A Portfolio Selection Method Validation: Max-Median Rule in Csi 300

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Abstract: We use an existing investment strategy, MaxMedian rule, which is introduced by Prof.James Thompson, a simple but power investment method for individuals that can even compute on a laptop. The huge impact of this investing strategy was satisfied through statistics data, which shows From the S&P 500 result, citation, over 1958-2016 period, this strategy is over the benchmark by 1.15. In this article we examine the way to operate the of MaxMedian rule in CSI 300, a chinese stock market based index. And also examining the results of the use, the result shows solid evidence that the Maxmedian rule still can apply to the CSI300 and outperform the benchmark through statistics.

1. Introduction

In the field of stock marketing, one of the biggest challenges for most investors is how to make profit while maintaining a low risk. In this article, we examine the stratigraphy of max median rule as a selection that is a strategy that has lower risks and while provides advantage over the S&P 500 benchmark index.

ETF is an investment fund and exchange-traded product. In some sense, ETF is similar to a mutual fund, but it can trade on the market on a daily basis. Some examples as SPY, QQQ, these ETFs are very popular due to the facts that over 90 percent of the professional asset management could not even beat the benchmark due to trading cost, failing of active management, which significantly increased the capital on these ETFs. Therefore, the easiest way to invest without paying management fees is to invest the benchmark ETFs. However, to generate a better profit is always good for investors. Here we introduce the Maxnedian rule to the investors and validate this method with CSI300 index. We investigated the result of max median rule that whether it was resulting in a higher return compared to the average benchmarks, and how the max median rule's return was the most effective compared to other rules, through states the data of max median rule and the regular benchmarks. From literature[1,2], the result for this method on S&P 500 which outperformed the benchmark in most of the years.

The Maxmedian rule was first invented by Prof. Thompson. It selects a set of stocks according to some restricted rules(e.g. the median daily return of the year) and rebalances consistently with the strategy. The Maxmedian rule has many advantages to any individual investors. It is simple to operate and effective to lower the risks. Through this method, any investor could easily manage his or her portfolio quite reasonably. Over a long period,this strategy would provide decent returns when compared to a benchmark index (e.g. the S&P 500 Index). The S&P 500 is one of the most used and oldest stock market indices. The index contains constituents that represent 500 of the largest companies listed on the New York Stock Exchange and the Nasdaq in broad industry sectors, and only US based companies. The S&P 500 only includes securities with a market cap greater than 4 billion USD and a minimum trading volume of 250,000 shares per month in every six month leading up to the evaluation date and an annual dollar value traded to float-adjusted market capitalization is greater than one.

In this article we sought to examine the MaxMedian rule of portfolio construction in order to determine whether it can provide excess return over the CSI 300 benchmark index through comparing the result of the Max Median Rule to the average stocks markets methods. Based on the previous research[1,2], this stock selection method provides excess cumulative return over S&P 500 from 1958 to 2016 by 1.15 with a selection of 20 stocks per year. It also beat the benchmark

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annually most of the time. The main purpose of this article is to evaluate this MaxMedian rule on a non US market and determine if this method can be generally applied to other stock markets.

Unlike the US equity market is a very stable and matured market with a long history, Chinese stock market is still on it's early stage, there would be plenty of opportunities to invest in this young market. While CSI 300 is a capitalization-weighted stock market index designed to replicate the performance of the top 300 most valuable companies stocks on the Shanghai stock Exchange and Shenzhen stock Exchange. Overall, the CSI 300 is a representative of 300 companies' A-Class stock with large value and highly liquidity which are considered to be blue chip stocks for Chinese stock exchanges. The index launched on April 2005, it has three basic criterias[3]:

1).For Non-ChiNext stocks: The listing time of a stock is more than three months unless the daily average total market value of a stock since its initial listing is ranked top 30 in all the A shares (Non-ChiNext stocks)

2).ChiNext stocks: The listing time of a stock is more than 3 years

3).Non-ST or *ST stocks, non-suspension stocks from listing

CSI300 index constituents are selected as follows and the candidate constituents should have good performance without serious financial problems or violation of laws and regulations and with no large price volatility that shows strong evidence of market manipulation:

1).Calculate the A share daily average trading value and A share daily average total market value during the most recent year for stocks in the index universe, or in case of a new issue, the data since the 4th trading day after listing is used for calculation;

2).Rank the stocks in the universe by A share daily average trading value of the most recent year in descending order and delete the bottom ranked 50% stocks;

3).Rank the rest stocks by A share daily average market value of the most recent year in descending order, those who rank top 300 are selected as index constituents

CSI300 is calculated according to the Paasche weighted composite price index formula. The formula is as follows:

$$\text{Current Index} = \frac{\text{Current Adjusted Market Capitalisation of Constitents}}{\text{Divisior}} * 1000$$

CSI300 uses category-weighted methods to adjust the shares of constituents. Hence, the calculation of the number of the adjusted shares of constituents depends on two factors, namely free float and category-weighted method. The detailed contents of category-weighted method.

