Financial Informatics

- Final Presentation

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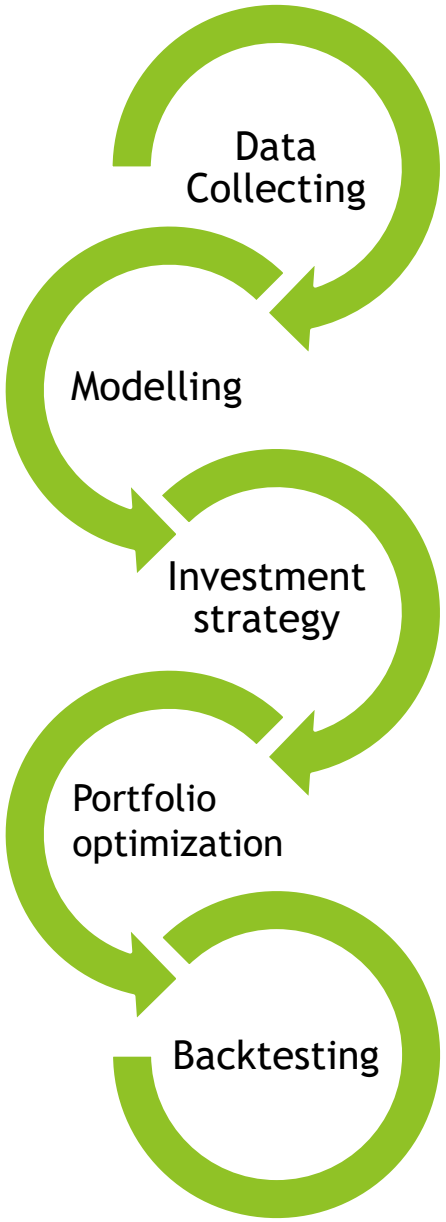
Obejective

- How much can I forecast the future price?

Process Overview



1. Data Collecting

Dow Jones Industrial Average

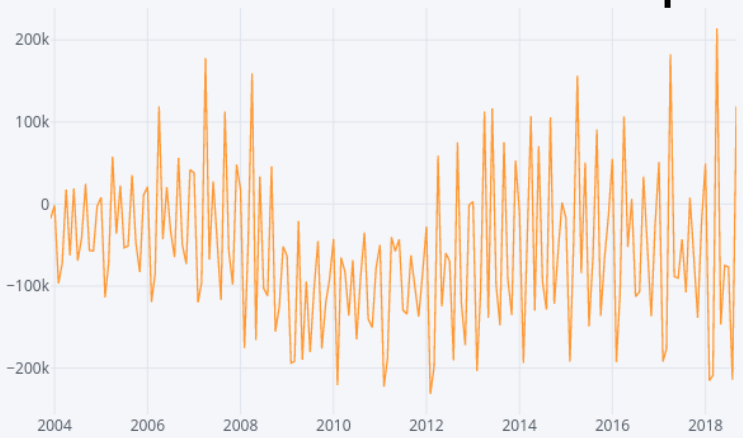
1. Good representation of US market
2. Big market cap
3. 30 stocks : X Survivorship Bias

