Is Low Volatility factor Effective in Taiwan?

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Abstract

This essay verifies the volatility factor is effective in Taiwan by empirical research. First, the empirical results shows that the performance of low volatility portfolios performed further better than the high volatility portfolios during the back-testing period. Moreover, the low sigma strategy performed better than the low beta strategy. Furthermore, we choose low sigma factor to construct a low volatility trading strategy on the benchmark. The empirical results shows that it is a long time holding strategy with average positive return.

1   Introduction

In general, there are two angles of low volatility, one is low sigma, and the other one is low beta. The relationship of the both factors of low volatility and the performance of the stocks are evidenced by a lot researchers, including The Cross-Section of Volatility and Expected Returns (ANDREW A., HODRICK J., YUHANG X., XIAOYAN Z.,2006 [1]), High idiosyncratic volatility and low returns: International and further U.S. evidence (ANDREW A., HODRICK J., YUHANG X., XIAOYAN Z., 2009 [2]), Stock return volatility, operating performance and stock returns: International evidence on drivers of the 'low volatility' anomaly (Dutt, T. Humphery-Jenner, M., 2013 [4]), Benchmarks as limits to arbitrage: Understanding the low-volatility anomaly (Baker, M.Bradley B. Wurgler J., 2011 [3]), and Beta Coefficients as Predictors of Return (Robert A. Levy, 2018 [5]). According to these researches, the effective of low volatility factor is because the stocks are undervalued by investors which causes the stock with low volatility. However, the value of stock will be find after it during a long-term low volatility.

2   Research Method

The goal of this project is to verify if the the low volatility factor effective in Taiwan. Please note that there are two different kind of strategies, including low Sigma and low beta, represent of low volatility factor in this essay. The project evaluates the effectiveness of low volatility factor by constructing two opposite portfolios in terms of the performance of the factor for each strategy. Moreover, we review the portfolios semiannually, and annually respectively. Then we can observe how frequency of portfolio review influence the performance of the portfolio. Furthermore, in order to cover bull markets, bear markets, and even financial crisis, we choose the back-testing period from 01/01/2008 to 31/12/2018.

In this chapter, firstly, the essay introduces the different strategies of low volatility factor in detail. Secondly, we show the back-testing method step by step. Finally, we discuss how to measure the performance of a portfolio.

2.1   Low Volatility Strategies

In general, there are two different kind of methods to measure the volatility of stocks. One way is to evaluate the volatility of a stock by the standard deviation of daily returns, which means it focuses on the volatility

of the daily returns of a stock. On the other hand, the other way is to evaluate the volatility of a stock by the beta, which means it concentrates on comparing the daily returns of a stock with the benchmark.

2.1.1 Low Sigma Strategy

Traditionally, the standard deviation of the daily returns represents the volatility of a stock.

$$\sigma = \sqrt{\frac{\sum_1^n (r_i - \bar{r})}{n}}$$

where r_i is the daily return of the stock,
$\bar{r}$ is the average of daily returns,
and n is the number of trading days in the period.

2.1.2 Low Beta Strategy

On the other hand, the beta also can represent the volatility of a stock comparing with the benchmark.

$$\beta = \frac{Cov(r_i, r_m)}{\sigma_m^2}$$

where r_i is the daily return of the stock,
r_m is the daily return of the benchmark,
and σ_m is the standard deviation of the benchmark.

If $|\beta| > 1$ means that when the benchmark goes up (down) 1%, the stock goes up (down) more than 1%. On the other hand, if $|\beta| < 1$ means that when the benchmark goes up (down) 1%, the stock goes up (down) less than 1%. Moreover, if $|\beta| = 1$ represents that the percentage change of benchmark is equal to the stock.

2.2 Back-testing Method

To do back-testing, we need to select the stocks based on the strategy from the universe on each portfolio-reviewing day to construct the portfolio. Then combine the returns of the constituent stocks of the portfolio with price-weighted method. Then we get the performance of the portfolio.

First, it is important to define the portfolio-reviewing day, which is the day for us to adjust the portfolio. To observe effectiveness of the low volatility factor with different frequencies, we adjust the portfolios semiannually and annually respectively. Moreover, in order to avoid the annually financial statements disclosure at the end of March, and the dividend payment season between June and September influence the stock prices in Taiwan, we choose the end of April and October as portfolio-reviewing day for semiannual review portfolio, and the end of October as portfolio-reviewing day for annual review portfolio respectively.

