GE Stock Performance analysis under MACD

Time scale between 10/1/2012 to 9/30/2016

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Abstract: Select GE Stock (NYSE), 4 years' time period and download relevant daily closing prices from yahoo finance. Test MACD method to yield positive total return. Define the performance measure: effective annual rate of return. Implement the bootstrap protocol for resampling the data set. Check performance of the chosen strategy on 100 resampled data sets. Make the conclusion that the MACD strategy is profitable for GE Stock over the last four years.
Key word: GE, MACD, Bootstrap, ARIMA, AR

1. Brief introduction

General Electric (GE) is an American multinational conglomerate corporation incorporated in New York, and headquartered in Boston, Massachusetts. As of 2016, the company operates through the following segments: Power & Water, Oil and Gas, Aviation, Healthcare, Transportation and Capital which cater to the needs of Financial services, Medical devices, Life Sciences, Pharmaceutical, Automotive, Software Development and Engineering industries.[1]

MACD, short for moving average convergence/divergence, is a trading indicator used in technical analysis of stock prices. The MACD indicator (or "oscillator") is a collection of three time series calculated from historical price data, most often the closing price. These three series are: the MACD series proper, the "signal" or "average" series, and the "divergence" series which is the difference between the two. The MACD series is the difference between a "fast" (short period) exponential moving average (EMA), and a "slow" (longer period) EMA of the price series. The average series is an EMA of the MACD series itself.[2]

2. Methodology

There are following 4 processes:

1, Test the performance of the original data under MACD method (assignment 3);

To build MACD, first make the signal vector by making the EMA9 (9 period exponential moving averages, the same below) of the difference between EMA12 and EMA26, which are built by the original price. Then compare signal vector with the difference between EMA12 and EMA26, if it is higher, then it is a buy signal, if it is lower, then it is a sell signal; and store these signals in a new vector. Next, pick the locations of "changing signals" and set them as action points. Finally, plug these action points back into price data, to see if we bought and sold the stock at those certain points, what the outcome will be.

2, Search for the best ARIMA model to fit the stock log returns;

A common approach in statistics to quantify the goodness of fit test is the AIC (for Akaike

Information Criteria) statistic. To summarize, all we need is a loop to go through all parameter combinations we deem reasonable, for instance from (0,0) to (5,5), inclusive, for each parameter pair fit the model, and finally pick the model with the lowest AIC or some other statistic. One of the common approaches is to use the function "armaFit" in "fArma" package. But note that sometimes "armaFit" fails to find a fit and returns an error, thus quitting the loop immediately. "armaSearch" handles this problem by using the "tryCatch" function to catch any error or warning and return a logical value (FALSE) instead of interrupting everything and exiting with an error. Some R packages, "forecast" and "rugarch" for instance, provide a similar, "auto.arima" function out of the box.[3]

3, Bootstrap the residuals to generate 100 new sets of price data;

To bootstrap the residuals, first transfer the original price data to log returns. Then, exact the residuals. At first, I tried ARIMA(5,0,2) model, but I failed to exact residuals. So I then changed to search a AR model and get the AR(2). Next, bootstrap the residuals by "sample" and generate 100 new sets, save them in matrix. Finally, transfer the new log returns back to prices.

4, Test the performance of the new sets of data, calculate overall performance and make conclusions.

This process is almost same as the first process. The only differences are to make "for" loops and to compute the average of the new 100 sets of data. At the end, graph P/L histogram to visualize the outcome.

3. Results

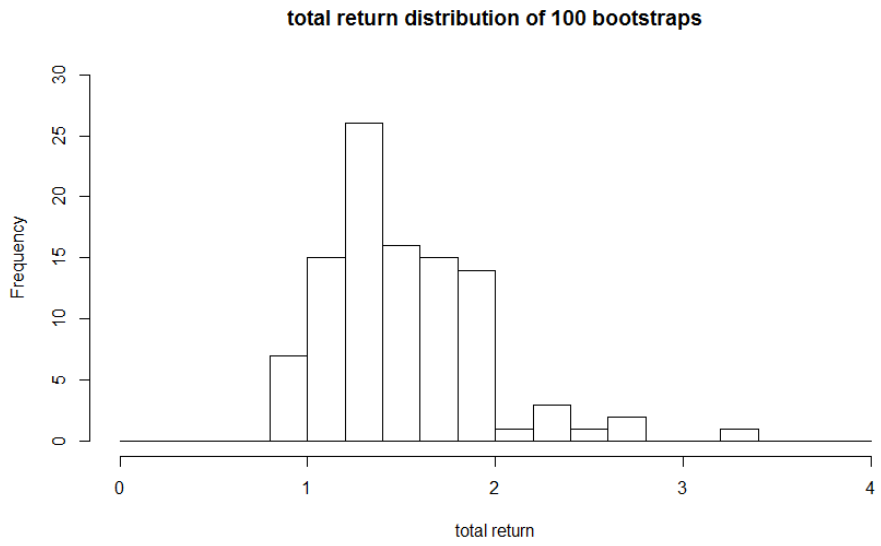
The performances of GE Stock under MACD between 10/1/2012 to 9/30/2016 are as follow:

# of roundtrip	Total return	EAR	Winning rate	Max drawdown
35	1.2756	1.0627	60%	17.69%

The performances of 100 bootstrap data (on the average) are as follow:

# of roundtrip	Total return	EAR	Winning rate	Max drawdown
38.91	1.5283	1.1041	73.37%	20.20%

Distribution histogram:



t-test:

t = 12.103, df = 100, p-value < 2.2e-16

alternative hypothesis: true mean is not equal to 1

99 percent confidence interval:

1.411728 1.639898

4. Conclusion and Discussion

From the tables and graphs above, we could see that the MACD is profitable method for GE Stock during the last four years, (under 99% confidence level). And we can see that the bootstrap performances are even better than GE Stock`s.

To improve the model, I should find a way to exact the residuals of ARIMA model, especially high-order MA. Therefore the model will be more precise to fit the data.

5. References

[1] https://en.wikipedia.org/wiki/General_Electric

[2] https://en.wikipedia.org/wiki/MACD

[3] http://www.quintuitive.com/2012/08/22/arma-models-for-trading/