

TIME SERIES MODELS

- AR(p)

$$X_t = C_0 + \phi_1 X_{t-1} + \phi_2 X_{t-2} + \dots + \phi_p X_{t-p} + \varepsilon_t$$

HOW TO CHOOSE p? PACF

↓
We stop to the last significant lag

- MA(q)

$$X_t = C_0 + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \dots + \theta_q \varepsilon_{t-q} + \varepsilon_t$$

HOW TO CHOOSE q? ACF

- ARMA(p, q)

$$X_t = C_0 + \phi_1 X_{t-1} + \dots + \phi_p X_{t-p} + \theta_1 \varepsilon_{t-1} + \dots + \theta_q \varepsilon_{t-q} + \varepsilon_t$$

HOW TO CHOOSE THE ORDER OF ARMA?

↳ INFORMATION CRITERIA
(AIC, SBIC)

↓

THIS METHOD CAN BE USED
FOR AR(p), MA(q) AS WELL

Exercise 4.5

1) CONSTRUCT CORRELOGRAM

$$\text{lags} = \ln(456) \approx 6$$

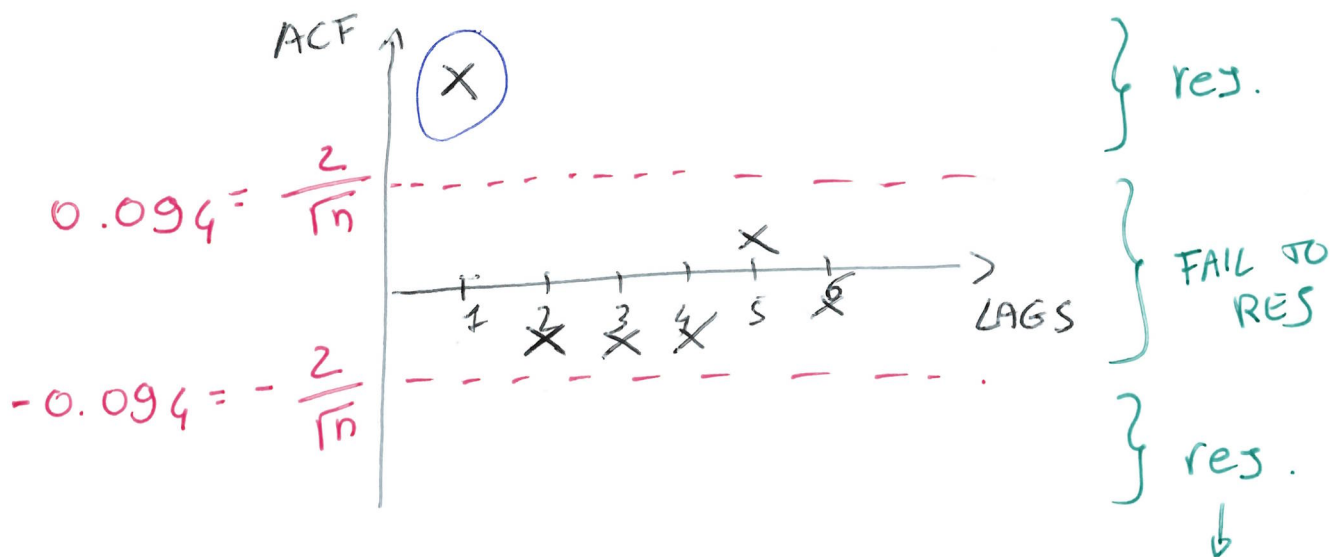
2) USE ACF FOR DETERMINING q

$$H_0: \rho_k = 0$$

$$H_1: \rho_k \neq 0$$

REJECTION RULE: reject H_0 IF $|\hat{\rho}_k| > \frac{2}{\sqrt{n}}$
(AT 5%)

$$\frac{2}{\sqrt{n}} = \frac{2}{\sqrt{456}} = 0.094$$



3) DETERMINE THE BEST MA MODEL
↓
MA(1)

IT MEANS CORR. COEFF. IS STAT. DIFF FROM ZERO

4) REPEAT STEPS 2 AND 3 FOR PACF

↓

THE BEST MODEL IS $AR(1)$

INFORMATION CRITERIA

$$AIC = \lg(\hat{\sigma}^2) + 2 \frac{K}{T}$$

$$SBIC = \lg(\hat{\sigma}^2) + \frac{K}{T} \lg(T)$$

$\hat{\sigma}^2$ = residual variance (from RSS)

K = n° parameters

T = obs

THE BEST MODEL IS THE MODEL
THAT MINIMISES THE IC

- SBIC IS CONSISTENT, BUT INEFFICIENT
- AIC IS NOT CONSISTENT, BUT MORE EFFICIENT

Exercise 5.2

1) COMPUTE THE CORRELOGRAM

↳ ACF → SUGGESTS MA (3)

PACF → SUGGESTS AR (1)

2) ESTIMATE THE MODEL IN EViews AND COLLECT THE AIC AND SBIC VALUES

WE DECIDE TO ESTIMATE ARMA MODELS AS WELL. WE STOP AT ARMA(1,1)

BECAUSE MA COMPONENT IS NOT SIGNIFICANT.

3)

	AIC	SBIC
AR(1)	8.738	8.789
MA(3)	8.772	8.873
ARMA(1,1)	8.748	8.824

↓
the lowest AIC value
is associated to AR(1)

↓
AR(1) IS THE BEST MODEL

↓
the lowest SBIC
model is associated
to AR(1)

↓
ACCORDING TO SBIC,
AR(1) IS THE
BEST MODEL