Ex) Apple: 2015

1. Data Collecting

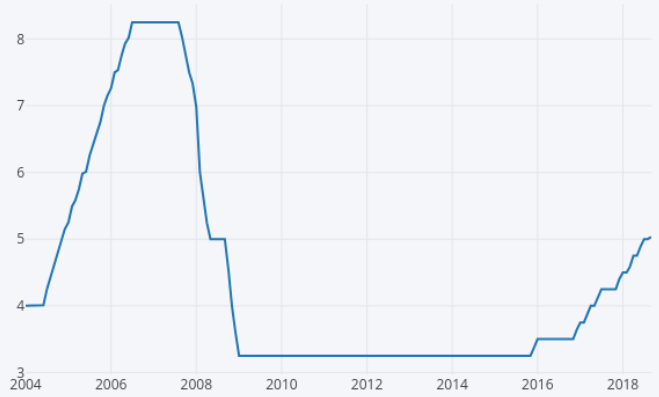
Unemployment Rate

Federal Deficit or Surplus



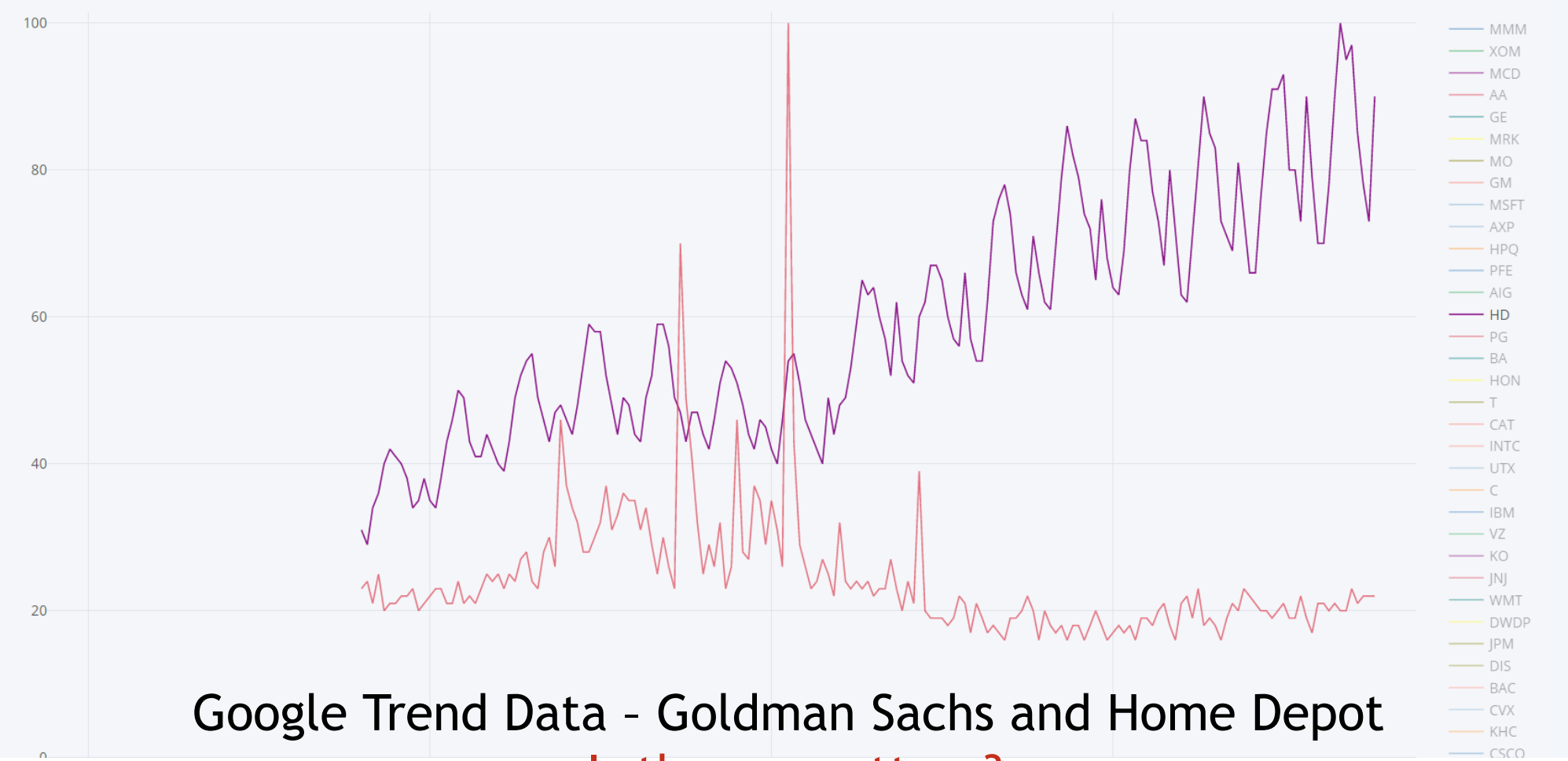
Purchasing Managers Index

Bank Loan Prime Rate



Dollar Index

1. Data Collecting



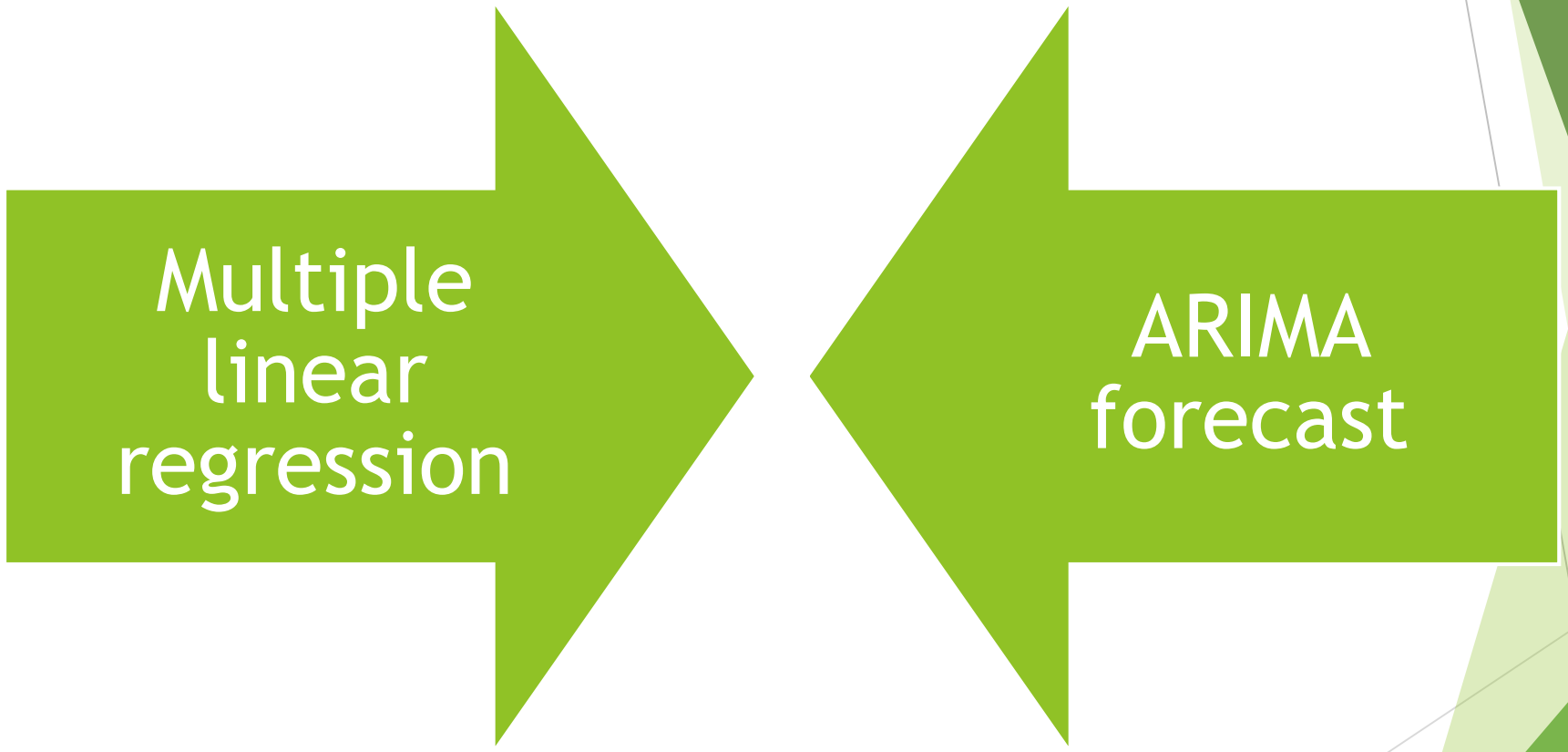
Google Trend Data – Goldman Sachs and Home Depot

