

# ARIMA – GARCH TRADING STRATEGY ON DIFFERENT ECONOMIC INDICATORS

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# ARIMA – GARCH

## ARIMA

- A generalization of an autoregressive moving average (ARMA) model.
  - Applied in cases where data show evidence of non-stationarity.
  - An initial differencing step can be applied one or more times to eliminate the non-stationarity.
  - We assume a stationary time series for our analysis. ( $d = 0$ )
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- Our looping procedure will provide us with the “best” fitting ARMA model, in terms of the Akaike Information Criterion(AIC) and then choose the parameters  $(p,d,q)$ .



# ARIMA – GARCH

## GARCH

- A statistical model used in analyzing time-series data where the variance error is believed to be serially autocorrelated.
  - Assume that the variance of the error term follows an autoregressive moving average process.
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- GARCH(1,1) is for a single time series. In GARCH(1,1) model, current volatility is influenced by past innovation to volatility. Therefore, we use GARCH(1,1) in our model.



# STRATEGY OVERVIEW

The strategy is carried out on a 'rolling' basis:

1. For each day,  $N$ , the previous  $K$  days of the differenced logarithmic returns of a stock market index are used as a window for fitting an optimal ARIMA and GARCH model.

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2. The combined model is used to make a prediction for the next day returns.

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3. If the prediction is negative the stock is shorted at the previous close, while if it is positive it is longed.

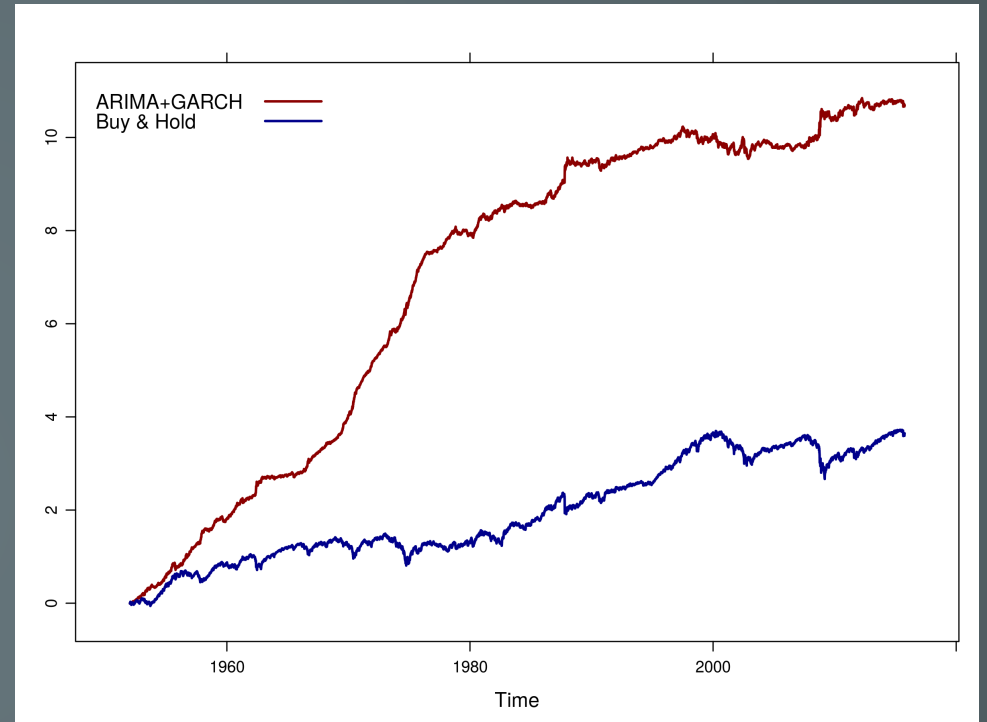
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4. If the prediction is the same direction as the previous day then nothing is changed.

