QUEEN'S UNIVERSITY

FACULTY OF ARTS AND SCIENCE

DEPARTMENT OF ECONOMICS

Economics 222 A&B
Macroeconomic Theory I

Final Examination
20 April 2009

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DURATION: 3 hours

INSTRUCTIONS: Show ALL RELEVANT STEPS**.** Use the EXAMINATION BOOKLETS to answer.

Calculators: non-programmable, Casio 991, blue sticker, gold sticker.

Part A (Short Questions):
Do **FOUR** of the **EIGHT** questions. Each question is worth **10 MARKS** for a total of **40 MARKS**.

Part B (Long Questions):
Do **THREE** of the **FIVE** questions. Each question is worth **20 MARKS** for a total of **60 MARKS**.

TOTAL: 100 MARKS.

Note: Proctors are unable to respond to queries about the interpretation of exam questions. Do your best to answer exam questions as written.

Part A (Short Questions): 40 MARKS

*Do **four (4)** of the **eight (8)** questions. Each question is worth **10 marks**, for a total of **40 marks**.*

Question A.1: Consumption, Saving and Investment

Consumption:

a) [4 MARKS] Do changes in current income compared with changes in permanent income have different effects on current consumption? In your analysis, be sure to highlight the role of access to credit. If there is a borrowing constraint, what is the likely effect on consumption?

Investment:

b) [4 MARKS] Let r be the real rate of interest, d the rate of depreciation, τ the rate of corporate taxation and p_K the price of capital. Derive the desired investment function I^d for this economy, given the following information about MPK^f, the future marginal product of capital, which in turn is related to K^d, the desired stock of capital, as follows:

$$MPK^f = 9.7\text{–}K^d$$

The actual stock of capital currently in place, K, is equal to 7.

c) [2 MARKS] Given the following values $r = 0.07$; $d = 0.10$; $\tau = 0.32$; and $p_K = 1.2$, what is the current level of investment?

Question A.2: Saving and Investment in an Open Economy

The Chairman of the Federal Reserve has said that an important source of the US current account deficit has been the large increase in national saving coming from Asia in particular. At the same time, some other commentators have claimed that it is the large and now growing US government fiscal deficits that are responsible for the deterioration in the US current account, importantly driven by tax cuts.

Start from a position in which the US has a current account surplus matched by a deficit in Asia and, using the graphical version of the open-economy saving and investment model, illustrate these two hypotheses. For each hypothesis be sure to spell out the implications for the world real interest rate and the forces acting on it. You may assume that the real exchange rate stays constant.

Question A.3: Long-Run Economic Growth

Using your knowledge of growth theory, briefly answer the following. Where appropriate, cite empirical evidence.

a) [5 MARKS] It has often been said that total factor productivity growth is the source of rising living standards. Explain why this may be so.

b) [3 MARKS] What is unconditional convergence and under what conditions would this occur?

c) [2 MARKS] What is conditional convergence?

Question A.4: The Asset Market, Money and Prices

Based on what you have learned about asset and money markets, briefly answer the following:

a) [4 MARKS] If the central bank increases the money supply, through what mechanism are other asset prices and rates of return affected? Describe this mechanism.

b) [2 MARKS] What is the velocity of money and why might it change?

c) [4 MARKS] When economists say "money is neutral", what do they mean? Does velocity have to be constant for money to be neutral?

Question A.5: The *AS-AD* Model and Business Cycles

This question asks you to explain *carefully* the key differences between Keynesian and Classical thought on the topic of business cycles, using as a framework the *AS-AD* model with a horizontal *SRAS* curve. Assume that we are initially in a long-run equilibrium, and that output is at its full-employment level $Y = \overline{Y}$. Consider a decrease in aggregate demand (i.e., an adverse demand shock).

a) [6 MARKS] Illustrate the situation graphically in the *AS-AD* framework, depicting both the short-run and the long-run equilibria. Explain any shifts in curves. Which effects are deemed temporary, which are deemed long-lasting, and by whom respectively?

b) [4 MARKS] What is the appropriate policy response advocated by each school of thought in reaction to such a contraction? Why? Express it graphically.

