ARIMAAnalysis

November 12, 2018

1 ARIMA Model

This project is to extract both seasonal trends and long-term trends in given time series.
These two kinds of trends can be well shown in ARIMA model results.
Then future time series is forcasted forward by making used of extracted ARIMA model.

In [1]:
```
# Import external Python packages
import numpy as np
import pandas as pd
import matplotlib as mpl
mpl.rcParams['font.family'] = 'serif'
from datetime import datetime
import matplotlib.pyplot as plt
plt.style.use('ggplot')
from statsmodels.tsa.stattools import adfuller
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf
from statsmodels.tsa.seasonal import seasonal_decompose
from statsmodels.tsa.arima_model import ARIMA, ARMA
import statsmodels.api as sm
import itertools
import sys
sys.path.append('C:/Users/acer/Desktop/BigW')

# Import sell-designed ARIMAEngine class
from timeSeriesAnalysis.arima import ARIMAEngine
```

In [2]:
```
if __name__ == '__main__':
    data = pd.read_table('D:/Cheese_Production_Data.txt', header=0, sep=',')
    months_dict = {'Jan':'01', 'Feb':'02', 'Mar':'03', 'Apr':'04', 'May':'05', 'Jun':'0
    years = data['Year']
    months = data['Month']
    dates = []
    for i in range(len(data)):
        dates.append('{}{}01'.format(years[i], months_dict[months[i]]))
    data['Date'] = pd.to_datetime(pd.Series(dates, index=data.index))
    data = data.set_index('Date')
    full_months = ['{}0{}01'.format(year, month) if month < 10 else '{}{}01'.format(ye
```

```python
full_months = pd.Series(full_months)
full_months = pd.to_datetime(full_months)
df = pd.DataFrame(index=full_months)
columns = list(data.columns)
df[data.columns] = data[columns]
df = df.fillna(method='ffill')
df.index = pd.DatetimeIndex(df.index.values, freq=df.index.inferred_freq)
engine = ARIMAEngine()
for c in ['Cheese1.Prod', 'Cheese2.Prod', 'Cheese3.Prod']:
    ts = df[c]
    print('*---' * 20)
    engine.draw_ts(ts, c)
    engine.draw_seasonal(ts)
    engine.testStationarity(ts)
    model = engine.proper_model(ts)
    engine.diag(model)
    predict = engine.forcast(ts, model)
```

