Multivariable Machine Learning for Predicting Future Stock Trends: Investigating the Impact of Key Variables in Financial Markets.

312707055 Tsu Zhirong

Motivation

1. Enhancing Predictive Accuracy in Financial Markets

2. Analyzing the Impact of Key Variables on Stock Trends

3. Optimizing Investment Portfolio Strategies

DATA Resources

- Underlying data source: Yahoo Finance 、FRED、Finlab
- Datatime: 2013/01/01-2020/12/31
- Number of Datas: 2,487
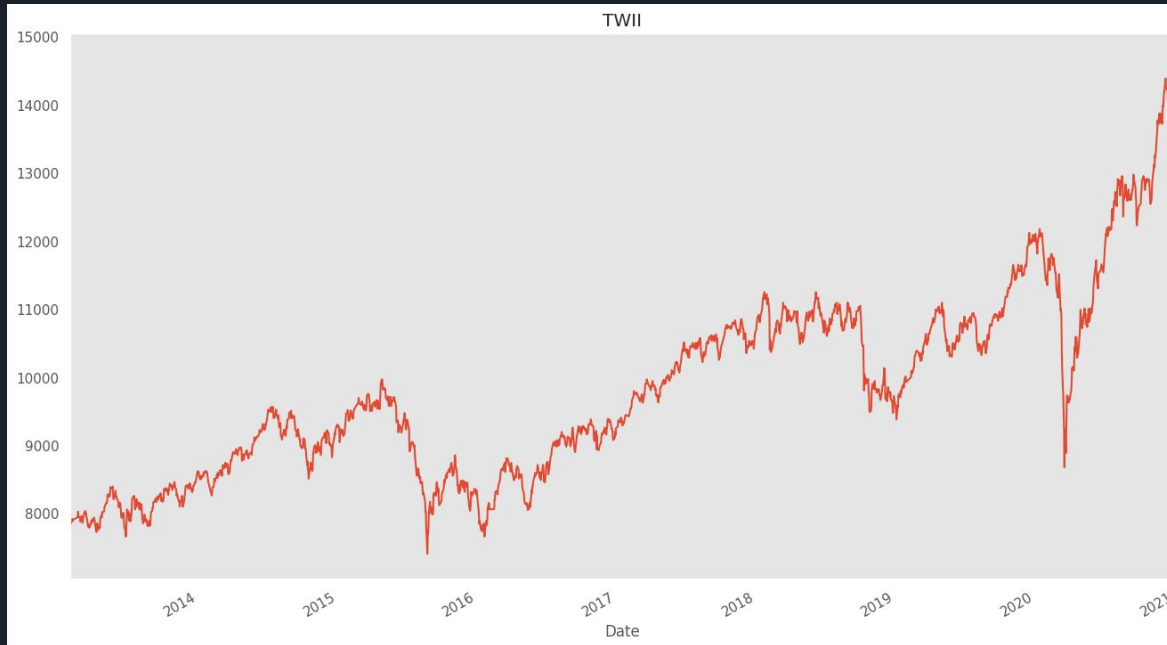- Macroeconomies(Monthly Data): 96

Model Selection

Models	Sample	Features	Response
Index using XGBoost (Benchmark)	75% for Training (6years) 25% for Testing (2years)	All Features	Taiwan Index
Return XGBoost	75% for Training (6years) 25% for Testing (2years)	All Features	Taiwan Index Return

Response Variable

- Taiwan Index

Summary Statistics (TAIWAN)

	Open	High	Low	Close	Volume
count	1951.000000	1951.000000	1951.000000	1951.000000	1.951000e+03
mean	9812.455930	9852.809960	9766.709371	9810.144461	2.309570e+06
std	1381.186869	1388.177951	1376.727300	1383.003322	7.952469e+05
min	7427.331987	7677.901359	7203.042771	7410.312012	0.000000e+00
25%	8671.127944	8699.428357	8619.944467	8660.105469	1.849500e+06
50%	9608.563334	9653.933549	9562.743210	9612.963867	2.146400e+06
75%	10769.300293	10806.054688	10721.265137	10758.569824	2.534850e+06
max	14500.910156	14695.440430	14476.690430	14687.700195	8.157200e+06

