## ADDITIVE ERROR MODELS Trend

 $y_t = \ell_{t-1} + b_{t-1} + \varepsilon_t$ 

 $\ell_t = \ell_{t-1} + b_{t-1} + \alpha \varepsilon_t$ 

 $y_t = \ell_{t-1} + \phi b_{t-1} + \varepsilon_t$ 

 $\ell_t = \ell_{t-1} + \phi b_{t-1} + \alpha \varepsilon_t$ 

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 $b_t = b_{t-1} + \beta \varepsilon_t$ 

 $b_t = \phi b_{t-1} + \beta \varepsilon_t$ 

 $y_t = \ell_{t-1}(1 + \varepsilon_t)$ 

 $\ell_t = \ell_{t-1} (1 + \alpha \varepsilon_t)$ 

 $\psi_t = (\ell_{t-1} + b_{t-1})(1 + \varepsilon_t)$ 

 $\ell_t = (\ell_{t-1} + b_{t-1})(1 + \alpha \varepsilon_t)$ 

 $b_t = b_{t-1} + \beta(\ell_{t-1} + b_{t-1})\varepsilon_t$ 

 $y_t = (\ell_{t-1} + \phi b_{t-1})(1 + \varepsilon_t)$ 

 $\ell_t = (\ell_{t-1} + \phi b_{t-1})(1 + \alpha \varepsilon_t)$ 

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Α

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Trend

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N	
$y_t = \ell_{t-1} + \varepsilon_t$ $\ell_t = \ell_{t-1} + \alpha \varepsilon_t$	$y_t = \ell_{t-1} + s_{t-m} + \varepsilon_t$ $\ell_t = \ell_{t-1} + \alpha \varepsilon_t$
	$s_t = s_{t-m} + \gamma \varepsilon_t$

$$s_t = s_{t-m} + \gamma \varepsilon_t$$

$$y_t = \ell_{t-1} + b_{t-1}$$

$$\ell_t = \ell_{t-1} + b_{t-1}$$

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 $y_t = (\ell_{t-1} + s_{t-m})(1 + \varepsilon_t)$ 

 $\ell_t = \ell_{t-1} + \alpha(\ell_{t-1} + s_{t-m})\varepsilon_t$ 

 $s_t = s_{t-m} + \gamma (\ell_{t-1} + s_{t-m}) \varepsilon_t$ 

 $y_t = (\ell_{t-1} + b_{t-1} + s_{t-m})(1 + \varepsilon_t)$ 

 $b_t = b_{t-1} + \beta(\ell_{t-1} + b_{t-1} + s_{t-m})\varepsilon_t$ 

 $s_t = s_{t-m} + \gamma (\ell_{t-1} + b_{t-1} + s_{t-m}) \varepsilon_t$ 

 $v_t = (\ell_{t-1} + \phi b_{t-1} + s_{t-m})(1 + \varepsilon_t)$ 

 $s_t = s_{t-m} + \gamma (\ell_{t-1} + \phi b_{t-1} + s_{t-m}) \varepsilon_t$ 

$$y_t = \ell_{t-1} + b_{t-1} + s_{t-m} + \varepsilon_t$$

$$\ell_t = \ell_{t-1} + b_{t-1} + \alpha \varepsilon_t$$

$$b_t = b_{t-1} + \beta \varepsilon_t$$

$$s_t = s_{t-m} + \gamma \varepsilon_t$$

$$\begin{aligned}
\ell_t &= \ell_{t-1} + b_{t-1} + \alpha \varepsilon_t \\
b_t &= b_{t-1} + \beta \varepsilon_t \\
s_t &= s_{t-m} + \gamma \varepsilon_t \\
y_t &= \ell_{t-1} + \phi b_{t-1} + s_t
\end{aligned}$$

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$$egin{array}{c} s_t \ y_t \ \ell_t \ b_t \end{array}$$

$$\begin{aligned} y_t &= \ell_{t-1} + \phi b_{t-1} + s_{t-m} + \varepsilon_t \\ \ell_t &= \ell_{t-1} + \phi b_{t-1} + \alpha \varepsilon_t \\ b_t &= \phi b_{t-1} + \beta \varepsilon_t \\ s_t &= s_{t-m} + \gamma \varepsilon_t \end{aligned}$$

 $b_t = \phi b_{t-1} + \beta (\ell_{t-1} + \phi b_{t-1}) \varepsilon_t$   $b_t = \phi b_{t-1} + \beta (\ell_{t-1} + \phi b_{t-1} + s_{t-m}) \varepsilon_t$ 

$$\begin{aligned} y_t &= (\ell_{t-1} + b_{t-1} + s_{t-m})(1 + \varepsilon_t) & y_t &= (\ell_{t-1} + b_{t-1})s_{t-m}(1 + \varepsilon_t) \\ \ell_t &= \ell_{t-1} + b_{t-1} + \alpha(\ell_{t-1} + b_{t-1} + s_{t-m})\varepsilon_t & \ell_t &= (\ell_{t-1} + b_{t-1})(1 + \alpha\varepsilon_t) \\ b_t &= b_{t-1} + \beta(\ell_{t-1} + b_{t-1} + s_{t-m})\varepsilon_t & b_t &= b_{t-1} + \beta(\ell_{t-1} + b_{t-1})\varepsilon_t \\ s_t &= s_{t-m} + \gamma(\ell_{t-1} + b_{t-1} + s_{t-m})\varepsilon_t & s_t &= s_{t-m}(1 + \gamma\varepsilon_t) \end{aligned}$$

 $\ell_t = \ell_{t-1} + \phi b_{t-1} + \alpha (\ell_{t-1} + \phi b_{t-1} + s_{t-m}) \varepsilon_t$   $\ell_t = (\ell_{t-1} + \phi b_{t-1}) (1 + \alpha \varepsilon_t)$ 

$$\mathbf{M}$$

$$y_t = \ell_{t-1} s_{t-m} (1 + \varepsilon_t)$$

$$\ell_t = \ell_{t-1} (1 + \alpha \varepsilon_t)$$

$$s_t = s_{t-m} (1 + \gamma \varepsilon_t)$$

M

 $y_t = (\ell_{t-1} + \phi b_{t-1}) s_{t-m} (1 + \varepsilon_t)$ 

 $b_t = \phi b_{t-1} + \beta (\ell_{t-1} + \phi b_{t-1}) \varepsilon_t$ 

 $s_t = s_{t-m}(1 + \gamma \varepsilon_t)$ 

 $b_t = \phi b_{t-1} + \beta \varepsilon_t / s_{t-m}$  $s_t = s_{t-m} + \gamma \varepsilon_t / (\ell_{t-1} + \phi b_{t-1})$ 

 $\ell_t = \ell_{t-1} + b_{t-1} + \alpha \varepsilon_t / s_{t-m}$  $b_t = b_{t-1} + \beta \varepsilon_t / s_{t-m}$ 

 $y_t = \ell_{t-1} s_{t-m} + \varepsilon_t$ 

 $\ell_t = \ell_{t-1} + \alpha \varepsilon_t / s_{t-m}$  $s_t = s_{t-m} + \gamma \varepsilon_t / \ell_{t-1}$ 

 $y_t = (\ell_{t-1} + b_{t-1})s_{t-m} + \varepsilon_t$ 

M

 $s_t = s_{t-m} + \gamma \varepsilon_t / (\ell_{t-1} + b_{t-1})$ 

 $v_t = (\ell_{t-1} + \phi b_{t-1}) s_{t-m} + \varepsilon_t$  $\ell_t = \ell_{t-1} + \phi b_{t-1} + \alpha \varepsilon_t / s_{t-m}$