Question A.6: Closed Economy *IS-LM-FE*

Consider a one-time increase in the nominal money supply M of 10% within the closed economy *IS-LM-FE* framework. Suppose that we initially are in a long-run equilibrium at full-employment output (i.e., $Y = \overline{Y}$).

a) [5 MARKS] Illustrate the short-run effects of this policy within the *IS-LM-FE* framework. Provide an explanation for any shifts, and carefully explain the *transition* by referring to the *monetary channel*.

b) [5 MARKS] Illustrate the long-run effects of this policy within the *IS-LM-FE* framework. What is this policy's effect on output? What is its *precise* impact on prices? Name the phenomenon at work here.

Question A.7: The Phillips Curve

Suppose that an economy is characterized by the expectations-augmented Phillips curve

$$\pi = \pi^e - h(u - \overline{u})$$

where $h > 0$ and $\overline{u}$ is the natural rate of unemployment.

a) [4 MARKS] Using the expectations-augmented Phillips curve model above, explain the effects of a *one-time increase* in the money growth rate (e.g., from 2% this year to 3% next year and thereafter) on inflation and output in the short and the long run. Be sure to support your answer with diagrams.

b) [4 MARKS] Suppose that the central bank tries to maintain the unemployment rate below the natural rate by *persistently* increasing the growth rate of money (e.g., from 2% this year, to 3% next year, to 4% the year after, etc.). What would happen? Be sure to support your answer with diagrams.

c) [2 MARKS] Explain the concept of the "sacrifice ratio".

Question A.8: Mundell-Fleming with Fixed Exchange Rates

Suppose that we are in a long-run equilibrium, such that $r = r_{for}$ (no-arbitrage, interest parity condition holds) and $Y = \overline{Y}$ (full-employment output). A country with a fixed exchange rate regime revalues its currency, that is it raises $\overline{e}_{nom}$ from $\overline{e}^1_{nom}$ to $\overline{e}^2_{nom}$.

a)[5 MARKS] Illustrate the short-run effects of this policy in an *IS-LM-FE* diagram. Explain carefully what triggers any shifts in curves, by relating them to the changes in the underlying goods and asset markets. What happens to the real exchange rate, net exports, and output?

b) [5 MARKS] Illustrate the long-run effects of this policy in the *IS-LM-FE* diagram. Again, explain carefully what triggers any shifts in curves, by relating them to the changes in the underlying goods and asset markets. What happened to the real exchange rate, net exports, and output in the long run, compared with the initial equilibrium where $\overline{e}_{nom} = \overline{e}^1_{nom}$?

Part B (Long Questions): 60 MARKS

*Do **three (3)** of the **five (5)** questions. Each question is worth **20 marks**, for a total of **60 marks**.*

Question B.1: Mundell-Fleming Model with Flexible Exchange Rates

Suppose that a small open economy can be represented by the following model with a flexible exchange rate:

$$\begin{aligned} C^d &= 300 + 0.6(Y - T) \\ I^d &= 175 - 400r \\ G &= 400 \\ T &= 400 \\ NX &= 245 - 0.1Y - 100e \\ \frac{M^d}{P} &= Y - 85(r + \pi^e) \\ \pi^e &= 0.20 \\ P &= 1 \end{aligned}$$

Assume initially that the economy is in a long-run equilibrium, where $e = 2$, $r = r_{for}$ holds, and output is at its full-employment level $Y = \overline{Y}$. Also assume here perfect capital mobility.

a) [3 MARKS] Find equations for the *IS* and *LM* curves in this economy. Keep the equation for the *IS* curve as a function of e (i.e., do not substitute in in the value yet).

b) [5 MARKS] Assuming that $r_{for} = 0.10$, find the long-run equilibrium values of Y, C, I, and NX. Find as well the nominal money supply M that is necessary to bring about this long-run equilibrium. Finally, represent the long-run equilibrium graphically in the (Y, r) space.

c) [6 MARKS] There is a surge in expected inflation, and now $\pi^e = 0.40$. Find the short-run equilibrium values for r, e, NX and Y. Depict the short-run equilibrium in a diagram, and explain what is at work here.

d) [6 MARKS] The central bank wants to avoid any change in the price level in the long run, following the shock in part c). What policy should it implement, so that the economy moves back to the long-run equilibrium found in b) without incurring any change in P? Find the new value of the money supply M, which corresponds to the central bank's choice of policy. Then, represent the new long-run equilibrium diagrammatically, explaining the transition.

