Assignments for:
'Econometrics, Theory and Applications with EViews'

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Contents

1 Introduction

In the cases that are introduced in the book 'Econometrics, Theory and Applications with EViews', it is possible to simulate a quantitative economic research project. A number of data sets are available on the companion website of the book. The book has been written as an econometric course to learn doing empirical econometric research in a correct way. That is the main feature of the book. Therefore, mathematical or statistical exercises have not been included in the book so far.

However, in addition to these cases it can be useful to look at some assignments at the end of a chapter. In the book's introduction a statement has been made that econometrics is not mathematics. Econometrics uses mathematical and statistical methods that are necessary to study econometrics. Therefore it is not interesting to do mathematical or statistical exercises without any benefit for a better understanding of econometrics. But sometimes, it is possible to formulate assignments that give students a checklist to be sure that they understand the discussed topics of that chapter well. Secondly, it is sometimes useful to let them perform calculations that can contribute to a better understanding of the computational aspects of some econometric methods that normally are done by the computer when doing real quantitative economic research. For the purpose of these points this supplement has been written. A companion instructor's manual with solutions or directions is available. For the above mentioned objectives it is not necessary to provide a large number of exercises as sometimes can be found in other econometric textbooks. Therefore this supplement to the book supplies only a limited number of assignments with the intention as formulated above.

The assignments that have been formulated are either real exercises or form a checklist for the student with respect to his understanding of subjects that have been introduced in the book. Sometimes only a checklist has been formulated in a section, when exercises are not considered as really useful for the subjects in question.

2 Assignments for Chapter 1: Basic Concepts of Econometric Models

2.1 Checklist

Check 1.1

Explain the difference between an economic model and an econometric model.

Check 1.2

Explain the essential difference between time-series data and cross-section data.

Check 1.3

What is an endogenous and what is an exogenous variable in an econom(etr)ic model?

Check 1.4

Why is an endogenous variable a stochastic variable in an economic model?

Check 1.5

When is a model 'linear in the variables' and when is it 'linear in the parameters'? What is the reason for this distinction?

Check 1.6

What is a 'structural-form model' and what is a 'reduced-form model'? What are the typical features of these two models?

Check 1.7

What is a classical regression model? Is a classical regression model a structural-form or a reduced-form model?

Check 1.8

Why is a 'disturbance term' introduced in an economic model? Explain the characteristics of the disturbance term when the equation has been formulated from some economic theory.

2.2 Exercises

Exercise 1.1

Determine and explain the nature of the variables in the following quarterly model for the money demand in a country.

$$M_t = \beta_1 + \beta_2 R_t + \beta_3 R_{t-1} + \beta_4 Y_t + \beta_5 M_{t-1} + \beta_6 M_{t-2} + \beta_7 M_{t-3} + u_t,$$

with M_t: a proxy for the money demand, R_t: interest rate, Y_t: GDP.

Different answers are possible, depending on the kind of model that is considered or the way the money market functions. Try to discuss different alternatives.

Exercise 1.2

Show that in the following macroeconomic consumption equation β_2 is a constant income elasticity.

$$\ln(CONS_t) = \beta_1 + \beta_2 \ln(Y_t) + \beta_3 \ln(CONS_{t-1}) + u_t.$$

3 Assignments for Chapter 2: Data Sets

3.1 Checklist

Check 2.1

Why is time-series data often offered as seasonally adjusted data?

Check 2.2

Mention some factors that determine the choice of the frequency of time-series data.

3.2 Exercises

As preparation for doing real quantitative economic research, it is sensible not only to use the offered Excel files for the cases from the booksite. It is useful to visit some of the websites that are mentioned in Chapter 2 of the book. Some suggestions are given below.

Exercise 2.1

Visit the website of the OECD and update one of the macroeconomic data sets with recent data. It is also possible to download the complete data set, with all the available variables, which can be used to estimate a more detailed specified macroeconomic model than formulated in the simplified cases in the book.

