Masters Programmes:
School of Economics, University of the West of England

Econometrics: UPEN3P-15-M

Mock Exam Paper: December 2004

Duration 2 hours

Answer Question 1 in section A and 2 other questions from Section B

Section A

Compulsory: Worth 40% of the marks

Question 1

Consider the following estimation results from Microfit:

```
                       Ordinary Least Squares Estimation
******************************************************************************
 Dependent variable is LC
 49 observations used for estimation from 1950 to 1998
******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 C                          .48291            .27276              1.7705[.084]
 LC(-1)                     1.3006            .15514              8.3835[.000]
 LC(-2)                    -.52965            .14277             -3.7098[.001]
 LY                         .53920           .077867              6.9246[.000]
 LY(-1)                    -.58446            .13664             -4.2775[.000]
 LY(-2)                     .23525            .11179              2.1045[.042]
 LP                        -.16115           .079246             -2.0335[.049]
 LP(-1)                     .23680            .15905              1.4888[.144]
 LP(-2)                   -.070647           .086534             -.81640[.419]
******************************************************************************
 R-Squared                      .99933   R-Bar-Squared                   .99920
 S.E. of Regression           .0097335   F-stat.    F(  8,  40)    7476.0[.000]
 Mean of Dependent Variable    12.4349   S.D. of Dependent Variable      .34370
 Residual Sum of Squares      .0037896   Equation Log-likelihood       162.4210
 Akaike Info. Criterion       153.4210   Schwarz Bayesian Criterion    144.9078
 DW-statistic                   2.0276
******************************************************************************


                               Diagnostic Tests
******************************************************************************
*    Test Statistics  *        LM Version        *         F Version
******************************************************************************
*                     *                          *
* A:Serial Correlation*CHSQ(   1)=   .54504[.460]*F(   1,  39)=   .43868[.512]
*                     *                          *
* B:Functional Form   *CHSQ(   1)=  .062481[.803]*F(   1,  39)=  .049793[.825]
*                     *                          *
* C:Normality         *CHSQ(   2)=   .37664[.828]*       Not applicable
*                     *                          *
* D:Heteroscedasticity*CHSQ(   1)=   5.3569[.021]*F(   1,  47)=   5.7690[.020]
******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

Where the variables are:

LC: Log of real consumers expenditure in 1995 prices
LY: log of real personal disposable income in 1995 prices
LP: log of the consumer price index

a.) Briefly explain what the results tell us about the determination of consumption.

b.) Briefly explain what the t ratios, the F-statistic, R-Squared, the DW statistic, diagnostic test A, diagnostic test B, and diagnostic test D are and what they tell us.

c.) Explain the following variable deletion test and what it tells us:

```
                       Variable Deletion Test (OLS case)
*******************************************************************************
 Dependent variable is LC
 List of the variables deleted from the regression:
 LP(-2)
 49 observations used for estimation from 1950 to 1998
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 C                          .55618            .25652              2.1681[.036]
 LC(-1)                     1.2401            .13571              9.1375[.000]
 LC(-2)                    -.48828            .13293             -3.6732[.001]
 LY                         .55998           .073288              7.6409[.000]
 LY(-1)                    -.61294            .13157             -4.6586[.000]
 LY(-2)                     .25645            .10828              2.3684[.023]
 LP                        -.10364           .036156             -2.8664[.007]
 LP(-1)                     .11027           .035575              3.0995[.003]
*******************************************************************************
 Joint test of zero restrictions on the coefficients of deleted variables:
 Lagrange Multiplier Statistic     CHSQ( 1)=   .80309[.370]
 Likelihood Ratio Statistic        CHSQ( 1)=   .80975[.368]
 F Statistic                    F(  1,  40)=   .66651[.419]
*******************************************************************************
```

d.) Using the autoregressive distributive lag (ARDL) procedure in Microfit 4.0, with two lags gave the same results as above, but also the error correction representation given below. Briefly explain what these error correction results tell us.