- 50% of Taiwan Index is 9608.56
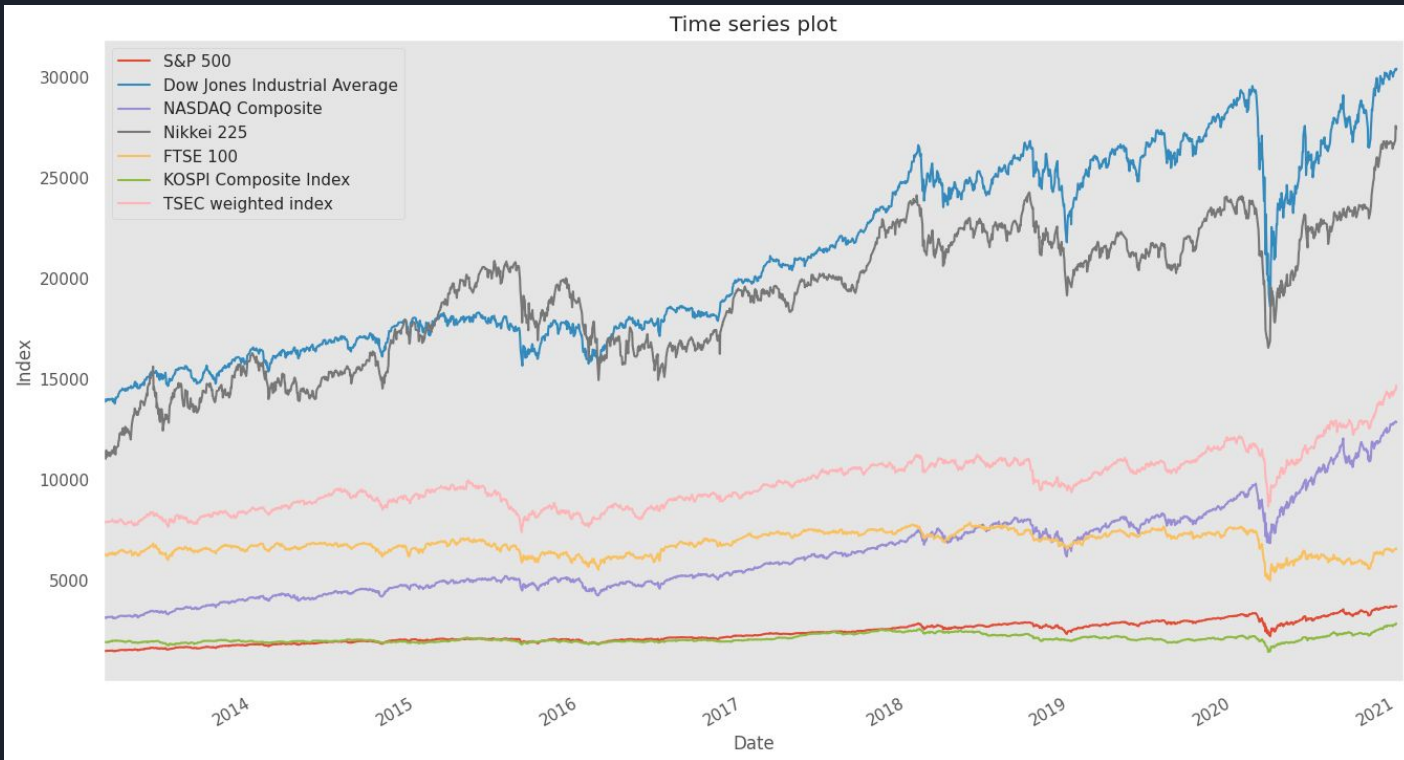- Mean of Taiwan Index is 9812.46

Features

Foreign Index	Macroeconomies	Technical Indicators
S&P 500	tw_business_indicators	MACD
Dow Jones Industrial	tw_electronic_pmi	RSI
NASDAQ Composite	TWD/USD	MA
Nikkei 225 (Japan)	USA pmi	
FTSE 100 (UK)	USA cpi	
KOSPI Composite Index	USA Unemployment	
	2-year Treasury bond	

Features (Foreign Index)

Index_Name	Index	Change	% Change
S&P 500	4551.89	-42.74	-0.93%
Dow Jones Industrial Average	36096.75	-148.75	-0.41%
NASDAQ Composite	14090.02	-215.01	-1.50%
Nikkei 225	33231.27	-200.24	-0.60%
FTSE 100	7517.41	-11.94	-0.16%
KOSPI Composite Index	2514.95	9.94	+0.40%
TSEC weighted index	17421.48	-16.87	-0.10%

- Index_Name
- Index: today's close
- Change: today's close-yesterday's close
- % Change: today's close-yesterday's close in percentage

Time series with Foreign Index

Time series plot

Features

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Why use electronic pmi?
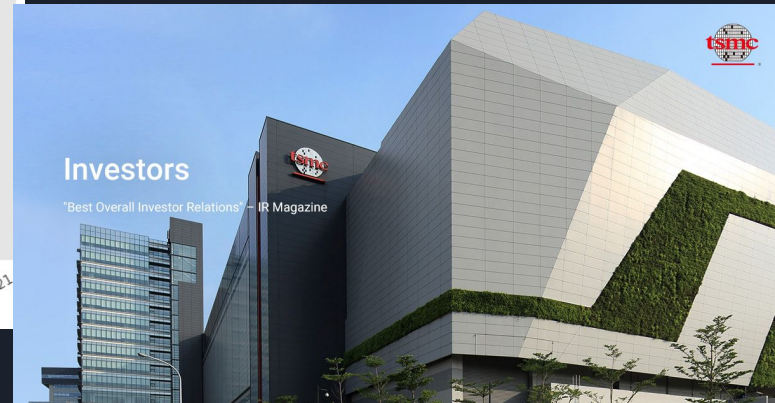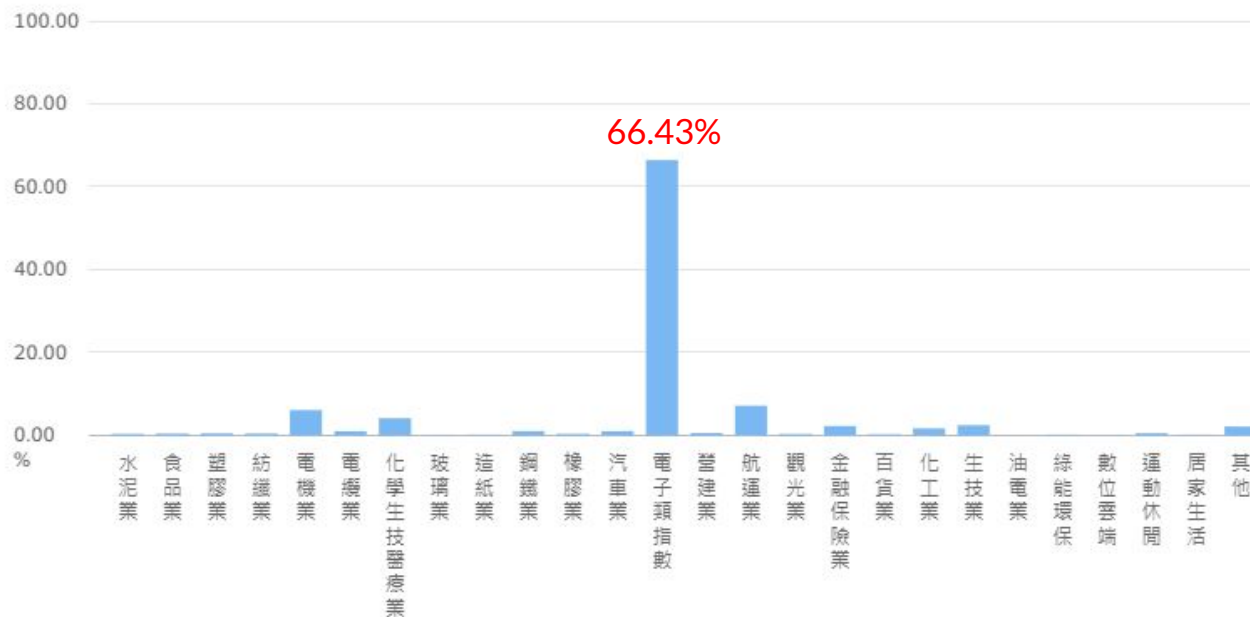
2330.TW