Exercise 2.2

Go to the site of the Energy Information Administration and download the file ‘World Oil Market and Oil Price Chronologies: 1970–2004’ that contains a lot of qualitative information concerning the world oil market. This can be very useful information when modelling the oil market, for example, when dummy variables are necessary in the model specification to eliminate outliers or to model different regimes because of oil crises.

Exercise 2.3

For the same reasons, it is useful to visit the website of the Federal Reserve Bank or some other national or international banks like the Bank of England (www.bankofengland.co.uk) or the European Central Bank (www.ecb.int). Many interesting links will be found when surfing along this kind of websites for searching for data or information.

4 Assignments for Chapter 4: Description of the Reduced-Form Model

4.1 Checklist

Check 4.1

Once more: What is a structural-form model? What is a reduced-form model? What is a classical regression model? What makes you decide what to model?

Check 4.2

Why is the assumption made that the disturbance term is a random variable, or in statistical terms, $Var(\mathbf{u}) = \sigma_u^2 \mathbf{I}_n$ has constant variance and is not autocorrelated?

Check 4.3

Check the following two properties of the matrix

$$\mathbf{M}_X = \mathbf{I}_n - \mathbf{X}\left(\mathbf{X}'\mathbf{X}\right)^{-1}\mathbf{X}',$$

which was introduced in Section 4.4 of the book:

1. $\mathbf{M}_X$ is idempotent;
2. The matrix $\mathbf{M}_X$ and the explanatory variables are orthogonal: $\mathbf{M}_X\mathbf{X} = \mathbf{0}$.

Check 4.4

Explain the following properties that an estimator may have: unbiasedness, efficiency and consistency.

Check 4.5

Why are the standard errors of the OLS estimates of the parameters β_k, $k = 1, \ldots, K$, wrongly calculated by your software in case of autocorrelation and/or heteroskedasticity in the disturbance term?

4.2 Exercises

Exercise 4.1

For a better understanding of the matrix notation of the linear model, it can be useful to perform a number of calculations manually before using EViews to estimate the parameters of a linear model. For this purpose, we use a simple static relationship between UK consumption and income, which actually is a mis-specified model.

In Table 1, a quarterly data set for UK consumption and income is given in ten thousands of billions of pounds, for the short period 1999:III–2003:I. These are rounded figures from Data set 2.

$CONS_t$	Y_t
13.0	20.2
13.2	20.4
13.4	20.5
13.6	20.7
13.7	20.8
13.8	20.9
14.0	21.1
14.1	21.1
14.3	21.2
14.4	21.3
14.5	21.4
14.7	21.5
14.8	21.7
14.9	21.8
15.0	21.8

Table 1: Data on consumption and income

Suppose we consider the simple static equation

$$CONS_t = \beta_1 + \beta_2 Y_t + u_t. \tag{1}$$

1. Determine the 'normal equations' (see: equation 4.15 in the book):

$$\mathbf{X}'\mathbf{y} = \mathbf{X}'\mathbf{X}\boldsymbol{\beta}, \tag{2}$$

   by using the given data, which are necessary to compute estimates of β_1 and β_2 in equation (1). Make use of a calculator or Microsoft Excel for the computations of the sums of squares and products that are necessary.

2. Then compute the OLS estimates $\widehat{\beta}_1$ and $\widehat{\beta}_2$ by solving the normal equations (2).

3. Compute the standard errors $\widehat{\sigma}_{\widehat{\beta}_1}$ and $\widehat{\sigma}_{\widehat{\beta}_2}$ of these estimates.

$$\widehat{\sigma}_{\widehat{\beta}_k} = \widehat{\sigma}_u \sqrt{x^{kk}}, \quad k = 1, 2.$$

   See in the book: equation 4.26 and what follows.

4. Check your computational results by calculating the estimates with EViews. Start EViews and open a new workfile for the given range. Select:

   Objects\New Object

   and choose 'Series'. For example, give it the name 'cons'; see the illustration in Figure 4.1.