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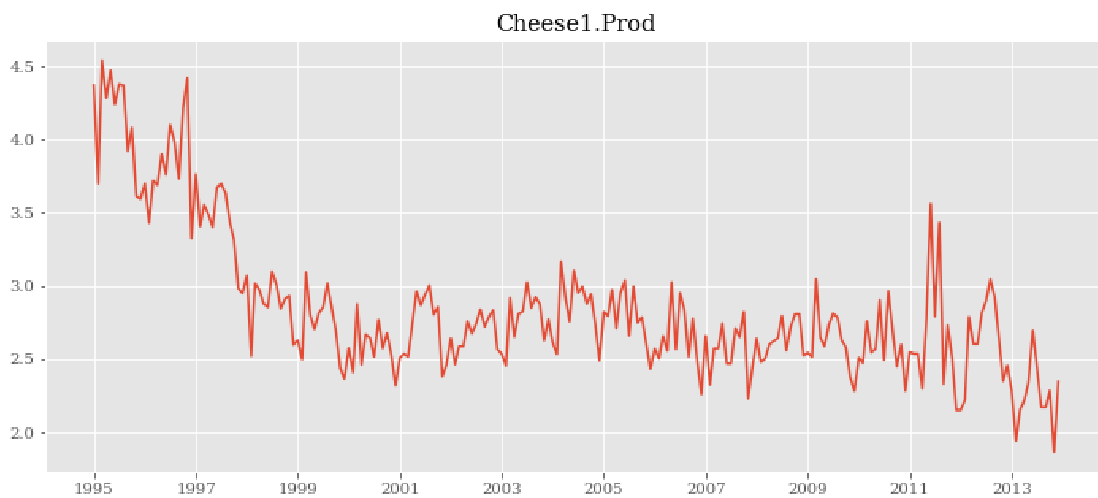
```

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C:\Users\acer\Anaconda3\lib\site-packages\statsmodels\base\model.py:508: ConvergenceWarning: Ma
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  "Check mle_retvals", ConvergenceWarning)


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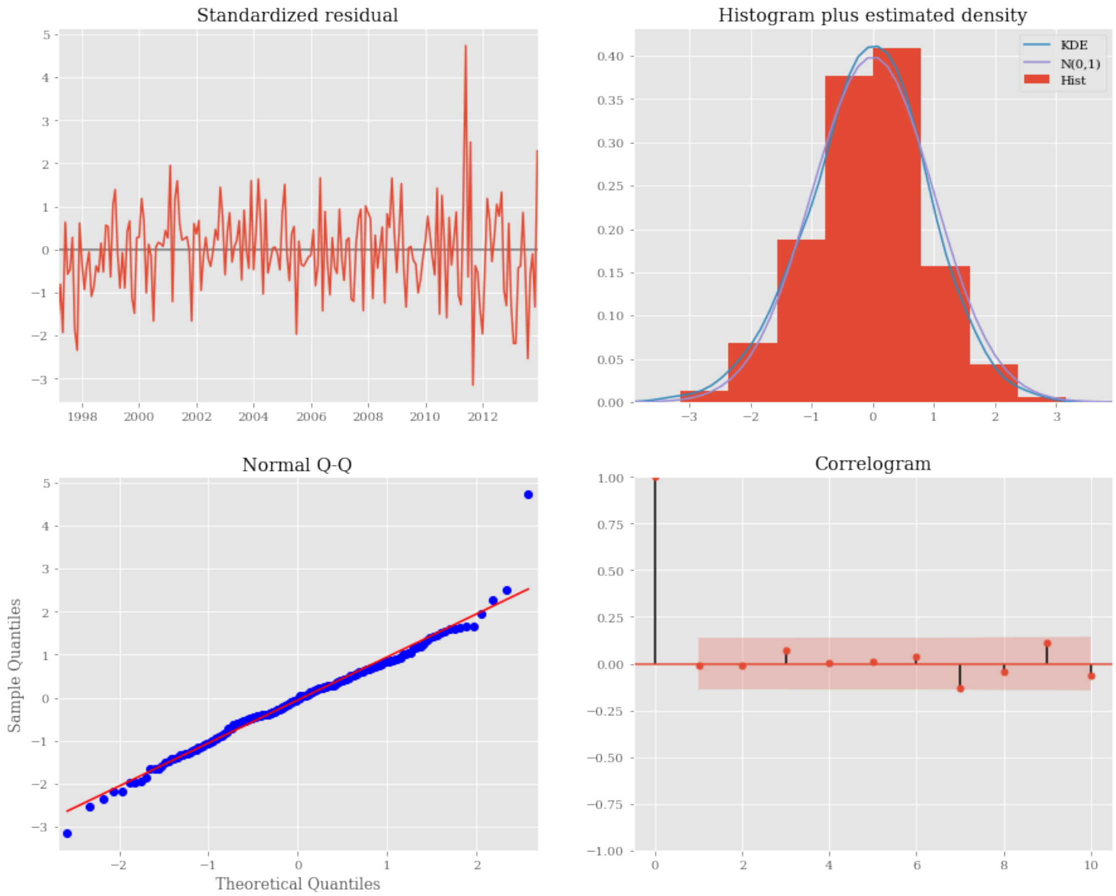
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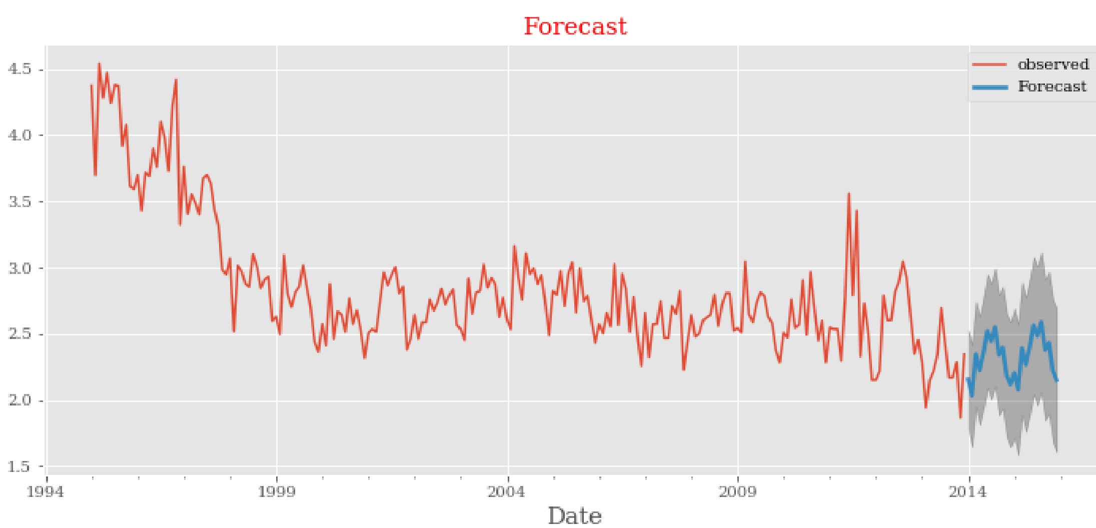
Histogram plus estimated density
KDE
N(0,1)
Hist
Normal Q-Q
