HOWARD UNIVERSITY
DEPARTMENT OF ECONOMICS

CODE NUMBER _____   **TOTAL NUMBER OF PAGES** _____

September 1, 2021

FALL 2021 PH.D. MACROECONOMIC THEORY COMPREHENSIVE EXAMINATION

Examiners:

1. Dr. Mika Kato, Chairperson

2. Dr. Gerald Daniels

3. Dr. Tingting Xiong

1. The examination is scheduled between the hours: 9:30 a.m-1.00 pm

    ALL STUDENTS ARE TO BE SEATED BY 9:25 a.m.

2. YOU ARE REQUIRED TO ANSWER ONLY FIVE (5) QUESTIONS.

    Any additional questions answered over the required number from each category will NOT receive credit.

3. Correct answers to questions NOT asked will receive NO credit.

4. Be sure to write the Code Number assigned to you in the TOP LEFT HAND CORNER OF THIS SHEET AND ON EACH ANSWER SHEET. DO NOT WRITE YOUR NAME ON ANY SHEET OF THE EXAMINATION.

5. Begin each question on a new page. Number each page used in sequence. Write only on one side of the paper.

6. Write clearly and illustrate your answers with graphs whenever and wherever possible.

7. USE ONLY BLACK INK PENS.

8. At the end of the examination, please indicate the total number of pages being submitted in the space provided in the TOP RIGHT HAND CORNER of this sheet.

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1. Bring your pens, pencils, calculators and rulers.

2. No briefcases, book bags or sacks, no handbags larger than 10 x 6 of any form are to be brought into the examination room.

3. No books, notes or other study material are to be brought into the examination room.

4. During the Examination there is to be no communication between or amongst students for any purpose. All questions must be directed to and channeled through the faculty member conducting the examination.

5. Only the scrap paper provided by the proctor is to be used for the examination. Scrap paper should bear the code number assigned to each student, and be handed over to the proctor along with the examination.

6. Students are not expected to leave the examination room before completing their examination and turning it in to the proctor.

7. NO FOOD OR SMOKING is permitted in the examination room.

8. It is the student's responsibility to remove any coffee or water containers taken into the examination room.

9. NO CELL PHONES ARE ALLOWED.

10. EXAMINATION RESULTS WILL ONLY BE GIVEN TO STUDENTS WHO ARE REGISTERED.

CODE NUMBER _____

STUDENTS: PLEASE CIRCLE ONLY THE QUESTIONS ANSWERED AND PROVIDE THE PAGE NUMBERS.

QUESTIONS	PAGE NUMBERS
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2.	
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FALL 2021 PH.D. MACROECONOMIC THEORY COMPREHENSIVE EXAMINATION

PART A. ANSWER ANY TWO (2) QUESTIONS FROM QUESTIONS 1-3.

1. **Write short definitions for (a)-(e). Use diagrams and/or equations where appropriate.**

   (a) Failure of Phillips curve.
   (b) Club convergence.
   (c) Money is neutral.
   (d) Knowledge spillover.
   (e) Voluntary and involuntary unemployment.

2. **Answer questions (a)-(c).**

   (a) What is the engine of growth in Romer (1990)'s product variety growth theory and in the Schumpeterian growth theory?
   (b) Compare it to the element driving endogenous growth in the AK theory. What does this comparison imply in terms of pro-growth policy design in both settings?
   (c) Both the product-variety and the Schumpeterian models predict scale effects, namely, that a larger population (a larger population of researchers) would predict faster growth. Is this prediction problematic? How would you empirically test this prediction?

3. **Consider a closed economy described by**

$$Y = E(Y, r, G, T); \ 0 < E_Y < 1, E_r < 0, E_G > 0, E_T < 0 \ (IS)$$

$$\frac{M}{P} = L(r, Y); \ \ L_r < 0, r_Y > 0 \ (LM)$$

   Answer questions (a)-(c).

