Research Methods For Economists

Use of Time Series and Cross Section Econometric Models for Economic Analysis

Lecture 5
AR(1), MA(1), ARMA(1,1)
Volatility Study with ARCH and GARCH
Dynamic Model
Unit root and Cointegration
Simultaneous equation Models
VAR-models
Panel Data Models
Logistic and Probit Models

h =1 period ahead Forecast in AR(1) Model

$$y_t = \delta + \theta_1 y_{t-1} + e_t$$

$$y_{T+1} = \delta + \theta_1 y_T + e_{T+1} \qquad e_{T+1} \sim N(0,1)$$

$$\hat{Y}_{T+1} = E(Y_{T+1}) = \delta + \theta_1 y_T$$

Error of Forecast

$$\hat{e}_{T+1} = Y_{T+1} - \hat{Y}_{T+1} = \delta + \theta_1 y_T + e_{T+1} - \delta - \theta_1 y_T = e_{T+1}$$

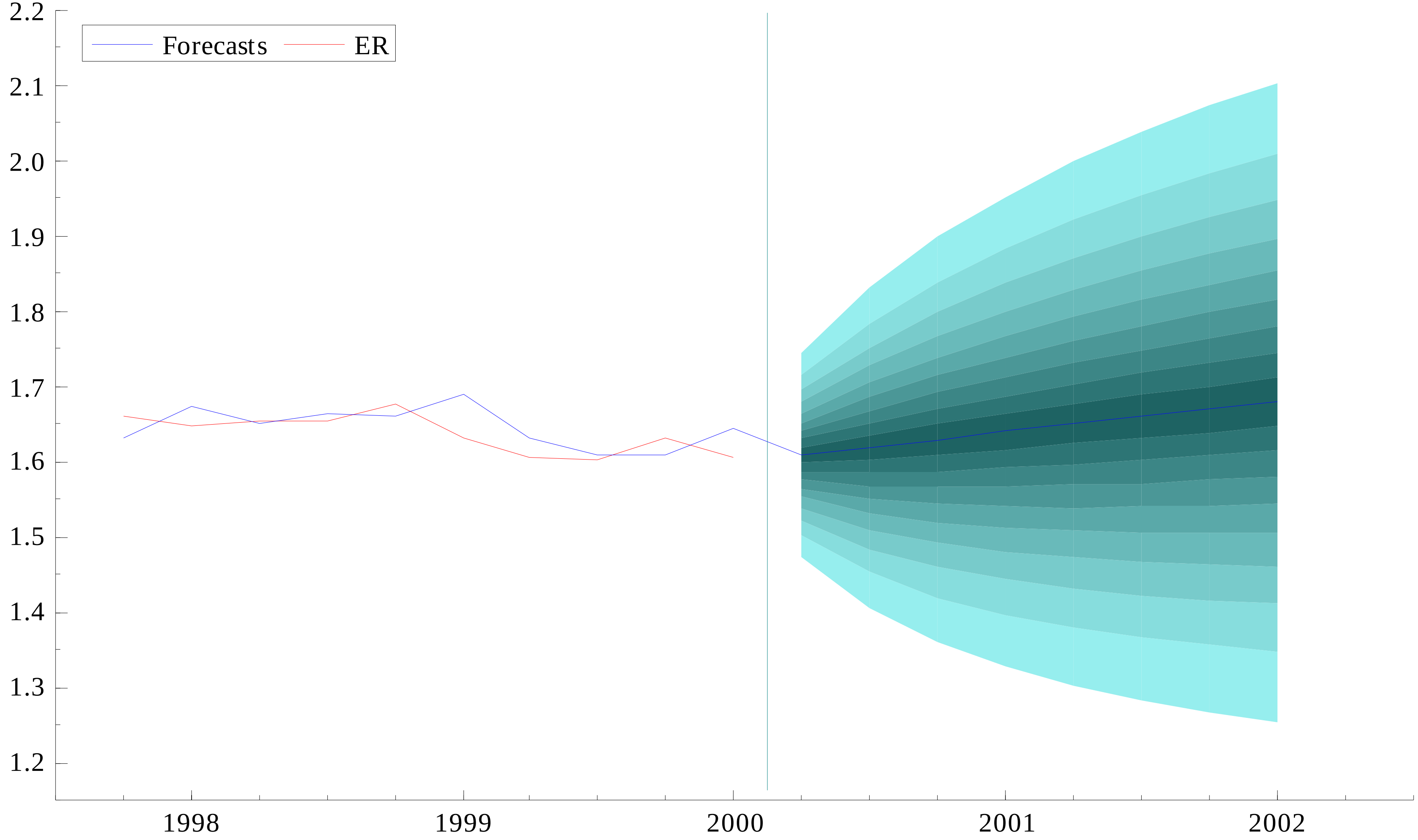
$$\mathrm{var}\left(\hat{e}_{T+1}\right) = \sigma_e^2$$

---- Maximum likelihood estimation of ARFIMA(2,d,0) model ----
The estimation sample is: 1970 (3) - 2000 (1)
The dependent variable is: ER (uk_r.xls)

	Coefficient	Std.Error	t-value	t-prob
d parameter	0.0433834	0.2621	0.166	0.869
AR-1	1.14930	0.2840	4.05	0.000
AR-2	-0.191757	0.2352	-0.815	0.417
Constant	1.86839	0.1918	9.74	0.000

log-likelihood	125.731401		
no. of observations	119	no. of parameters	5
AIC.T	-241.462801	AIC	-2.02909917
mean(ER)	1.82648	var(ER)	0.12318
sigma	0.0830594	sigma^2	0.00689886

PcGive AR(2) Forecasts of Exchange Rate



h =1 period ahead Forecast in MA(1) Model

$$y_t = \mu + e_t + \alpha_1 e_{t-1}$$

$$y_{T+1} = \mu + e_{T+1} + \alpha_1 e_T$$

$$E\left(y_{T+1}\right) = \hat{y}_{T+1} = \mu + \alpha_1 e_T$$

$$\left(y_{T+1} - \hat{y}_{T+1}\right) = \mu + e_{T+1} + \alpha_1 e_T - \mu - \alpha_1 e_T = e_{T+1}$$

$$E\left(y_{T+1} - \hat{y}_{T+1}\right)^2 = \operatorname{var}\left(e_{T+1}\right)^2 = \sigma_e^2$$

