AFRICAN ECONOMIC RESEARCH CONSORTIUM

Collaborative PhD Programme in Economics for Sub-Saharan Africa

COMPREHENSIVE EXAMINATIONS IN CORE AND ELECTIVE FIELDS

FEBRUARY 13 – MARCH 3, 2017

MACROECONOMICS

Time: 08:00 – 11:00 GMT **Date: Monday, February 13, 2017**

INSTRUCTIONS:

Answer a total of FOUR questions: ONE question from Section A, ONE question from Section B, and TWO questions from Section C (at least one of which MUST BE Question 5 or 6).

The sections are weighted as indicated on the paper.

SECTION A: (15%)

Answer only ONE Question from this Section

Question 1

Suppose that an economy is characterized by the following behavioural equations:

$$C = c_0 + c_1 Y_D$$

$$Y_D \equiv Y - T$$

$$I = \bar{I}$$

$$G = \bar{G}$$

$$T = \bar{T}$$

(a) Solve for:

(i) Equilibrium GDP (Y). **[2 Marks]**

(ii) Interpret the term on the right-hand side of (a) when income is zero. **[2 Marks]**

(iii) Derive the investment multiplier. **[2 Marks]**

(b) Suppose that taxes depend linearly on income, according to the equation $T = T_0 + t_1 Y$, where t_1 is the tax rate, and is between 0 and 1.

(i) Find the equation for equilibrium GDP. **[2 Marks]**

(ii) Find the expression for the tax multiplier. Is the multiplier when taxes are endogenous, larger than, smaller than, or the same as when taxes are exogenous? **[3 Marks]**

(c) Distinguish between changes in c_0 and changes in $c_1 Y_D$. **[4 Marks]**

Question 2

(a) Why are cheques and credit cards not money? **[4 Marks]**

(b) What are the defining features of classical macroeconomics and what policies do classical macroeconomics suggest with regard to unemployment and the role of government? **[6 Marks]**

(c) Using the Quantity Theory of Money, show how the quantity of money triggers inflation in the economy. **[5 Marks]**

SECTION B: (25%)

Answer only ONE Question from this Section

Question 3

The household's utility in period t is derived from consumption and employment, which is summarized:

$$U_t = \log C_t + \psi \log (1 - N_t)$$

The budget constraint for this problem is then expressed as;

$$P_t C_t = W_t N_t$$

where C_t, N_t, P_t and W_t refer to consumption, employment, prices of consumer goods, and wages. It is then assumed that $\psi > 0$.

(a) Derive the first order conditions for the household, with respect to consumption and employment. **[13 Marks]**

(b) How does labour supply depend on the wage in this example? **[12 Marks]**

Question 4

Suppose an individual lives for 2 periods in an economy where money exists and is valued. Utility maximization problem for the individual born in time *t*, $t \geq 0$, is expressed as:

Max. $u(C_{1t}, C_{2t+1})$

subject to

$P_t(1 - C_{1t}) = M_t^d$ and $P_{t+1}C_{2t+1} = M_t^d$,

where C_{it} and P_t denote consumption and price at time *t*, and M_t^d is the individual's demand for money.

(a) Explain how this individual consumes in both periods. [**5 Marks**]

(b) If there is no intrinsic uncertainty in this problem, and so perfect foresight is assumed, which means the actual and expected prices at time $t + 1$ are the same. What is the first order condition for utility maximization of this individual? **[10 Marks]**

(c) Write the implied demand for money function as of time *t*, and briefly explain its intuition. [**10 Marks**]

SECTION C: (60%)

Answer TWO Questions from this Section,

AT LEAST one of which MUST BE Question 5 or 6

Question 5

Consider the new Keynesian Phillips curve with indexation, which may be written as,

$$\pi_t = \frac{1}{1+\beta}\pi_{t-1} + \frac{\beta}{1+\beta}\mathrm{E}_t\pi_{t+1} + \chi y_t, \qquad 1 > \chi > 0$$

where π_t represents inflation, derived from the price index (p_t), and y_t is a measure of real output. m_t is a measure of nominal output and can be expressed as, $m_t = y_t + p_t$, which is the target of central bank monetary policy.

All of the above variables are expressed in terms of natural logarithms.

