Candidate instructions

ECON4325 - Monetary Policy

This is some important information about the written exam in ECON4325. Please read this carefully before you start answering the exam.

Date of exam: Monday, May 27, 2019
Time for exam: 09.00 - 12.00 (3 hours)
The problem set: The problem set consists of 3 problems - with subquestions. They will count as indicated.

Sketches: You may use sketches on all problems. You are to use the sketching sheets handed to you. You can use more than one sketching sheet per problem. See instructions for filling out sketching sheets below. It is very important that you make sure to allocate time to fill in the headings (the code for each problem, candidate number, course code, date etc.) on the sheets that you will use to add to your answer. You will find the code for each problem under the problem text. You will NOT be given extra time to fill out the "general information" on the sketching.

Access: You will not have access to your exam right after submission. The reason is that the sketches with equations and graphs must be scanned in to your exam. You will get access to your exam within 2-3 days.

Resources allowed: No written or printed resources - or calculator - is allowed (except if you have been granted use of a dictionary from the Faculty of Social Sciences).
Grading: The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.
Grades are given: Monday, June 17.

Problem 1 (20%)

This part contains two short problems. You need to answer both to get full score.

1. The policy rate of the central bank (the reserve rate) affects market rates via the banking sector through three channels: the bank lending channel, the bank capital channel, and the deposit channel. Explain the mechanisms through which these channels affect the market rates.
2. What is forward guidance and what is the "forward guidance puzzle"? Use the following model to explain the "forward guidance puzzle":

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \kappa y_t$$
$$y_t = E_t\{y_{t+1}\} - \tfrac{1}{\sigma}(i_t - E_t\{\pi_{t+1}\}).$$

Hint: Solve the model forward.

Fill in your answer here and/or on sketching paper

Maximum marks: 20

Attaching sketches to this question?
Use the following code:

X X X X X X X

2 # Problem 2 (30 %)

In this problem, we are going to solve the firm problem with sticky prices. The firm problem is:

$\max_{P_t^*,\{N_{t+k},Y_{t+k}\}_{k=0}^{\infty}} E_t \sum_{k=0}^{\infty}(\beta\theta)^k \left\{ \frac{U_{c,t+k}}{U_{c,t}} \frac{P_t}{P_{t+k}} \left(P_t^*(i) Y_{t+k|t}(i) - W_{t+k} N_{t+k|t}(i) \right) \right\}$

subject to

$Y_{t+k}(i) = N_{t+k}(i)^{1-\alpha}$

$Y_{t+k|t}(i) = \left(\frac{P_t^*(i)}{P_{t+k}} \right)^{-\epsilon} Y_{t+k}$

where θ is the probability that the firm cannot change the price in a period, β is the discount factor, P_t^* is the optimal price in period t, $U_{c,t+k}$ is the marginal utility of consumption in period $t+k$, W is the aggregate nominal wage, N is hours worked, Y is output, P is the price, α governs the curvature of the production function, and the notation $\cdot_{t+k|t}$ refers to the value of that variable in period $t+k$ for a firm that last reset its price in period t.

1. The current period version of the demand for goods is $Y_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\epsilon} Y_t \qquad \textbf{(DEMAND)}$

Interpret equation (DEMAND).

2. Log-linearize equation (DEMAND).

3. The Lagrangian for the firm problem is

$$L_t = E_t \sum_{k=0}^{\infty} (\beta\theta)^k \frac{U_{c,t+k}}{U_{c,t}} \frac{P_t}{P_{t+k}} \Big[P_t^*(i) Y_{t+k|t}(i) - W_{t+k} N_{t+k|t}(i) - \zeta_{t+k|t}(i) \left(Y_{t+k|t}(i) - \left(\frac{P_t^*(i)}{P_{t+k}} \right)^{-\epsilon} Y_{t+k} \right) - \Psi_{t+k|t}(i) \left(Y_{t+k|t}(i) - N_{t+k|t}(i)^{1-\alpha} \right) \Big]$$

Find the first order conditions with respect to hours $N_t(i)$ and output $Y_t(i)$ and solve them for $\Psi_t(i)$ and $\zeta_t(i)$, respectively. What is $\Psi_t(i)$? What is $\zeta_t(i)$?

