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| **Examination:** | 20386 – Financial Econometrics | **Summer Term 2012** |
| **Examiner:** | Prof. Dr. Dr. Bodo Vogt | **24.07.2012** |
| **Aids permitted:** | pocket calculators, English dictionaries, two sheets of paper (double sided) typed or hand written with formulas, definitions, solved problems etc. | |

The examination is comprised of **six** problems. All of them are to be solved. You can reach a maximum of **100 points. Good luck!**

**Problem 1: (18 points)**

Please answer the following questions.

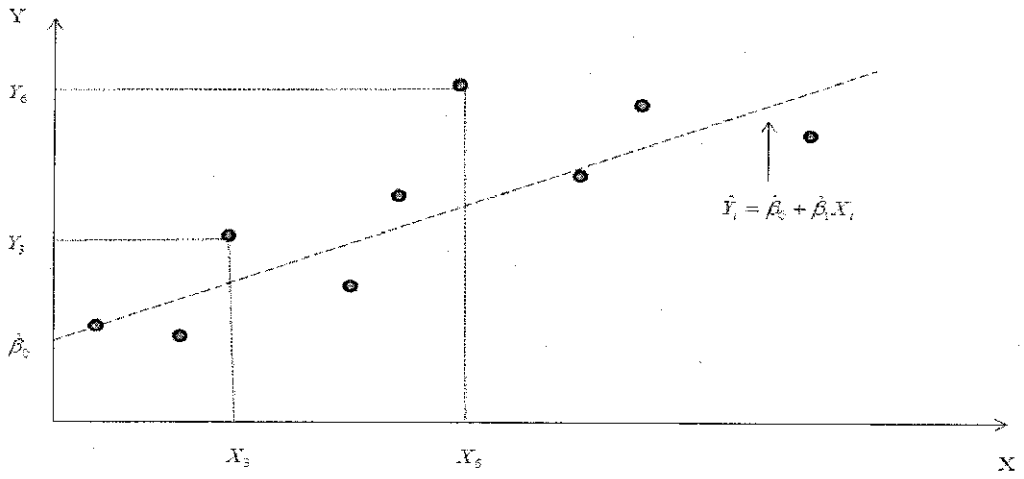
a) The t-test is the test that econometricians usually use to test hypotheses about individual regression slope coefficients. Under what assumption is the use of t-test for hypotheses testing appropriate? Shortly discuss whether in practical applications this assumption is reasonable. (5 points)

b) Please define what is meant under "sampling distribution of $\hat{\beta}$". (4 points)

c) Consider the following simple regression equation:

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

The estimated regression line $\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_i$ is plotted on the graph below together with some of the sample observations. Please use the graph to indicate which distances correspond to the stochastic error term $\varepsilon_6$ and the residual $e_6$. (Mark clearly your answers directly on the graph and make sure that at the end of the exam you submit this sheet of paper together with your answer sheets.) (5 points)




d) Define what is meant under unbiased estimator. (4 points)

**Problem 2: (20 points)**

Let's assume that you were hired by the Department of Agriculture to do a cross-sectional study of weekly expenditures for food consumed at home by the ith household ( $F_i$ ) and that you estimated the following equation (standard errors in parentheses):

$$\hat{F}_i = -10.5 + 2.1Y_i - 0.04Y_i^2 + 13H_i - 2A_i$$
$$\quad\quad\quad\quad\quad\quad (0.7)\ \ (0.05)\quad (2)\quad (2)$$
$$\overline{R}^2 = 0.46 \quad N = 235$$

$Y_i$ – the weekly disposable income of the ith household

$H_i$ – the number of people in the ith household

$A_i$ – the number of children (under 19) in the ith household

a) Create and test appropriate hypotheses at the 10 percent level. (Hint: $t_c \approx 1.282$ and the expected sign of $\beta_{Y^2}$ is negative.) (5 points)
b) Which economic problems (omitted variables, irrelevant variables, or multicollinearity) appear to exist in this equation? Explain your answer. (4 points)
c) Suppose that you were now told that the VIFs for A and H were both between 5 and 10. How does this change your answer to part b above? (4 points)
d) Would you suggest changing this specification for one final run of this equation? How? (2 points)
e) Explain how the variance inflation factors (VIFs) are calculated (in the general case, not for the equation above). Assume a model with three independent variables. In addition, explain the intuition behind the fact that higher VIFs are associated with stronger linear relationship between the independent variables. (5 points)

**Problem 3: (15 points)**

a) Will the inclusion of an omitted variable in a regression equation have any effect on $\overline{R}^2$ and the estimated coefficients of the other independent variables? Explain your answer. (5 points)
b) What is the impact of irrelevant variables? (5 points)
c) Define pure and impure heteroscedasticity. In what data sets is pure heteroscedasticity likely to occur? (5 points)

**Problem 4: (12 points)**

Consider the following small macroeconomic model in which current consumption ( $\hat{C}_t$ ) is modeled as a function of current disposable income ( $\hat{YD}_t$ ) and consumption in the previous period ( $\hat{C}_{t-1}$ ) (standard errors in parentheses):

$$\hat{C}_t = -239.6 + 0.41\hat{YD}_t + 0.62\hat{C}_{t-1}$$
$$(0.15) \quad (0.16)$$
N=28 (annual 1976-2003) $\bar{R}^2 = 0.998$ DW=0.81

a) Test the above equation for first-order positive serial correlation using the Durbin-Watson test at the 5 percent level. (Hint: $d_L = 1.26$ and $d_U = 1.56$). (5 points)

b) Is it likely that the consumption equation above will encounter a bias? If your answer to that question is yes, briefly outline the reasons responsible for that bias. (7 points)

**Problem 5: (15 points)**

Write the meaning of each of the following terms:

a) Endogenous variable (2 points)
b) Structural equation (2 points)
c) Reduced-form equation (3 points)
d) Simultaneity bias (5 points)
e) Spurious correlation (3 points)

**Problem 6: (20 points)**

a) Please write down the equation of an ARMA (1, 3) process. (3 points)
b) Please write down the conditions which have to be met in order a time series to be weakly stationary. (3 points)
c) Please define what is meant under partial autocorrelation function (PACF). What is the interpretation of the coefficients in the PACF. (6 points)
d) Please explain in detail how the sample PACF can be used to determine the order of an AR time series. (6 points)
e) AR models are estimated with OLS. In contrast, MA models are estimated with MLE. Why isn't it appropriate to use OLS for the estimation of MA models? (2 points)