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Problem set – Aggregate demand and supply

Keywords: Phillips curve; Taylor rule; Aggregate demand.

1. Consider the following equation for the Taylor rule: $i = \bar{r} + \pi + (\alpha - 1)(\pi - \bar{\pi}) + \beta(Y/\bar{Y} - 1)$ and the following parameterization: $\bar{\pi} = 0.03$, $\bar{r} = 0.05$, $\bar{Y} = 100$, $(\alpha - 1) = 0.5$, $\beta = 0.5$. Also consider the following equation describing the money demand $m^d = Y/(1 + i)$ and $P = 1$.

a) Describe, in two different graphs, the TR - space (i, Y) - and the money market equilibrium - space $(i, M/P)$ – an initial equilibrium, assuming that parameterization: $\pi = 0.03$, $Y = 100$. How much is the money supply, M, in this case?

b) Departing from (a), assume that Y increases to Y=105. How will the central bank react? Describe the adjustment process in the money market and in the TR locus.

c) Departing from (a), assume that π increases to $\pi = 0.11$. How will the central bank react? Describe the adjustment process in the money market and in the TR locus.

2. Consider a closed economy described by the following equations: market of goods and services: $q = k\left[\bar{A} - dr\right] + \varepsilon$ where $\bar{A} = 25$, $k = 5$, $d = 100$, and ε is an exogenous shock, initially equal to zero. Monetary policy: $i = \bar{i} + a\left[\pi - \bar{\pi}\right]$, where $\bar{\pi} = 0.02$, and $a = 2$. Phillips curve: $\pi = \pi^e + \gamma\left[q - q_n\right]$, with $\gamma = 0.002$ and $q_n = 100$.

a) Find out the natural real interest rate r_n in this economy. Which nominal interest rate $\bar{i}$ shall the central bank target?

b) Find out the expression of the aggregate demand. Explain its slope.

c) Describe the long run equilibrium in a graph.

d) Analyse the short run and the long run impacts of a one-period shock amounting to $\varepsilon = 10$, distinguishing the following two cases: (i) prices and wages are flexible and expectations are well anchored at $\pi^e = \bar{\pi} = 0.02$; (ii) $\pi^e = \pi_{-1}$. Use graphical analysis.

3. Consider a closed economy described by the following equations: market of goods and services: $q = k\left[\bar{A} - dr\right]$. Monetary policy: $r = \bar{r} + b\left[q - \bar{q}\right]$. Phillips curve: $\pi = \pi^e + \gamma\left[q - q_n\right]$.

a) Show that the IS curve can be described as $q = q_n - kd\left[r - r_n\right]$

b) Find out the expression of aggregate demand. Represent in a graph.

c) Describe the short-run equilibrium assuming that the central bank targets $\bar{q} > q_n$. Represent in a graph. Discuss the dynamic implications of the central bank policy.

4. Consider a closed economy described by the following equations: Consumption function: $C = 3 + 0.8(q - T)$; Investment function: $I = 30 - 125r$; Autonomous government spending and taxes: $G = T = 35$; Monetary policy: $i = \bar{i} + a[\pi - \bar{\pi}]$, where, $\bar{\pi} = 10\%$ and $a = 2$. The natural level of output, q_n, is equal to 125.

a) Show that the IS curve can be described as $q = 200 - 625r$. Find out the natural real interest rate r_n in this economy.

b) Find out the expression of the aggregate demand and describe the long run equilibrium in a graph.

c) Consider that in each period there is a fixed proportion $(1 - \sigma)$ of firms in this economy that are able to reset their prices according to $p_t = \bar{p}_t + \alpha(q_t - q_n)$, where σ is 0.8, α is 0.016, p is the price of the firm and $\bar{p}$ is the average price level in this economy, while the proportion σ of firms that cannot reset prices are tied to a previous expectation of the price level: $p_t^e = \bar{p}_{t-1} + \pi_t^e$ (prices are in logs). Show that the Phillips curve, which corresponds to our short-run aggregate supply, can be described as $\pi_t = \pi_t^e + 0.004[q - q_n]$.

d) Now, suppose that the central bank changes its inflation target to 3%. Describe the disinflation process towards the new long run equilibrium assuming adaptive expectations ($\pi^e = \pi_{t-1}$).