NOVA SCHOOL OF BUSINESS & ECONOMICS

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Project Overview

This paper will present a strategy based on a signal (Change in current operating working capital - cowc_gr1a) that represents the performance or risk of various companies on specific end-of-month (EOM) dates. The signal is constructed by assigning a unique identifier to each company (e.g., "comp_001034_01") along with an end-of-month date and a corresponding floating-point number that represents the signal value.

The potential ability to quantify the performance or risk of a certain security is the economic driver behind using this signal as a predictor of security returns or risk. By analyzing historical data, investors can identify trends and patterns that may indicate future performance or the level of risk associated with a security. This approach is supported by many, including Benjamin Graham and David Dodd, known as the fathers of value investing. In their classic text “Security Analysis”, they defend the analysis of a company's financial history to determine its intrinsic value. There is also the Efficient Market Hypothesis, which states that stock prices reflect all available information, including the historical research of famous investors, such as Warren Buffett.

In terms of performance, the primary strategy can be evaluated both as a stand-alone investment and as part of a broadly diversified portfolio. As a stand-alone investment, the strategy may be subject to higher levels of risk due to the inherent volatility of individual securities. In contrast, when incorporated into a broadly diversified portfolio, the strategy can help mitigate risk by spreading investments across various securities and asset classes.

To determine whether this primary strategy should be included as part of an investor's portfolio, we would need to consider factors such as the investor's risk tolerance, investment objectives, and the overall performance of the strategy in relation to the market and other investments. If the strategy demonstrates a consistent ability to outperform the market or align with the investor's goals, it can be considered a worthwhile addition to the portfolio.

Strategy Analysis

The analysis done in this section is constructed by sorting stocks into terciles (three equal parts)

References:

[1] Most of the code used was extracted from class notebooks and assignments. Some of my course colleagues contributed with opinions on code and discussions were made around best approaches to achieve desired results.

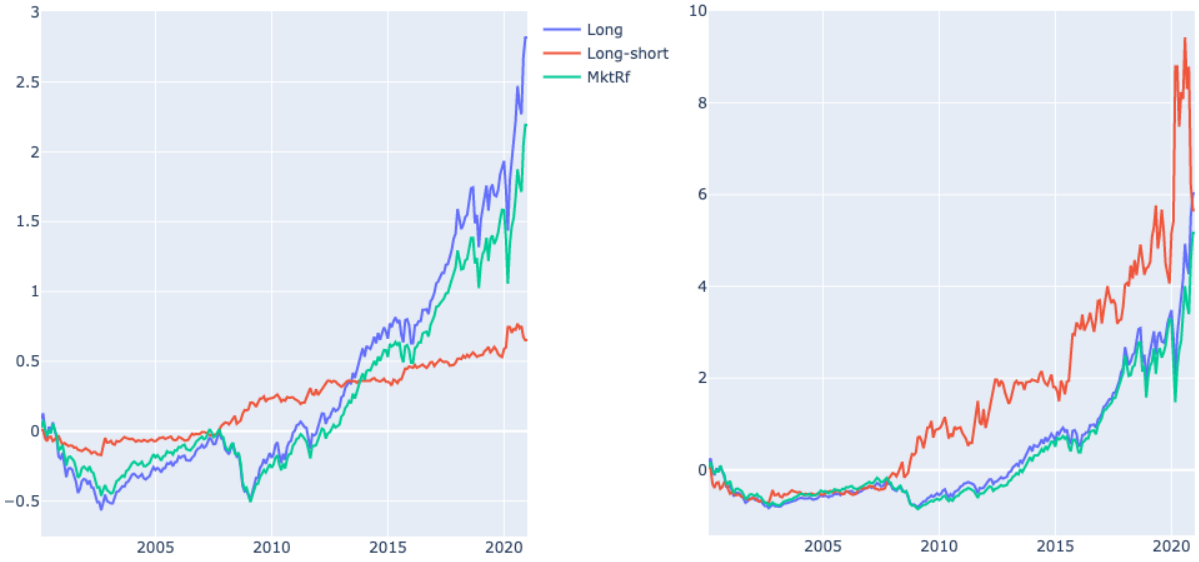
[2] This paper was assisted by Chat GPT 4 in collecting most external information, including references to classic texts, improving, and commenting code used, and providing extra input in results’ analysis.

