Comparação de *softwares* em modelos ARIMA

1

Programa de Aperfeiçoamento de Ensino

Supervisora: Profª Clélia Maria de Castro Toloi

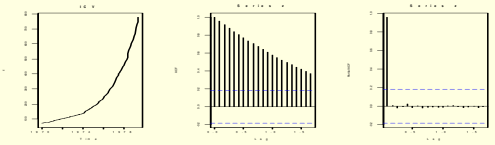
2

Série ICV

(Morettin e Toloi, 2004), janeiro de 1970 a junho de 1979.
Disponíveis em
http://www.ime.usp.br/pam/icv.txt

Leitura dos dados - R:

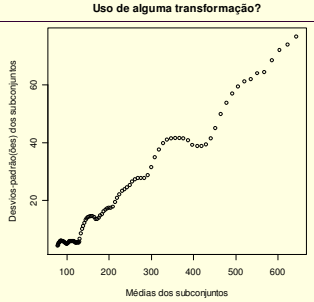
- z = scan(file='http://www.ime.usp.br/~pam/icv.txt')
- par(mfrow=c(1,3))
- z = ts(z,freq=12,start=c(1970,1))
- plot(z,main='ICV'); acf(z); pacf(z)



Verificação da necessidade do uso de alguma transformação

- n<- length(z)
- j<-12 # dados mensais #
- abcissa<- NULL
- ordenada<- NULL
- for (i in 1: (n-j)){
- abcissa[i]<-mean(z[i:(i+j)])
- ordenada[i]<-sd(z[i:(i+j)])
- }
- plot(x=abcissa,y=ordenada, xlab='Médias dos subconjuntos', ylab= 'Desvios-padrão(*ões*) dos subconjuntos', main='Uso de alguma transformação?')

5



y = log(z)

- transformação logarítmica usada para induzir simetria aproximada e tentar estabilizar a variância.

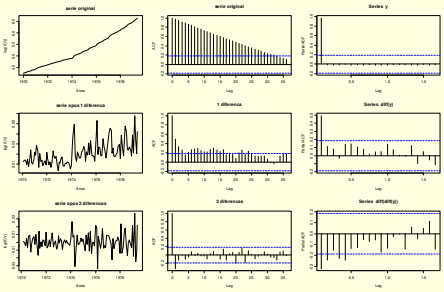
```
par(mfrow=c(3,3))

plot(y,main='serie original',xlab='Anos',ylab='log(ICV)')
m = acf(y,lag.max=36, plot=F)
m$lag = m$lag*12
plot(m,main='serie original')
pacf (y)

plot(diff(y),main='serie apos 1 diferenca',xlab='Anos',ylab='log(ICV)')
m = acf(diff(y),lag.max=36, plot=F)
m$lag = m$lag*12
plot(m,main='1 diferenca')
pacf (diff(y))

plot(diff(diff(y)),main='serie apos 2 diferencas',xlab='Anos',ylab='log(ICV)')
m = acf(diff(diff(y)),lag.max=36, plot=F)
m$lag = m$lag*12
plot(m,main='2 diferencas')
pacf (diff(diff(y)))
```

O que parece melhor?



Candidatos:

- Um primeiro modelo candidato é então o ARIMA(1,1,0)
- Um segundo modelo candidato é então o ARIMA(1,1,0) + tendência determinística
- m1 = arima(y,order=c(1,1,0))
- m2 = arima(y,order=c(1,1,0), xreg = seq(1,114,1))

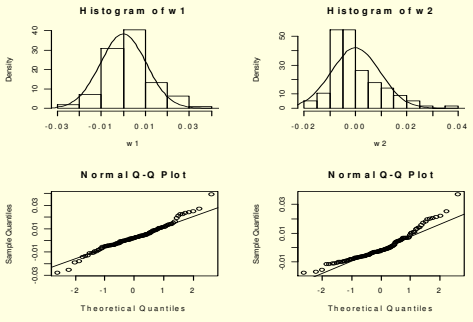
Análise de resíduos (m1)

- tsdiag(m1)
- par(mfrow=c(2,1))
- w1=m1$residuals
- hist(w1,freq=F)
- d = seq(range(w1)[1]-3*sd(w1),range(w1)[2]+3*sd(w1),0.001)
- lines(d,dnorm(d,0,sd(w1)))
- qqnorm(w1)
- qqline(w1)
- shapiro.test(w1)

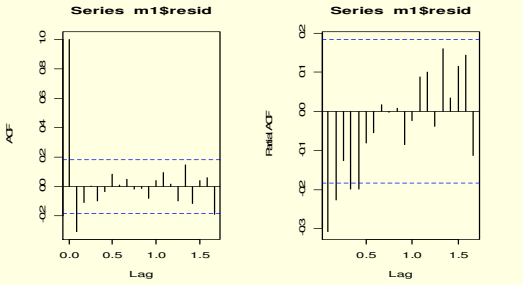
Análise de resíduos (m2)

