

Macroeconomics II: A Note on Price Indices

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The price level and its relation to individual prices

- In the NK model presented yesterday, P_t referred to the price of “final goods” and P_{it} to the price of “intermediate goods”
- With a CES production function in the final goods producer problem, we showed that they are related through

$$P_t = \left(\int_0^1 P_{it}^{1-\epsilon} di \right)^{\frac{1}{1-\epsilon}}$$

- Hence, we can interpret the final good price P_t as a “Producer Price Index” (PPI)

Another setup

- An alternative, but equivalent, setup is to assume that there exist only one firm layer, which produce differentiated consumer goods
- In such a setup, the household problem becomes

$$\begin{aligned} \max_{\{C_{it}, N_t, B_{t+1}\}} \quad & Eo \sum_{t=0}^{\infty} \beta^t [U(C_t) - V(N_t)] \\ \text{s.t.} \quad & \int_{i=0}^1 P_{it} C_{it} di + Q_t B_{t+1} \leq W_t N_t + B_t + T_t \end{aligned}$$

with

$$C_t = \left(\int_0^1 C_{it}^{\frac{\epsilon-1}{\epsilon}} di \right)^{\frac{\epsilon}{\epsilon-1}}$$

Another setup II

- By first solving the within-period cost-minimization problem:

$$\begin{aligned} \min_{C_{it}} \quad & \int_{i=0}^1 P_{it} C_{it} di \\ \text{s.t.} \quad & \int_{i=0}^1 P_{it} C_{it} \leq E \\ & \left(\int_0^1 C_{it}^{\frac{\epsilon-1}{\epsilon}} di \right)^{\frac{\epsilon}{\epsilon-1}} = C_t \end{aligned}$$

one will similarly find that

$$C_{it} = \left(\frac{P_{it}}{P_t} \right)^{-\epsilon} C_t$$

with

$$P_t = \left(\int_0^1 P_{it}^{1-\epsilon} di \right)^{\frac{1}{1-\epsilon}}$$

- In this setting, P_t can be interpreted as a “Consumer Price Index” (CPI)

Another setup III

- After having solved the static expenditure allocation problem, the household problem becomes

$$\begin{aligned} \max_{C_t, N_t, B_{t+1}} \quad & E_0 \sum_{t=0}^{\infty} \beta^t [U(C_t) - V(N_t)] \\ \text{s.t.} \quad & P_t C_t + Q_t B_{t+1} \leq W_t N_t + B_t + T_t \end{aligned}$$

where C_t now is an optimally chosen consumption bundle

Models vs data

- ⇒ In these models, not really any distinction between PPI and CPI
- In the data, they can differ a lot

