

Department of Economics,
Management and Quantitative Methods

B-74-3-B Time Series Econometrics
Academic year 2019-2020

Computer Session 3
Output file

Exercise 8: Modelling Vector Autoregressions.
8.2 Estimated VAR(2) for series y and x .

Vector Autoregression Estimates
Sample (adjusted): 3 500
Included observations: 498 after adjustments
Standard errors in () & t-statistics in []

	X	Y
X(-1)	1.379441 (0.10277) [13.4223]	1.825399 (0.23663) [7.71428]
X(-2)	-0.331967 (0.10422) [-3.18530]	-0.655644 (0.23996) [-2.73236]
Y(-1)	-0.081603 (0.04495) [-1.81546]	0.327596 (0.10349) [3.16543]
Y(-2)	0.006900 (0.04511) [0.15295]	-0.012786 (0.10386) [-0.12311]
C	0.268125 (0.07001) [3.82986]	1.042881 (0.16119) [6.46987]
R-squared	0.865614	0.832925
Adj. R-squared	0.864524	0.831569
Sum sq. resids	508.0782	2693.396
S.E. equation	1.015177	2.337366
F-statistic	793.8842	614.4416

Log likelihood	-711.6202	-1126.933
Akaike AIC	2.877993	4.545915
Schwarz SC	2.920268	4.588191
Mean dependent	1.889507	4.739197
S.D. dependent	2.758100	5.695290
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Determinant resid covariance (dof adj.)		1.066805
Determinant resid covariance		1.045491
Log likelihood		-1424.340
Akaike information criterion		5.760401
Schwarz criterion		5.844951
Number of coefficients		10
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8.3 Select lag length

VAR Lag Order Selection Criteria
 Endogenous variables: X Y
 Exogenous variables: C
 Sample: 1 500
 Included observations: 492

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1969.217	NA	10.35347	8.013076	8.030143	8.019777
1	-1436.619	1058.700	1.207499	5.864305	5.915506	5.884410
2	-1410.060	52.57865*	1.101693*	5.772601*	5.857936*	5.806109*
3	-1407.679	4.693588	1.108972	5.779183	5.898652	5.826095
4	-1406.532	2.252897	1.121911	5.790779	5.944382	5.851094
5	-1404.252	4.456758	1.129793	5.797774	5.985511	5.871492
6	-1402.254	3.890593	1.139036	5.805911	6.027782	5.893033
7	-1401.292	1.865464	1.153204	5.818261	6.074266	5.918786
8	-1399.459	3.540449	1.163425	5.827067	6.117206	5.940996

* indicates lag order selected by the criterion
 LR: sequential modified LR test statistic (each test at 5% level)
 FPE: Final prediction error
 AIC: Akaike information criterion
 SC: Schwarz information criterion
 HQ: Hannan-Quinn information criterion

