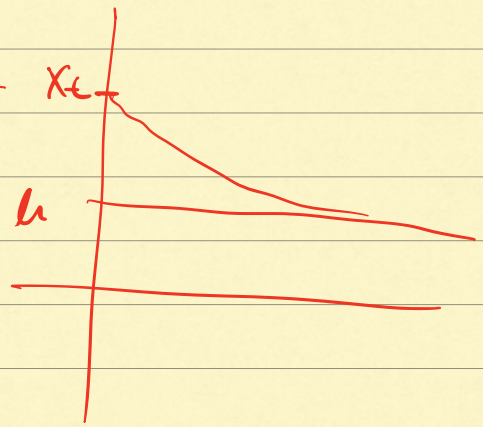
$X_{t+1} = \phi_0 + \phi_1 X_t + \varepsilon_{t+1}$ $\sim N(0, \sigma^2)$

$|\phi_1| \to 1$

$\frac{\sigma^2}{1-\phi_1^2}$

$\phi_1 = 0.9$



$N(0, \Omega)$

$X_{t+1} = \phi_0 + \phi_1 X_t + \varepsilon_{t+1} \sim N(0, \sigma^2)$

$P(X_1, X_2, \cdots, X_T)$

$$P(X_2 | X_1) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(X_2 - \phi_0 - \phi_1 X_1)^2}{2\sigma^2}}$$ ✓

$P(X_3 | X_2)$

$\vdots$

$P(X_T | X_{T-1})$

$$P(X_2, X_3 | X_1) = P(X_3 | X_1, X_2) P(X_2 | X_1)$$ ✓

$$= P(X_3 | X_2) \times P(X_2 | X_1)$$

$$P(X_2, X_3, \cdots, X_T | X_1) = P(X_2|X_1) \cdot P(X_3|X_2) \times \cdots \times P(X_T|X_{T-1})$$

$\times P(X_1)$

$$\max_{\phi_0, \phi_1, \sigma} \mathcal{L} = \ln P(X_2, X_3, \cdots, X_T | X_1)$$

T

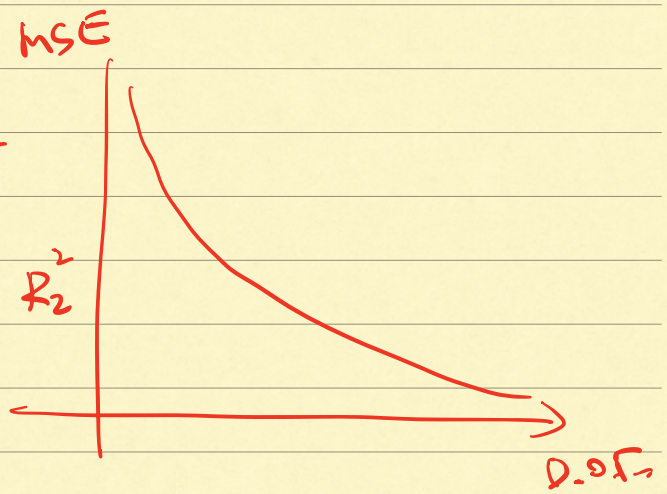
$$\Longleftrightarrow \quad \min \sum_{t=2} (x_t - \phi_0 - \phi_1 x_{t-1})^2$$

$x_1, x_2, x_3, \cdots, x_T$

① $x_t = \phi_0 + \phi_1 x_{t-1} + \varepsilon_t$ AR(1) → L_1

② $x_t = \phi_0 + \phi_1 x_{t-1} + \phi_2 x_{t-2} + \varepsilon_t$ AR(2) → L_2

③ $x_t = \phi_0 + \phi_1 x_{t-1} + \varepsilon_t - \theta_1 \varepsilon_{t-1}$ ARMA(1,1) → L_3



$y_i = a + bx_{1i} + \varepsilon_i$ R_1^2

$y_i = a + bx_{1i} + cx_{2i} + \varepsilon_i$ R_2^2

$\min_{a,b} \sum (y_i - a - bx_{1i})^2$

$\min_{a,b,c} \sum (y_i - a - bx_{1i} - cx_{2i})^2$ ↓ → R^2 ↑

$c = 0$

AIC BIC

$2 \times L_1$	penalty (1)	1×2	$\ln T \times 1$
$2 \times L_2$	penalty (2)	2×2	$\ln T \times 2$
$2 \times L_3$	penalty (2)	2×2	$\ln T \times 2$