Second, we choose 6 months as the parameter for each low volatility strategies to calculate the standard deviations and the betas, because it implies that if the daily returns performed stably of the stock at least during the past half year. Moreover, we choose TAIEX index as the benchmark, which is the universe of the portfolios, to calculate the betas.

Finally, let's look at the processes of constructing the portfolios for each strategy.
Step1. Collect all the listed companies in Taiwan Stock Exchange on the portfolio-reviewing day.
Step2. Select 50 stocks in terms of the performance of volatility strategy as the portfolio. In this essay, we construct two 50-stock portfolios. One portfolio consists of stocks with the lowest volatility, while the other is formed by stocks with highest volatility.
Step3. Price-weighted for each stock in the portfolio, which means the unit of each stock is the same.

2.3 Portfolio Performance Evaluating

We calculate total return, annualized return, standard deviation, and Sharpe ratio to evaluate a portfolio performance during the back-testing period. Furthermore, we calculate the annual returns to check if a portfolio performed stably during every year. Finally, we compare the performance of portfolio with the benchmark to see if it outperformed steadily.

$$Sharpe \ \ Ratio = \frac{R_p - r_f}{\sigma_p}$$

where R_p is annualized return of the portfolio, r_f is risk-free rate, and σ_p is the standard deviation of the portfolio.

In this project, we choose $r_f = 0$, because the interest rate is very low. Moreover, The goal is to compare the performances of these portfolios with the performance of the benchmark, so it is reasonable to make $r_f=0$, since it will not affect the results.

3 Empirical Analysis

3.1 Data Description

A. Back-testing Period: 01/01/2008-31/12/2018
B. Data for Portfolio Construction: Daily adjusted prices of stocks and TAIEX total return index
C. Back-testing Data: Daily adjusted prices of stocks
D. Benchmark: TAIEX total return index, which is the universe of the portfolios.
E. Data Resource: Bloomberg Terminal

3.2 Empirical Results of Low Sigma Strategy

First, looking at Figure 1, clearly, the low σ portfolios performed better than high σ portfolios, and even beat the benchmark. Moreover, the portfolio with annual review performed a bit better than semiannual review, which implies that those stocks under value during the past six months are much likely going up for a long time. Moving on to Table 1, focusing on the top50 portfolios first. Both the portfolios with semiannual review and annual review beat the benchmark a lot, and the standard deviations are less than the benchmark. Therefore, the Sharpe ratio of both portfolios are much better than the benchmark, which means these two portfolios get more returns than the benchmark with the same risk. On the other hand, the performances of high σ portfolios are much worse than the benchmark, even got the negative annualized returns. Furthermore, the standard deviations of the portfolios are bigger than the benchmark. Thus the Sharpe ratio of the portfolios are awful.

Second, Figure 2 shows the annual returns of low sigma portfolios and the benchmark. It is clear that most of the time both portfolios with semiannually review and annually review performed better than the benchmark, especially in the bear markets. However, they not performed as well as the benchmark during the super bull market.

To sum up, low sigma is a stable strategy, the value of the portfolios went up steadily with low standard deviations.
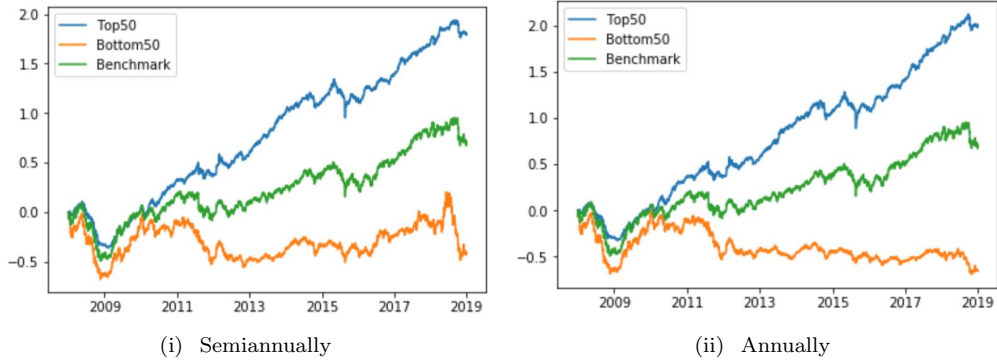
| | |
| (i) Semiannually | (ii) Annually |

