**Queen's University**
**Faculty of Arts and Science**
**Department of Economics**
**ECON 222**
**Macroeconomic Theory I**
Winter Term 2007/08

**Sections A and B**
**Final Examination**
23rd April 2008

Please read all questions carefully. Record your answers in the answer booklet provided. You are encouraged to draw diagrams to support your answers. Please label the axis and lines or curves on your diagrams.

The exam has two parts. The 100 marks will be awarded also on the basis of the logical arguments given to support your answers.

Part A consists of short questions. Do **FOUR** of the *eight* questions. Each question is worth 10 marks for a total of 40 marks.

Part B consists of long questions. Do **THREE** of the *six* questions. Each question is worth 20 marks for a total of 60 marks.

The exam is **180 minutes** long. Budget your time carefully.

Hand calculators (non programmable) are permitted for this exam.

Upon completion of your exam, only hand in the answer booklet clearly labeled with your student number and class section.

Any cheating attempt will be sanctioned with the toughest possible punishment.

If the instructor is unavailable in the examination room, and if doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper a clear statement of any assumptions made.

**PART A:** Short Questions.

Answer any **FOUR** of the following *eight* questions. Each question is worth 10 marks for a total of 40 marks.

**Question A.1: The Role of Fiscal Policy in Fighting Recessions (10 Marks)**

What is the key difference that causes Classical and Keynesian economists to have different views about the role of fiscal policy in fighting recessions? Make use of the AD-AS diagram to explain whether fiscal policy can fight a recession when a closed economy suffers from an adverse aggregate demand shock in terms of both Classical and Keynesian views.

**Question A.2: Predicting Future Nominal Exchange Rate (10 Marks)**

a) A Canadian investor is given the following data about some Canadian and EU financial variables (Canada is the home country): nominal interest rates $i_{CAN} = 4\%$ and $i_{EU} = 2\%$, and the nominal exchange rate $e_{nom} = 0.65$ (Euro per Canadian Dollar). Find the expected future nominal exchange rate ($e^f_{nom}$).

b) Assume that the relative PPP holds. Find the expected future nominal exchange rate ($e^f_{nom}$) if $\pi_{CAN} = 2\%$ and $\pi_{EU} = 1\%$.

c) Suppose that the interest rate parity yields an unbiased prediction of expected future nominal exchange rate. In general, why would the relative PPP predicts a different expected future nominal exchange rate compare to the one predicted by the interest rate parity, especially for low-inflation countries like Canada?

**Question A.3: Open-economy Trilemma and Overvalued Exchange Rate (10 Marks)**

a) When selecting an exchange-rate system, a country can choose only two of the three features based on the open-economy trilemma. What are these three features? Discuss the tradeoffs for having a fixed exchange rate regime as opposed to a flexible exchange rate regime.

b) Consider a small open economy with a fixed exchange rate regime. Suppose that the central bank lowers the domestic interest rate below the world interest rate. How does the central bank support an overvalued currency under a fixed exchange rate system? Make use of the appropriate diagram to relate official fixed exchange rate with the fundamental value of the exchange rate to help you discuss the tradeoffs based on the open-economy trilemma.

**Question A.4: Tax rebates, Consumption, and the Current Account (10 Marks)**

The US government plans to have a temporary tax rebate in 2008 in lump-sum amount of $600 per person. Assuming that 1) there is no change of government spending behaviour before and after the temporary tax rebate, 2) the US is a large open economy, and 3) the US is running a large current account deficit. How effective would this tax rebate be for stimulating private consumption in the US for 2008 when Ricardian Equivalence holds? What are the effects on the equilibrium real interest rate and the current account? Compare with the case when Ricardian Equivalence does not hold using savings-investment diagrams.

**Question A.5: Long-Run Economic Growth (10 Marks)**

a) Explain the difference between absolute and conditional convergence, relying also on figures to represent graphically these concepts.

b) Which factors might explain that some Countries' economic well-being does not seem to converge over time?

