

$$Y_t = C_t + S_t + T_t + \epsilon_t \quad \text{Additive}$$

$$Y_t = C_t * S_t * T_t * \epsilon_t$$

$$\underbrace{\Theta_P(B^s)}_{\text{AR}} \underbrace{\phi_P(B)}_{\text{circular}} Y_t = \underbrace{\Theta_Q(B^s)}_{\text{MA}} \underbrace{\theta_Q(B)}_{\text{circular}} \epsilon_t$$

The diagram illustrates the decomposition of the ARMA model into its constituent parts. The left side represents the ARMA model, and the right side represents the MA model. The terms $\Theta_P(B^s)$ and $\Theta_Q(B^s)$ are circled in yellow and labeled "AR" and "MA" respectively. The terms $\phi_P(B)$ and $\theta_Q(B)$ are circled in blue and labeled "circular". A yellow arrow points from the word "rational" to the left side of the equation.

$$\phi_p(0) \cdot Y_t = \theta_f(0) \cdot \varepsilon_t$$

$$(1 - \phi_1 B - \phi_2 B^2 - \dots - \phi_p B^p) Y_t = (1 - \theta_1 B - \dots - \theta_f B^q) \varepsilon_t$$

$$\underbrace{\theta_p(B)}_{\phi_p(B)}$$

$$(1 - \phi_{12} B^{12} - \phi_{24} B^{24} - \dots - \phi_p B^p) (\dots) Y_t$$

$$\Theta_P(B^s)\phi_p(B)\underbrace{\nabla_s^D \nabla^d}_{z_t} Y_t = \phi_0 + \Theta_Q(B^s)\theta_q(B)\epsilon_t$$

$$z_t = \nabla_s^D \nabla^d Y_t$$

$$\nabla^d \equiv (1 - \beta)^d$$

$$\nabla_s^D \equiv (1 - \beta_s)^D$$

NDIFFS \rightarrow

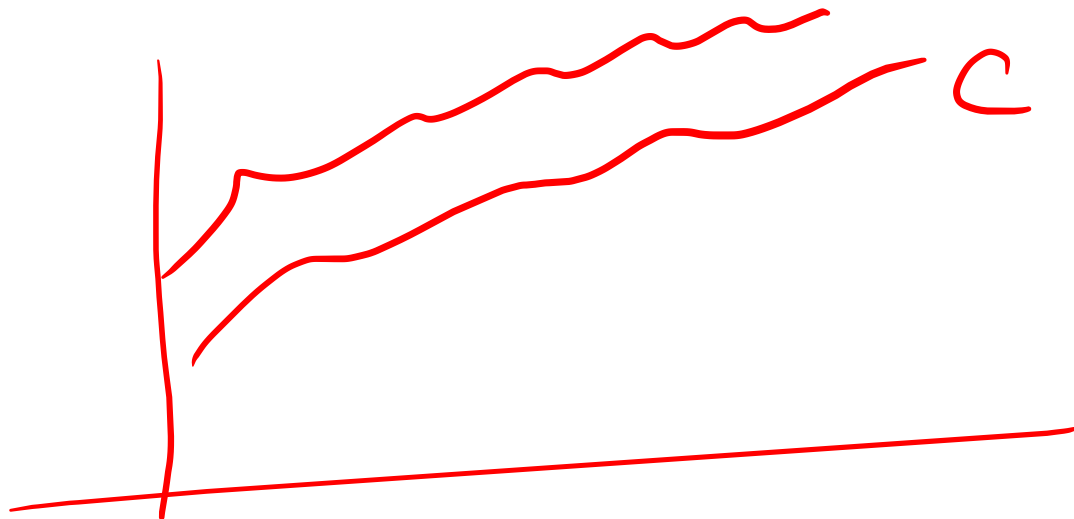
NSDIFFS \rightarrow

$$D_{12}(DY_t) = \underline{D_{12}X_t}$$

$$X_t: \text{SARIMA}(2, 1, 0)(0, 1, 3)[12]$$

\downarrow
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$$\nabla D_{12} X_t = Z_t : \underline{\text{SARIMA}(2, 0)(0, 3)[12]}$$



