
Project 1
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Problem 1

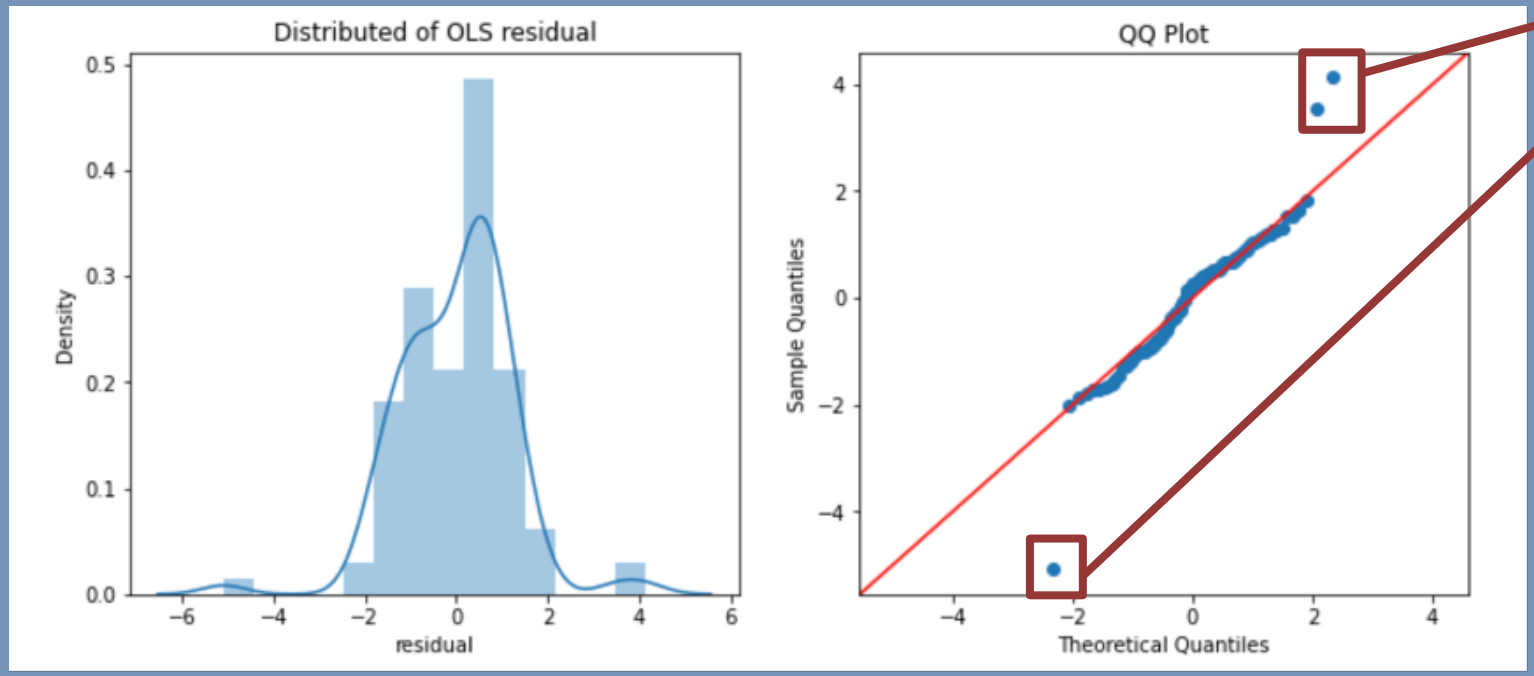
- Use Stat package (stats.skew(data), stats.kurtosis(data))
  - *skewness : - 0.17526772024433832*
  - *kurtosis : - 0.1554047077420786*
- Our function (unbiased)

$$Skewness = E\left[\left(\frac{X-\mu}{\sigma}\right)^3\right], \qquad kurtosis = E\left[\left(\frac{X-\mu}{\sigma}\right)^4\right] - 3$$