Is there a pattern?

1. Data Collecting

1. Different Time range
    1. Jan 2004 to Present
    2. Dollar index: no data for November 2018
    3. Missing data: ARIMA forecast
2. Different Time frequency
    1. Monthly terms
    2. Forecasting results -> Monthly
    3. Lagged independent variables
2. Divide the Dataset
    1. Training set : 2004-02 to 2013 -11
    2. Backtesting set : 2013 – 12 to 2018-11

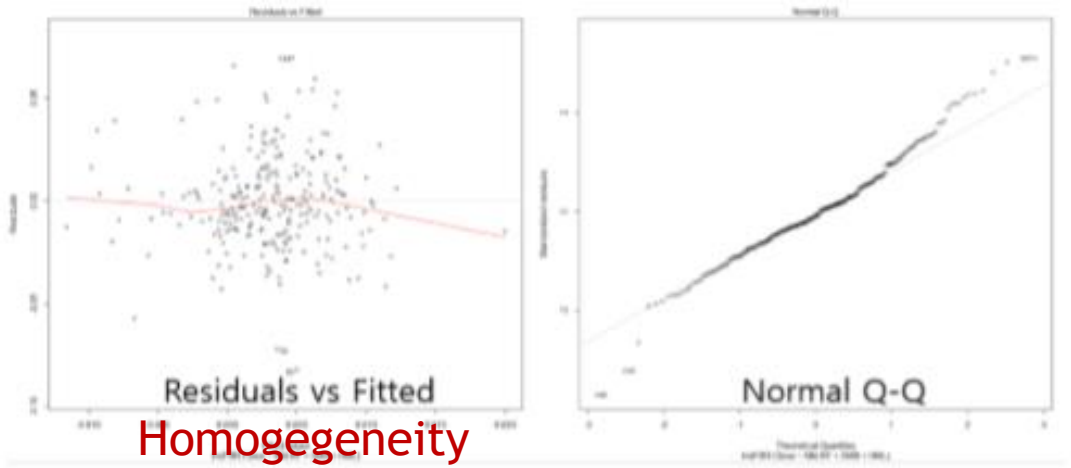
2. Forecasting Model



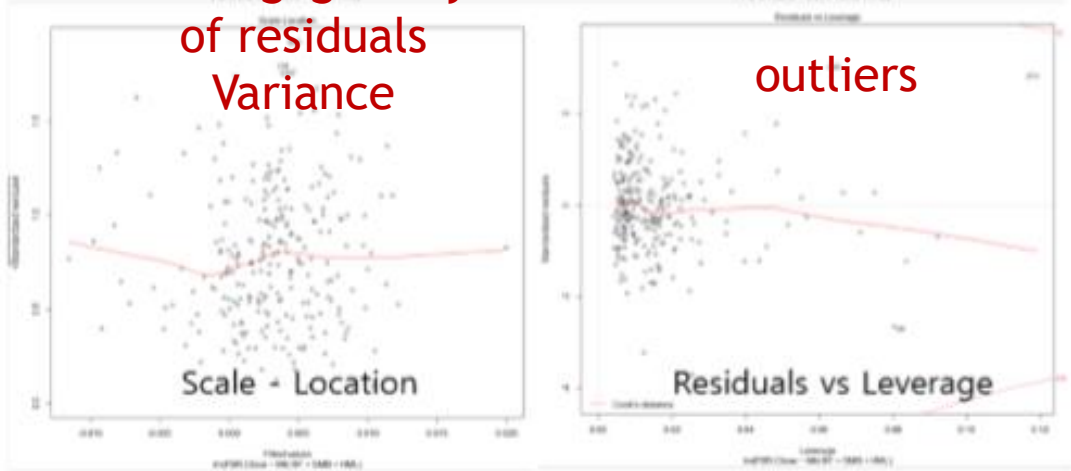
2. Forecasting Model - Regression

Linearity of the data

Normality of Residuals

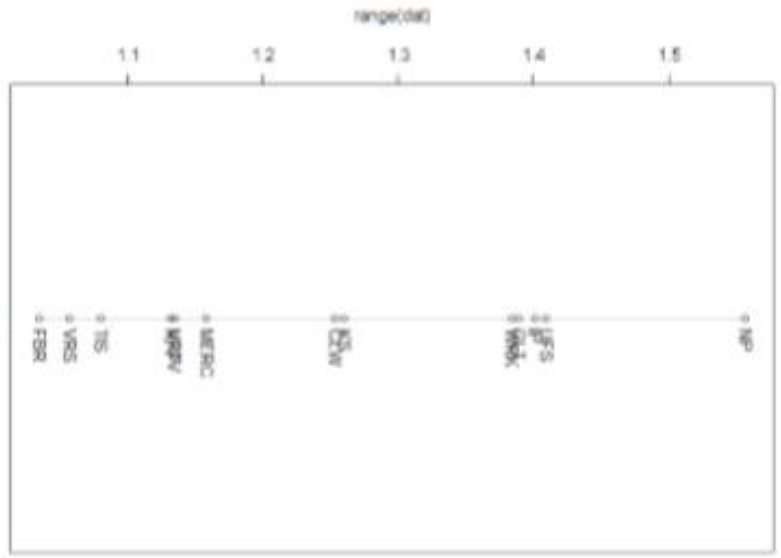


Homogegeneity of residuals Variance



outliers

Varance inflation factors



Multicollinearity

Purchasing Managers Index Example

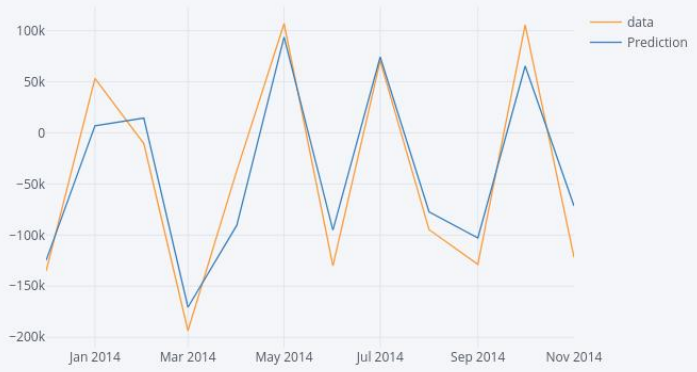
2. Forecasting Model – ARIMA model

In [126]:
```
trend_list = []
for column in trend:
    temp = auto_arima(trend[column], start_p=1, start_q=1,
                      max_p=3, max_q=3, m=12,
                      start_P=0, seasonal=True,
                      d=1, D=1, trace=True,
                      error_action='ignore',
                      suppress_warnings=True,
                      stepwise=True)
    trend_list.append(temp)
```

