# Import packages

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import os

# Save it to more directory

os.chdir(r"C:\Users\reece\Downloads\BANA 7360")

os.getcwd()

# Load data and look at first 5 rows

df = pd.read\_csv("JTU1000LDL.csv",index\_col=0,parse\_dates=True)

df.head()

# Plot data from FRED

df.plot()

A graph with blue lines

Description automatically generated with low confidence

# Classical Decomposition Example

# import packages

import statsmodels.api as sm

from statsmodels.tsa.seasonal import DecomposeResult

# Create additive decomposition

# Additive decomposition and plot data

decomposition\_a = sm.tsa.seasonal\_decompose(df,model='additive')

fig = decomposition\_a.plot()

A picture containing text, line, plot, diagram

Description automatically generated

# created new columns to for original data

df['Observed'] = decomposition\_a.observed

df['Trend'] = decomposition\_a.trend # short coming of classical decomposition

df['Seasonal'] = decomposition\_a.seasonal

df['Resid'] = decomposition\_a.resid

df

JTU1000LDL Observed Trend Seasonal Resid

DATE

2000-12-01 2201 2201.0 NaN 197.570820 NaN

2001-01-01 2894 2894.0 NaN 442.007328 NaN

2001-02-01 1444 1444.0 NaN -388.679180 NaN

2001-03-01 1568 1568.0 NaN 130.600582 NaN

2001-04-01 1768 1768.0 NaN 193.360502 NaN

... ... ... ... ... ...

2022-12-01 1606 1606.0 NaN 197.570820 NaN

2023-01-01 2222 2222.0 NaN 442.007328 NaN

2023-02-01 1275 1275.0 NaN -388.679180 NaN

2023-03-01 1468 1468.0 NaN 130.600582 NaN

2023-04-01 1397 1397.0 NaN 193.360502 NaN

# Multiplicate decomposition, same steps as addictive decomposition

# change model name to multiplicative and plot it

decomposition\_m = sm.tsa.seasonal\_decompose(df,model='multiplicative')

fig = decomposition\_m.plot()

A picture containing text, line, plot, diagram

Description automatically generated

df['Observed'] = decomposition\_m.observed

df['Trend'] = decomposition\_m.trend # short coming of classical decomposition

df['Seasonal'] = decomposition\_m.seasonal

df['Resid'] = decomposition\_m.resid

df

# STL decomposition

# import packages and call df

from statsmodels.tsa.seasonal import STL

df = pd.read\_csv('JTU1000LDL.csv',index\_col=0,parse\_dates=True)

df

# Look at index freq, changed it to MS for STL

df.index

df.index.freq = 'MS'

df.index

# called and fitted our STL model

model = STL(df,robust=True)

fit = model.fit()

fit.plot()

plt.show()

A picture containing text, line, plot, diagram

Description automatically generated

# Created new columns and call df

df['Observed'] = fit.observed

df['Trend'] = fit.trend

df['Seasonal'] = fit.seasonal

df

JTU1000LDL Observed Trend Seasonal Resid

DATE

2000-12-01 2201 2201 1943.796671 233.988170 23.215160

2001-01-01 2894 2894 1940.390890 948.923050 4.686060

2001-02-01 1444 1444 1937.030504 -439.813591 -53.216912

2001-03-01 1568 1568 1933.699240 -446.547029 80.847789

2001-04-01 1768 1768 1930.396294 -118.656337 -43.739957

... ... ... ... ... ...

2022-12-01 1606 1606 1485.048838 130.147141 -9.195980

2023-01-01 2222 2222 1496.144126 746.540311 -20.684437

2023-02-01 1275 1275 1507.127407 -198.618577 -33.508829

2023-03-01 1468 1468 1518.012552 -62.391664 12.379112

2023-04-01 1397 1397 1528.829508 -145.897988 14.068480df['Resid'] = fit.resid