  - *skewness : - 0.17264528797569992*
  - *kurtosis : - 0.2120121540580113 3*

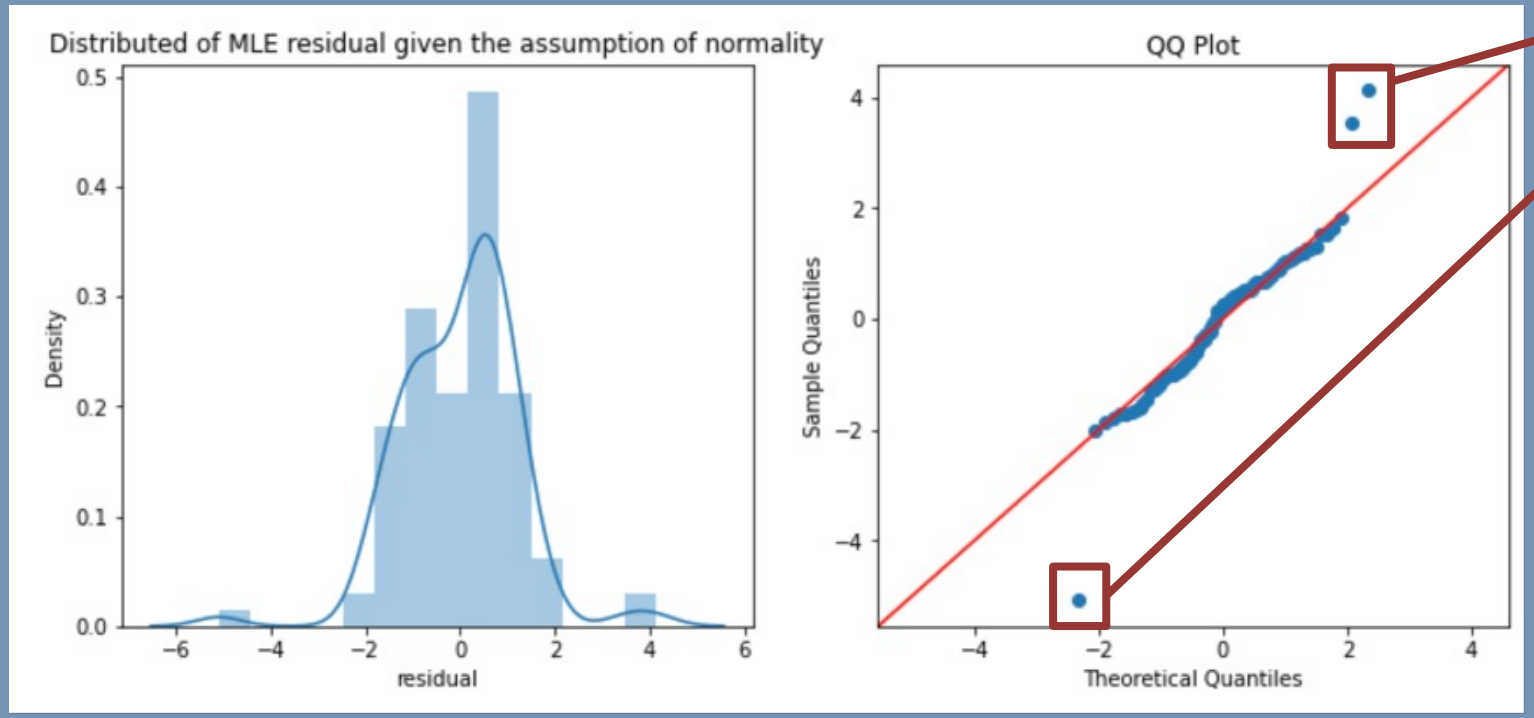
Problem 2

- Fit data using OLS (use package statsmodels.formula)



