Question 1-(a)

[Answer] If we substitute $gGDP_{t-1}$ in the second equation:

$$\begin{aligned} int_t &= \gamma_0 + \gamma_1(gGDP_{t-1} - 3) + v_t \\ &= \gamma_0 + \gamma_1(\alpha_0 + \delta_0 int_{t-1} + \delta_1 int_{t-2} + u_{t-1} - 3) + v_t \\ &= \gamma_0 + \gamma_1(\alpha_0 - 3) + \gamma_1\delta_0 int_{t-1} + \gamma_1\delta_1 int_{t-2} + \gamma_1 u_{t-1} + v_t \\ &= \lambda_0 + \lambda_1 int_{t-1} + \lambda_2 int_{t-2} + \lambda_3 u_{t-1} + v_t \end{aligned} \tag{1}$$

where $\lambda_0 = \gamma_0 + \gamma_1(\alpha_0 - 3)$, $\lambda_1 = \gamma_1\delta_0$, $\lambda_2 = \gamma_1\delta_1$ $\lambda_3 = \gamma_1$. If v_t is uncorrelated with all past values of int_t and u_t, we can caculate $\hat{\lambda}$ from OLS. From the following equation:

$$\begin{aligned} \hat{\lambda} &= (X'X)^{-1}X'Y \\ (X'X)\hat{\lambda} &= X'Y \end{aligned} \tag{2}$$

From Gauss Elimination, we can induce $\lambda_3 = Cov(int_t, u_{t-1})/Cov(int_t, int_t)$ and $\lambda_3 = \gamma_1 > 0$, we can conclude that $Cov(int_t, u_{t-1}) \neq 0$

Question 1-(b)

[Answer] We have the following equation in the problem:

$$gGDP_t = \alpha_0 + \delta_0 int_t + \delta_1 int_{t-1} + u_t \tag{3}$$

This violates $GMA.3_{mi}$ as explanatory variable int_t has correlation to u_{t-1}, therefore, $E(u_{t-1}|int_t) \neq 0$.