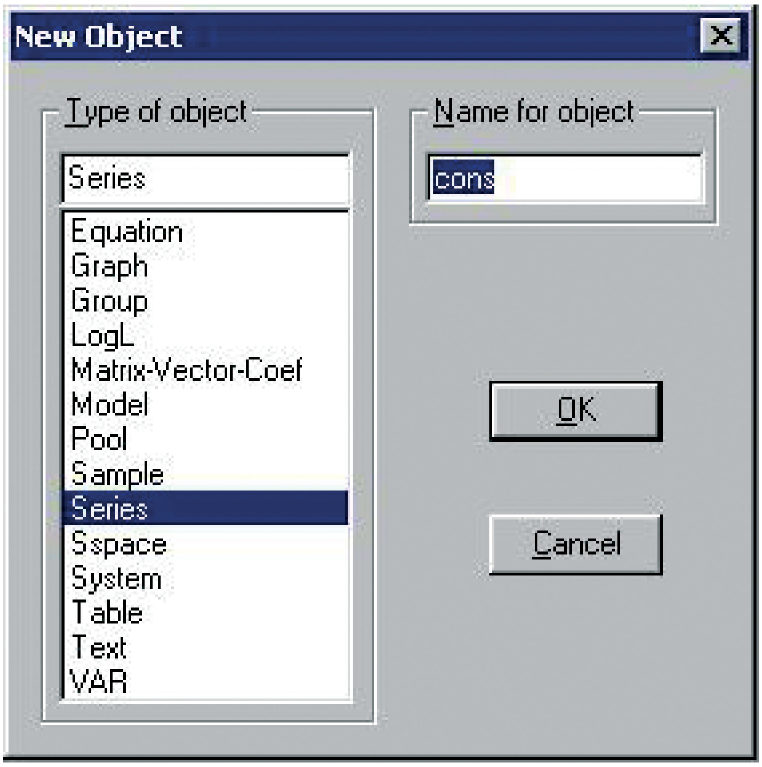

Figure 4.1: Defining the variable 'cons' as a new 'Series' object

Then double-click on 'cons', click the button 'Edit+/−' and type the data in the Excel sheet for the consumption $CONS_t$. Do the same for the income variable Y_t. Next specify the equation and estimate the parameters β_1 and β_2.

5. What is your comment, as an economist, on the values of the estimated parameters?

Exercise 4.2

Look at the following model of two equations used by a telephone company. One equation determines their supply of mobile phones $\left(Q_t^{mphone}\right)$, and one determines the price of a subscription to the mobile telephone supplier $\left(P_t^{subscr}\right)$.

$$Q_t^{mphone} = \beta_1 + \beta_2 P_t^{subscr} + \beta_3 P_t^{trad} + \beta_4 C_t^{mphone} + u_t$$

$$P_t^{subscr} = \gamma_1 + \gamma_2 C_t^{mphone} + \gamma_3 P_t^{comp} + v_t.$$

The other variables are: P_t^{trad} as a price of 'traditional' telephone services, P_t^{comp} the subscription price of a competitive supplier of mobile telephone services, and C_t^{mphone} the costs of a mobile telephone. These three variables are considered as exogenous variables for the mobile telephone market in this question. This is a complete simultaneous equation model (SEM), which will be discussed in detail in Chapter 10. In a SEM, the assumption is made that the disturbances of all the equations are contemporaneously dependently distributed. So:

$$E\left(u_t v_s\right) = \begin{cases} \sigma_{uv}, & t = s \\ 0, & t \neq s \end{cases}, \qquad t, s = 1, \ldots, n.$$

The usual disturbance-term assumptions are valid for each individual equation:

$$u_t \sim NID\left(0, \sigma_u^2\right)$$
$$v_t \sim NID\left(0, \sigma_v^2\right).$$

1. Under which conditions is the OLS estimator a consistent estimator of the parameters?
2. Are these conditions valid for the equations of the model specified above?
3. In case OLS yields inconsistent estimates for the parameters of one or both equations, then compute the inconsistencies.

