Intercepts and drift in ARIMA functions

FISH 507 – Applied Time Series Analysis

Eli Holmes

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Cover on your own: Intercepts and drift in `Arima()`

$d = 0$ `Arima(x, order=c(1,0,0), include.drift=FALSE, include.mean=TRUE)`

m is estimated and called `intercept`.

$$(x_t - m) = \phi_1(x_{t-1} - m) + w_t$$

`Arima(x, order=c(1,0,0), include.drift=TRUE, include.mean=FALSE)`

μ is estimated and called `drift`.

$$x_t = \mu + \phi_1 x_{t-1} + w_t$$

```
Arima(x, order=c(1,0,0), include.drift=TRUE,
include.mean=TRUE)
```

μ and m are estimated and called `drift` and `intercept`.

$$(x_t - m) = \mu + \phi_1(x_{t-1} - m) + w_t$$

If $d = 1$, then `include.mean` is ignored in `Arima()` and `include.drift` estimates an intercept like `include.mean` in the $d = 0$ case, but it is called `drift` in the output. $y_t = x_t - x_{t-1}$.

- `Arima(x, order=c(1,1,0), include.drift=TRUE)`

m is estimated and called `drift`.

$$(y_t - m) = \phi_1(y_{t-1} - m) + w_t$$

- `Arima(x, order=c(1,1,0), include.drift=FALSE)`

$$y_t = \phi_1 y_{t-1} + w_t$$

- `Arima(x, order=c(0,1,0), include.drift=TRUE)`

This is a random walk with drift.

$$(y_t - m) = w_t$$

which is

$$x_t = m + x_{t-1} + w_t$$

If $d \geq 2$, then both `include.mean` and `include.drift` are ignored. $z_t = y_t - y_{t-1} = (x_t - x_{t-1}) - (x_{t-1} - x_{t-2})$.

- `Arima(x, order=c(1,2,0))`

$$z_t = \phi_1 z_{t-1} + w_t$$

Intercepts in `arima()`

If $d = 0$,

- `arima(x, order=c(1,0,0), include.mean=TRUE)`

m is estimated and called `intercept`.

$$(x_t - m) = \phi_1(x_{t-1} - m) + w_t$$

If $d = 1$, then `include.mean` is ignored and no intercept can be estimated.

- `arima(x, order=c(1,1,0), include.mean=TRUE)`

$$y_t = \phi_1 y_{t-1} + w_t$$

- `arima(x, order=c(0,1,0))`

Because an intercept cannot be estimated, this means that a random walk with drift cannot be estimated by `arima()`.

$$y_t = w_t$$

only can be estimated which is random walk without drift.

$$x_t = x_{t-1} + w_t$$