8.5 Granger Causality test

VAR Granger Causality/Block Exogeneity Wald Tests

Sample: 1 500

Included observations: 498

Dependent variable: X

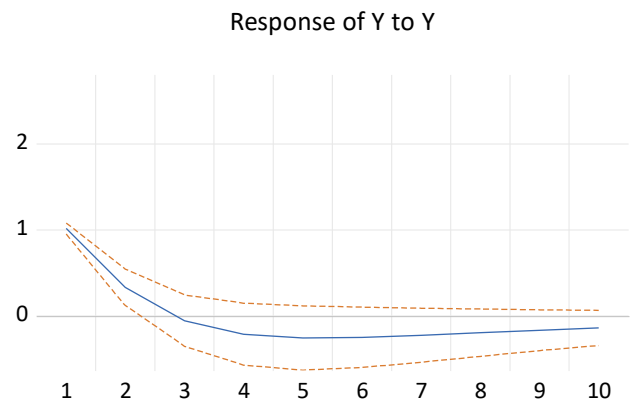
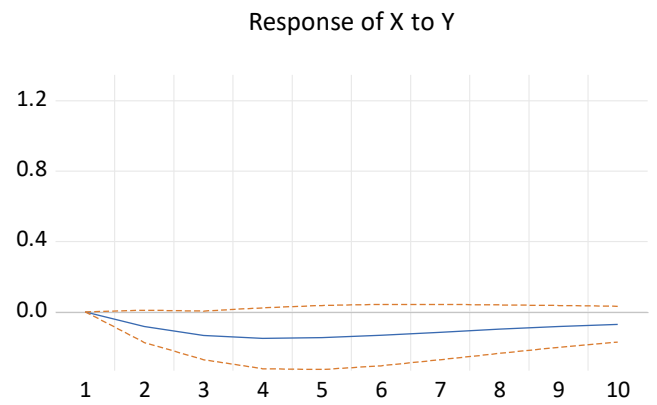
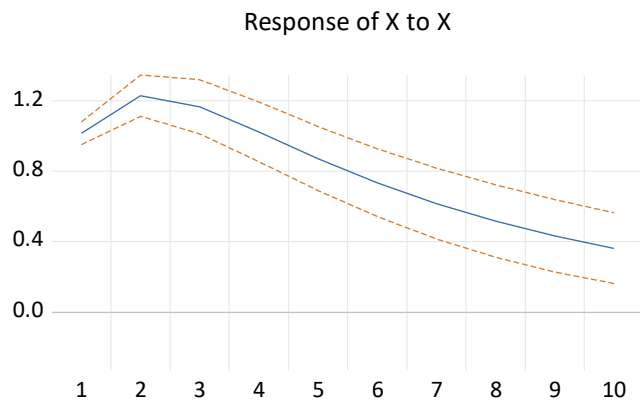
Excluded	Chi-sq	df	Prob.
Y	3.973915	2	0.1371
All	3.973915	2	0.1371

Dependent variable: Y

Excluded	Chi-sq	df	Prob.
X	64.45366	2	0.0000
All	64.45366	2	0.0000

8.6 Impulse Response Functions, X causes Y

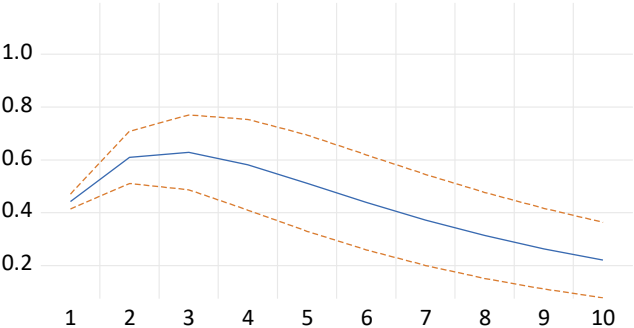
Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.



