$$tb_t = y_t - c_t - i_t - g_t$$

$$Ratio_t = \frac{tb_t}{y_t} = \underbrace{1 - \frac{c_t}{y_t} - \frac{i_t}{y_t} - \frac{g_t}{y_t}}_{\text{log-linearize this side}}$$

$$\therefore \ Ratio_t = 1 - \frac{\bar{c}}{\bar{y}}(1 + \tilde{c}_t - \tilde{y}_t) - \frac{\bar{i}}{\bar{y}}(1 + \tilde{i}_t - \tilde{y}_t) - \frac{\bar{g}}{\bar{y}}(1 + \tilde{g}_t - \tilde{y}_t)$$

$$= 1 - \frac{\bar{c}}{\bar{y}} - \frac{\bar{i}}{\bar{y}} - \frac{\bar{g}}{\bar{y}} - \frac{\bar{c}}{\bar{y}}\tilde{c}_t - \frac{\bar{i}}{\bar{y}}\tilde{i}_t - \frac{\bar{g}}{\bar{y}}\tilde{g}_t$$

$$+ \left(\frac{\bar{c}}{\bar{y}} + \frac{\bar{i}}{\bar{y}} + \frac{\bar{g}}{\bar{y}}\right)\tilde{y}_t$$

('$\sim$' means log-linearized)

steady state: $\overline{Ratio} = 1 - \frac{\bar{c}}{\bar{y}} - \frac{\bar{i}}{\bar{y}} - \frac{\bar{g}}{\bar{y}}$

$$\therefore \ Ratio_t - \overline{Ratio} = (1 - \overline{Ratio})\tilde{y}_t - \frac{\bar{c}}{\bar{y}}\tilde{c}_t - \frac{\bar{i}}{\bar{y}}\tilde{i}_t - \frac{\bar{g}}{\bar{y}}\tilde{g}_t$$

$\overline{Ratio}$ is average of $\frac{\text{Trade balance}}{\text{Output}}$ ratio

model (linear);

$$\frac{tb_t}{y_t}\_obs = Ratio_t$$

$\Downarrow$

original $\frac{\text{Trade balance}}{\text{Output}}$ data.