   Remark: It is not necessary to calculate the elements of the matrix $\mathbf{\Omega}_{XX}^{-1}$; denote the elements of $\mathbf{\Omega}_{XX}^{-1}$ as ω^{ij}, $i, j = 1, 2, 3$. The matrix $\mathbf{\Omega}_{XX}$ is defined as being a matrix with finite elements: $\mathbf{\Omega}_{XX} = \underset{n\to\infty}{P\lim}\ \frac{1}{n}\mathbf{X}'\mathbf{X}$.
4. Which estimator(s) would you choose to consistently estimate the parameters β_k and γ_k of the two equations of this model?

Exercise 4.3

In a model with a geometrically distributed lag for one explanatory variable, for this exercise just denoted as

$$Y_t = f\left(X_t\right) + u_t$$
$$u_t \sim NID\left(0, \sigma_u^2\right), \quad t = 1, \ldots, n,$$

Koyck's transformation yields the following specification (this transformation is discussed in Section 13.3):

$$Y_t = \beta_1 + \beta_2 X_t + \beta_3 Y_{t-1} + v_t$$
$$v_t = u_t - \beta_3 u_{t-1}$$

1. Why is it impossible to obtain consistent estimates of the parameters β_k with OLS?
2. Compute the inconsistency of the OLS estimator. The same remark as in Exercise 4.2 is valid.

Exercise 4.4 (Exercise 4.1 continued)

A more realistic estimation result is obtained when lagged consumption is included in the model.

1. Estimate the parameters of the following equation with EViews:

   $$CONS_t = \beta_1 + \beta_2 Y_t + \beta_3 CONS_{t-1} + u_t \tag{3}$$

   and compare the estimates with those from Exercise 4.1.
2. Compute the income elasticity for the sample means of the variables.
3. Compute income elasticities for all the observations. Make a graph and report the range and the mean of this series. See also Section 3.4 in the book.
4. Estimate equation (3) for the logs of the variables:

   $$\ln(CONS_t) = \beta_1 + \beta_2 \ln(Y_t) + \beta_3 \ln(CONS_{t-1}) + u_t \tag{4}$$

   and compare the estimated constant income elasticity with the previous results.

5 Assignments for Chapter 5: Testing the Deterministic Assumptions

5.1 Checklist

Check 5.1

What is the orthogonality property of the OLS estimator? What is an important consequence of this property when the model has a constant term?

Check 5.2

What is the difference between a Likelihood Ratio test, a Wald test and a Lagrange Multiplier test? What kind of test is the t-test, to test $H_0: \beta_k = 0$?

5.2 Exercises

Exercise 5.1

Prove that the three definitions of the determination coefficient in Section 5.3 of the book (R_1^2, R_2^2, and R_3^2) are identical when an intercept term has been included in the model.

$$R_1^2 = 1 - \frac{RSS}{TSS} = 1 - \frac{\sum_{t=1}^{n} e_t^2}{\sum_{t=1}^{n} \left(Y_t - \overline{Y}\right)^2},$$

$$R_2^2 = \frac{ESS}{TSS} = \frac{\sum_{t=1}^{n} \left(\widehat{Y}_t - \overline{Y}\right)^2}{\sum_{t=1}^{n} \left(Y_t - \overline{Y}\right)^2},$$

$$R_3^2 = r_{Y\widehat{Y}}^2 = \frac{\left(\sum_{t=1}^{n} \left(\widehat{Y}_t - \overline{Y}\right)\left(Y_t - \overline{Y}\right)\right)^2}{\sum_{t=1}^{n} \left(\widehat{Y}_t - \overline{Y}^2\right) \sum_{t=1}^{n} \left(Y_t - \overline{Y}\right)^2}.$$

Exercise 5.2

Consider the following four, with OLS, estimated equations.