Sample Quantiles
Theoretical Quantiles
Correlogram


Forecast
observed
Forecast
Date

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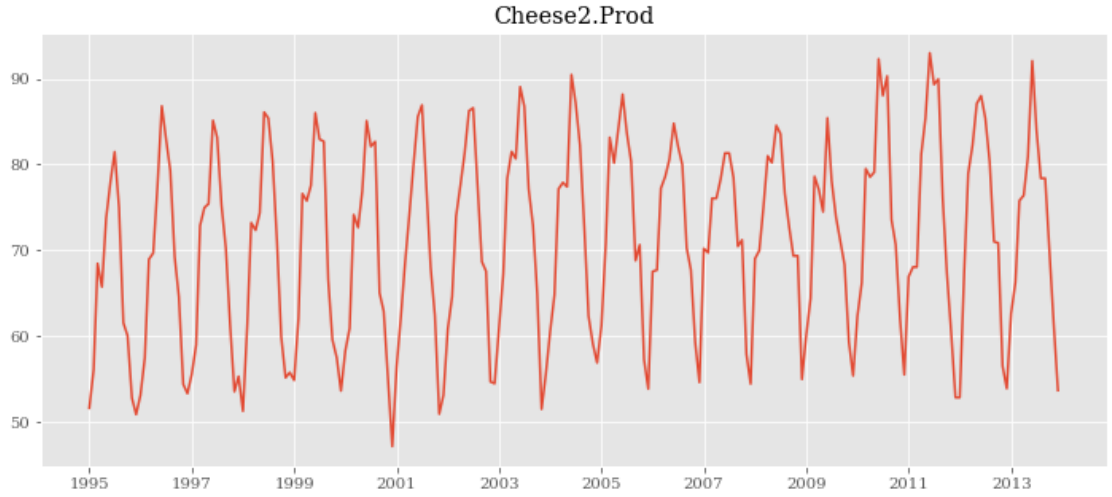

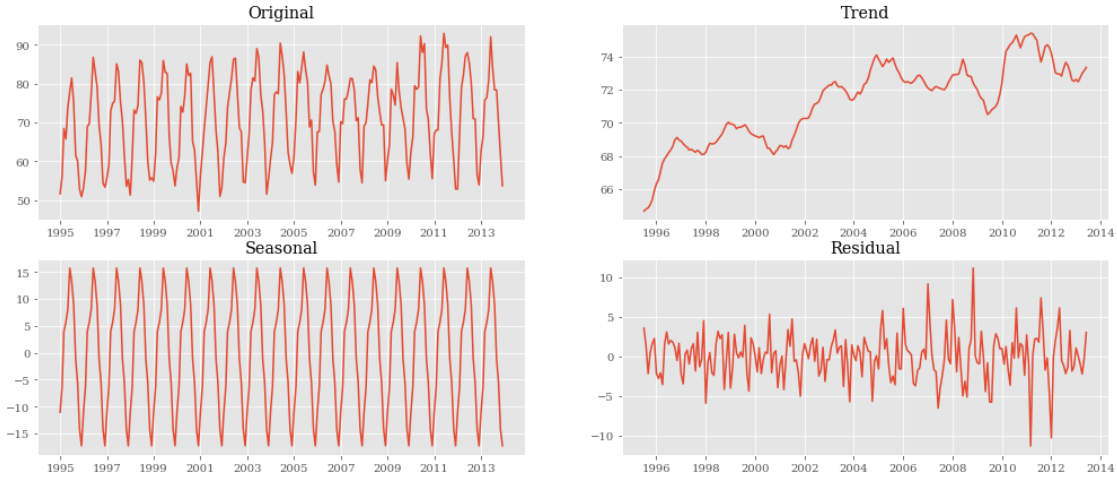


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Number of Observations Used    216.000000
Critical Value (1%)             -3.460992
Critical Value (5%)             -2.875016
Critical Value (10%)            -2.573952
dtype: float64
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C:\Users\acer\Anaconda3\lib\site-packages\statsmodels\base\model.py:508: ConvergenceWarning: Ma
