



AFRICAN ECONOMIC RESEARCH CONSORTIUM

Collaborative PhD Programme in Economics for Sub-Saharan Africa

COMPREHENSIVE EXAMINATIONS IN CORE AND ELECTIVE FIELDS

FEBRUARY 14 – MARCH 6, 2018

MACROECONOMICS

Time: 08:00 – 11:00 GMT

Date: Wednesday, February 14, 2018

INSTRUCTIONS:

Answer a total of FOUR questions: ONE question from Section A, ONE question from Section B, and TWO questions from Section C. The sections are weighted as indicated on the paper.

SECTION A: (15%)

Answer only ONE Question from this Section

Question 1

- (a) Use the open economy IS-LM model to contrast the predicted implications for the exchange rate in a country with a floating exchange rate and international capital flows of the following (derive your answers graphically):
- (i) Expansionary fiscal policy. **(5 marks)**
 - (ii) Expansionary monetary policy. **(5 marks)**
- (b) Use the uncovered interest parity condition to derive the “impossible trinity” for the monetary policy regime of a small open economy. **(5 marks)**

Question 2

Consider the world economy with two countries. The home country is characterized by:

$$C = c_0 + c_1 Y$$

$$I = c_2$$

$$X = \frac{d_1}{e}$$

$$\frac{M}{e} = d_2 Y$$



where $C, Y, \tilde{Y}, I, M, X, e$ denote aggregate consumption, domestic output, foreign output, imports, exports and real exchange rate, respectively. Assume $c_0, c_2 > 0$, $0 \leq c_1 \leq 1$, $0 \leq d_1 \leq 1$, $1 - c_1 + m > 0$, $0 \leq d_2 \leq 1$.

The foreign country is characterized by

$$\begin{aligned}\tilde{C} &= \tilde{c}_0 + \tilde{c}_1 \tilde{Y} \\ \tilde{I} &= \tilde{c}_2 \\ \frac{\tilde{M}}{\tilde{e}} &= \frac{d_2 \tilde{Y}}{e} \\ \frac{M}{e} &= d_2 Y\end{aligned}$$

Assume that parameters in the foreign economy satisfy assumptions analogous to the ones for the domestic economy. Further, assume throughout that the real exchange rate (e) is exogenously given.

- Find the equilibrium level of output in the domestic goods market as a function of e , G , $\tilde{Y}$ and parameters. Find the multiplier. Find the equilibrium in foreign goods market as a function of $\tilde{e}$, $\tilde{G}$, Y and parameters. **(7 marks)**
- How do net exports depend on the real exchange rate in this model? **(5 marks)**
- State a condition relating e and $\tilde{e}$. **(3 marks)**

SECTION B: (25%)

Answer only ONE Question from this Section

Question 3

In line with the Solow growth model, use the following information:

$$\begin{aligned}k_t &= \frac{K_t}{A_t L_t}, \quad L_t = L_0 e^{nt} \\ y_t &= k_t^\alpha, \quad A_t = A_0 e^{gt}, \quad \dot{K}_t = sY_t - \delta K_t\end{aligned}$$

where s is the saving rate allocated towards physical capital accumulation.

- Derive the law of motion of capital per effective worker. **(8 marks)**
- Determine the balanced growth path level of capital per effective worker. **(5 marks)**
- Briefly explain what break-even investment or required investment means. **(5 marks)**
- Outline any two key predictions of the Solow growth model. **(7 marks)**



Question 4

Consider the following model:

$$\text{Profits: } \Pi = F[e(w)L] - wL, \quad F'(\cdot) > 0, \quad F''(\cdot) < 0$$

$$\text{Effort function: } e = \begin{cases} \left(\frac{w-x}{x}\right)^\beta & \text{if } w > x \\ 0 & \text{otherwise} \end{cases}$$

$$x = (1 - bu)w_a,$$

where $F(\cdot)$ is the firm's production function. There are N identical competitive firms seeking profit maximization, w is the real wage that the firm pays, w_a is the wage paid by other firms in the economy, L represents the number of workers the firm hires, e denotes workers' efforts, x is an index of labour market conditions, $0 < \beta < 1$ and $b > 0$, and the variable u stands for the unemployment rate.

- Derive the first-order conditions for profit maximization by the representative firm and explain the economic intuition. **(5 marks)**
- Give a graphical representation of the result in (i) above. **(5 marks)**
- Derive the equilibrium unemployment rate. **(5 marks)**
- Derive the equilibrium effort (e^*) and the equilibrium wage rate (w^*). **(5 marks)**
- Give two reasons why firms pay efficiency wage. **(5 marks)**

SECTION C: (60%)

Answer any TWO Questions from this Section.

Question 5

Consider a Tobin q-model of investment in which the equations of motion for $K(t)$ and $q(t)$ are:

$$\begin{aligned} \dot{K}(t) &= NC''^{-1(q-1)} \\ \dot{q}(t) &= rq(t) - \pi(K(t)) \end{aligned}$$

There are N identical competitive firms in the industry. The representative firm's profit function is $\pi(K(t))$ and $\pi'(\cdot) < 0$. The adjustment cost represented by $C(k)$ satisfies $C(0) = 0$, $C'(\cdot) = 0$, $C''(\cdot) > 0$. [N = total number of firms in the industry; $K(t)$ = the industry's capital stock; $k(t)$ = capital stock of the representative firm].