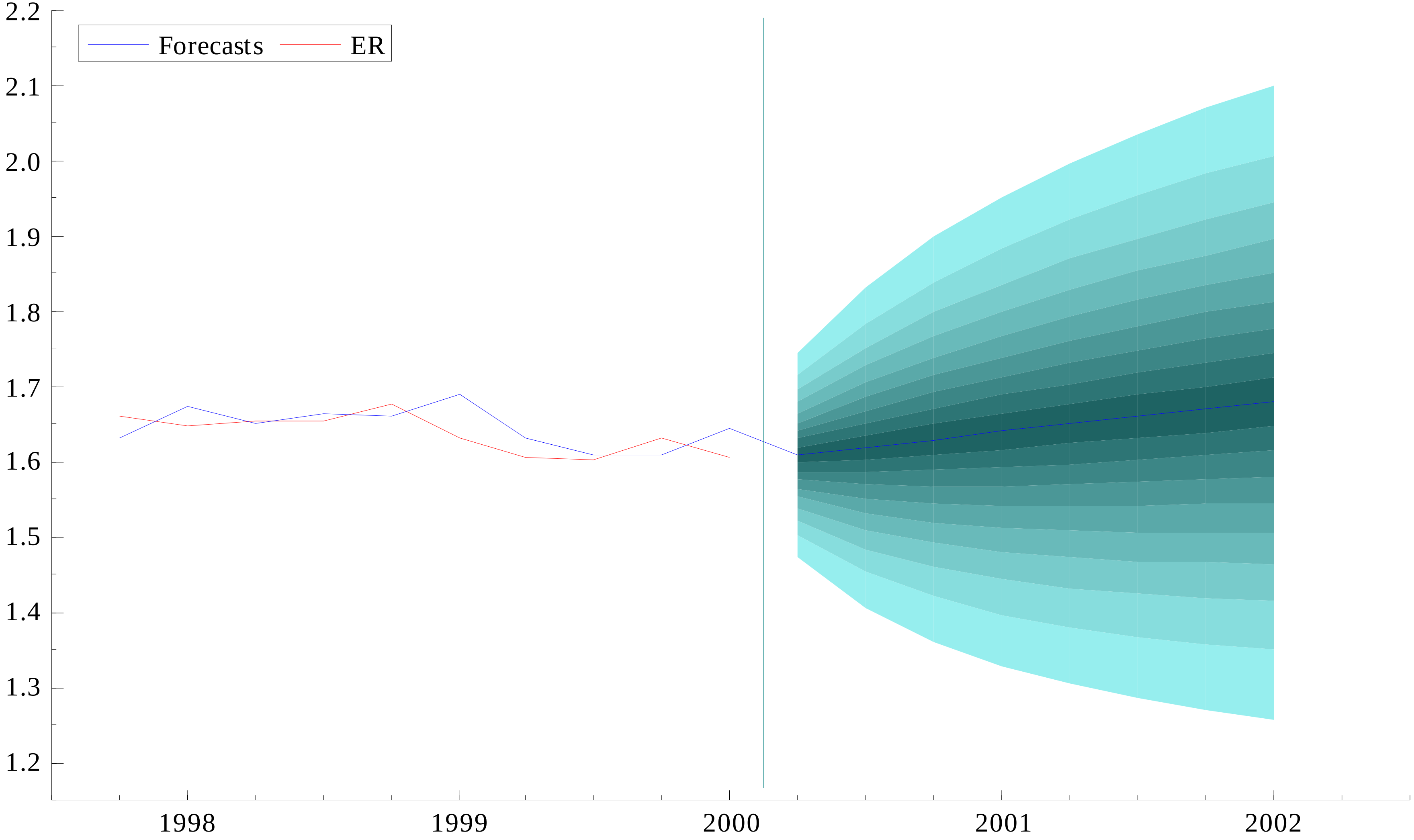
---- Maximum likelihood estimation of ARFIMA(0,d,4) model ----

The estimation sample is: 1970 (3) - 2000 (1)

The dependent variable is: ER (uk_r.xls)

	Coefficient	Std.Error	t-value	t-prob
d parameter	0.464654	0.04509	10.3	0.000
MA-1	0.824885	0.1008	8.18	0.000
MA-2	0.571403	0.1403	4.07	0.000
MA-3	0.388408	0.1284	3.02	0.003
MA-4	0.312203	0.08660	3.60	0.000
Constant	1.88171	0.4767	3.95	0.000

log-likelihood	124.254262		
no. of observations	119	no. of parameters	7
AIC.T	-234.508524	AIC	-1.97065986
mean(ER)	1.82648	var(ER)	0.12318
sigma	0.0834514	sigma^2	0.00696413


Forecasts
ER
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1998
1999
2000
2001
2002

h =1 period ahead Forecast in ARMA(1,1) Mode

$$Y_t = \delta + \theta_1 y_{t-1} + e_t + \alpha_1 e_{t-1}$$

$$y_{T+1} = \delta + \theta_1 y_{t-1} + e_{T+1} + \alpha_1 e_T$$

$$E\left(y_{T+1}\right) = \hat{y}_{T+1} = \delta + \theta_1 y_{t-1} + \alpha_1 e_T$$

$$\hat{e}_{T+1} = \left(y_{T+1} - \hat{y}_{T+1}\right) = \delta + \theta_1 y_{t-1} + e_{T+1} + \alpha_1 e_T - \delta - \theta_1 y_{t-1} - \alpha_1 e_T = e_{T+1}$$

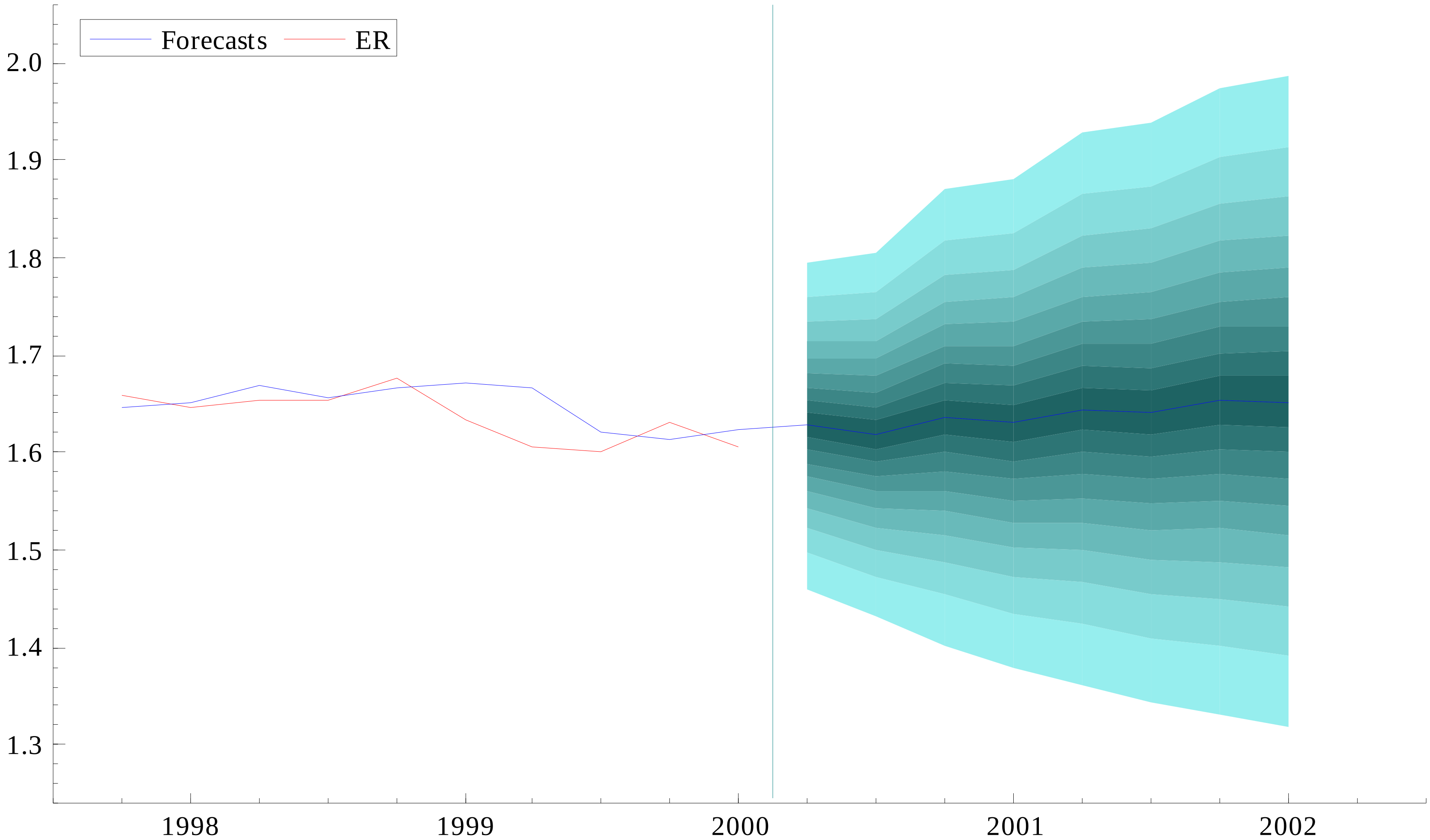
$$\mathrm{var}\left(\hat{e}_{T+1}\right) = E\left(y_{T+1} - \hat{y}_{T+1}\right)^2 = \mathrm{var}\left(e_{T+1}\right) = \sigma_e^2$$

