Absolute Alpha with Moving Averages

a Consistent Trading Strategy

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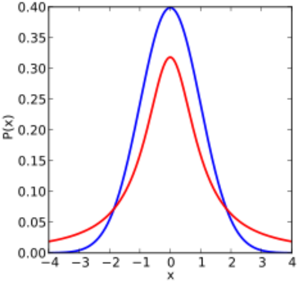
Introduction

- Carhart (1995, 1997) discussed a 4-factor model using Fama and French's (1993) 3-factor model plus an additional factor capturing Jegadeesh and Titman's (1993) one-year momentum anomaly.
- De Bondt and Thaler (1984), provided empirical evidence to show that the overreaction hypothesis is consistent in market level. That is, they have shown that portfolios of prior "losers" are found to outperform prior "winners".
- Question: if short- and long-run reversals do exist, what would be an ideal entry?

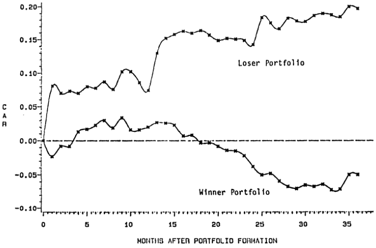
Assumptions

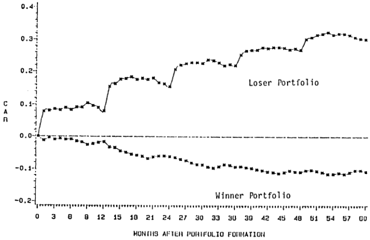
- Malkiel (2005) discussed that the price follows random walk. We take this as our major assumption.



Assumptions

- From De Bondt and Thaler (1984), we observe that the loser portfolios outperform the winner portfolios in both 1-36 months time period and 1-60 months period.





Mathematical Model

- Definition of moving averages.
- Simple Moving Averages

$$SMA(i,t)_n = \frac{1}{n}\sum_{j=1}^{n} P(i,t)_j$$

- Exponential Moving Averages

$$EMA(i,t)_n = P_{i,t}\theta + \frac{1}{n}\sum_{j=1}^{n} P(i,t)_j(1-\theta)$$

with $\theta = 1/(n+1)$.

Mathematical Model

- We denote the upper bound of the price of a benchmark, $\lceil P_{i,t} \rceil$, and the lower bound of the price of a benchmark, $\lfloor P_{i,t} \rfloor$, to be the following forms.
- Price Ceiling:

$$\lceil P_{i,t} \rceil = \bar{k} \times SMA(i,t)_n = \bar{k} \times \frac{1}{n} \sum_{j=1}^{n} P(i,t)_j$$

- Price Floor:

$$\lfloor P_{i,t} \rfloor = \underline{k} \times SMA(i,t)_n = \underline{k} \times \frac{1}{n} \sum_{j=1}^{n} P(i,t)_j$$

.

Mathematical Model

- We can also use exponential moving averages. Then the upper bound and lower bound take the following form
- Price Ceiling:

$$\lceil P_{i,t} \rceil = \bar{k} \times EMA(i,t)_n = \bar{k} P_{i,t}\theta + \frac{\bar{k}}{n}\sum_{j=1}^{n} P(i,t)_j(1-\theta)$$

- Price Floor:

$$\lfloor P_{i,t} \rfloor = \underline{k} \times EMA(i,t)_n = \underline{k} P_{i,t}\theta + \frac{\underline{k}}{n}\sum_{j=1}^{n} P(i,t)_j(1-\theta)$$

.

Mathematical Model

- For each trader, there exists a pair of parameters, $(\bar{k}, \underline{k})$, such that the trader is comfortable with. Given a pair of parameters preferred by a trader, $(\bar{k}^*, \underline{k}^*)$, we can calculate exit price and entry price (buy low sell high) for an ideal position:
- Price Ceiling and Floor by simple moving averages and exponential moving averages:
$$\lceil P^*_{i,t} \rceil = \bar{k}^* \times \frac{P_{i,t}}{SMA(i,t)_n}, \; \lceil P^*_{i,t} \rceil = \bar{k}^* \times \frac{P_{i,t}}{EMA(i,t)_n},$$
$$\lfloor P^*_{i,t} \rfloor = \underline{k}^* \times \frac{P_{i,t}}{SMA(i,t)_n}, \; \lfloor P^*_{i,t} \rfloor = \underline{k}^* \times \frac{P_{i,t}}{EMA(i,t)_n}.$$

