EVIEWS tutorial:

Cointegration and error correction

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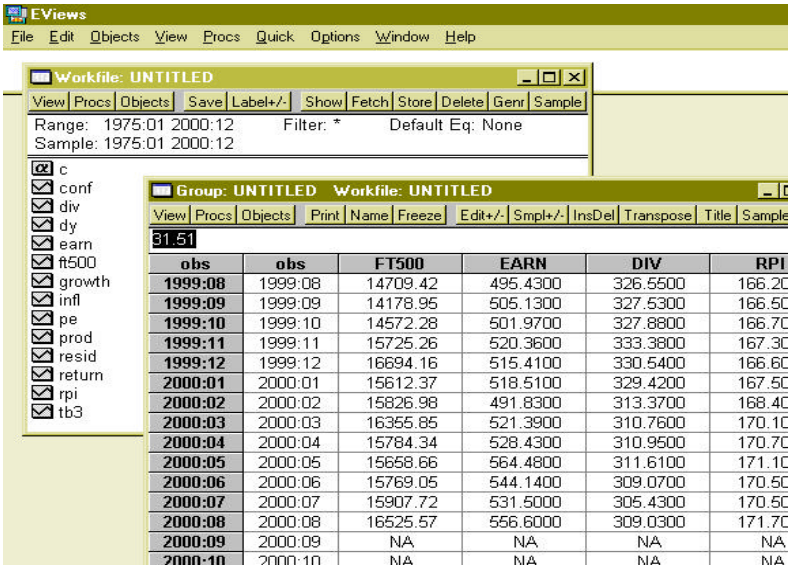
EVIEWS

- On the City University system, EVIEWS 3.1 is in Start/ Programs/ Departmental Software/CUBS
- Analysing stationarity in a single variable using VIEW
- Analysing cointegration among a group of variables
- Estimating an ECM model
- Estimating a VAR-ECM model

The FT500M workfile

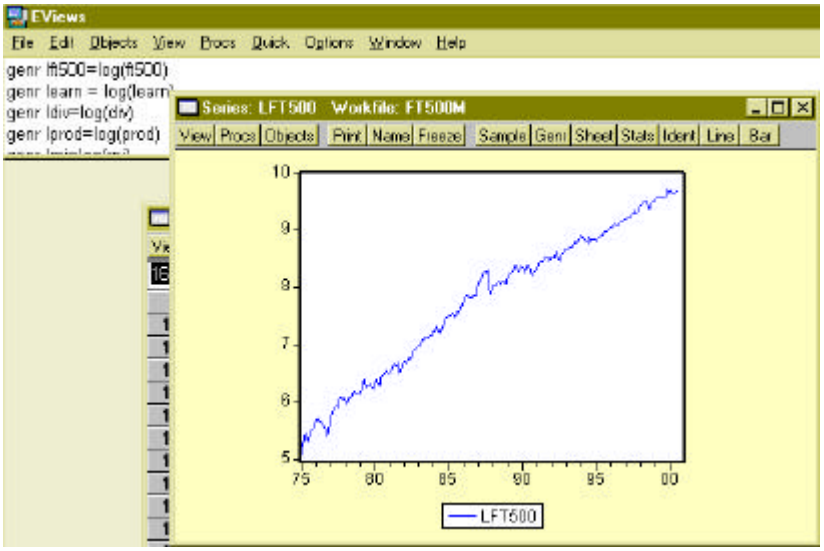


obs	obs	FT500	EARN	DIV	RPI
1999:08	1999:08	14709.42	495.4300	326.5500	166.2C
1999:09	1999:09	14178.95	505.1300	327.5300	166.5C
1999:10	1999:10	14572.28	501.9700	327.8800	166.7C
1999:11	1999:11	15725.26	520.3600	333.3800	167.3C
1999:12	1999:12	16694.16	515.4100	330.5400	166.6C
2000:01	2000:01	15612.37	518.5100	329.4200	167.5C
2000:02	2000:02	15826.98	491.8300	313.3700	168.4C
2000:03	2000:03	16355.85	521.3900	310.7600	170.1C
2000:04	2000:04	15784.34	528.4300	310.9500	170.7C
2000:05	2000:05	15658.66	564.4800	311.6100	171.1C
2000:06	2000:06	15769.05	544.1400	309.0700	170.5C
2000:07	2000:07	15907.72	531.5000	305.4300	170.5C
2000:08	2000:08	16525.57	556.6000	309.0300	171.7C
2000:09	2000:09	NA	NA	NA	NA
2000:10	2000:10	NA	NA	NA	NA