- tsdiag(m2)
- par(mfrow=c(2,1))
- w2=m2$residuals
- hist(w2,freq=F)
- d = seq(range(w2)[1]-3*sd(w2),range(w2)[2]+3*sd(w2),0.001)
- lines(d,dnorm(d,0,sd(w2)))
- qqnorm(w2)
- qqline(w2)
- shapiro.test(w2)

m1 m2

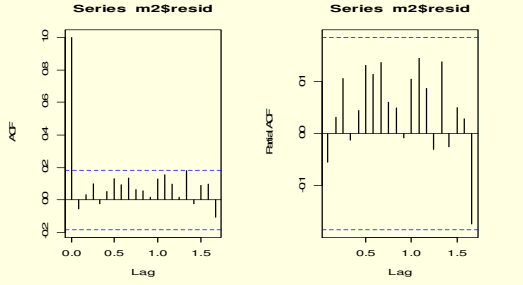


par(mfrow=c(1,2));
acf(m1$resid);
pacf(m1$resid)



13

par(mfrow=c(1,2));
acf(m2$resid);
pacf(m2$resid)



14

Modelo com tendência determinística

- Call:
- arima(x = y, order = c(1, 1, 0), xreg = seq(1, 114, 1))

- Coefficients:
- ar1 seq(1, 114, 1)
- 0.5073 0.0212
- s.e. 0.0822 0.0018

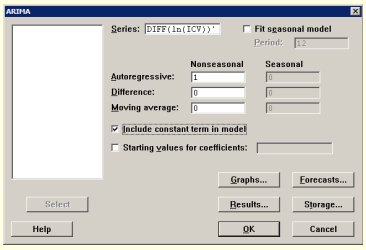
- sigma^2 estimated as 9.076e-05: log likelihood = 365.38, aic = -724.75

- LEMBRE-SE: $\delta = \mu(1-\phi...)$

15

Mesmo modelo no Minitab

- Stat -> Time Series -> ARIMA



16

Saídas

- **Results for: ICV.MTW**
- **ARIMA Model: DIFF(ln(ICV))**
- Estimates at each iteration (Estimativas a cada iteração)

- Iteration SSE Parameters
  0 0,929375 0,100 0,109
  1 0,039267 0,242 0,032
  2 0,015942 0,392 0,020
  3 0,010439 0,494 0,012
  4 0,010257 0,509 0,011
  5 0,010255 0,512 0,010
  6 0,010255 0,512 0,010
- Relative change in each estimate less than 0,0010

17

Saídas

- Final Estimates of Parameters

- Type Coef SE Coef T P
- AR 1 0,5119 0,0833 6,14 0,000
- Constant 0,0103600 0,0009040 11,46 0,000
- Mean 0,021224 0,001852

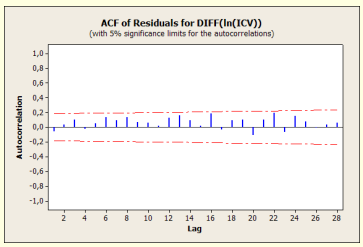
- Number of observations: 113
- Residuals: SS = 0,0102405 (backforecasts excluded)
- MS = 0,0000923 DF = 111

- Modified Box-Pierce (Ljung-Box) Chi-Square statistic

- Lag 12 24 36 48
- Chi-Square 10,5 34,1 43,3 67,1
- DF 10 22 34 46
- P-Value 0,398 0,048 0,132 0,023

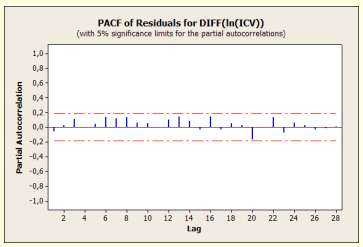
18

ACF dos resíduos – modelo com constante



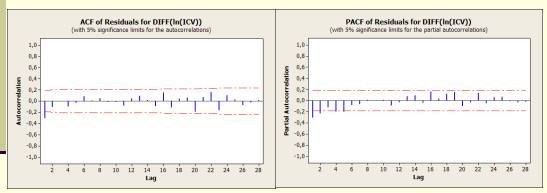
19

PACF dos resíduos – modelo com constante



20

ACF e PACF do modelo sem tendência determinística



21

S-PLUS

- z<-scan("F:\\PAE\\icv.txt", what=list(icv=0))
- attach(z)
- z <- ts(z,freq=12,start=c(1970,1))
- z<-z$icv
- y<-log(z)

- par(mfrow=c(1,3))
- ts.plot(y,xlab="Tempo")
- acf(y)
- acf(y,type="partial")
- fit<-arima.mle(y,model = list(order=c(1,1,0)), xreg = seq(1, length(y), 1))

22

Saídas

- Coefficients:
- AR : 0.50932

- Variance-Covariance Matrix:
- ar(1)
- ar(1) 0.006612406
- Coeffficients for regressor(s): seq(1, length(y), 1)
- [1] 0.02146 (ISSO QUE É ESTIMADO É A MÉDIA!!!)