Data

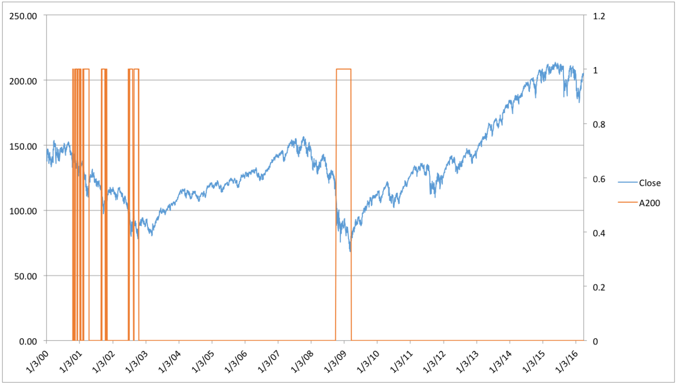
- We took S&P 500 ETF SPY from Jan. 3rd, 2000 to Mar. 29th, 2016. We run the model with only past data.
- From the period Jan. 3, 2000 to Mar. 29, 2016, we have 4,084 observations of prices for benchmark and we chose moving averages, 10, 20, 30, 50, 100, 200, and 300 as sample moving averages.
- We chose a parameter of $\underline{\mathbf{k}} = \{\underline{k}_{SMA(i)} : i = [10, 20, 30, 50, 100, 200, 300]\}$ to be "buy" signal.

Empirical Results

- For S&P 500 ETF SPY, given the trader's parameter, using 200-day simple moving average
- The "buy" signals are plotted with prices.

Empirical Results

- Figure as below:

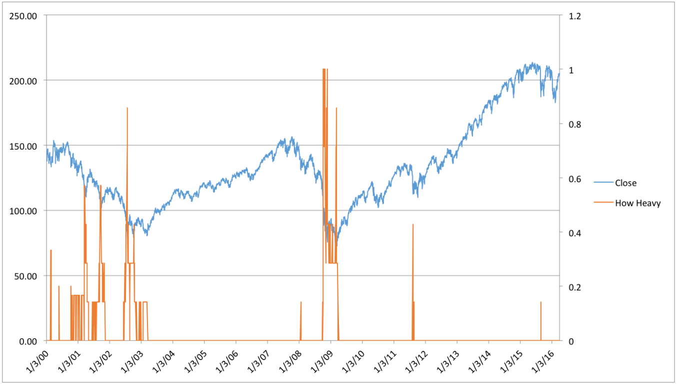


Empirical Results

- One simple moving average may or may not be precise. We can also calculate a the average "buy" signal from all of the moving averages.
- The next figure plots the price of the benchmark and the average of "buy" signal if the average of "buy" signal is bigger than 50%.
- The more simple moving averages signal traders to buy the heavier he should buy.
- The plot only plots the average of "buy" signal if the average of "buy" signal is higher than 3.5 ($= 7/2$, i.e. 7 moving averages in total, for 10, 20, 30, 50, 100, 200, 300).

Empirical Results

- Figure as below:



Discussion

- This paper introduces a model to take advantage of the volatilities in a benchmark and to outperform a benchmark by consistently allocating risk at probabilistically unlikely pricing events.
- However, this paper is not meant to attack the Efficient Market Hypothesis. As a matter of fact, the belief of EMH exhibits no effect on this trading strategy.
- Liquidity Problem: at a certain price, there are only so many shares sold and bought.

Discussion

- AUM: for a trader with an arbitrary assets under management, it is easy for him to turn \$1 million to \$2 million but it will be a lot more difficult for him to turn \$1 billion to \$2 billion dollars.
- Time: eventually there will be one day that he acquires all of the stocks available at that price he desires yet still not big enough for him to grow his assets at a rate he could have done with less assets. Ex: For 10% annual return on one dollar, easier for $1.1^{10} = 2.59$, but a lot harder to do $1.1^{50} = 117.39$.

Discussion

- U.S. equity market has about $17 trillion market capital. It is not likely a trader could grow big enough to match this size in his life time. Eventually, we, the good ones among us together, are managing the market, but before one of us get to a size that is comparable to all the good ones among us, there is a lot of profitable opportunities for one to exploit.

Conclusion

- This paper introduces a trading strategy such that a trader can beat the benchmark by directly investing the benchmark with a weight allocated by difference of price and moving averages under the martingale assumption.
- The paper also opens up a range of new research topics: after a trader enter a position, what percentage of position should he sell when the algorithm tells him it is an ideal exit point? What sort of game plan should he execute to achieve the maximum payoff? Will strictly following the algorithm gives him optimal psychological behavior in a volatile trading environment?