Now, we have a good understanding of the CSI300 and S&P 500. Compared with S&P 500, CSI 300 updates more frequently since the companies in this index are relatively less valuable than those in S&P 500, therefore they can be replaced by other tickers easily. If a portfolio construction method can work and perform well in such a dynamically changed index, It should be able to apply generally to any other stock market.

2. Data, Methodology, and Setup

In order to gather the data necessary to perform our trading strategy backtesting, we utilized the JoinQuant API. JoinQuant is a cloud based platform designed for quantitative researchers and quantitative traders for data downloading, sharing, strategy testing. Specifically, we downloaded our data from JoinQuant API, the data covered the daily close for CSI300 and its constituents. Since our time period of interest was 2007 until 2019, we downloaded data from 2007-01-01 to 2019-12-31 for the entire database. Based on the Maxmedian rule, the procedure can be described as following :

1).On a day to day basis(for *T* trading days in any given year), compute the daily returns(rj) from the daily close price(Pj) for CSI 300 constituents.

$$r_j(t) = \frac{P_j(t) - P_j(t-1)}{P_j(t-1)}; t = 1, 2, ..., T$$

2).Sort these for the years trading days

3).Calculate the median daily return for the stocks.

$$\bar{r_j} = median(r_j)$$

4).Rank the median daily return for the stocks.
5).Select the top N stocks(e.g. N = 20) from the rank.
6).Equal weighted invest these N stocks for next year.
7).Hold for one year then liquidate
8).Repeat steps(1-7) through the interested period

We pick a subset of N stocks from the CSI 300 constituents based on the criterion of the Maxmedian rule at the end of any given year. Then on the first trading of the subsequent year, we allocate the capital equally for the N stocks and hold the portfolio for one year and collect data during the year to repeat this method at the end of the year. We keep repeating this process over the period we are interested to evaluate this simple investment strategy.

The algorithm is written in Python and computed on a Macbook, which means this method can be simply used by any investor who has a computer and basic knowledge to implement in a program language.

3. Result and Discussion

First of all, we selected 3 sets of N, and tested the period from 2008 through 2019, and tried to find out which one gave the best performance. We picked N= 20, N=30 and N=40, respectively. The overall performance of the selection vs CSI300 benchmark is plotted in Fig1-Fig.3.(Fig.1 shows N= 20, Fig.2 shows N=30, and Fig.3 shows N=40.) In these figures, the orange line is the Maxmedian rule and the blue curve is the CSI300. Comparing these two curves, the overall result indicates the Maxmedian rule beat the CSI300 most of the time, which demonstrates this method has a good potential for markets outside of the US. Among those 3 Ns, N = 40 yields the best result from the normalized cumulative return plot. To further investigate the daily return on the portfolio and the benchmark, we plotted the histogram of the daily return of Maxmedian (N = 40) vs CSI_300 as shown in Fig.4 . From the result, we can see the Maxmedian portfolio has a shoulder on the right side which indicates more positive returns than the CSI_300 index has. It is also observed that the Maxmedian portfolio return distribution is much closer to the normal distribution than the CSI_300. When we take infinite bins and smooth them out for the histogram plot, it became the density map as shown in Fig.5, and we can clear see the mean of the distribution is slight on the right side of the CSI_300 index.

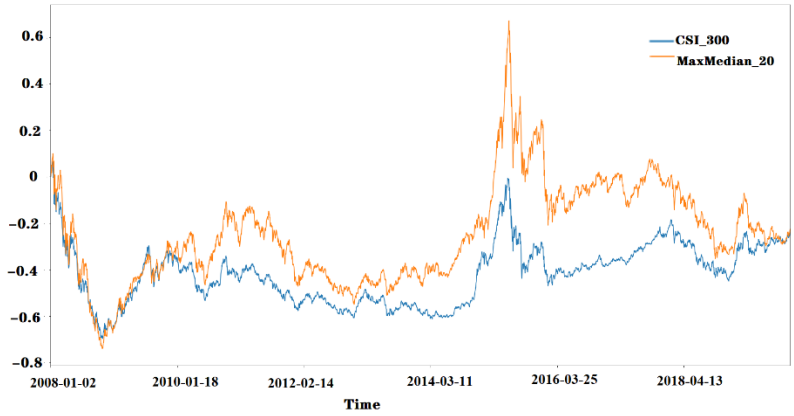

Fig.1 N=20, Maxmedian Vs Csi_300 (2008-2019)

