Time Series
Electronic Production

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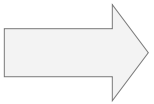
Mean and Median Electric Production Every Three Months

Tools: Google Spreadsheet (**Pivot table**)

The original data is **Electric_Production.csv** and the result of the pivot table is **Pivot_Table_Electric_Production.csv**

	A	B
1	DATE	IPG2211A2N
2	1/1/1985	72.5052
3	2/1/1985	70.672
4	3/1/1985	62.4502
5	4/1/1985	57.4714
6	5/1/1985	55.3151
7	6/1/1985	58.0904
8	7/1/1985	62.6202
9	8/1/1985	63.2485



	A	B	C
1	*Date - Year-Quarter*	AVERAGE of Electric Production	MEDIAN of Electric Production
2	1985-Q1	68,5425	70,6720
3	1985-Q2	56,9590	57,4714
4	1985-Q3	62,1511	62,6202
5	1985-Q4	61,0101	58,0005
6	1986-Q1	67,8382	67,9869
7	1986-Q2	57,5824	57,0329
8	1986-Q3	63,7492	64,4816
9	1986-Q4	61,6698	59,3417

02

Stationary Test

Tools: Python, the complete code can be looked at
Time Series Electric Production.ipnyb

```python
#Stationary test for mean data
print('Stationary test for mean data')
time_series = df['Mean of Electric Production']
#ADF test
result = adfuller(time_series)
p_value = result[1]
print("p-value:", p_value)
#Check the p-value against a significance level (e.g., 0.05) to make a decision
if p_value <= 0.05:
    print("The time series is stationary (reject H0).")
else:
    print("The time series is non-stationary (fail to reject H0).")


#Stationary test for median data
print('Stationary test for median data')
time_series = df['Median of Electric Production']
#ADF test
result = adfuller(time_series)
p_value = result[1]
print("p-value:", p_value)
#Check the p-value against a significance level (e.g., 0.05) to make a decision
if p_value <= 0.05:
    print("The time series is stationary (reject H0).")
else:
    print("The time series is non-stationary (fail to reject H0).")
```

Stationary Test Result

```
Stationary test for mean data
p-value: 0.010744380138396811
The time series is stationary (reject H0).
Stationary test for median data
p-value: 0.025118743593809674
The time series is stationary (reject H0).
```

The data is **stationary**, so we can continue to do forecasting

03

Forecasting

Tools: Python, the complete code can be looked at
Time Series Electric Production.ipnyb
In this powerpoint, we discuss the mean electric production every three months data

First, choose the best model **ARIMA/ARMA/MA**, by choosing the smallest RMSE

```
RMSE ARIMA Model:  20.06012630106035
RMSE ARMA Model:  10.294734842533138
RMSE MA Model: 4.228275975288996
```

Choose **MA** model, since it has the smallest RMSE.

MA Summary

SARIMAX Results

Dep. Variable:	y	No. Observations:	133
Model:	ARIMA(0, 0, 1)	Log Likelihood	-528.162
Date:	Fri, 28 Jul 2023	AIC	1062.324
Time:	15:17:30	BIC	1070.995
Sample:	0	HQIC	1065.848
	- 133		
Covariance Type:	opg		

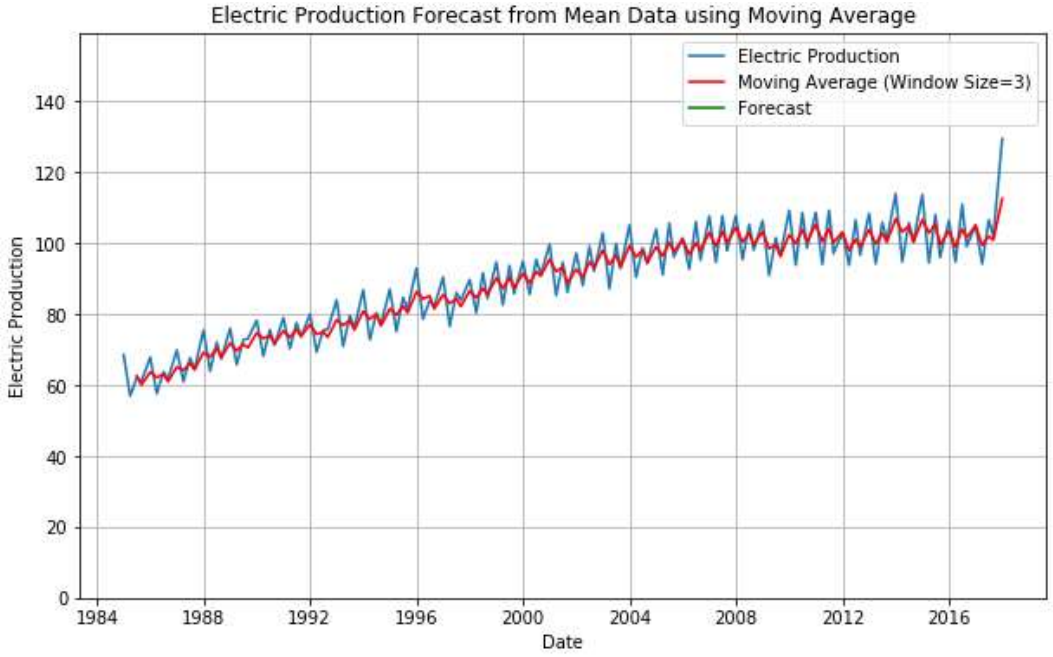
	coef	std err	z	P>|z|	[0.025	0.975]
const	89.1148	1.850	48.176	0.000	85.489	92.740
ma.L1	0.3283	0.160	2.046	0.041	0.014	0.643
sigma2	164.6049	23.929	6.879	0.000	117.705	211.504

Ljung-Box (Q):	1272.80	Jarque-Bera (JB):	1.73
Prob(Q):	0.00	Prob(JB):	0.42
Heteroskedasticity (H):	0.91	Skew:	0.12
Prob(H) (two-sided):	0.75	Kurtosis:	2.50

Our **model** is

$$X_t = c + \epsilon_t + 0.3283\epsilon_{t-1}$$

Forecasting in 6 Months



Forecast Electric Production Based on Mean Data for 2018-07-01 is 112.62063333333333

The electric production in 6 months is **112.6206** based on **MA Model**

Thank You.