4. One can combine the first order condition with respect to $P_t(i)$ with the two first order conditions we have found in (3) to get the following price setting equation:

$$\sum_{k=0}^{\infty} \underbrace{\theta^k}_{i} E_t \Bigg\{ \underbrace{\beta^k \frac{U_{c,t+k}}{U_{c,t}} \frac{P_t}{P_{t+k}} Y_{t+k|t}(i)}_{ii} \underbrace{\left[P_t^*(i) - \frac{\epsilon}{\epsilon - 1} \Psi_{t+k|t}(i) \right]}_{iii} \Bigg\} = 0$$

Interpret this price setting equation. The answer should explain the intuition for why each of the three terms (i, ii, and iii) are in the optimal price setting equation.

Fill in your answer here and/or on sketching paper

Maximum marks: 30

Attaching sketches to this question?
Use the following code:

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3 # Problem 3 (50%)

We are going to use the New Keynesian model to see how the economy responds to a discount rate shock under an interest rate rule. We assume that the model is

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \kappa \tilde{y}_t \qquad \text{(PC)}$$
$$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - \tfrac{1}{\sigma}(i_t - E_t\{\pi_{t+1}\}) + z_t \qquad \text{(DIS)}$$
$$i_t = \phi_\pi \pi_t + \phi_y \tilde{y}_t \qquad \text{(TR)}$$
$$z_t = \rho_z z_{t-1} + u_t^z$$
$$u_t^z \sim N(0, \sigma_z)$$
$$\kappa = \left(\sigma + \tfrac{\phi+\alpha}{1-\alpha}\right)\left(\tfrac{1-\theta}{\theta}\right)(1-\beta\theta)\left(\tfrac{1-\alpha}{1-\alpha+\alpha\epsilon}\right)$$

1. By inserting (TR) into (DIS), we get

$$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - \tfrac{1}{\sigma}(\phi_\pi \pi_t + \phi_y \tilde{y}_t - E_t\{\pi_{t+1}\}) + z_t \qquad \text{(DIS-TR)}$$

