ARIMA

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The ARIMA model is an extension of the ARMA model that applies to non-stationary time series (the kind of time series with one or more integrated unit-roots).By definition, the auto-regressive integrated moving average (ARIMA) process is an ARMA process for the differenced time series:.

$$ (1-\phi_1 L - \phi_2 L^2 -\cdots - \phi_p L^p)(1-L)^d x_t - \phi_o= (1+\theta_1 L+\theta_2 L^2 + \cdots + \theta_q L^q)a_t$$ $$ y_t = (1-L)^d x_t $$

Where:

- x_t is the original non-stationary output at time t.
- y_t is the observed differenced (stationary) output at time t.
- d is the integration order of the time series.
- a_t is the innovation, shock or error term at time t.
- p is the order of the last lagged variables.
- q is the order of the last lagged innovation or shock.
- $\{a_t\}$ time series observations are independent and identically distributed (i.e. i.i.d) and follow a Gaussian distribution (i.e. $\Phi(0,\sigma^2)$

Remarks

1. The variance of the shocks is constant or time-invariant.
2. Assuming y_t (i.e. $(1-L)^d x_t$) is a stationary process with a long-run mean of μ, then taking the expectation from both sides, we can express ϕ_o as follows: $$\phi_o = (1-\phi_1-\phi_2-\cdots -\phi_p)\mu $$
3. Thus, the ARIMA(p,d,q) process can now be expressed as: $$ (1-\phi_1 L - \phi_2 L^2 - \cdots - \phi_p L^p) (y_t-\mu) = (1+\theta_1 L + \theta_2 L^2 + \cdots + \theta_q L^q) a_t $$ $$z_t=y_t-\mu$$ $$(1-\phi_1 L - \phi_2 L^2 - \cdots - \phi_p L^p) z_t = (1+\theta_1 L + \theta_2 L^2 + \cdots + \theta_q L^q) a_t$$
4. In sum, z_t is the differenced signal after we subtract its long-run average.
5. The order of an ARIMA process is solely determined by the order of the last lagged variable with a non-zero coefficient. In principle, you can have fewer number of parameters than the order of the model.
6. **Example:** Consider the following ARIMA(12,2) process:

   $$ (1-\phi_1 L -\phi_{12} L^{12}) (y_t-\mu) = (1+\theta_2 L^2) a_t$$

Requirements

Header	SFSDK.H
Library	SFSDK.LIB
DLL	SFSDK.DLL

References

Hamilton, J .D.; Time Series Analysis , Princeton University Press (1994), ISBN 0-691-04289-6

Tsay, Ruey S.; Analysis of Financial Time Series John Wiley & SONS. (2005), ISBN 0-471-690740

See Also

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