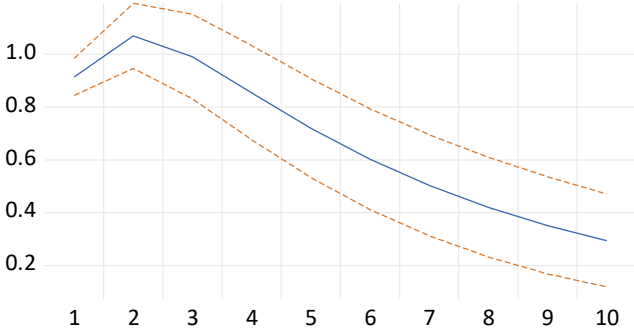
Y causes X

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

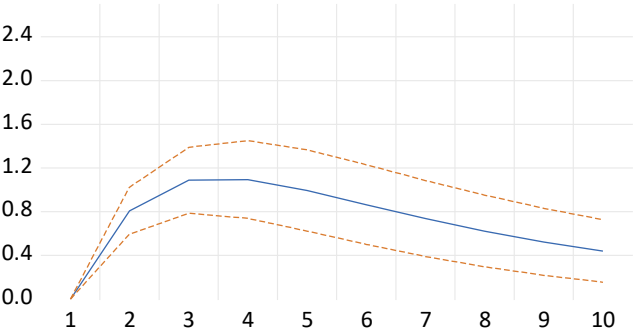
Response of X to X



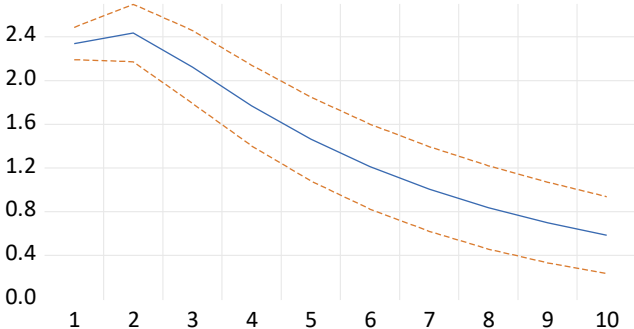
Response of X to Y



Response of Y to X



Response of Y to Y



9.2 Lag length criteria for X1 Y1

VAR Lag Order Selection Criteria

Endogenous variables: X1 Y1

Exogenous variables: C

Sample: 1 500

Included observations: 492

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2710.756	NA	210.9690	11.02747	11.04453	11.03417
1	-1551.139	2305.093	1.923370	6.329833	6.381034	6.349938
2	-1404.807	289.6901	1.078417	5.751247	5.836582	5.784755
3	-1373.422	61.87607	0.964811	5.639927	5.759396*	5.686839
4	-1363.063	20.33962	0.940194*	5.614076*	5.767679	5.674391*
5	-1361.307	3.432566	0.948817	5.623200	5.810937	5.696919
6	-1360.737	1.109537	0.962150	5.637144	5.859015	5.724266
7	-1355.710	9.748440*	0.958152	5.632967	5.888972	5.733492
8	-1353.179	4.887524	0.963906	5.638938	5.929077	5.752866

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Cointegration test, 4 lags

Sample: 1 500
 Included observations: 495
 Series: X1 Y1
 Lags interval: 1 to 4

Selected
 (0.05 level*)
 Number of
 Cointegrating
 Relations by
 Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	1	2	2	2
Max-Eig	2	1	2	2	2

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information
 Criteria by
 Rank and
 Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend

	Log Likelihood by Rank (rows) and Model (columns)				
0	-1410.383	-1410.383	-1410.271	-1410.271	-1409.971
1	-1374.795	-1373.383	-1373.276	-1371.288	-1370.989
2	-1372.299	-1369.184	-1369.184	-1364.721	-1364.721

	Akaike Information Criteria by Rank (rows) and Model (columns)				
0	5.763165	5.763165	5.770792	5.770792	5.777663
1	5.635537	5.633870	5.637478	5.633485	5.636319
2	5.641611	5.637109	5.637109	5.627154	5.627154*

	Schwarz Criteria by Rank (rows) and Model (columns)				
0	5.899070	5.899070	5.923685	5.923685	5.947544
1	5.805418*	5.812245	5.824348	5.828849	5.840177
2	5.845469	5.857954	5.857954	5.864988	5.864988

Cointegration test, 3 lags

Sample: 1 500
 Included observations: 496
 Series: X1 Y1
 Lags interval: 1 to 3

Selected
 (0.05 level*)
 Number of
 Cointegrating
 Relations by
 Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	1	2	1	2
Max-Eig	1	1	2	1	2

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information
 Criteria by
 Rank and
 Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
	Log Likelihood by Rank (rows) and Model (columns)				
0	-1419.866	-1419.866	-1419.733	-1419.733	-1419.425
1	-1377.820	-1376.370	-1376.239	-1374.404	-1374.096
2	-1375.853	-1372.901	-1372.901	-1368.836	-1368.836

Akaike
 Information
 Criteria by
 Rank (rows)
 and Model
 (columns)

0	5.773654	5.773654	5.781180	5.781180	5.788003
1	5.620242	5.618429	5.621931	5.618564	5.621357
2	5.628438	5.624599	5.624599	5.616273	5.616273*

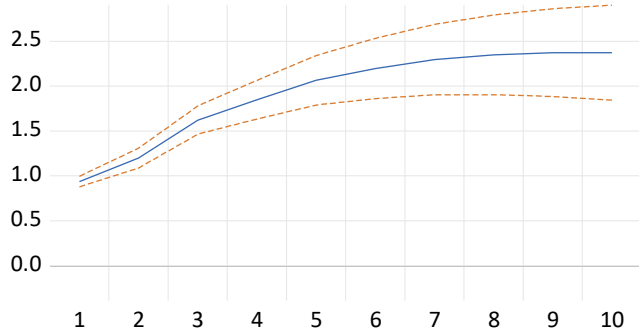
Schwarz
 Criteria by
 Rank (rows)
 and Model
 (columns)