1. $\widehat{Y}_{t1} = \widehat{\beta}_1 + \widehat{\beta}_2 X_{t1} + \widehat{\beta}_3 X_{t2}$
2. $\widehat{Y}_{t1} = \widehat{\beta}_1 + \widehat{\beta}_2 X_{t1}$
3. $\widehat{Y}_{t1} = \widehat{\beta}_1 + \widehat{\beta}_2 X_{t1} + \widehat{\beta}_3 Y_{t-1,1}$
4. $\widehat{Y}_{t1} = \widehat{\beta}_2 X_{t1} + \widehat{\beta}_3 Y_{t2}$.

Notation: X_{tk} are *exogenous* variables and Y_{tk} are *endogenous* variables.

Is a calculated *coefficient of determination* (R^2) a useful statistic in these four estimated equations? Explain your answers.

Exercise 5.3 (Exercise 4.1 continued)

Consider the estimated equation (3):

$$\widehat{CONS}_t = \beta_1 + \beta_2 Y_t + \beta_3 CONS_{t-1}.$$

1. Test the $H_0\colon \beta_2 = 0$; what is your H_1?
   Test the $H_0\colon \beta_3 = 0$; what is your H_1?
   Use a significance level of 5%.

2. In model (4), test the null hypothesis that the income elasticity is equal to 1.0 with a Student t-statistic. Compute the p-value. Secondly, test this null hypothesis with a Wald F-test and compute the p-value. Compare both p-values. What is your comment on this result?

6 Assignments for Chapter 6: Testing the Stochastic Assumptions and Model Stability

6.1 Checklist

Check 6.1

Why is a normality test called a non-constructive test in econometrics? If the null hypothesis of normality has been rejected, what can you do?

Check 6.2

Why is the F-statistic that is given in the EViews output of the *Breusch–Godfrey* *(BG)* test and the *White*-test not used?

Check 6.3

Why is the Ljung–Box test preferred over the Box–Pierce test, and why is the use of a minimum significance level of 10% advised?

Check 6.4

Why is it necessary to do two regressions for applying the Goldfeld–Quandt (*GQ*) test, instead of dividing up one regression into two parts?

Check 6.5

When the plot of the CUSUM of Squares test returns to one at the end of the sample, is that an indication that the model behaviour becomes more stable when considering the complete sample period?

Check 6.6

In a paper or article, you find, under the estimates of an estimated regression equation standard errors or t-statistics in parenthesis. Explain when standard errors or t-statistics are useful to show under the estimated coefficients.

Check 6.7

In what kind of data can autocorrelation and/or heteroskedasticity be a problem?

6.2 Exercises

Exercise 6.1

1. Can the *Durbin–Watson* (*DW-*) statistic be applied to test the assumption of independently distributed disturbances in the following five equations? Notation: X_{tk} are *exogenous* variables and Y_{tk} are *endogenous* variables. Explain your answers.

   1. $Y_{t1} = \beta_1 + \beta_2 X_{t1} + \beta_3 X_{t2} + u_t$
   2. $Y_{t1} = \beta_1 + \beta_2 X_{t1} + u_t$
   3. $Y_{t1} = \beta_1 + \beta_2 X_{t1} + \beta_3 Y_{t-1,1} + u_t$

4. $Y_{t1} = \beta_2 X_{t1} + \beta_3 X_{t2} + u_t$
5. $Y_{t1} = \beta_1 + \beta_2 X_{t1} + \beta_3 Y_{t2} + u_t$

2. What is your opinion about the utility of the DW-test in testing for significant autocorrelation?
3. What is a test that can generally be used to test the null hypothesis of no residual autocorrelation?

Exercise 6.2

This exercise concerns the Goldfeld–Quandt test.

1. How can the power of the GQ-test be improved?
2. Is it necessary to cut the sample exactly in the middle to apply the GQ-test?
3. You have a linear model with four explanatory variables and a constant term. You wish to apply the GQ-test and divide a sample with 120 observations into two subsamples with 40 observations in the beginning of the period and 60 observations at the end of the period. So 20 observations have been deleted from the middle of the sample. What is the critical value of the F-test when you test at a significance level of 5%?