---- Maximum likelihood estimation of ARFIMA(2,d,2) model ----
The estimation sample is: 1970 (3) - 2000 (1)
The dependent variable is: ER (uk_r.xls)

	Coefficient	Std.Error	t-value	t-prob
d parameter	0.491109	0.01253	39.2	0.000
AR-2	0.729690	0.09313	7.84	0.000
MA-2	-0.256079	0.1294	-1.98	0.050
Constant	1.89002	1.145	1.65	0.101

log-likelihood	99.8674294		
no. of observations	119	no. of parameters	5
AIC.T	-189.734859	AIC	-1.59441058
mean(ER)	1.82648	var(ER)	0.12318
sigma	0.101928	sigma^2	0.0103893

Forecasts of Exchange Rate from ARMA(2,d,2) Model



Dicky-Fuller and Augmented Dicky-Fuller Tests

$$y_t = \rho y_{t-1} + v_t$$

$$\Delta y_t = (1-\rho) y_{t-1} + v_t \, ;$$

Random Walk:

$$\Delta y_t = \gamma y_{t-1} + v_t$$

Random Walk with a drift (intercept):

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + v_t$$

Trend stationary process

$$\Delta y_t = \alpha_0 + \alpha_1 t + \gamma y_{t-1} + v_t$$

Augmented Dicky Fuller Test

$$\Delta y_t = \alpha_0 + \alpha_1 t + \gamma y_{t-1} + \sum_{i=1}^{m} a_i \Delta y_{t-i} + v_t$$

Null hypotheses:
There is unit root and time series in non-stationary
K=0 ➔ (1-Ψ)=0
Alternative hypothesis:
There is no unit root and time series is stationary
K<0 ➔ (1-Ψ)<0 ➔ Ψ<1

Unit Root Tests of Unemployment Rate

Unit root exists in the level of unemployment rate

URT: ADF tests (T=373, Constant; 5%=-2.87 1%=-3.45)

D-lag	t-adf	beta Y_1	sigma	t-DY_lag	t-prob	AIC	F-prob
3	-1.143	0.99595	0.1969	-0.4586	0.6468	-3.237	
2	-1.165	0.99588	0.1967	-0.9016	0.3679	-3.242	0.6468
1	-1.209	0.99573	0.1966	6.955	0.0000	-3.245	0.6005
0	-0.9868	0.99630	0.2088			-3.127	0.0000

There is no unit root in the first difference

DURT: ADF tests (T=372, Constant; 5%=-2.87 1%=-3.45)

D-lag	t-adf	beta Y_1	sigma	t-DY_lag	t-prob	AIC	F-prob
3	-7.625**	0.40441	0.1948	-3.144	0.0018	-3.258	
2	-10.17**	0.28958	0.1971	0.4874	0.6263	-3.237	0.0018
1	-11.59**	0.30717	0.1969	0.9270	0.3545	-3.242	0.0068
0	-13.52**	0.33903	0.1969			-3.245	0.0125

Output from the PcGive

Engle-Granger Approach to Co-integration

$$Y_t = \beta_1 + \beta_2 X_t + e_t$$

$$e_t = Y_t - \beta_1 - \beta_2 X_t$$

If Y_t and X_t I(1) but e_t I(0)

$$e_t = \alpha_0 + \gamma e_{t-1} + v_t$$

$\gamma = 0$ ⟶ Cointegration

Long-Run Multiplier in ARDL(1,1)

$$Y_t = \beta_1 + \beta_2 Y_{t-1} + \beta_3 X_t + \beta_4 X_{t-1} + \varepsilon_t$$

$$\varepsilon_t \sim N(0,1)$$

$$Y_t = Y_{t-1} = \bar{Y} \qquad X_t = X_{t-1} = \bar{X}$$

$$\bar{Y} - \beta_2 \bar{Y} = \beta_1 + \beta_3 \bar{X} + \beta_4 \bar{X}$$

$$\bar{Y} = \frac{\beta_1}{(1-\beta_2)} + \left(\frac{\beta_3 + \beta_4}{(1-\beta_2)}\right)\bar{X}$$

Steps for Granger Causality Test

Does increase in money supply increase GDP or an increase In GDP increase money supply?

$$Y_t = \sum_{i=1}^{n} \alpha_i M_{t-i} + \sum_{j=1}^{n} \beta_j Y_{t-j} + u_{1,t}$$

$$M_t = \sum_{i=1}^{n} \lambda_i M_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + u_{2,t}$$

Four possible cases for Granger Causality

1. Uni-directional causality from money to GDP

$$\sum_{i}^{n} \alpha_i \neq 0 \qquad \sum_{i}^{n} \delta_i = 0$$

2. Uni-directional causality from GDP tp money

$$\sum_{i}^{n} \alpha_i = 0 \qquad \sum_{i}^{n} \delta_i \neq 0$$

3. Bilateral causality

$$\sum_{i}^{n} \alpha_i \neq 0 \qquad \sum_{i}^{n} \delta_i \neq 0$$

3. Independence from each other

$$\sum_{i}^{n} \alpha_i = 0 \qquad \sum_{i}^{n} \delta_i = 0$$

Steps for Granger Causality Test

- Regress GDP to all lagged GDP and other variables but not to the lagged money terms and get error some square of the restricted model
- Include lags for GDP as well as money and get the unrestricted residual sum square

$$F_{m,(n-k)} = \frac{\left(RSS_R - RSS_{UR}\right)/m}{RSS_{UR}/\left(n-k\right)}$$

$$H_0 : \sum_i^n \alpha_i = 0$$ No causality

Analysis of Volatility using ARCH(p)

Consider an ADL(1,1) model

$$Y_t = \beta_1 + \beta_2 Y_{t-1} + \beta_4 X_{t-1} + \varepsilon_t$$

ARCH Model Engle (1982)

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \varepsilon_{t-2}^2 + \alpha_3 \varepsilon_{t-2}^2 + \ldots + \alpha_p \varepsilon_{t-p}^2$$

Analysis of Volatility using GARCH(p,q): Bollersev(1986)

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \varepsilon_{t-2}^2 + \alpha_3 \varepsilon_{t-3}^2 + \ldots + \alpha_p \varepsilon_{t-p}^2 + \phi_1 \sigma_{t-1}^2 + \phi_2 \sigma_{t-2}^2 + \phi_3 \sigma_{t-3}^2 + \ldots + \phi_q \sigma_{t-q}^2$$