  "Check mle_retvals", ConvergenceWarning)


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Min AIC:1074.6891750365667, p-lab:0, d-lag:1, q-lag:1, seasonal-lag:12
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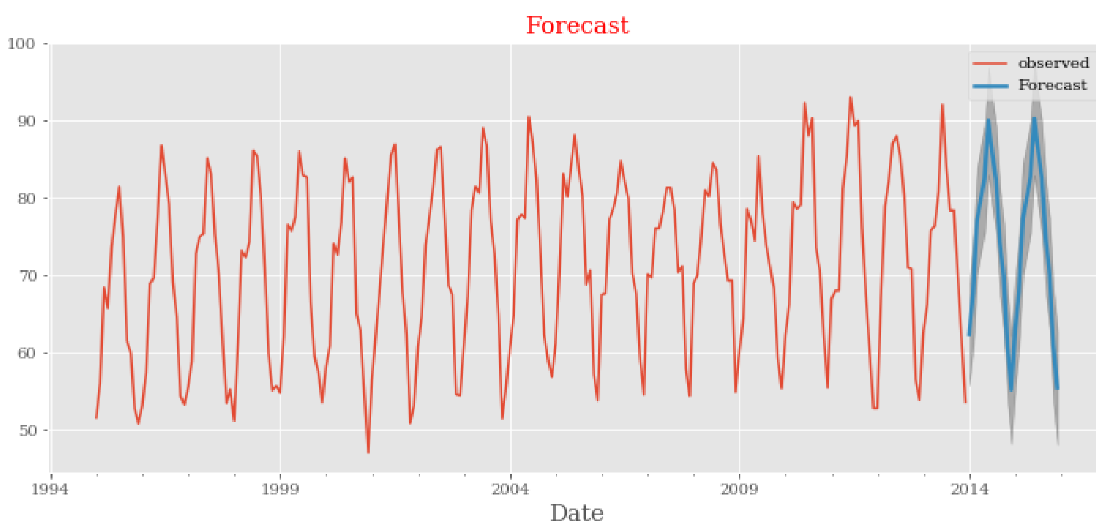
Standardized residual
Histogram plus estimated density
KDE
N(0,1)
Hist
Normal Q-Q
Sample Quantiles
Theoretical Quantiles
Correlogram


Forecast
observed
Forecast
Date

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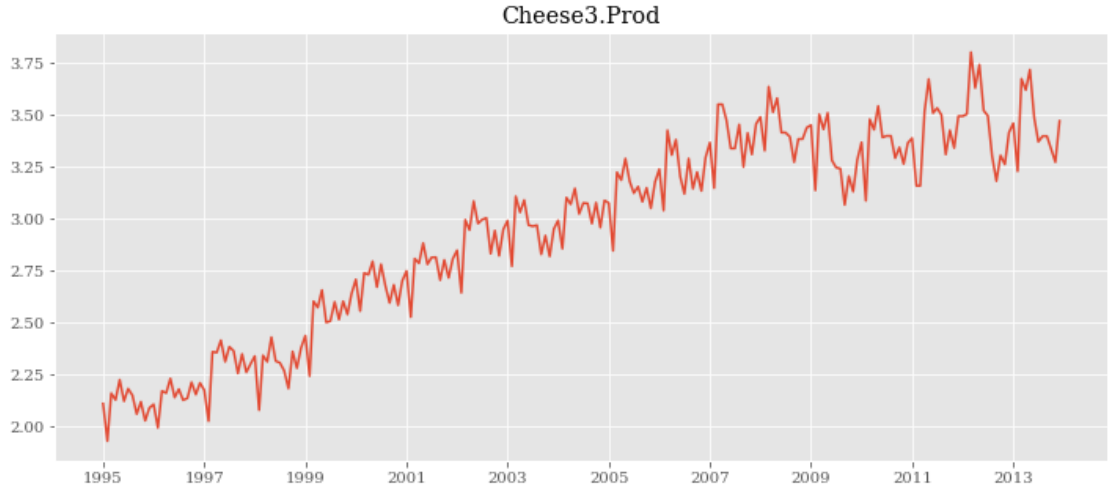

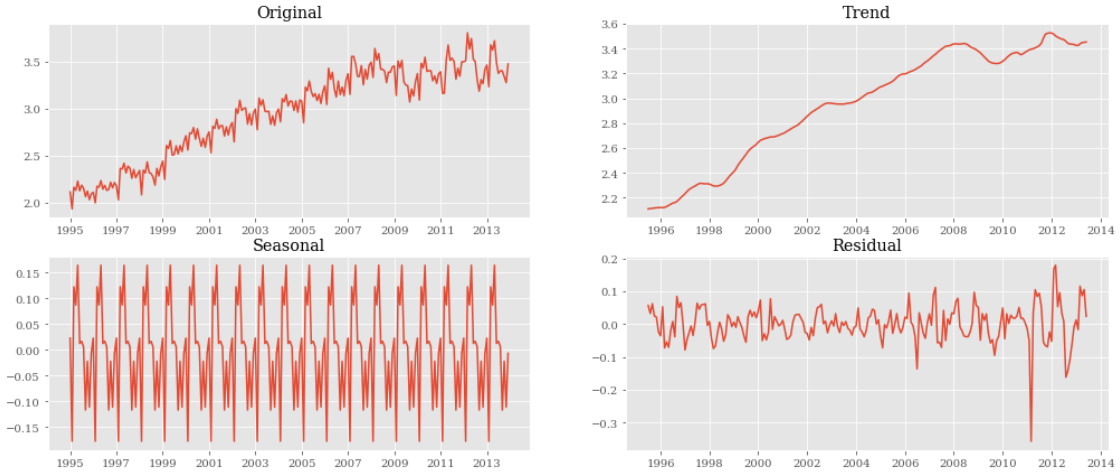


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Test Statistic                  -1.957577
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Number of Observations Used    215.000000
Critical Value (1%)             -3.461136
Critical Value (5%)             -2.875079
Critical Value (10%)            -2.573986
dtype: float64
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********************
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********************
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********************
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```