Investors
"Best Overall Investor Relations" – IR Magazine

Reference: https://investor.tsmc.com/chinese

Reference: Yahoo Finance:https://tw.stock.yahoo.com/trading-vol-ratio

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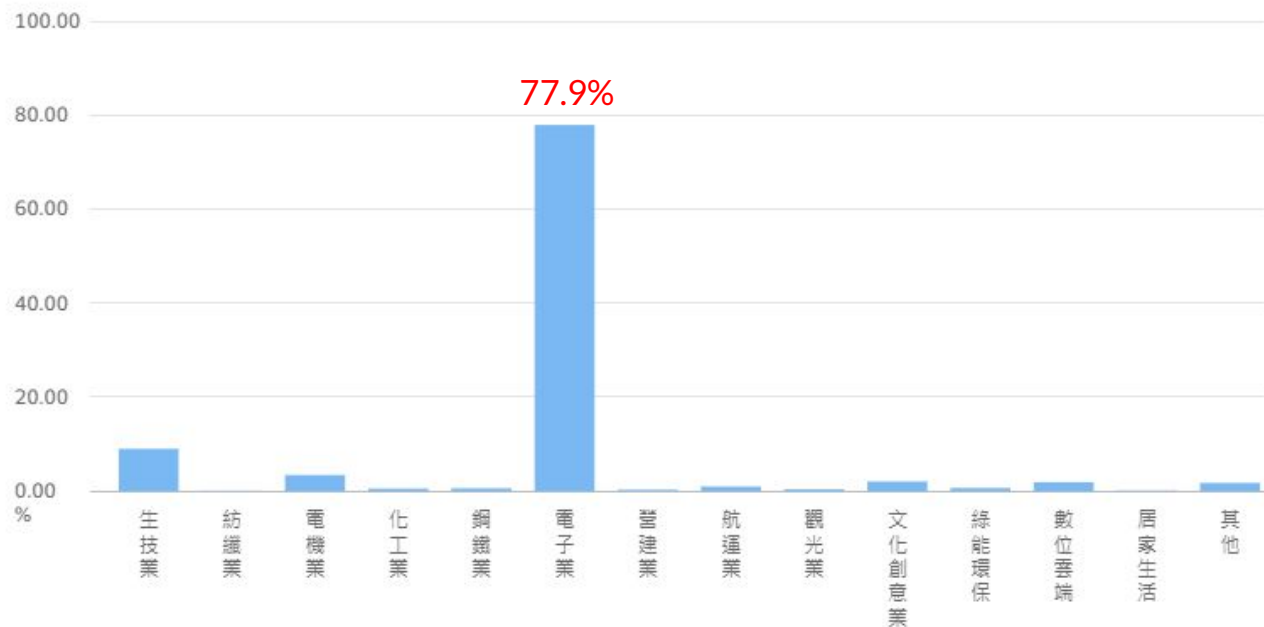
Features (Macroeconomies)
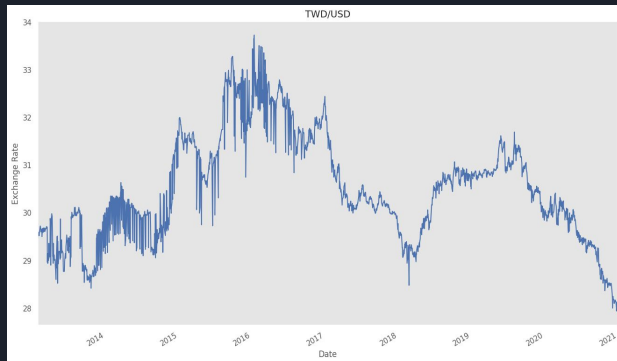
TWD/USD
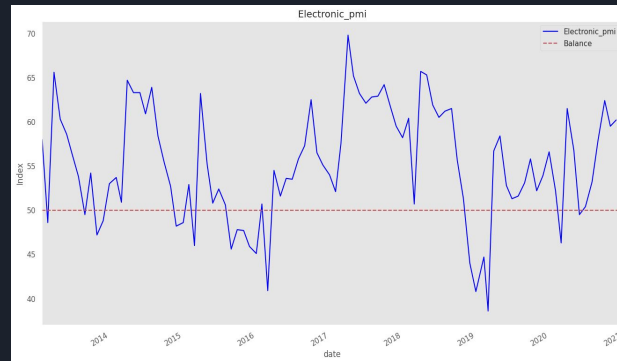
Electronic_pmi
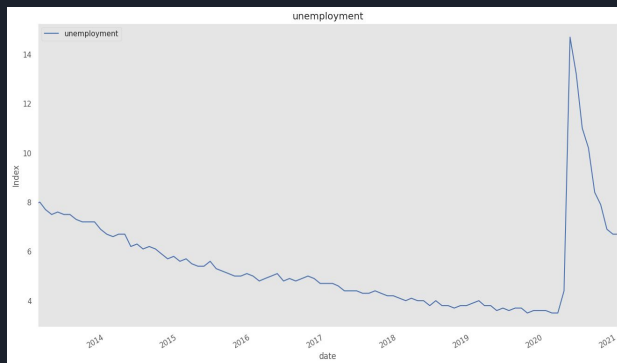
Unemployment(USA)
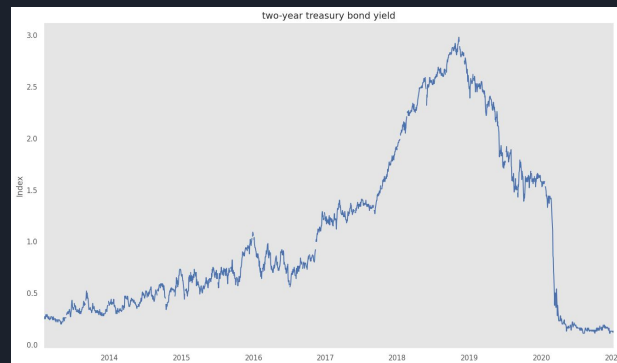
Two-year treasury bond yield(USA)

