

Elements of Econometrics. 2022-2023.

Class 18. Autocorrelation

Problem 1. (Theoretical exercise). Explain how autocorrelation of the first order is defined. And what about autocorrelation of the second order? Is some sense in the autocorrelation of the higher order?

Problem 2. (Theoretical and practical exercise). How the autocorrelation could be detected using residual plot? What is the difference in residual plot under positive and negative autocorrelation?

In all practical exercises of this class file EXPEND.WF1 is used.

Problem 3. (Theoretical exercise). How specification errors can cause autocorrelation? How to distinguish between true and false autocorrelation?

Problem 4. (Practical exercise). What are symptoms and consequences of the autocorrelation when estimating regressions? Illustrate topics discussed in Problem 1 and Problem 2 using regression of the expenditures on clothes (CLOT) and houses (HOUS) on disposable personal income (DPI).

Problem 5. (Theoretical exercise). Explain what you understand by the Durbin-Watson test. Under what conditions DW test could be done? Why is it important in econometrics? What advantages and disadvantages of this test?

Problem 6. (Theoretical exercise). Explain why DW statistic close to 2 indicates on the probable absence of the autocorrelation. Explain why DW statistic close to 0 indicates on the probable presence of the autocorrelation. What does it mean if DW is close to 4?

Problem 7. (Practical exercise). How to do this test in practice in case of positive and negative autocorrelation. Use DW tables to test for autocorrelation. Illustrate topics discussed here using regression of the expenditures on houses (CLOT) on disposable personal income (DPI).

Problem 8. (Theoretical exercise). How to evaluate autoregression coefficient? What are the problems connected with this?

Problem 9. (Theoretical exercise). What is Durbin h-test? How to use Durbin h-statistic to test for autocorrelation?

Problem 10. (Practical exercise). Illustrate using Durbin h-statistic to test for autocorrelation.

Problem 11. (Theoretical exercise). Describe Breusch–Godfrey test for autocorrelation of the first order

Problem 12. (Theoretical exercise). Describe Breusch–Godfrey test for autocorrelation of the higher order

Problem 13. (Practical exercise). Illustrate Breusch–Godfrey test for autocorrelation of different orders

Real Problems from London and ICEF exams

Problem 14. Consider a two variable regression model

$$Y_t = \hat{a}_1 + \hat{a}_2 X_t + u_t; \quad t = 1, 2, \dots, T$$

where $u_t = \rho u_{t-1} + \varepsilon_t$ for all t , $E(\varepsilon_t) = 0$, $E(\varepsilon_s \varepsilon_t) = \sigma_\varepsilon^2$ if $s = t$ and $E(\varepsilon_s \varepsilon_t) = 0$ if $s \neq t$

Derive:

- (i) the variance of u_t and
- (ii) $E(u_t u_{t-1})$.

Problem 15. The following set of models for the demand for holidays abroad by UK residents produced the estimates:

	I	II	III
<i>EXCH</i>	0.226 (0.19)	0.338 (0.40)	1.127 (0.95)
<i>RDISPY</i>	0.240 (8.65)	0.232 (10.46)	0.147 (2.60)
<i>HOL</i> ₋₁	-	-	0.66 (3.20)
<i>TEMP</i>	-	-0.792 (1.61)	-0.592 (1.11)
<i>RAIN</i>	-	0.0045 (2.74)	0.0042 (2.37)
Constant	19.436 (2.11)	26.43 (2.74)	-461.91 (0.91)
R^2	0.60	0.67	0.68
Adjusted R^2	0.57	0.65	0.65
<i>Dw</i>	0.71	1.71	2.25
N	20	19	19

(figures in brackets are *t* values) and where

HOL is the number of overseas holidays taken by UK residents in the current year.

EXCH is the average exchange rate (\$/£)

RDISPY is the real disposable income at 1980 prices

HOL₋₁ is the number of holidays taken by UK residents in the previous year

TEMP is the mean daily temperature in the UK in the previous year

RAIN is the annual level of rainfall in the UK in the previous year

N is the sample size, *dw* is the Durbin - Watson statistic.

- (a) Interpret the estimated equations. Why is the sample size different for model I?
- (b) The coefficient on *RAIN* is very small. Does this suggest that *RAIN* is not important? Explain your answer.
- (c) The researcher suspects that autocorrelation of disturbance term might be a problem here in models I, II, III. Perform appropriate tests paying attention to the proper assumptions.
- (d) Which of the 3 models do you prefer as an explanation of the demand for holidays abroad and why?