SEMESTER TWO 2026

ABERYSTWYTH BUSINESS SCHOOL

ABM1720: FINANCIAL ECONOMETRICS

Time allowed: **3 HOURS**

Answer **THREE** Questions. You need to answer at least **ONE** question from **EACH SECTION**. All questions carry equal marks.

CALCULATORS ARE PERMITTED (Casio FX83 or FX85 models only)

Statistical tables are provided.

STUDENTS ARE EXPECTED TO SUBMIT ANSWERS TO THIS PAPER IN ENGLISH DUE TO THE ASSESSMENT REQUIREMENTS OF THE MODULE

Once seated, students may complete the front cover of the answer book(s) and the attendance slip ONLY.

DO NOT TURN THE EXAMINATION QUESTION PAPER OVER UNTIL INSTRUCTED TO DO SO.

TURN OVER

SECTION A

1.

a) Define and distinguish between correlation, regression, and causation. (27%)

b) Explain with examples what parameters, estimators, and estimates are. (27%)

c) Describe the main assumptions about the behaviour of the disturbance term in a classical linear regression model. What are the consequences for the Ordinary Least Squares (OLS) estimators if the disturbance term does not satisfy any of these assumptions? (46%)

2.

a) Suppose you are interested in studying effects of various firm-specific factors on the returns of a sample of 200 firms. You run cross-sectional regression with 200 firms and obtain the following results:

$$r_i = 0.08 + 0.80S_i + 0.32MB_i + 0.16PE_i - 0.08BETA_i + \hat{u}_i$$
$$(0.06)\quad (0.15)\quad (0.11)\qquad (0.42)\qquad (0.10)$$

$$R^2 = 0.27 \qquad\qquad DW = 2.01$$

where r_i is return on stock i, S_i is the size of firm i, measured in terms of the natural log of sales revenue, MB_i is market to book ratio of the firm, PE_i is the price/earnings (P/E) ratio of the firm, and $BETA_i$ is the stock's CAPM beta coefficient. Standard errors of individual coefficients are reported in parentheses.

Answer the following questions:

i. Using t-tests, check if individual coefficients are significantly different from zero at 5% level of significance. (15%)

ii. Based on your tests, can you consider deleting any variable from the regression? (5%)

iii. Interpret the coefficients. If the value of Beta increases from 1.0 to 1.5, what is the expected effect on the stock's return? Is the sign of beta as you would have expected? (15%)

b) Suppose you are considering the following model:

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + u_t$$

Regarding this model, explain which of the following hypotheses would require a *t*-test and which of them would require an *F*-test. How many restrictions are implied in each case? (15%)

i. H_0: $\beta_3 = 5$

ii. H_0: $\beta_2 = 1$ and $\beta_3 = 1$

iii. H_0: $\beta_2 = 0$, $\beta_3 = 0$, and $\beta_4 = 0$

c) Let us assume that you want to test whether the dependent variable y in the equation b) above shows unit sensitivity to first two variables, x_2 and x_3, included in the model.

Answer the following questions:

i) How do you distinguish between restricted and unrestricted regressions? Given the null hypothesis of H_0: $\beta_2 = 0$ and $\beta_3 = 0$, derive the equation for the restricted regression. (25%)

ii) The restricted and unrestricted versions of this model were estimated using 144 observations. The residual sum of squares for the restricted (RSS_R), and unrestricted regressions (RSS_U) were reported to be 436.1 and 397.2 respectively. Perform an appropriate test for H_0: $\beta_2 = 0$ and $\beta_3 = 0$ at 5% level of significance. (25%)

3.

a) Assume that to investigate possible reasons for automobile theft in your area, you developed the following model:

$$Yi = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + u_i$$

where
Yi = Number of automobile thefts
X_{2i} = Population density, households per square mile
X_{3i} = Average market value of a car at the time of theft, thousand pounds
u_i = Disturbance term

Using 50 cross-section observations, you obtained the following results:

$$\hat{Y}i = -339.9 + 0.31 X_{2i} + 0.25 X_{3i}$$
$$(224.2) \quad (0.123) \quad (0.121)$$

$$R^2 = 0.62 \qquad RSS = 707745$$

(The figures in parentheses are the estimated standard errors. RSS are the residual sum of squares.)

i. Are the signs of the variables in the model in accordance with your expectations? (12%)
ii. Interpret individual coefficients. (15%)
iii. If X_3 increased by 20 units; calculate the expected change in Y. (10%)
iv. Interpret the R^2 of the model. (10%)
v. Using t-tests show whether individual coefficients are significantly different from zero at 5% level of significance. (25%)

To avoid omission of important variables two more variables (X_{4i} = personal disposable income, in pounds, and X_{5i} = the average age of a stolen car since the original purchase, in weeks) were added and the model was re-estimated. The RSS of the new regression was 536875. Using an F test, check whether the added variables belong to the model or not. (28%)

4.