[3] Jensen, T. I., Kelly, B., & Pedersen, L. H. (2021). Is there a replication crisis in finance? National Bureau of Economic Research.

based on this specific signal. Stocks with the worst expected performance go to the bottom tercile, while those with the best expected performance go to the top. Portfolios are formed for each tercile, and their returns are calculated in excess of the risk-free rate to ensure the returns reflect the risk undertaken. The top tercile portfolio represents a long-only strategy, while a long-short strategy is implemented by going long on the top portfolio and short on the bottom portfolio. The purpose of this analysis is to measure the effectiveness of the investment strategy by comparing it to a benchmark (MktRf) and to understand the risks and rewards associated with it.

As the signal analyzed, "cowc_gr1a", has negative direction, the values need to be multiplied by -1. This allows for an analysis where the top tercile is in fact expected to have the best performance.

Bellow, two graphs are presented comparing cumulative returns for the Long and Long-short portfolios and excess returns of the value-weighted stock market portfolio (MktRf) without any leverage (on the left) and with constant leverage applied to have an annualized volatility of 10% (on the right).



A long portfolio involves buying stocks with the expectation that they will increase in value in the long run, while a long-short portfolio involves buying some stocks (going long) while simultaneously selling other stocks short (betting they will decrease in value). If the cumulative return of the long-short portfolio is consistently higher, it may be that the long-short strategy is more effective. Analyzing the graphs, without leverage, the value-weighted stock market and long portfolios have higher expected returns than the long-short, at least after 2012. However, the introduction of volatility changes the scenario, with the long-short portfolio expected to be the most profitable after a few years. This may happen because long-short portfolios are often more diversified than long only ones and can potentially benefit from volatility by correctly timing entry and exit points for both long and short positions. Long-short portfolios can turn profit by taking advantage of mispriced stocks on both the upside and the downside, and high volatility contributes to this.

Another way to compare portfolios is to evaluate their performance through statistic measures. The following table presents performance measures for the long-only, long-short, and value-weighted market portfolios for the first half of the sample, the second half, and the full period.

	Portfolio	Period	AvgExcessReturn	SharpeRatio	CapmAlpha	CapmAlphaTStat	FF3Alpha	FF3AlphaTStat	InformationRatio
0 ->	Long	First Half	0,0003359849021016679	0,01986284720377159	0,001369773400013849	1,0455570617417893	0,0023088353160840695	2,113091888741322	0,09353610647769213
1 ->	Long	Second Half	0,013036387381669411	1,0374004530571217	0,0004534904979121938 7	0,6723214639575283	-0,0002845587254554084	-0,45304076663688386	0,06268639097543324
2 ->	Long	Full Period	0,006686186141885539	0,4462327117508477	0,0004096462410146534	0,5376734976756791	0,0004906280602022736	0,7610451293258454	0,034200039320133525
3 ->	Long-Short	First Half	0,0017858663308349594	0,33177620249816925	0,0018093006463858303	1,087227417032686	0,0024207450385800556	1,4329239102355136	0,09726395924830937
4 ->	Long-Short	Second Half	0,002493323985919797	0,5446117729990867	0,00398477176839208	2,8451882349173463	0,002749348816405957	2,0655954683809594	0,26528170176640165
5 ->	Long-Short	Full Period	0,002139595158377378	0,42896893387473756	0,002336440452677273	2,1349262869514947	0,0025438897558470734	2,40670681116647	0,13579721387601226
6 ->	vwMktRf	First Half	-0,0008833333333333323	-0,0631187665657363	0	0	0	0	0
7 ->	vwMktRf	Second Half	0,01221428571428571	1,015433023850136	0	0	0	0	0
8 ->	vwMktRf	Full Period	0,00566547619047619	0,43051314331428014	0	0	0	0	0

Due to extension restrictions, only the most important values will be analyzed.

For the Long portfolio, the Sharpe ratio increased from the first half (0.0199) to the second half (1.0374). This suggests that in the second half of the period, the portfolio achieved a much higher risk-adjusted return. The Long-Short portfolio also showed a marginal improvement, indicating a more stable risk-adjusted performance throughout the periods. The value-weighted portfolio moved from negative to positive territory (from -0.0631 to 1.0154), suggesting a significant improvement in risk-adjusted performance.

