

## 11.8 Moving Average Processes

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$$MA(1): Y_t = \phi + \varepsilon_t + \theta \varepsilon_{t-1} \rightarrow \theta \varepsilon_{t-1} = \text{residual}$$

"innovations"  
"shocks"  
"disturbances"

$$\begin{aligned} &\downarrow E(\varepsilon_t) = 0 \\ &\text{Var}(\varepsilon_t) = \sigma^2 \\ &\text{stationary / weakly dependent} \end{aligned}$$

$Y_t$  is corr w/  $Y_{t-1}$  not corr w/  $Y_{t-2}$

$$\hookrightarrow Y_{t-2} = \phi + \varepsilon_{t-2} + \theta \varepsilon_{t-3}$$

$$Y_t = \phi + \varepsilon_t, \quad \varepsilon_t = \varepsilon_t + \theta \varepsilon_{t-1}$$

$MA(q)$

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

$$|\theta_n| < 1$$

$$Y_t = \phi + \sum_{h=0}^q \theta_h \varepsilon_{t-h}$$

ARMA or ARIMA

$$Y_t = \alpha + \sum_{h=1}^p Y_{t-h} + \sum_{g=0}^q \theta_g \varepsilon_{t-g} \rightarrow \text{ARMA}$$

ARIMA

$\hookrightarrow$  Integrated

I(1)    AR(1)     $\rho_1 = 1$     Unit root process Integrated of order 1 process