7 Assignments for Chapter 7: A Collection of Topics Around the Linear Model

7.1 Checklist

Check 7.1

What is a necessary assumption that has to be made when an estimated linear model will be used for forecasting?

Check 7.2

If you want to forecast post-sample predictions $Y_{n+1}, \ldots, Y_{n+p}$ of an endogenous variable, how do you obtain the necessary out-of-sample values of the explanatory variables?

Check 7.3

What is the difference between the root mean squared error (RMSE) and the Theil inequality coefficient?

Check 7.4

What is a 'leading indicator'?

Check 7.5

What is a qualitative variable? Give some examples of qualitative variables.

7.2 Exercises

Exercise 7.1

1. Prove that the expectation of the OLS estimator of parameters of exogenous variables that do not belong to the model is zero.
2. What is the importance of this result for the econometric practice?

Exercise 7.2

1. How can you recognise multicollinearity effects in your estimation results?
2. In the example in the book's Section 7.4, the following model was analysed in deviation form ($x_{ti} = X_{ti} - \overline{X}_i$):

$$y_t = \beta_2 x_{t2} + \beta_3 x_{t3} + (u_t - \overline{u}),$$

   with the assumptions:

$$x_{t3} = \alpha x_{t2} + v_t,$$

   and for reasons of simplicity:

$$\sum_{t=1}^{n} x_{t2}^2 = \sum_{t=1}^{n} x_{t3}^2 = 1, \quad \sum_{t=1}^{n} v_t = 0, \text{ and } \sum_{t=1}^{n} v_t x_{t2} = 0.$$

   Show that $\widehat{\beta}_3$ can be estimated with a wrong sign.

Exercise 7.3

What is the essential difference between the Chow forecast test and the Chow break-point test?

8 Assignments for Chapter 8: Estimation with More General Disturbance-Term Assumptions

8.1 Checklist

Check 8.1

Normally the assumption is made that

$$\mathbf{u} \sim N\left(\mathbf{0}, \sigma_u^2 \mathbf{I}_n\right).$$

When is the assumption

$$\mathbf{u} \sim N\left(\mathbf{0}, \boldsymbol{\Omega}\right),$$

with $\boldsymbol{\Omega}$ being a general covariance matrix, a correct assumption and when is that assumption wrongly made?

Check 8.2

Suppose you have found explicable residual heteroskedasticity, and so you want to use the GLS estimator. Explain the difference in computing GLS estimates: directly with the GLS estimator, or indirectly by estimating the transformed model (the model multiplied by $\mathbf{C}$, $\mathbf{C}'\mathbf{C} = \boldsymbol{\Omega}^{-1}$) with OLS,

$$\mathbf{Cy} = \mathbf{C}\boldsymbol{\beta} + \mathbf{Cu}$$

What do you prefer?

Check 8.3

Heteroskedasticity is always present in OLS residuals to some extent. Is it a good advise always to use the White standard errors?

Check 8.4

Is GLS an appropriate estimator in the following two situations?

1. After a linear model for quarterly time-series data has been estimated, the residuals appear to follow an AR(4) process.
2. A linear model for cross-section data has been estimated and the disturbance variance is increasing with the squared values of an explanatory variable.

8.2 Exercises

Exercise 8.1

In the book, no expression of the White standard errors has been derived. Suppose that

$$\mathbf{\Omega} = \begin{pmatrix} \sigma_1^2 & 0 & \cdots & \cdots & 0 \\ 0 & \sigma_2^2 & & & \vdots \\ \vdots & & \ddots & & \vdots \\ \vdots & & & \ddots & 0 \\ 0 & \cdots & \cdots & 0 & \sigma_n^2 \end{pmatrix},$$

then obtain the expression for the White standard errors yourself by deriving the correct covariance matrix of the OLS estimator.

Exercise 8.2

Prove remark 8.1 in the book: when the disturbance terms of the equations of a SUR model are independently distributed, then the SUR estimates are identical to the OLS estimates in each equation.

