Financial Econometrics
Review Session Notes 8: Cointegration

March 4, 2011
We will be working the T-bills data, contained in Tbill.xls. For simplicity, rename the series yield3m, yield6m, yield1y, yield5y. We begin by testing whether yield3m and yield6m have unit roots. Recall that, to do this in EViews, open the corresponding time series and, under the View tab, select Unit root test.... The results of the two unit root tests are below.

Null Hypothesis: YIELD3M has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=16)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.131257</td>
<td>0.0018</td>
</tr>
</tbody>
</table>

Test critical values: 1% level -2.571925
5% level -1.941778
10% level -1.616062


Null Hypothesis: YIELD6M has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=16)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.076323</td>
<td>0.0021</td>
</tr>
</tbody>
</table>

Test critical values: 1% level -2.571925
5% level -1.941778
10% level -1.616062


Although neither of these time series has a unit root, we will proceed as if they do have unit roots and test for cointegration.

Consider first testing whether the difference between the two variables has a unit root. To do this, create a new time series – corresponding to the difference between the 6 month yield and the 3 month yield – using:

```plaintext
series yielddiff36m=yield6m-yield3m
```

Then, open the time series and, under the View tab, select Unit root test.... The result of this test is below:

Null Hypothesis: YIELDDIFF36M has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=16)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
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</tbody>
</table>

2
Augmented Dickey-Fuller test statistic -3.558345 0.0004
Test critical values: 1% level -2.571946
5% level -1.941781
10% level -1.616060


Consider now performing a cointegration test but this time test if yield3m and yield6m are cointegrated with a unknown relationship, so that we have the relationship:

\[ z_t = yield6m_t - \gamma yield3m_t. \]

To do this, open the two time series as a group and, under the View tab, select Cointegration test→single-equation cointegration test. This will open a cointegration Test Specification window. To test the above relationship, select the default option. The (relevant) results of the test are presented below. Since the p-value is less than 5%, we reject the null and draw the conclusion that those two series are cointegrated.

Null hypothesis: Series are not cointegrated
Cointegrating equation deterministics: C
Automatic lags specification based on Schwarz criterion (maxlag=16)

Dependent tau-statistic Prob.* z-statistic Prob.*
YIELD3M -6.316075 0.0000 -68.13557 0.0000
YIELD6M -6.362810 0.0000 -68.47795 0.0000


Intermediate Results:
YIELD3M YIELD6M
Rho - 1 -0.203999 -0.205024
Rho S.E. 0.032298 0.032222
Residual variance 0.011612 0.012347
Long-run residual variance 0.011612 0.012347
Number of lags 0 0
Number of observations 334 334
Number of stochastic trends** 2 2

Consider now estimating an Error Correction Model (ECM) of order 1 for all four yield time series. To do this, under the Quick tab, select Estimate VAR.... Then, under the VAR type box, select the Vector Error Correction button. In the Endogenous variables box, enter yield3m yield6m yield1y yield5y; in the Lag Intervals for Endogenous, enter 1 1.
Consider now forecasting from the VAR(1) model. Unlike with equation objects, we cannot forecast directly from a VAR object. Instead, we must first create a model. To do this, under the Proc tab of the VAR object, select Make Model. Once the model object has been created, click on the Solve tab. For the one-step-ahead forecast, select the Static solution option under the Dynamics heading. Then, to view the graph with actuals vs forecasts, under the Proc tab, select Make Graph..., and make sure that the Actuals radio button is clicked. The plots for the four time series are presented in Fig. 1.

Figure 1: Static forecasts