```
C:\Users\acer\Anaconda3\lib\site-packages\statsmodels\base\model.py:508: ConvergenceWarning: Ma
  "Check mle_retvals", ConvergenceWarning)


********************
AIC:-446.59176499107673, p-lab:0, d-lag:1, q-lag:0, seasonal-lag:12
********************
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********************
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********************
AIC:-547.2057967062648, p-lab:1, d-lag:0, q-lag:1, seasonal-lag:12
********************
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********************
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********************
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********************
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********************
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```

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********************
AIC:-358.3760261080109, p-lab:0, d-lag:0, q-lag:1, seasonal-lag:12


C:\Users\acer\Anaconda3\lib\site-packages\statsmodels\base\model.py:508: ConvergenceWarning: Ma
  "Check mle_retvals", ConvergenceWarning)


********************
AIC:-442.73518211171813, p-lab:0, d-lag:1, q-lag:0, seasonal-lag:12
********************
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********************
AIC:-458.870778153789, p-lab:1, d-lag:0, q-lag:0, seasonal-lag:12
********************
AIC:-545.223024668585, p-lab:1, d-lag:0, q-lag:1, seasonal-lag:12


C:\Users\acer\Anaconda3\lib\site-packages\statsmodels\base\model.py:508: ConvergenceWarning: Ma
  "Check mle_retvals", ConvergenceWarning)