0	5.875426	5.875426	5.899914	5.899914	5.923699
1	5.755938*	5.762606	5.774589	5.779703	5.790977
2	5.798058	5.811181	5.811181	5.819817	5.819817

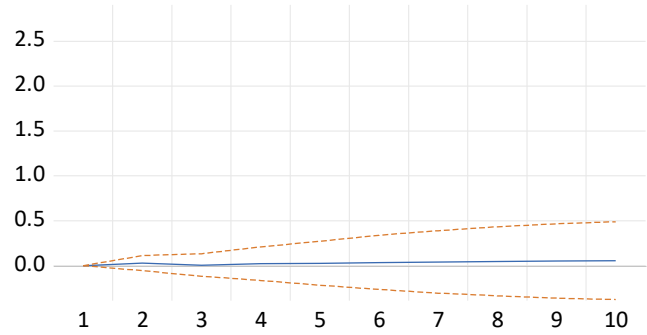
9.4 VAR Benchmark: VAR 3 IRF with X1 causing Y1

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

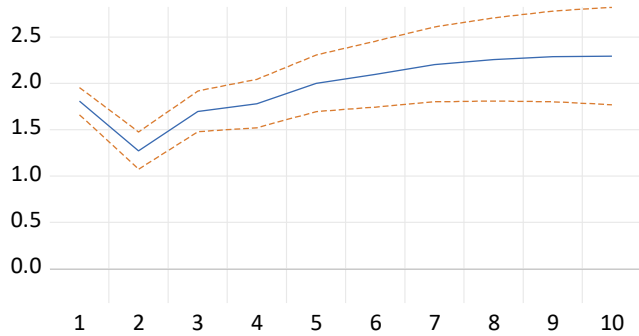
Response of X1 to X1



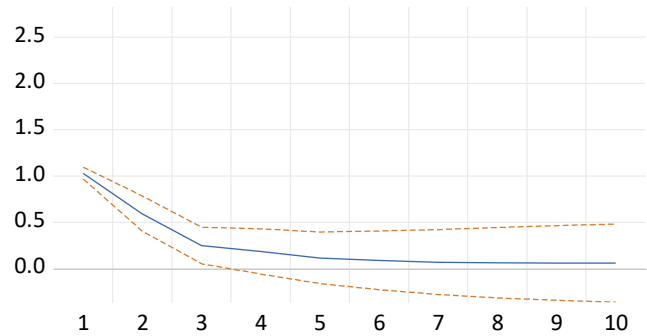
Response of X1 to Y1



Response of Y1 to X1



Response of Y1 to Y1



Cointegration estimation output

Vector Error Correction Estimates

Sample (adjusted): 4 500

Included observations: 497 after adjustments

Standard errors in () & t-statistics in []

Cointegrating Eq:	CointEq1	
X1(-1)	1.000000	
Y1(-1)	-1.002620 (0.01087) [-92.2188]	
C	0.151179 (0.11328) [1.33455]	
Error Correction:	D(X1)	D(Y1)
CointEq1	-0.028097 (0.04182) [-0.67178]	0.415551 (0.09270) [4.48280]
D(X1(-1))	0.255114 (0.07971) [3.20058]	-0.167727 (0.17667) [-0.94940]
D(X1(-2))	0.431007 (0.06930) [6.21932]	0.668188 (0.15360) [4.35024]
D(Y1(-1))	0.002242 (0.04232) [0.05297]	3.51E-05 (0.09380) [0.00037]
D(Y1(-2))	-0.026506 (0.03119) [-0.84989]	-0.070390 (0.06912) [-1.01831]
R-squared	0.327029	0.166693
Adj. R-squared	0.321558	0.159918
Sum sq. resids	437.1502	2147.428
S.E. equation	0.942612	2.089184
F-statistic	59.77161	24.60461
Log likelihood	-673.3266	-1068.876
Akaike AIC	2.729685	4.321434
Schwarz SC	2.772025	4.363774
Mean dependent	0.073831	0.076137
S.D. dependent	1.144396	2.279376
Determinant resid covariance (dof adj.)	0.936517	
Determinant resid covariance	0.917768	
Log likelihood	-1389.101	
Akaike information criterion	5.642258	
Schwarz criterion	5.752342	
Number of coefficients	13	

9.6 Test cointegration restrictions

Vector Error Correction Estimates

Sample (adjusted): 4 500

Included observations: 497 after adjustments

Standard errors in () & t-statistics in []

Cointegration Restrictions:

$B(1,1)=1, B(1,2)=-1, A(1,1)=0$

Convergence achieved after 2 iterations.

