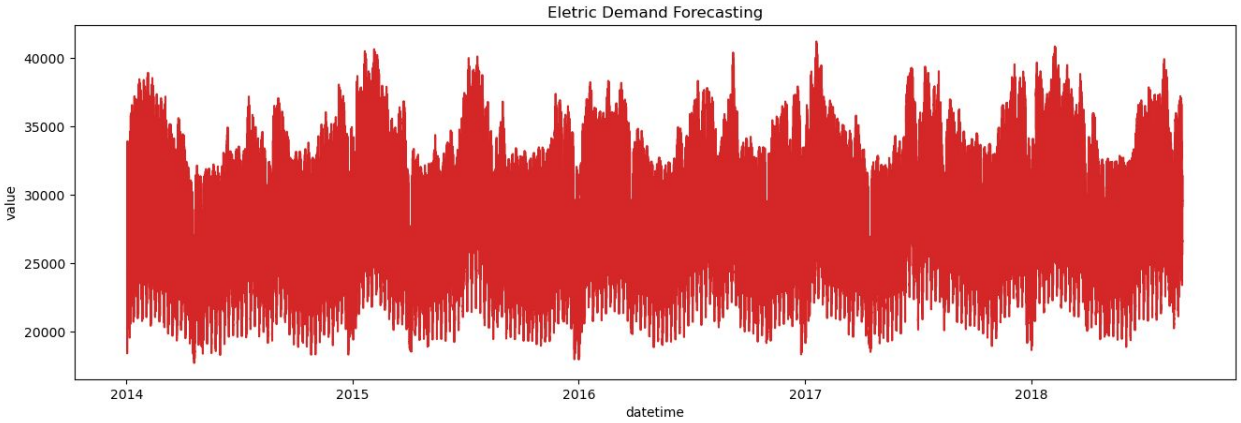
Universidade de Pernambuco
Escola Politécnica de Pernambuco
Engenharia da Computação

Previsão de Séries Temporais

Disciplina: Modelagem Analítica
Professor: Mêuser Valença
Alunos: Daniel Neto, Estyvison Linhares, Guilherme Teixeira e Kelly Mota.

Sumário

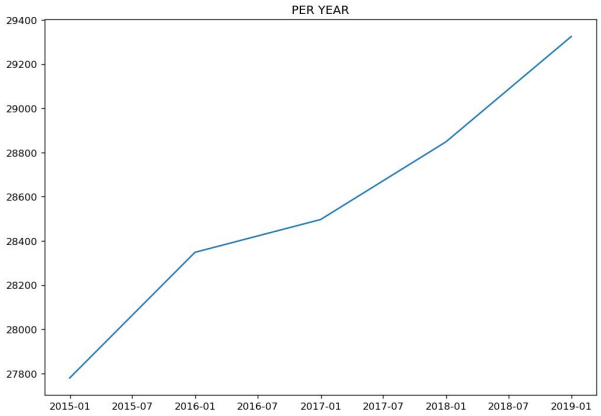
1. Série: Electric Demand Forecasting-DL -de 10 em 10 horas- Kelly Mota

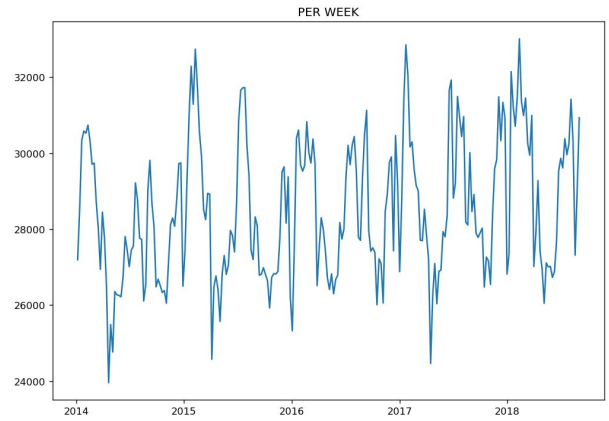


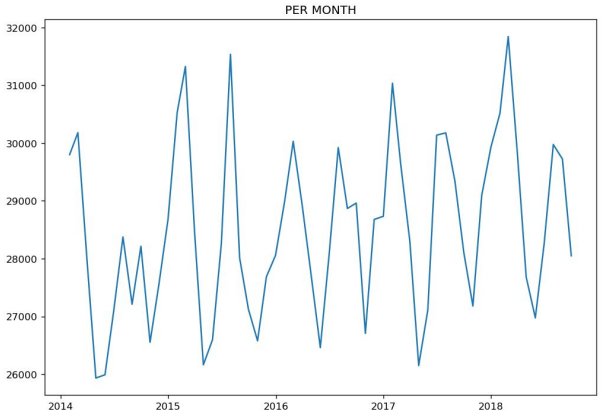
,

Análise

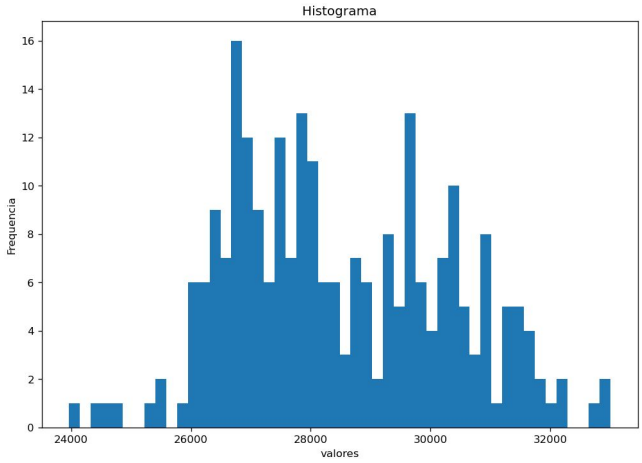
1. Série por ano, mês e semana



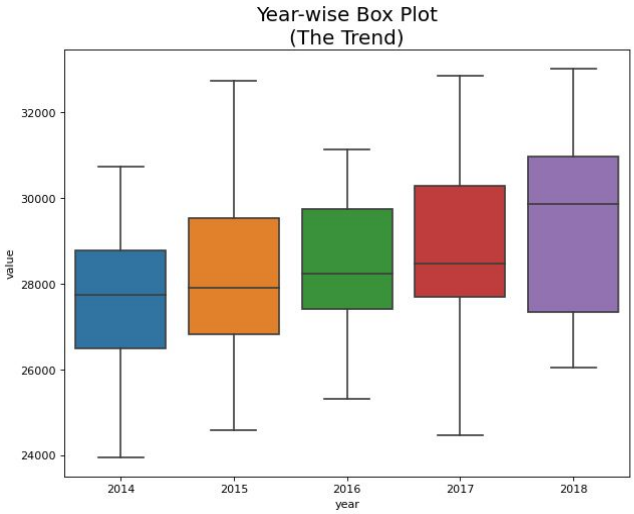


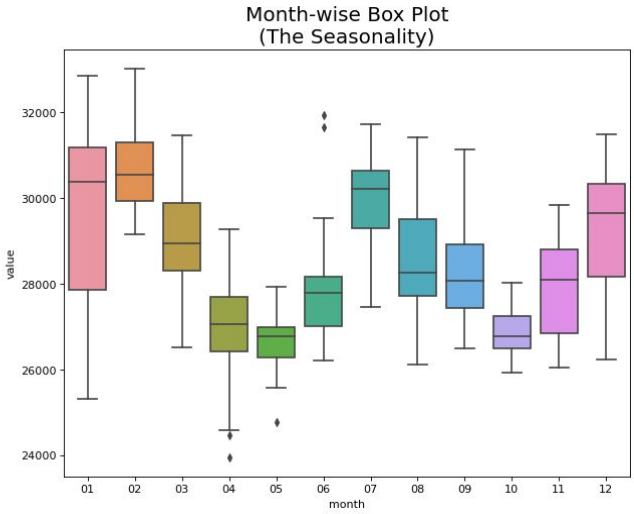


2. Histograma

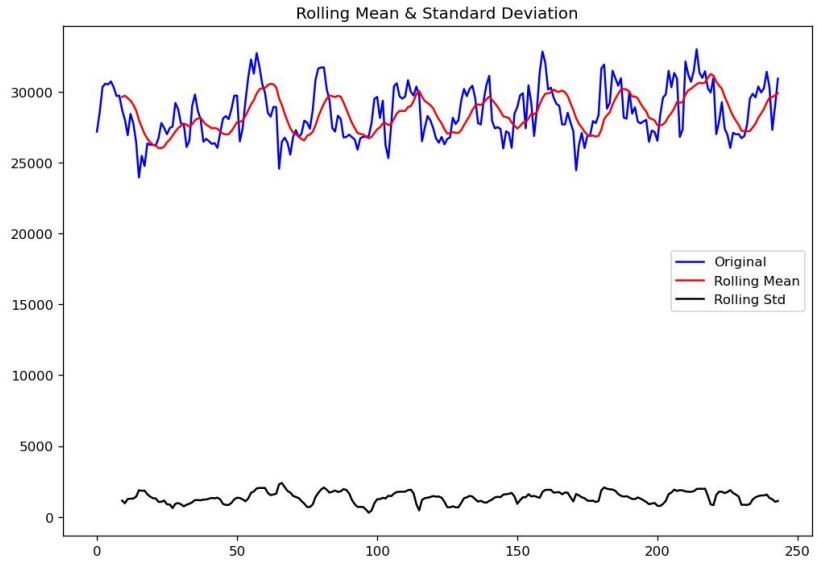


3. Box-Plot

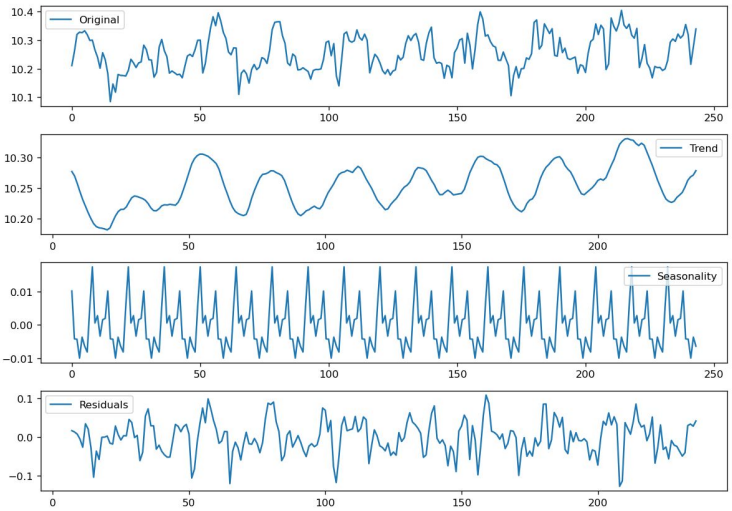




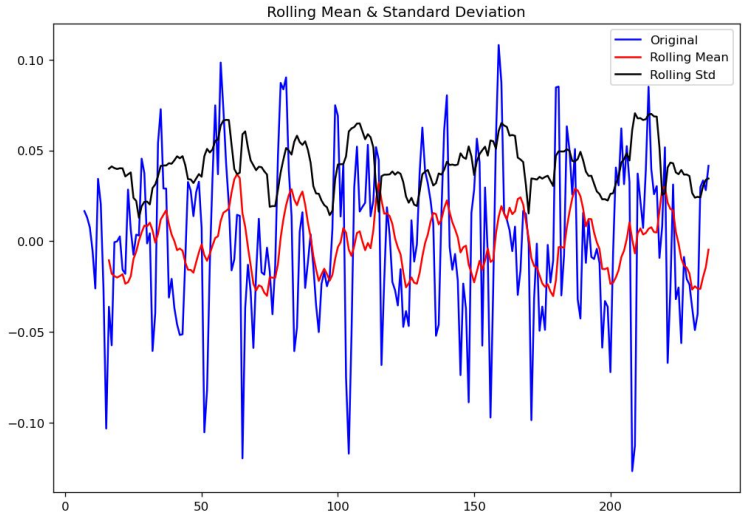
4. Média móvel e desvio padrão



5. Decomposição da série transformada (log)



6. Média móvel e desvio padrão da série transformada (log)



7. Teste de Dickey-Fuller

Test Statistic	-4.926370
p-value	0.000031
#Lags Used	3.000000
Number of Observations Used	240.000000
Critical Value (1%)	-3.457894
Critical Value (5%)	-2.873659
Critical Value (10%)	-2.573229

Como o valor do teste é menor que o critical value de 1%, podemos afirmar que a série é estacionária com uma confiança de 99%.

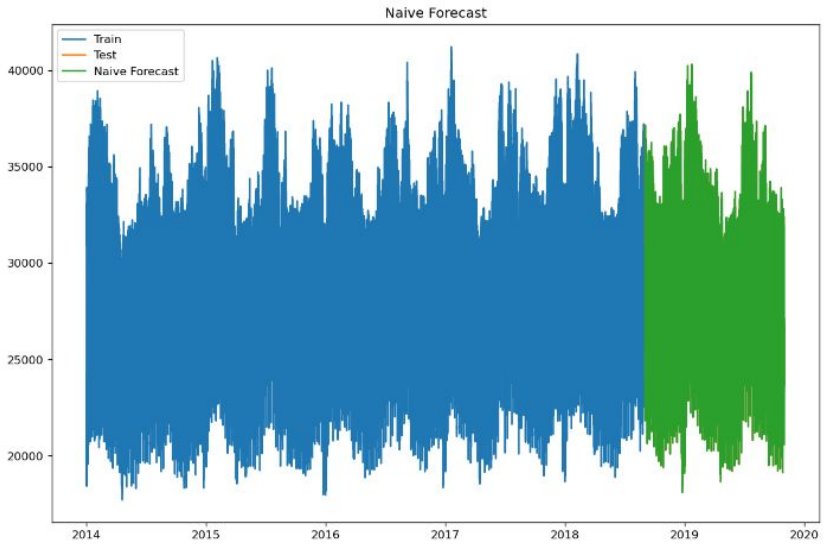
8. Teste de Dickey-Fuller da série transformada (log)

Test Statistic	-7.777345e+00
p-value	8.598813e-12
#Lags Used	1.500000e+01
Number of Observations Used	2.140000e+02
Critical Value (1%)	-3.461282e+00
Critical Value (5%)	-2.875143e+00
Critical Value (10%)	-2.574020e+00

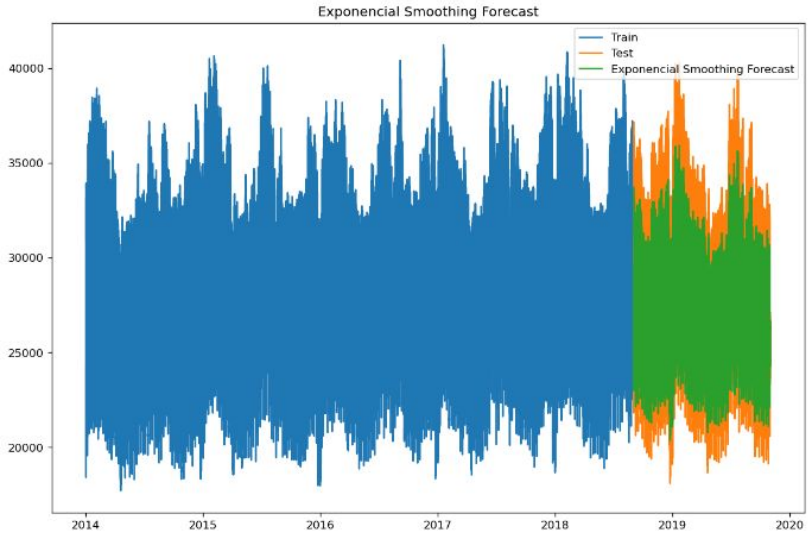
Realizamos o teste de dickey-fuller na série transformada também apenas por medidas de visualização, já que o teste da série sem transformação já mostra que ela é estacionária.