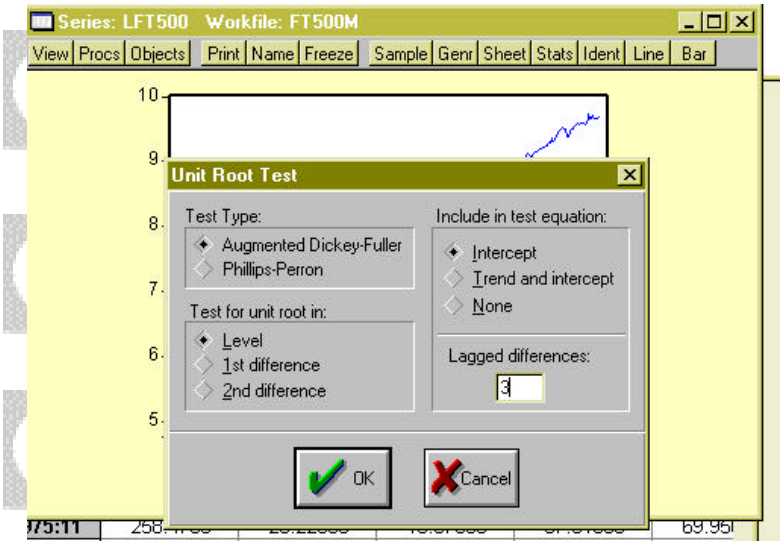
Data transformation

- Generate a series for the natural log of the FT500 index (lft500)
- Test for stationarity in
  - the level of this series
  - the first difference of this series (dlft500)
- Results show that lft500 is an I(1) variable

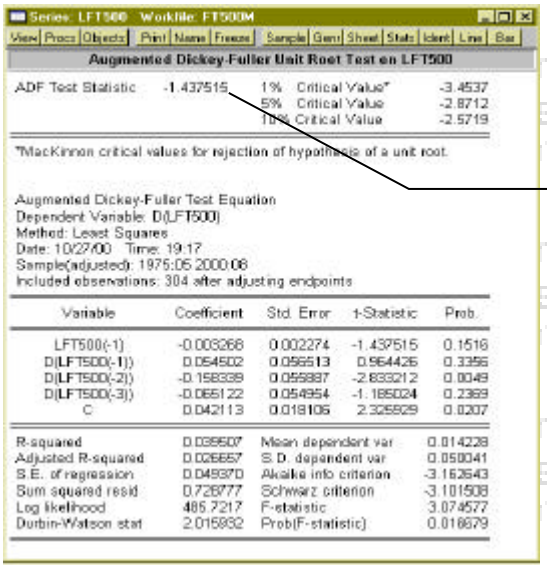
Generate ln(FT500)



Augmented Dickey-Fuller (ADF) Test

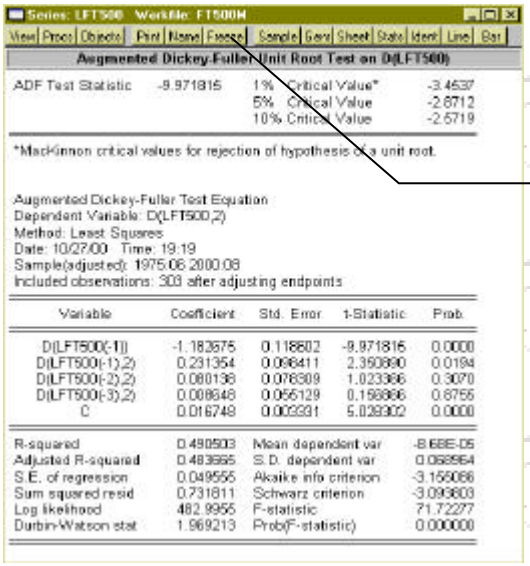


ADF results: level



The hypothesis that lft500 has a unit root cannot be rejected

ADF test results: first difference



The hypothesis that the first difference of lft500 has a unit root ***can*** be rejected.

