

---

# 14.02 Principles of Macroeconomics

## Problem Set 5 Solutions

### Spring 2003

---

#### Question 1: True/False/Uncertain

(based on the material in Chapters 19 and 20 of Blanchard)

Decide whether each of the following statements is True, False or Uncertain (ie. neither always true nor always false). Justify your answer, in a few lines or a simple diagram if appropriate.

- a) The larger the marginal propensity to import (w.r.t. domestic GDP), the smaller the multiplier.

*True: The multiplier is  $1/(1-c-m-d)$  where  $d$  is the marginal propensity to invest,  $m$  is the marginal propensity to import, and  $c$  is the marginal propensity to consume.*

- b) Trade deficits are problematic as they lead to a flight of capital (i.e. capital flows from the domestic economy to the rest of the world).

*False: Trade deficits can be thought of as a credit to a country, they lead to an influx of capital. The problem is that the foreign debt has to be paid back eventually.*

- c) Countries prefer expansions in foreign demand to expansions in domestic demand.

*True: Expansions in foreign demand lead to a reduction in the trade deficit, whereas expansions in domestic demand tend to increase the trade deficit.*

- d) Coordinated fiscal policies across countries avoid trade deficits.

*True: When countries conduct expansionary fiscal policies at the same time, this leads to a smaller increase or even no increase at all in the trade deficits of these countries. A country that conducts expansionary fiscal policy unilaterally definitely increases its trade deficit (provided that the Marshall-Lerner condition holds).*

- e) Given domestic inflation and the nominal exchange rate, inflation abroad tends to depreciate the real exchange rate.

*True: The rate of change of the real exchange rate is  $d\varepsilon/\varepsilon + dP^*/P^* - dP/P$ , and thus inflation abroad ( $dP^*/P^* > 0$ ) tends to increase the real exchange rate, which is a real exchange rate depreciation.*

- f) The J-curve implies that a depreciation will lead to an increase in the trade deficit in the long run.  
*False: If the Marshall-Lerner condition holds, a depreciation leads to a decrease in the trade deficit in the long run.*
- g) An increase in the government's budget deficit always leads to a deterioration of the trade balance.  
*False: Recall that  $NX = S - I + (T - G)$ . An increase in the government's budget deficit ( $G - T$ ) is associated with a deterioration of the trade balance only if private savings net of private investment ( $S - I$ ) are constant.*
- h) A depreciation leads to a decline in the trade deficit in the short run, and an increase in domestic GDP in the long-run.  
*False: The J-curve implies that depreciation leads to a deterioration of the trade balance in the short run, and a reduction of the trade deficit in the long run.*
- i) Monetary Policy is more effective (in terms of affecting GDP) under fixed exchange rates than under flexible exchange rates.  
*False: Under fixed exchange rates, there is no room for monetary policy.*
- j) Fiscal policy is more effective (in terms of affecting GDP) under flexible exchange rates than under fixed exchange rates.  
*False: Under flexible exchange rates, a fiscal expansion leads to an appreciation of the domestic currency, which partially offsets its effect on output. Under fixed exchange rates, expansionary fiscal policy is associated with expansionary monetary policy (precisely in order to offset the potential of an appreciation), and a given increase in public spending leads to a larger increase in output.*
- k) The appearance of twin deficits is typical in an economy with 1) flexible exchange rates 2) expansionary fiscal policy 3) restrictive monetary policy, assuming that the net effect of these policies on output is zero.  
*True: Expansionary fiscal policy leads to an increase in the budget deficit. Furthermore, as the net effect on output is assumed to be zero, the domestic interest rate increases, which leads to an appreciation, and thus a worsening of the trade deficit (assuming that Marshall-Lerner holds).*
- l) Maintaining a fixed exchange rate can be difficult as the foreign currency reserves of central banks are finite.