Previsões

1. Modelo trivial de previsão (naive):



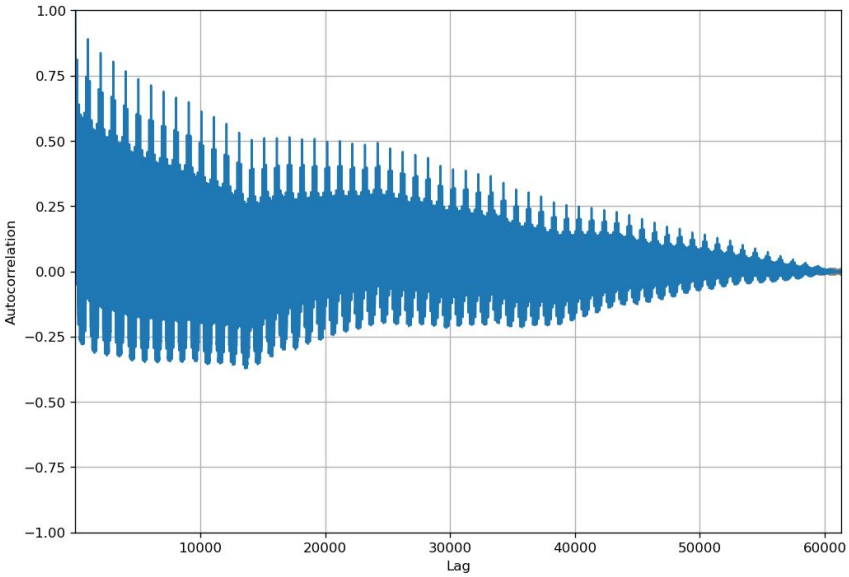
2. Modelo suavização exponencial

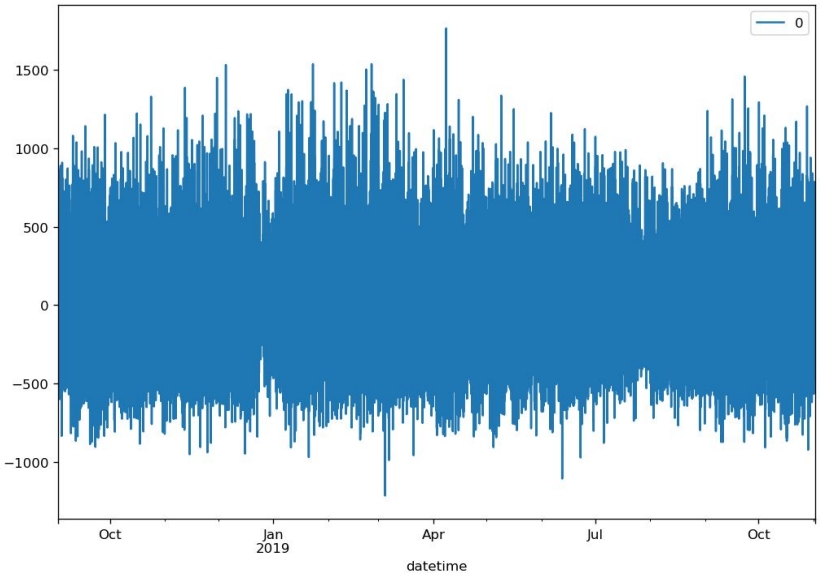


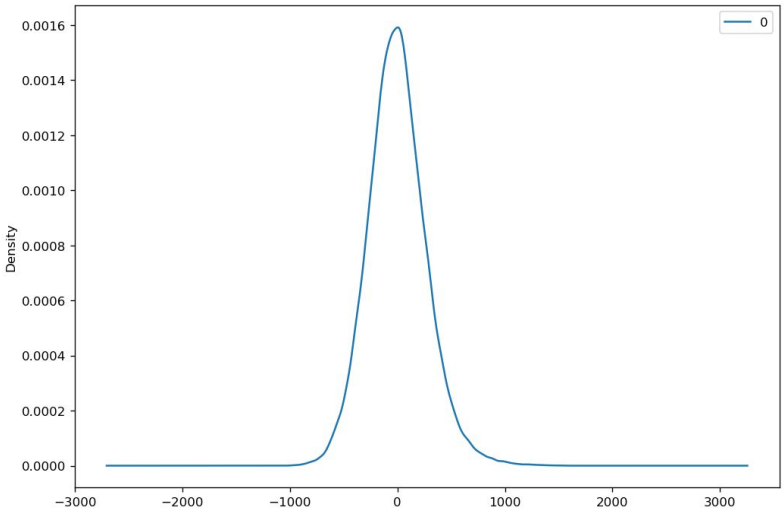
3. Modelo Holt-Winters:

4. Modelo Arima

4.1. Gráficos de autocorrelação, resíduos e densidade







4.2 Resumo do modelo

ARIMA Model Results

Dep. Variable:	D.value	No. Observations:	61342
Model:	ARIMA(1, 1, 0)	Log Likelihood	-430809.183
Method:	css-mle	S.D. of innovations	271.546
Date:	Tue, 03 Nov 2020	AIC	861624.366
Time:	17:54:34	BIC	861651.439
Sample:	09-01-2018 - 11-01-2019	HQIC	861632.767

	coef	std err	z	P>|z|	[0.025	0.975]
const	-0.0332	2.001	-0.017	0.987	-3.955	3.889
ar.L1.D.value	0.4521	0.004	125.523	0.000	0.445	0.459

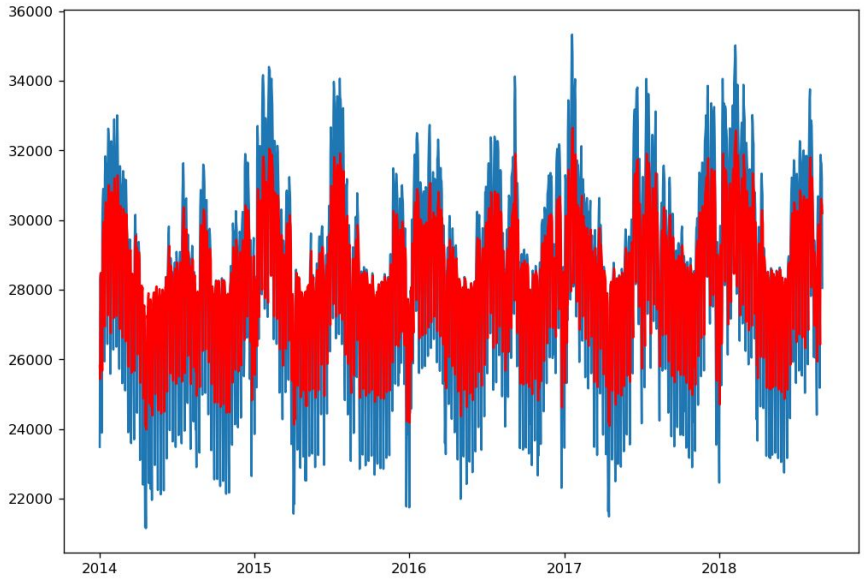
Roots

	Real	Imaginary	Modulus	Frequency
AR.1	2.2121	+0.0000j	2.2121	0.0000

	0
count	61342.000000
mean	-0.002785
std	271.547836
min	-1214.607892
25%	-177.361073
50%	-10.190582
75%	163.289654
max	1764.975933

4.3 Previsão do modelo Arima

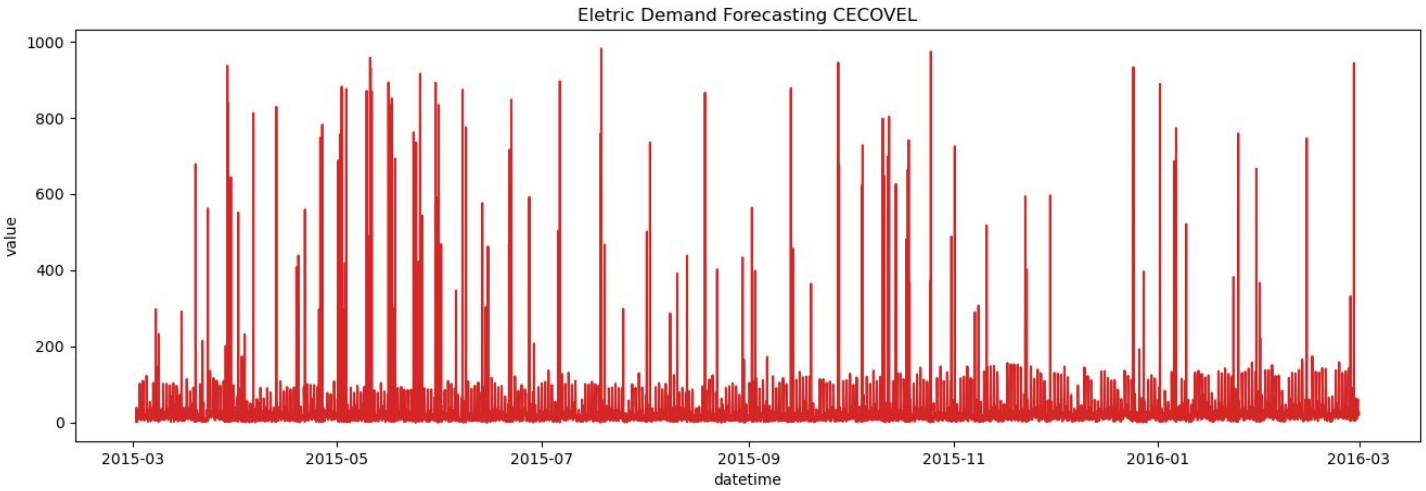
Test MSE: 4703942.971

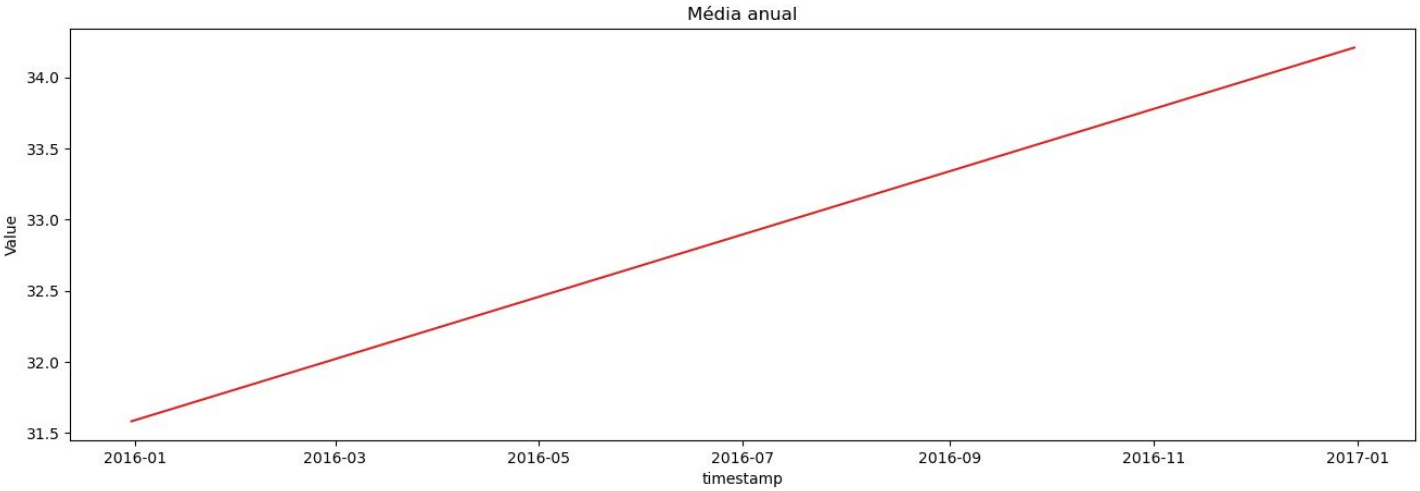


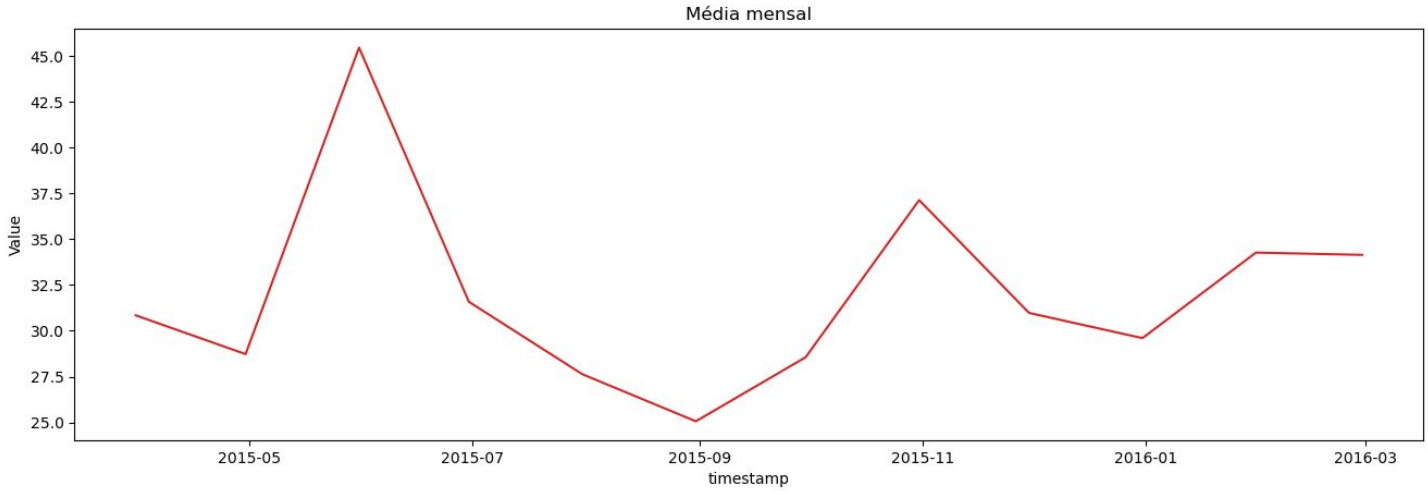
2. Série: CECOVEL - Guilherme Teixeira

Análise

1. Série completa e média por ano, mês, semana e dia



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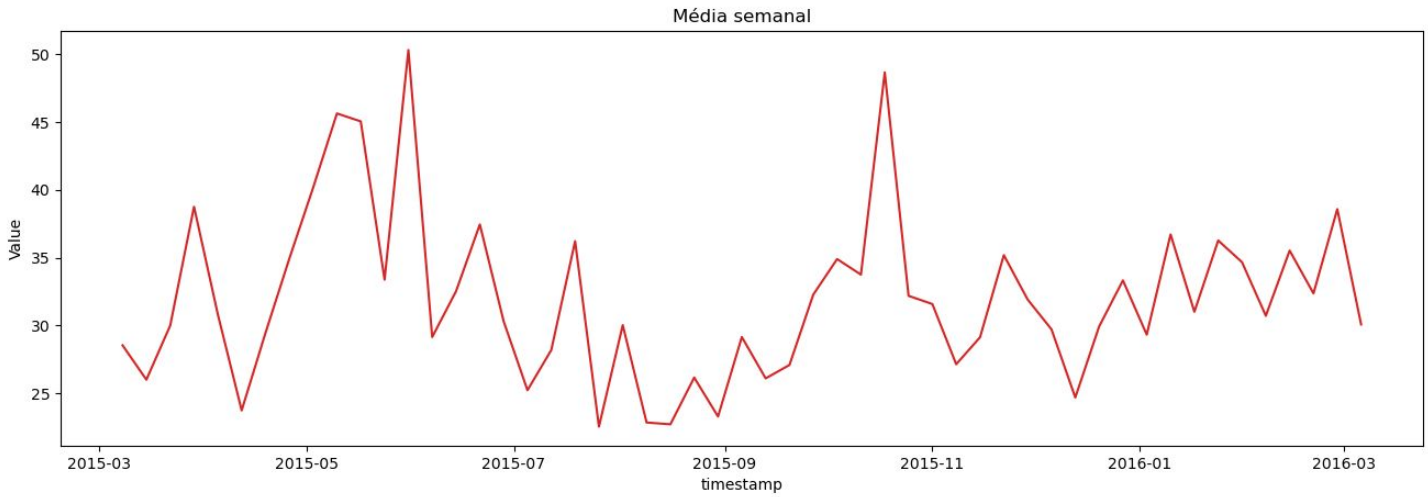
2015-07
2015-09
2015-11
2016-01
2016-03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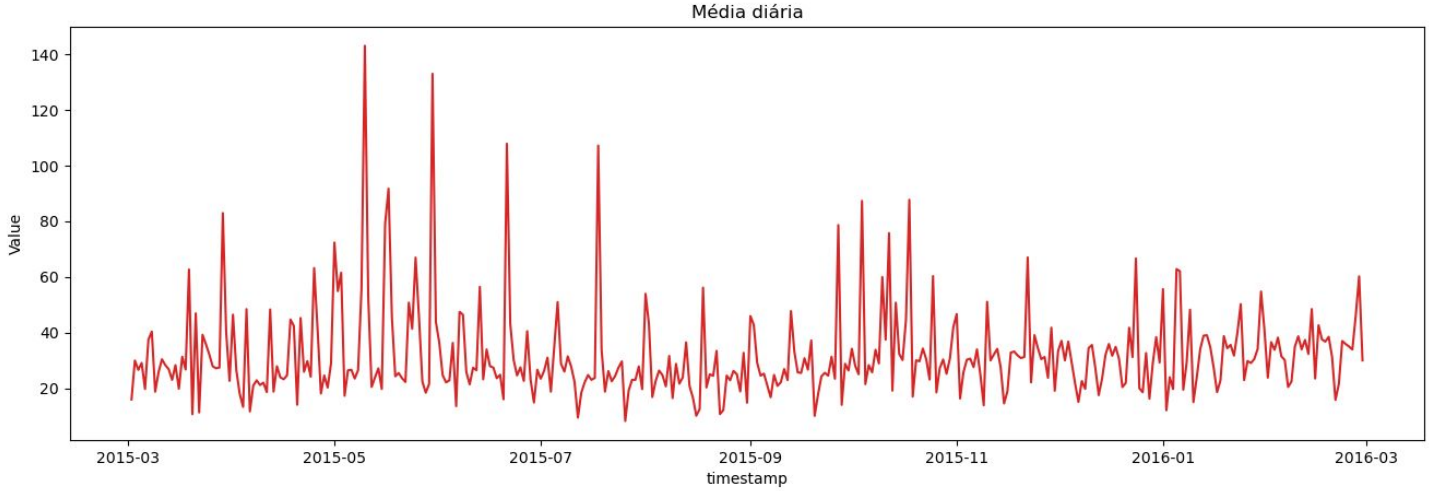
2016-03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2015-11
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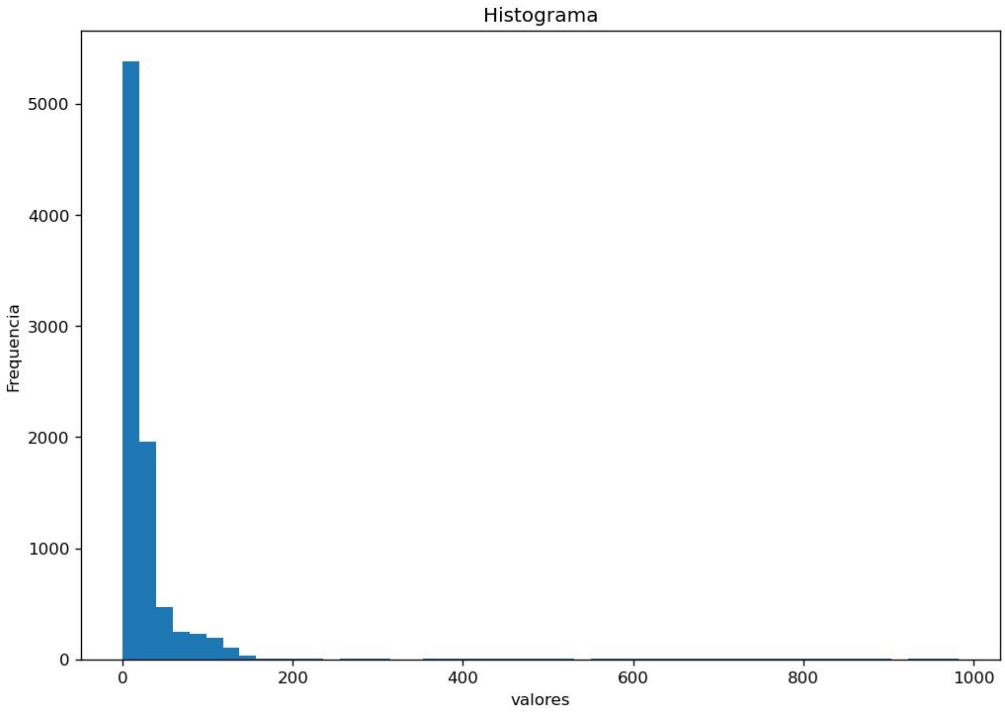
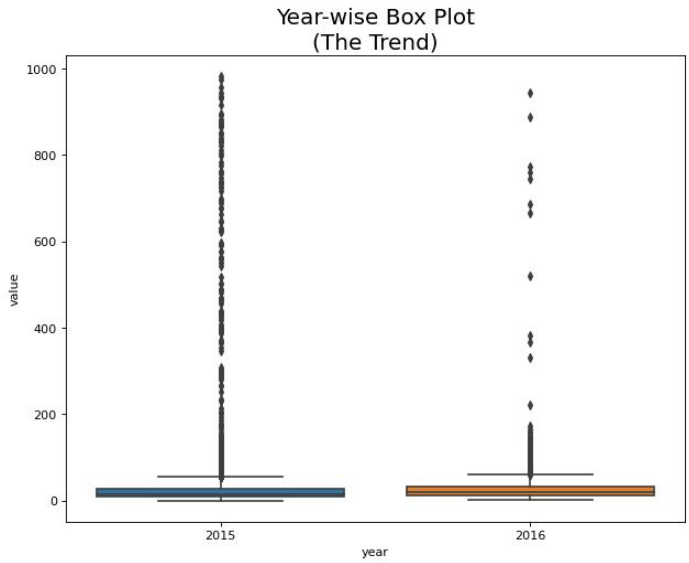
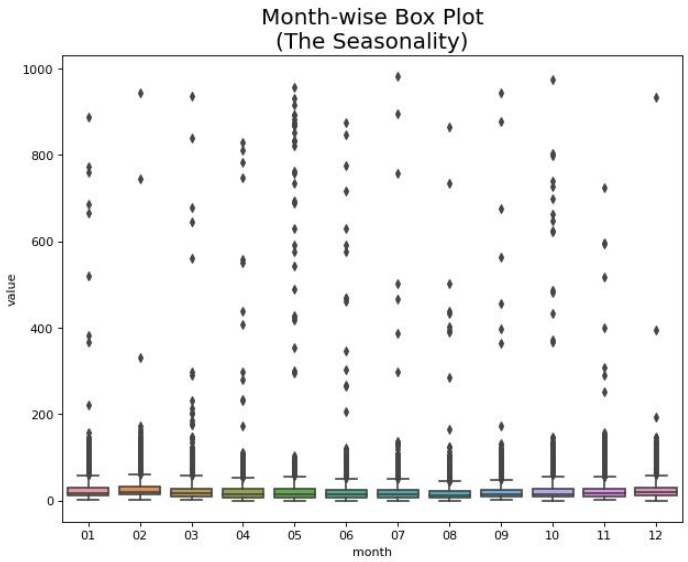
2016-03