So lft500 is I(1)

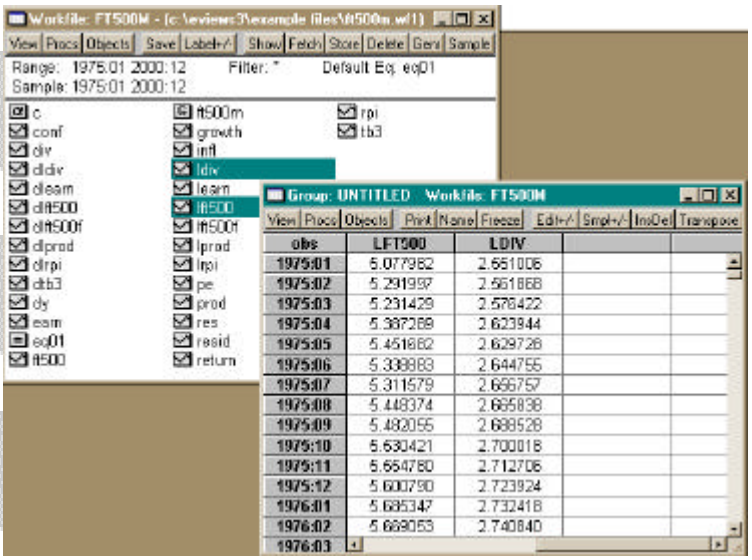
Cointegration: two variables

- The variables lft500 (log of stock index) and ldiv (log of dividends per share) are both I(1)
- We can test whether they are cointegrated
  - that is, whether a linear function of these is I(0)
  - An example of a linear function is

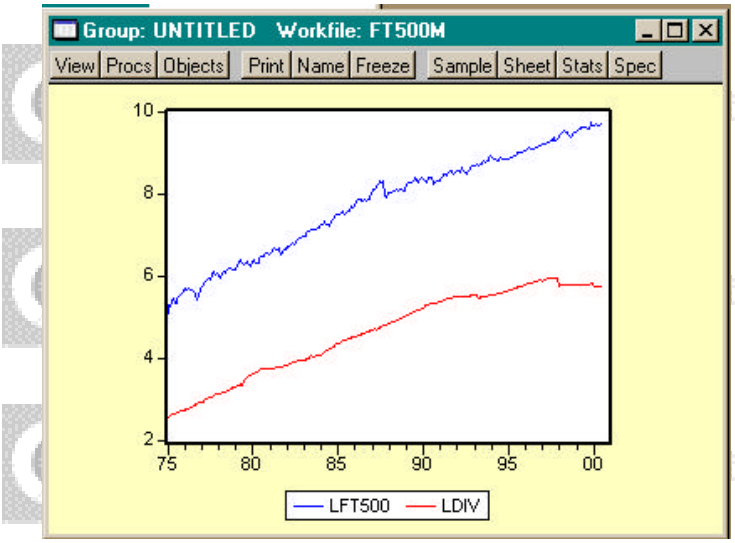
    $lft500_t = a_0 + a_1 ldiv_t + u_t$

    when $u_t = [lft500_t - a_0 - a_1 ldiv]$ might be I(0)
- The expression in brackets [] is called the ***cointegrating vector***, which has normalised coefficients [1, $-a_0$, $-a_1$]

Form new group ...



Common trends?



Engle-Granger: first stage regression

Equation: UNTITLED Workfile: FT500M

View | Procs | Objects | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

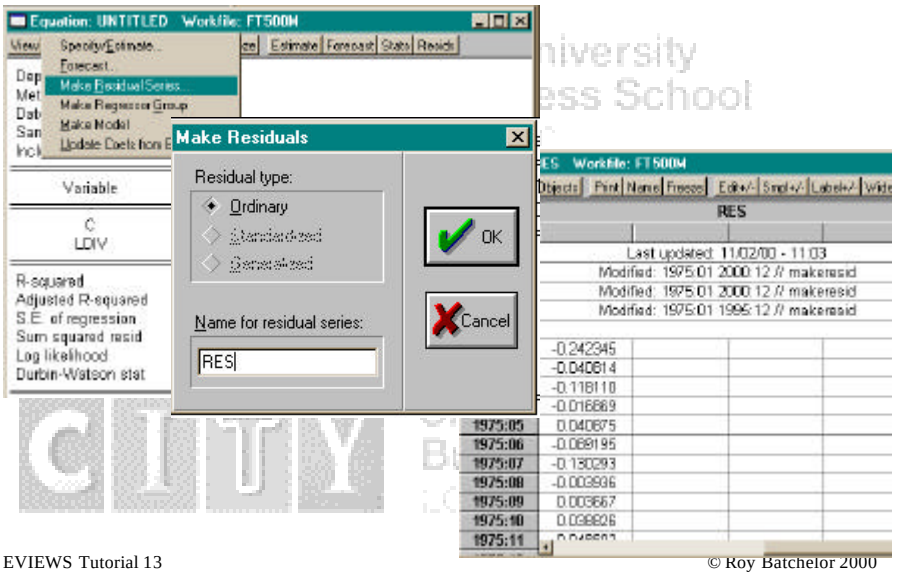
Dependent Variable: LFT500
Method: Least Squares
Date: 11/02/00 Time: 11:01
Sample: 1975:01 1995:12
Included observations: 252