*True: Imagine that foreign investors anticipate a devaluation of the domestic currency in the near future. They will start to sell domestic bonds (i.e. sell the domestic currency), which puts pressure on the domestic interest to rise relative to the foreign interest rate. This puts pressure on the domestic currency to fall. In order to maintain the exchange rate, the central bank has to sell foreign currency for domestic currency. However, the amount of foreign currency the central bank has in reserve is limited, so that it might be forced to devalue once it runs out of the foreign currency reserves.*

m) The US trade deficit has declined in recent years.

*False: The US trade deficit has increased in the past years, see for example table 19.1 in Blanchard up to 2000.*

n) The degree of openness of the US economy has been very stable over the past century.

*False: The degree of openness of the US economy  $(IM + EX) / GDP$  has declined in the 1930's, and then more or less steadily increase after WWII.*

o) The US\$ exchange rate is fixed vis-à-vis the Euro.

*False.*

## Question 2: NAFTA and Fiscal Policy

The creation of NAFTA has led to the abolishment of many trade barriers between Canada and the US. Let's analyze the implications of NAFTA for macro policies.

Assume that the US economy is characterized by the following equations:

$$Y = C + I + G + X - IM$$

$$C = c_0 + c_1(Y - T)$$

$$I = I_0 + I_1Y$$

$$IM = mY$$

$$X = xY^*$$

Where the usual notation is used, and  $Y^*$  denotes Canada's GDP. For simplicity, we assume that Canada is the only trading partner of the US. Assume that  $c_1 + I_1 < 1$  and  $c_1 + I_1 - m > 0$ .

- 1) What is the impact of a change in Canada's GDP on the US GDP and the US trade balance? Explain.

We can solve for

$$Y = [1 / (1 - c_1 - I_1 + m)] \{c_0 + I_0 + c_1T + G + xY^*\}$$

$$NX = xY^* - m [1 / (1 - c_1 - I_1 + m)] \{c_0 + I_0 + c_1T + G + xY^*\}$$

So the multipliers are:

$$dY / dY^* = x [1 / (1 - c_1 - I_1 + m)]$$

$$dNX / dY^* = x \{1 - m [1 / (1 - c_1 - I_1 + m)]\}$$

Because of the assumption  $(c_1 + I_1 - m) < 1$ , it follows that  $dY / dY^* > 0$ : higher foreign demand increases domestic GDP.  $dNX / dY^* > 0$  if  $c_1 + I_1 < 1$ . There are two opposing effects: on the one hand, an increase in Canada's output increases the US output because exports are higher. On the other hand, higher US GDP leads to higher imports, which reduces US net exports. As long as  $m [1 / (1 - c_1 - I_1 + m)] < 1$ , the first effect dominates. We can rewrite this as  $c_1 + I_1 < 1$ , which is assumed to hold.

- 2) NAFTA increased trade between Canada and the US, i.e. an increase in  $x$  and  $m$ . How does such an increase in trade impact the results that you derived above? Explain.

Let's start with the foreign GDP multiplier:  $dY / dY^* = x [1 / (1 - c_1 - I_1 + m)]$ . An increase in the propensity to export clearly increases the dependency of US GDP on Canada's GDP:  $d^2Y / (dY^* dx) > 0$ . An increase in the propensity to import decreases the dependence of US GDP on Canada's GDP, i.e.  $d^2Y / (dY^* dm) < 0$ . This is because a higher propensity to import leads to a stronger demand of US

households for Canadian products. Thus, when  $m$  is large, an increase in  $Y^*$  leads to stronger demand for Canadian products from the US.

Provided that  $c_1 + I_1 < 1$ , a higher propensity to export clearly increases net exports  $d^2NX / (dY^* dx) > 0$ : higher  $x$  means that a boom in Canada leads to more US exports, which reduces US current account deficits. A higher propensity to import by the US leads to a higher current account deficit, i.e.  $d^2NX / (dY^* dm) < 0$ . The reasoning is as follows: higher GDP in Canada leads to higher exports from the US to Canada, which increases US GDP, leading to higher imports of the US, which worsens the current account deficit. So the overall effect of NAFTA on the current account deficit is ambiguous.

3) Now let's study the effectiveness of fiscal policy. Does an increase in  $m$  and  $x$  due to NAFTA lead to a more or less effectiveness of fiscal policy? Explain.