9 Assignments for Chapter 9: Models with Endogenous Explanatory Variables

9.1 Checklist

Check 9.1

When the 2SLS estimator is used, according to which criteria are instrumental variables chosen?

Check 9.2

Although the IV and the 2SLS estimator are similar estimators, what is the difference between these estimators?

Check 9.3

If the parameters of a model have been estimated with 2SLS, is it possible to test g restrictions on the parameters with the F-test given in the following formula?

$$F = \frac{(S_R - S)/g}{S/df}.$$

Here, S_R is equal to the residual sum of squares of the restrictedly estimated model, S is the residual sum of squares of the unrestrictedly estimated model, and df is the number of degrees of freedom of the unrestricted model. Motivate your answer, and give a solution.

10 Assignments for Chapter 10: Simultaneous Equation Models

10.1 Checklist

Check 10.1
Describe shortly the identification problem of the equations of a Simultaneous Equation Model.

Check 10.2
What is the 'transformation method' to check the identifiability of an equation?

Check 10.3
Which methods do you use in practice to check the identifiability of an equation? Describe these methods.

Check 10.4
Describe the three (historical) stages of the 3SLS estimation method.

10.2 Exercises

Exercise 10.1
Look again at the 'telephone model' introduced in Exercise 4.2,

$$\begin{aligned} Q_t^{mphone} &= \beta_1 + \beta_2 P_t^{subscr} + \beta_3 P_t^{trad} + \beta_4 C_t^{mphone} + u_t \\ P_t^{subscr} &= \gamma_1 + \gamma_2 C_t^{mphone} + \gamma_3 P_t^{comp} + v_t, \end{aligned}$$

with

$$\begin{aligned} u_t &\sim NID\left(0, \sigma_u^2\right) \\ v_t &\sim NID\left(0, \sigma_v^2\right) \end{aligned}$$

and

$$E\left(u_t v_s\right) = \begin{cases} \sigma_{uv}, & t = s \\ 0, & t \neq s \end{cases}, \qquad t, s = 1, \ldots, n.$$

1. Write the model in the matrix notation of a SEM.
2. Determine whether the equations are identified.
3. When is this model a recursive model?

11 Assignments for Chapter 11: Qualitative Dependent Variables

11.1 Checklist

Check 11.1
What is a qualitative dependent variable? Give an example different from the one in the book.

Check 11.2
What is a linear probability model, and mention three problems when you estimate its parameters with OLS?

Check 11.3
How can the problems mentioned in Check 11.2 be solved?

Check 11.4
Why do you find an *LR*-test in the output of an estimated logit model?

12 Assignments for Chapter 12: Dynamic Models, Unit Roots and Cointegration

12.1 Checklist

Check 12.1
When is a dynamic short-run model, for example, the following bi-variate model in general notation

$$\beta(L)\,Y_t = b_0 + \gamma(L)\,X_t$$

a stable model?

Check 12.2
What is the definition of the first differences ∇Y_t and ΔY_t?

Check 12.3
Why is a non-stationary variable called an 'integrated' variable? What denotes the notation $Y_t \sim I(2)$?

Check 12.4
Explain the essentials of the error-correction model.

Check 12.5
When is a model an irreversible model?

Check 12.6
What is the economic interpretation of an $I(1)$, an $I(2)$ and an $I(3)$ variable?

Check 12.7
Why can the Student t-distribution not be used when testing for a unit root?

Check 12.8
Why is the OLS estimator called 'super-consistent' when it estimates the parameters of a non-spurious static relationship between non-stationary variables?