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.388322	0.040888	58.41105	0.0000
LDIV	1.149353	0.009165	125.4075	0.0000

R-squared	0.984353	Mean dependent var	7.395240
Adjusted R-squared	0.984290	S.D. dependent var	1.117301
S.E. of regression	0.140042	Akaike info criterion	-1.085842
Sum squared resid	4.902952	Schwarz criterion	-1.057830
Log likelihood	138.8160	F-statistic	15727.05
Durbin-Watson stat	0.167088	Prob(F-statistic)	0.000000

Don't worry about this...

Save first-stage residuals (u_t = RES)



Engle-Granger:stage two (ECM) regression

Equation: UNTITLED Workfile: FT500M

View | Procs | Objects | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: DLFT500
Method: Least Squares
Date: 11/02/00 Time: 11:06
Sample(adjusted): 1975:03 1995:12
Included observations: 250 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010568	0.005777	1.829286	0.0686
DLFT500(-1)	0.059286	0.062509	0.948434	0.3438
DLDIV	0.148933	0.257720	0.577887	0.5639
DLDIV(-1)	0.125376	0.255328	0.491037	0.6238
RES(-1)	-0.073868	0.025017	-2.952702	0.0035

R-squared	0.035776	Mean dependent var	0.014948
Adjusted R-squared	0.020034	S.D. dependent var	0.053987
S.E. of regression	0.053443	Akaike info criterion	-3.000598
Sum squared resid	0.699762	Schwarz criterion	-2.930169
Log likelihood	380.0748	F-statistic	2.272610
Durbin-Watson stat	1.929673	Prob(F-statistic)	0.062054

About 7% of disequilibrium "corrected" each month

General model: stage one (I(1) variables)

Equation: UNTITLED Workfile: FT500M

View | Proc | Objects | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: LFT500
Method: Least Squares
Date: 11/02/00 Time: 11:09
Sample: 1975:01 1995:12
Included observations: 252

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.438814	1.006762	4.408999	0.0000
LDIV	0.824636	0.070706	11.66295	0.0000
LEARN	0.400457	0.065511	6.112645	0.0000
LPROD	-0.603047	0.210528	-2.864443	0.0045
LRPI	0.041873	0.105460	0.397051	0.6917
CONF	0.005704	0.000478	11.93730	0.0000
TB3	-1.857279	0.271673	-6.836465	0.0000

R-squared	0.993328	Mean dependent var	7.395240
Adjusted R-squared	0.993164	S.D. dependent var	1.117301
S.E. of regression	0.092376	Akaike info criterion	-1.898520
Sum squared resid	2.090654	Schwarz criterion	-1.800480
Log likelihood	246.2135	F-statistic	6079.104
Durbin-Watson stat	0.451858	Prob(F-statistic)	0.000000

General model: stage two

Equation: UNTITLED Workfile: FT500M

View | Proc | Objects | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: DLFT500
Method: Least Squares
Date: 11/02/00 Time: 11:13
Sample(adjusted): 1975:03 1995:12
Included observations: 250 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.008040	0.005069	1.586178	0.1133
DLFT500(-1)	0.075496	0.060525	1.247361	0.2135
DLDIV	0.295524	0.262421	1.126143	0.2612
DLEARN	0.068821	0.127303	0.539040	0.5904
DLPROD	0.289909	0.224758	1.289640	0.1984
DLRPI	0.044388	0.454291	0.097708	0.9222
DCONF	0.001385	0.000500	2.768013	0.0061
DTB3	-2.542017	0.409831	-6.202603	0.0000
RES(-1)	-0.152015	0.037486	-4.056259	0.0001

R-squared	0.195254	Mean dependent var	0.014948
Adjusted R-squared	0.168540	S.D. dependent var	0.053987
S.E. of regression	0.049227	Akaike info criterion	-3.149394
Sum squared resid	0.584026	Schwarz criterion	-3.022622
Log likelihood	402.6743	F-statistic	7.309158
Durbin-Watson stat	1.935520	Prob(F-statistic)	0.000000