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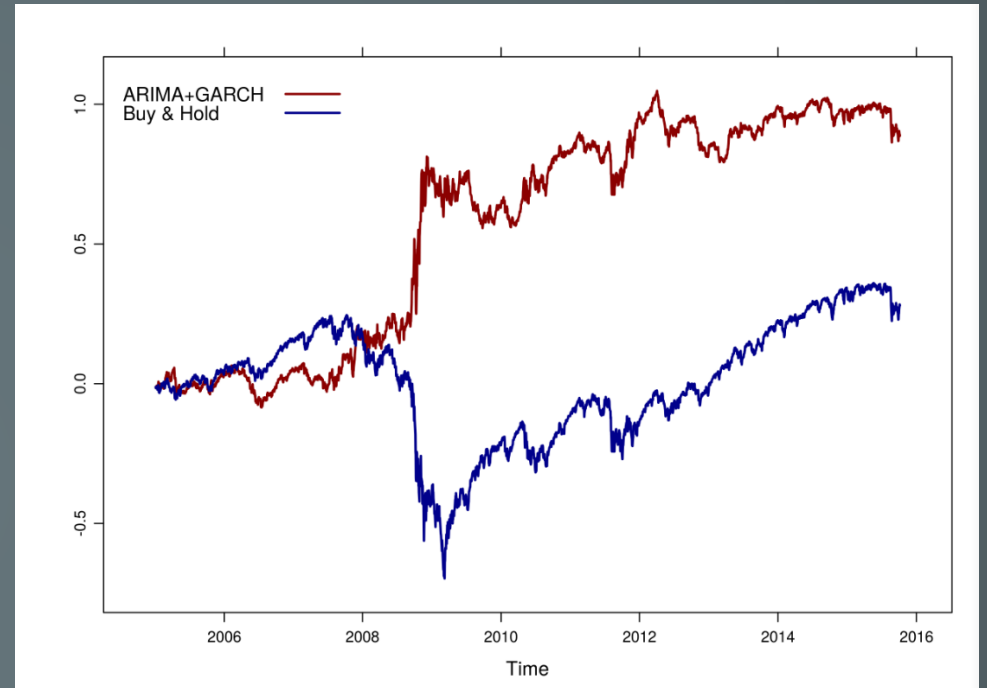
# S&P 500

Scope : 1950 - 2015



# S&P 500

Scope : 2006 - 2016



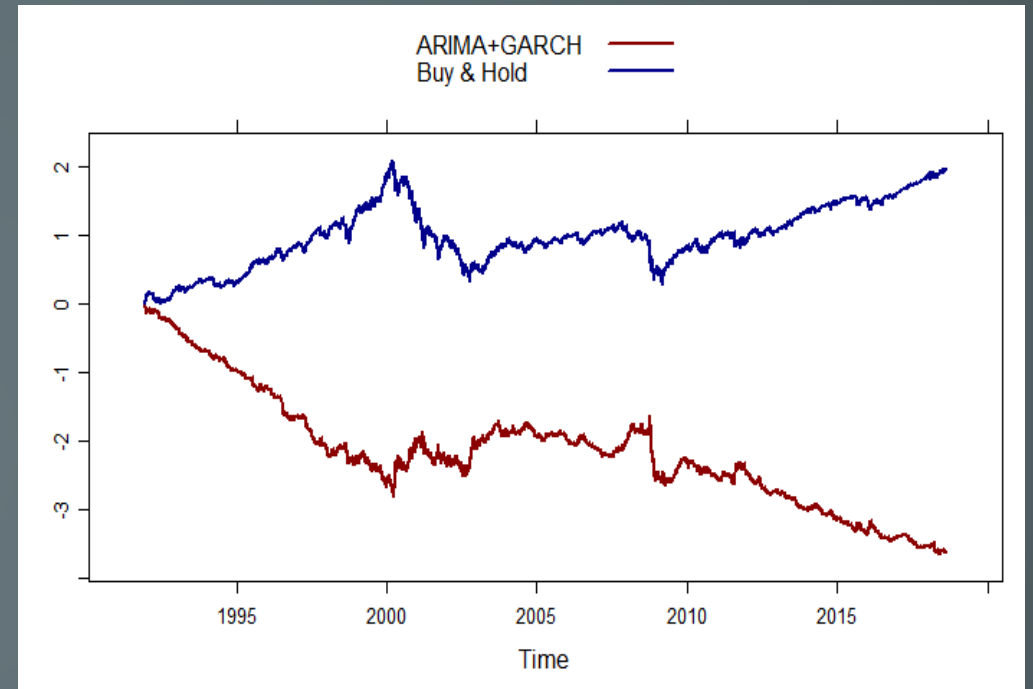


NASDAQ

ARIMA(3,0,5) - GARCH(1,1)