2. Histograma

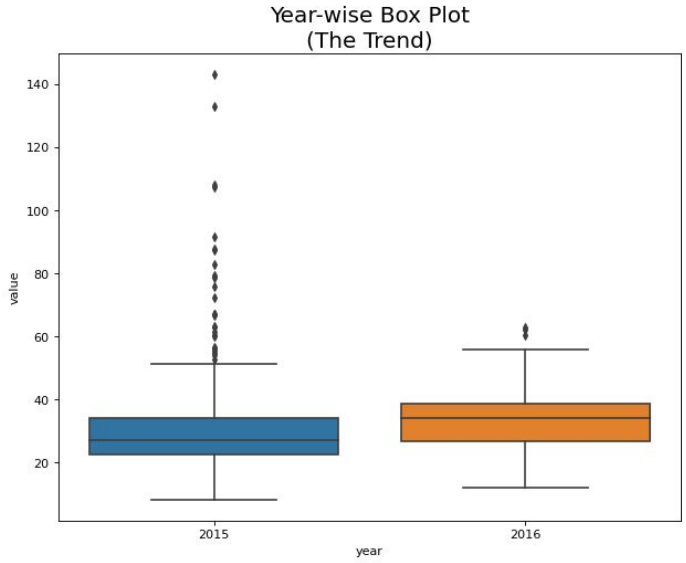


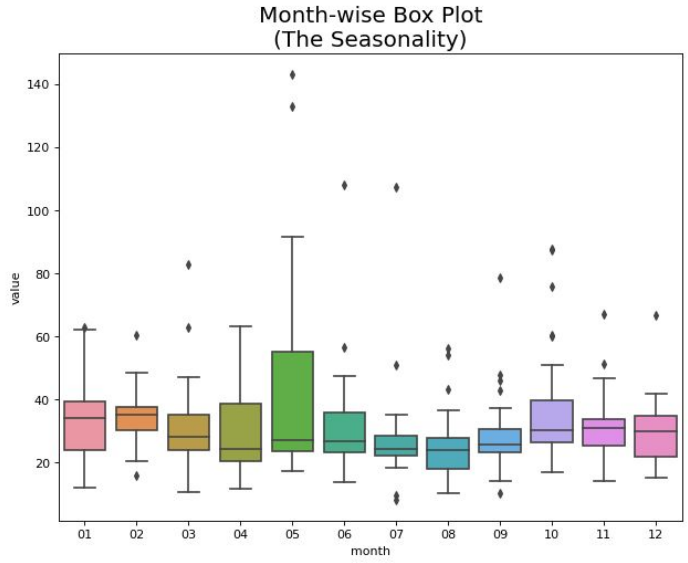
3. Box-Plot



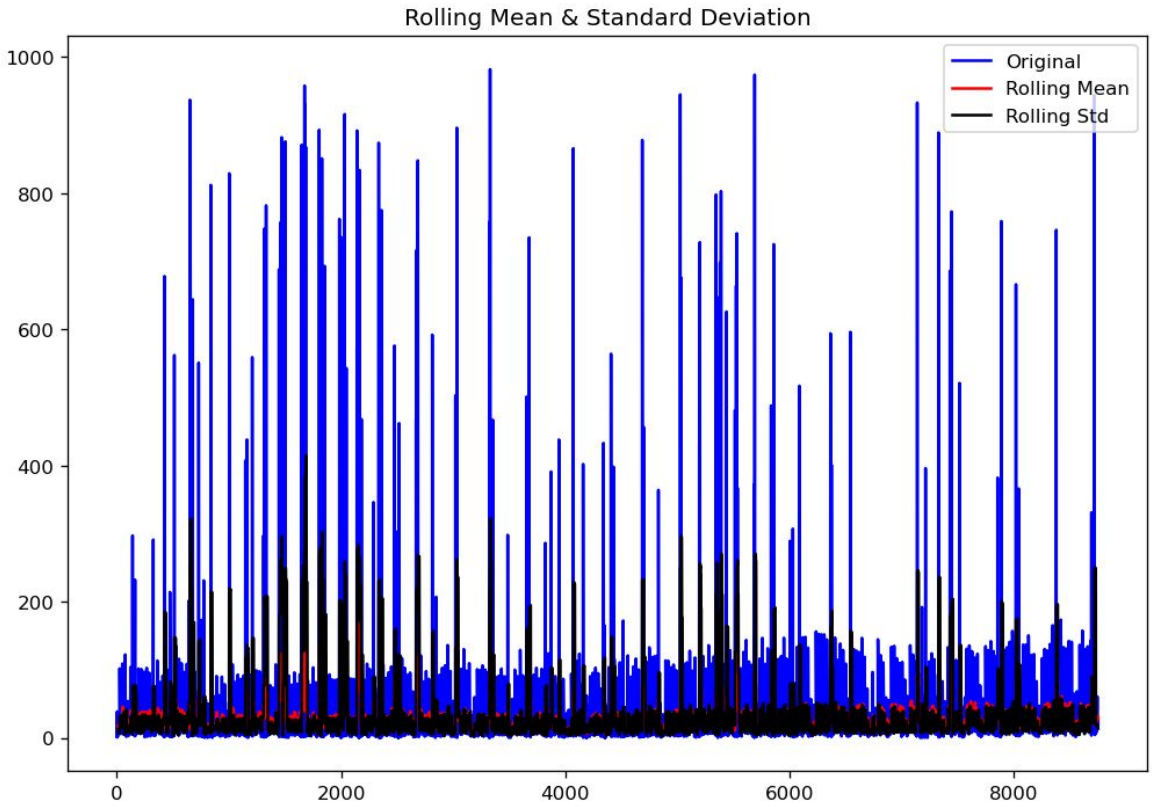


Box-Plot média diária

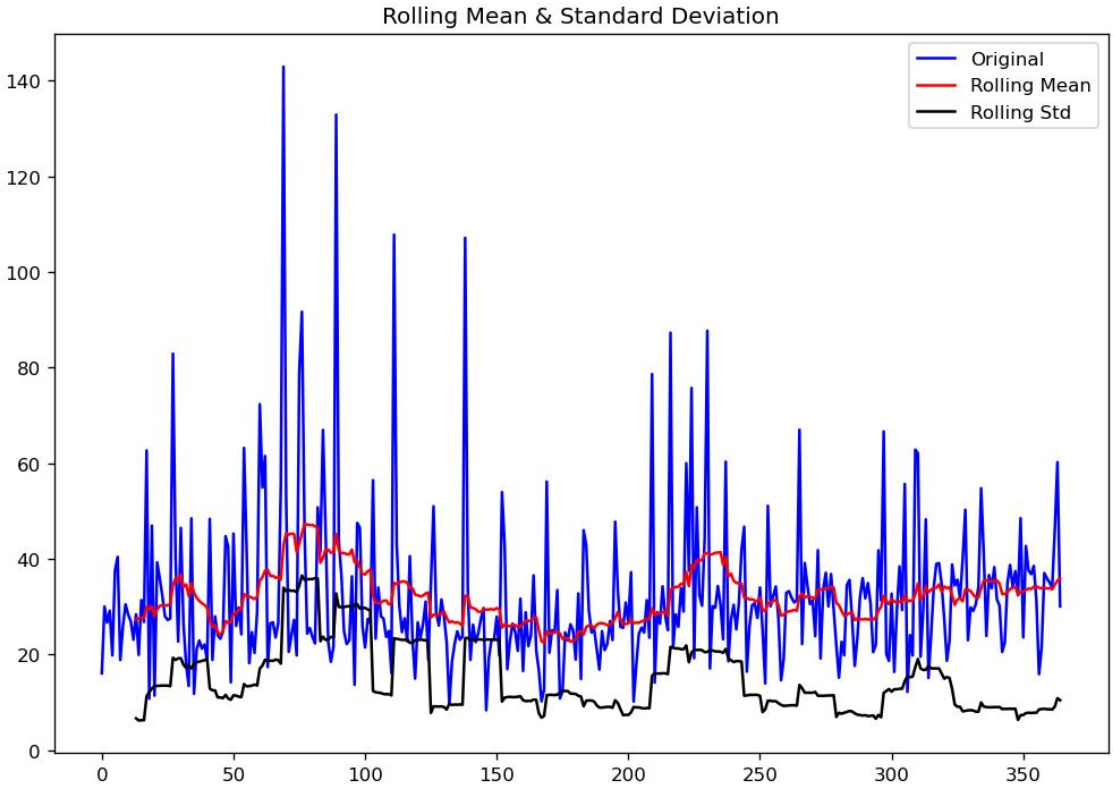




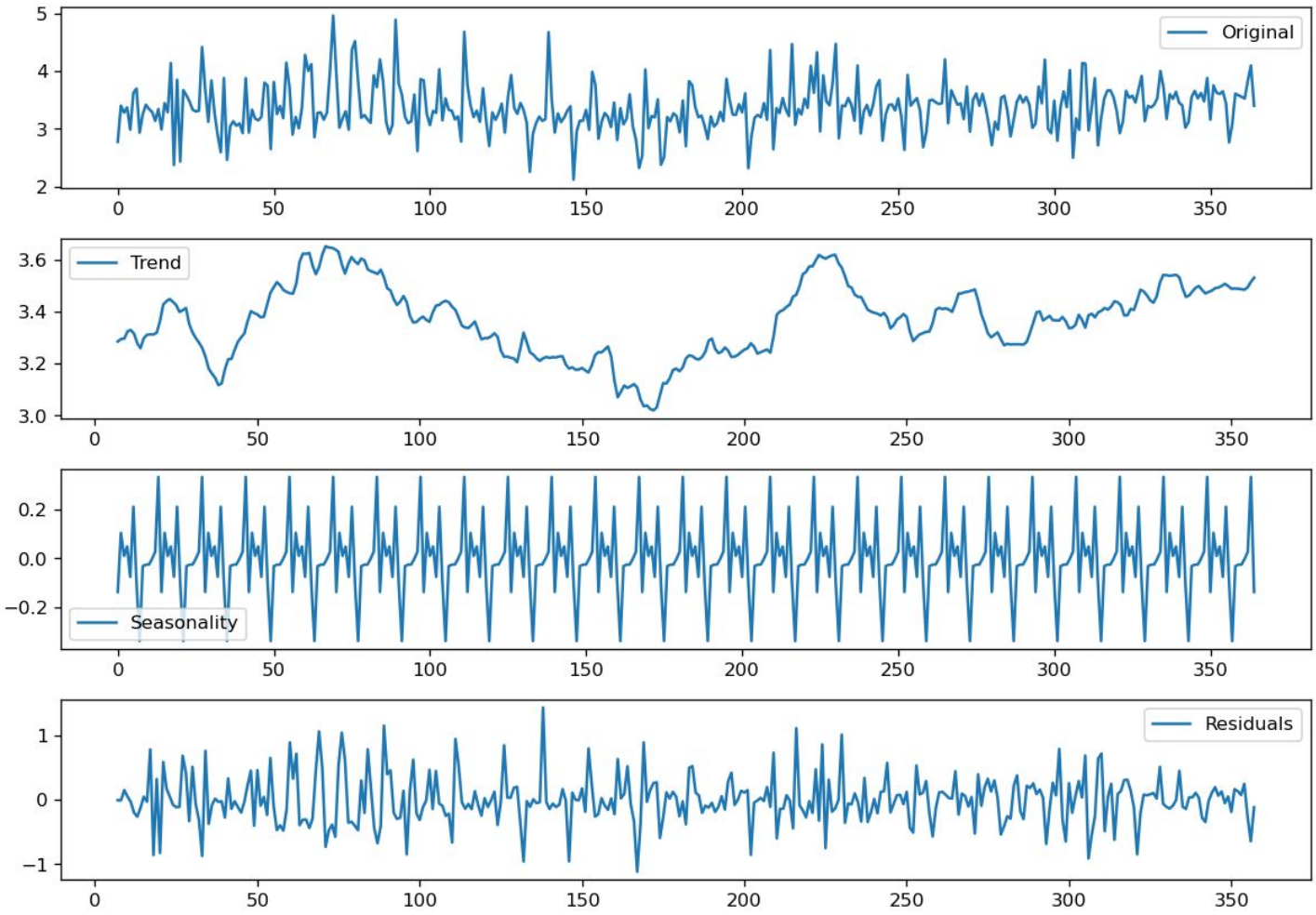
4. Média móvel e desvio padrão



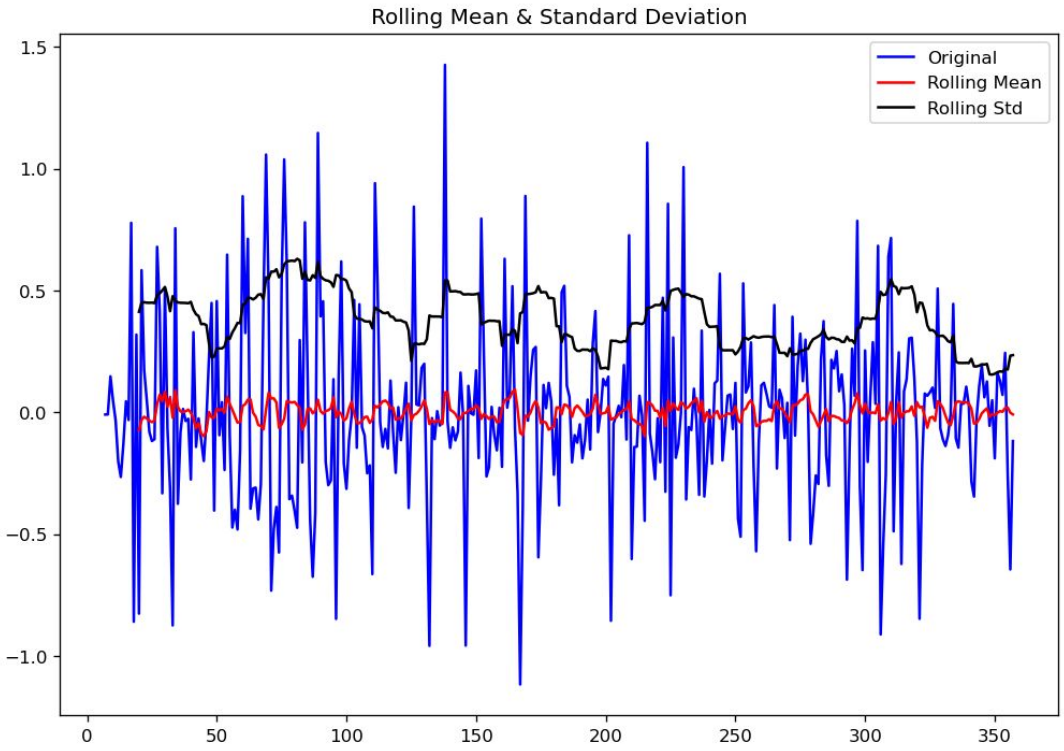
Para média diária



5. Decomposição da série transformada (log)



6. Média móvel e desvio padrão da série transformada (log)



7. Teste de Dickey-Fuller

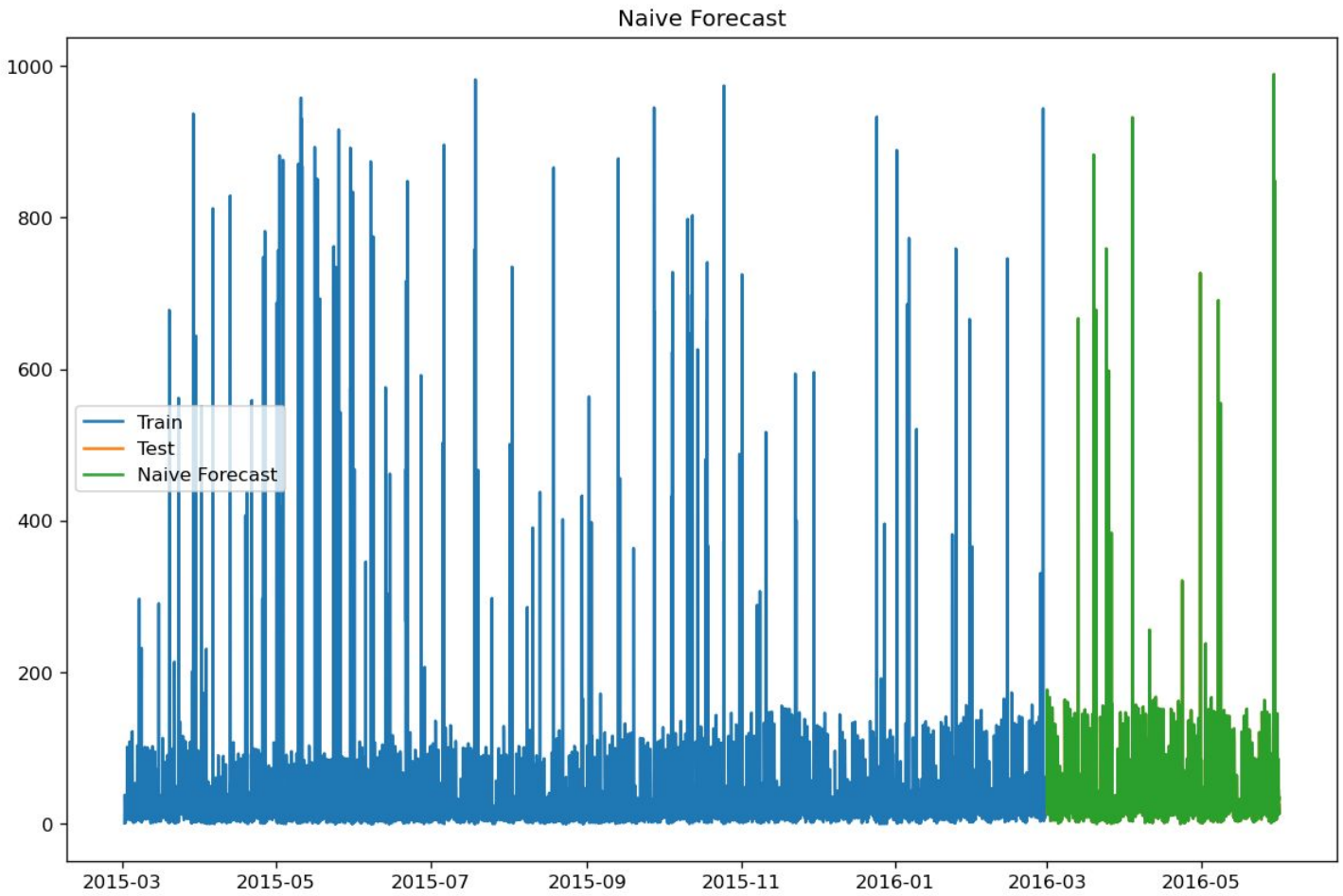
Test Statistic	-2.882258
p-value	0.047450
#Lags Used	13.000000
Number of Observations Used	351.000000
Critical Value (1%)	-3.449119
Critical Value (5%)	-2.869810
Critical Value (10%)	-2.571176