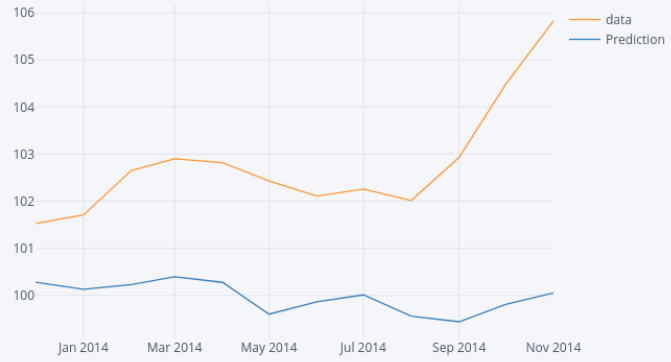
```
Fit ARIMA: order=(1, 1, 1) seasonal_order=(0, 1, 1, 12); AIC=866.235, BIC=881.764, Fit time=3.274 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(0, 1, 0, 12); AIC=986.669, BIC=992.881, Fit time=0.040 seconds
Fit ARIMA: order=(1, 1, 0) seasonal_order=(1, 1, 0, 12); AIC=936.644, BIC=949.068, Fit time=0.642 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(0, 1, 1, 12); AIC=864.247, BIC=876.671, Fit time=2.293 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(1, 1, 1, 12); AIC=866.145, BIC=881.675, Fit time=3.942 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(0, 1, 0, 12); AIC=933.125, BIC=942.443, Fit time=0.198 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(0, 1, 2, 12); AIC=866.110, BIC=881.640, Fit time=8.920 seconds
Fit ARIMA: order=(0, 1, 1) seasonal_order=(1, 1, 2, 12); AIC=866.450, BIC=885.086, Fit time=9.699 seconds
Fit ARIMA: order=(0, 1, 0) seasonal_order=(0, 1, 1, 12); AIC=934.376, BIC=943.694, Fit time=1.206 seconds
Fit ARIMA: order=(0, 1, 2) seasonal_order=(0, 1, 1, 12); AIC=866.234, BIC=881.764, Fit time=3.454 seconds
Fit ARIMA: order=(1, 1, 2) seasonal_order=(0, 1, 1, 12); AIC=867.818, BIC=886.453, Fit time=4.094 seconds
Total fit time: 37.767 seconds
```

