1. **Equilibrium in the New-Keynesian model of monetary policy**

In class we derived the equations that define the equilibrium path of output, Y_t, hours, L_t, the real wage, W_t/P_t, inflation, π_t, the nominal interest rate, i_t, and the real interest rate, r_t. We consider these equations here with the addition of three shocks. The IS curve, derived from the household's savings decision reads

$$\ln Y_{t+1} = \frac{\ln \beta}{\theta} + \frac{1}{\theta} r_t + \ln Y_t - \ln D_t.$$

Here, D_t, is a demand shock. When it is positive the household will be more eager to substitute consumption towards the present and thus demand will go up. The upward-sloping AS-curve is generated by the New-Keynesian Phillips Curve

$$\pi_t = \left[\frac{\eta}{(\eta - 1)} \frac{W_t}{P_t} - 1 \right] \frac{\eta - 1}{\xi} Y_t + \frac{1}{1 + r_t} \pi_{t+1}.$$

The Monetary Policy Rule reads

$$i_t = \bar{i} + \gamma_\pi \pi_t + \gamma_y \left(\ln Y_t - \ln \overline{Y} \right) + \mu_t.$$

Here μ_t is the monetary policy shock. It reflects an unexpected deviation of the central bank from the policy rule to which it has credibly committed. The labor supply decision yields

$$\ln L_t = -\frac{\ln B}{\gamma - 1} + \frac{\theta}{\gamma - 1} \ln Y_t + \frac{1}{\gamma - 1} \ln \left(\frac{W_t}{P_t} \right),$$

while the Fisher identity links the real interest rate to the nominal interest rate and expected inflation.

$$i_t = r_t + \pi_{t+1}.$$

Finally, the production function reflects the technology with which output is produced. We assume a linear technology of the form

$$\ln Y_t = \ln L_t + \ln Z_t,$$

where $\ln Z_t$ reflects the shock to productivity. Here, the natural rate of interest and the natural rate of output are respectively given by

$$\bar{i} = \left(\frac{1}{\beta} - 1 \right) \approx -\ln \beta \text{ and } \overline{Y} = \left(\frac{\eta - 1}{\eta B} \right)^{\frac{1}{\theta + \gamma - 1}}.$$

Each of the shocks follows an AR(1) process as defined in class. In this problem, we will analyze the properties of this equilibrium. Both analytically as well as using the computer to approximate the dynamic equilibrium path of the variables.

(a) What is the name of the parameter β? What does it represent? Why is the steady-state nominal interest rate rate declining in β?

(b) What is the Frisch elasticity of the labor supply in this model? What does is its interpretation?

(c) Show that if prices are flexible, the equilibrium level of output equals

$$Y_t = \overline{Y} Z_t^{\frac{\gamma - 1}{\theta + \gamma - 1}}$$

(d) What happens to the slope of the IS curve in this model when the intertemporal elasticity goes to zero? How does that affect the monetary transmission mechanism (the way the montery policy rule affects output in this economy)?

Scoring: (a) 4, (b) 4, (c) 4, (d) 8.

Table 1: Parameters and shock differences across cases

	A	B	C	D
ξ	5	5	0.5	0.5
$\ln Z_0$	-1%	0	-1%	10
$\ln D_0$	0	-1%	0	1%

2. **Impulse response logikwiz**

In this problem we consider four particular cases for parameters and shocks for the model of the previous question. For all four cases θ, β, γ, B, η, γ_π, γ_y, μ_0 and the persistence parameters of the shocks are the same. The differences in parameters and initial shocks across these cases are listed in Table 1. The figure plots four impulse responses of output as well as of inflation. They are labeled I through IV in the panels of the figure. Each of these roman-numeral responses corresponds to one of the cases in Table 1. It is your job to figure out which responds to which. Explain the reason why the impulse responses are shaped the way they are.

(a) Fill in Table 2 with zeros and pluses. For each element either use an argument or derive it through deduction based on other elements derived in the table.

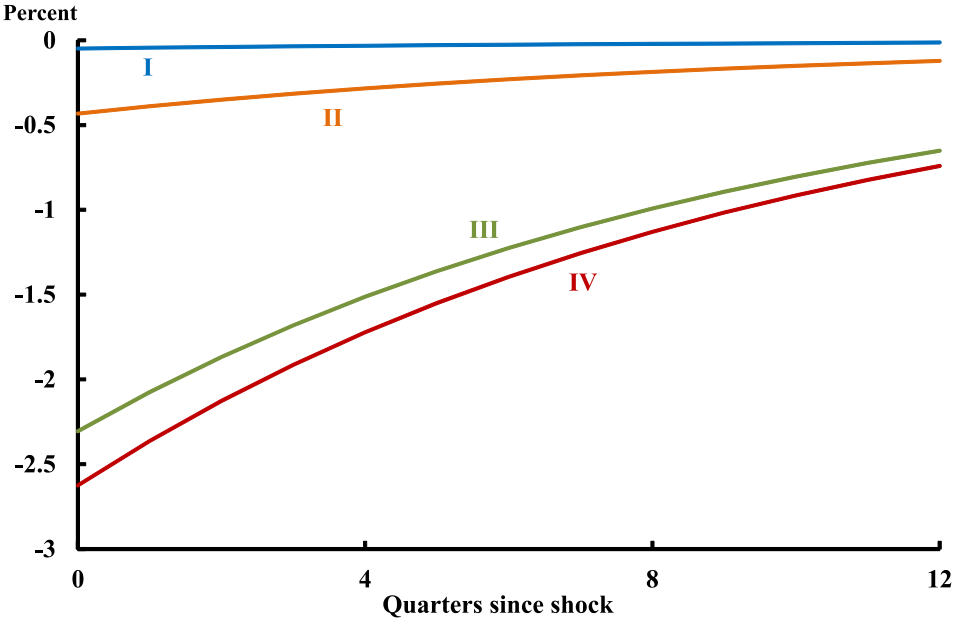
Table 2: Parameters and shock differences across cases

	A	B	C	D
I				
II				
III				
IV				

Scoring: one right: 6 pts, two right: 13 pts, all right 20 pts.

Impulse response of output

Output deviations measured in percent annualized rate



Impulse response of inflation

Annualized inflation (steady-state value is 0)