Specific model:stage two

Equation: UNTITLED Workfile: FT500M

View | Procs | Objects | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: DLFT500
Method: Least Squares
Date: 11/02/00 Time: 11:14
Sample(adjusted): 1975:02 1995:12
Included observations: 251 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.015636	0.003412	4.582659	0.0000
DCONF	0.001246	0.000523	2.381295	0.0180
RES(-1)	-0.128131	0.038395	-3.338063	0.0010

R-squared	0.053258	Mean dependent var	0.015741
Adjusted R-squared	0.045623	S.D. dependent var	0.055324
S.E. of regression	0.054048	Akaike info criterion	-2.986023
Sum squared resid	0.724444	Schwarz criterion	-2.943886
Log likelihood	377.7459	F-statistic	6.975430
Durbin-Watson stat	1.809954	Prob(F-statistic)	0.001129

1-month ahead forecasts of lft500 from first stage regression

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genr res=lft500-lft500f
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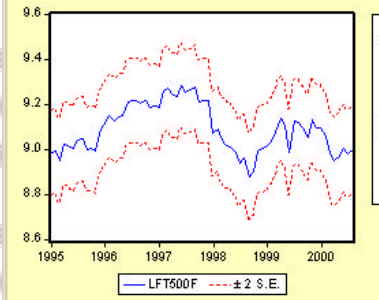
Equation: UNTITLED Workfile: FT500M

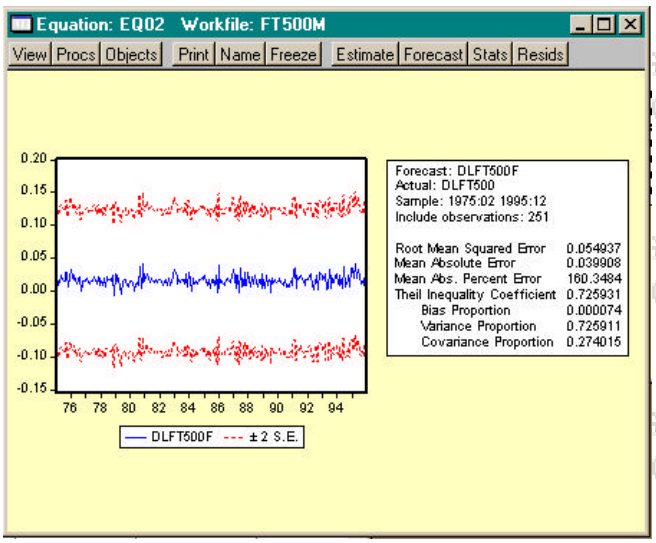
View | Procs | Objects | Print | Name | Freeze | Estimate | Forecast | Stats | Resids



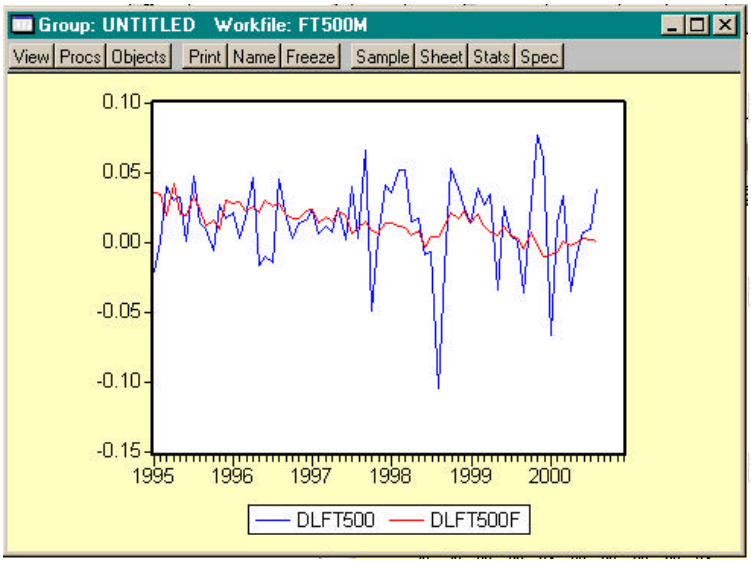
Forecast: LFT500F
Actual: LFT500
Sample: 1995:01 2000:08
Include observations: 68