**Question A.6: Accounting for Growth (10 Marks)**

a) Briefly explain the Solow residual.

b) In the past ten years, Colombia's total output has increased from 3000 to 4000, the capital stock has risen from 4000 to 5500, and the number of workers has increased from 400 to 500. Suppose $\alpha_K = 0.4$ and $\alpha_N = 0.6$.

i. How much did capital contribute to economic growth over the decade?

ii. How much did labor contribute to economic growth over the decade?

iii. How much did productivity contribute to economic growth over the decade?

**Question A.7: Money (10 Marks)**

Briefly explain the three functions of Money and the factors affecting the demand for Money.

**Question A.8: Saving and Investment in a Large Open Economy (10 Marks)**

Illustrate the determination of the world real interest rate, when in the world there are only two large economies: the domestic one and the foreign (Rest of the World) economy.

**PART B:** Long Questions.

Answer any **THREE** of the following *six* questions. Each question is worth 20 marks for a total of 60 marks.

**Question B.1: Macroeconomic Policy in the Closed-Economy IS-LM-FE Framework (20 Marks)**

This question studies the effects of fiscal and monetary policy in a closed, Keynesian economy. The economy is characterized by the following:

$$\begin{aligned} C^d &= 280 + 0.6(Y - T) - 1300r \\ I^d &= 400 - 2700r \\ \frac{M^d}{P} &= 0.08Y - 200(r + \pi^e) \end{aligned}$$

The full-employment output $\bar{Y}$ is 1600, the expected rate of inflation $\pi^e$ is 0, and the nominal money supply $M$ is 124. Also, government purchases and taxes are $G = T = 100$.

(a) Derive the $FE$ curve, the $IS$ curve with real interest rate $r$ as a function of output $Y$, and the $LM$ curves with real interest rate $r$ as a function of output $Y$ and price level $P$.

(b) Using your equations, find the long-run equilibrium values of real output $Y$, real interest rate $r$, price level $P$, consumption $C$, and investment $I$. Illustrate the results using a $IS - LM - FE$ diagram to depict the long-run equilibrium.

c) Suppose that the government has decided to increase its spending $G$ from 100 to 300.

i) Derive the new $IS$ curve.

ii) Find the short-run equilibrium values of $Y$, $r$, $C$, and $I$ when the price is fixed.

iii) Find the long-run (general) equilibrium values of $Y$, $r$, $P$, $C$, and $I$.

iv) Illustrate the short and long-run equilibria using a $IS - LM - FE$ diagram.

v) How much investment $I$ is crowded out in the short-run and long-run?

(d) Suppose the central bank uses the nominal money supply as its policy instrument. The central bank has explicitly announced its policy goal to tolerate zero inflation, so that $\pi = \pi^e = 0$ at all time. How would the central bank react to the increase in government purchases in order to achieve its policy goal? How much would the nominal money supply be?

**Question B.2: A Numerical Example of the Open-Economy IS-LM-FE Framework (20 Marks)**

This question considers a small open-economy, which is characterized by the following:

$$\begin{aligned} C^d &= 230 + 0.7(Y - T) \\ I^d &= 500 - 1800r \\ e &= 5 + r - r_{for} \\ NX &= 1000 - 0.1Y - 200e \\ \frac{M^d}{P} &= 0.6Y - 600(r + \pi^e) \end{aligned}$$

The full-employment output $\bar{Y}$ is 1000, the foreign real interest rate $r_{for}$ is 0.1, the expected rate of inflation $\pi^e$ is 0.02, and the nominal money supply $M$ is 948. Also, government purchases and taxes are $G = T = 100$.

(a) Derive the $FE$ curve, the $IS$ curve with real interest rate $r$ as a function of output $Y$, and the $LM$ curves with real interest rate $r$ as a function of output $Y$ and price level $P$.