Question B.2: Lifetime consumption

An individual lives for two periods, 1 and 2. In the first period, she is young and attends university, and hence has little revenues of her own: $y_1 = 12$. In the second period (adulthood), she earns $y_2 = 110$. She dies after the second period. She aims to smooth her consumption across time periods: her preferences are characterized by her marginal rate of inter-temporal substitution ($MRIS$), $MRIS = (11/10) \cdot (c_2/c_1)$. The real interest rate in this economy is initially given by $r = 0.10$.

a) [3 MARKS] Find the individual's budget constraint in every period. From that, find an equation for her inter-temporal budget constraint.

b) [3 MARKS] Find the individual's optimal consumption and savings in each period.

c) [8 MARKS] Suppose that the interest rate decreases from $r = 0.10$ to $r = 0.05$, before the individual has made any decisions. Determine numerically how this affects her consumption and saving decisions. Illustrate the change graphically, first identifying the total effect, then decomposing it in income and substitution effects, and differentiating clearly between them.

d) [6 MARKS] Suppose that we are back at $r = 0.10$, yet the individual now also faces a *borrowing constraint* at time $t = 1$, such that her first-period savings must be non-negative (i.e., $s_1 \geq 0$).

i) Find her new consumption and saving decisions in each period, given that her decisions are no longer governed by the $MRIS$ if the constraint is binding (i.e., if $s_1 = 0$).

ii) Could the government improve on this individual's situation, for instance by making her a transfer at time $t = 1$ funded by issuing debt, which is to be repaid in full by taxing the individual at time $t = 2$? Explain what is at work here.

Question B.3: Mundell-Fleming with Fixed Exchange Rates

Consider the following small open economy, with fixed exchange rates and perfect capital mobility:

$$\begin{aligned} C^d &= 245 + 0.67Y \\ I^d &= 225 - 500r \\ T &= 0 \\ NX &= 85 - 0.07Y - 65\overline{e} \\ \overline{e} &= 1.8 \\ M &= 600 \\ \frac{M^d}{P} &= 0.5Y - 75r \\ P &= 1 \end{aligned}$$

Assume that the economy is initially in a long-run equilibrium, such that $r = r_{for}$ holds, and output is at its full-employment level $Y = \overline{Y}$.

a) [3 MARKS] Find equations for the *IS* and *LM* curves in this economy. Keep the equation for the *IS* curve as a function of G and $\bar{e}$ (i.e., do not substitute in values yet).

b) [5 MARKS] Assuming that $r_{for} = 0.12$, find the long-run equilibrium value of Y. Then, proceed to find the level of government spending G required to sustain this long-run equilibrium, *ceteris paribus*, and find equilibrium values of C, I, and NX. Finally, represent the long-run equilibrium graphically in the (Y, r) space.

c) [6 MARKS] Contractionary monetary policies in foreign economies have caused the foreign interest rate to increase above the domestic value, such that $r_{for} = 0.18 > r = 0.12$. Explain what implications this has for the domestic currency: is it now undervalued or overvalued, and why? The government does not want the fixed exchange rate or monetary policy to change in the short run. What fiscal policy must it implement in order to achieve this? Find short-run equilibrium output Y, and the implied policy response by thereafter finding G. Then, illustrate and explain its effect using the *IS-LM-FE* diagram.

d) [6 MARKS] Suppose that instead of intervening right away, the government in c) decides to dither about the choice of policy. This leads speculators to believe that the domestic currency's fixed exchange rate no longer matches its fundamental value.

i) What options does the country's central bank have in the event of a speculative run on its currency, and what are their effects?

ii) In the end, the central bank has no other choice but to change $\overline{e}$ to match the fundamental value of the exchange rate, and achieve interest rate parity again. If G, M, and P remain constant at their values specified or found in parts a) and b), what would be the new $\overline{e}$ and the short-run equilibrium Y?