Root Mean Squared Error	0.377337
Mean Absolute Error	0.287069
Mean Abs. Percent Error	3.019446
Theil Inequality Coefficient	0.020497
Bias Proportion	0.367632
Variance Proportion	0.174242
Covariance Proportion	0.458126

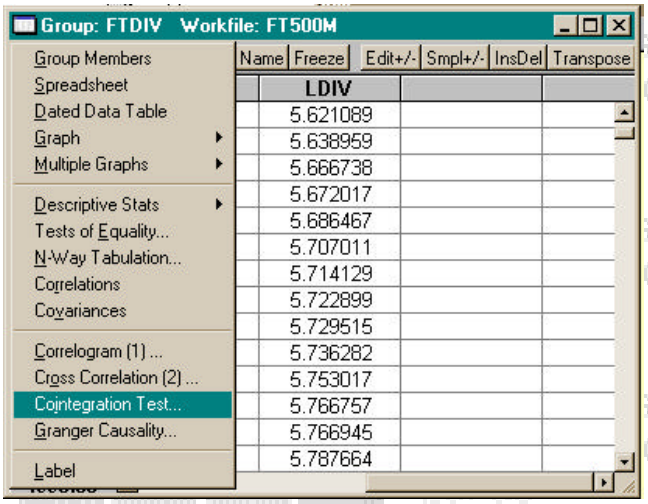
1-month ahead forecasts of dlft500 from the second stage ECM



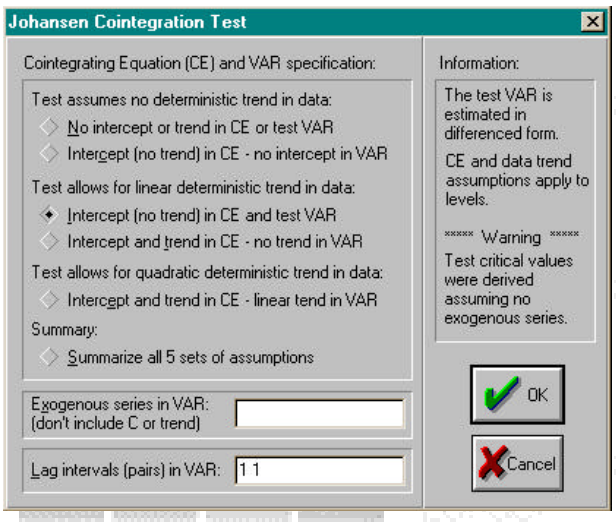
1-month ahead changes in lft500: actual v. forecast



Johansen method: make group of associated I(1) variables (lft500, ldiv)



Set up Johansen procedure



Johansen test for cointegrating vector(s)

Group: FTDIV Workfile: FT500M

View | Procs | Objects | Print | Name | Freeze | Sample | Sheet | Stats | Spec

Johansen Cointegration Test

Date: 11/02/00 Time: 11:38
Sample: 1975:01 1995:12
Included observations: 250
Test assumption: Linear deterministic trend in the data
Series: LFT500 LDIV
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.066904	25.25193	15.41	20.04	None **
0.031261	7.940121	3.76	6.65	At most 1 **

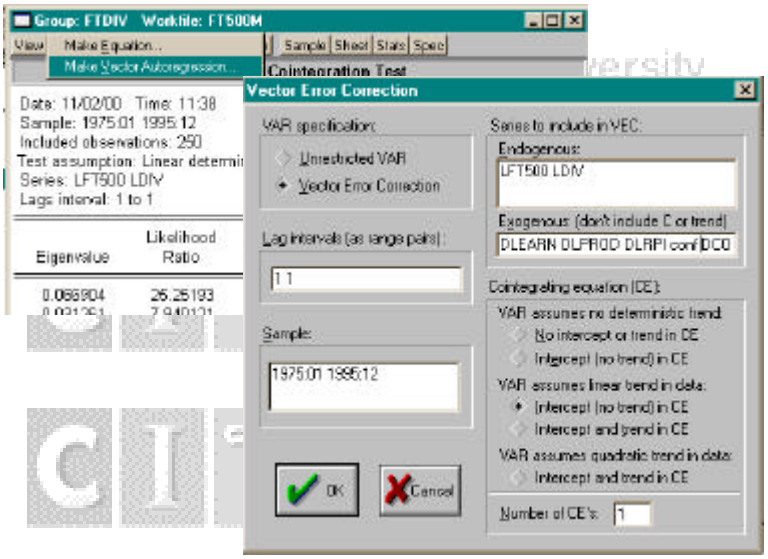
*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Cointegrating vector (cf. First stage regression)