Features

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Features (Technical Indicators)
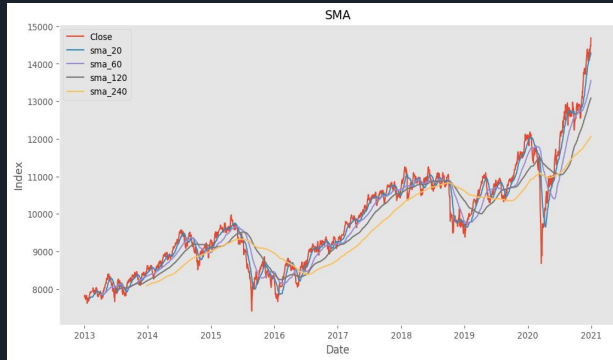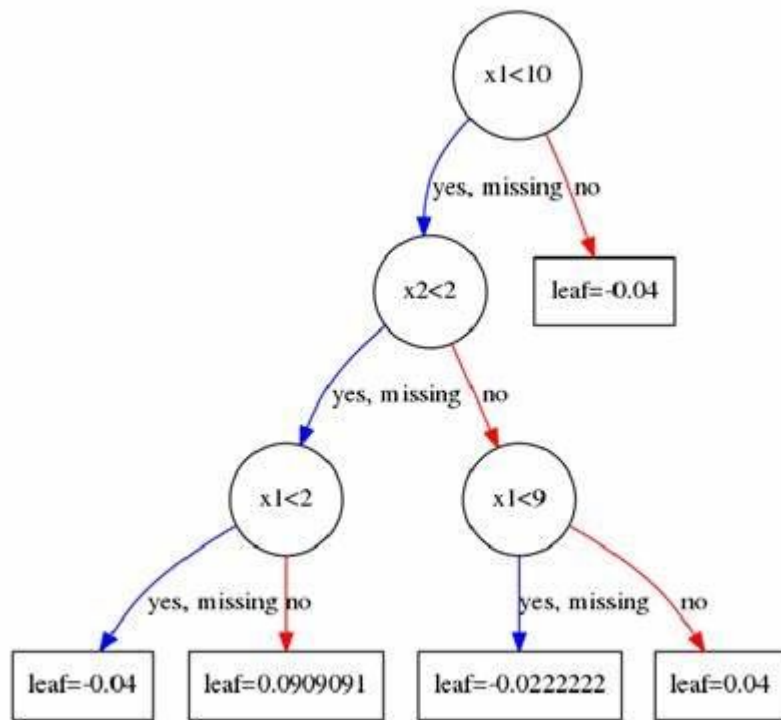