(b) Using your equations, find the long-run equilibrium values of $Y$, $r$, $e$, $P$, $NX$, $C$ and $I$. Illustrate the results using a $IS - LM - FE$ diagram to depict the long-run equilibrium.

c) Nowadays many people use the internet for online shopping. This phenomenon helps promoting economic transactions without the use of cash. Suppose that this new consumption trend reduces the demand of money to conduct transactions, so that the nominal money demand curve now becomes:

$$\frac{M^d}{P} = 0.48Y - 600(r + \pi^e)$$

i) Derive the new $LM$ curve.

ii) Find the short-run equilibrium values of $Y$, $r$, $e$, $NX$, $C$, and $I$ when the price is fixed.

iii) Find the long-run (general) equilibrium values of $Y$, $r$, $e$, $P$, $NX$, $C$, and $I$.

iv) Illustrate the short and long-run equilibria using a $IS - LM - FE$ diagram.

d) Suppose that the small open-economy chooses a fixed exchange rate system, and the central bank chooses to fix the real exchange rate at the long-run equilibrium value of $e$ you have found in part (b). When the economy faces the money demand shock as described in part (c), what should the central bank do to maintain the fixed exchange rate system if the central bank has the ability to control the nominal money supply? How much would the nominal money supply be? (Hint: For the case of a small open-economy under fixed exchange rate system, $r = r_{for}$ to prevent arbitrage opportunities which can cause the official rate to deviate from the fundamental value of the exchange rate.)

**Question B.3: Savings, Investment, and Current Account (20 Marks)**

Consider a world with only two countries, country $A$ and $B$. Output equals the full-employment level in each country. Suppose that country $A$'s expected future marginal product of capital is given by:

$$MPK^f = 370 - 5K$$

where $MPK^f$ is the expected future marginal product of capital, $r_A$ is the real interest rate, and $K$ is capital stock. The price of capital, $p_k$, is 400, and the depreciation rate, $\delta$, is 5%. The current capital stock $K$ is 50.

The consumption function for country $A$ is $C_A^d = 0.6Y_A - 20r_A$, where $C_A^d$ is the desired consumption, $Y_A$ is total output. There is no government purchases or taxes in country $A$.

(a) Find an expression for country $A$'s desired capital stock $K^*$ as a function of real interest rate $r_A$. Find an expression for country $A$'s desired gross investment $I_A^d$ as a function of real interest rate $r_A$ for country $A$. (Hint: Gross investment $I_A^d = K^* - (1 - \delta)K$.)

(b) Find an expression for desired national savings ($S_A^d$) as a function of real interest rate ($r_A$) and full-employment output ($Y_A$).

(c) Given that full-employment output $Y_A = 43.75$. Assume that country $A$ is a closed economy. Find the equilibrium real interest rate $r_A$, and equilibrium national savings and investment for country $A$.

Suppose that country $B$'s desired national savings ($S^d$) and desired investment ($I^d$) are given by:

$$S_B^d = 0.2Y_B + 200r_B, \qquad I_B^d = 40 - 100r_B$$

(d) Assume that country $B$ is a closed economy. Given that full-employment output $Y_B = 50$, find the equilibrium real interest rate $r_B$, and equilibrium national savings and investment for country $B$.

(e) Suppose that both countries can freely trade with each other without barriers, and can freely access the international market for borrowing and lending. Find the world real interest rate ($r_w$), and the current account balances for each country. Compare the world real interest rate to the real interest rates in part (a).

(f) Now suppose that country $B$'s full-employment output increases to $Y_B = 150$. Find the new equilibrium world real interest rate $r'_w$, and the new current account balances for each country. Compare to the results in part (e), how does the increase in country $B$'s full-employment output affect each country's current account balances? Make use of saving-investment diagrams for both countries to illustrate the impact of an increase in $Y_B$.

**Question B.4: Quasi-Solow Growth (20 Marks)**

Consider a simple variant of the Solow Growth model. The main difference from the standard model is in the aggregate production function, while all the other aspects are the same as in the Solow framework (and the steps in the solution of the model are the same). The aggregate production function is as follows:

$$Y_t = \alpha K_t + \beta N_t; \alpha > 0, \beta > 0$$

where $Y_t$ stands for output, $K_t$ for the aggregate capital stock, $N_t$ for the size of the labor force (there is no unemployment), and $\alpha$ and $\beta$ are two positive numbers. Notice that the aggregate production function is linear in the inputs (i.e. if you were to graph their marginal products, they would be constant and not decreasing as in the 'pure' Solow case). The labor force grows at rate $n$, capital depreciates at rate $d$, and the households save a constant fraction $s$ of their income.

a) Manipulate the aggregate production function to express output per worker $y_t$ as a function of the capital-labor ratio $k_t$.

