Final Exam

Directions: Answer all questions - they are weighted equally. Remember, to receive full credit you must provide complete explanations for your answers. Relax and Good Luck.

1. Consider the following simple structural macroeconomic model:

   \[
   \begin{align*}
   \text{consumption} & : \quad c = a + b(y - t) \\
   \text{investment} & : \quad i = i_0 - dr \\
   \text{money demand} & : \quad m^d = ey - fr \\
   \text{government} & : \quad g = g_0 \\
   \text{taxes} & : \quad t = t_0 \\
   \text{money supply} & : \quad m^s = m_0 \\
   \text{goods market eq} & : \quad y = c + i + g \\
   \text{money market eq} & : \quad m^s = m^d
   \end{align*}
   \]

The terms \(a, b, d, e, f\) are positive coefficients while the following are exogenous \((t_0, g_0, m_0, i_0)\). Represent the model in reduced form.

**ANSWER:** Solving yields

\[
\begin{align*}
   y &= \frac{f}{f(1-b) + de} \left[ a - bt_0 + i_0 - \frac{d}{f}m_0 + g_0 \right] \\
   r &= \frac{e}{f(1-b) + de} \left[ a - bt_0 + i_0 - \frac{d}{f}m_0 + g_0 \right] - \frac{1}{f}m_0
\end{align*}
\]

2. Within the context of the Lucas Imperfect Information model, answer the following

   (a) It was assumed that agents in the model formed expectations rationally. This implied that they knew that the aggregate price level, \(p\), was distributed normally with mean of \(\mu_p\) and variance of \(\sigma_p^2\) while the relative price of good \(i\), \(r_i\), was distributed normally with mean of 0 and variance of \(\sigma_i^2\). Furthermore, it was known that \(p\) and \(r_i\) were independently distributed. What did this imply for the distribution of the price of good \(i\), \(p_i\)?

**ANSWER:** Since \(p_i = p + r_i\), this implies \(p_i \sim N(\mu_p, \sigma_p^2 + \sigma_i^2)\)
(b) Explain what factors determine the slope of the aggregate supply curve.

**ANSWER:** The slope is determined by the signal extraction problem - i.e. determining the contribution of $r_i$ to a change in $p_i$. The relevant term is $\frac{\sigma_p}{\sigma_{p}^{2}+\sigma_{r}^{2}}$. Hence, the greater the variability of the $r_i$ relative to $p$, then movements in $p_i$ will be attributed to a relative price shock.

3. Blinder makes the following statement with regard to Poole’s analysis: “..it is hard to think of an aspect of monetary policy in which theory and practice have interacted more fruitfully.” Why does he make such a strong statement? Use graphs to support your answer.

**ANSWER:** Straight from the graphs in Poole’s article.

4. In the paper by Clarida, Gali, and Gertler, they show that the IS curve can be written in two ways:

$$x_t = -\phi \left[ i_t - E_t (\pi_{t+1}) \right] + E_t (x_{t+1}) + g_t = E_t \left[ \sum_{i=0}^{\infty} \left\{ -\phi \left[ i_{t+i} - E_t (\pi_{t+i+1}) \right] + g_{t+i} \right\} \right]$$

Show how term 1 implies term 2 and discuss the importance of this result.

**Answer:** Updating the expression in term 1 by one period and substituting into $x_{t+1}$ yields

$$x_t = -\phi \left[ i_t - E_t (\pi_{t+1}) \right] + E_t \left[ -\phi \left[ i_{t+1} - E_t (\pi_{t+2}) \right] + E_{t+1} (x_{t+2}) + g_{t+1} \right] + g_t$$

Repeating this leads to term 2. The importance is that, unlike the traditional Keynesian IS curve, today’s output is affected by the entire path of expected interest rates and demand shocks. This reflects the infinite horizon optimization problem that households’ are solving.

5. In his critique of economic policy analysis, Lucas derived the following demand curve for capital (i.e. investment) in a hypothetical industry:

$$k_t (1 - \delta) + i_t = \frac{1}{\lambda} E_t (a_{t+1}) - \frac{b}{\lambda^2} \left[ \frac{r_t}{1 - \theta_t} + \delta \right] + \frac{b}{\lambda^2} \left[ \psi_t (1 + r_t) - E_t (\psi_{t+1}) \left( \frac{1 - \delta}{1 - \theta_t} \right) \right]$$

where $r_t$ denotes the current one-period interest rate, $\theta_t$ is the current tax rate on profits, $\psi_t$ is the investment tax credit. Answer the following:
(a) Explain why the factors on the right-hand side of eq. (1) affect investment demand.

**ANSWER:** $a_t$ is the demand shock - this positively affects the demand for capital. $\left[ \frac{1}{1 - \delta} \right]$ represents the ‘rental rate of capital’ and negatively affects demand. Higher interest reduce the demand for investment since they lower the present value of future returns. A higher depreciation rate also lowers the demand for capital since it reduces the life of the asset. The last term reflect the expected change in the price of capital due to the investment tax credit - the price of capital is $(1 + \psi_t)$.

(b) What two properties were used to derive this investment demand function.

**ANSWER:** Optimizing behavior of firms (the FOC) and then equilibrium in the output market.

(c) Lucas criticized Hall and Jorgenson’s analysis of the 1962 tax credit - where did they go wrong?

**Answer:** they treated the change in the investment tax credit as permanent.

6. Estimates of the Taylor rule during the sample period 1960-1979 produce the following (ignoring constants) values:

$$R_t = 0.813 \left( \pi_t - \pi^* \right) + 0.252 \left( y_t - \bar{y}_t \right)$$

What is the implication of these estimates? In particular, do they help to explain the U.S. economic experience during this time?

**ANSWER:** The coefficient on inflation implies that increases in inflation lead to a lower real interest rate - this stimulates AD which raises inflation the process is repeated. It is consistent with the behavior of inflation in the ’70s.

7. One of the Federal Reserve’s mission assigned by the Congress is to guarantee price stability in the US. Referring to a discussion between the Chairman and Janet Yellen as reported by L. Meyer, explain how different members of the FOMC define price stability.

**ANSWER:** See the passage in Meyer’s book.