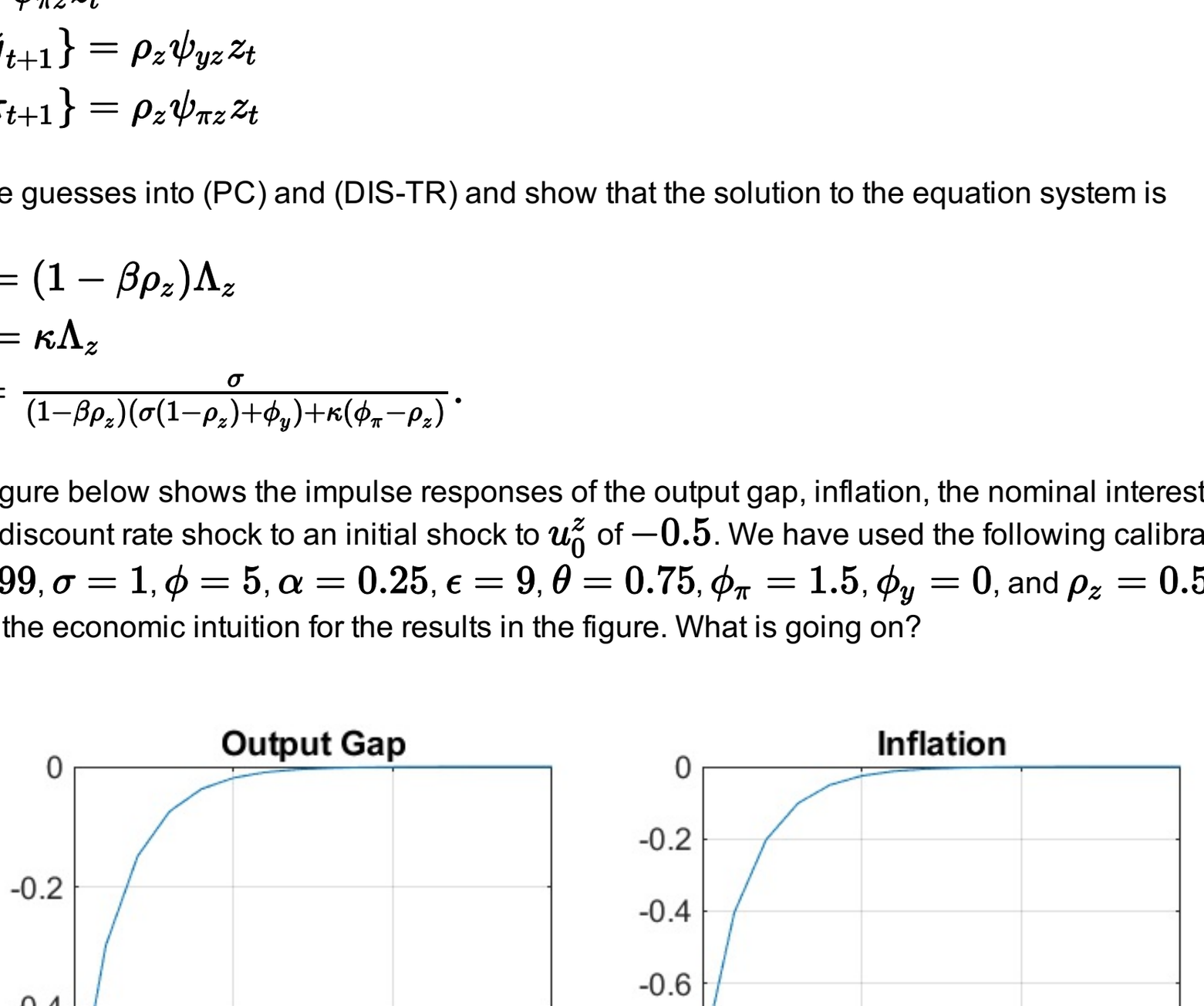
Guess that

$$\tilde{y}_t = \psi_{yz} z_t$$
$$\pi_t = \psi_{\pi z} z_t$$
$$E_t\{\tilde{y}_{t+1}\} = \rho_z \psi_{yz} z_t$$
$$E_t\{\pi_{t+1}\} = \rho_z \psi_{\pi z} z_t$$