b) Write the condition for a steady-state and find the expression for the steady-state capital-labor ratio $k^*$, assuming that $s\alpha < d + n$.

c) How much are the steady-state values of the output per worker, the consumption per worker and the investment per worker?

d) Represent graphically the effect of an increase in $\alpha$, that is in the marginal productivity of capital. Is there any effect on the steady state of the economy? Describe how the economy adjusts after the change in $\alpha$ and if the economy is going to have long run growth in the output per worker $y_t$.

e) Does it make sense to talk about the Golden Rule if the economy looks like the one in this exercise? (hint: you have to discuss three cases, depending on how $\alpha$ and $(d + n)$ relate to each other.)

**Question B.5: Money and Inflation (20 Marks)**

Suppose that a typical country's money demand function $M^d$ is given by:

$$M^d = PY^{0.5}$$

where $P$ stands for the price level and $Y$ for output.

a) What is the income elasticity of money demand?

b) If in the current year the price level is $P = 5$, output is $Y = 100$, how much does the money supply $M^s$ need to be for the velocity $V$ to be equal to 10?

c) Are the following money demand functions compatible with the Quantity Theory of Money? Why?

i) $M^d = PY^{0.5}$;

ii) $M^d = \sqrt{3.14Y}$;

iii) $M^d = \frac{1}{2}Y - \frac{1}{2}i$;

d) State a formula that predicts the inflation rate given the growth rates of the money supply and of real income.

e) How much is the predicted inflation rate if the money supply has been growing at 2.0% per year, while real output has been growing at 4.0% per year?

**Question B.6: Consumption over Three Periods (20 Marks)**

Assume that Bernanke's life can be divided into three periods: youth, adulthood and retirement. Denote with $Y_1, Y_2$ and $Y_3$ the income obtained in the first, second and third period, respectively. Similarly, denote with $TR_1, TR_2$ and $TR_3$ the transfers given to him by the government in the first, second and third period. Tax rates on income are denoted with $t_1, t_2$ and $t_3$ in the three periods, while $S_1, S_2$ and $S_3$ represent the savings in the three periods. Finally, $r$ stands for the interest rate.

Part A

a) Write the budget constraint for each of the three periods. (hint: assume that there are perfect capital markets, that is Bernanke can freely borrow and save in the first two periods at rate $r$, while he is going to have zero savings in the last period of his life.)

b) Derive the lifetime budget constraint. (hint: economic resources obtained two periods from now are discounted at rate $\frac{1}{(1+r)^2}$)

Part B

Consider the case where Bernanke has the following income profile during his life-cycle: $Y_1 = 500$ (from summer jobs), $Y_2 = 3000$ (from the FED stipend), and $Y_3 = 6000$ (from royalties on his book). Assume that there are no taxes and no transfers, that is $t_1 = t_2 = t_3 = 0$, and $TR_1 = TR_2 = TR_3 = 0$. Assume also that the interest rate $r$ is equal to $r = 100\%$.

Under the assumption of consumption smoothing (i.e. consumption is constant over the life-cycle and equal to $c^*$), find:

c) The Present Value of Lifetime Resources (PVLR).

d) The "No borrowing/No lending" points.

e) The level of consumption in each period.

f) Is this person going to be a borrower or a lender in the first period? And what about in the second period?

g) Redo points c) through f) when the interest rate $r$ is equal to $r = 0\%$, and all the other variables are unchanged.

Part C

Consider now the role of the government. More in detail, the government subsidizes Bernanke in his youth by giving him a transfer, but taxes him in the remaining two periods of his life. The income profile in the three periods is the same as in part B. The transfers now are $TR_1 = 1500$, and $TR_2 = TR_3 = 0$, while the tax rates over the life-cycle are now $t_1 = 0$, and $t_2 = t_3 = 50\%$. Denote with $B_1, B_2$ and $B_3$ the government's budget.

h) What is the PVLR under this new scenario?

i) What happens to Bernanke's consumption profile over the life-cycle (focusing again on the case of consumption smoothing)?

l) Compute the government's budget in each of the three periods (when every person in the economy looks like Bernanke), is the government running a deficit or a surplus in the three periods?