2. Forecasting Model – ARIMA model

Federal Deficit or Surplus

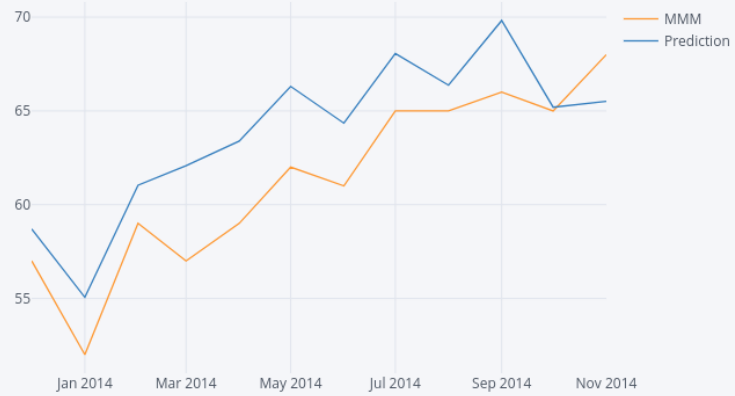


Dollar Index

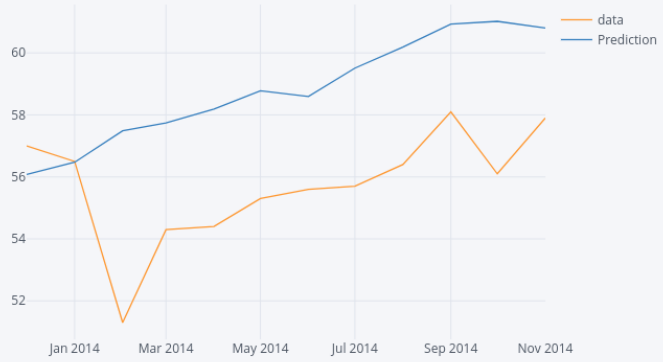


2014

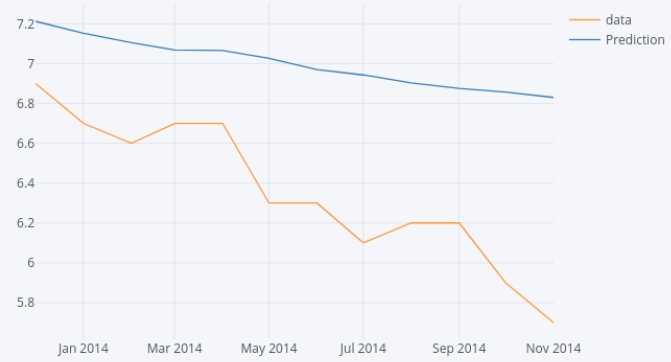
Google Trend – 3M



Purchasing Managers Index

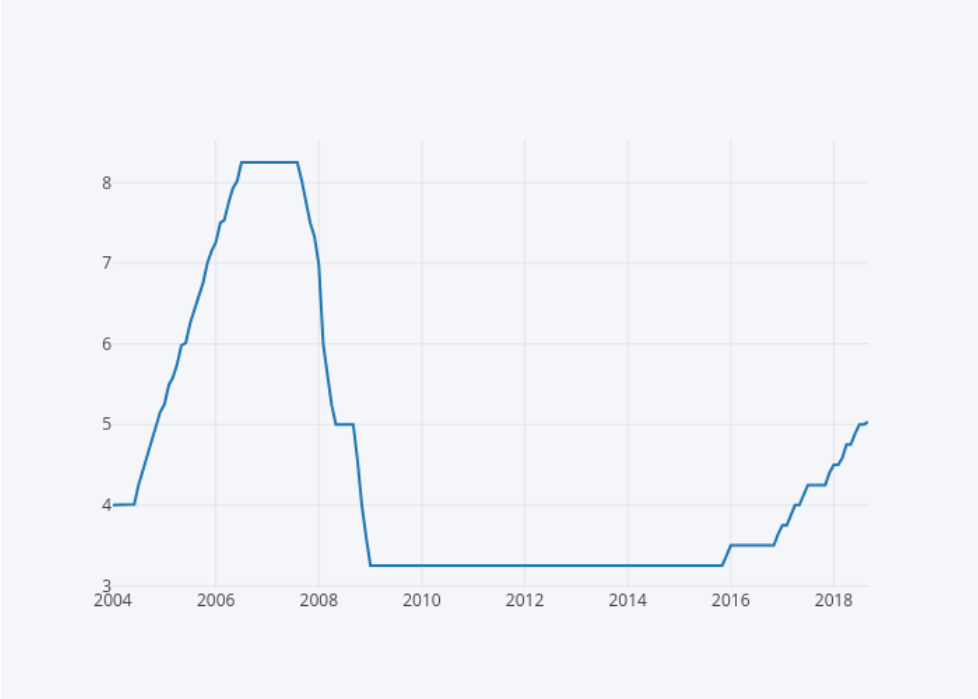


Unemployment Rate

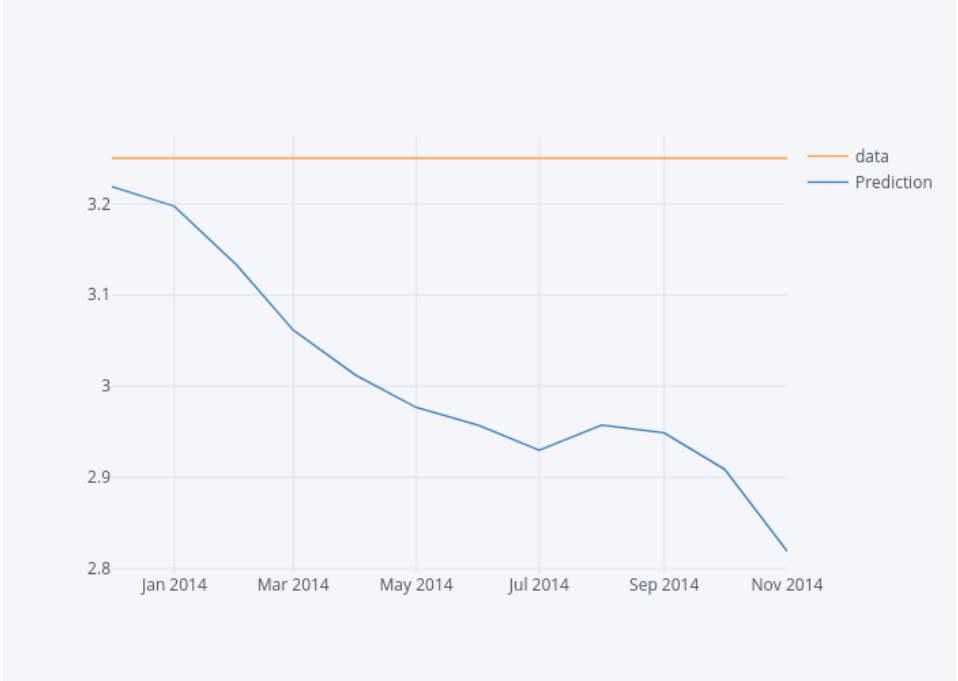


2. Forecasting Model – ARIMA model

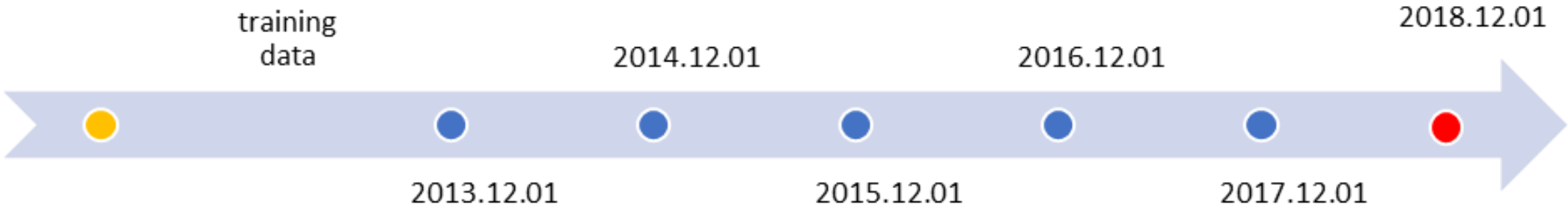
Bank Loan Prime Rate



Forecast



3. Backtesting Process



4. Investment Strategy

- conditions in addition to the investment decision rules.

- My initial investment is $100,000 (sadly I do not have this much in real life)
