

# 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 `ec1` option with the `ardl` command.