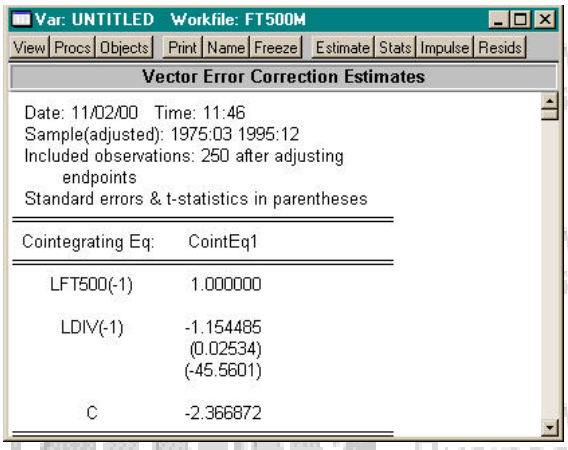
Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LFT500	LDIV	C
1.000000	-1.278575	-1.826107
	(0.06102)	
Log likelihood	1110.932	

Set up VAR-ECM



Cointegrating vector of both endogenous I(1) variables



VAR-ECM-X models for both endogenous variables

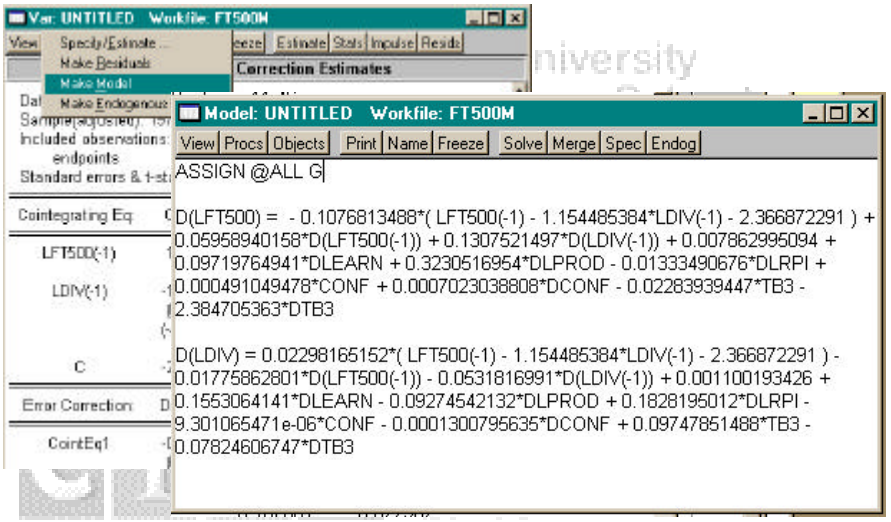
Error Correction:	D(LFT500)	D(LDIV)
CointEq1	-0.107681	0.022982
	(-3.17746)	(2.86534)
D(LFT500(-1))	0.059589	0.017759
	(0.96838)	(1.21614)
D(LDIV(-1))	0.130752	-0.053182
	(0.52210)	(-0.39414)
C	0.007863	0.001100
	(0.54340)	(0.32614)
DLEARN	0.097196	0.155306
	(0.76997)	(5.11290)
DLPROD	0.323052	-0.092745
	(1.39484)	(-1.68621)
DLRPI	-0.013935	0.182820
	(-0.02745)	(1.58431)
CONF	0.000491	-9.30E-06
	(1.69946)	(-0.13654)
DCONF	0.000702	-0.000130
	(1.36623)	(-1.06648)
TB3	-0.022839	0.097479
	(-0.16817)	(3.02206)
DTB3	-2.384705	-0.078246
	(-5.52037)	(-0.76267)
R-squared	0.176485	0.232243
Adj. R-squared	0.142029	0.200120
Sum sq. resids	0.597646	0.033711