   (a) How does a change in the marginal propensity to consume (mpc) affect the IS and/or LM curve?
   (b) Show graphically that an expansionary monetary policy is more effective in an economy with a high mpc.
   (c) Show mathematically, using the given model, that the multiplier effect is stronger in an economy with a high mpc.

4. **Consider a Ramsey-Cass-Koopmans model where a representative agent consumes and engages in production for $t \in [0, \infty)$. The agent's utility depends on its current consumption $u(c_t)$ and its production technology is $y_t = f(k_t)$. Both functions have usual properties.**

   Answer questions (a)-(d).

   (a) Write down the representative agent's problem to find the optimal consumption to maximize the present-value of utility when its subjective discount rate is ρ and the depreciation rate of capital is δ.
   (b) Show the first-order necessary conditions for maximization.
   (c) Using a phase diagram, show that there is a unique steady state and that the steady state is stable.
   (d) Show that the golden rule capital stock is not guaranteed in the steady state.

5. **Consider a policymaker whose objective function is to minimize the social-welfare loss,**

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

   where y is the output, π is the inflation rate, y^* and π^* are their target levels respectively. A Phillips curve relationship is given by

$$y = y^n + b(\pi - \pi^e); b > 0 \; and \; y^n < y^*,$$

   where y^n is the natural output and π^e is the expected inflation.

   Answer questions (a)-(f).

   (a) How do you interpret the parameter a in the loss function? What does a larger value of a mean?
   (b) Assume that the policy maker makes a binding commitment about inflation. Derive the policy maker's optimal response function.
   (c) What are the levels of inflation and output in the economy under the policy by rule?
   (d) Now assume that the policy maker sets inflation by discretion. Derive the policy maker's optimal response function.
   (e) What are the levels of inflation and output in the economy under the policy by discretion?
   (f) Do the economic outcomes obtained in (c) and (e) imply that there is a dynamic inconsistency problem? Explain.

6. **Given the following production function:**

$$Q = F(K, L) = K^\alpha (AL)^{1-\alpha},$$

where $A > 0$ and $0 < \alpha < 1$ and with output Q divided between consumption and investment. The fraction of income devoted to investment is s, a constant, productivity A grows at a constant rate g, capital K depreciates at the rate δ, and labor L grow at a constant rate n.

Answer questions (a)-(d).

(a) Write Q in an intensive (per effective worker) form, q.
(b) Find the equation that describes the evolution of the capital stock per effective worker, k.
(c) Find the steady-state levels, k^* and q^*.
(d) Find the steady-state values of:
     i.   growth rate of output per effective worker
     ii.   growth rate of output per worker
     iii. growth rate of output
(e) If the saving rate s increases show what happens to the steady-state q^*. You may use a diagram.

7. **Suppose that there is a large number of competitive firms. The representative firm seeks to maximize profits,**

$$\pi = Y - wL,$$

and the output technology is described by

$$Y = F(eL),$$

where effort e depends on the wage the firm pays

$$e = e(w).$$

Answer questions (a)-(c).

(a) Write down the problem of the representative firm.
(b) Show the first-order necessary conditions for maximization.
(c) Compute the efficiency wage when the effort function is given as
$$e(w) = 0.001w + 0.1w^2 - 0.05w^3.$$

8. **Consider a simple investment problem. A firm maximizes its present value of profit:**

$$max \int_{t=0}^{\infty} \{\pi(K) - I - \varphi(I)\}e^{-rt}dt$$

$$s.t. \ \dot{K} = I$$

where r is the interest rate, π is the firm's profit function, K is the capital stock, I is the investment, and φ is the adjustment cost of investment.

Answer questions (a)-(c).

(a) Write down the firm's problem to find the optimal investment to maximize its present value of profit.

(b) Show the first-order necessary conditions for maximization.

(c) Find the optimal investment rule. Show that the derived rule is actually compatible with the Tobin's q (Tobin, 1969) theory of investment.