Question B.4: Long-Run Economic Growth

For this economy, there is an aggregate production function of the following form:

$$Y = AK^{\alpha}N^{1-\alpha}$$

where Y is output, which is produced by combinations of capital (K) and labour (N). The exponent, α, is positive and less than one. The variable A measures how efficiently firms use K and N to produce Y. The economy is assumed to be at full employment. As well, saving is a constant fraction (s) of output. The capital stock depreciates by a certain percentage d per year. The labour force grows at a constant rate n.

a) [5 MARKS] Write down the production function in terms of output per worker, y, as a function of capital per worker, k. Supposing that this economy is in a steady-state equilibrium, what does it imply for investment? Show how you would derive your results.

The values of some of the key parameters are: $A = 8$; $\alpha = 0.25$; $n = 0.03$; and $d = 0.22$. With this information, answer the following questions, making sure that you explain your results:

b) [5 MARKS] What would be the level of k that would maximize consumption per worker (the "Golden-Rule" level of capital, k_g) and the constant rate of saving that would get the economy to that position? Given the above information, what would be the maximum level of consumption? Graphically illustrate your answer.

c) [5 MARKS] If the price of capital was equal to one and there were no taxes on capital, what would be the rate of interest at the point where consumption per worker is maximized? (Hint: use the user-cost relationship.)

d) [5 MARKS] If the actual saving rate equalled 0.20, what would be the steady-state level of output per worker, y; capital per worker, k; and consumption per worker, c? Show your results graphically and locate this equilibrium in relation to the Golden Rule. Explain why, given the nature of the production function and the required investment schedule, must the economy approach a steady-state equilibrium with a constant saving rate.

Question B.5: Macroeconomic Policy in a Closed Economy Using the *IS-LM-FE* Framework

An economy is characterized by the following equations:

$$\begin{aligned} C^d &= 300 + 0.7(Y - T) - 75r \\ I^d &= 185 - 75r \\ \frac{M^d}{P} &= 0.6Y - 100(r + \pi^e) \end{aligned}$$

Assume that government spending is $G = 100$; that total tax revenues are $T = 150$; and expected inflation π^e is not known for the moment.

a) [5 MARKS] Derive an equation for the *IS* curve (showing the interest rate as a function of output) and the *LM* curve (interest rate as a function of output, real money balances and π^e). As well, derive the aggregate demand curve and explain the relationship between output and the price level that you find.

b) [5 MARKS] Suppose that the interest rate is 5%. What is the level of real output consistent with this interest rate? Given an aggregate price level of unity ($P = 1$) and expected inflation (π^e) equal to zero, find the nominal money supply. What are the levels of C^d and I^d?

For the following two parts, assume that the values of Y and r found in b) represent the economy's long-run equilibrium position.

c) [5 MARKS] Suppose that there is an unanticipated oil-price shock that raises inflation expectations π^e to 2% for one period. No other variables are affected. Assuming that the economy starts from the long-run equilibrium, what would happen in the short run if the central bank held the nominal money supply unchanged at the level found in part b)? Assuming that the bank continues to hold the money supply constant, to what equilibrium would the economy return? Show your results graphically.

d) [5 MARKS] For this part, assume that inflation expectations are zero ($\pi^e = 0$). The government decides to stimulate the economy by lowering taxes by 10. What is the short-run effect on both output and interest rates? If the central bank holds the nominal money supply unchanged, what will happen over time? Show your results graphically. What will be the new level of Y, r, I^d and C^d? Comparing investment to the level found in part (a), what phenomenon do you observe?