$\chi_t \rightarrow \text{FAC} \rightarrow \text{no trends}$
Returns

$\chi_t^2 \rightarrow$ The sign. Results
 $\rightarrow \text{ARCH} / \text{GARCH}$

ANCH(γ)

GANCH(P, γ)

IGANCH(P, α, γ)

\bar{F} , GANCH

T-GANCH

APANCH



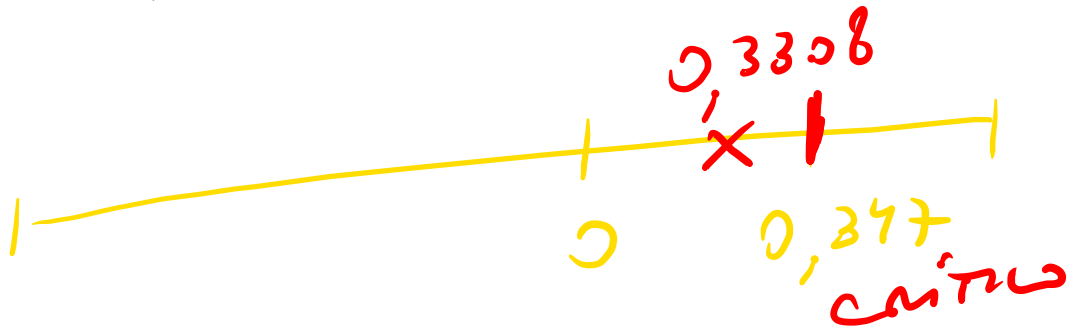
$\alpha = 10\%$

μH_0

no $\mu H_0 \rightarrow \underline{\underline{II(1)}}$

$$y_t = \beta_0 + \beta_1 t + \varepsilon_t \rightarrow \text{Linear Simple}$$

$$y_t = \beta_0 + \beta_1 t + \beta_2 t^2 + \varepsilon_t$$



$$H_0: \mu_1 - \mu_2 = 0$$

$$H_a: \mu_1 - \mu_2 \neq 0$$

$$T_e = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{S_a \left(\frac{1}{n} + \frac{1}{m} \right)}} \sim t_{n+m-2}$$

various
deterministic
I64033

$$T^e = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \sim t_v$$

DETERMINATION
OF DEGREES OF FREEDOM



WELCH

$$v =$$

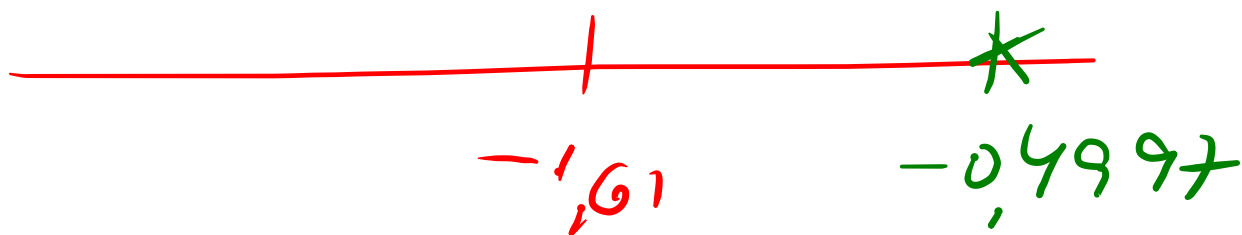
$$\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} \right)$$

-2

$$(1) \quad Y_t = \phi_0 + \phi_1 \cdot X_t + \varepsilon_t$$

$$(2) \quad Y_t = (\phi_0 + \beta_0) Z_t + \phi_1 \cdot Y_{t-1} + \varepsilon_t$$

$$Z_t = \begin{cases} 1 & \text{si } t > 1670 \\ 0 & \text{si } t \leq 1670 \end{cases}$$



$\underbrace{\hspace{10em}}$
LH

$\underbrace{\hspace{10em}}$
no LH