GARCH(1,1) Estimations of Stock Price Volatility

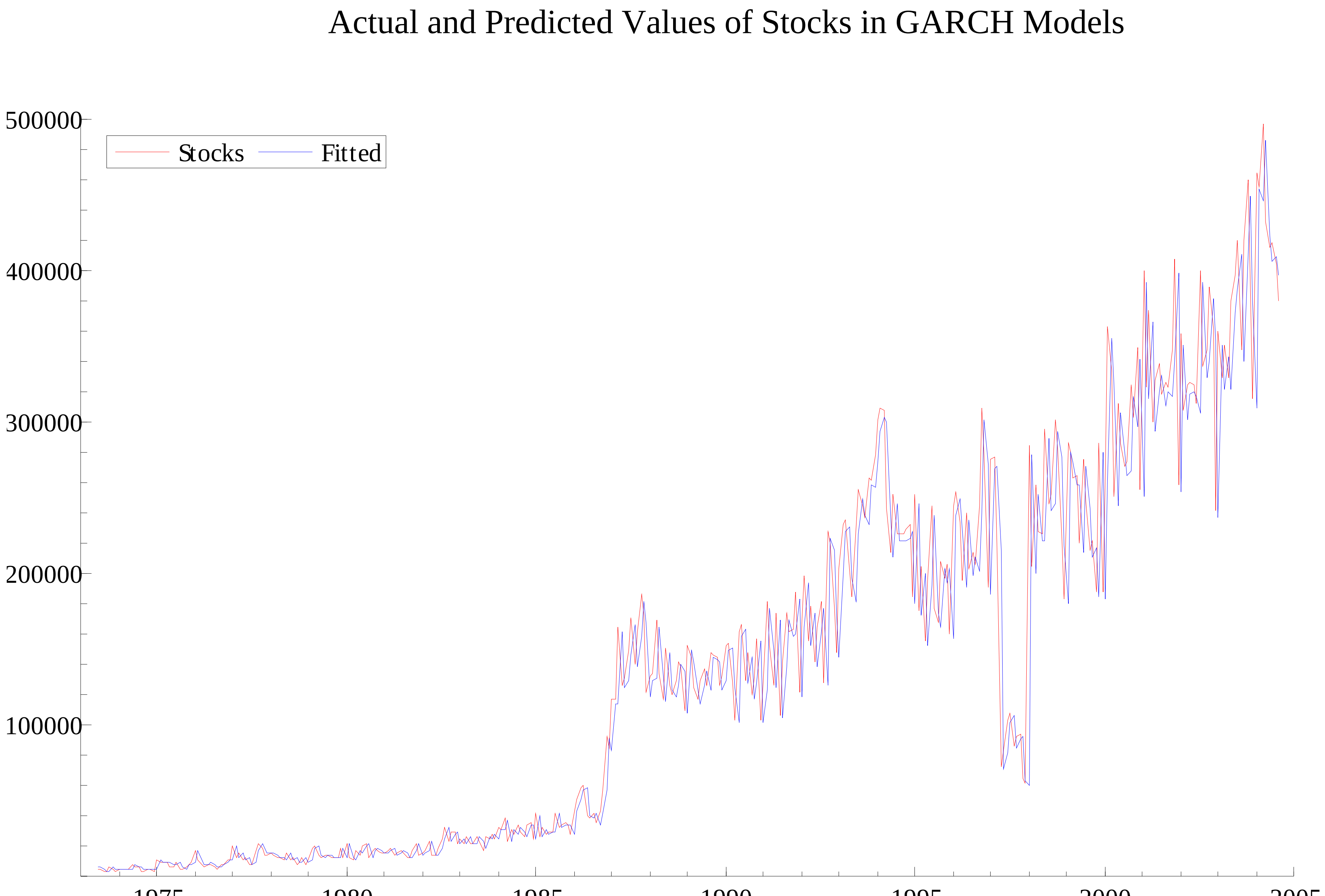
VOL(13) Modelling Stocks by restricted GARCH(1,1) (stocksandprice.xls)
The estimation sample is: 1973 (6) to 2004 (8)

Warning: invertgen: singular matrix
../garch/garch.ox (2108): garchCovar

		Coefficient	Std.Error	robust-SE	t-value	t-prob
Stocks_1	Y	0.981930	0.01201	0.01968	49.9	0.000
Constant	X	611.394	475.6	539.0	1.13	0.257
alpha_0	H	1.15359e+006	2.890e-010	5.154e-010	2.238e+015	0.000
alpha_1	H	0.183221				
beta_1	H	0.816779	0.01692	0.03018	27.1	0.000

log-likelihood -4235.07013 HMSE 6.17577
mean(h_t) 1.36184e+009 var(h_t) 3.26996e+018
no. of observations 375 no. of parameters 5
AIC.T 8480.14025 AIC 22.6137073
mean(Stocks) 137837 var(Stocks) 1.58637e+010
alpha(1)+beta(1) 1 alpha_i+beta_i>=0, alpha(1)+beta(1)<1

Initial terms of alpha(L)/[1-beta(L)]: 0.18322 0.14965 0.12223 0.099836
0.081544 0.066604 0.054400 0.044433 0.036292 0.029643 0.024211
0.019775


Actual and Predicted Values of Stocks in GARCH Models
Stocks
Fitted
500000
400000
300000
200000
100000
1975
1980
1985
1990
1995
2000
2005