- (a) Assume that the government of an import-dependent economy has decided to permanently reduce the tariff rate on imported capital goods. With the aid of a diagram, describe the effects of this policy on the $\dot{K} = 0$ and $\dot{q} = 0$ loci, and on the behavior of K and q over time. Assume that the industry was initially in long-run equilibrium. **(8 marks)**
- (b) Assume that the policy of tariff reduction is temporary, explain the effects on the $\dot{K} = 0$ and $\dot{q} = 0$ loci, and on the behavior of K and q over time. **(8 marks)**
- (c) Plot the phase diagram associated with the model. Explain the quadrant where both $\dot{K} > 0$ and $\dot{q} > 0$. **(8 marks)**
- (d) Briefly explain the economic meaning of Tobin's q . **(6 marks)**

Question 6

Consider the following economy:

Time: discrete, infinite horizon.

Demography: A mass $N_t \propto N_0(1+n)^t$ of newborns enter in every period. Everyone lives for 2 periods except for first generation of old people.

Preferences: For the generations born in and after period 0;

$$U_t(c_{1,t}, c_{2,t+1}) = u(c_{1,t}) + \beta u(c_{2,t+1}),$$

where $c_{i,t}$ is consumption in period t and stage i of life, $u(\cdot)$ is increasing strictly concave and twice differentiable $\lim_{c \rightarrow 0} u'(c) = \infty$, $\lim_{c \rightarrow \infty} u'(c) = 0$. For the initial old generation $\tilde{U}(c_{2,0}) = u(c_{2,0})$.

Productive technology: $f(h, l)$ is a neoclassical production technology which uses human capital and labour to produce consumption good, where f is homogeneous of degree 1, twice differentiable, increasing in both arguments, strictly concave with $\lim_{h \rightarrow 0} f_1(h, l) = \infty$ for all $l > 0$ and $\lim_{l \rightarrow 0} f_2(h, l) = \infty$ for $h > 0$.

Human capital technology: $h_{t+1} = 1 - l_t$. Time not spent working in youth contributes to human capital available in old age.

Endowments: Everyone has one unit of labour services when young. They can use any fraction of this to work in the first period of life. Any unused labour services become human capital for use in the second period of life (when old, only human capital can be used to earn money for consumption). The initial old have h_0 units of human capital.



Institutions: There are competitive markets, for labour and human capital (you can think of a single collectively owned firm, which takes wages and interest rates as given). Using the consumption good as a numeraire let the per unit wage for each market in period t be w_t^l and w_t^h for labour and human capital respectively.

- (a) Write out and solve the problems faced by generation t workers and period t firms in this economy. **(9 marks)**
- (b) Define a competitive equilibrium and solve for the implied law of motion for the per-old person stock of human capital, h_t , in the economy. **(6 marks)**
- (c) If $u(c) = \ln c$ and $f(h, l) = Ah^a l^{1-a}$, what is the law of motion for h_t ? **(7 marks)**
- (d) Maintaining these functional forms, solve for the steady state level of human capital, $\bar{h}$. What can you say about its dynamic properties (i.e. stability, oscillatory)? **(8 marks)**

Question 7

Suppose an economy is characterized by the following equations:

$$y = \bar{y} + b(\pi - \pi^e)$$

$$b > 0$$

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

where the first equation stands for the aggregate output given by a Lucas-type aggregate supply function and the second reflects the assumptions which imply the social welfare function is quadratic in both output and inflation.

where:

y = real output

$\bar{y}$ = full employment output

y^* = desired output of the policymaker

π = inflation rate

π^e = expected inflation rate

π^* = optimal inflation rate

- (a) Based on these models, explain dynamic inconsistency of discretionary monetary policy. Your submission must include a graphical illustration. **(12 marks)**
- (b) Explain the importance of dynamic inconsistency of discretionary monetary policy. **(6 marks)**



- (c) Briefly distinguish between rules-based and discretion-based monetary policy. Discuss the problems of rules-based policy. **(7 marks)**
- (d) Inflation targeting has become a popular framework for monetary policy regimes in developed and developing countries. Briefly show how inflation targeting could be interpreted as an example of a rules-based policy regime. Give a clear description of a typical contingent rule such as would be used by an inflation-targeting central bank. **(5 marks)**

Question 8

Assume the “world” is comprised of two similar countries where one is net debtor. Each country consumes home and foreign goods and maximizes

$$V_t = \sum_{s=0}^{\infty} \beta^s \frac{(c_{H,t+s}^a c_{F,t+s}^{1-a})^{1-s}}{1-s}$$

subject to its budget constraint. Expressed in terms of home’s prices, the home country budget constraint is

$$P_{H,t} c_{H,t} + S_t P_{F,t} c_{F,t} + DB_{t+1} = P_{H,t} y_{H,t} + R_t B_t,$$

where $c_{H,t}$ is the price of home country’s output which is denoted $y_{H,t}$ and is exogenous; $P_{F,t}$ is the price of the foreign country’s output in terms of foreign prices; and B_t is the home country’s borrowing from abroad expressed in domestic currency, which is at the nominal rate of interest R_t and S_t is the nominal exchange rate. Interest parity is assumed to hold.

- (a) Using an asterisk to denote the foreign country equivalent variable (*e.g.* $c_{H,t}^*$ is the foreign country’s consumption of domestic output), what are the national income and balance of payments identities for the home country? **(7 marks)**
- (b) Derive the optimal relative expenditure on home and foreign goods taking the foreign country – its output, exports and prices – and exchange rate as given. **(8 marks)**
- (c) Obtain the consumption Euler equation for the home country. **(4 marks)**
- (d) Derive the implications for the current account and the net foreign asset position. **(7 marks)**
- (e) Comment on the implications for the home country being a debtor nation. **(4 marks)**