Scope : 1990 – 2020

Reason :  
2000 recession ( Dot-com bubble)

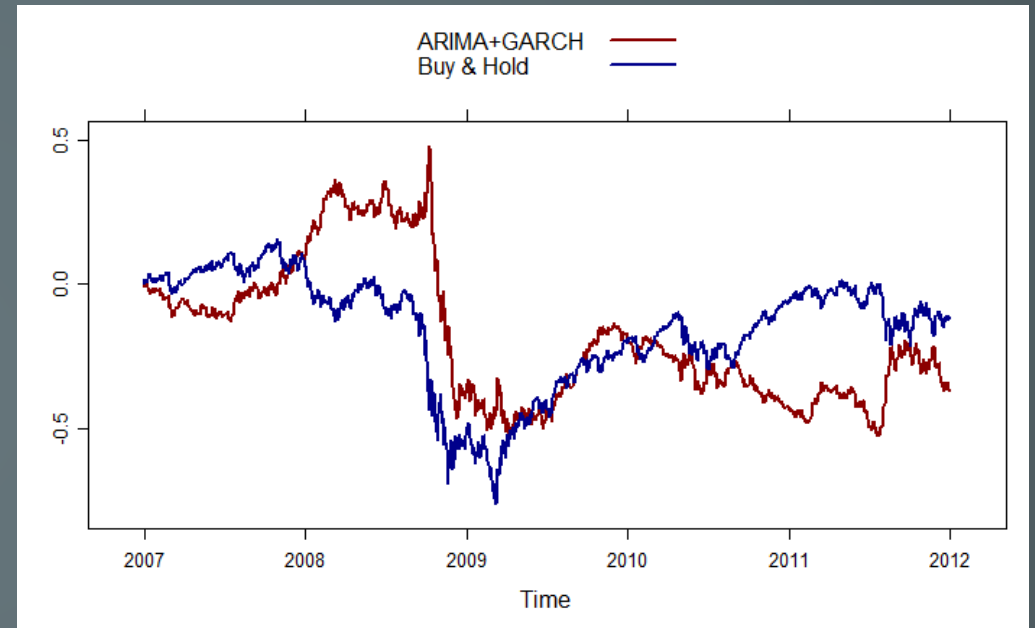


NASDAQ

ARIMA(3,0,5) - GARCH(1,1)

Scope : 2007 – 2012

Reason:  
2008 recession

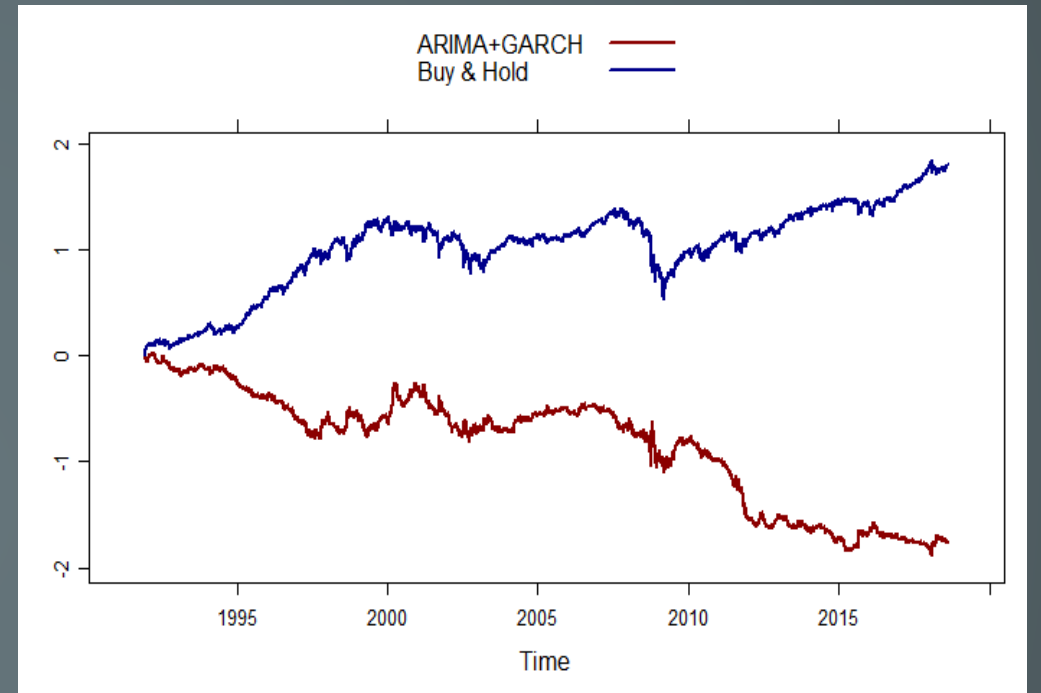


# DOW-JONES

ARIMA(4,0,4) - GARCH(1,1)