Analysis of Unit Root in a VAR Model

$$y_t = a_{11} y_{1t-1} + b_{11} x_{t-1} + e_{1t}$$

$$x_t = a_{21} y_{1t-1} + b_{21} x_{1,t-1} + e_{2t}$$

$$y_t = a_{11} L y_t + a_{12} L x_t + e_{1t}$$

$$x_t = a_{21} L y_t + a_{22} L x_t + e_{2t}$$

$$y_t \left(1 - a_{11} L\right) - a_{12} L x_t = e_{1t}$$

$$x_t \left(1 - a_{21} L\right) - a_{22} L x_t = e_{2t}$$

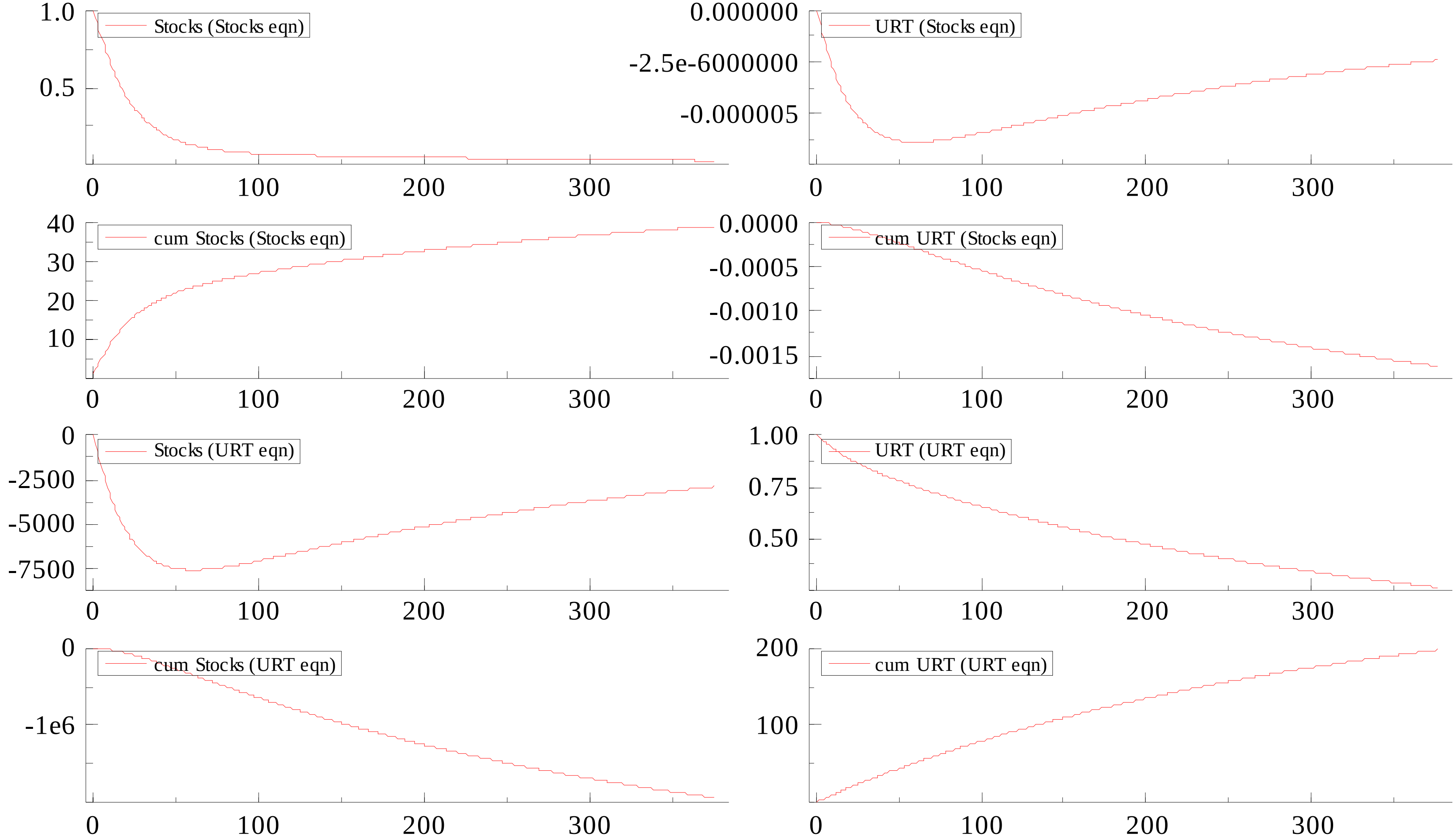
$$\begin{bmatrix} (1 - a_{11}L) & -a_{12}L \\ -a_{21}L & (1 - a_{22}L) \end{bmatrix} \begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix}$$

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} (1 - a_{11}L) & -a_{12}L \\ -a_{21}L & (1 - a_{22}L) \end{bmatrix}^{-1} \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix}$$

$$y_t = \frac{(1 - a_{22}L)e_{1t} + a_{12}Le_{2t}}{(1 - a_{11}L)(1 - a_{22}L) - a_{12}a_{21}L^2}$$

$$x_t = \frac{(1 - a_{11}L)e_{2t} + a_{22}Le_{1t}}{(1 - a_{11}L)(1 - a_{22}L) - a_{12}a_{21}L^2}$$

Impulse Response Analysis with Unit Shocks to Stock Prices and Unemployment Rates in the UK



A Simultaneous Equations Model with Two Endogenous and Two Exogenous Variables.

$$a_{11}y_{1i} + a_{12}y_{2i} + b_{11}x_{1i} + b_{12}x_{2i} = e_{1i}$$

$$a_{21}y_{1i} + a_{22}y_{2i} + b_{21}x_{1i} + b_{22}x_{2i} = e_{2i}$$

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}\begin{bmatrix} y_{1i} \\ y_{2i} \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix}\begin{bmatrix} x_{1i} \\ x_{2i} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1}\begin{bmatrix} e_{1i} \\ e_{2i} \end{bmatrix}$$

$$\begin{bmatrix} y_{1i} \\ y_{2i} \end{bmatrix} = -\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1}\begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix}\begin{bmatrix} x_{1i} \\ x_{2i} \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1}\begin{bmatrix} e_{1i} \\ e_{2i} \end{bmatrix}$$

A simple Example of the Simultaneous Equation System

$$\begin{bmatrix} y_{1i} \\ y_{2i} \end{bmatrix} = -\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} x_{1i} \\ x_{2i} \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1} \begin{bmatrix} e_{1i} \\ e_{2i} \end{bmatrix}$$

$$\begin{bmatrix} y_{1i} \\ y_{2i} \end{bmatrix} = -\frac{1}{\left(a_{11}a_{22} - a_{12}a_{21}\right)} \begin{bmatrix} a_{22} & -a_{12} \\ -a_{21} & a_{11} \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{21} \end{bmatrix} \begin{bmatrix} x_{1i} \\ x_{2i} \end{bmatrix} + \frac{1}{\left(a_{11}a_{22} - a_{12}a_{21}\right)} \begin{bmatrix} a_{22} & -a_{12} \\ -a_{21} & a_{11} \end{bmatrix} \begin{bmatrix} e_{1i} \\ e_{2i} \end{bmatrix}$$

$$y_{1i} = -\frac{\left(a_{22}b_{11} - a_{12}b_{21}\right)}{\left(a_{11}a_{22} - a_{12}a_{21}\right)} x_{1i} - \frac{\left(a_{22}b_{12} - a_{12}b_{12}\right)}{\left(a_{11}a_{22} - a_{12}a_{21}\right)} x_{2i} + \frac{1}{\left(a_{11}a_{22} - a_{12}a_{21}\right)} e_{1i}$$

$$y_{2i} = -\frac{\left(-a_{21}b_{11} + a_{11}b_{21}\right)}{\left(a_{11}a_{22} - a_{12}a_{21}\right)} x_{1i} - \frac{\left(-a_{21}b_{12} + a_{11}b_{22}\right)}{\left(a_{11}a_{22} - a_{12}a_{21}\right)} x_{2i} + \frac{1}{\left(a_{11}a_{22} - a_{12}a_{21}\right)} e_{2i}$$

Estimation of a Simultaneous Equation Model

MOD(3) Estimating the model by FIML (using quarterly.xls)

The estimation sample is: 2 to 120

Equation for: ER

		Coefficient	Std.Error	t-value	t-prob
GGDP		0.00753102	0.01143	0.659	0.511
GDEF		-0.0125529	0.006666	-1.88	0.062
PPI USA		0.0516368	0.005925	8.72	0.000
Constant	U	1.60349	0.05025	31.9	0.000

sigma = 0.269782

Equation for: RPI

		Coefficient	Std.Error	t-value	t-prob
GGDP		-0.424455	0.1610	-2.64	0.010
GDEF		0.0456598	0.09392	0.486	0.628
PPI USA		0.842092	0.08348	10.1	0.000
Constant	U	5.23671	0.7079	7.40	0.000