12.2 Exercises

Exercise 12.1
Determine the long-run solution of the short-run model from Exercise 1.1:

$$M_t = \beta_1 + \beta_2 R_t + \beta_3 R_{t-1} + \beta_4 Y_t + \beta_5 M_{t-1} + \beta_6 M_{t-2} + \beta_7 M_{t-3} + u_t.$$

Exercise 12.2
Consider the following, partly given, fictitious estimation results for the demand for wine $\left(D_t^{wine}\right)$ in a country. The equations are specified as error-correction models in the logs of the variables, and have been estimated for 29 observations. Only a price index of

wine $\left(P_t^{wine}\right)$ and an error-correction term (e_{t-1}) are considered as explanatory variables in this example. An unrestricted estimation result and a restricted estimation result are as follows:

$$\begin{aligned}
\widehat{\nabla \ln\left(D_t^{wine}\right)} &= 0.44 - 0.20\nabla^{+}\ln\left(P_t^{wine}\right) + 0.40\nabla^{-}\ln\left(P_t^{wine}\right) \\
&\quad + 0.90\nabla\ln\left(D_{t-1}^{wine}\right) + 0.35e_{t-1}, \qquad (5)\\
R^2 &= 0.75;\\
\widehat{\nabla \ln\left(D_t^{wine}\right)} &= 0.52 - 0.35\nabla\ln\left(P_t^{wine}\right) + 0.92\nabla\ln\left(D_{t-1}^{wine}\right) + 0.31e_{t-1}, \qquad (6)\\
R^2 &= 0.60.
\end{aligned}$$

In equation (5) the variables $\nabla^{+}\ln\left(P_t^{wine}\right)$ and $\nabla^{-}\ln\left(P_t^{wine}\right)$ are defined as follows:

$$\nabla^{+}\ln\left(P_t^{wine}\right) = \begin{cases} \nabla\ln\left(P_t^{wine}\right) & \text{if } \nabla\ln\left(P_t^{wine}\right) > 0\\ 0 & \text{if } \nabla\ln\left(P_t^{wine}\right) \leq 0,\end{cases}$$

and $\nabla^{-}\ln\left(P_t^{wine}\right)$ is defined the other way around. You may assume that residual autocorrelation is absent.

1. Test the null hypothesis that the relationship between the demand for wine and the price of wine is a reversible relationship.
2. What is the short-run price elasticity with respect to price increases and price decreases in Model (5)?

13 Assignments for Chapter 13: Distributed Lag Models

13.1 Checklist

Check 13.1

Which estimation problem comes up when the parameters of a model, specified with a number of lags of one or more explanatory variables, has to be estimated?

How can that problem be solved?

Check 13.2

Which estimation problem comes up when the parameters of a model, specified with an infinite number of lags of one or more explanatory variables, has to be estimated?

How can that problem be solved?

Check 13.3

When using the Almon procedure to estimate the parameters of a finite distributed lag model, you have to choose an appropriate degree r of the polynomial. Why is it advised to choose a degree $r \geq 3$?

Check 13.4

In a dynamic model for time-series data it should be a (strange) restriction not to specify lagged dependent variables. In the (historical) econometric literature a number of economic reasons for the specification of a lagged dependent variable are given.

Mention these reasons and comment on their economical realism.

14 Assignments for Chapter 14: Univariate Time-Series Models

14.1 Checklist

Check 14.1

What is a stochastic process? What is a Gaussian process? When is a stochastic process stationary?

Check 14.2

What is a weak-stationary process, and what is a strong-stationary process? Is a Gaussian process weak or strong stationary?

Check 14.3

Mention some possibilities of how stationarity or non-stationarity of an economic variable can be established.

Check 14.4

If a time-series is not stationary, how can stationarity of that series be obtained?

Check 14.5

An autocorrelation coefficient of the second order is written as $\widehat{\rho}_2$, and a partial autocorrelation coefficient is $\widehat{\rho}_2^*$.

What is the difference between $\widehat{\rho}_2$ and $\widehat{\rho}_2^*$?

Check 14.6

During a model selection procedure sometimes the Akaike Information Criterion (*AIC*) and the Schwarz Information Criterion (*SIC*) are used. What kind of information is given by these criteria, and in which situation are they used?

Check 14.7

Why should only a limited number of lags be used when computing the autocorrelation functions as a tool to identify a time-series model?