a) Define 'dummy' variables and discuss possible cases where you need to include dummy variables in econometric models. Using diagrams, explain the difference between an intercept dummy variable and a slope dummy variable. (30%)

b) Distinguish between a positive and a negative autocorrelation. Explain main causes of autocorrelation and its implication for OLS estimators. (30%)

c) Assume you are investigating the relationship between the level of capital investment (I) and manufacturing output (Y) for the UK economy. You estimated the

following distributed lag model using 100 quarterly observations and obtained the results below:

$$LnI_t = 2.01 + 0.11LnY_t + 0.08\ LnY_{t-1} + 0.05\ LnY_{t-2} + 0.04\ LnY_{t-3} + \hat{u}_t$$
$$(1.01 \quad (0.04) \qquad (0.03) \qquad (0.03) \qquad (0.04)$$

$$R^2=0.77 \qquad RSS = 0.497$$

where Standard errors of the coefficients are in parentheses; RSS is the residual sum of squares; and $\hat{u}_t$ is the estimate of a random error. All the variables are in log form.

Answer the following questions:

i. If manufacturing output were to rise by 1%, how much would you expect the capital investment to rise in the same quarter? (5%)

ii. What is the long-run elasticity of investment with respect to manufacturing output? (10%)

iii. Now suppose that you decided to re-estimate the model after transforming it using the Koyck methodology and obtained the following results:

$$LnI_t = 1.01 + 0.05\ LnY_t + 0.80\ LnI_{t-1}$$

Using these results, calculate the following: (25%)

1. The speed of adjustment

2. The median lag

3. The Mean Lag

SECTION B

5.

a) What is meant by an autoregressive moving average (ARMA) model? Why might you prefer an ARMA model to a structural econometric model to analyse movements in the return from holding a particular financial asset? (30%)

b) Discuss the Box-Jenkins methodology of determining an appropriate lag length for an ARMA model.
(20%)

c) Describe what stylised shapes would be expected for the autocorrelation function (ACF) and partial autocorrelation function (PACF) for the following stochastic processes and write down appropriate models corresponding to AR(2), and MA(3), and ARMA(2,2): (7.5x4 = 30%)

i) White noise

ii) AR(2)

iii) MA(3)

iv) ARMA(2,2)

d) Assume you estimated the following ACF and PACF coefficients for a sample of 100 observations from actual data:

Lags	***1***	***2***	***3***	***4***	***5***
ACF	*0.19*	*0.17*	*0.15*	*0.11*	*0.08*
PACF	*0.51*	*0.43*	*0.32*	*0.25*	*0.18*

Answer the following questions:

i. Are the individual autocorrelation and partial autocorrelation coefficients significantly different from zero? Show your work. (10%)

ii. What is the most appropriate time series process (AR, MA, or ARMA) for this data? (10%)

6.

a) Explain why it is important to test for non-stationarity in time series data before attempting to build an empirical model. (35%)

b) Assume you obtained the following results using annual time series data on UK real corporate dividends for the period 1955 to 2011.

1) $$\Delta D_t = \underset{(4.48)}{31.03} - \underset{(-1.28)}{0.188\, D_{t-1}}$$

2) $$\Delta\Delta D_t = \underset{(1.04)}{4.76} - \underset{(-5.89)}{1.39\, \Delta D_{t-1}} + \underset{(1.92)}{0.313\, \Delta\Delta D_{t-1}}$$

where t-ratios are in brackets. Δ is the difference operator.

Note: the 5% critical Dickey Fuller τ value is -2.93 and the 10% critical Dickey-Fuller τ value is -2.60.

Answer the following questions:

i. Based on these results, what is your conclusion about the stationarity of real corporate dividend payments? Explain your answer. (35%)

ii. Explain why you might wish additionally to include a time trend in equation (1). (15%)

iii. Under what circumstances would you accept and interpret the results from a regression between two time series variables, both of which are integrated to order 1, i.e. I(1)? (15%)

7.

a) Explain the following concepts: leptokurtosis, volatility clustering, leverage effects. Discuss the relevance of these concepts to ARCH type of modelling. (35%)

b) The following model describes the daily returns to holding a particular share, R_t:

$$R_t = b_0 + b_1 RM_t + u_t \qquad u_t \sim N(0, \sigma_t^2) \qquad (1)$$

$$\sigma_t^2 = a_0 + a_2 \sigma_{t-1}^2 \qquad (2)$$

where RM_t is the daily return to a market portfolio.

i) Explain carefully this model structure. What is the interpretation of the various coefficients? What method would you use to estimate this model? (35%)
ii) What are the limitations of ARCH models such as the above? (12%)
iii) How might such limitations be overcome? (18%)

8.

a) Briefly explain any FOUR concepts from the following list:

(25x4 = 100%)

i. ADF Test
ii. Vector Auto Regressive Process (VAR).
iii. The Hausman test for exogeneity.
iv. Ramsay's RESET test.
v. Spurious regression.
vi. Error Correction Models (ECM)
vii. Dummy variable trap

END OF PAPER