8. Teste de Dickey-Fuller da série transformada (log)

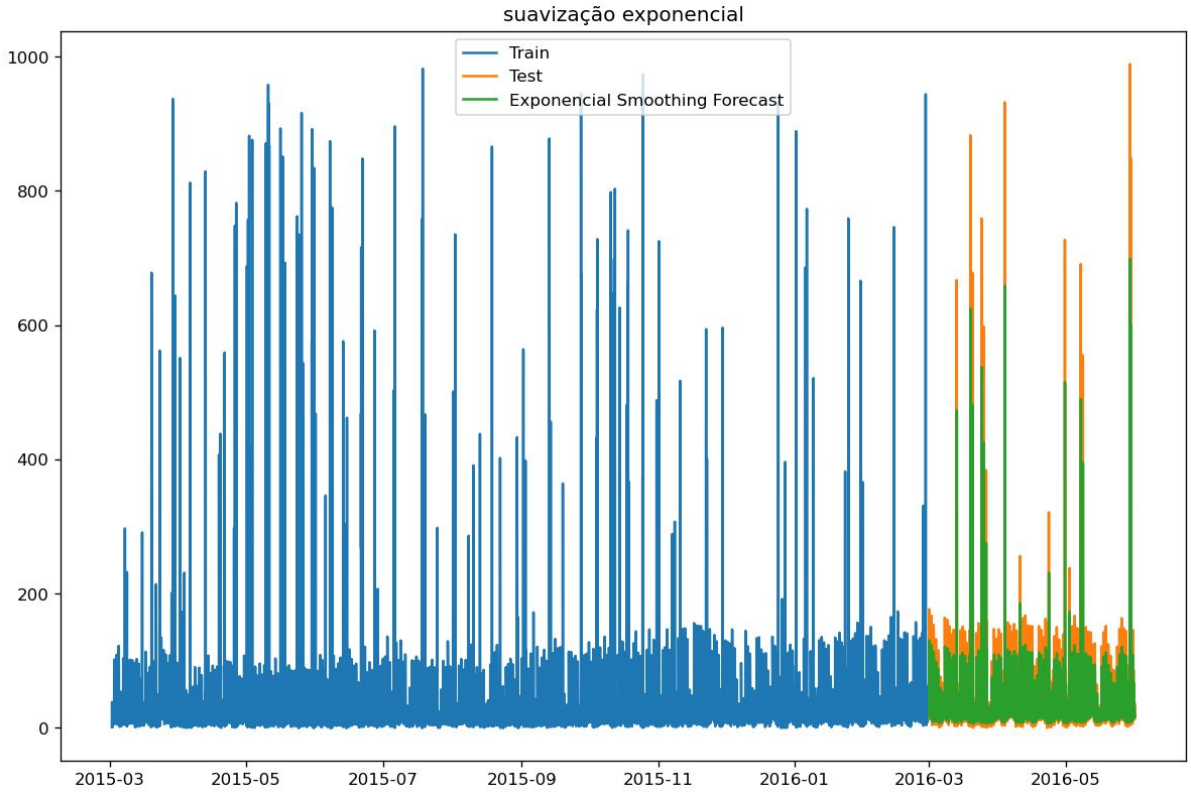
Test Statistic	-1.183958e+01
p-value	7.645888e-22
#Lags Used	1.100000e+01
Number of Observations Used	3.390000e+02
Critical Value (1%)	-3.449788e+00
Critical Value (5%)	-2.870104e+00
Critical Value (10%)	-2.571332e+00

Previsões

1. Modelo trivial de previsão (naive):



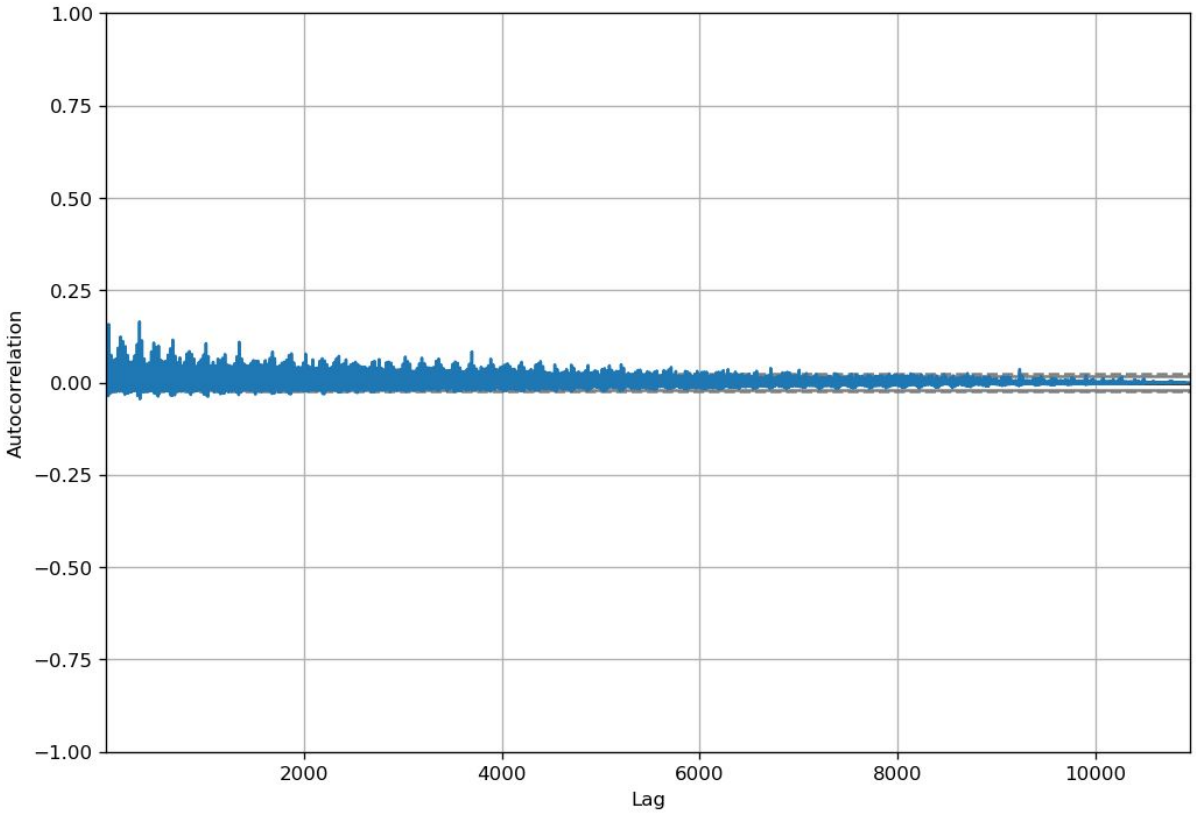
2. Modelo suavização exponencial

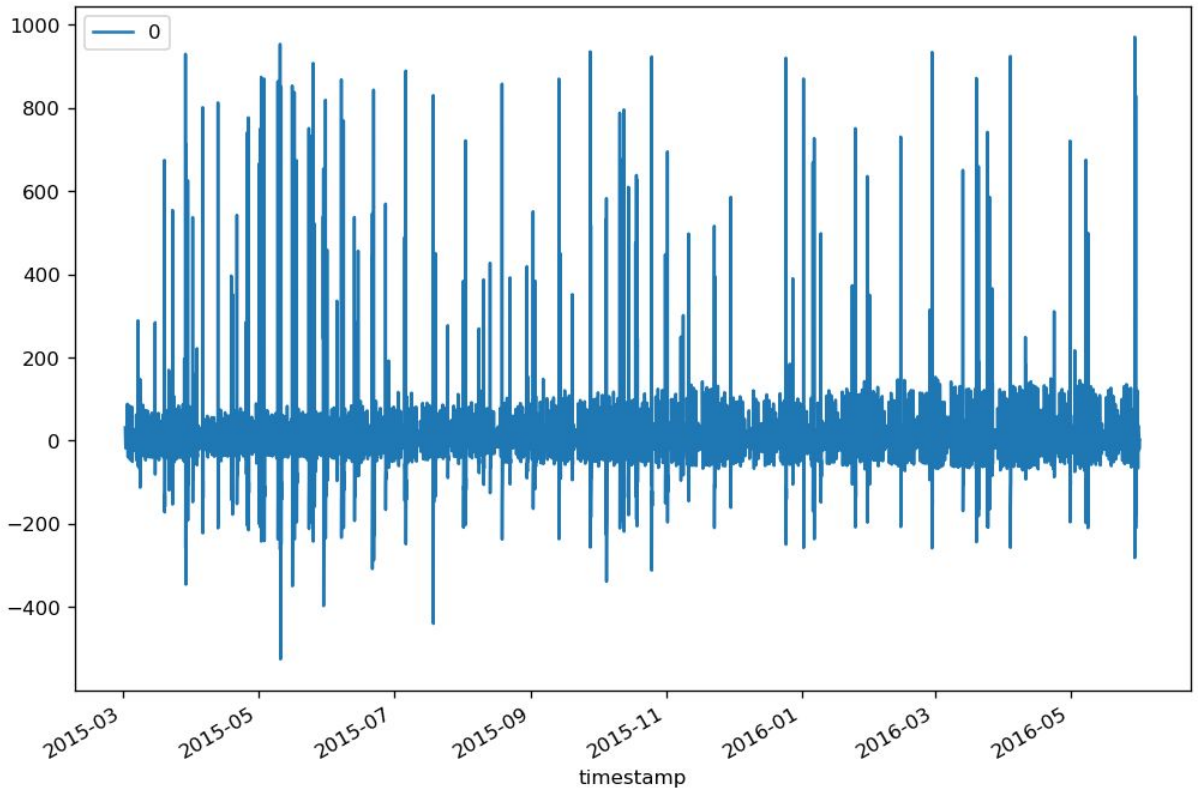


3. Modelo Holt-Winters:

4. Modelo Arima:

4.1. Gráficos de autocorrelação, resíduos e densidade

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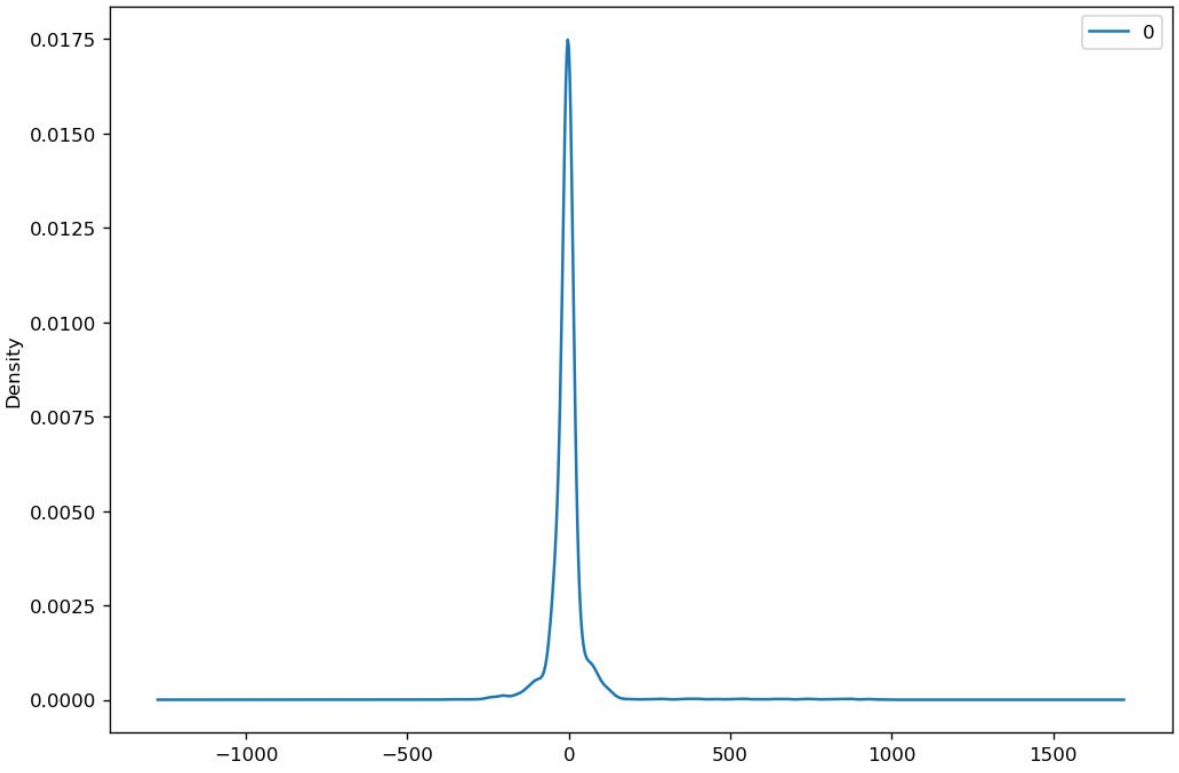
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500
1000
1500

4.2 Resumo do modelo

ARIMA Model Results

Dep. Variable:	D.value	No. Observations:	10965
Model:	ARIMA(5, 1, 0)	Log Likelihood	-63625.802
Method:	css-mle	S.D. of innovations	80.130
Date:	Tue, 03 Nov 2020	AIC	127265.603
Time:	20:21:51	BIC	127316.721
Sample:	1	HQIC	127282.827

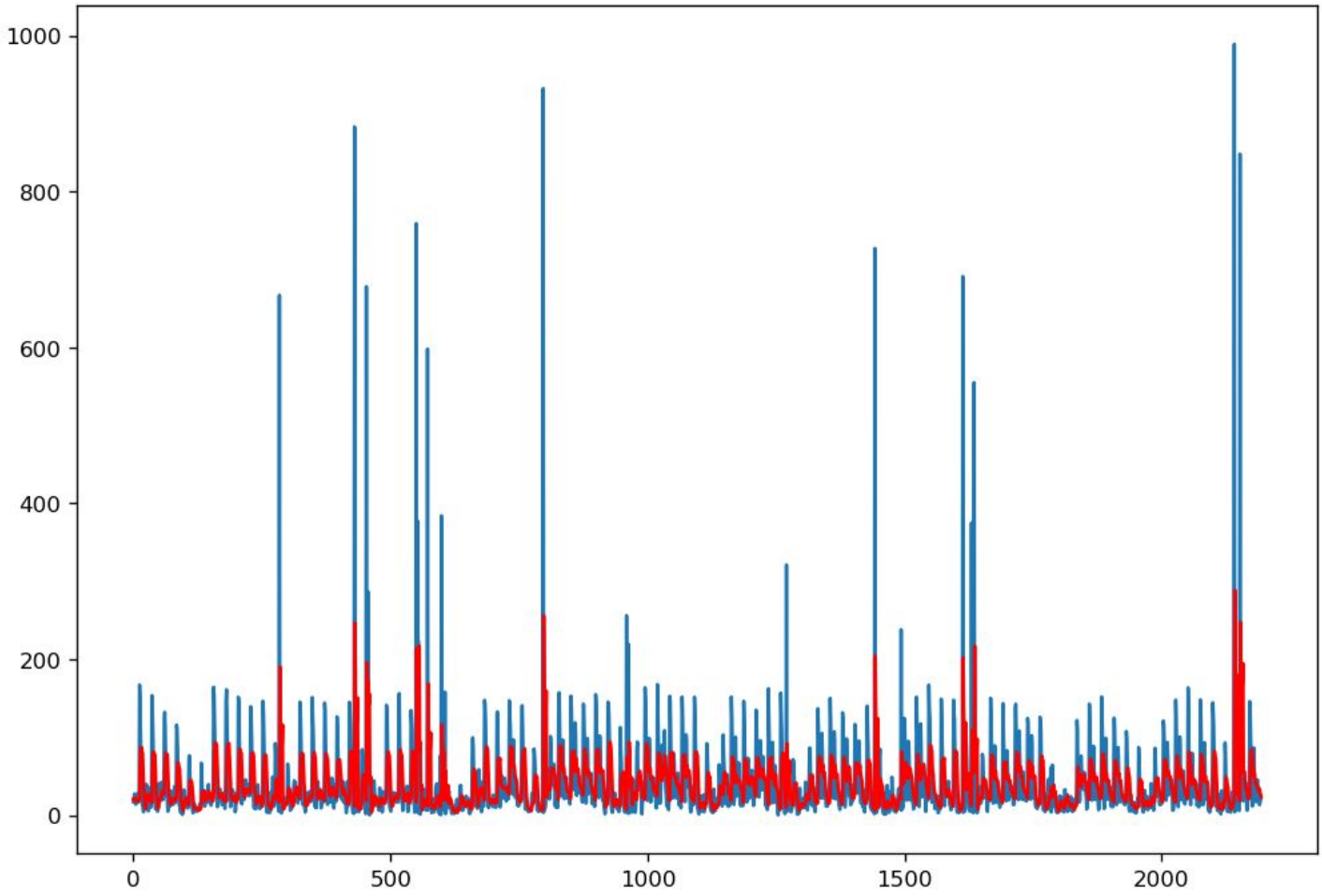
	coef	std err	z	P>|z|	[0.025	0.975]
const	0.0001	0.244	0.000	1.000	-0.478	0.478
ar.L1.D.value	-0.7263	0.009	-77.059	0.000	-0.745	-0.708
ar.L2.D.value	-0.5455	0.011	-47.954	0.000	-0.568	-0.523
ar.L3.D.value	-0.4160	0.012	-35.068	0.000	-0.439	-0.393
ar.L4.D.value	-0.2876	0.011	-25.282	0.000	-0.310	-0.265
ar.L5.D.value	-0.1606	0.009	-17.043	0.000	-0.179	-0.142

