A1 (required) The Poole Model

Consider the following version of the Poole model for a closed economy:

(1) $y = y^* + a - br + u$ where $a, b > 0$ (IS)

(2) $m - p = cy - dr + v$ where $c, d > 0, p = 1$ (LM)

(3) $E(u) = E(v) = 0$

(4) $Var(u) = \sigma_u^2$ and $Var(uv) = \sigma_v^2$

(5) $Cov(u, v) = E(uv) = \sigma_{uv}$

where y = output, y^* = target level of output, r = interest rate, m = money supply, p = fixed price level. Note that the unobservable random shocks u and v in the goods and money markets are *not* independent here.

The policymaker can either fix:

a. the interest rate ($r = r^*$)

b. the money supply ($m = m^*$)

to minimize output deviations from the target level. Use mathematical analysis to explain how the presence of correlated IS and LM shocks affects the policymaker's choice of optimal policy instrument.

Also, discuss and explain this quote from Poole (Poole, William. 1988. "Monetary Policy Lessons of Recent Inflation and Disinflation." *Journal of Economic Perspectives*, 2 (3): 73-100):

> [T]his paper is devoted to the decline of M1 velocity after 1981 and the demise of the "standard" money demand function. Some authors conclude that this evidence leaves us so uncertain about the nature of money demand that policymakers cannot rely at all on any presumed money demand regularities. In contrast, my working hypothesis is that the money demand continues to be a stable function of relatively few variables, but that the interest elasticity of money demand is substantially higher than previously thought. Events have not been kind to Keynesian monetary policy positions either. Keynesians tend to concentrate on interest rates -- especially real interest rates -- as the best guide to the effects of monetary policy on the economy.

A2 (required): IS-LM and the Phillips Curve

Using "normal" IS-LM graphs, equations, *and words*, explain how/why the economy responds to (ceteris paribus) changes in the short run, while wages and prices are fixed.

A. You must create *three* intelligent changes that can be meaningfully analyzed using IS-LM *and analyze them.*

   For example, "Real money demand increases exogenously." **Yes, you are writing part of your own question.**

B. Now change your model to an IS-MP model – include a Phillips Curve – and reevaluate the changes you wrote for **Part A.**

C. Using equations, graphs, and words, explain IS-LM, the Phillips Curve, and Keynesian Economics in the context of the quote below (Whelan, Karl, 2015. "University College Dublin, Advanced Macroeconomics Notes" pg. 21 https://www.karlwhelan.com/Macro2/Notes1.pdf):

   > However, Milton Friedman's 1968 presidential address to the American Economic Association produced a well-timed and influential critique of the thinking underlying the Phillips curve. Friedman pointed out that it was expected real wages that affected wage bargaining. If low unemployment means workers have a strong bargaining position, then high nominal wage inflation on its own is not good enough: They want nominal wage inflation greater than price inflation.
>
> Friedman argued that if policy-makers tried to exploit an apparent Phillips curve tradeoff, then the public would get used to high inflation and come to expect it. Inflation expectations would move up and the previously-existing tradeoff between inflation and output would disappear. In particular, he put forward the idea that there was a "natural" rate of unemployment and that attempts to keep unemployment below this level could not work in the long run.

Section A: ANY 2 of 3

A3 (choice): Statements

Select *three of the four statements below* and explain carefully why each is true, false, or uncertain in all its parts. You must use graphical and/or mathematical analysis to support your arguments. Your score depends on the quality and completeness of your explanations.

a) In a closed economy, whether the Fisher effect is full or partial depends entirely on the degree of wage and price flexibility.

b) In a stochastic world, whether the optimal policy is a fixed rule or a feedback rule depends entirely on the nature of the uncertainty.

c) According to the Solow growth model, output per worker tends to be higher in countries with high saving rates, high skill ratios, high levels of technology, and high population growth rates, all else equal.

d) In the R&D growth model, a ceteris paribus increase in the share of labor employed in the R&D sector will permanently raise the growth rate of output per worker.

Part B: Answer Both Questions.