The CAPM Alpha also increased from the first half (0.0018) to the second half (0.0039) of the Long-Short portfolio, and it was always higher than the Long portfolio's Alpha. This suggests that the Long-Short portfolio consistently outperformed the market, and this outperformance was more pronounced in the second half. Similar trends can be observed for the Fama-French 3-Factor Alpha.

The T-statistics for CAPM Alpha and Fama-French 3-Factor Alpha in the Long-Short portfolio are significant in the second half and for the full period (over 2), indicating that the alphas are statistically significant and not due to chance. This further supports the idea that the Long-Short portfolio strategy is successful in outperforming the market.

The Long-Short portfolio demonstrated higher Information Ratios across all periods when compared to the Long portfolio. This indicates that the Long-Short portfolio has consistently been more effective at generating returns above the benchmark, considering the level of risk taken.

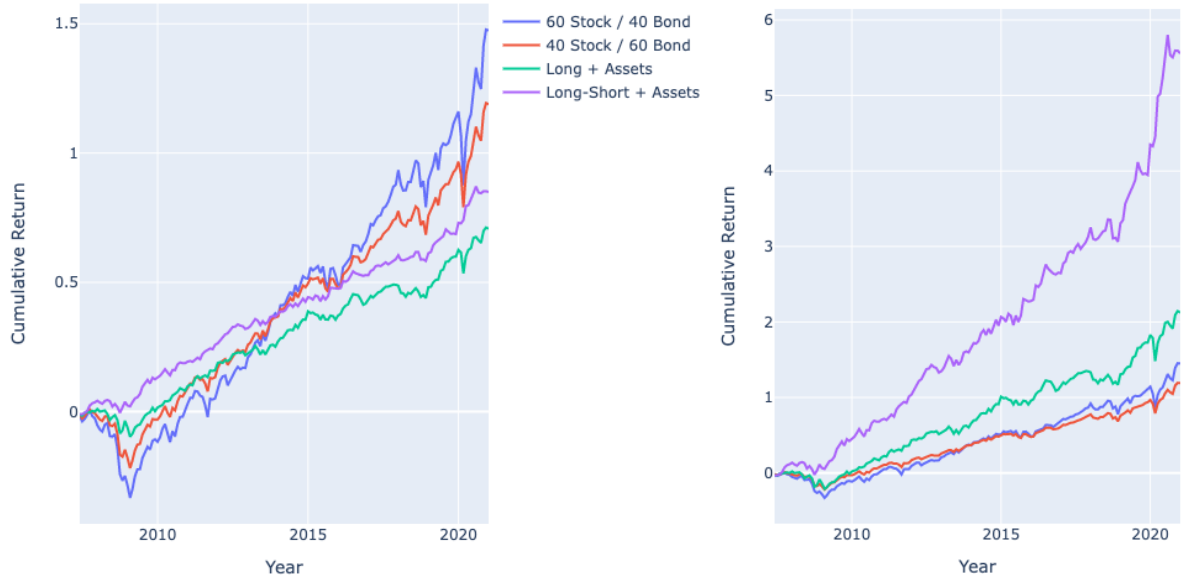
In terms of trends, the improvement in the Sharpe Ratio and Alpha values for the Long-Short portfolio over time suggests that this strategy became increasingly effective. The Long portfolio, while showing a significant jump in the Sharpe Ratio in the second half, wasn't as successful in generating significant alpha. The overall better results in the second half of the period can be explained by the higher stats of the value-weighted market portfolio, indicating that market-wide factors became more favorable for investors during that period.

Strategy as part of a diversified portfolio

This phase of the study consists of locating mean-variance effective portfolios, contrasting them with diversified portfolios, and evaluating the performances of each. This is helpful for figuring out how the main strategy fits into a diverse portfolio and contributes to its overall success.

Both ETFs analyzed, VTI and BND, have data for the same dates starting in May 2007, so the data was filtered accordingly.