Scope : 1990 – 2020

Reason:  
2000 recession ( Dot-com bubble)



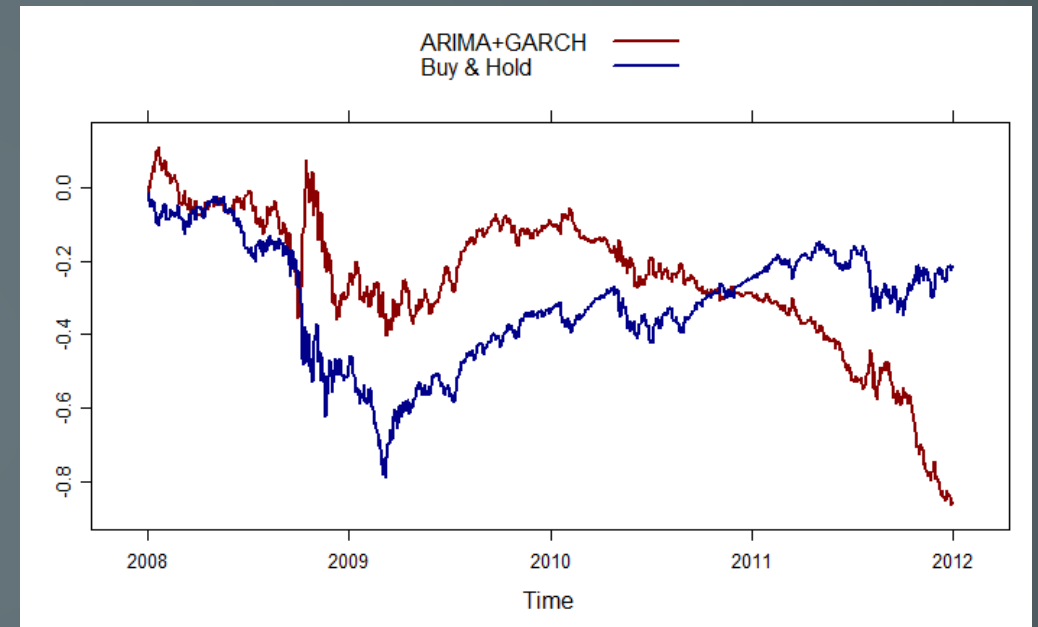


# DOW-JONES

ARIMA(4,0,4) - GARCH(1,1)