Roots

	Real	Imaginary	Modulus	Frequency
AR.1	0.6292	-1.2302j	1.3818	-0.1748
AR.2	0.6292	+1.2302j	1.3818	0.1748
AR.3	-1.4853	-0.0000j	1.4853	-0.5000
AR.4	-0.7818	-1.2587j	1.4818	-0.3385
AR.5	-0.7818	+1.2587j	1.4818	0.3385

	0
count	10965.000000
mean	0.003024
std	80.133939
min	-525.160431
25%	-16.533209
50%	-3.487433
75%	6.566467
max	970.936758

4.2 Previsão



Test MSE: 4844.838

3. Série MA Estyvison:

Análise

1. Série por ano, mês e semana
2. Histograma
3. Box-Plot
4. Média móvel e desvio padrão
5. Decomposição da série transformada (log), média móvel e desvio padrão da série transformada (log)
6. Decomposição aditiva e multiplicativa
7. Teste de Dickey-Fuller

Test Statistic	-3.518286
p-value	0.007530
#Lags Used	16.000000
Number of Observations Used	475.000000
Critical Value (1%)	-3.444192
Critical Value (5%)	-2.867644
Critical Value (10%)	-2.570021

8. Teste de Dickey-Fuller da série transformada (log)

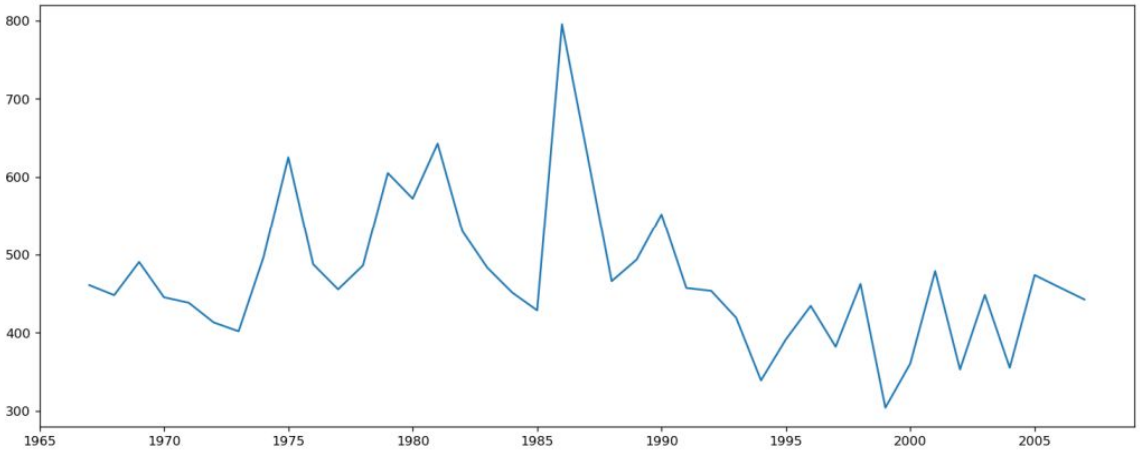
Test Statistic	-5.081687
p-value	0.000015
#Lags Used	16.000000
Number of Observations Used	375.000000
Critical Value (1%)	-3.447909
Critical Value (5%)	-2.869278
Critical Value (10%)	-2.570892

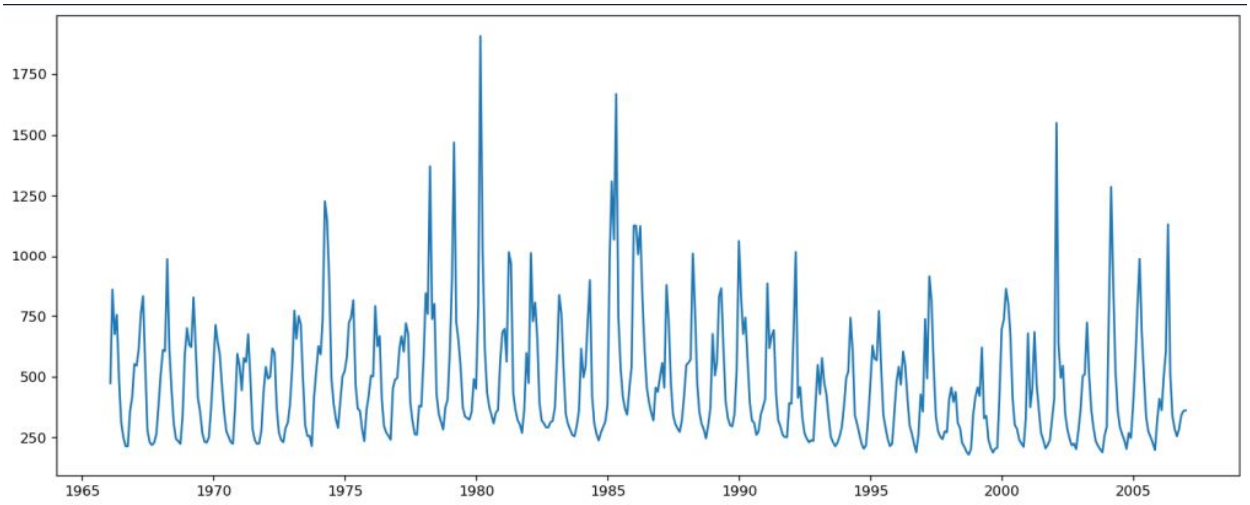
Previsões

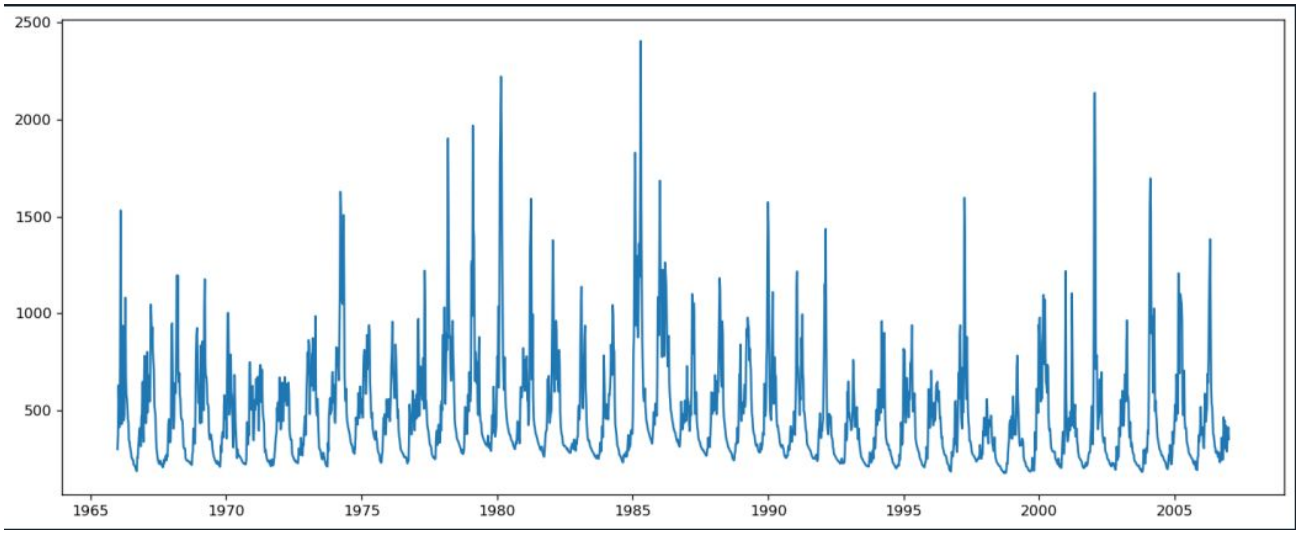
1. Modelo trivial de previsão (naive):
2. Modelo suavização exponencial
3. Modelo Holt-Winters:
4. Modelo Arima:

