

PRELIMINARY EXAMINATION FOR THE PH.D. DEGREE

Answer all questions.

1. Consider the following limited participation monetary model. Firms hire labor (h_t) to produce output (y_t) using the linear production function:

$$y_t = \gamma h_t ; \gamma > 0$$

Output is sold at the nominal price of P_t per unit of output.

Firms pay labor in advance of production – they borrow the wage bill from financial intermediaries. Hence the cost of labor inputs is:

$$Cost = R_t W_t h_t$$

Where R_t denotes the (gross) nominal interest rate and W_t is the nominal wage. Financial intermediaries receive funds from two sources: Households make deposits (I_t) at the beginning of the period before the current state of the world is known and the current monetary transfer (which determines the current state) is received from the government. The financial intermediary inelastically provides the funds in the form of loans to businesses to finance their wage bill. That is, financial intermediaries make no profits by assumption:

$$I_t + g_t \bar{M}_{t-1} = W_t h_t$$

The income from the loans is distributed entirely to the households.

Households make deposit, consumption, and labor decisions in order to maximize lifetime expected utility. Preferences are given by:

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t [\ln c_t + A(1 - h_t)] \right\}$$

As mentioned above, before knowing the current realization of the monetary growth rate, they allocate part of their nominal wealth to the banking sector. Then, after observing g_t , they make consumption and labor decisions. It is assumed that the consumption is subject to a cash-in-advance constraint. This scenario implies the following budget and cash-in-advance constraints:

$$M_t = W_t h_t + M_{t-1} - I_t - P_t c_t + R_t (I_t + g_t \bar{M}_{t-1})$$
$$M_{t-1} + W_t h_t - I_t > P_t c_t$$

Note that, as implied by the discussion above, current labor income can be used to finance current consumption. The only source of uncertainty in the economy is due to the monetary growth rate; this random variable is assumed to be independently and identically distributed with $E(g_t) > 0$. Given this environment, do the following:

- a. Set up the firm's and household's maximization problem. Derive and interpret the associated necessary condition. In your answer, demonstrate how this model is distinguished from a typical cash-in-advance model
- b. Define a stationary monetary equilibrium in this economy.
- c. Demonstrate that the liquidity effect is present – i.e. that the correlation of interest rates and money growth is negative. Show that this implies that money growth is procyclical in the economy. Again, compare this result to a standard CIA model.

2. In the 1970's, much effort was spent on developing rational expectations models in which, even though prices were perfectly flexible, monetary policy influenced equilibrium. That is, money was not neutral. Examples of this literature are the models by Barro and Lucas. Currently, we see similar efforts, e.g. the papers by Christiano and Eichenbaum, to construct models in which money affects equilibrium even though agents make rational forecasts and prices are flexible. Yet there is a dramatic difference in the way that agents' forecasts of money influence activity in these two classes of models. Comment carefully on the change that has occurred, discuss why this evolution has taken place and offer an opinion on the merits of this development.

3. Consider a model of agency costs. Assume there are two types of agents, entrepreneurs and lenders, both risk neutral. Entrepreneurs have access to a stochastic technology that contemporaneously transforms i units of consumption goods into ωi units of capital, with i distributed *i.i.d.*, $i > 0$, $E(i) = 1$, with distribution Φ and density ϕ . ω is privately observed by entrepreneurs but can only be observed by lenders by incurring a monitoring cost μi capital units. The lending contract stipulates an interest rate r^k . Thus, an entrepreneur borrows $(i - n)$ and repays $(1 + r^k)(i - n)$. The entrepreneur defaults if $\omega < (1 + r^k)(i - n)/i \equiv \bar{\omega}$. The lender only monitors in case of default, in which case, he can confiscate all the returns on the project. The optimal contract is completely defined by the pair $(i, \bar{\omega})$ since the implied rate of interest can be found from the condition $(1 + r^k) \equiv \bar{\omega}i/(i - n)$.

- a. Calculate expected entrepreneurial income. *Hint:* notice that $i\bar{\omega} = (1 + r^k)(i - n)$ so that you can write income as a function of $i, \bar{\omega}$
- b. Calculate expected lender's income. Use the same hint as above.
- c. Design the optimal contract as the pair $(i, \bar{\omega})$ that maximizes entrepreneur's expected return subject to the lender being indifferent between lending or retaining funds. Give necessary conditions for the entrepreneur's participation.
- d. Derive the first order conditions.
- e. Carlstrom and Fuerst use this model of agency costs into a monetary business cycle model in order to study the *amplification* of monetary shocks due to the Bernanke, Gertler, and Gilchrist financial accelerator effect. Briefly comment on the results obtained by both approaches and comment on the sources for their difference.

4. Compare and contrast the Fuhrer-Moore, McCallum's P-bar, and Gali-Gertler's models of inflation dynamics, making special emphasis on their advantages/disadvantages in the context of the evaluation of optimal monetary policy rules and explaining the mechanisms that deliver persistence in the dynamics.