Macro-econometrics: Notes on Week 2 Exercise

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Some remarks:

- These notes will be posted on:
  `http://www.nuff.ox.ac.uk/Users/giese/Teaching.htm`
- As class teacher, I am your supervisor for Hilary and Trinity 2008 (and write reports). Please feel free to contact me if you have questions on the econometrics, the MPhil in general, and the thesis in particular.

Notes on suggested solutions:

1. a) Equation (9) should read $\Delta^2 y_t = \nu + \epsilon_t$.

   b) In Equation (14) the formula for the autocorrelation function should read

$$\rho_t(h) = \frac{\gamma_t(h)}{\sqrt{\gamma_t(0)\gamma_{t-h}(0)}}$$

   c) The answers use results derived in Week 1 for stationary processes under the assumption of $t \to \infty$, but then assume $t = 1, ...20$ for deriving solution for random walk. This is clearly inconsistent. However, deriving autocorrelation functions for stationary process and finite t is messy and not very interesting. Therefore, I would argue to use $t \to \infty$ argument in both cases, but also calculate the autocorrelation function for random walk for some finite t to illustrate. What matters most, is that you can argue that the persistence decays linearly in random walk and geometrically in stationary process.

2. b) Note that in the case of non-stationary data, talking about "significance" of coefficients may be misleading as t-distribution is the wrong distribution. Make clear that conclusions based on t-distribution can only be tentative.

   d) See Figure 1 below which shows unit root tests for 1-month US T-bills, 1970 to 2000. The first table shown is a summary table for the ADF test just including a constant. Four equations are estimated, and the left-most column shows you which model you are looking at: one with 3 lags in differences down to none lagged difference. The model with three lagged differences is as follows:

$$\Delta y_t = \nu + \gamma y_{t-1} + \phi_1 \Delta y_{t-1} + \phi_2 \Delta y_{t-2} + \phi_3 \Delta y_{t-3} + \epsilon_t$$

   The second column shows you the t-statistic of γ for each model. This needs to be compared with the critical values above the table. If |t-statistic| < |critical value|, we do not reject the null hypothesis, in this case $\gamma = 0$. The third column gives the coefficient value of $\gamma + 1$. The columns t-DY lag and t-prob give the t-statistic for the longest lag and its respective probability based

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Unit-root tests
The dataset is: C:\Docs\DPhil\Yield curve\yielddata.xls
The sample is: 1970(5) - 2000(12)

onem: ADF tests (T=368, Constant; 5%=-2.87 1%=-3.45)
D-lag    t-adf      beta Y_1    sigma   t-DY_lag  t-prob       AIC  F-prob
  3     -2.374       0.96711   0.6704    -0.8029  0.4226   -0.7863
  2     -2.501       0.96567   0.6701     -1.184  0.2373   -0.7899  0.4226
  1     -2.691       0.96340   0.6704      1.532  0.1264   -0.7915  0.3608
  0     -2.508       0.96611   0.6717                       -0.7906  0.2240

Unit-root tests
The dataset is: C:\Docs\DPhil\Yield curve\yielddata.xls
The sample is: 1970(5) - 2000(12)

Augmented Dickey-Fuller test for onem; regression of Donem on:

               Coefficient    Std.Error      t-value
onem_1           -0.032888     0.013852      -2.3743
Constant           0.20949     0.095889       2.1847
Donem_1           0.078558     0.052483       1.4968
Donem_2          -0.059928     0.052416      -1.1433
Donem_3          -0.041903     0.052189     -0.80291

sigma = 0.670393  DW = 2.003  DW-onem = 0.06792  ADF-onem = -2.374
Critical values used in ADF test: 5%=-2.87, 1%=-3.45
RSS = 163.1421286 for 5 variables and 368 observations

Unit-root tests
The dataset is: C:\Docs\DPhil\Yield curve\yielddata.xls
The sample is: 1970(5) - 2000(12)

onem: ADF tests (T=368, Constant+Trend; 5%=-3.42 1%=-3.99)
D-lag    t-adf      beta Y_1    sigma   t-DY_lag  t-prob       AIC  F-prob
  3     -2.481       0.96430   0.6708    -0.7714  0.4409   -0.7823
  2     -2.612       0.96279   0.6705     -1.154  0.2491   -0.7861  0.4409
  1     -2.806       0.96041   0.6708      1.557  0.1203   -0.7879  0.3827
  0     -2.616       0.96337   0.6721                       -0.7867  0.2280
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Figure 1: Unit root tests for yield curve data

on the t-distribution. This allows us to assess which model we might want to use from the summary table.

The second table presents regression results just for the model with three lags in difference. Again the coefficient on the lagged level γ should be compared with Dickey-Fuller critical values given below the table.

Finally, the third table shows the summary table now including a constant and a trend in the equations estimated. Note that the Dickey-Fuller critical values are different to above when only a constant was included.