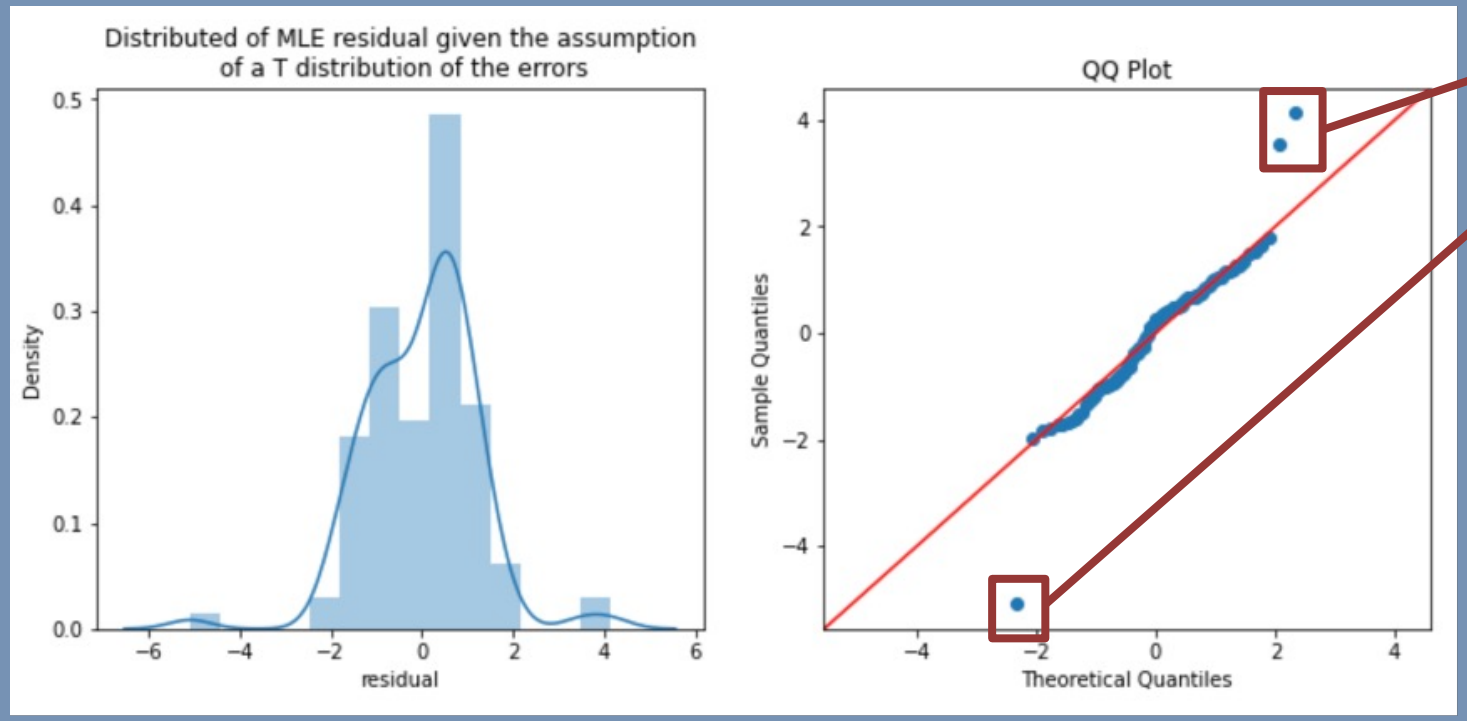
Problem 2

- Fit data using MLE given assumption of normality



Problem 2

- Fit data using MLE given assumption of a T distribution of the errors



Problem 2

- Summary

	regression intercept	regression slope	MSE
OLS	0.119836	0.605205	1.436148
MLE given the assumption of normality	0.119836	0.605205	1.436148
MLE using the assumption of a T distribution of the errors	0.123685	0.595034	1.436261

- The regression parameters and MSE are the same
- Fit the MLE using the assumption of a T distribution of the errors has the highest MSE and is the worst fitting method.
- All three methods are breaking of the normality assumption in regards to expected values in this case, which means that the prediction results of the model are not accurate enough, there may be potential model bias, or the assumption of the model may be incorrect.