- Money gains are reinvested

4. Investment Strategy

- *I only buy and sell once a year on December 1st and the 2nd.*

- Calculate 1 year average return for each of the stocks using my forecasting models
- Select top 5 stocks that has highest expected return for my portfolio
- Figure out an optimal portfolio weight by drawing efficient frontier graph and finding a maximum sharpe ratio point

4. Investment Strategy

✓ make changes to my current portfolio according to the optimal portfolio calculation

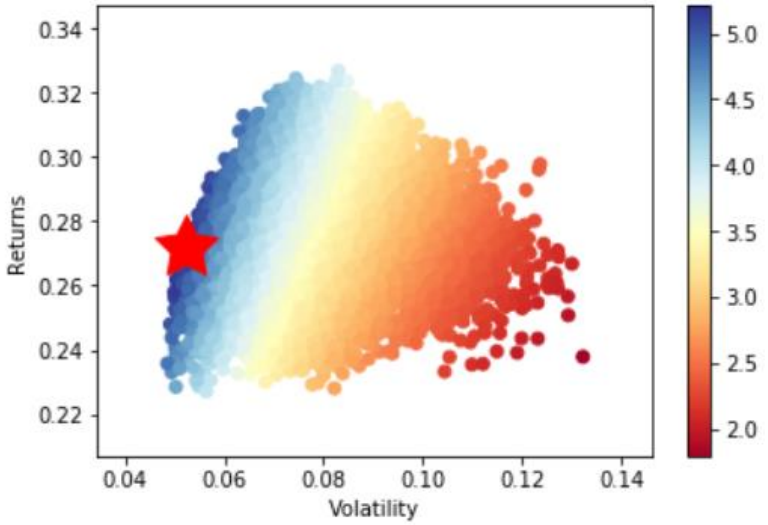
1) Sell whatever I decided to sell on December 1st

