Department of Economics
Queen's University

**ECON320: Macroeconomic Theory II**
Instructor: Khazri Afifa

**mid-term exam**
Wednesday, October 18, 2004

**Section A** (40percent)**:** Read the following statements and indicate whether they are **True**, **False** or **Uncertain**. Briefly explain your answer. All questions have equal value. NO MARKS WILL BE GIVEN FOR UNSUPPORTED ANSWERS.

1**) In the Solow model, both capital growth and population growth have an effect on the steady state rate of growth in income per worker.**
**False**
In the Solow model, we find that only technological progress can affect the steady state rate of growth in income per worker. Growth in the capital stock(through high saving) has no effect on the steady state growth rate of income per worker; neither does population growth. But technological progress can lead to sustained growth.

2) **Changes in consumption are predictable if consumers obey the permanent-income hypothesis and have rational expectations.**
**False**
According to Hall 1976, the combination of the permanent income hypothesis and rational expectations implies that consumption follows a random walk:

$$C_{t+1} = C_t + \varepsilon_{t+1}$$

Changes in consumption reflect “surprises” about lifetime income. If consumers are optimally using all available information, then they should be surprised only by events that were entirely unpredictable. *Therefore, changes in their consumption should be unpredictable as well.*
The rational expectations approach to consumption has implications not only for forecasting but also for the analysis of economic policies. If consumers obey the permanent income hypothesis and have rational expectations, then only unexpected policy changes influence consumption. Hence, if consumers have rational expectations, policymakers influence the economy not only through their actions but also through the public’s expectation of their actions. Expectations, however, cannot be observed directly. Therefore, it is pften hard to know how and when changes fiscal policy alter aggregate demand.

3) **Keynesian cross model shows that the tax multiplier is greater than the government multiplier.**
**False**
The tax multiplier is:

$$Y = C(Y - T) + I + G$$

holding I and G fixed, differentiate to obtain

$$dY = C'(dY - dT)$$

$$\Rightarrow \frac{dY}{dT} = \frac{-C'}{1 - C'}$$

The government multiplier is

$$Y = C(Y - T) + I + G$$

holding I and T fixed, differentiate to obtain

$$dY = C'dY + dG$$

$$\Rightarrow \frac{dY}{dG} = \frac{1}{1 - C'}$$

Hence

$$\frac{dY}{dG} = \frac{1}{1 - C'} \rangle \frac{dY}{dT} = \frac{-C'}{1 - C'}$$

4) **The permanent-income hypothesis solves the consumption puzzle by suggesting that the standard Keynesian consumption function uses the wrong variable.**

**True**. According to the permanent-income hypothesis (PIH), consumption depends on permanent income; yet many studies of the consumption try to relate consumption to current income. According to the PIH, the average propensity to consume (APC) depends on the ratio of permanent income to current income. When current income temporarily rises above permanent income, the APC temporarily falls; when current income temporarily falls below permanent income, the APC temporarily rises.

**Section B** (60 percent) : Answer the two following **Long question:**

I) A consumer is making saving plans for this year and next. He knows that his real income after taxes will be \$30,000 in both years. Any part of his income saved this year will earn a real interest rate ( r ) of 10% between this year and next year. Currently the consumer has no wealth (no money in the bank or other financial assets, and no debts). There is no uncertainty about the future.

The consumer wants to save an amount this year that will allow him to (1) make university tuition payments (T) next year equal to \$8,400 in real terms; (2) enjoy exactly the same amount of consumption; and (3) have neither assets nor debts at the end of next year.

a) Make a general formulation of the problem

A general formulation of the problem is useful. With income of $Y_1$ in the first year and $Y_2$ in the second year, the consumer saves $Y_1$-C in the first year and $Y_2$-C in the second year, where C is the consumption amount, which is the same in both years. Saving in the first year earns interest at rate r. The consumer needs to accumulate just enough after two years to pay for college tuition, in the amount of T. so the key equation is :

$$(Y_1 - C)(1+r) + (Y_2 - C) = T$$

b) How much should the consumer save this year? How should he consume?

$$Y_1 = Y_2 = \$30{,}000$$
$$T = 8{,}400$$
$$r = 10\%$$
$$\Rightarrow (30{,}000 - C)1.1 + (30{,}000 - C) = 8{,}400$$
$$\Rightarrow (30{,}000 - C) = \frac{8{,}400}{2.1} = 4{,}000$$
$$\Rightarrow C = 26{,}000$$
$$\Rightarrow S = 4{,}000$$

c) How are the amounts that the consumer should save and consume affected by each of the following changes (taken one at a time, with other variables held at their original values)?

