## ECON 3350/7350: Applied Econometrics for Macroeconomics and Finance

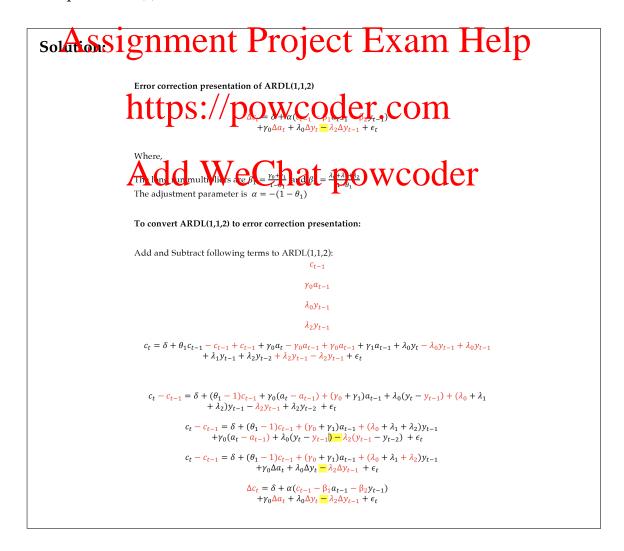
Tutorial 4: Single Equation Models of Multiple Time Series

## ARDL and ECM.

1. Derive the ECM representation of the following ARDL(1,1,2) model:

$$c_{t} = \delta + \theta_{1}c_{t-1} + \gamma_{0}a_{t} + \gamma_{1}a_{t-1} + \lambda_{0}y_{t} + \lambda_{1}y_{t-1} + \lambda_{2}y_{t-2} + \epsilon_{t}$$

Which parameter(s) in the resulting ECM are long-run multiplier(s) and adjustment parameter(s)?



2. The file wealth.csv contains observations on:

- $c_t$  = the log of total real per capita expenditures on durables, nondurables and services;
- $a_t$  = the log of a measure of real per capita household net worth(including all financial and household wealth); and
- $y_t$  = the log of after-tax labour income.

The data are from 1952Q2 through 2006Q2 (see Koop, G., S. Potter and R. W. Strachan (2008) "Re-examining the consumption-wealth relationship: The role of uncertainty" *Journal of Money, Credit and Banking*, Vol. 40, No. 2.3, 341-367.

- (a) Draw time series plots of  $c_t$ ,  $a_t$ , and  $y_t$ . Compute and plot the ACF and PACF of  $c_t$ ,  $a_t$ , and  $y_t$ . Comment on your findings.
- (b) Fit ARDL(p, q, m) models to the data with each component order of (p, q, m) up to 2. Use BIC for model selection. Report the best model. Hint: Install the ardl package and use its ardl command.
- (c) Estimate the ECM representation of the ARDL model selected in Part (b) and report the estimated model. Hint: Use the ecl option with the ardl command.

## soldssignment Project Exam Help

- (a) For all these three processes, we can see that
  - (1) There is an obvious (upward) trend.
  - (2) ACF decays very slowly.
  - (3) PAAFMED NAME & CET PLANE TO WOODE I

These results imply that none of these three processes is stationary and probably the most suitable model for them is an ARMA model with AR coefficient  $\approx 1$ .

(b) Based on BIC, we choose the ARDL(1,2,2) model. The estimated model can be represented as

$$\widehat{c}_{t} = 0.0725 + 0.0002t + 0.9145c_{t-1} + 0.0558a_{t} + 0.0009a_{t-1} - 0.0511a_{t-2}$$

$$+ 0.3589y_{t} - 0.1204y_{t-1} - 0.1972y_{t-2}$$

$$R^{2} = 0.9998$$

(c) The estimated ECM can be represented as

$$\widehat{\Delta c_t} = 0.0725 + 0.0002t - 0.0855(c_{t-1} - 0.0651a_{t-1} - 0.4836y_{t-1} + 0.0558\Delta a_t + 0.0511\Delta a_{t-1} + 0.3589\Delta y_t - 0.1972\Delta y_{t-1} + 0.0187(0.0187)$$

$$R^2 = 0.4142$$