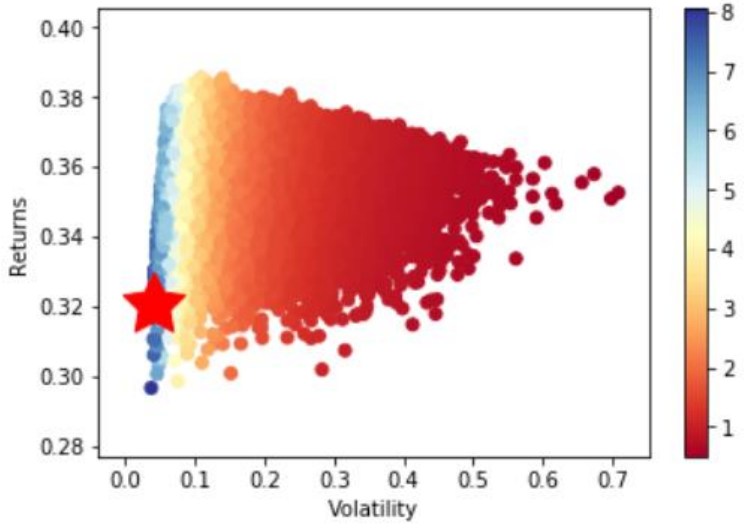
2) Buy whatever I decided to buy on December 2nd

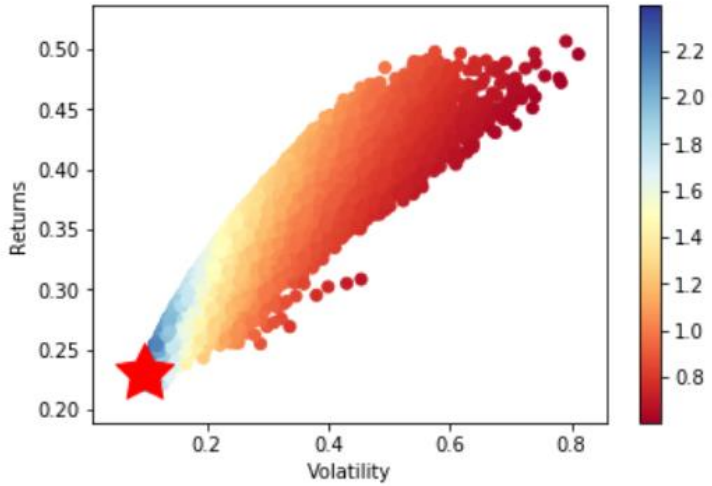
-> realize my loss or gain before buying so

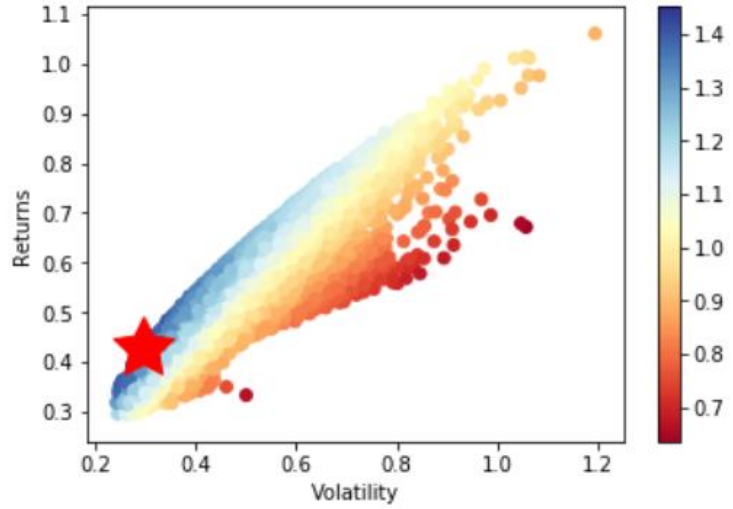
that I can reinvest my money of there is any gain.

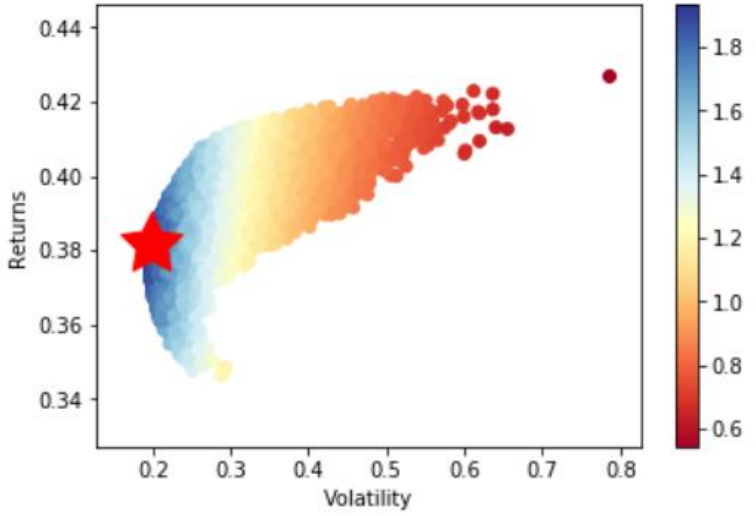
5. Portfolio optimization











5. Portfolio optimization

```
ret       0.381604
stdev     0.197560
sharpe    1.931589
TRV       0.058199
HON       0.141758
AA        0.348781
AIG       0.422935
C         0.028327
Name: 14374, dtype: float64
```

```
ret       0.428975
stdev     0.295625
sharpe    1.451080
AA        0.124056
TRV       0.070883
HON       0.174574
C         0.026935
AIG       0.603552
Name: 10412, dtype: float64
```

```
ret       0.320590
stdev     0.039809
sharpe    8.053163
AA        0.031318
C         0.051973
AIG       0.374081
TRV       0.010850
BAC       0.531778
Name: 20439, dtype: float64
```

