

Problem Set 8  
Due in lecture, Thursday, November 29

1. (The investment problem of a monopolist.) Consider the q-theory model. Suppose, however, that the industry consists of a single firm rather than many firms. Specifically, suppose the firm's profits at time  $t$ , instead of being  $\pi(K(t))\kappa(t)$  (where  $K$  is the aggregate capital stock and  $\kappa$  is the firm's capital stock), are equal to  $\pi(\kappa(t))\kappa(t)$  (where  $\kappa$  is the firm's capital stock).

In addition, the firm is a monopsonist in the investment market: the price of investment goods, rather than always being equal to 1, is given by  $P(I)$ , with  $P'(I) > 0$  and  $P(0) = 1$ .

The firm's objective function is therefore:

$$\int_{t=0}^{\infty} e^{-rt} [\pi(\kappa(t))\kappa(t) - P(I(t))I(t) - C(I(t))] dt.$$

The firm takes  $\kappa(0)$  as given. As usual,  $\dot{\kappa}(t) = I(t)$  for all  $t$ .

- What is the present value Hamiltonian?
- Find the conditions that characterize the solution to the firm's maximization problem.

2. Consider the model of investment with kinked adjustment costs. Let  $c^+ > 0$  denote the adjustment cost for the first unit of positive investment, and  $c^- > 0$  denote the adjustment cost for the first unit of negative investment. Define  $K_1$  by  $\pi(K_1)/r = 1 + c^+$ , and define  $K_2$  by  $\pi(K_2)/r = 1 + c^-$ .

Initially, the economy is in steady state with  $q = 1 + c^+$  and  $K = K_1$ . At time 0, there is news: from date  $t_1$  to date  $t_2$  (where  $t_2 > t_1 > 0$ ), there will be an investment subsidy that has the effect that the purchase price of investment goods over that period will be  $1 - s$  rather than 1. Assume  $0 < s < c^+ + c^-$ .

Sketch the resulting paths of  $q$  and  $K$  over time. Explain your answer.

3. Romer, Problem 9.13.

4. If the expected return on Asset A exceeds the expected return on Asset B:

- Financial markets cannot be in equilibrium.
- Financial markets can be in equilibrium, but only if there are noise traders.
- A rational investor would choose to hold Asset B only if the covariance of Asset B's return with the marginal utility of consumption is greater than the covariance of Asset A's return with the marginal utility of consumption.
- A rational investor would choose to hold Asset B only if the covariance of Asset B's return with the marginal utility of consumption is less than the covariance of Asset A's return with the marginal utility of consumption.

EXTRA PROBLEMS (NOT TO BE HANDED IN/ONLY SKETCHES OF ANSWERS WILL BE PROVIDED)

5. Consider the q-theory model where  $K$  is converging to its long-run equilibrium level from below. Over time,  $K$  is rising, and:

- A.  $q$  is falling, and investment is positive but falling.
- B.  $q$  is falling, and investment is positive but can be sometimes rising and sometimes falling.
- C.  $q$  is falling, and investment can be sometimes positive and sometimes negative.
- D.  $q$  can be sometimes rising and sometimes falling.

6. Romer, Problem 9.12.

7. Romer, Problem 9.14.

8. If the manager of a hedge fund believes that an asset's price exceeds its fundamental value, he or she may be reluctant to sell large amounts of the asset short because:

- A. There is some chance that the asset's fundamentals may improve.
- B. The misvaluation of the asset may increase in the short run.
- C. If the investment strategy is unprofitable in the short run, the hedge fund may face withdrawals that would force it to liquidate its position at a loss.
- D. (A) and (B).
- E. (A) and (C).
- F. (B) and (C).
- G. All of the above.
- H. None of the above.