1- His current income rises from 30,000 to 32,100.

$$Y_1 = \$32{,}100$$
$$T = 8{,}400$$
$$r = 10\%$$
$$\Rightarrow (32{,}100 - C)1.1 + (30{,}000 - C) = 8{,}400$$
$$\Rightarrow 56{,}910 = 2.1C$$
$$\Rightarrow C = 27{,}100$$
$$\Rightarrow S = (Y_1 - C) = 5{,}000$$

This illustrate that a rise in current income increases saving

2- The income he expects to receive next year roses from 30,000 t0 32,100.

$$Y_2 = \$32{,}100$$
$$T = 8{,}400$$
$$r = 10\%$$
$$\Rightarrow (30{,}000 - C)1.1 + (32{,}100 - C) = 8{,}400$$
$$\Rightarrow 56{,}700 = 2.1C$$
$$\Rightarrow C = 27{,}000$$
$$\Rightarrow S = (Y_1 - C) = 3{,}000$$

This illustrate that a rise in future income decreases savings.

3- During the current year he receives an inheritance of \$525 (an increase of wealth not income).

$$Y_1 = Y_2 = \$30{,}000$$
$$T = 8{,}400$$
$$r = 10\%$$
$$W = \$525$$
$$\Rightarrow (30{,}000 + 525 - C)1.1 + (30{,}000 - C) = 8{,}400$$
$$\Rightarrow 55{,}177.5 = 2.1C$$
$$\Rightarrow C = 26{,}275$$
$$\Rightarrow S = Y_1 - C = 3{,}725$$

That illustrate that a rise in wealth decreases saving

4- The expected tuition payment for next year rises from \$8,400 to \$9,450.

$$Y_1 = Y_2 = \$30{,}000$$
$$T = 9{,}450$$
$$r = 10\%$$
$$\Rightarrow (30{,}000 - C)1.1 + (30{,}000 - C) = 9{,}450$$
$$\Rightarrow (30{,}000 - C) = \frac{9{,}450}{2.1} = 4{,}500$$
$$\Rightarrow C = 25{,}500$$
$$\Rightarrow S = 4{,}500$$

The rise in targeted wealth needed in the future raises current saving.

5- The real interest rate rises from 10% to \$ 25%.

$$Y_1 = Y_2 = \$30{,}000$$
$$T = 8{,}400$$
$$r = 25\%$$
$$\Rightarrow (30{,}000 - C)1.25 + (30{,}000 - C) = 8{,}400$$
$$\Rightarrow (30{,}000 - C) = \frac{8{,}400}{2.25} = 3{,}733$$
$$\Rightarrow C = 26{,}267$$
$$\Rightarrow S = 3{,}733$$

This illustrate that a rise in the real interest rate, with a given wealth target, reduces current saving.

II) In the United State, the capital share of GDP is about 30 percent; the average growth in output is about 3 percent per year, the depreciation rate is about 4 percent per year; and the capital-output ratio is about 2.5. Suppose that the production function is Cobb-Douglas: $y = k^{\alpha}$, so that the capital share in output is constant, and that the United states has been in a steady state.

**a. What must the saving rate be in the initial steady state?**

A Cobb-Douglas production function has the form $y = k^{\alpha}$, where α is capital's share of income. The question tell us that α = 0.3, so we know that the production function is $y = k^{0.3}$.
In the steady state, we know that the growth rate of output equals 3 percent, so we know that (n+ g) =0.03
The depreciation rate δ = 0.04
The capital-output ratio K/Y=2.5. Because k/y = [K/(L*A)]/[Y/(L*A)]=K/Y, we also know that k/y = 2.5.

Begin with the steady state condition, sy = (δ+ n +g)k. Rewriting this equation leads to a formula for saving in the steady state:

$$s = (\delta + n + g)(k/y)$$
$$s = (0.04 + 0.03)(2.5) = 0.175$$

The initial saving rate is 17.5 percent.

b. What is the marginal product of capital in the initial steady state?

$$MPK = \alpha/(K/Y)$$
$$MPK = 0.3/2.5 = 0.12$$

c. Suppose that public policy raises the saving rate so that the economy reaches the Golden Rule level of capital. What will the marginal product of capital be at the Golden Rule steady state? Compare the MPK at the Golden Rule steady state to the MPK in the initial steady state. Explain.

We know that at the Golden Rule steady state:

$$MPK = ( n+ g + \delta )$$

$$MPK = (0.03+0.04) = 0.07$$

At the Golden Rule steady state, the MPK is 7 percent, whereas it is 12 percent in the initial steady state. Hence, from the initial steady state we need to increase k to achieve the Golden Rule steady state.

d. What will the capital-output ratio be at the Golden Rule steady state?

$$MPK = \alpha /(K/Y)$$
$$K/Y = \alpha / MPK$$
$$K/Y = 0.3 /0.07 = 4.29$$

In the Golden Rule steady state, the capital-output ratio equals 4.29, compared to the current capital-output ratio of 2.5

e. What must the saving ratio be to reach the Golden Rule steady state?
In the steady state:

$$s = (n + g + \delta )(k/y)$$
$$s = (n + g + \delta )( K/Y)$$
$$s = (0.04+0.03)\ 4.29$$
$$s = 0.30$$

To reach the Golden Rule steady state, the saving rate must rise from 17.5 to 30 percent.