(a) Under the assumptions of perfect foresight and $\beta = 1$, express p_t in terms of m_t, p_{t+1}, p_{t-1} and p_{t-2} **[8 Marks]**

(b) If we assume that the values of p_{t+1}, p_{t-1} and p_{t-2} remain constant, what would be the effect of an increase in m_t on current prices? **[7 Marks]**

(c) If it is assumed that there is a positive relationship between m_t and p_{t+1}, would the effect of an increase in m_t on current prices, be greater or less than in the previous case? **[7 Marks]**

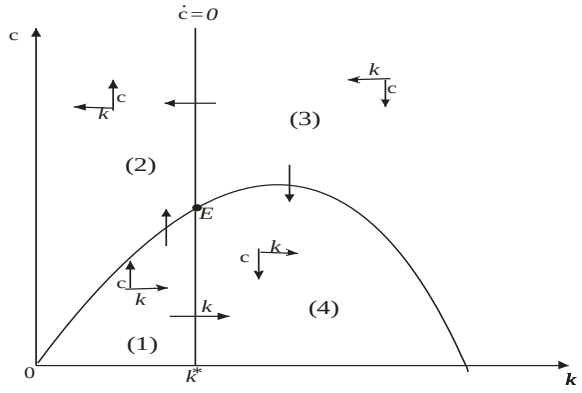
(d) If we now assume that $\chi = 0.5$, would the use of the new Keynesian Phillips curve without indexation allow for a stronger or weaker relationship between m_t and p_t? Consider the cases where there is, and is not, a relationship between m_t and p_{t+1} and the new Keynesian Phillips curve without indexation is written as,

$$\pi_t = \beta\mathrm{E}_t\pi_{t+1} + \chi y_t$$

[8 Marks]

Question 6

Consider a Ramsey-Cass-Koopmans type growth model in which the equations of motion of consumption per unit of effective labour and capital stock per unit of effective labour are $\dot{c}(t) = \frac{r(t) - \rho - \theta g}{\theta} c(t)$ and $\dot{k}(t) = \left[f(k(t) - c(t) \right] - \left[(n+g)k(t) \right]$, respectively. The phase diagram associated with the model is drawn below. The $\dot{c} = 0$ line and the $\dot{k} = 0$ locus divide the figure into quadrants 1, 2, 3 and 4. Use your knowledge of the workings of the model to answer the following questions. [*c* represents consumption per unit of effective labour, *n* is population growth, *r* is rental price of capital, *k* is capital per unit of effective labour, *g* denotes growth of knowledge and ρ is discount rate]



(a) Why is $\dot{c} > 0$ and $\dot{k} > 0$ in quadrant 1? **[6 Marks]**

(b) Explain the dynamics in quadrant 2. **[6 Marks]**

(c) Why is $\dot{c} < 0$ and $\dot{k} < 0$ in quadrant 3? **[6 Marks]**

(d) At point *E*, what happens to consumption per worker and output per worker? **[2 Marks]**

(e) Explain the effects of a decline the discount rate, ρ on the $\dot{c} = 0$ line and the $\dot{k} = 0$ curve. Explain the adjustment process. **[10 Marks]**

Question 7

Consider a standard optimal growth model in continuous time in which the aggregate production function is given by:

$$Y(t) = F[k(t), N(t)],$$

where $F(\cdot)$ has standard properties and $N(t)$ is growing at the rate $n > 0$. The depreciation rate of capital is given by $d > 0$. The single household inelastically supplies labour each period and then chooses consumption and savings in order to maximize

$$\int_0^{\infty} e^{-rt} U(c(t)) N(t)\, dt,$$

where $c(t) = \dfrac{c(t)}{N(t)}$ is per-capita consumption and $U(\cdot)$ has the functional form:

$$U(c(t)) = \begin{cases} \dfrac{c(t)^{1-q}}{1-q}; q \neq 1 \\ \ln c(t); q = 1 \end{cases}$$

It is assumed that all parameter values are such that a well behaved equilibrium exists. In addition to output produced via production function, output arrives exogenously every period at the rate f units per person. Given this environment do the following:

(a) Express the social planner problem in intensive form (i.e. per-capita) form – show your derivation. **[6 Marks]**

(b) Write down the Hamiltonian for this problem and derive the necessary conditions; including the transversality condition. **[8 Marks]**

(c) Derive the phase diagram for the economy (be sure to explain your diagram). **[8 Marks]**

(d) Define the steady-state. What fraction of the exogenous output, f is consumed in the steady-state? Why? **[8 Marks]**

Question 8

In the New Keynesian model of the business cycle it is assumed that the representative household will consume a variety of different goods that are indexed by j, which has a continuous distribution that may be formulated as $j \in [0,1]$. The broad consumption index, C_t, could then be expressed as

$$C_t = \left[\int_0^1 C_{j,t}^{1-\frac{1}{\epsilon}} dj\right]^{\frac{\epsilon}{\epsilon-1}}$$

where $C_{j,t}$ is the quantity of good j consumed by the representative household and ϵ is the marginal rate of substitution between goods. The budget constraint for this household is represented as,

$$\int_0^1 P_{j,t}\, C_{j,t}\ \ dj = W_t N_t,$$

where $P_{j,t}$ refers to the price of good j, W_t refers to wages and N_t, refers to labour.

(a) Derive an expression that identifies the optimal value of $C_{j,t}$ as a function of prices and the index of total consumption (i.e., C_t). **[16 Marks]**

(b) Use this expression to derive the aggregate price index of all goods. **[14 Marks]**