Some useful log-linearization rules:
(Note that the notation is a bit different from Galí and the exercises)

$$x_t \equiv \log(X_t) - \log(\bar{X})$$

$$X_t \approx \bar{X}(1 + x_t)$$

$$X_t^{\rho} \approx \bar{X}^{\rho}(1 + \rho x_t)$$

$$aX_t \approx a\bar{X}(1 + x_t)$$

$$X_t Y_t \approx \bar{X}\bar{Y}(1 + x_t + y_t)$$

$$Y_t(a + bX_t) \approx \bar{Y}(1a + b\bar{X}) + a\bar{Y}y_t + b\bar{X}\bar{Y}(x_t + y_t)$$

$$Y_t(a + bX_t + cZ_t) \approx \bar{Y}(a + b\bar{X} + c\bar{Z}) + \bar{Y}(a + b\bar{X} + c\bar{Z})y_t + b\bar{X}\bar{Y}x_t + c\bar{Z}\bar{Y}z_t$$

$$\frac{X_t}{aY_t} \approx \frac{\bar{X}}{a\bar{Y}}(1 + x_t - y_t)$$

$$\frac{X_t}{Y_t + aZ_t} \approx \frac{\bar{X}}{\bar{Y} + a\bar{Z}}\left[1 + x_t - \frac{\bar{Y}}{\bar{Y} + a\bar{Z}}y_t - \frac{a\bar{Z}}{\bar{Y} + a\bar{Z}}z_t\right]$$