Exercize 1: Identification of conduct

- The task is to investigate competition in Dutch coffee market.
- Time-series monthly data contains information about the Dutch coffee market during the period 1990-1996 (more information in Bettendorf and Verboven (1998)).
- The data include the following variables:
  - month: year and month of observation;
  - qu: per capita consumption of roasted coffee in kg;
  - cprice: price of roasted coffee per kg in current guilders;
  - tprice: price of per kg tea in current guilders;
  - oprice: price index for other goods;
  - incom: income per capita in current quilders;
  - q1-q4: dummy variables for seasons 1 to 4;
  - bprice: price of coffee beans per kg in current guilders;
  - wprice: price of labor per man hours (work 160 hours per month).

Empirical model

- Market demand is assumed to be linear:

$$Q_t = \beta(\alpha - P_t)^\gamma + \epsilon_t \tag{1}$$

which assuming that $\alpha = 0$ and $\gamma < 0$ is a log-linear demand function:

$$ln(Q_t) = ln(-\beta) + \gamma ln(P_t) + \epsilon_t \tag{2}$$

where Q_t is total output in the market and P_t is the market price and ϵ_t is an error term, $\epsilon_t \sim N(0, \sigma^2)$

- The coffee market is characterized by a relatively simple production technology with constant marginal cost:

$$c = c_0 + kP_{coffebeans}, \tag{3}$$

where c_0 represents all variable costs other than those related to coffee beans, i.e., labor and packages; and k is a parameter that measures the fixed technology in production. It is estimated that one kg of roasted coffee requires 1.19 kg of beans. The c_0 is estimated to be around 4 guilders.

- The profit for firm i is given by:

$$\pi(q_i, q_{-i}) = (P(Q) - c)q_i \tag{4}$$

where $Q = \sum_J q_i$. The first order condition of profit maximization in the Cournot model implies:

$$\frac{\partial \pi(q_i, q_{-i})}{\partial q_i} = 0 \Rightarrow P(Q) + \lambda_i q_i \frac{\partial P(Q)}{\partial Q} = c \tag{5}$$

where $\lambda_i = 1 + \sum_{j \neq i} \frac{\partial q_j}{\partial q_i}$ represents conjectural variation.

$$P(Q) + \lambda_i \frac{q_i}{Q} Q \frac{\partial P(Q)}{\partial Q} = c \tag{6}$$

In the case of N identical firms we have: $\frac{q_i}{Q} = \frac{1}{N}$:

$$P(Q) + \theta Q \frac{\partial P(Q)}{\partial Q} = c \tag{7}$$

- The conduct parameter can take the following values:
  - $\theta = 0$ for perfect competition
  - $0 < \theta < 1$ for oligopoly
  - $\theta = 1$ for for monopoly or collusion

- If we have access to information about costs, conduct parameter θ can be expressed in the following way:

$$\theta = -\gamma \frac{P - c}{P} \equiv L_\eta \tag{8}$$

where $\eta(P)$ is the elasticity of demand and L_η is the adjusted Lerner index, i.e., Lerner index adjusted for elasticity (Genesove and Mullin, 1998).

- The market price can be written as a function of the conduct parameter θ, the estimated demand, and cost parameters:

$$P(c) = \frac{\gamma}{\gamma + \theta} c \tag{9}$$

where γ is the estimated demand elasticity in log-linear demand specification.

Your task

- Analyze data by computing simple statistics and graphical illustration.
- Estimate demand for roasted coffee using reasonable explanatory variables and instrumental variables.
- Explain what allows for identification of conduct in this model.
- Estimate Lerner index adjusted for elasticity and conduct parameter, and provide interpretation.