Fig. 1. Performances with Low σ strategy

Table 1. Empirical Results of Sigma Portfolios

| Top50 portfolio (Low σ)	Semiannually	Annually	Benchmark
Total Return (%)	181.13	200.71	71.47
Annualized Return(%)	9.85	10.53	5.02
Standard Deviation (%)	7.62	7.66	15.14
Sharpe Ratio (%)	129.23	137.38	33.18
Bottom50 portfolio (High σ)	Semiannually	Annually	Benchmark
Total Return (%)	-41.42	-64.84	71.47
Annualized Return (%)	-4.74	-9.07	5.02
Standard Deviation (%)	23.16	21.89	15.14
Sharpe Ratio (%)	-20.46	-41.43	33.18
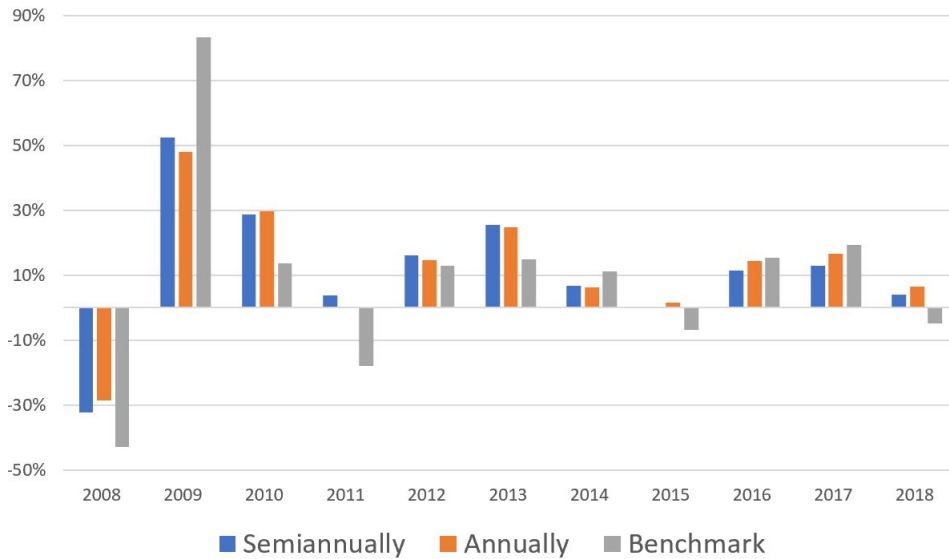
Fig. 2. Low Sigma Portfolio Annual Returns with Benchmark

3.3 Empirical Results of Low Beta Strategy

Looking at Figure 3, the low beta portfolios performed better than the high beta portfolios, and also better than the benchmark. Moving on to Table 2, focusing on the top50 portfolios, the standard deviations of both

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the portfolio with semiannual review and annual review are smaller than the benchmark, which make the Sharpe ratio of both portfolios performed much better than the benchmark. Moreover, the annualized return of the portfolio with annual review is a bit higher than the portfolio with semiannual review. However, the standard deviation of the portfolio with semiannual review is smaller than the portfolio with annual review, which causes the Sharpe ratio performed a bit better than the portfolio with annual review. On the other hand, the portfolios with high beta strategy performed bad, even lost the benchmark a lot.
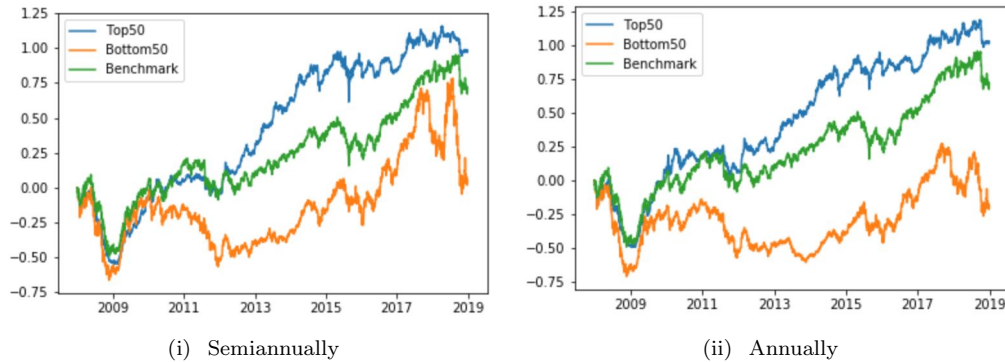