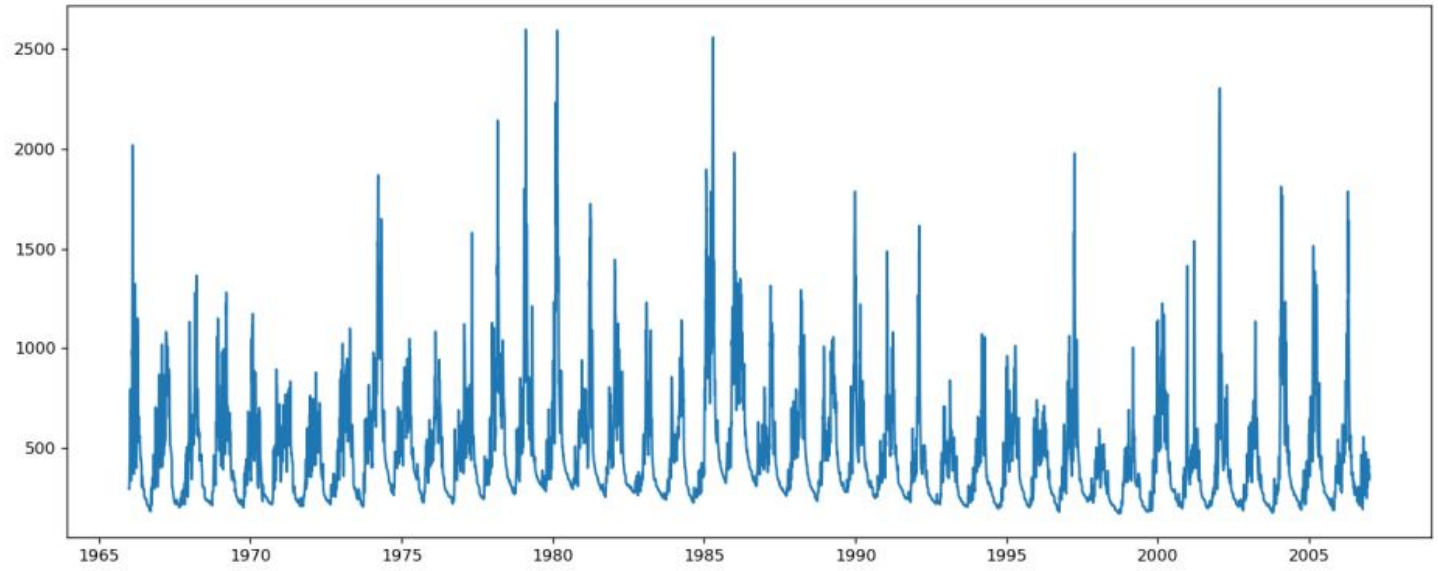
Análise

1. Série por ano, mês, semana e dia

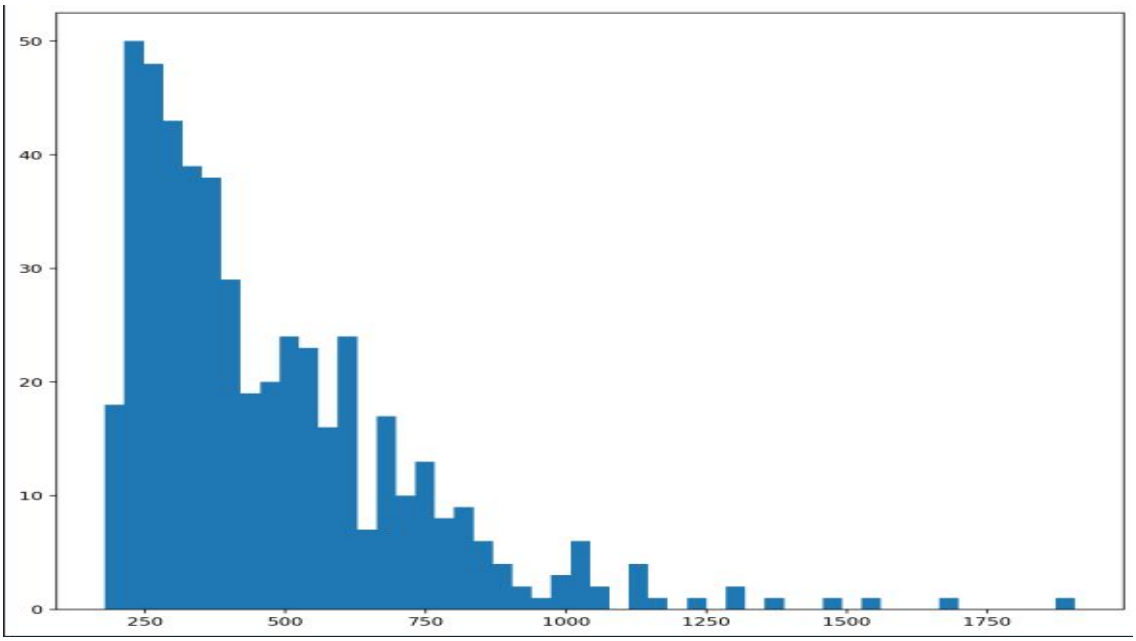




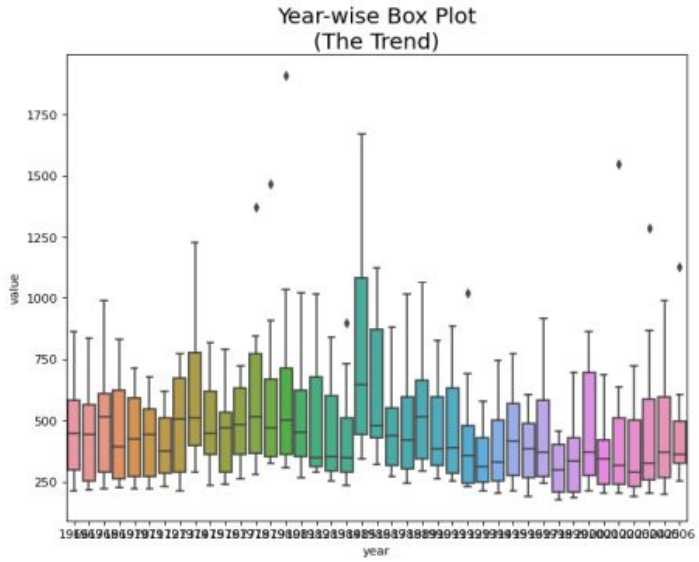

2500
2000
1500
1000
500
1965
1970
1975
1980
1985
1990
1995
2000
2005

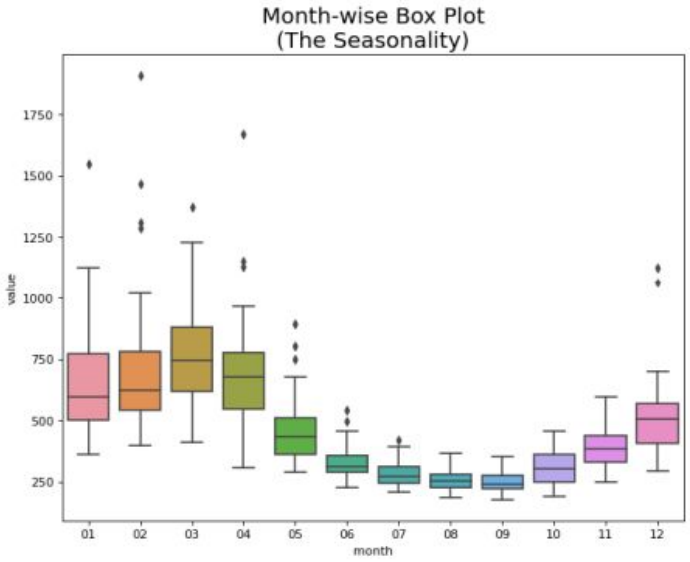

2500
2000
1500
1000
500
1965
1970
1975
1980
1985
1990
1995
2000
2005

2. Histograma

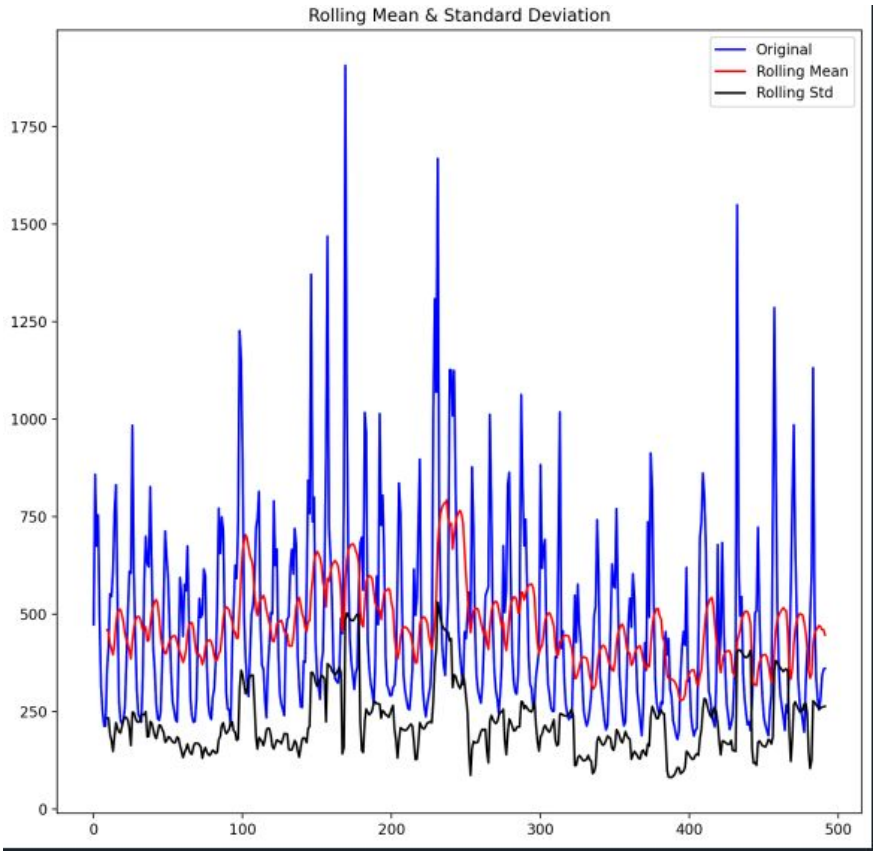


3.Box-Plot

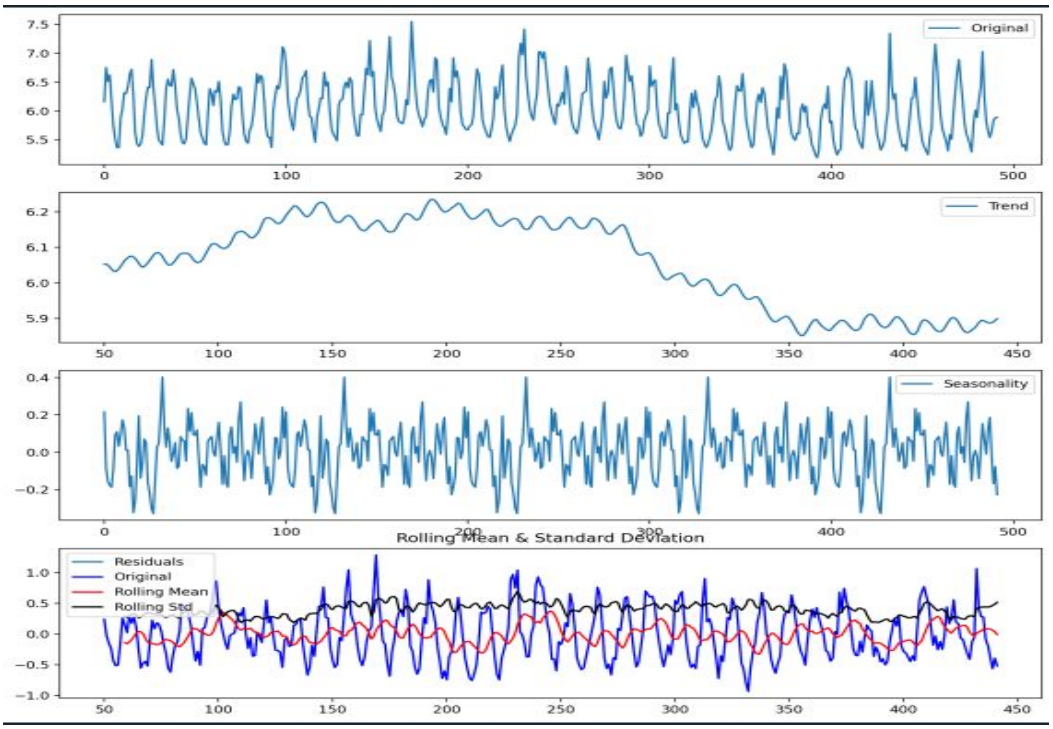




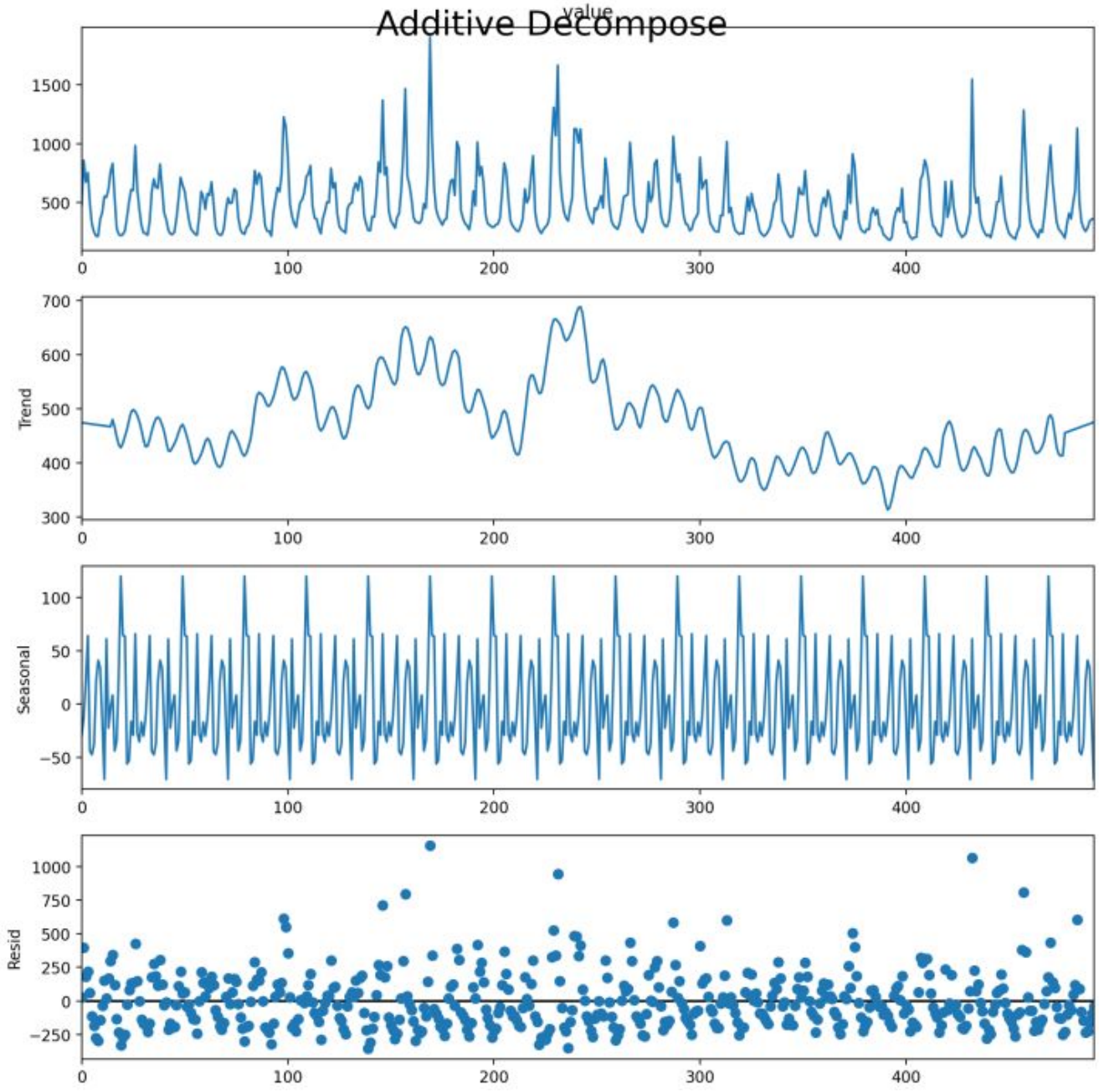
4. Média móvel e desvio padrão

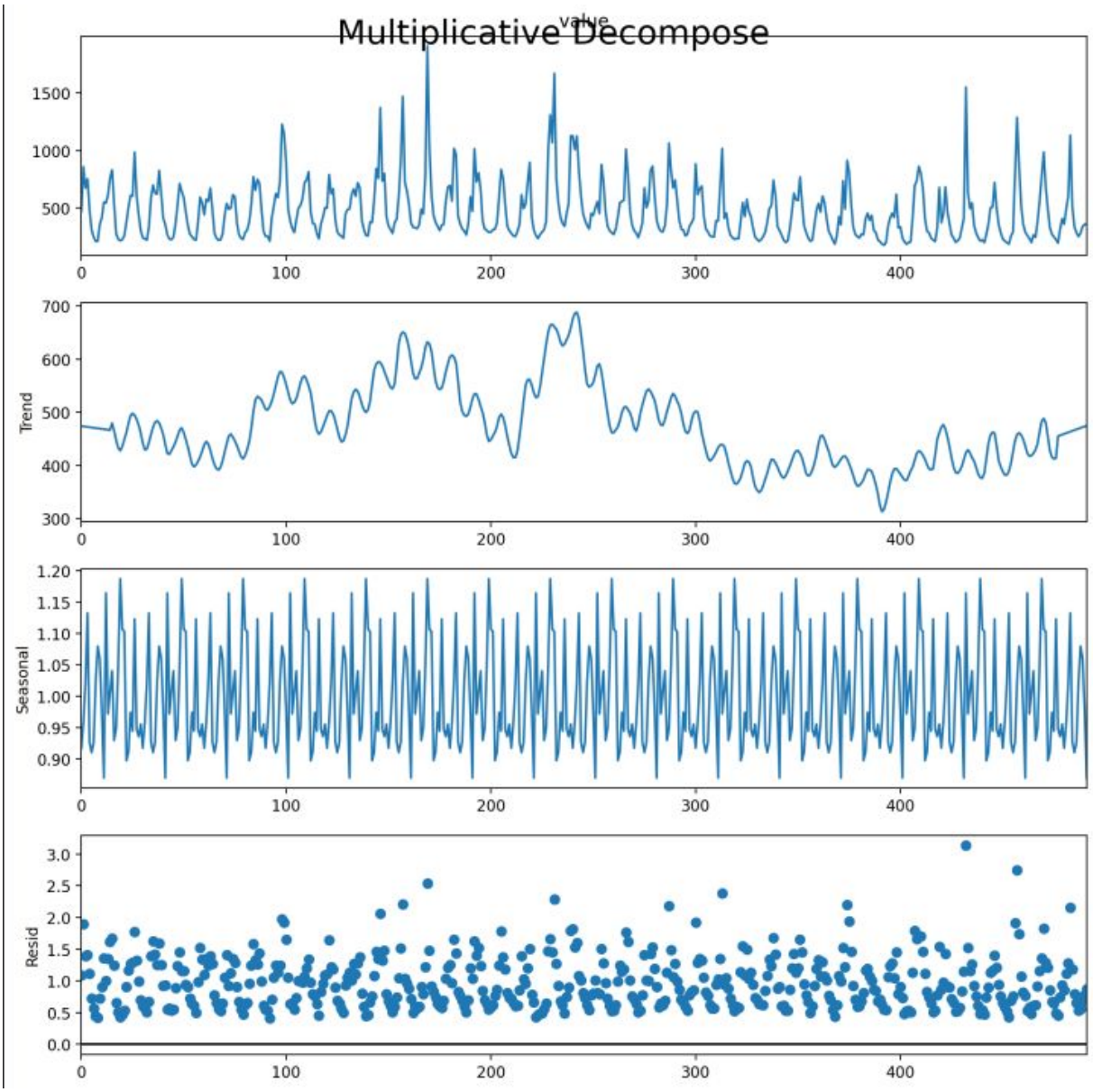


5. Decomposição da série transformada (log), média móvel e desvio padrão da série transformada (log)



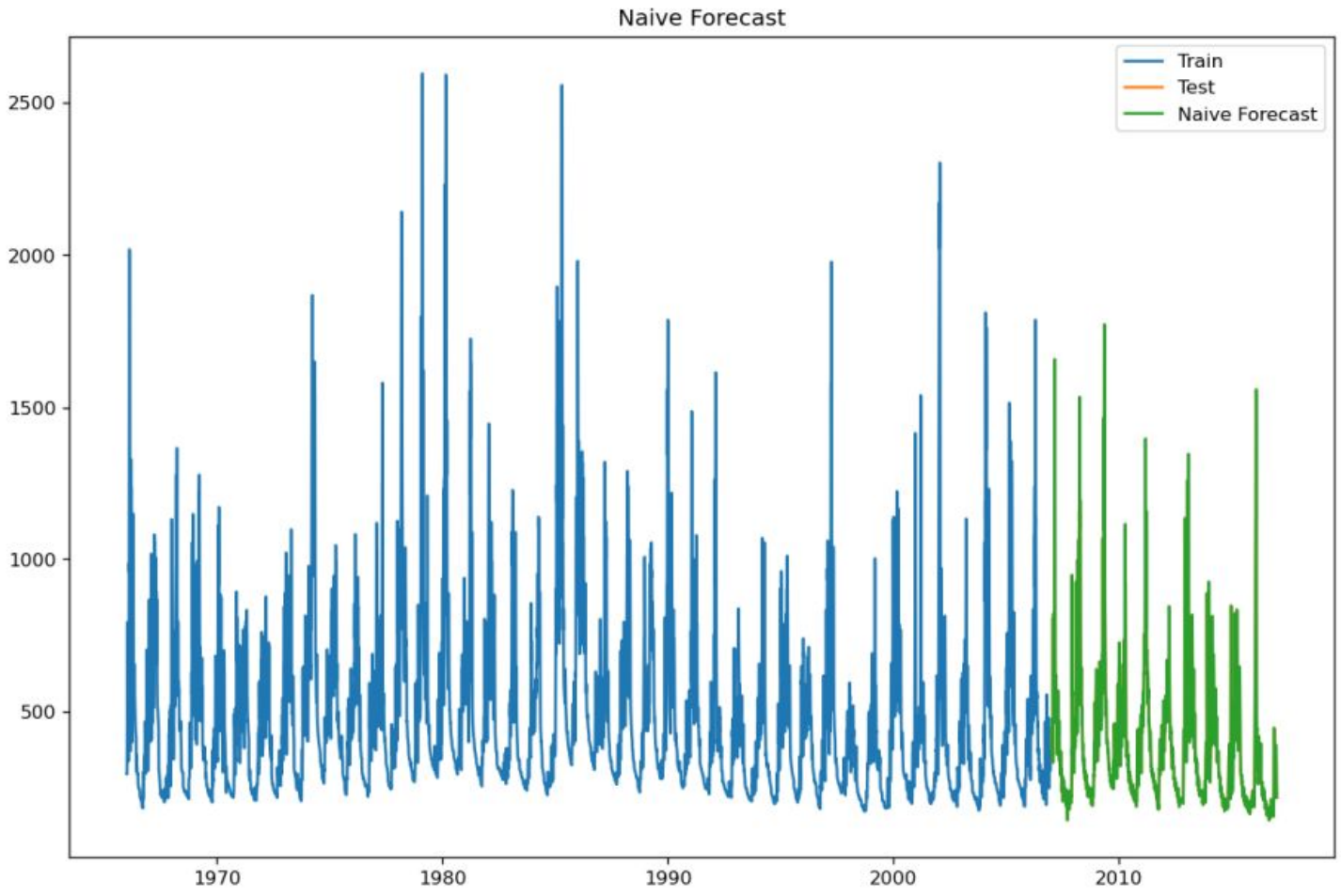
6. Decomposição aditiva e multiplicativa



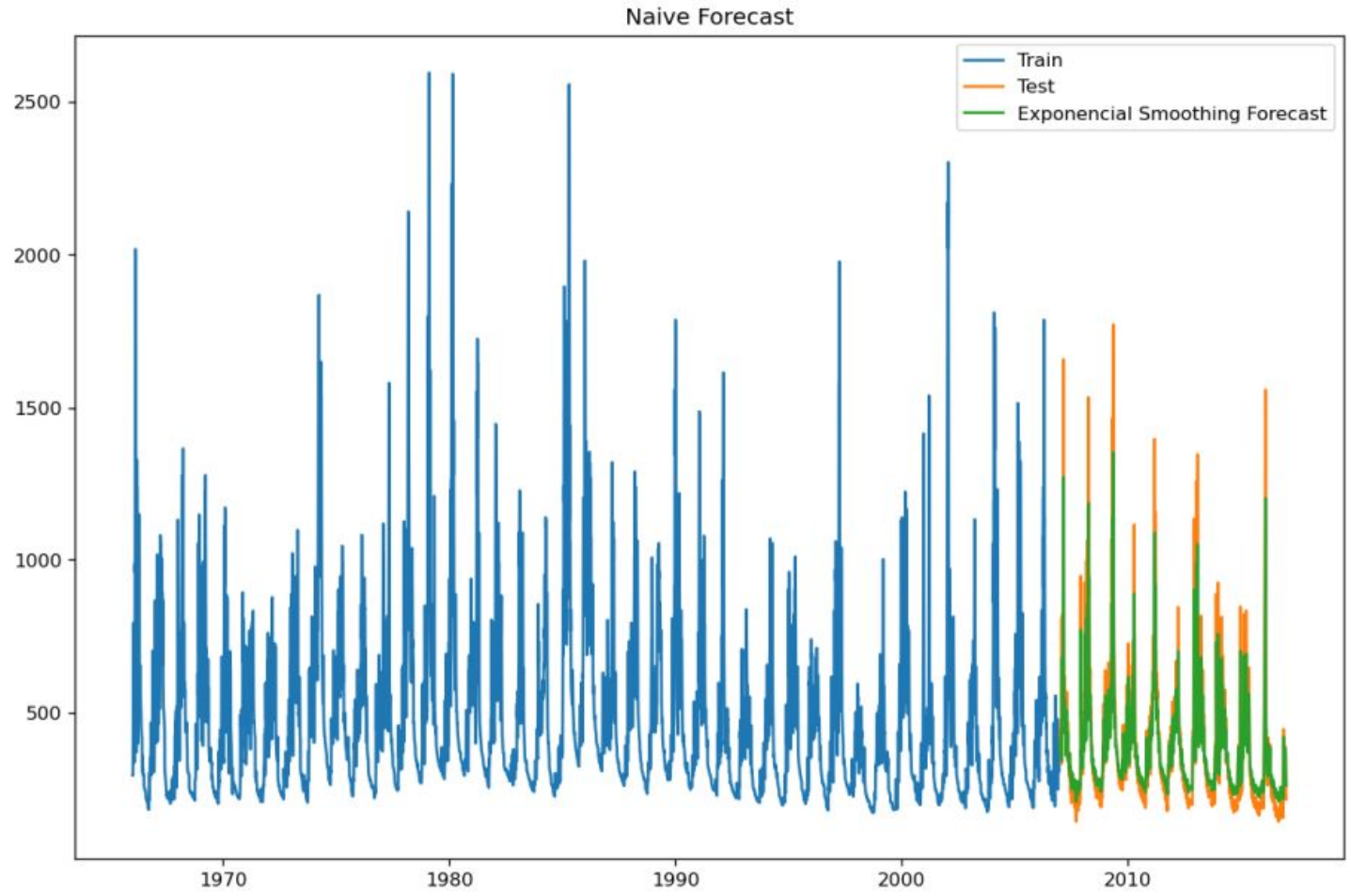

Multiplicative Decompose
value
1500
1000
500
0
100
200
300
400
Trend
700
600
500
400
300
Seasonal
1.20
1.15
1.10
1.05
1.00
0.95
0.90
Resid
3.0
2.5
2.0
1.5
1.0
0.5
0.0

Previsões

1. Modelo trivial de previsão (naive):



2. Suavização exponencial



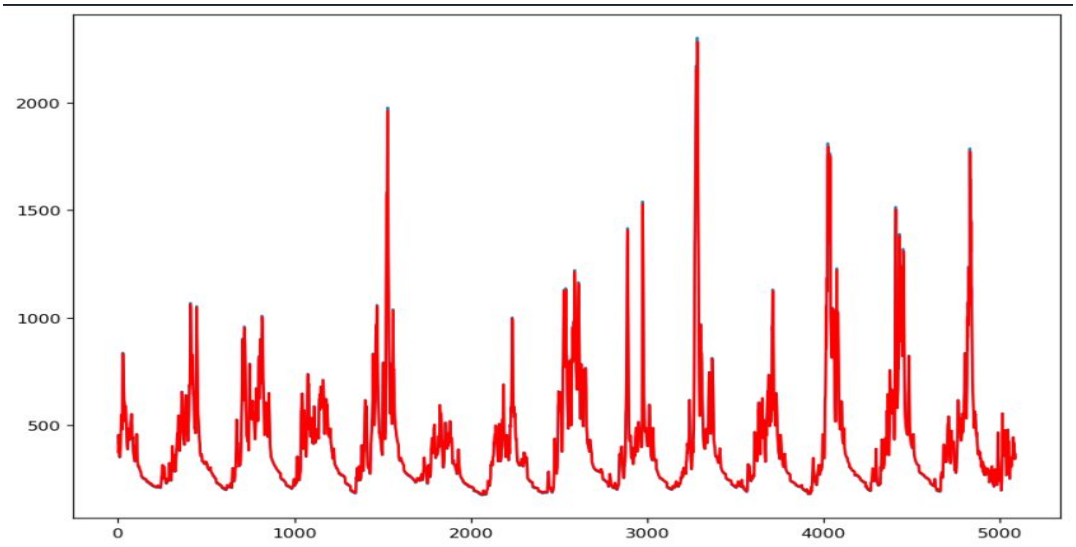
3.