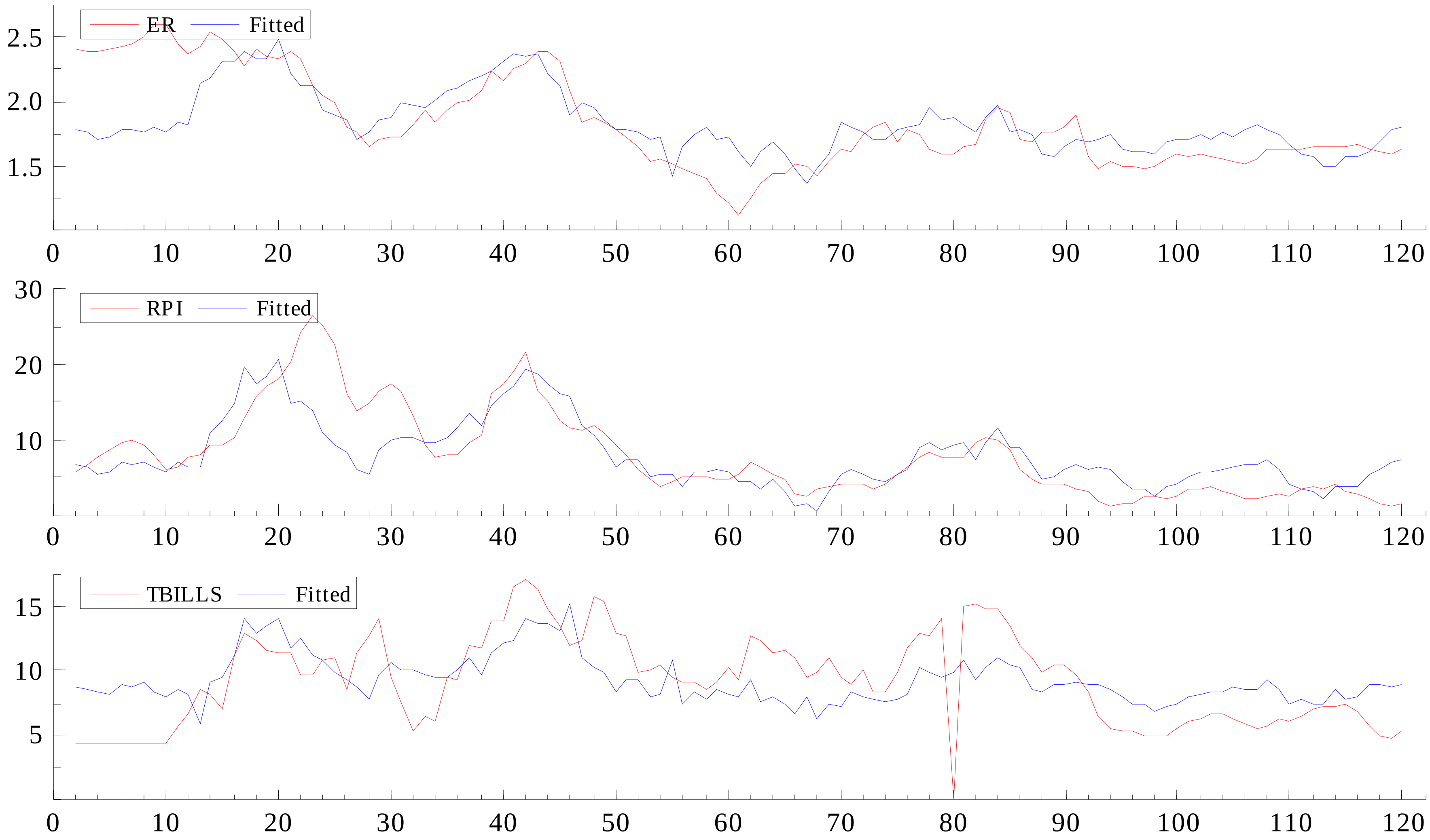
sigma = 3.80106

Equation for: TBILLS

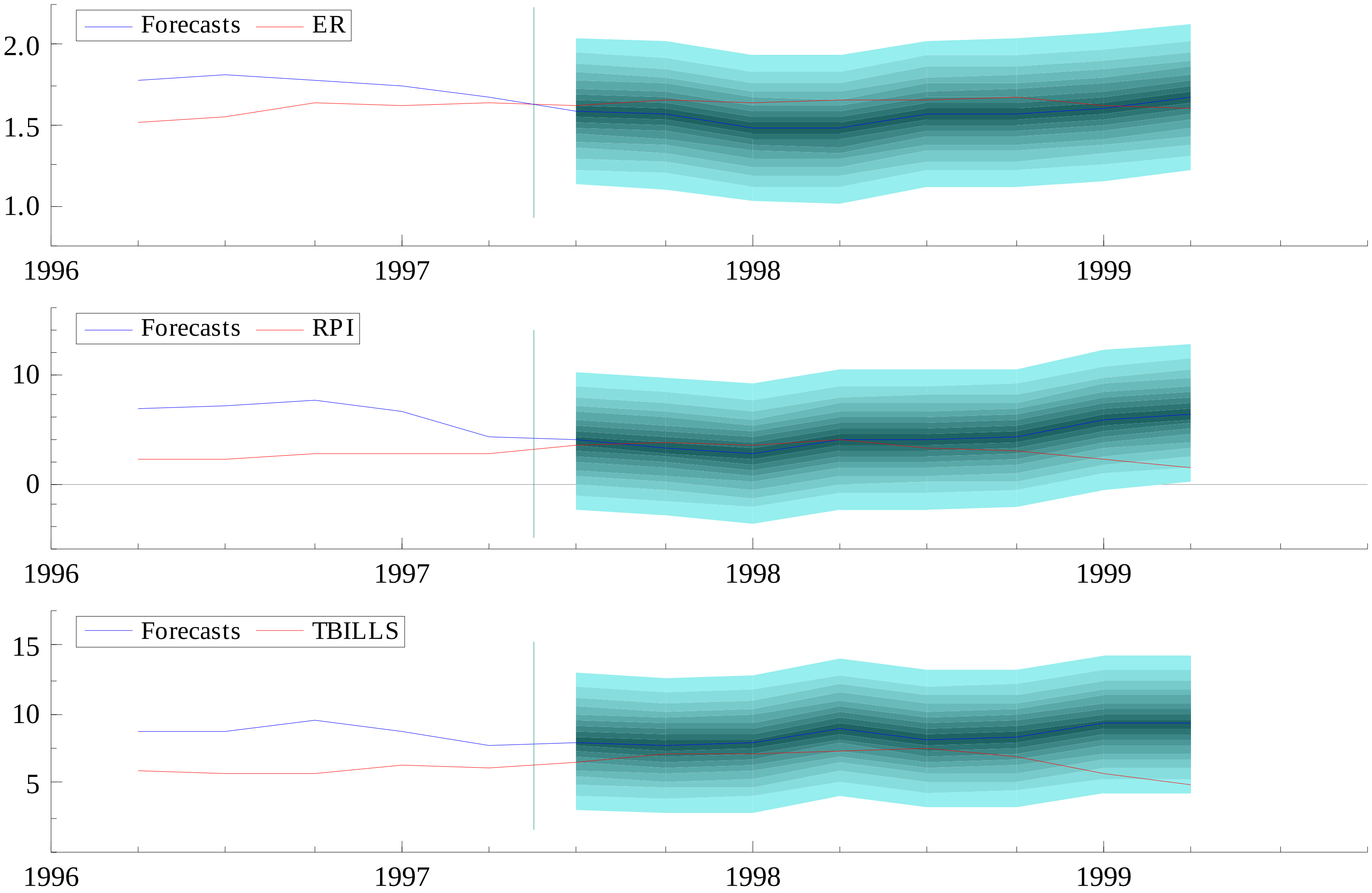
		Coefficient	Std.Error	t-value	t-prob
GGDP		-0.340249	0.1269	-2.68	0.008
GDEF		0.143437	0.07401	1.94	0.055
PPI USA		0.272943	0.06578	4.15	0.000
Constant	U	8.71464	0.5579	15.6	0.000

sigma = 2.99528

Historical Simulation with Simultaneous Equation Model



Forecasting with a with Simultaneous Equation Model



A Panel Data Model of Economic Growth

$$g_{i,t} = \alpha_i + x_{i,t}\beta_{i,t} + \lambda_t + e_{i,t}$$

$g_{i,t}$ growth rate of output $x_{i,t}$ determinants

α_i country specific effects λ_t Time specific effects

Static Panel Data Model Estimates of Economic Growth

gy = + 0.3932*inv + 0.1345*rint + 0.4469*ppg - 0.004203*trd
(SE) (0.153) (0.0803) (0.506) (0.0172)
- 5.091 - 0.1429*I1 - 2.273*I2 - 1.426*I3 - 3.827*I4
(2.52) (0.938) (0.895) (0.714) (2.1)

Based on PcGive output using growth5panel_gw.xls file.