(i) Semiannually   (ii) Annually

Fig. 3. Performances with Low β strategy

Table 2. Empirical Results of Low Beta Portfolios

Top50 portfolio (Low β)	Semiannually	Annually	Benchmark
Total Return (%)	98.45	102.25	71.47
Annualized Return (%)	6.43	6.61	5.02
Standard Deviation (%)	9.90	10.27	15.14
Sharpe Ratio (%)	64.95	64.40	33.18
Bottom50 portfolio (high β)	Semiannually	Annually	Benchmark
Total Return (%)	4.49	-19.41	71.47
Annualized Return (%)	0.40	-1.94	5.02
Standard Deviation (%)	25.32	25.02	15.14
Sharpe Ratio (%)	1.58	-7.77	33.18

Next, looking at Figure 4, the annual returns of low beta portfolios are not performed well all the time, although the total returns of the portfolios beat the benchmark during the back-testing period. In general, they performed well when the benchmark mark going down. However, the benchmark performed better than the portfolios during the financial crisis. Moreover, low beta portfolios usually beat the benchmark in the bull markets, especially in the super bull market. However, we also can see that the portfolios of low beta strategy got the negative return while the benchmark was positive return.

To sum up, low beta strategy performed better than the benchmark, including higher returns, and lower standard deviation. However, the annual returns of the portfolios can not beat the benchmark steadily.
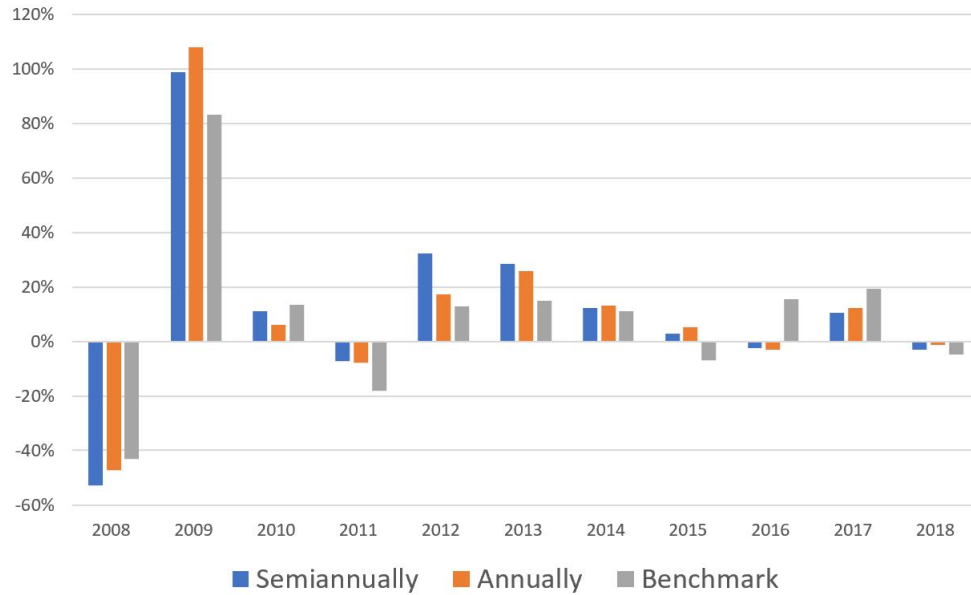
Fig. 4. Low Beta Portfolio Annual Returns with Benchmark

4 Conclusion

According to the empirical results, it is clear that low volatility strategies, including low sigma and low beta, are effective in Taiwan. Both of them have the higher returns and lower standard deviations comparing with the benchmark. Moreover, the performances of low sigma strategy are better than the low beta strategy, since the Sharpe ratios of the low sigma are about 2 times of the low beta strategy. It implies that the annualized return of the low sigma strategy is double of the low beta strategy with the same risk. Furthermore, the annualized returns of portfolio with annual review is a bit higher than the portfolio with semiannual review for both strategies, which means that those stocks which be undervalued in the past half year are much like going up for the next year. Obviously, they also perform well for the next half year.

On the other hand, there are some issues should be considered. First, in this project, we didn't consider the transaction cost and the investable capacity. Second, in fact, the TAIEX total return index is not tradable. Therefore, if we want to apply this trading strategy, we can choose the future of TAIEX instead. Of course, it is better to do back-testing on it first. Finally, In this project, we only use adjusted close price to calculate and trade. In the real world, we can choose other price like AVE, VWAP, and so on to evaluate.

In conclusion, low volatility is a good strategy to select the stocks to invest. Moreover, it is also a good idea to imply it to trading signals.

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