SMA
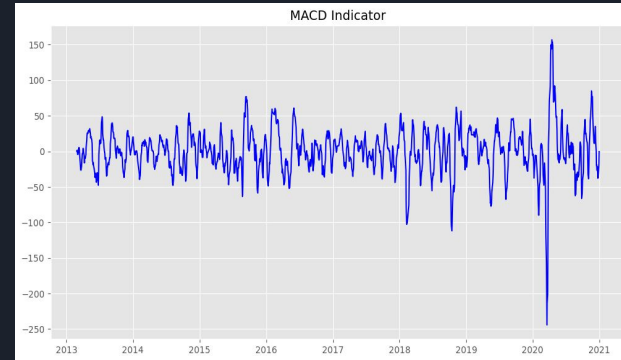
MACD
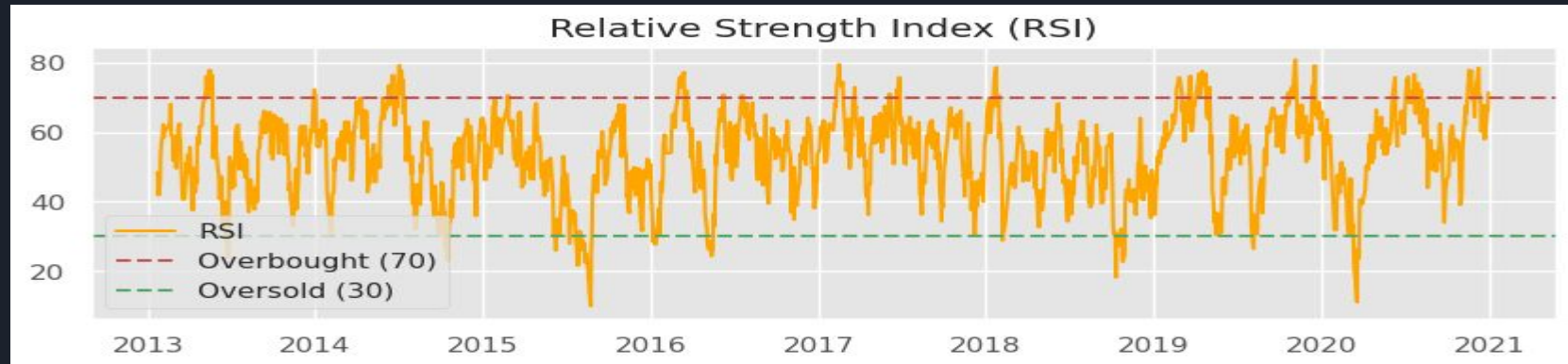
RSI

Heatmap of correlations
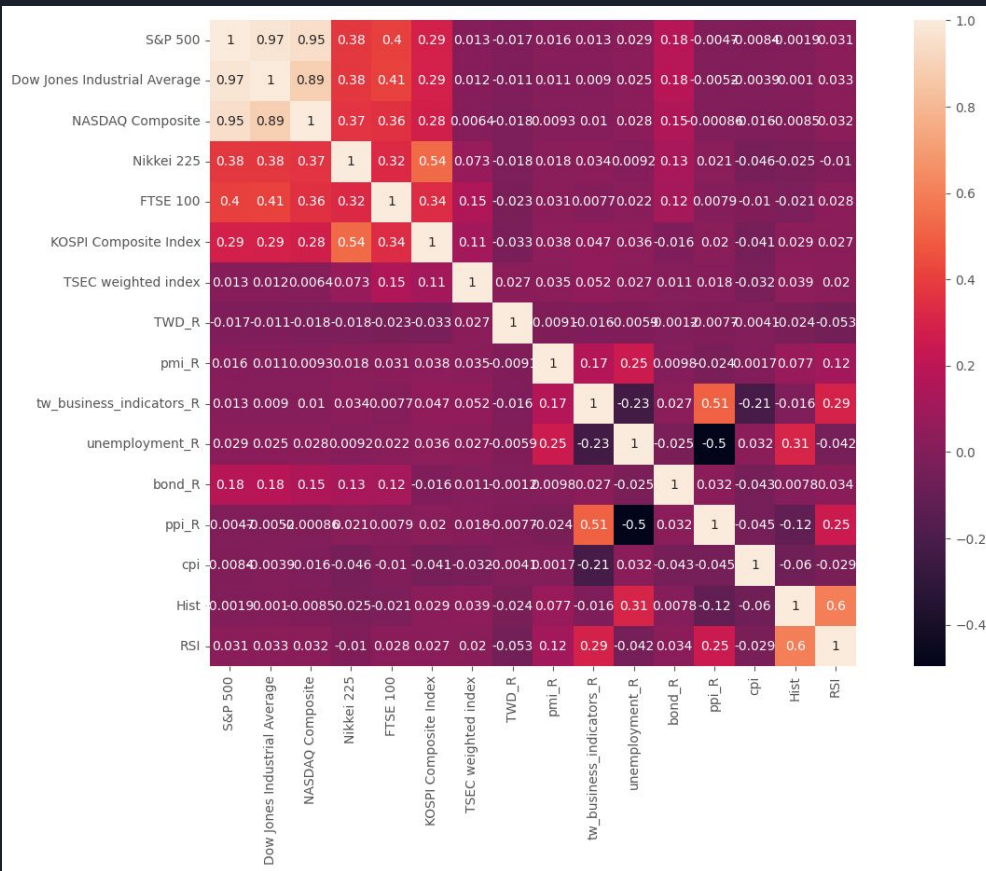
Rolling window
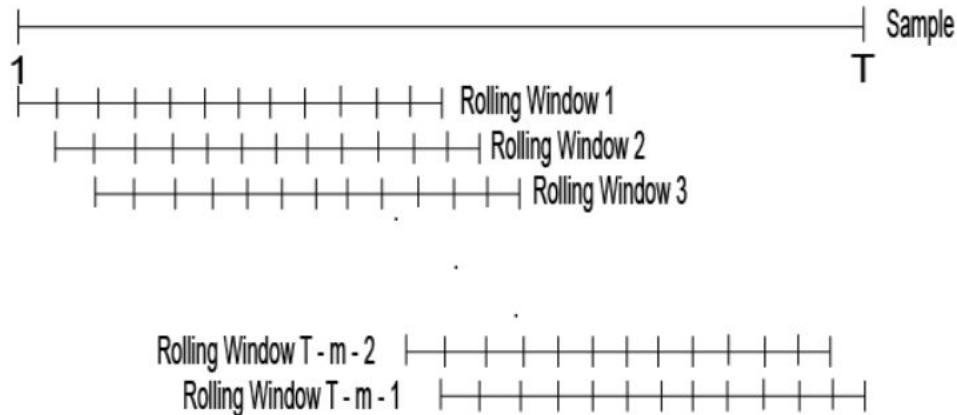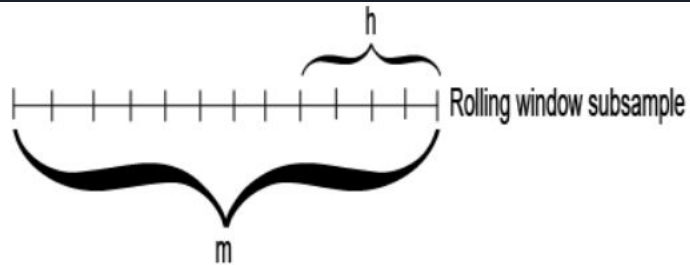
- For Backtesting
- Window = 5
- Data = 2,487
- Subsamples = 2,483