********************
AIC:-463.9706234789857, p-lab:1, d-lag:1, q-lag:0, seasonal-lag:12
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********************
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********************
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********************
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********************
AIC:-509.5435324366067, p-lab:1, d-lag:1, q-lag:1, seasonal-lag:12
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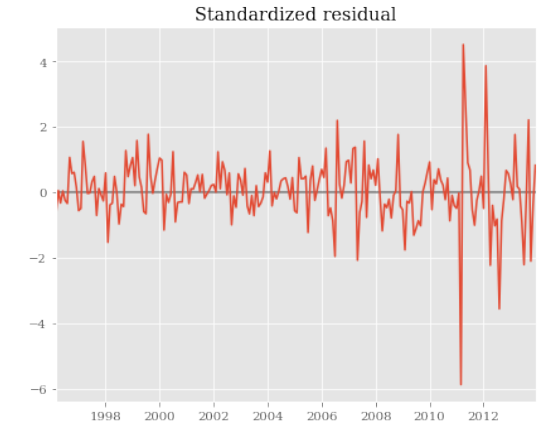
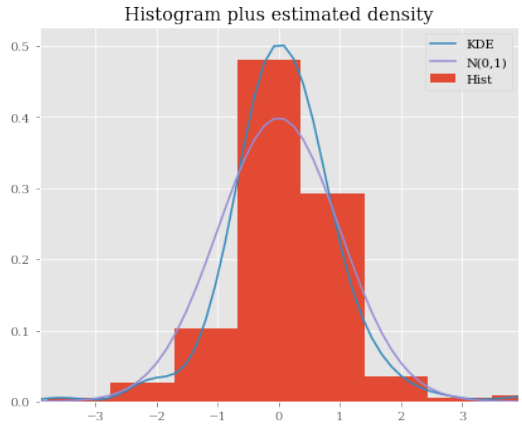
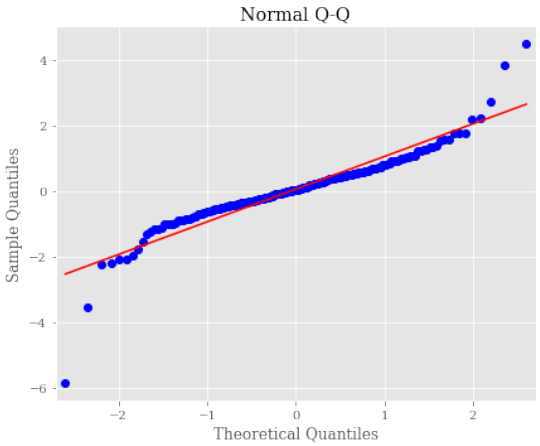
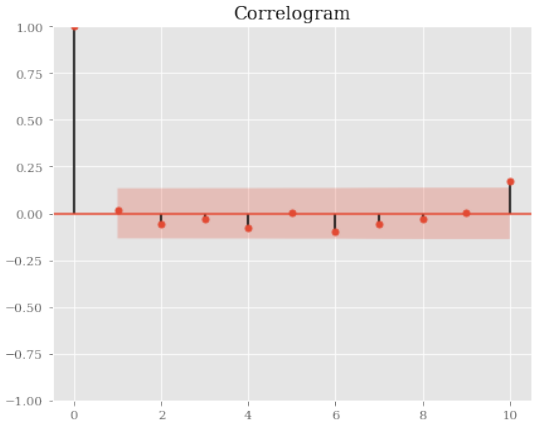
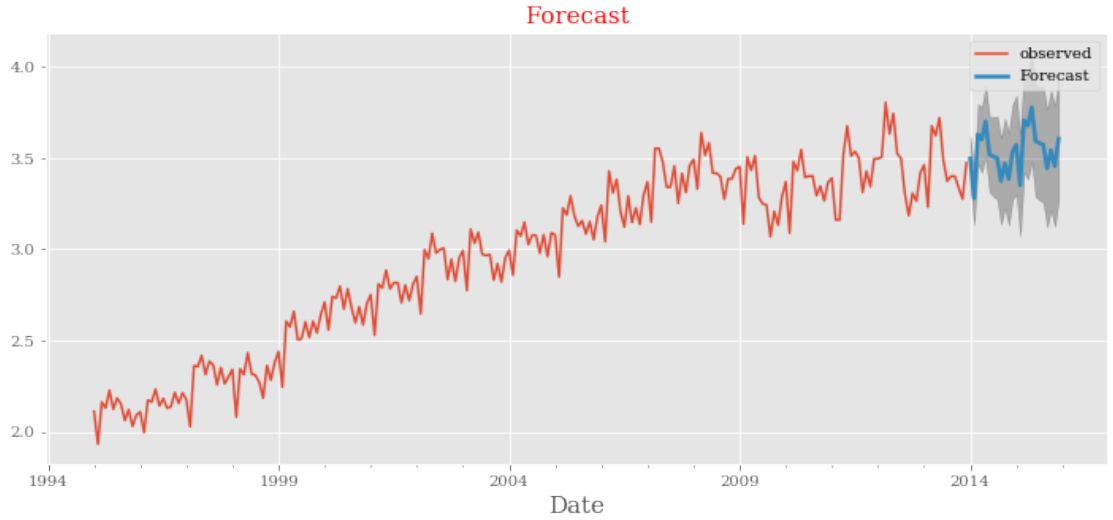

Standardized residual
4
2
0
−2
−4
−6
1998
2000
2002
2004
2006
2008
2010
2012


Histogram plus estimated density
KDE
N(0,1)
Hist
0.5
0.4
0.3
0.2
0.1
0.0
−3
−2
−1
0
1
2
3


Normal Q-Q
Sample Quantiles
Theoretical Quantiles
4
2
0
−2
−4
−6
−2
−1
0
1
2


Correlogram
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
2
4
6
8
10


Forecast
observed
Forecast
4.0
3.5
3.0
2.5
2.0
1994
1999
2004
2009
2014
Date