Restrictions identify all cointegrating vectors

LR test for binding restrictions (rank = 1):

Chi-square(2) 0.599064

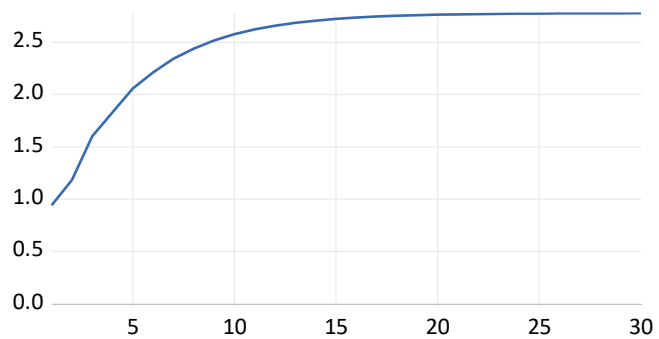
Probability 0.741165

Cointegrating Eq:	CointEq1		
X1(-1)	1.000000		
Y1(-1)	-1.000000		
C	0.140775 (0.09856) [1.42838]		
Error Correction:	D(X1)	D(Y1)	
CointEq1	0.000000 (0.00000) [NA]	0.468899 (0.04550) [10.3054]	
D(X1(-1))	0.255296 (0.07970) [3.20319]	-0.167016 (0.17675) [-0.94490]	
D(X1(-2))	0.432130 (0.06935) [6.23130]	0.667750 (0.15380) [4.34178]	
D(Y1(-1))	0.000938 (0.04225) [0.02220]	-0.004034 (0.09371) [-0.04305]	
D(Y1(-2))	-0.027424 (0.03118) [-0.87945]	-0.072323 (0.06916) [-1.04580]	
R-squared	0.327149	0.165820	

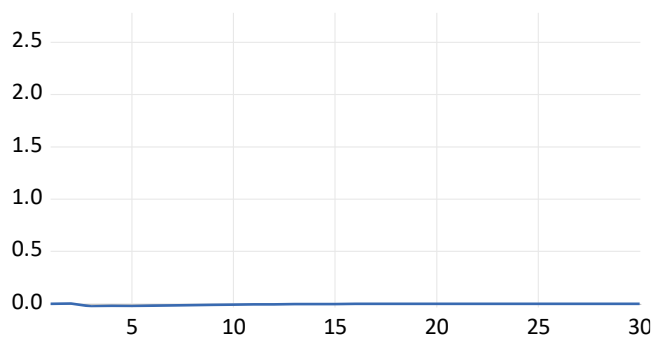
9.7 IRF from cointegrated model

Response to Cholesky One S.D. (d.f. adjusted) Innovations

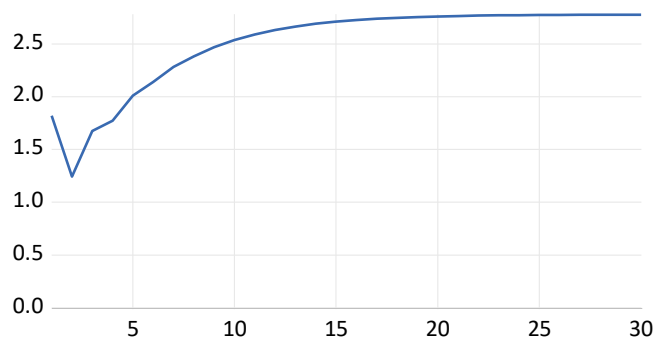
Response of X1 to X1



Response of X1 to Y1



Response of Y1 to X1



Response of Y1 to Y1

