

[Frequently Asked Questions]

Autocorrelation

Subject:

Business Economics

Course:

Paper No. & Title:

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B. A. (Hons.), 5th Semester, Undergraduate

Paper – 531 Elective Paper Q1 – Advanced Econometrics

Unit – 1 Relaxing the Assumptions of The Classical Linear Model

Lecture No. & Title:

Lecture – 5 Autocorrelation

Frequently Asked Questions

Q1. What do you mean by the term autocorrelation?

A1. Autocorrelation occurs when in the case of linear models under heteroscadastic situation, any pair of disturbance is found to be correlated by means of the first order autoregressive scheme.

Q2. How can we detect autocorrelation graphically?

A2. If we plot the value of u_t or \hat{u}_t against time, we can find either linear or curvilinear trend of variational pattern arising due to autocorrelation.

Q3. Which reasons are accountable for the phenomena of autocorrelation?

A3. In practice autocorrelation occurs due to some of the reasons like inertia of data, manipulation of data, specification bias, incorrect specification of the model, cobweb phenomena, due to lag structure of the model etc.

Q4. What is serial correlation and autocorrelation?

A4. In linear models, for the expression presented by $u_t = \rho U_{t-1} + \epsilon_t$ (with usual assumptions for the term ϵ_t) ρ is called autocorrelation coefficient of the first order or serial correlation, in general $\rho_s = \rho^s$ where $\rho_s =$ Autocorrelation coefficient of order S and when s = 1, $\rho_s = \rho$ which is serial correlation coefficient.

Q5. What happens if we ignore the presence of autocorrelation in the model and analyse the problem?

A5. If we undermine the effect due to autocorrelation and use least squares by OLS (or GLS) method the variance of the regressors remain underestimated.

Q6. What is the formula for DW test statistic? How it is related with serial correlation?

A6. DW test statistic is given by the formula $d = \frac{\sum_{i=2}^{n} (e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}$

Where e_i = error term for i^{th} observation an approximation gives $d \approx 2(1 - \rho^*)$

Where $\rho^* = Estimate of \rho$ given by $\sum_{i=2}^{n} e_i e_{i-1} / \sum_{i=1}^{n} e_i^2$

Also we can find approximate estimate of ρ given by ρ^* as $\rho^* \approx 1 - \frac{d}{2}$,

d = DW statistic

Q7. What is minimum and max value d Statistic? How can you take an abrupt decision beased upon d?

A7. d lies between 0 and 4

(I) If d is very near to 2, there is no positive autocorrelation

(II) If d is very close to 0, there is positive autocorrelation (perfect if d = 0)

(III) If d is near to 4, negative autocorrelation (Perfect if d = 4)

Q8. What is generalised difference equation? How it can be useful as remedial measure?

A8. For the case of two variable model

$$Y_t = \beta_1 + \beta_2 X_t + U_t$$

with $U_t = \rho U_{t-1} + \epsilon_t$ with usual assumptions,

We can obtain the equation as

 $Y_t - \rho Y_{t-1} = \beta_1 (1 - \rho) + \beta_2 (X_t - \rho X_{t-1}) + \epsilon_t$

If ρ is known then we can run this regression and estimate β_1 and β_2 .

Here first observation of X and Y series are lost. We can take it as $X_1\sqrt{1-\rho^2}$ and $Y_1\sqrt{1-\rho^2}$.

Q9. What is Theil Nagar formula?

A9. A relation given by $\widehat{\rho} = \frac{n^2 \left(1 - \frac{d}{2}\right) + K^2}{n^2 - K^2}$

Where n = Sample size, d = DW statistic, k = Number of Coefficients including intercept term is called Theil Nagar formula

It gives an estimate of serial correlation coefficient ρ .

Q10. What is Conchran Orcutt iterative procedure?

A10. It is a method to solve the problem of autocorrelation, when ρ is unknown.

We use successive iterations using basic model AR relation and GDE to obtain actual estimate of ρ and hence ran the regression. In a finite number of steps we can complete this operation. However there are other modified methods like Cochran – Orcutt two stage iterative procedure , Durbin's two step method of estimating and etc. which can be used as remedial measures to tackle the problem of auto correlation.