B1: Inefficiency of the Financial System in an Optimal Growth Model

Consider the model of an economy in competitive equilibrium, where there are inefficiencies in the financial markets. There is a representative household and a representative firm. The household's utility functional is

$$U \equiv \int_0^\infty u(c_t) e^{-(\rho - n)t} dt,$$

with

$$u(c_t) = \lim_{\theta \to 1} \frac{c_t^{1-\theta} - 1}{1 - \theta},$$

and $1 > \rho > n > 0$.

The representative firm has a production function $F[K_t, L_t] = K_t^{\alpha} {L_t}^{1-\alpha}$, with $0 < \alpha < 1$. Assume capital does not depreciate after production ($\delta = 0$).

The total assets that banks receive as deposits are $\mathcal{A}_t$, but there are inefficiencies in the financial system, so that assets do not transfer one-to-one into capital. Specifically, the total capital a bank creates becomes a fraction ϕ of total assets [hint: translate this sentence into math, and be very careful when you set up the equilibrium conditions of the financial system].

a) Write down representative household's maximization problem, solve it, and derive the equations that characterize the solution.

b) Write down firm's maximization problem and the first-order conditions for this problem. Translate these conditions into intensive form. Derive the equations that characterize the solution.

c) What are the equilibrium conditions for this economy? Be very careful here, and *carefully* explain your work.

d) Combine your answers to parts a) - c) and derive a pair of differential equations for the variables c and k. Can you draw a phase diagram? If yes, draw the phase diagram, carefully identifying (and deriving mathematically) all the important points, including all steady-states.

e) Do the following comparative dynamics exercise. Initially, the economy is with $\phi < 1$, and now technological innovations and government regulations remove the inefficiencies of the financial system ($\phi = 1$). Draw the phase diagram for both cases, indicating what is different, show the transition between steady-states (stable manifold, if there is one), and the time paths of the logs of c and k for both cases. *Carefully* discuss.

B2: Inefficiency of the Financial System in an OLG Model

Consider an economy consisting of an infinite sequence of two period lived, overlapping generations. N_t agents are born in period t, with the constant population growth rate $n > 0$.

Agents have the utility function

$$u(c_{1,t}, c_{2,t+1}) = \lim_{\theta \to 1} \left[\frac{c_{1,t}^{1-\theta} - 1}{1-\theta} + (1+\rho)^{-1} \frac{c_{2,t+1}^{1-\theta} - 1}{1-\theta} \right]$$

with $\rho > 0$.

In each period there is a single final good that is produced using a constant returns to scale technology with capital and labor as inputs. The representative firm has a production function $F[K_t, L_t] = K_t^{\alpha} {L_t}^{1-\alpha}$, with $0 < \alpha < 1$. Assume capital does not depreciate after production ($\delta = 0$).

The total assets that banks receive as deposits are $\mathcal{A}_t$, but there are inefficiencies in the financial system, so that assets do not transfer one-to-one into capital in the next period (K_{t+1}). Specifically, the total capital a bank creates becomes a fraction ϕ of total assets [hint: translate this sentence into math, and be very careful when you set up the equilibrium conditions of the financial system].

a) Write down the household's maximization problem and derive the equations that characterize the solution. Discuss.

b) Write down firm's maximization problem and the first-order conditions for this problem. Translate these conditions into intensive form.

c) What are the equilibrium conditions for this economy? Be very careful here, and *carefully* explain your work.

d) Combine your answers to parts a) - c) and derive a *Law of Motion* (*LoM*) equation that defines a difference equation for the variable k. Get rid of all prices. Looking at it, can we say anything about a steady-state solution? Can you graph the *LoM?* If yes, carefully identify (and derive mathematically) all the important points, including all steady-states.

e) Is the non-trivial steady-state in the Competitive Equilibrium (CE) Pareto Optimal (PO)? Carefully show and discuss why, or why not.

f) Do the following comparative dynamics exercise. Initially, the economy is with $\phi < 1$, and now technological innovations and government regulations remove the inefficiencies of the financial system ($\phi = 1$). Draw the *LoM* for both cases, indicating what is different, and the time paths of the logs of c and k for both cases. *Carefully* discuss and compare your findings to your results of question B1.