University of Toronto

Department of Economics

ECO 2061H

Economic Theory - Macroeconomics (MA)

Winter 2012

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Assignment 3

Due: Thursday, April 5, 2012 (9:00a.m. in class)

1. Consider the Lucas imperfect information model. There are many different segmented markets (islands) in the economy. Each market produces a different good, and each is perfectly competitive. All variables are expressed in logarithmic form. Let the nominal price in market i be p_i. Denote the aggregate price level (average of market basket of goods) as p. A typical producer i produces output according to a linear production function $q_i = \ell_i$, where q_i is the amount of output produced, and ℓ_i is the amount of labor supplied. From the individual producer's maximization problem, you can show that the supply of labor in market i is $\ell_i = \frac{1}{\gamma - 1}(p_i - p)$ with $\gamma > 1$. Assume that the demand for good i is given by $q_i = y + z_i - \eta(p_i - p)$, with $\eta > 0$. y is aggregate output in the economy (average across all goods), and z_i's are relative demand shocks with a mean of zero. Aggregate demand in the model is assumed to be equal to $y = m - p$, where m is a monetary shock. Assume that m and z_i's are normally distributed, but independent: $m \sim N(E(m), V_m)$ and $z_i \sim N(0, V_z)$. The individual observes his price p_i but cannot distinguish the source of the variation in this price (aggregate price level, p, or relative price, r_i). In order for the individual supplier to make his production decision he has to form an estimate of relative price r_i given the "signal" he receives p_i, i.e. calculate $E(r_i \mid p_i)$. Assume that the individual producer: (i) exhibits certainty-equivalence behavior, (ii) has rational expectations.

   (a) Assume that suppliers, before entering the market, have a prior distribution for p that is normal: $p \sim N(E(p), V_p)$. Then they observe the "signal" p_i, and update their expectation for p according to $E(p \mid p_i) = (1 - \theta) E(p) + \theta p_i$, where $\theta = \frac{V_p}{V_p + V_r}$, with V_r being the variance of the relative price r_i. Derive the individual producer's supply curve in terms of $p_i - E(p)$. Show that the *Lucas aggregate supply* function is of the form $y = b(p - E(p))$.

(b) Using the aggregate demand equation and the Lucas aggregate supply equation find expressions for p and y in terms anticipated and unanticipated money, i.e., $E(m)$ and $m - E(m)$ respectively. What is the economic interpretation of these equations?

(c) Evaluate the following statement (true, false, uncertain) in the context of the above model: "Since unanticipated money growth raises both inflation and output, the government should inflate to raise output."

2. Consider the Kydland and Prescott (1977) model on the time inconsistency of low inflation monetary policy. Aggregate supply is given by,

$$y = \bar{y} + b(\pi - \pi^e), \quad b > 0$$

where y is the log of output, and $\bar{y}$ is its flexible price level. Note, that this can be different from the socially optimal level, y^*. π is the economy's inflation rate, while π^e is the inflation rate that the public expects to prevail. The policymaker chooses inflation to minimize a social welfare loss function, L, which depends on deviations of inflation and output from their socially optimal levels,

$$L = \frac{1}{2}(y - y^*)^2 + \frac{1}{2}a(\pi - \pi^*)^2, \quad a > 0, \quad \bar{y} > y^*$$

(a) What are the equilibrium levels of output and inflation if the policymaker can commit to a policy, before the public forms its expectations?

(b) What are the equilibrium levels of output and inflation if the policymaker has discretion, i.e., chooses policy taking expectations as given?