

MACROECONOMICS II 2025
PROBLEM SET 2
DUE BEFORE TUESDAY APRIL 22

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Instructions: Write up answers neatly using a LaTeX editor (or similar program). Hand in answers (in pdf form) and any code used for computations in a zipped folder named using the convention `macro_ps2_your_firstnames.zip`. You may work in groups of up to 3 students. It is enough for one group member to hand in the problem set. Make sure that *all* names and NetIDs of the group members are listed on the front page. Grades are Pass or Fail. If Fail, you can hand in again one week after deadline for half credit (if Pass at second attempt).

Consider the basic New Keynesian Model with only technology shocks.

New Keynesian Phillips Curve

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \kappa \tilde{y}_t \quad (0.1)$$

Dynamic IS Equation

$$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - \frac{1}{\sigma}(i_t - E_t\{\pi_{t+1}\} - r_t^n) \quad (0.2)$$

where $r_t^n = \rho - \sigma(1 - \rho_a)\psi_{ya}a_t + (1 - \rho_z)z_t$.

Interest rate rule

$$i_t = \rho + \phi_\pi \pi_t + \phi_y \tilde{y}_t \quad (0.3)$$

Exogenous process for log productivity and demand shocks

$$a_t = \rho_a a_{t-1} + \varepsilon_t^a : \varepsilon_t^a \sim N(0, \sigma_a^2) \quad (0.4)$$

$$z_t = \rho_z z_{t-1} + \varepsilon_t^z : \varepsilon_t^z \sim N(0, \sigma_z^2) \quad (0.5)$$

- (1) Solve the model using the method of undetermined coefficients while assuming that there is a production subsidy in place such that the steady state is efficient.
- (2) Simulate 100 periods of the model using Matlab (or your computer language of choice) and the parametrization

σ	φ	ε	α	β	θ	ϕ_π	ϕ_y	ρ_a	σ_a^2	ρ_z	σ_z^2
2	3	5	0.3	0.99	0.75	1.5	0.5	0.8	1	0.5	1

Plot the time series of output, inflation, the real wage and the nominal interest rate.

- (3) For the simulated path of the aggregate economy from (2), consider following a single firm (e.g. firm j) throughout the sample.
 - (a) Plot the simulated path of $p_t(j)$. How many times did firm j change its price? What is the average price duration of the simulated price of firm j ? Compare to the value of θ .
 - (b) Plot the relative price of good j and the aggregate price level.
 - (c) Plot the output of good j relative to aggregate output.

- (d) Plot the marginal cost of firm j relative to aggregate marginal cost.
What do you conclude about the relationship between the price, output and marginal cost?

- (4) Redo Step 2 and 3 for
- (a) $\varepsilon = 10$ (all other parameters as in the table above) and compare the variances of the computed objects with this parametrization vs the original. What do you conclude?
 - (b) $\alpha = 0$ (all other parameters as in the table above) and compare the variances of the computed objects with this parametrization vs the original. What do you conclude?
 - (c) $\phi_\pi = 10$ and $\phi_y = 0$ (all other parameters as in the table above) and compare the variances of the computed objects with this parametrization vs the original. What do you conclude?
- (5) What would the price path be for a firm that, unlike all the other firms in the economy, could change the price of its good in every period? Is it the same price all firms would charge if prices were perfectly flexible? Why or why not?