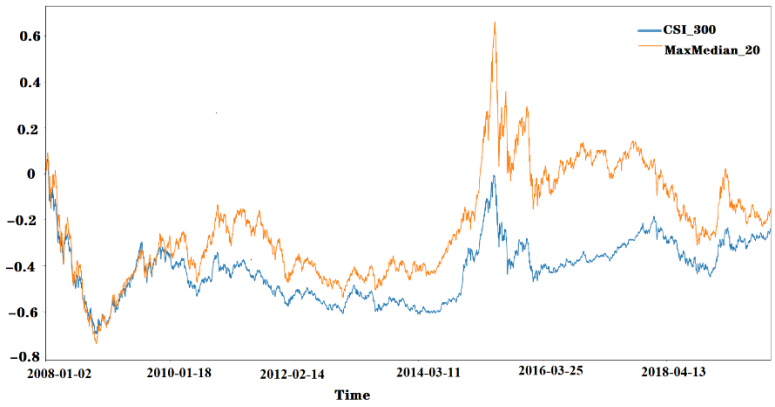

Fig.2 N=30, Maxmedian Vs Csi_300 (2008-2019)

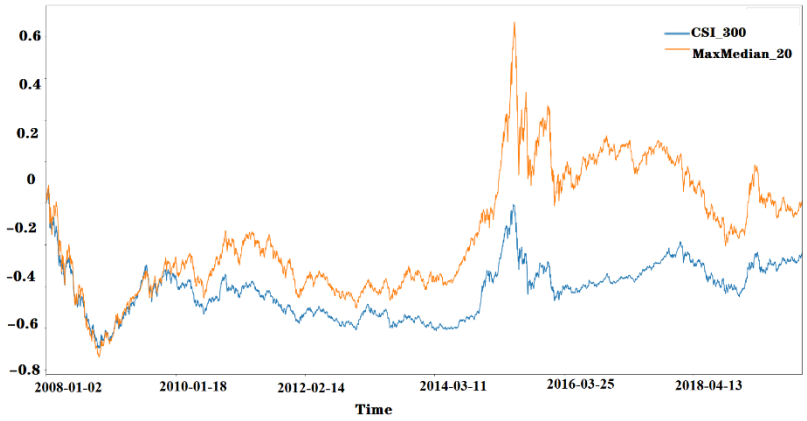

Fig.3 N=40, Maxmedian Vs Csi_300 (2008-2019)

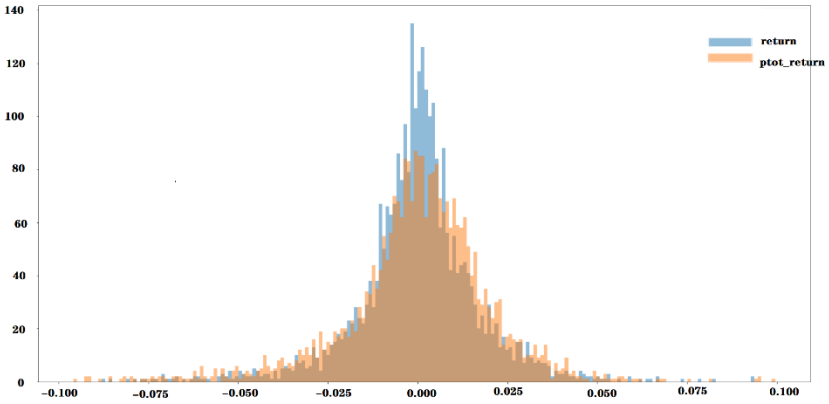

Fig.4 N=40, Histogram Plot of Return Distribution. Maxmedian Vs Csi_300 (2008-2019)

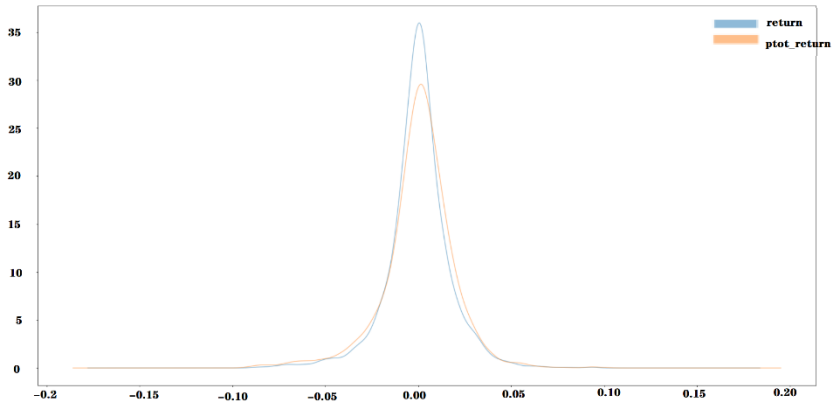

Fig.4 N=40, Density Plot of Return Distribution. Maxmedian Vs Csi_300 (2008-2019)

4. Future Directions

Several items are currently available that may be worth investigating in future studies.

Evaluate the repeatability (or general performance) of the program in other markets (international markets) and other indices (Nikkei HSI, etc.).

Investigate more meaningful rules about when to stop random search and how it relates to overall program performance.

References

[1] Ernst, P.A; Thompson, J.R.; Miao, Y.; Portfolio Selection: the power of equal weight. Arxiv : https://arxiv.org/pdf/1602.00782.pdf Aug. 8,2017

[2] Steven J. Cox; The Coordinated Max-Median Rule for Portfolio Selection.