

Econometrics 1, Coursework

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1 Introduction

- This coursework does not count to your final assessment.
- It is designed to provide you with practice in applied econometrics that will be useful both for questions in the January exam and for your project.
- Email your answer as a pdf file to me at r.smith@bbk.ac.uk by **2 January 2020**. You can send it as early as you like and I will provide feedback, soon after I get it.
- On your answer put (i) your name (ii) your programme (MSc Economics, etc) and (iii) the statistical program you used (gretl, Mfit, R, Stata, EViews, etc).

2 Data

The data are in a spreadsheet file called Coursework. The series are for 1760-2016 from the Bank of England, Millennium of Macroeconomic Data, source given as column in Sheet A1 Headline Series.

- U_t : percent unemployment rate. Col A1.AB;
- P_t : PGDP: GDP deflator, 2013=100. Col A1.AI
- Q_t : real UK GDP at market prices, geographically consistent estimate based on post 1922 borders. £mn Chained Volume measure, 2013 prices. Col A1.B.
- RS_t : short interest rates, percent per annum, (Bank Rate). Col A1.AS
- RL_t : long interest rates, percent per annum, (Consol/10 year debt) Col A1.AV

3 Exercise

- Do the exercise on your own sample of 100 years, which finishes in the year of your birth. For instance if you were born in 1990, your sample is 1891-1990.
- You can use any program. Put the program output in an appendix, but summarise the main results briefly in the text. The answers can be quite short.
- In doing the exercise you may have to make choices about things such as lag lengths, type of test, and significance level. Just say what you chose.
- When it says comment on your results, comment on any relevant statistical or economic aspects.
- The marks for each part are given in [...]. The total is 100.

4 Steps

1. Data generation and description.

- (a) [5] Load the data and generate log GDP, LQ_t , log GDP deflator, LP_t , inflation, $INF_t = 100 * (LP_t - LP_{t-1})$, and growth, $G_t = 100 * (LQ_t - LQ_{t-1})$. Inflation and growth are in percent per annum.
- (b) [5] Suggest four economic relationships that you might expect between these variables?
- (c) [5] For your sample, plot unemployment, growth, inflation and short and long interest rates. Calculate descriptive statistics. Comment on the main features.

2. Unrestricted model

- (a) [5] Estimate over your sample

$$U_t = \alpha_0 + \alpha_1 U_{t-1} + \alpha_2 U_{t-2} + \beta_0 LQ_t + \beta_1 LQ_{t-1} + \beta_2 LQ_{t-2} + \gamma t + \varepsilon_{1t}. \quad (1)$$

- (b) [5] Which coefficients are significant?
- (c) [5] Plot the residuals and comment on the results.
- (d) [5] Carry out diagnostic tests on the residuals for (i) serial correlation, (ii) heteroskedasticity, (iii) normality, and (iv) non-linearity using a RESET test.
- (e) [5] Briefly explain the form of the tests and what the results show.

3. Restricted model

- (a) [5] Over your sample, estimate

$$\Delta U_t = a_0 + a_1 \Delta U_{t-1} + b_0 \Delta LQ_t + \varepsilon_{2t}. \quad (2)$$

Which coefficients are significant? Plot the residuals, repeat the four diagnostic tests and comment on the results.

- (b) [5] What restrictions on (1) give (2). Test the restrictions.
(c) [5] Compare the models, (1) and (2), and the results of the diagnostic tests.

4. Univariate models

- (a) [5] Over your sample conduct an ADF unit root test on INF_t , U_t , RL_t and G_t .
(b) [5] Estimate (i) a random walk with drift, and (ii) an ARMA(1,1) model for INF_t .
(c) [5] Use a LR test and information criteria to choose between the two models in 4(b).

5. VAR

- (a) [5] Over your sample estimate a VAR between the four variables INF_t , RL_t , U_t and G_t .
(b) [5] Test for (i) Granger causality, and (ii) cointegration. Comment on your results.
(c) [10] Using the unrestricted VAR. Estimate impulse response functions for (i) a shock to G_t (ii) a shock to RL_t . Explain what assumptions you have made to estimate the impulse response functions. What economic interpretation would you give to the results?

6. Instrumental variables

- (a) [5] Over your sample estimate by instrumental variables a regression of INF_t on a constant U_t and INF_{t-1} using as instruments a constant, INF_{t-1} , U_{t-1} , G_{t-1} , RL_{t-1} . Comment on your results.
(b) [5] Estimate the reduced form equation for unemployment. Does there seem to be a weak instrument problem? Save the residuals. Estimate by OLS a regression of INF_t on a constant U_t , INF_{t-1} and these residuals. Compare these estimates with those in 6a. What do your results tell you about the exogeneity of U_t ?