About 2% of disequilibrium "corrected" each month by changes in dividends ldiv

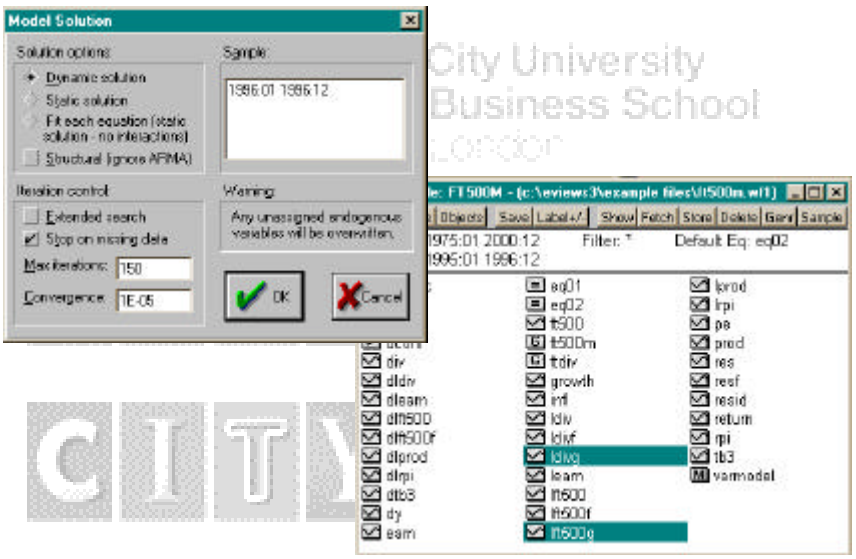
About 10% of disequilibrium "corrected" each month by changes in stock index lft500

Exogenous I(0) variables affecting stock index and dividends

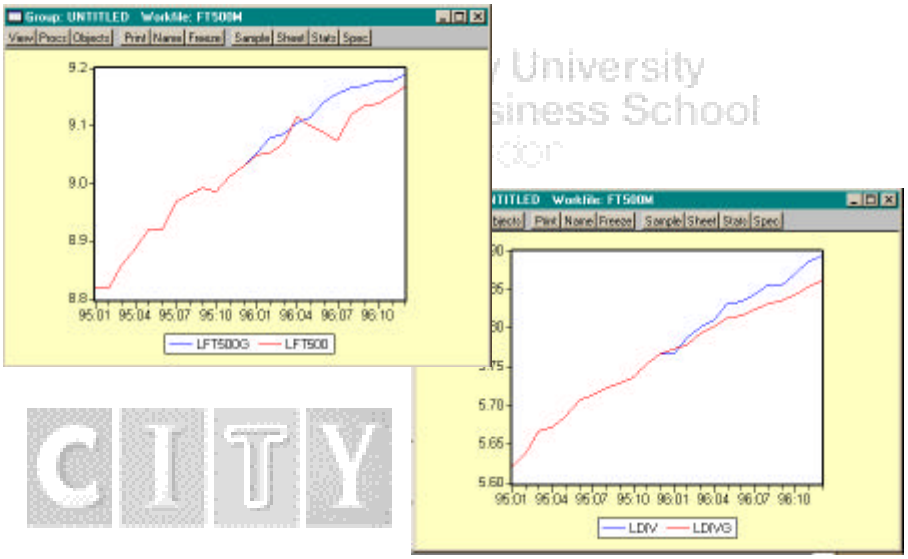
Forecasting: make VAR-ECM model



Dynamic forecasting: 1 year ahead



Stock index and dividend forecasts, 1996



Updated model (1975-98)

Model: UNTITLED Workfile: FT500M

View | Proc | Objects | Print | Name | Freeze | Solve | Merge | Spec | Endog

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ASSIGN @ALL F

D(LFT500) = - 0.044087707267*( LFT500(-1) - 1.008512935*LDIV(-1) - 3.050155907 ) +
0.018010318 6*D(LFT500(-1)) - 0.102089227 6*D(LDIV(-1)) + 0.02403719422 +
0.099220331 26*DLEARN + 0.330589691*DLPROD - 0.247183345 5*DLRPI +
3.471881081e-05*CONF + 0.000732948398 4*DCONF - 0.093727712 79*TB3 -
2.328070308*DTB3

D(LDIV) = - 0.008344001406*( LFT500(-1) - 1.008512935*LDIV(-1) - 3.050155907 ) -
0.007264535378*D(LFT500(-1)) - 0.015787364 25*D(LDIV(-1)) - 0.000732115437 +
0.188836783 9*DLEARN - 0.084763355 91*DLPROD + 0.034839934 33*DLRPI +
0.000149212 1049*CONF - 0.000198095254 9*DCONF + 0.091420863 34*TB3 -
0.096329788 6*DTB3
```


Forecasts for 1999-2000: a Crash coming?