

### Econ 7007 2019 Qualifier questions:

There are three questions to answer. Questions are equally weighted.

#### PART I: Answer the following question

1. Consider an economy with monopolistic competition in the product market. Let  $i$  be the continuous index of firms/commodities in the  $(0,1)$  interval. Firm  $i$  produces commodity  $i$  with the production function:

$$Q_{i,t} = L_{i,t}.$$

$Q_{i,t}$ : Quantity of good  $i$ ;  $L_i$ : Labor input.

Firm  $i$  faces the demand function:

$$Y_{i,t} = Y_t \left( \frac{P_{i,t}}{P_t} \right)^{-\eta}, \quad \eta > 1.$$

$Y_{i,t}$ : the demand for good  $i$ ;  $Y_t$ : aggregate demand;  $P_t$ : average price level;  $P_{i,t}$ : price of good  $i$ .

Households are indexed continuously by  $j$ , also in the  $(0,1)$  interval. They are monopolistically competitive suppliers of labor (i.e. each household's labor is specialized but they are close substitutes). Demand for each household's labor is:

$$L_{j,t}^d = L_t^d \left( \frac{W_{j,t}}{W_t} \right)^{-\theta}, \quad \theta > 1.$$

$L_{j,t}^d$ : the demand for labor of household  $j$ ;  $L_t^d$ : aggregate demand for labor;  $W_t$ : average wage level;  $W_{j,t}$ : wage paid to household  $j$ .

Household  $j$  maximizes the utility function:

$$U(C_{j,t}, L_{j,t}) = C_{j,t} - \frac{1}{2} L_{j,t}^2.$$

$C_{j,t}$ : Consumption of household  $j$ .

All output is domestically consumed; there is no investment, government, or international trade. We are assuming, as usual, symmetric equilibrium.

- a. Find the optimal nominal price  $P_t^*$  and show that  $p_t^* (\equiv \ln P_t^*)$  takes the form:  $p_t^* = k_0 + w_t$ , where  $w_t \equiv \ln W_t$  and  $k_0 (> 0)$  is a constant. Explain your result intuitively.
- b. Show that the optimal nominal wage  $W_t^*$  takes the form:  $W_t^*/P_t = \left( \frac{\theta}{1-\theta} \right) L_t^d$ . Explain your result intuitively. Show that this result is equivalent to (in log):  $w_t^* - p_t = k_1 + y_t$ , where  $y_t \equiv \ln Y_t$  and  $k_1 \equiv \ln \frac{\theta}{1-\theta}$ .
- c. Suppose nominal wages and prices are perfectly flexible. Show that the imperfectly competitive (log) equilibrium level of output is  $y_t^{ICE} = -k_0 - k_1$ . Compare the imperfectly competitive equilibrium output level with the perfectly competitive equilibrium output level  $y_t^{CE}$ . Explain these results intuitively.
- d. Suppose that nominal prices are perfectly flexible, but nominal wages are partially rigid. Specifically, in each period only a proportion of households are free to set the

- nominal wage at the optimal level  $w_t^*$ . show that the optimal wage relative to the average wage (in log) is:  $w_t^* - w_t = y_t - y_t^{ICE}$ . Explain this result intuitively.
- e. Suppose that a fraction  $\varphi$  of households are free to set the nominal wage at the optimal level  $w_t^*$ . Remaining households follow the indexation rule:  $w_{j,t} = w_{j,t-1} + \pi_{t-1}^w$  where  $\pi^w$  is nominal wage inflation. Interpret the indexation rule. Then show that wage inflation evolves as follows:  $\pi_t^w = \pi_{t-1}^w + \left(\frac{1-\varphi}{\varphi}\right)(y_t - y_t^{ICE})$ . Explain this result intuitively. Discuss what this relationship tells you about the supply side of the economy?

**PART II: Answer two of the following questions:**

2. The arc of the natural rate theory extends from Friedman (1968) to the new-Keynesian DSGE models. Write an essay discussing how the theory changed and/or remained the same over the 50 years.
3. There exist a variety of theories about involuntary unemployment. Write an essay that responds to the following questions:
- Present two distinct examples of theories that rely on nominal rigidities to explain involuntary unemployment and discuss how real wage responds to business cycles according to each theory.
  - Present two distinct examples of theories that rely on real rigidities to explain involuntary unemployment and discuss how real wage responds to business cycles according to each theory.
4. “Elastic labor supply interacts with countercyclical markups so that they reinforce each other. A model with both features has a government purchases multiplier of 0.98. Without the elastic labor supply, the multiplier drops to 0.40, and without the countercyclical markup, it drops to 0.60. Both features are needed to get the kind of amplification that seems to exist in the U.S. economy.” Explain rigorously the theory behind this statement.