



## AFRICAN ECONOMIC RESEARCH CONSORTIUM

*Collaborative PhD Programme in Economics for Sub-Saharan Africa*

**COMPREHENSIVE EXAMINATIONS IN CORE AND ELECTIVE FIELDS**

**FEBRUARY 19 – MARCH 10, 2021**

### MACROECONOMICS

**Time: 08:00 – 11:00 GMT**

**Date: Friday, February 19, 2021**

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#### **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.

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#### **SECTION A: (15%)**

**Answer only ONE Question from this Section**

#### **Question 1**

- (a) Briefly explain the concept of rational expectations. **[9 Marks]**
- (b) Provide three examples where the concept in (a) has been applied in macroeconomics. **[6 Marks]**

#### **Question 2**

In the Mundell-Fleming model, briefly explain:

- (a) a general equilibrium point; and **[7 Marks]**
- (b) the effects of an increase in money supply under a fixed exchange rate policy when capital is perfectly immobile across countries. **[8 Marks]**



## SECTION B: (25%)

### Answer only ONE Question from this Section

#### Question 3

Discuss the following:

- (a) The Lucas critique of macroeconomics. [10 Marks]
- (b) The Classical Dichotomy. [10 Marks]
- (c) The implications of wage-price flexibility in the classical model. [5 Marks]

#### Question 4

Consider a discrete-time economy. The paths of output ( $Y$ ), government purchases ( $G$ ), and the real interest rate ( $r$ ) are exogenously given and certain. The real interest rate is constant. There is some initial stock of outstanding government debt,  $D_0$ . The government wants to choose the path of taxes ( $T$ ) to satisfy its budget constraint while minimizing the present value of the costs of the distortions that the taxes create. Assume that the distortion costs from raising amount  $T_t$  are given by:

$$C_t = Y_t f\left(\frac{T_t}{Y_t}\right), \quad f(0) = 0, f'(0) = 0, f''(\bullet) > 0,$$

where  $C_t$  is the cost of the distortions in period  $t$ . This implies that distortions relative to output are a function of taxes relative to output, and that they rise more than proportionally with taxes relative to output. The government's problem is to choose the path of taxes to minimize the present value of the distortion costs subject to the requirement that it satisfies its overall budget constraint. The problem is:

$$\min_{T_0, T_1, \dots} \sum_{t=0}^{\infty} \frac{1}{(1+r)^t} Y_t f\left(\frac{T_t}{Y_t}\right)$$

Subject to:

$$\sum_{t=0}^{\infty} \frac{1}{(1+r)^t} T_t = D_0 + \sum_{t=0}^{\infty} \frac{1}{(1+r)^t} G_t$$

Solve the government's problem of tax smoothing using the perturbation arguments and give the policy implication of the model.

- (a) Under certainty. [13 Marks]
- (b) Under uncertainty. [12 Marks]



## SECTION C: (60%)

### Answer ANY TWO Questions from this Section

#### Question 5

Suppose the central bank has the same utility function as that of its society. The utility function of the central bank is specified as:

$$U^m = -\gamma\pi^2 - [y - ky^f]^2; \gamma > 0; k > 1$$

The aggregate supply function for the economy takes the form:

$$y = y^f + \alpha(\pi - \pi^e); \alpha > 0$$

[Where,  $y$  = aggregate output,  $y^f$  = full employment output,  $\pi^e$  = expected inflation by the public and the  $ky^f$  = monetary authority's target output].

- (a) Assume that the central bank takes the public's expected inflation as given. Derive the values for actual inflation and output. **[12 Marks]**
- (b) Derive the values for output and inflation given that the monetary authority announces the per period inflation rate it intends to achieve and the public believes it. **[8 Marks]**
- (c) Explain two major sources of credibility problem in the conduct of monetary policy. **[10 Marks]**

#### Question 6

Consider an economy where capital and knowledge are both endogenous state variables. The production function for output is given as:  $Y(t) = [(1 - a_K)K(t)]^a [A(t)(1 - a_L)L(t)]^{1-a}$ , where  $0 < a < 1$ .  $Y(t)$  is output at time  $t$ ,  $K(t)$  is the quantity of capital at time  $t$ ,  $L(t)$  quantity of labour at time  $t$ , and  $A(t)$  is the level of knowledge at time  $t$ . The parameter  $a$  is the returns to scale,  $a_L$  is a fraction of the labour force used in the R&D sector (for the production of knowledge),  $1 - a_L$  is a fraction of labour force used in the goods-producing sector.  $a_K$  is a fraction of the capital stock used in R&D and the rest in goods production. Both  $a_L$  and  $a_K$  are exogenous and constant. The dynamics of knowledge is given by  $\dot{A}(t) = B[a_K K(t)]^\beta [(a_L)L(t)]^\gamma A(t)^\theta$ ,  $B > 0, \beta > 0, \gamma > 0, \theta > 0$ , where  $B$  is a shift parameter. The equation of motion of capital is given as  $\dot{K}(t) = sY(t)$ , where  $s$  is saving



rate. Assume that population growth is exogenous and constant and is given by  $\dot{L}(t) = nL(t)$ , where  $n > 0$ .

- (a) Show that:
- (i) the initial values of labour, knowledge, capital and the parameters of the model determine the initial value of growth in knowledge and capital. **[5 Marks]**
  - (ii) growth over time is determined by growth in knowledge, capital and labour. **[5 Marks]**
- (b) Assuming that the sum of the returns to scale of factors in the knowledge production sector is less than 1 (i.e.  $\beta + \theta < 1$ ), derive the balanced growth path (BGP) for knowledge ( $\dot{g}_A = 0$  line) and capital ( $\dot{g}_K = 0$  line). **[6 Marks]**
- (c) Show in a  $g_A$ - $g_K$  space that the economy converges to a balanced-growth path (use a phase diagram), regardless of the initial conditions. **[5 Marks]**
- (d) Show that on the balanced growth path (BGP), capital, knowledge and output grow at constant rates. **[5 Marks]**
- (e) Explain one key economic policy implication of the endogenous growth model. **[4 Marks]**

## Question 7

- (a) Dynamic Stochastic General Equilibrium (DSGE) models are founded on Real Business Cycle theory that are used to characterize business cycle activities. Outline three important strategic modelling choices made in typical DSGE models in characterizing business cycle activities. **[15 Marks]**
- (b) Briefly explain what stochastic and general equilibrium means in the DSGE model. **[5 Marks]**
- (c)
- (i) Briefly describe the type of conditions in which aggregate demand is derived in a standard DSGE model. **[5 Marks]**
  - (ii) Explain how price adjustment is characterized in a standard DSGE model. **[5 Marks]**

*[Hint: Your response to c(i) and c(ii) should take into account the implications associated with each of these conditions and characterizations].*



## Question 8

- (a) Should deficits be financed by increasing borrowing or by raising taxes? Discuss **[6 Marks]**
- (b) Comment on any two schools of thought regarding the burden of public debt. **[6 Marks]**
- (c) Public debt literature argues that debt relief in itself cannot reverse the downward slide and return countries to a path of sustained growth. Discuss two critical factors necessary for breaking the vicious cycle of debt in Africa. **[6 marks]**
- (d) Discuss the consequences of public debt in Sub-Saharan Africa. **[6 Marks]**
- (e) Briefly explain any two ways in which Africa's creditors and the donor community need to assist African countries in combatting the Covid-19 pandemic and minimizing its impact on their economies. **[6 Marks]**