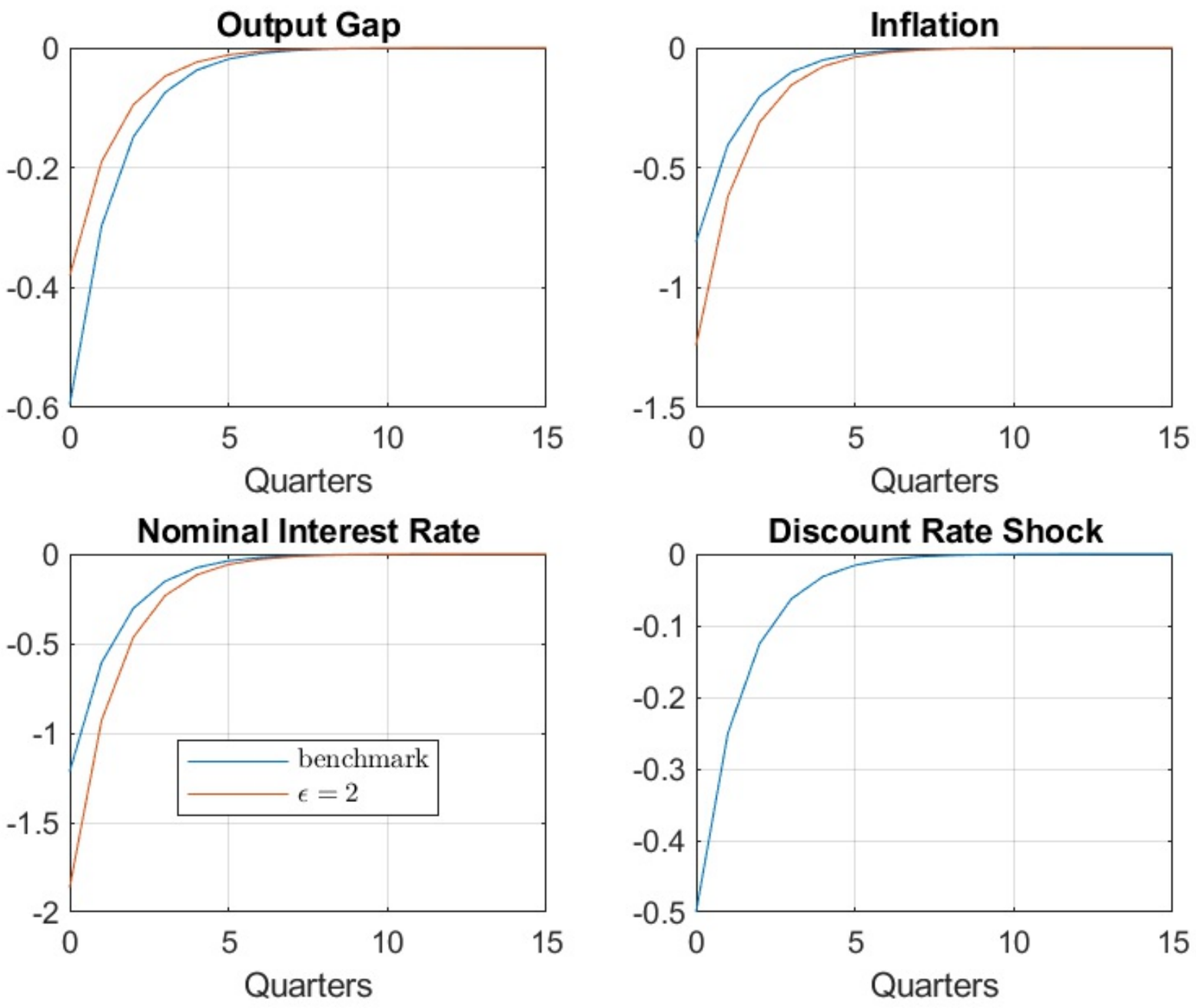
Insert the guesses into (PC) and (DIS-TR) and show that the solution to the equation system is

$$\psi_{yz} = (1 - \beta\rho_z)\Lambda_z$$
$$\psi_{\pi z} = \kappa \Lambda_z$$
$$\Lambda_z = \frac{\sigma}{(1-\beta\rho_z)(\sigma(1-\rho_z)+\phi_y)+\kappa(\phi_\pi-\rho_z)}.$$