```
          Error Correction Representation for the Selected ARDL Model
           ARDL(2,2,1) selected based on Schwarz Bayesian Criterion
*******************************************************************************
 Dependent variable is dLC
 49 observations used for estimation from 1950 to 1998
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 dLC1                       .48828            .13293              3.6732[.001]
 dLY                        .55998           .073288              7.6409[.000]
 dLY1                      -.25645            .10828             -2.3684[.022]
 dLP                       -.10364           .036156             -2.8664[.006]
 dC                         .55618            .25652              2.1681[.036]
 ecm(-1)                   -.24820           .078649             -3.1558[.003]
*******************************************************************************
 List of additional temporary variables created:
 dLC = LC-LC(-1)
 dLC1 = LC(-1)-LC(-2)
 dLY = LY-LY(-1)
 dLY1 = LY(-1)-LY(-2)
 dLP = LP-LP(-1)
 dC = C-C(-1)
 ecm = LC   -.81989*LY  -.026702*LP   -2.2408*C
*******************************************************************************
 R-Squared                     .76103   R-Bar-Squared                   .72023
 S.E. of Regression          .0096938   F-stat.    F(  5,  43)   26.1140[.000]
 Mean of Dependent Variable   .023698   S.D. of Dependent Variable     .018327
 Residual Sum of Squares     .0038528   Equation Log-likelihood       162.0162
 Akaike Info. Criterion      154.0162   Schwarz Bayesian Criterion    146.4489
 DW-statistic                  1.9423
*******************************************************************************
 R-Squared and R-Bar-Squared measures refer to the dependent variable
 dLC and in cases where the error correction model is highly
 restricted, these measures could become negative.
```

SECTION B

Choose 2 Questions

Question 2

In the following linear model:

$$y_t = \alpha + \beta x_t + u_t$$

a.) Show that the least squares estimate of β is equivalent to the maximum likelihood estimate when $u_t \sim N(0, \sigma^2)$. (40%)

b.) Show that the least squares estimate of β is unbiased. (30%)

b) Discuss how the results in sections a and b would be affected if a lagged dependent variable was introduced into the equation. (30%)

Question 3

Consider:

$$Y_t = BX_t^{\beta 1} X_{t-1}^{\beta 2} \ Y_t^{\beta 3}$$

a.) Show how you would transform this model to estimate it by OLS and relate it to at least 6 alternative static and dynamic forms, giving the restrictions implied. (40%)

b) Derive the static long run equilibrium of the equations in part a. (40%)

c) Write out the ARDL(2,2) and ARIMA(2,1,2) time series models. (20%)

Question 4

a.) Define a stationary process, explain the difference between trend and difference stationary processes, and show how you would test between the two. (40%)

b.) Explain how you would test for a unit root in a time series. (30%)

c.) Explain what cointegration is and how you would test for it using the Engle-Granger method. How would your answer change if you were dealing with more than 2 variables? (30%)

Question 5

Consider the following model of supply and demand:

Demand: $Q_t^D = \beta_0 + \beta_1 P_t + \beta_2 W_t + u_{1t}$

Supply: $Q_t^S = \alpha_0 + \alpha_1 P_t + \alpha_2 Z_t + u_{2t}$

a.) Derive the reduced form of the system stating your assumptions. (50%)

b.) Explain how you would estimate the structural parameters of the system and how your answer would be affected by α_1 being zero and by an extra exogenous variable in the demand equation. (50%)

Question 6

Consider the following model

$$y_t = \alpha + \beta x_t + u_t$$

where $E(u_t) = 0$
$E(u_t) = \sigma^2$
$E(u_s, u_t) \neq 0 \ \forall s \neq t$

a.) What problems would least squares estimators of this model have and what are the likely causes? (50%)

b.) How would you test for first order serial correlation and then for higher order serial correlation? (30%)

c.) If you knew $u_t = 0.4\, u_{t-1} + \varepsilon_t$ where $\varepsilon_t \sim IN(0, \sigma^2)$, then how would you proceed? (20%)

Question 7

a.) Explain what heteroscedasticity is and why it is a problem. Outline two general tests that could be used to detect it. (60%)

b.) Show how you could use the generalised least squares (GLS) approach to deal with heteroscedasticity. (40%)

Question 8

Consider the following model

$$y_i^* = \alpha + \beta x_i + u_i$$

where y_i^* is not observed but we observe a dummy variable y_i which takes the value 1 if y_i^*

is positive and 0 otherwise.

a.) Show how you would estimate the model by the maximum likelihood method, when the distribution of u_i is normal and when it is logistic. (40%)

b.) How would proceed if y_i equal to y_i^* when y_i^* is positive but equal to zero when y_i^* is 0 or less. (30%)

c.) Discuss why these approaches to estimating the model are better than OLS. (30%)