CS(6) Modelling work by Logit

The estimation sample is 1 - 10906

	Coefficient	Std.Error	t-value	t-prob
Constant	-3.63070	0.2187	-16.6	0.000
YOS	0.0724139	0.01111	6.52	0.000
AGE	0.144445	0.008800	16.4	0.000
AGESQ	-0.00226966	0.0001037	-21.9	0.000
QUAL	0.210829	0.05049	4.18	0.000
SEX	0.0826730	0.04858	1.70	0.089
PRO	1.44090	0.1447	9.96	0.000
MT	1.33334	0.09497	14.0	0.000
SNM	1.47340	0.09059	16.3	0.000
MN	1.12794	0.09357	12.1	0.000
PSC	1.04270	0.09216	11.3	0.000
MRSIDE	-0.00663397	0.1604	-0.0414	0.967
ROFNW	-0.219358	0.1066	-2.06	0.040
SHYORK	0.0846749	0.1507	0.562	0.574
WYORK	-0.126050	0.1249	-1.01	0.313

	Count	Frequency	Probability	loglik
State 0	5799	0.53173	0.53173	-2977.
State1	5107	0.46827	0.46827	-2788.
Total	10906	1.00000	1.00000	-5766.

CS(7) Modelling work by Probit

The estimation sample is 1 - 10906

	Coefficient	Std.Error	t-value	t-prob
Constant	-2.10516	0.1295	-16.3	0.000
YOS	0.0445378	0.006661	6.69	0.000
AGE	0.0832578	0.005097	16.3	0.000
AGESQ	-0.00131181	5.879e-005	-22.3	0.000
QUAL	0.124464	0.03016	4.13	0.000
SEX	0.0506438	0.02908	1.74	0.082
PRO	0.833594	0.08562	9.74	0.000
MT	0.767445	0.05611	13.7	0.000
SNM	0.851964	0.05337	16.0	0.000
MN	0.647562	0.05539	11.7	0.000
PSC	0.598890	0.05467	11.0	0.000
MRSIDE	-0.00651500	0.09640	-0.0676	0.946
ROFNW	-0.133409	0.06436	-2.07	0.038
SHYORK	0.0541642	0.08991	0.602	0.547
WYORK	-0.0829530	0.07523	-1.10	0.270

	Count	Frequency	Probability	loglik
State 0	5799	0.53173	0.53138	-2981.
State 1	5107	0.46827	0.46862	-2788.
Total	10906	1.00000	1.00000	-5769.

Four Components of a Time Series

Time Series

$$y_t = \mu_t + \gamma_t + \psi_t + \nu_t + \varepsilon_t \qquad \varepsilon_t \sim NID\left(0, \sigma_\varepsilon^2\right)$$

Trend $\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t \qquad \varepsilon_t \sim NID\left(0, \sigma_\eta^2\right)$

$$\beta_t = \beta_{t-1} + \zeta_t \qquad \zeta_t \sim NID\left(0, \sigma_\zeta^2\right)$$

Season $\gamma_t = -\gamma_{t-1} - .. - \gamma_{t-s+1} + \omega_t \qquad \omega_t \sim NID\left(0, \sigma_w^2\right)$

$$\begin{bmatrix} \gamma_{j,t} \\ \gamma_{j,t}^* \end{bmatrix} = \begin{bmatrix} \cos\lambda_j & \sin\lambda_j \\ -\sin\lambda_j & \cos\lambda_j \end{bmatrix} \begin{bmatrix} \lambda_{j,t-1} \\ \lambda_{j,t-1}^* \end{bmatrix} + \begin{bmatrix} \omega_{j,t} \\ \omega_{j,t}^* \end{bmatrix} \qquad \begin{matrix} j = 1, ..., [s/2] \\ t = 1, ..., T \end{matrix}$$

Cycle $\begin{bmatrix} \psi_t \\ \psi_t^* \end{bmatrix} = \rho_\psi \begin{bmatrix} \cos\lambda_c & \sin\lambda_c \\ -\sin\lambda_c & \cos\lambda_c \end{bmatrix} \begin{bmatrix} \psi_{j,t-1} \\ \psi_{t-1}^* \end{bmatrix} + \begin{bmatrix} \kappa_t \\ \kappa_t^* \end{bmatrix} \qquad t = 1, ..., T \qquad 0 < \rho_\psi < 1$

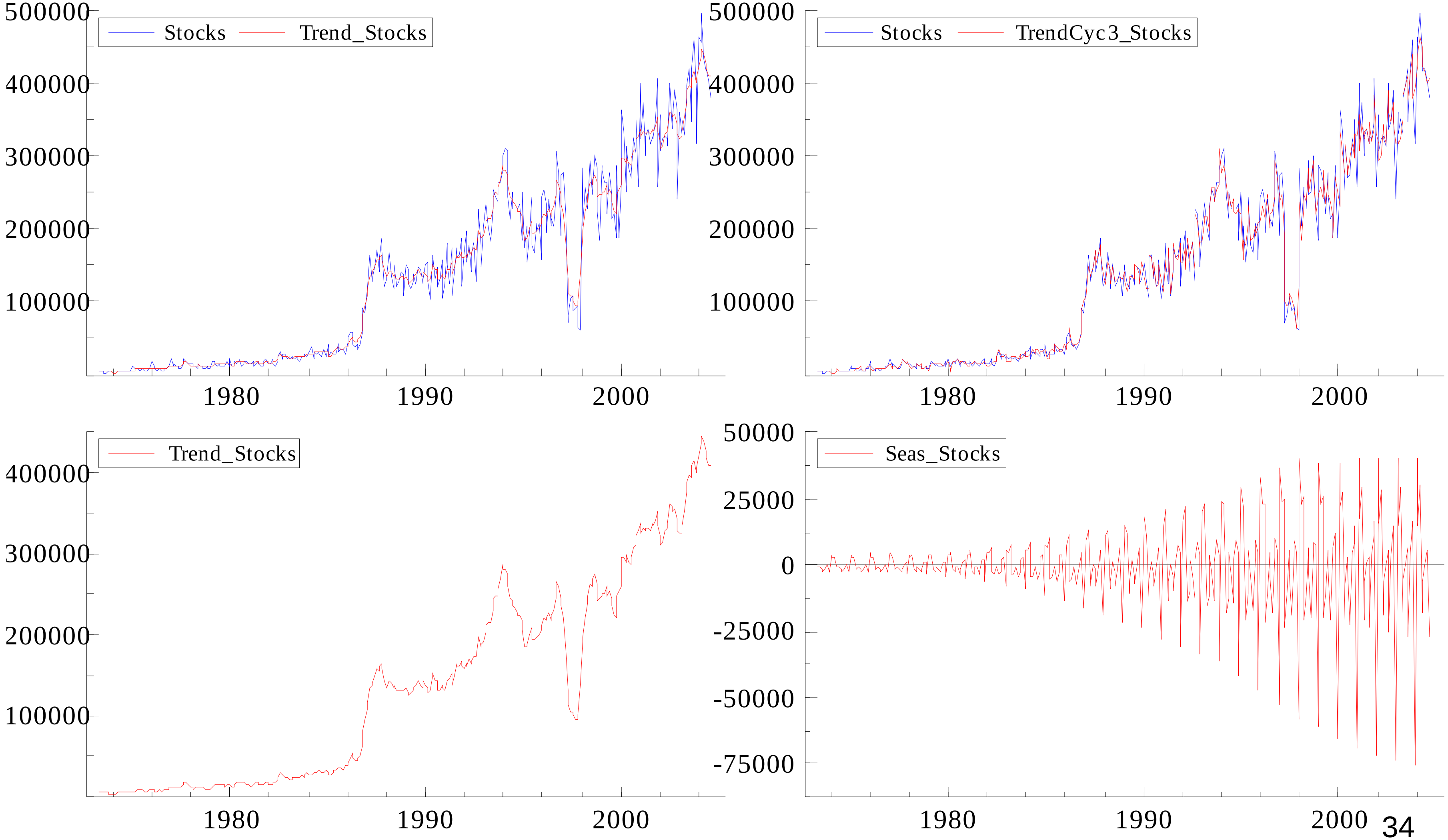
Random $\nu_t = \rho_\nu \nu_{t-1} + \xi_t \qquad \xi_t \sim NID\left(0, \sigma_\zeta^2\right)$

