101 Formulaic Alphas

Jun 25, 2022

Ramakrishnan NA18B030

Contents

1 Introduction

Algorithmic trading strategies are driven by signals that indicate when to buy or sell assets to generate superior returns relative to a benchmark such as an index. The portion of an asset's return that is not explained by exposure to this benchmark is called alpha, and hence the signals that aim to produce such uncorrelated returns are also called **alpha factors**.

Ultimately, the goal of active investment management is to generate alpha, defined as portfolio returns in excess of the benchmark used for evaluation. The **fundamental law of active management** postulates that the key to generating alpha is having accurate return forecasts combined with the ability to act on these forecasts

In this project we have attempted to develop the code and results based on the formulaic alphas mentioned in the paper **101 Formulaic Alphas**

2 Data

The data was collected using the **yahoo api**.

We have collected the daily historical time series data of **9 ETF fund** from **SEP-2003 to JUN-2001** to perform our backtesting.

We have used the ETF fund to limit the dynamic asset universe for backtesting

An **exchange-traded fund (ETF)** is a type of pooled investment security that operates much like a mutual fund. Typically, ETFs will track a particular index, sector, commodity, or other asset, but unlike mutual funds, ETFs can be purchased or sold on a stock exchange the same way that a regular stock can. An ETF can be structured to track anything from the price of an individual commodity to a large and diverse collection of securities. ETFs can even be structured to track specific investment strategies.

For example, **XLB** tracks a market-cap-weighted index of US basic Material companies of the SP 500 index

The 9 ETF fund names are: [**'XLB', 'XLE', 'XLF', 'XLI', 'XLK', 'XLP', 'XLU', 'XLV', 'XLY'**]

3   Pipeline

- The model pipeline is : **data -> alpha -> portfolio trading -> evaluation**

We have used the **qstrader** library to help with the backtesting process

Our portfolio consists of a dynamic universe of one or more positions in each of the assets The allocation of these assets is determined by our alphas

Initially in out portfolio we have zero positions

Our alpha model outputs a set of weights for each asset allocation. Accordingly our portfolio is constructed

These positions are rebalanced after a fixed period of time which can be end of day, end of week, end of month

We have assumed our benchmark return to be buy and hold of SP 500 index fund We then compare our alpha results with the benchmark results to evaluate each alpha

4   Assumptions

- The portfolio is actively managed form SEP-2003 to JUN-2021

- Only long positions are allowed

- The portfolio is rebalanced at end of the day

- The benchmark is buy and hold of SP 500 index fund

- No slippage or trading costs

5 Alphas

5.1 Alpha 001

The formula for alpha is

$$(rank(TsArgMax(SignedPower(((returns < 0)?stddev(returns, 20) : close), 2.), 5)) - 0.5)$$

The weights of each asset is determined by the rank of the maximum values of volatiltiy over the past 20 days for a backward period of 5 days minus 0.5
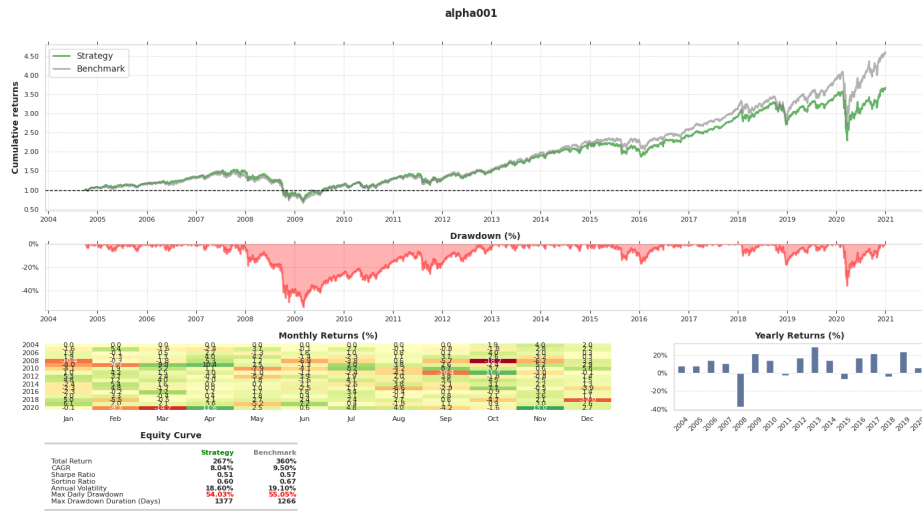

Figure 1: evaluation of alpha001

Observations

- The alpha underperforms the benchmark fund

- The alpha performs comparatively better in sideways market rather than long term bull and bear market

- Although the returns are comparatively lower the portfolio volatity is lower compared to the benchmark fund

5.2 Alpha 002

The formula for alpha is

$$(-1 * correlation(rank(delta(log(volume), 2)), rank(((close - open)/open)), 6))$$

The weights of each asset is determined by correlation of the rank of change in volume and percent change in close and open prices

Figure 2: evaluation of alpha002

Observations

- The alpha outperforms the benchmark in sideways and short term bull market

- The alpha performs comparatively better in sideways market rather than long term bull and bear market

- Although the returns are comparatively lower the drawdown is significantly limited

5.3 Alpha 003

The formula for alpha is

$$(-1 * TsRank(rank(low), 9))$$

The weights of each asset is determined by the time series rank of the low prices over a period of 9 days
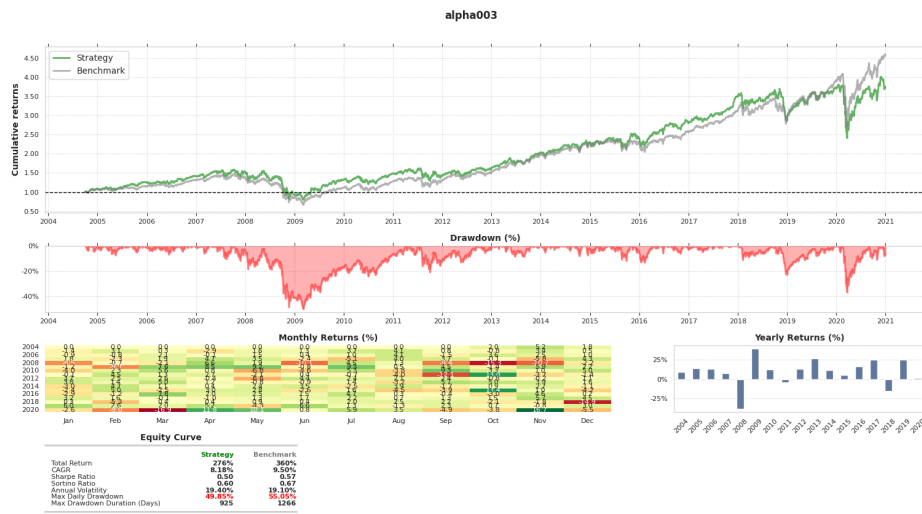

Figure 3: evaluation of alpha003

Observations

- The alpha outperforms the benchmark fund from 2007 - 2018

- The alpha performs comparatively better in sideways market rather than long term bull and bear market

- Although the returns are comparatively lower the drawdown is significantly limited

6 Appendix

The code for running the backetest can be found in the github repo :
`https://github.com/ram-ki/101_formulaic_alphas`