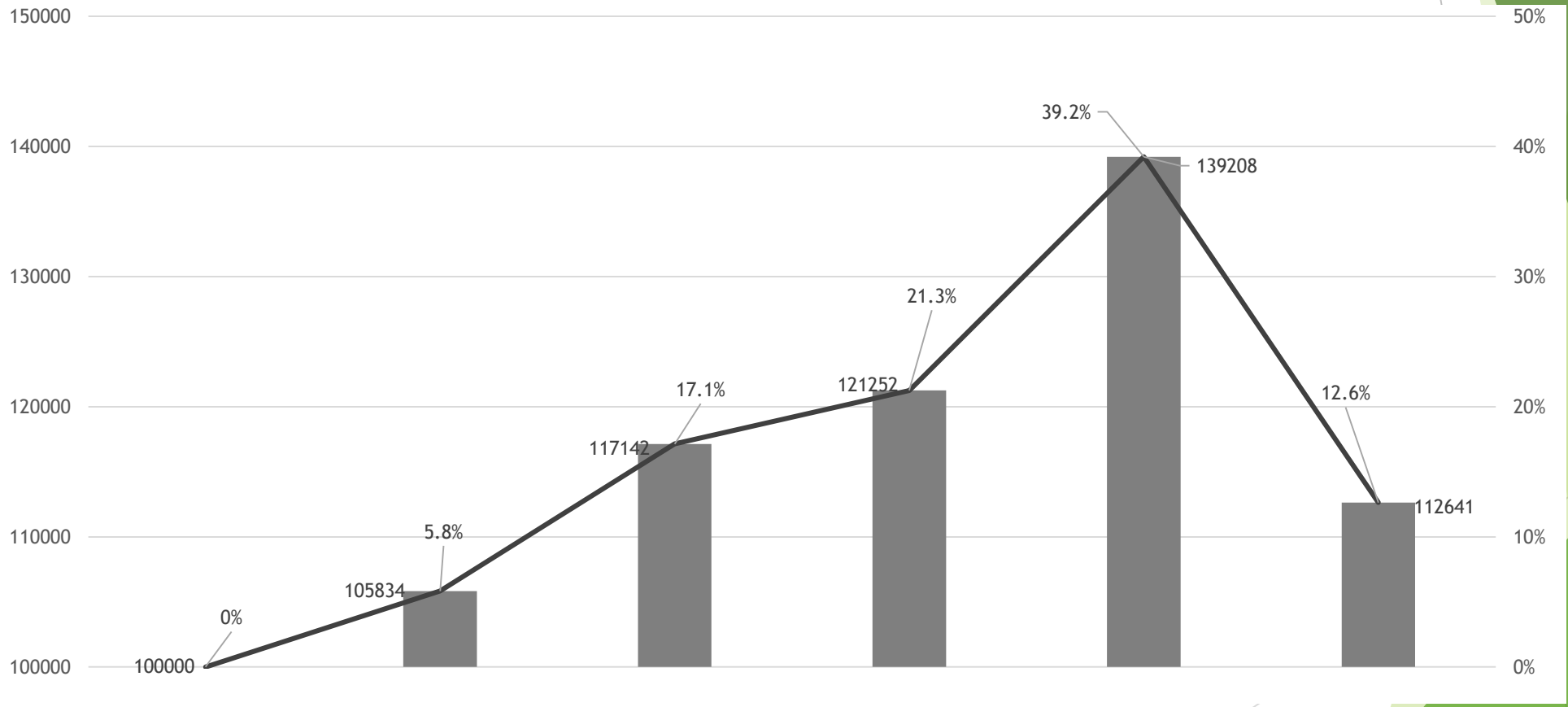
```
ret       0.271705
stdev     0.052184
sharpe    5.206664
AIG       0.054353
C         0.472458
AA        0.011174
CAT       0.027263
BAC       0.434752
Name: 10229, dtype: float64
```

```
ret       0.302727
stdev     0.125707
sharpe    2.408196
AA        0.010220
TRV       0.010207
C         0.185974
HON       0.057599
AIG       0.736000
Name: 8543, dtype: float64
```

6. Evaluation

	2013-12-01	2014-12-01	2015-12-01	2016-12-01	2017-12-01	2018-12-01
Current Portfolio (weight %)	C (47%) BAC (43%) AIG (5%) AA (0%) CAT (0%)	BAC (53%) AIG (37%) TRV (0%) C (0%) AA (0%)	AIG (74%) C (19%) HON (0%) AA (0%) TRV (0%)	AIG (60%) HON (17%) AA (12%) TRV (0%) C (0%)	AIG (42%) AA (35%) HON (14%) TRV (0%) C (0%)	X (Sell everything)
Gain	X (initial investment)	$5,834	$11,308	$4,110	$ 17,956	X
Loss	X (initial investment)	X	X	X	X	$26,567

6. Evaluation



- Alcoa Shares Fall as Tariffs, Energy Costs Weigh on Forecast
- general insurance business failed to show improvement

7. Investment decision for 2019

- According to my model, optimal portfolio for 2019 is
- Alcoa Corp (60%)
- Honeywell International Inc (33%)
- Caterpillar Inc (6%)