also has higher drawdown and more trading. Rank-weighted version is more moderate. It sacrifices some of the return but the portfolio is less volatile and hence simpler to hold. And this is what makes the rank-weighted volatility portfolio experience lower drawdown and lower turnover. In practice, such a balance can be more valuable as opposed to the higher gross return by itself.

Beta is also an important element of the discussion. The optimal volatility approach will have a beta greater than 1, indicating that it continues to move with the market. Following beta hedging, there is a significant decrease in the return. It does not imply that the strategy is ineffective, but it implies that one must read the headline return closely. Long-short portfolio is not necessarily market-neutral simply because both long and short-side are of the same value.

On the whole, the discussion can support the general conclusion. The choice of signal is important, but the construction of a portfolio and trading costs are also relevant. A plan that has a high gross return may not be necessarily superior when it has excessive turnover or market exposure.

6. Limitations and future research

There are a number of limitations in this paper. Firstly, the stock universe relies on a static picture of S&P 500 membership instead of using point-in-time index data. This can induce survivorship bias. Secondly, the calculation of returns is done by month-end closing prices, and dividends are not distinguished in the data. Thirdly, the transaction cost model is simplistic. It assumes a flat 25-basis-point-per-side cost and excludes bid-ask spread, market impact, borrow cost, and financing cost.

The strategy design does have limits. Portfolios are not sector-neutral, therefore, some of the outcome could also be attributed to industry exposure, rather than just stock picking. It is important since how a portfolio is constructed and managed can influence factor returns [9]. The sample also examines various signals using one dataset, and thus, the results should be viewed with a certain degree of caution. It would be helpful to conduct a more specific significance test, which is not within the framework of the present paper.

The future studies may enhance the project in several aspects. The point-in-time constituent file would clean the sample up. More realistic transaction cost models, particularly those which consider spreads and market impact, would also be useful. An additional improvement would be to ensure that the comparison of results with a standard market index or an asset pricing model is performed more thoroughly [10]. It would also be valuable to test sector-neutral portfolios and compare them with other popular signals, including quality or value. Such extensions might indicate that the volatility effect remains significant when using more rigorous conditions.

7. Conclusion

The paper studies five basic ranking signals of long-short equity strategies in the S&P 500 universe. The most important finding is that return volatility outperforms past-return signals in this sample. The volatility decile portfolio would have the highest gross and net return, whereas the rank-weighted volatility portfolio would have less turnover and a smaller drawdown. On the other hand, past-return strategies are significantly weaker when transaction costs are added.

The findings also indicate that portfolio construction is important. Decile rule could produce greater returns, but it does increase the frequency of trading as well as risk. Rank-weighted rule is more consistent but at the expense of a little return. It indicates that the decision of weighting technique is a crucial element in the development of strategies.

The other factor that cannot be considered is beta. Even the most efficient volatility strategy does not leave the market; hence, some of its returns are due to the market as opposed to solely stock selection. The return after beta hedging decreases significantly. Due to it, a long-short strategy must be assessed based on the combination of return, turnover, transaction costs, drawdown, and beta.

On balance, the paper indicates that volatility-based ranking has been found to be the strongest signal within this sample. Simultaneously, the outcome also demonstrates that trading costs and exposure to the market may alter the end result. The future research may involve more practical data and an improved cost model.

References

- [1] Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance*, 48(1), 65–91.
- [2] Frazzini, A., Israel, R., & Moskowitz, T. J. (2018). Trading costs. SSRN Working Paper.
- [3] Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *Journal of Finance*, 19(3), 425–442.
- [4] Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), 3–56.
- [5] Novy-Marx, R., & Velikov, M. (2016). A taxonomy of anomalies and their trading costs. *Review of Financial Studies*, 29(1), 104–147.
- [6] Carhart, M. M. (1997). On persistence in mutual fund performance. *Journal of Finance*, 52(1), 57–82.
- [7] Ang, A., Hodrick, R. J., Xing, Y., & Zhang, X. (2006). The cross-section of volatility and expected returns. *Journal of Finance*, 61(1), 259–299.
- [8] DeMiguel, V., Garlappi, L., & Uppal, R. (2009). Optimal versus naive diversification: How inefficient is the 1/N portfolio strategy? *Review of Financial Studies*, 22(5), 1915–1953.
- [9] Asness, C. S., Moskowitz, T. J., & Pedersen, L. H. (2013). Value and momentum everywhere. *Journal of Finance*, 68(3), 929–985.
- [10] Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116(1), 1–22.