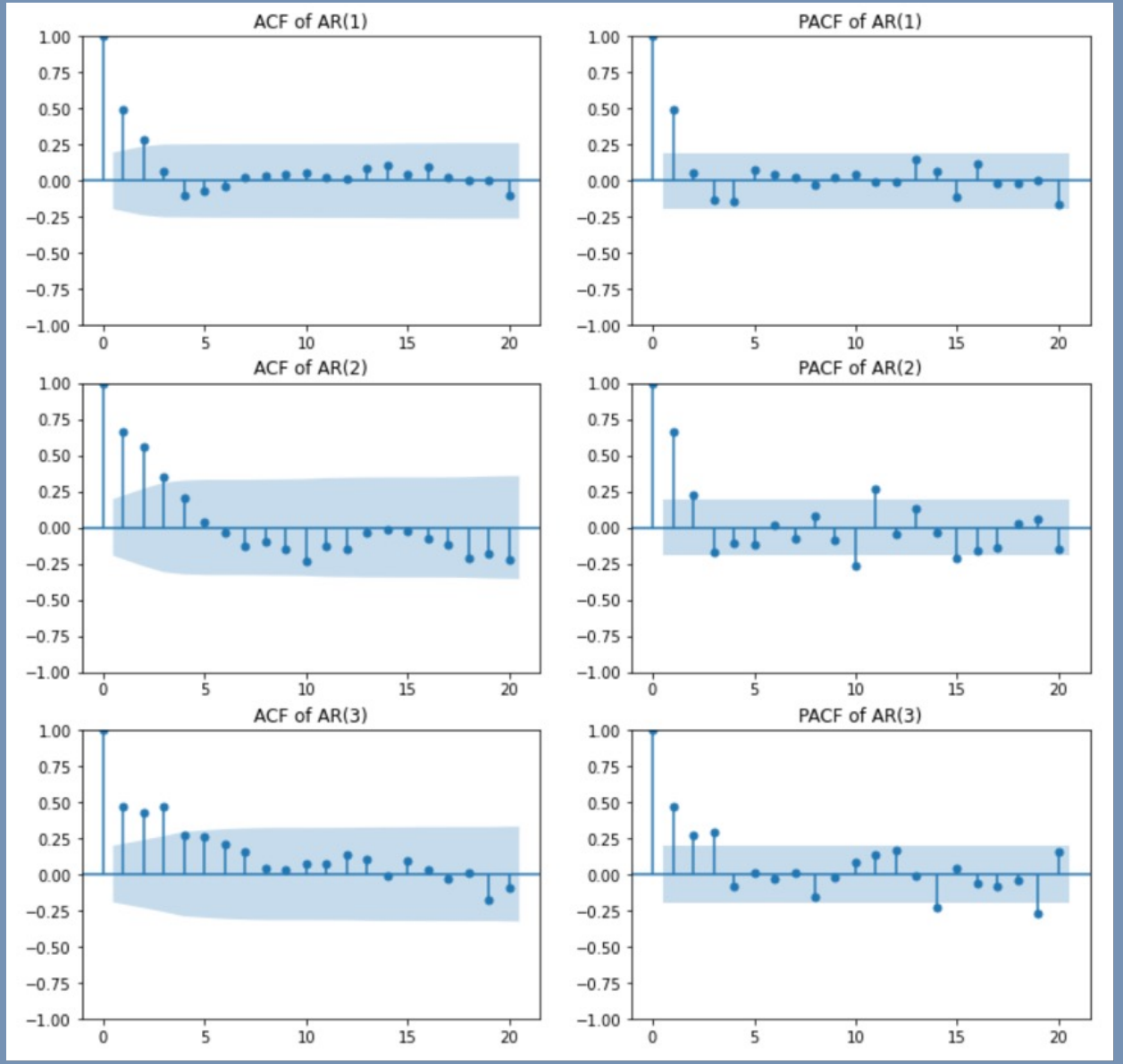
Problem 3

- AR

- ACF graph shows an exponential decay
- PACF graph shows a sharp cut-off after the order of the process

For example:

- ACF graph for AR(2) process shows an exponential decay, with the lag- 1 and lag-2 autocorrelation coefficients being the highest.
- PACF graph shows a sharp cut-off after lag-2, indicating that only the lag-1 and lag-2 autocorrelations are significant.



Problem 3

- MA

- ACF graph shows a sharp cut-off after the order of the process
- PACF graph shows an exponential decay

For example:

- ACF graph for MA(2) process shows a sharp cut-off after lag-2, indicating that only the lag-1 and lag-2 autocorrelations are significant
- PACF graph shows an exponential decay, with the lag- 1 autocorrelation coefficient being the highest.