XGBoost

Results

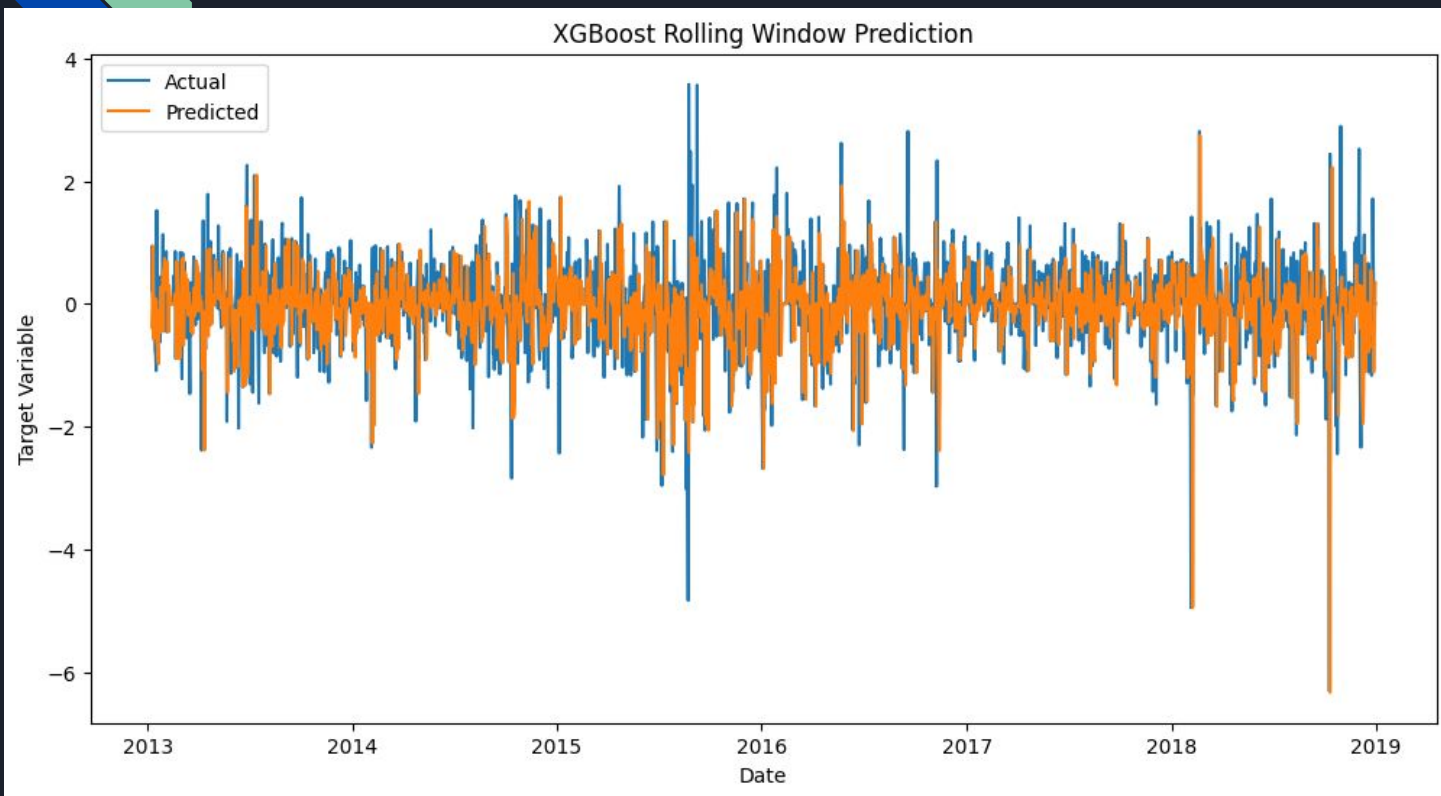| Model	train MSE	predict MSE
Index Return	0.6174640892326609	1.0746160384510368
Macroeconomies	0.8926548223543281	1.2208795632584622
Tech	0.6082591735669215	0.8915359261845326
all_Features	0.5615349825622786	0.8205483167895213

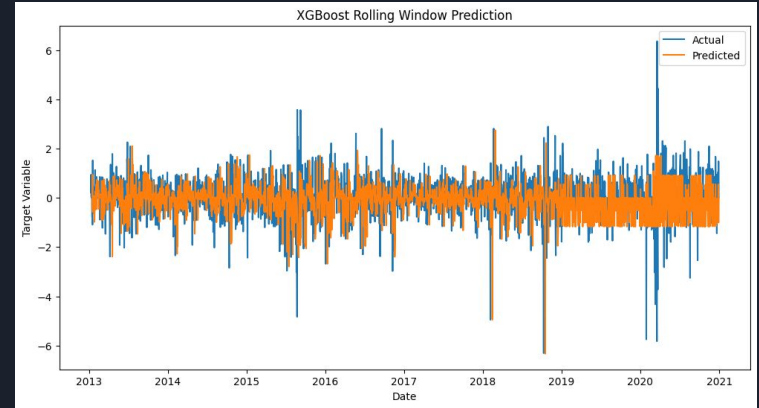# Index Prediction

XGBoost Rolling Window Prediction

Return Prediction (Index)