(refer STAMP manual p.140)

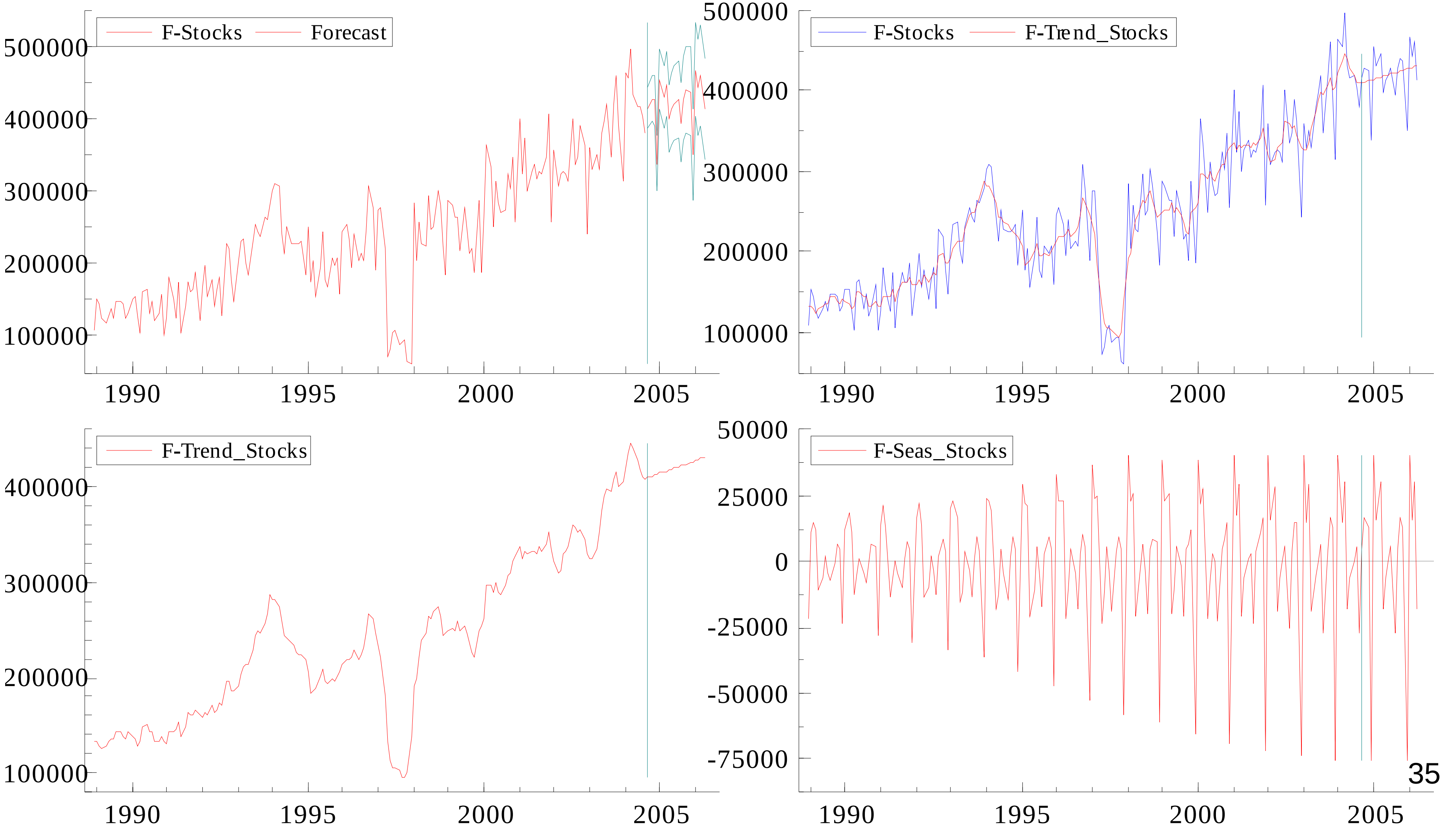
Estimating the coefficients for Trend, Cycle and Seasonal Elements of stock prices

Variable	Coefficient	R.m.s.e.	t-value
Lvl	4.0928e+005	13705.	29.864 [0.0000]
Slp	1074.5	739.27	1.4535 [0.1469]
Cy3_ 1	-2056.5	12528.	
Cy3_ 2	36.425	14759.	
Sea_ 1	-6624.9	4908.1	-1.3498 [0.1779]
Sea_ 2	-1928.7	4947.0	-0.38988 [0.6969]
Sea_ 3	10023.	4023.8	2.4909 [0.0132]
Sea_ 4	9006.1	4056.2	2.2203 [0.0270]
Sea_ 5	-25443.	3760.5	-6.7659 [0.0000]
Sea_ 6	-1753.8	3788.0	-0.46299 [0.6436]
Sea_ 7	-1212.4	3645.3	-0.33259 [0.7396]
Sea_ 8	-12152.	3670.5	-3.3106 [0.0010]
Sea_ 9	10984.	3591.4	3.0584 [0.0024]
Sea_10	9769.1	3617.2	2.7007 [0.0072]
Sea_11	-14643.	3013.8	-4.8589 [0.0000]

Decomposing a Stock Price Series in Trend, Cycle and Seasonal Elements



Forecasting Trend, Cycle and Seasonal Elements of stock prices



Research Process

- Issues and Questions? Why is it interesting?
- Most relevant theory: from Adam Smith up to you.
- Literature review (most important and most recent ones
  - Econlit, JOSTR: Electronic Resources from Library Web page
- Specification of the Model or formulation of problems
  - Diagrams and equations (prototype models)
  - Mathematical proofs , theorem, lemma, propositions
- Empirical analyses (relating theory to data) -GivWin
  - Statistical and econometric analysis and tests
  - Simulation based on econometric or calibrated model
- Input-output analysis and Models of the economy
- Main results/ policy recommendations
- references

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