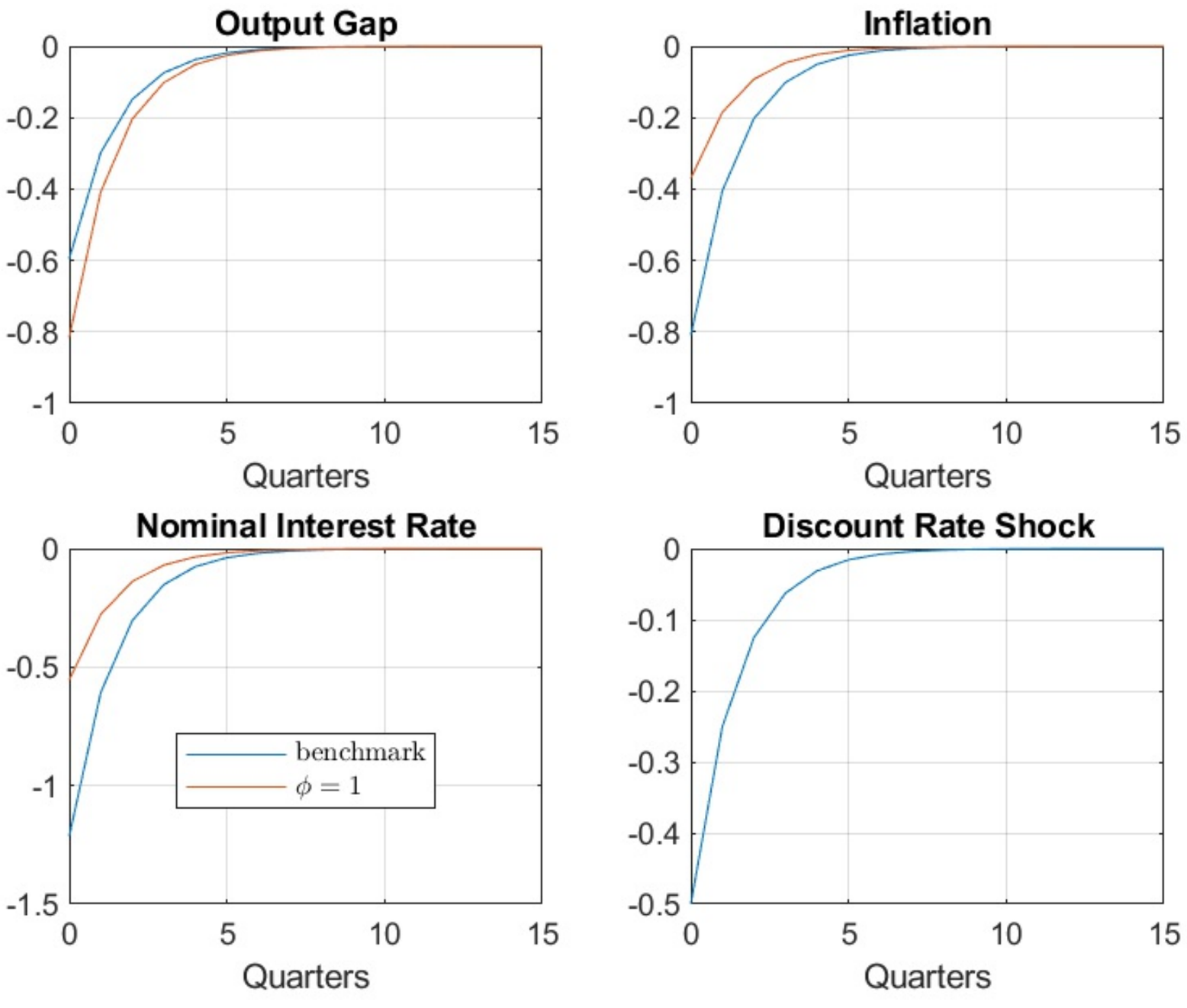
2. The figure below shows the impulse responses of the output gap, inflation, the nominal interest rate, and the discount rate shock to an initial shock to u_0^z of -0.5. We have used the following calibration: $\beta = 0.99, \sigma = 1, \phi = 5, \alpha = 0.25, \epsilon = 9, \theta = 0.75, \phi_\pi = 1.5, \phi_y = 0$, and $\rho_z = 0.5$. Provide the economic intuition for the results in the figure. What is going on?



3. We now change the calibration by reducing ϵ from 9 to 2. All other parameters are the same as in problem 2. The figure below presents the impulse responses in the benchmark scenario and in the new calibration. Explain what ϵ is and why it affects all the impulse responses to the discount rate in the way presented in the figure below.



4. We now change the calibration by reducing ϕ from 5 to 1. All other parameters are the same as in problem 2. The figure below presents the impulse responses in the benchmark scenario and in the new calibration. Explain what ϕ is and why it affects all the impulse responses to the discount rate in the way presented in the figure below.



5. We are now going to solve for the optimal simple rule of the form:

$$\tilde{y}_t = \omega z_t \qquad (\text{SR})$$

Assume that the central bank minimizes the following loss function

$$L = \tfrac{1}{2}\mathbb{E}_t \sum_{k=0}^{\infty} \beta^k (\lambda \tilde{y}_{t+k}^2 + \pi_{t+k}^2) \qquad (\text{LOSS})$$

where $\lambda > 0$. Minimize equation (LOSS) subject to the Phillips curve (PC) under the simple rule (SR). What is the optimal simple rule? How can one implement this optimal simple rule with an interest rate rule of the form $i_t = \omega_i z_t$?

Fill in your answer here and/or on sketching paper

Maximum marks: 50

Attaching sketches to this question?
Use the following code:

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