4. Modelo ARIMA

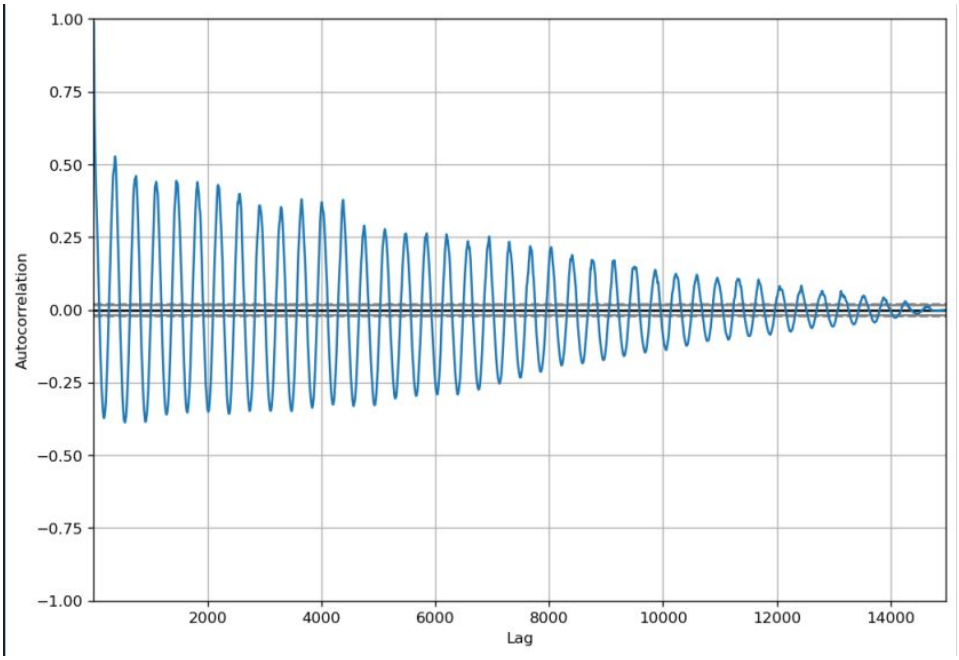
4.1. Resumo do modelo

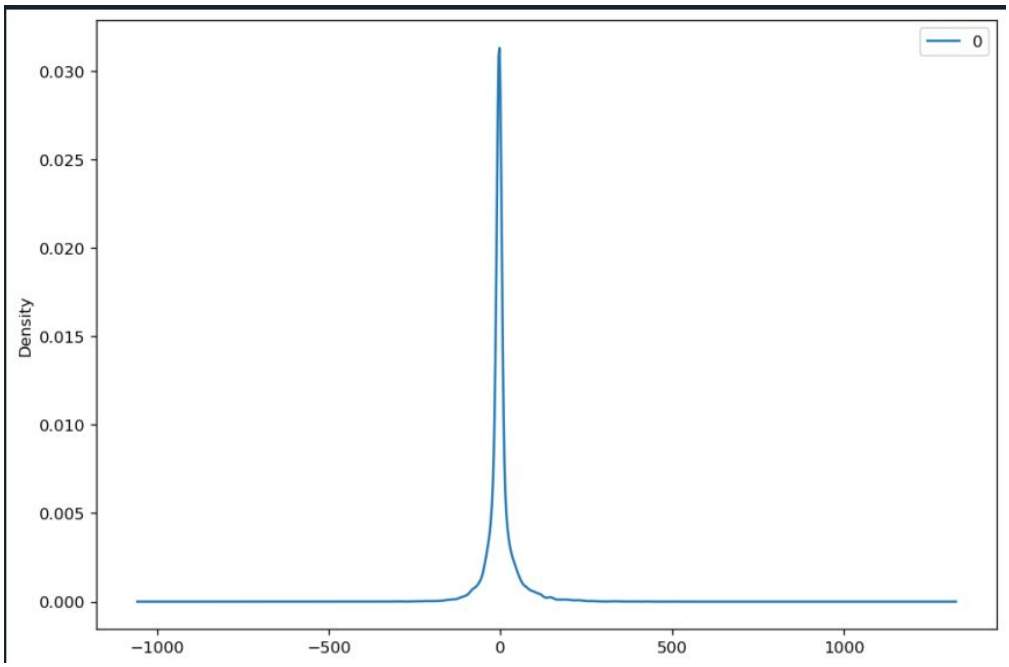
```
                              ARMA Model Results
==============================================================================
Dep. Variable:                  value   No. Observations:                14975
Model:                     ARMA(1, 0)   Log Likelihood              -78052.289
Method:                       css-mle   S.D. of innovations             44.394
Date:                Tue, 03 Nov 2020   AIC                         156110.579
Time:                        20:55:26   BIC                         156133.421
Sample:                  01-01-1966   HQIC                        156118.158
                       - 12-31-2006
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
const        471.0590     28.282     16.656      0.000     415.627      526.491
ar.L1.value    0.9872      0.001    761.998      0.000       0.985       0.990
                                    Roots
=============================================================================
                  Real          Imaginary           Modulus         Frequency
-----------------------------------------------------------------------------
AR.1            1.0129           +0.0000j            1.0129            0.0000
-----------------------------------------------------------------------------
```

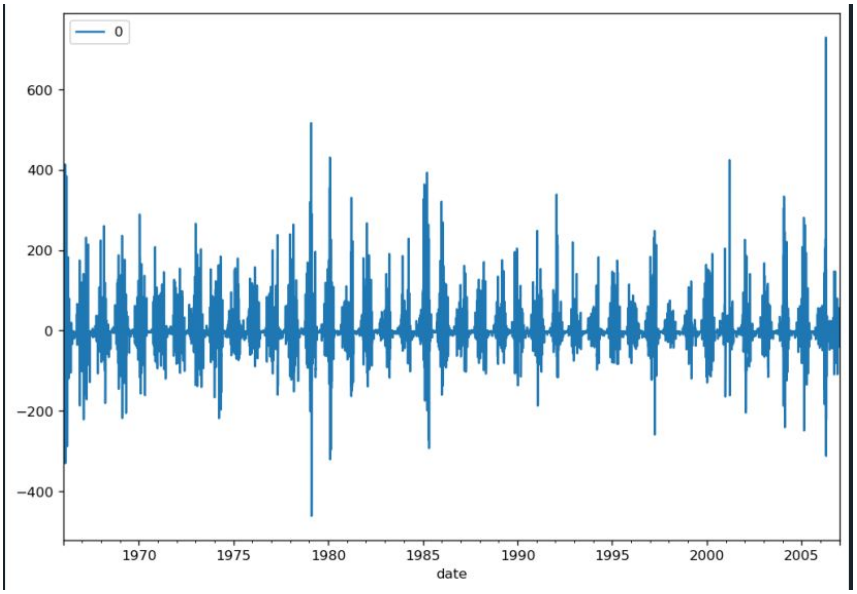
4.2. Previsão



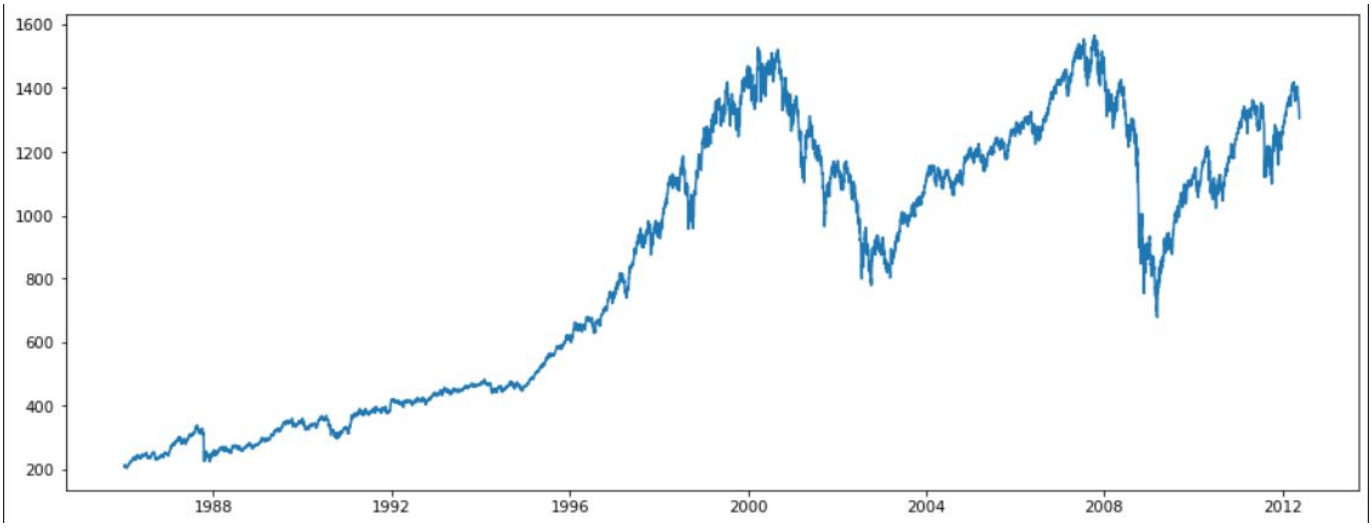
4.2. Gráficos de autocorrelação, resíduos e densidade




0
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Density
−1000
−500
0
500
1000

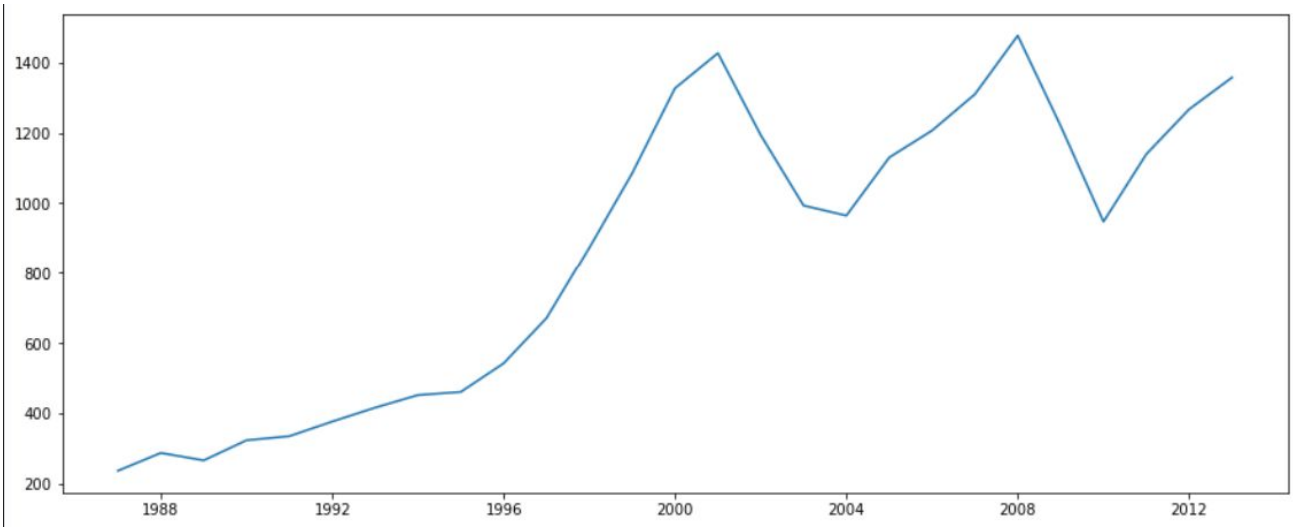

0
600
400
200
0
−200
−400
1970
1975
1980
1985
1990
1995
2000
2005
date

4. Série Financeira(Datasets) - Daniel Almeida

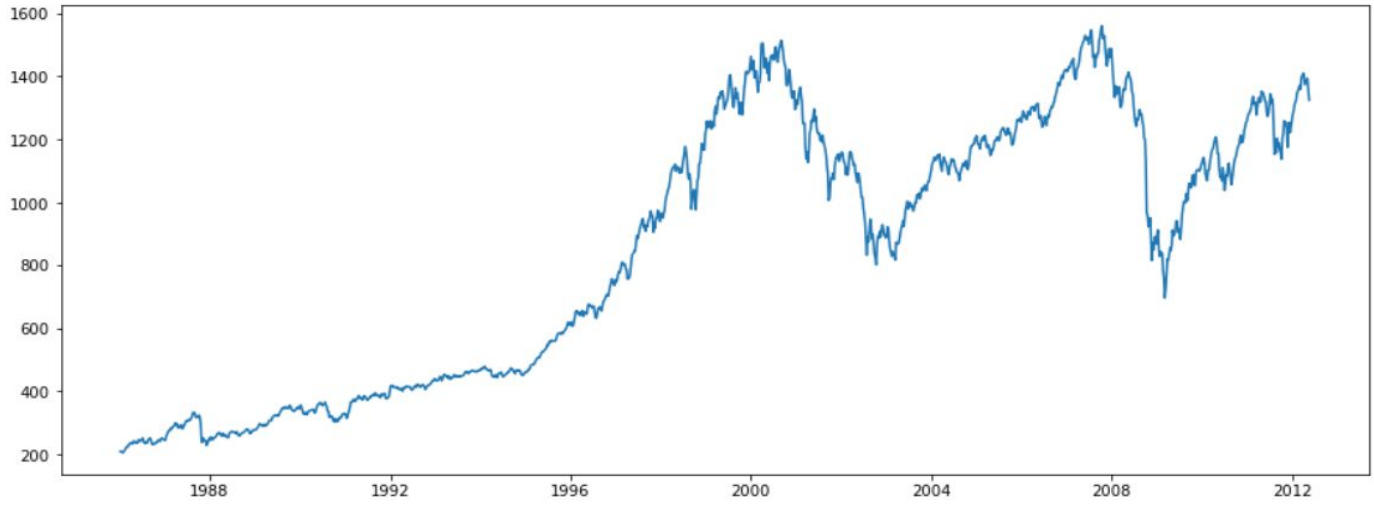


Análise:

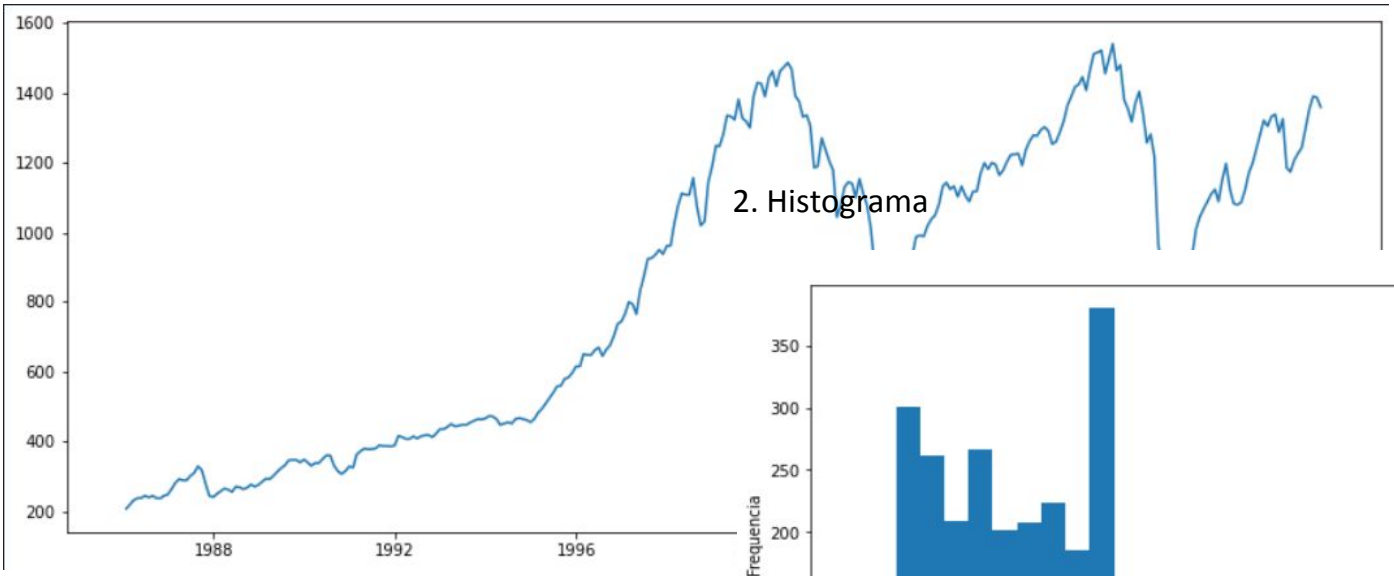
1.Série por ano:



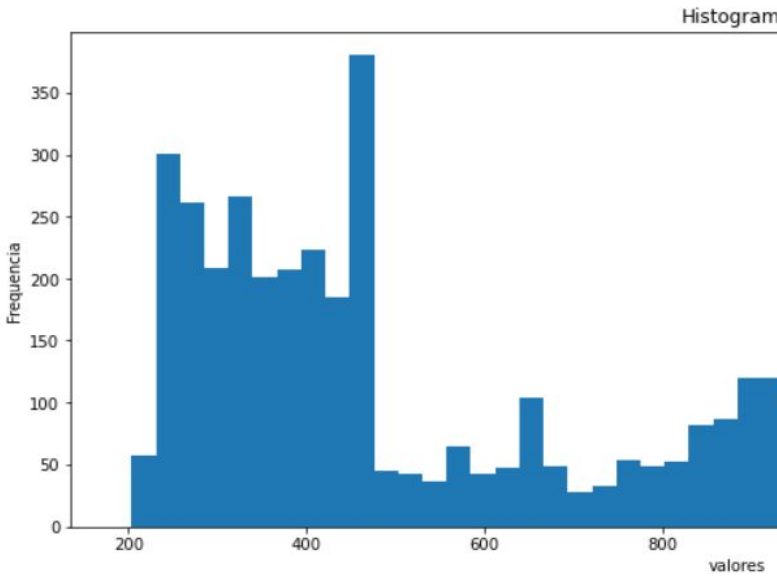
1.Série por semana:



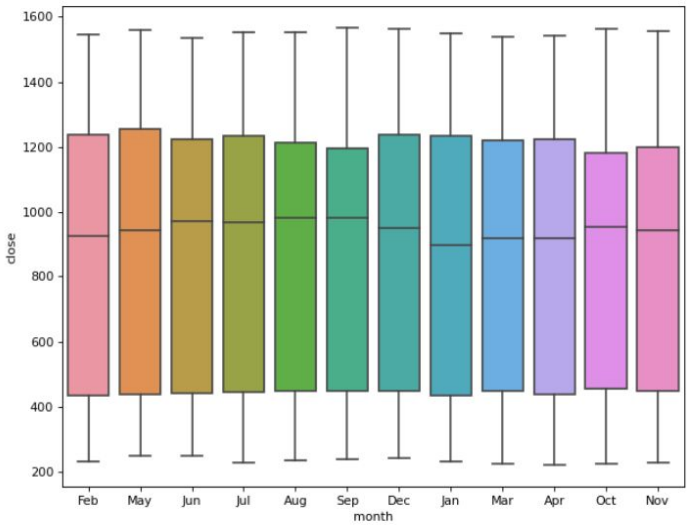
1.Série por mês:



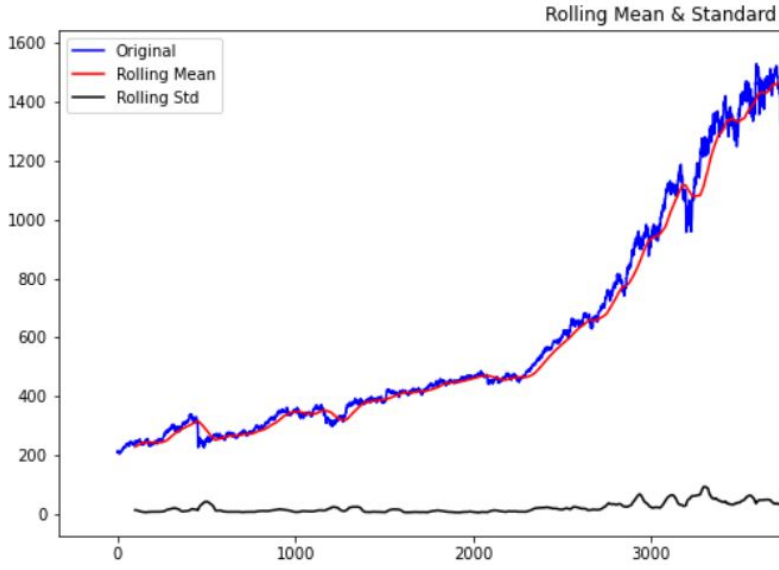
2. Histograma



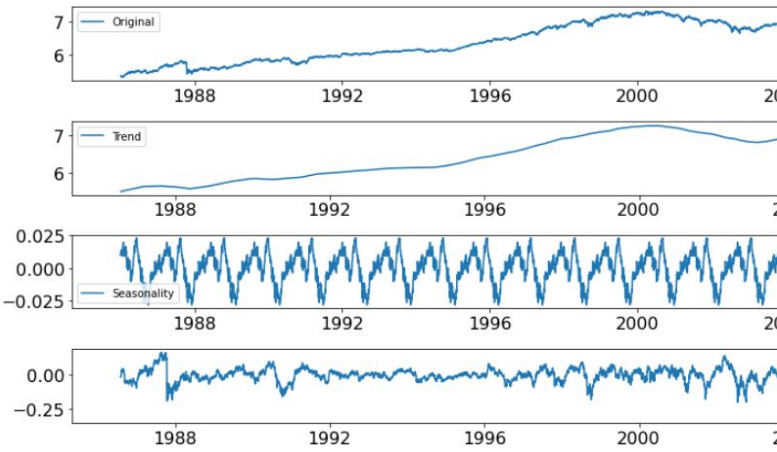
3. Box-Plot(mensal e anual)

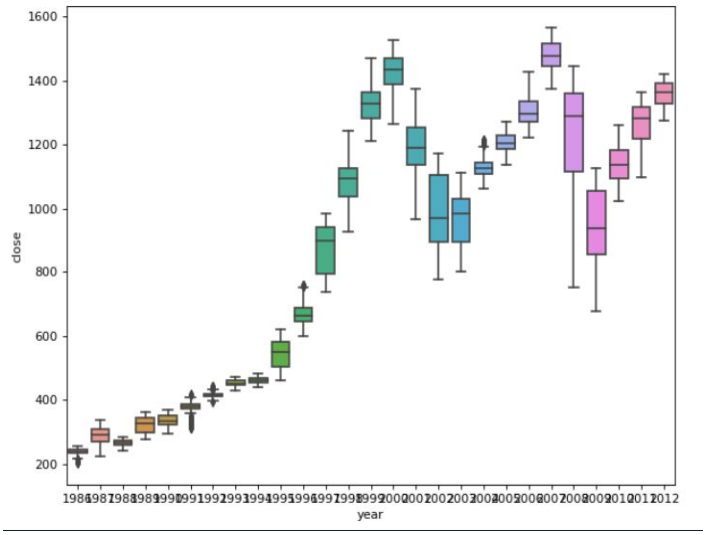


4. Média móvel e Desvio Padrão:

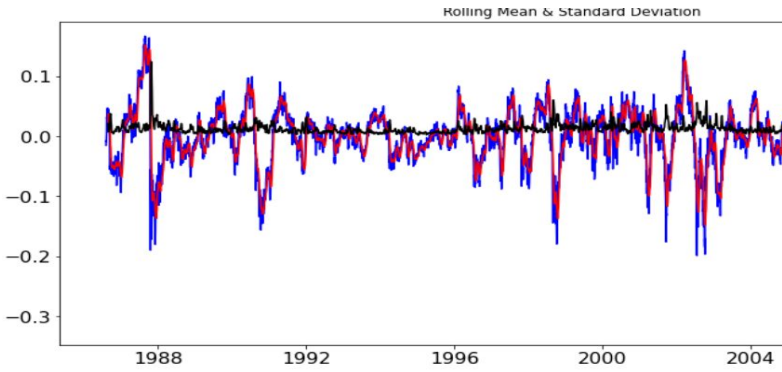


5. Decomposição da série transformada (log)





6. Média móvel e desvio padrão da série transformada (log)



7. Teste de Dickey-Fuller

```
Results of Dickey-Fuller Test:
Test Statistic                  -1.208085
p-value                          0.670108
#Lags Used                      34.000000
Number of Observations Used    6618.000000
Critical Value (1%)              -3.431338
Critical Value (5%)              -2.861977
Critical Value (10%)             -2.567003
dtype: float64

In [4]: runfile('C:/Users/Daniel Souza/Desktop/modelagem/rolli
wdir='C:/Users/Daniel Souza/Desktop/modelagem')
Results of Dickey-Fuller Test:
Test Statistic                  -1.208085
p-value                          0.670108
#Lags Used                      34.000000
Number of Observations Used    6618.000000
Critical Value (1%)              -3.431338
Critical Value (5%)              -2.861977
Critical Value (10%)             -2.567003
dtype: float64
```

Através desse teste, pode-se afirmar que a série é não-estacionária, já que o valor do teste é maior do que os valores críticos.

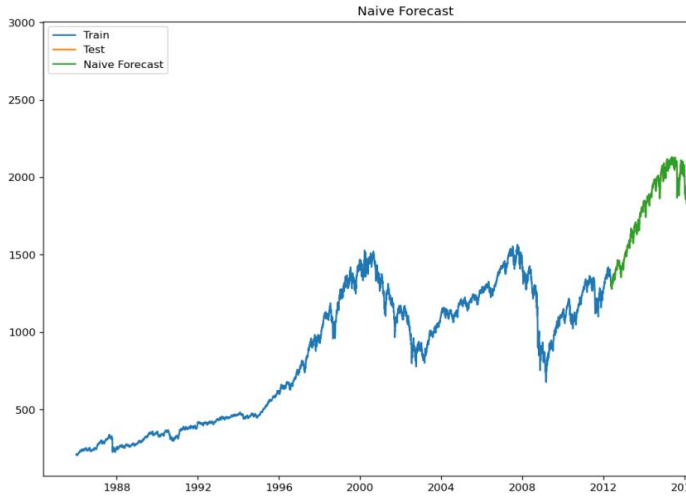
8. Teste de Dickey-Fuller para a série transformada(log)

```
Results of Dickey-Fuller Test:
Test Statistic                  -1.769431
p-value                          0.395741
#Lags Used                      34.000000
Number of Observations Used    6618.000000
Critical Value (1%)              -3.431338
Critical Value (5%)              -2.861977
Critical Value (10%)             -2.567003
dtype: float64
```

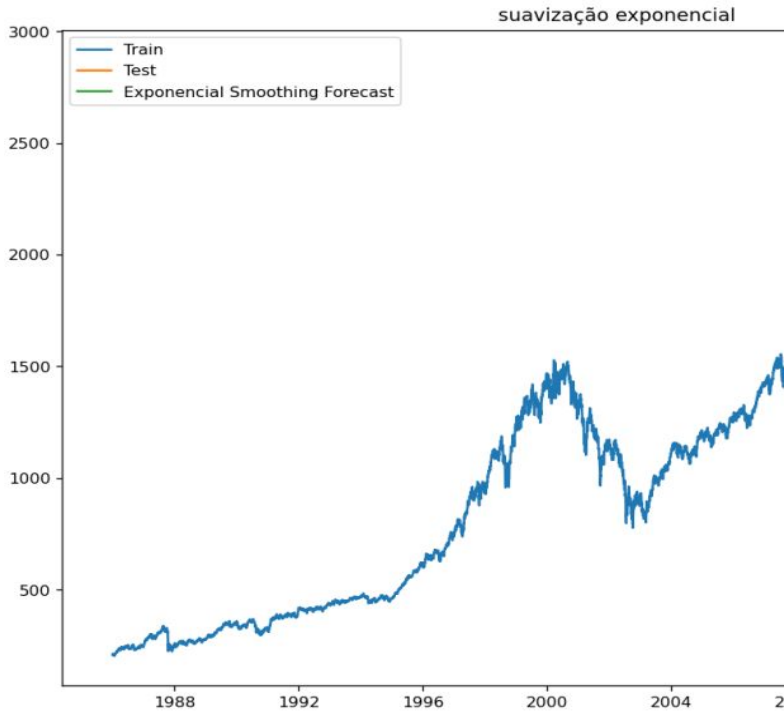
Mesmo utilizando a transformada percebe-se que a série continua não-estacionária, já que o test statistic é maior que os valores críticos.

Previsões

1. Modelo trivial de previsão (naive):

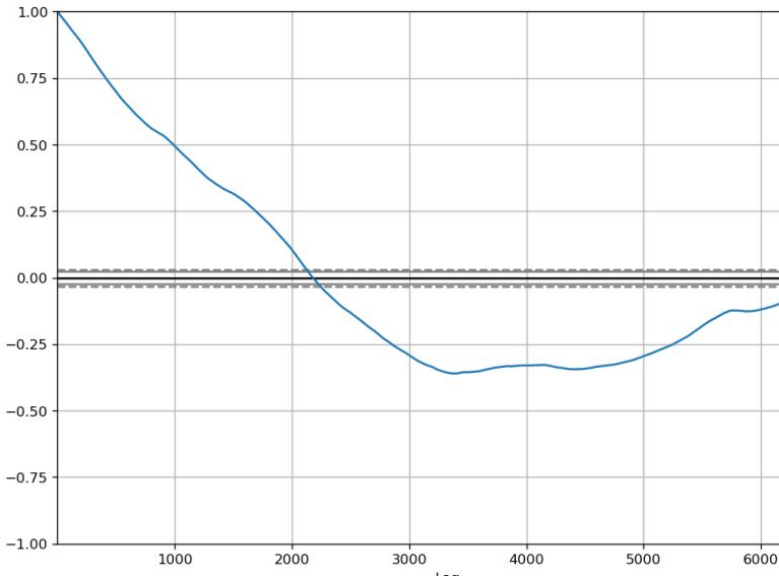


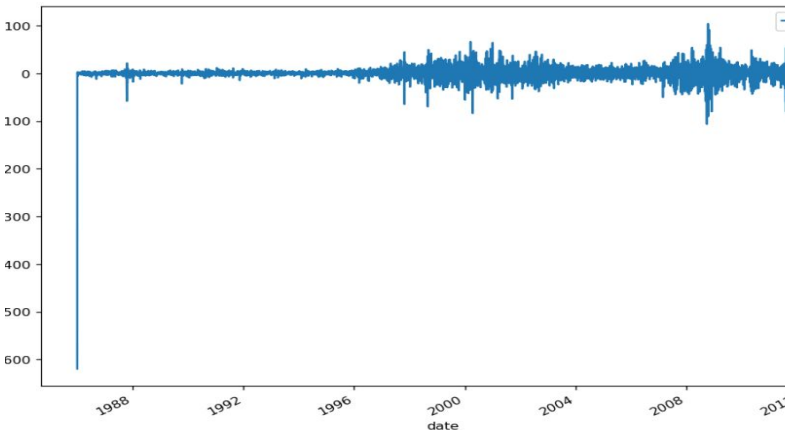
2. Modelo suavização exponencial

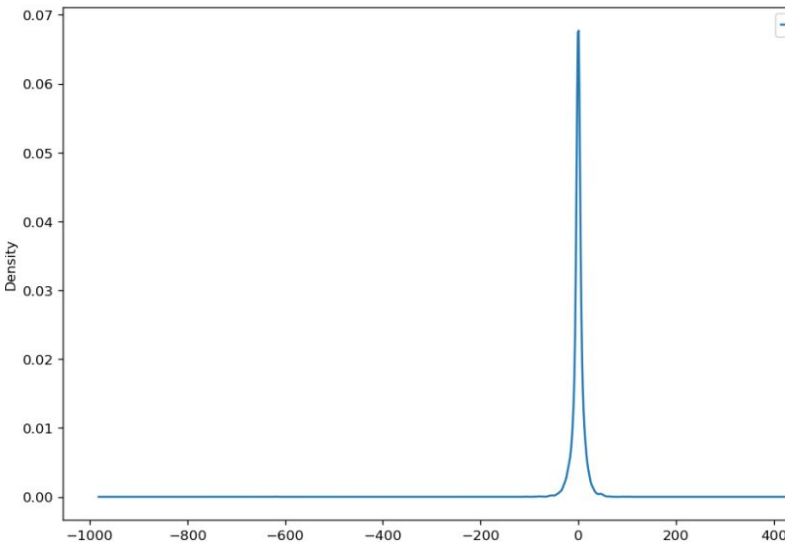


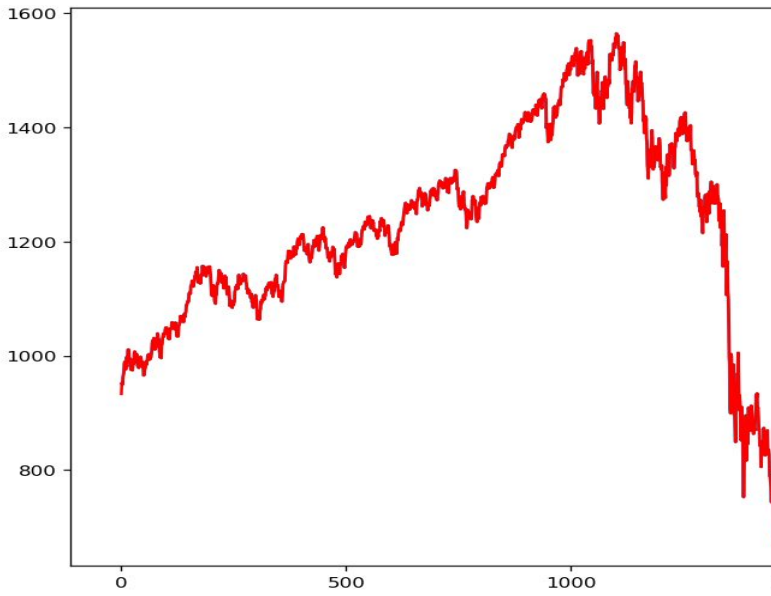
4. Modelo Arima:

4.1. Gráficos de autocorrelação, resíduos e densidade









Resumo modelo ARIMA:

```
                              ARMA Model Results
==============================================================
Dep. Variable:                   close   No. Observation
Model:                     ARMA(1, 0)   Log Likelihood
Method:                       css-mle   S.D. of innovat
Date:                Tue, 03 Nov 2020   AIC
Time:                        22:09:55   BIC
Sample:                             0   HQIC

==============================================================
                 coef    std err          z      P>|z|
--------------------------------------------------------------
const         829.1386    331.346      2.502      0.012
ar.L1.close     0.9997      0.000   3798.206      0.000
                                    Roots
==============================================================
                 Real          Imaginary           Mod
```