ECON 5345 Homework 1 Report

Harlly Zhou

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Question 1

a. Note that for any t, we have

$$C_t = C_{t-3} + e_{t-2} + e_{t-1} + e_t.$$

Substituting this into the

$$\begin{aligned}\Delta C_t &\equiv \frac{C_t + C_{t+1} + C_{t+2}}{3} - \frac{C_{t-3} + C_{t-2} + C_{t-1}}{3} \\ &= \frac{e_{t-2} + 2e_{t-1} + 3e_t + 2e_{t+1} + e_{t+2}}{3}.\end{aligned}$$

b. No. They are correlated. At $t+3$, we have

$$\Delta C_{t+3} = \frac{e_{t+1} + 2e_{t+2} + 3e_{t+3} + 2e_{t+4} + e_{t+5}}{3}.$$

It is clear that

$$\mathrm{Cov}(\Delta C_t, \Delta C_{t+3}) = \frac{2}{9}(\mathrm{Var}[e_{t+1}] + \mathrm{Var}[e_{t+2}]) > 0,$$

as long as $\mathrm{Var}[e_{t+1}] + \mathrm{Var}[e_{t+2}] > 0$.

c. No for the first part. Since e_{t-2} and e_{t-1} are known, ΔC_t is correlated with C_{t-2} and C_{t-1}.

Yes for the second part. Information known at $t-3$ only includes white noise no later then $t-3$, while ΔC_t is a linear combination of white noises after $t-3$. Given the serial uncorrelation property of white noise, they are not correlated.

d. The ACF and PACF of the change in measured consumption are shown in Figure **??**. Codes in "hongyi_zhou_hw1_q1d.R".

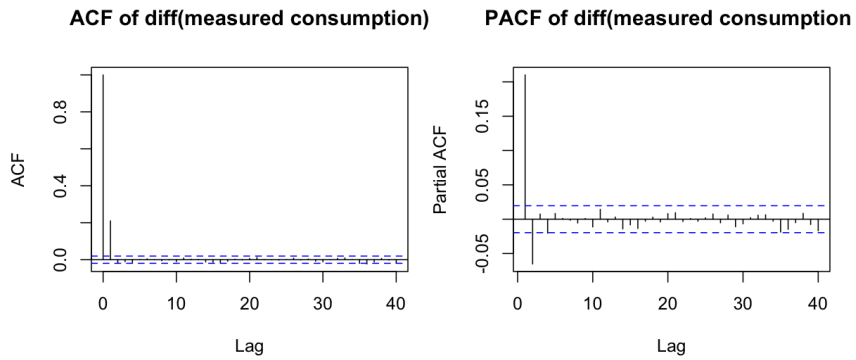

Figure 1: ACF and PACF of the change in measured consumption

e. The ACF and PACF of the change in measured consumption are shown in Figure **??** and Figure **??**. Codes in "hongyi_zhou_hw1_q1d.R".

Question 2

Question 3

Figure 2: ACF and PACF of the change in measured consumption using monthly data from Jan 1, 2007 to Sep 30, 2025. Months after Sep 2025 are excluded since the quarterly data only goes to Q3 2025.

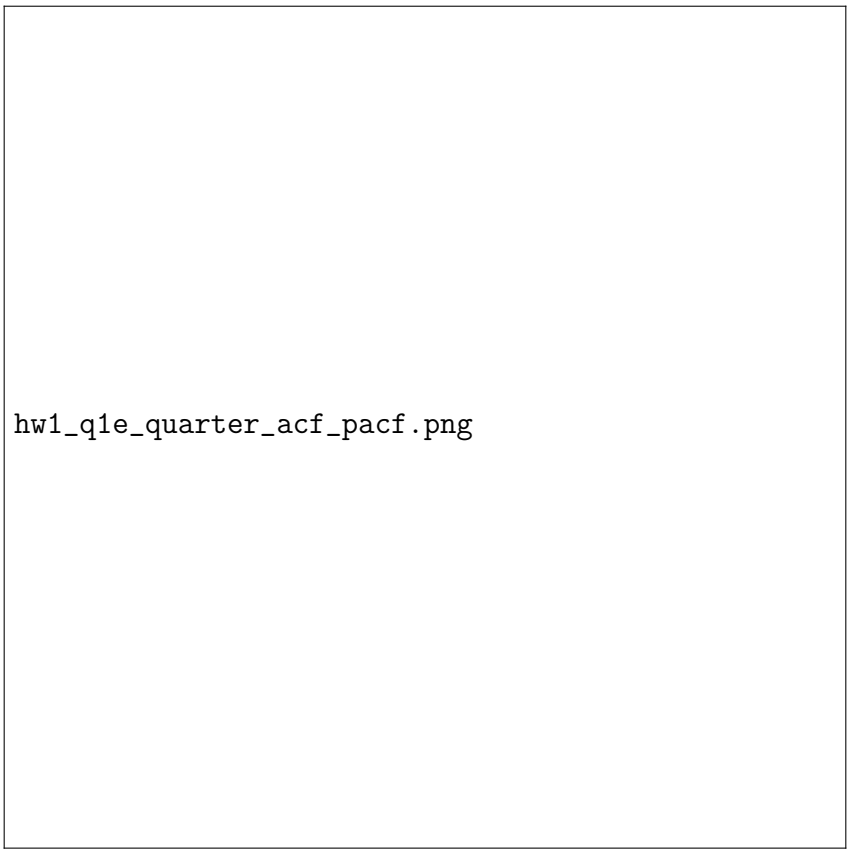

Figure 3: ACF and PACF of the change in measured consumption using quarterly data from Q1 2007 to Q3 2025