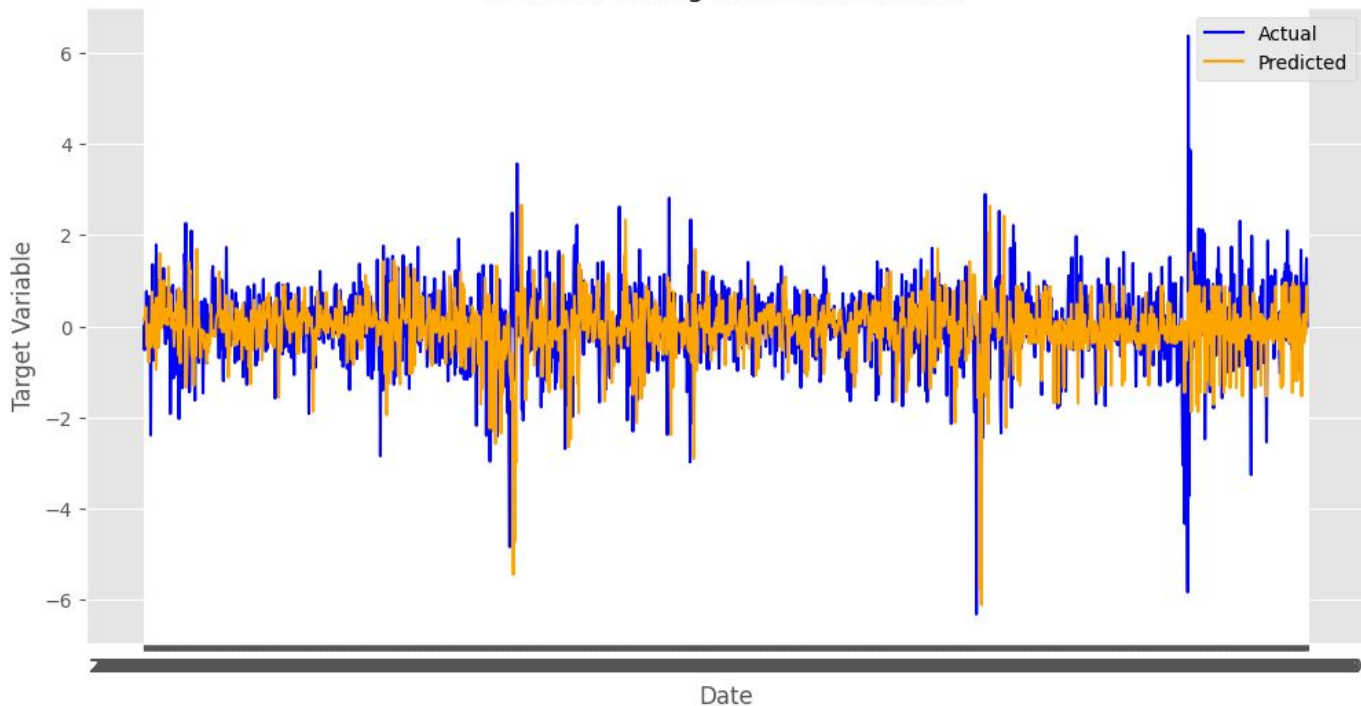XGBoost Rolling Window Prediction

Return Prediction
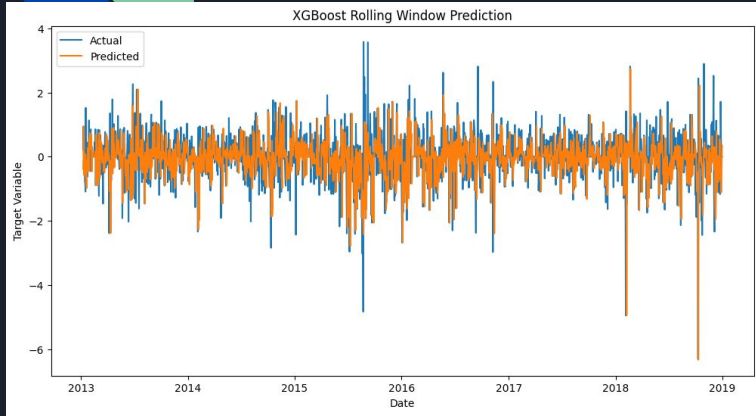
Index
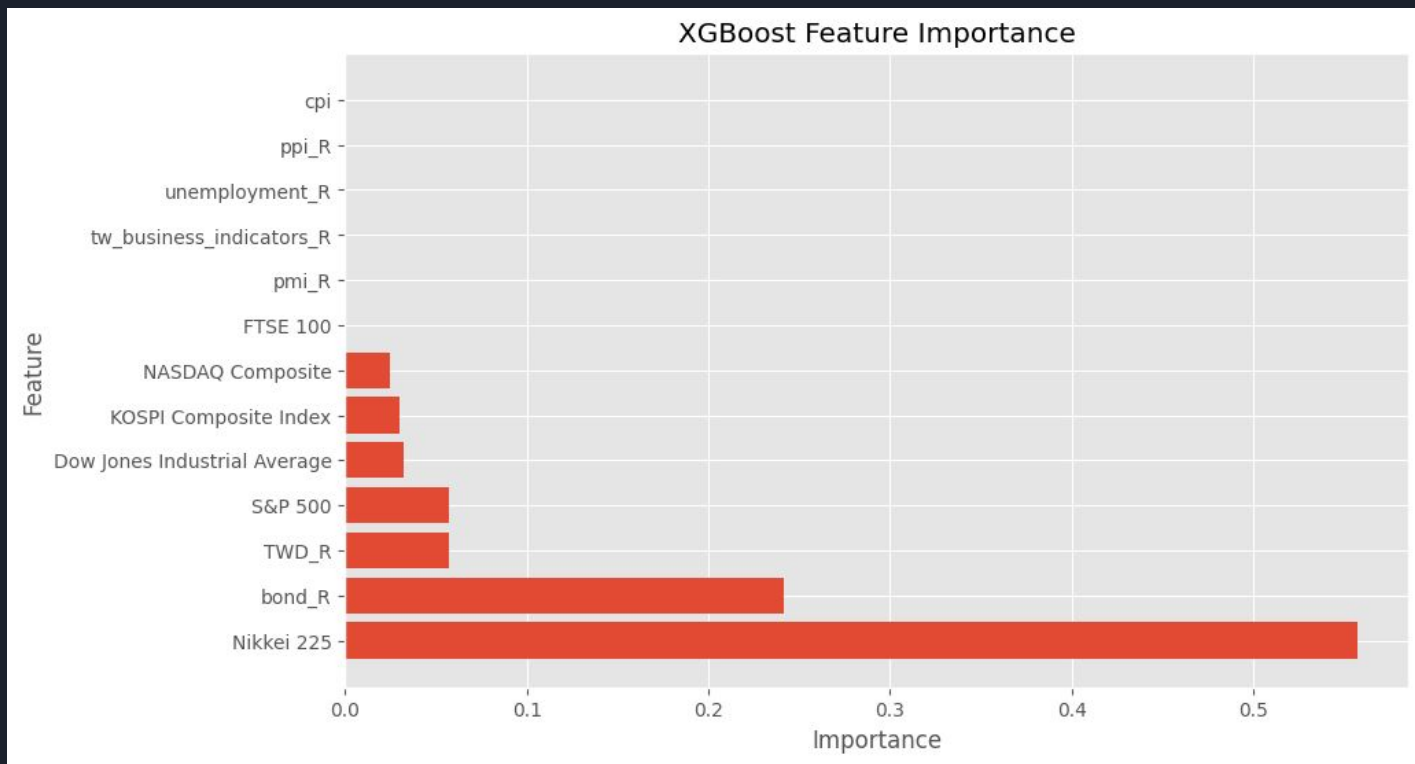

all features
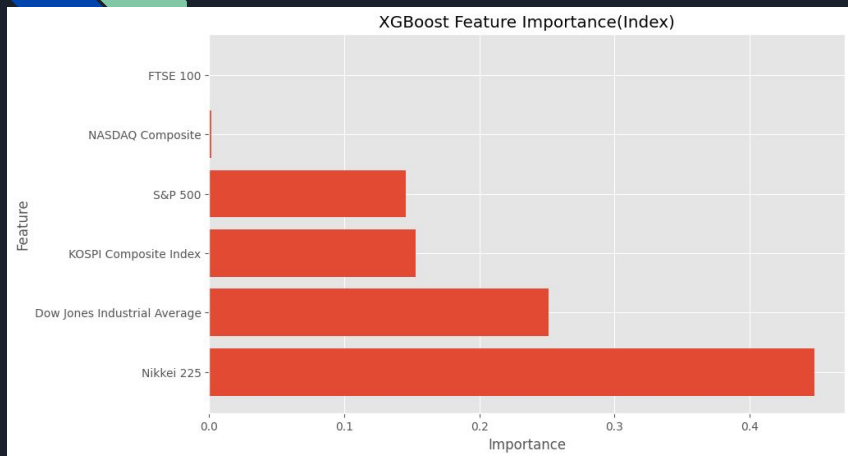
Test_prediction
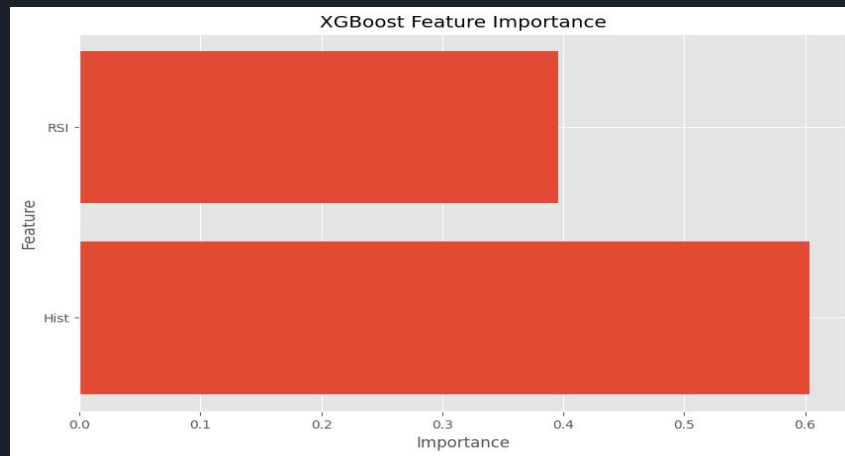

XGBoost Rolling Window Prediction

Feature Importance(all features)

Feature Importance

Index

technical indicators

Conclusion

- Machine learning can assist us in portfolio management

- It just a tool for us to trade

- We have to get more information in market