- Optimizer has converged
- Convergence Type: relative function convergence
- AIC: -720.22055

23

Umidade – S-PLUS

- u<-scan("F:\\PAE\\umidade.txt", what=list(umid=0))
- attach(u)
- u<- ts(u)
- u<-u$umid
- par(mfrow=c(1,3))
- ts.plot(u,xlab="Tempo")
- acf(u)
- acf(u,type="partial")
- regres<-1 # (NOTE QUE NO MODELO ARMA É NECESSÁRIO ACRESCENTAR UM VETOR DE COMPRIMENTO 1 PARA QUE O S-PLUS ESTIME A CONSTANTE!)
- fit<-arima.mle(u, model = list(order=c(3,0,0)), xreg= regres)
- arima.diag(fit,std.resid=F, plot=T)

24

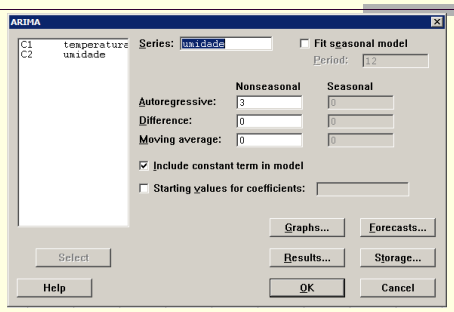
Saídas – S-PLUS

- Call: arima.mle(x = u, model = list(order = c(3, 0, 0)), xreg = regres)
- Method: Maximum Likelihood
- Model : 3 0 0
- Coefficients:
- AR : 0.5968 -0.16656 0.11326
- Variance-Covariance Matrix:
- ar(1) ar(2) ar(3)
- ar(1) 0.0027269958 -0.001596508 0.0002734048
- ar(2) -0.0015965084 0.003634254 -0.0015965084
- ar(3) 0.0002734048 -0.001596508 0.0027269958
- Coeffficients for regressor(s): intercept
- [1] 81.16082

- Optimizer has converged
- Convergence Type: relative function convergence
- AIC: 2409.55443

25

Menu – MINITAB



26

Umidade – MINITAB

- Final Estimates of Parameters

Type		Coef	SE Coef	T	P
AR	1	0,5973	0,0523	11,42	0,000
AR	2	-0,1666	0,0605	-2,75	0,006
AR	3	0,1133	0,0524	2,16	0,031
Constant		36,9862	0,3499	105,71	0,000
Mean		81,1191	0,7674		

- Number of observations: 365
- Residuals: SS = 16129,9 (backforecasts excluded)
- MS = 44,7 DF = 361

27

Umidade – R

```
u<-scan("F:\\PAE\\umidade.txt")
u<- as.ts(u)
par(mfrow=c(1,3))
plot(u,xlab="Tempo")
acf(u)
pacf(u)
regres<-seq(1,length(u),1)
fit<-arima (u, order=c(3,0,0), xreg= regres)
par(mfrow=c(1,2));
acf(fit$resid);
pacf(fit$resid)
```

28

fit<-arima (u, order=c(3,0,0), xreg= regres, include.mean = T)

- Call:
- arima(x = u, order = c(3, 0, 0), xreg = regres, include.mean = T)

- Coefficients:

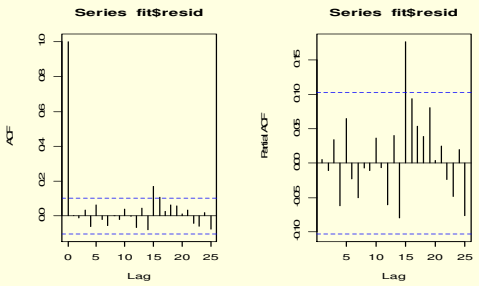
ar1	ar2	ar3	intercept	regres
0.5956	-0.1657	0.1124	81.0381	0.0004
s.e. 0.0519	0.0600	0.0519	1.5103	0.0071

- sigma^2 estimated as 44.19: log likelihood = -1209.53, aic = 2431.05

- ESTIMATIVAS SEMELHANTES ÀS DO MINITAB E DO S-PLUS!!!

29

Análise de resíduos – acf e pacf



30