Besides creating a 60/40 portfolio (60% VTI and 40% BND), a 40/60 portfolio (40% VTI and 60% BND) was created as well to analyze the differences inverse weights make in the portfolios' performance. Therefore, the graphs presented will have four lines, one for each weighted portfolio and one for the Long + Assets and Long-short + Assets portfolios.



In the graphs, the previous Long and Long-short portfolios are being compared to two portfolios with different weights of the ETFs referred. As stocks are typically more volatile and offer higher potential returns, a 60/40 stock-bond portfolio has the highest cumulative returns, without any leverage applied. In contrast, a 40/60 stock-bond portfolio has a higher allocation to bonds, which are typically less volatile and offer more stable, though typically lower, returns. They are still above in cumulative returns terms compared to Long and Long-short portfolios. Regarding market conditions, during periods of economic growth, a 60/40 portfolio might outperform due to the higher allocation to stocks, with the inverse applying to bonds. Overall, these balanced portfolios provide a compromise between risk and return, being more profitable compared to a more volatile long or long-short portfolio.

On another hand, leverage can make the long-short strategy more profitable because it increases the potential gains from both the long and the short positions. However, it also increases the potential losses if the positions move against the investor. The increased potential for profit explains why the long-short strategy outperforms after the introduction of leverage.

The four portfolios can now be compared evaluating their performance through statistic measures. The following table presents performance measures for the long-only, long-short, 60/40 and 40/60 portfolios.

	Portfolio	AvgExcessReturn	SharpeRatio
0 ->	Long + Assets	0,040220737562480964	0,8867086855693627
1 ->	Long Short + Assets	0,04556859903288041	1,4330014841462437
2 ->	60 Stock / 40 Bond	0,07160604975778448	0,7075955162116981
3 ->	40 Stock / 60 Bond	0,059995028120978	0,8423552961248844

The 60/40 Stock-Bond portfolio has the highest average excess return, followed by the 40/60 Stock-Bond portfolio, the Long-Short + Assets, and the Long + Assets portfolio. This suggests that the mixed stock-bond portfolios performed above the risk-free rate compared to the other portfolios.

Despite having a lower average excess return compared to the 60/40 and 40/60 Stock-Bond portfolios, the Long-Short + Assets portfolio has the highest Sharpe ratio at 1.43. This implies that it provided the best risk-adjusted performance, meaning it delivered a higher return per unit of risk taken.

These trends highlight the trade-off between risk and return. A portfolio might deliver high raw returns, but if those returns come with high risk, the portfolio might not be as effective. This is proved with the graphs analysis where it was concluded volatility reduces the stocks-bonds portfolios value compared to the others, which should be more stable.

Conclusions

Including the strategies in a diversified portfolio can be beneficial, each for different reasons:

- Long + Assets Portfolio: This strategy provides exposure to asset classes that have the potential for growth over time. However, it also carries the inherent market risk of these assets, plus the expectation assets will increase their value.
- Long-Short + Assets Portfolio: This strategy can provide a level of downside protection and potential profit in both rising and falling markets. It introduces a degree of hedging into the portfolio, which can help to manage risk and improve the risk-adjusted return, as suggested by its high Sharpe ratio.
- 60/40 and 40/60 Stock-Bond Portfolios: These balanced portfolios can provide a more stable backbone for a diversified portfolio. They balance the growth potential of stocks with the stability of bonds. As seen from their high average excess returns, they can provide solid performance over time.

On a personal note, I think an investor should the Long-Short + Assets Portfolio as a riskier option, because of the duality previously referred. The Stock-Bond portfolios should be considered as a safer option, with a higher bond weight associated with more stable returns.

However, it's important to keep in mind that these conclusions are based on historical performance over a relatively short period of time, financially speaking. Markets can be influenced by many factors, and past performance by definition is not indicative of future results. The relatively short time period might not fully capture different market cycles and conditions, so the effectiveness of these strategies could vary in different time periods or market environments. These strategies involve different degrees

of complexity and costs, which should also be considered. A Long-Short portfolio is often more difficult to manage, because of their “duality complexity” that requires an extra expertise.

In conclusion, while these strategies can potentially provide benefits in a diversified portfolio, it's essential to understand their risks and complexities, and to consider them within the broader context of an investor's individual circumstances and market conditions.