Scope : 2008 – 2012

Reason:  
2008 recession

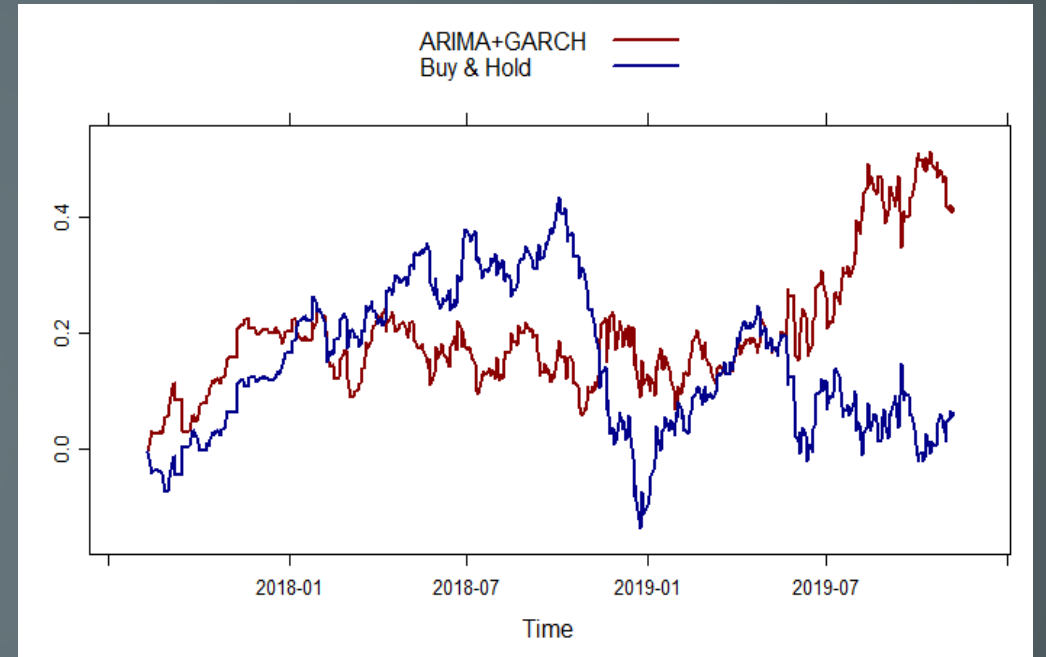


# CRUDE OIL

ARIMA(1,0,0) - GARCH(1,1)

Scope : 2017.07 – 2020.04

Reason:  
2018.10-2019.01: Increase in production



# BITCOIN

ARIMA(1,0,1) - GARCH(1,1)

Scope : 2016 - 2020

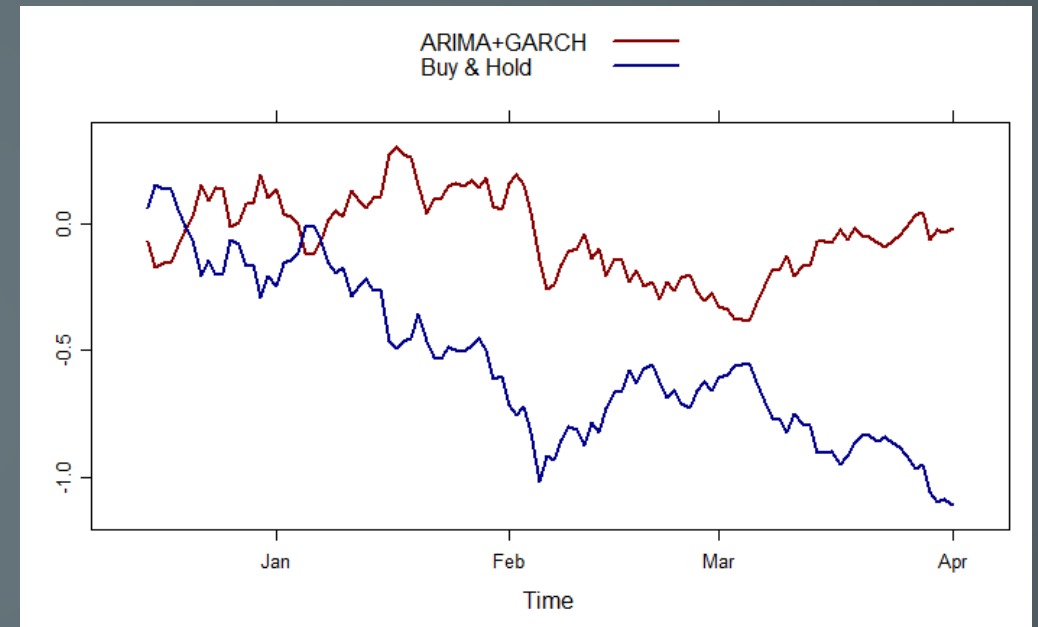




# BITCOIN

ARIMA(1,0,1) - GARCH(1,1)

Scope : 2017.12 - 2018.04



## CONCLUSION FOR THE STRATEGY

- The strategy performs well in crisis because there is likely to be a significant serial correlation in the period and it will be well-captured by the ARIMA and GARCH models.
- In the long run, it basically didn't perform better than buy & hold in the normal time (without crisis) during these 30 years for most of the main indicators.
- We should start using our strategy after there is a 'Black Swan' event.

# APPENDIX

- Reference: <https://www.quantstart.com/articles/ARIMA-GARCH-Trading-Strategy-on-the-SP500-Stock-Market-Index-Using-R/>
- Data source: <https://finance.yahoo.com>





THANK YOU