The multipliers w.r.t  $dG$  are:

$$\begin{aligned} dY / dG &= 1 / (1 - c_1 - I_1 + m) \\ dNX / dG &= - m [1 / (1 - c_1 - I_1 + m)] \end{aligned}$$

Fiscal policy clearly becomes less efficient with an increase in the propensity to import, and the current account worsens more  $d^2NX / (dG dm) < 0$ . The reason is that part of the expansionary fiscal policy is spent on Canadian products, which reduces the effectiveness of US fiscal policy, and worsens the current account impact of expansionary fiscal policy.

Now assume that the following macroeconomic model characterizes Canada's economy:

$$\begin{aligned} Y^* &= C^* + I^* + G^* + X^* - IM^* \\ C^* &= c_0^* + c_1^* (Y^* - T^*) \\ I^* &= I_0^* + I_1^* Y^* \\ IM^* &= m^* Y^* \\ X^* &= x^* Y^* \end{aligned}$$

Assume from now on that  $x < (1 - c_1 - I_1 + m)$  and  $x^* < (1 - c_1^* - I_1^* + m^*)$ .

4) Solve for US' GDP as a function of  $(G, G^*, T, T^*)$ , and the parameters. Interpret. Check your answer by showing that when  $m = x = 0$ , the usual equations of the closed economy apply.

From part 1), we know:

$$\begin{aligned} Y &= [1 / (1 - c_1 - I_1 + m)] \{c_0 + I_0 + c_1 T + G + x Y^*\} \\ Y^* &= [1 / (1 - c_1^* - I_1^* + m^*)] \{c_0^* + I_0^* + c_1^* T^* + G^* + x^* Y\} \end{aligned}$$

These are 2 equations in 2 unknowns  $Y$  and  $Y^*$  of the form:

$$Y = a + b Y^* \qquad Y^* = a^* + b^* Y$$

The solution is:

$$Y = [a + b a^*] / \{1 - b b^*\} \quad Y = [a^* + b^* a] / \{1 - b b^*\}$$

Replacing gives the solutions for  $Y$  and  $Y^*$ :

$$Y = \left[ \frac{1}{1 - c_1 - I_1 + m} \right] \{c_0 + I_0 + c_1 T + G\} \\ + x \left[ \frac{1}{1 - c_1 - I_1 + m} (1 - c_1^* - I_1^* + m^*) \right] \{c_0^* + I_0^* + c_1^* T^* + G^*\} \\ \times \left[ \frac{1}{1 - (x x^* / (1 - c_1 - I_1 + m)(1 - c_1^* - I_1^* + m^*))} \right]$$

There are thus 3 terms. The first term is the US autonomous demand, multiplied by the open economy multiplier. The second term is the autonomous demand of Canada, multiplied by the Canadian and the US multiplier as well as the propensity of the US to export to Canada. This term comes from the fact that if Canadian demand changes, it has a multiplier effect in Canada as well as the US. The impact to the US, however, is only proportional to the fraction that the US imports from Canada. The third term is an additional multiplier term (that is always positive per assumption). It captures the fact that any change in autonomous demand in one country has a multiplier effect in the other country via a change in imports. It is clear that the economies are very interdependent, anything that happens in Canada affects the US and vice-versa.

In the closed economy when  $x$  and  $m$  are 0, the solution boils down to:

$$Y = \left[ \frac{1}{1 - c_1 - I_1} \right] \{c_0 + I_0 + c_1 T + G\}$$

This is the usual equation in the closed economy.

- 5) What is the impact of US fiscal policy on US GDP? How does the degree of openness impact the effectiveness of fiscal policy? Interpret, and compare with your answers from part 3).

US fiscal policy:

$$dY / dG = \left[ \frac{1}{1 - c_1 - I_1 + m} \right] \\ \times \left[ \frac{1}{1 - (x x^* / (1 - c_1 - I_1 + m)(1 - c_1^* - I_1^* + m^*))} \right]$$

The role of imports can be seen from the first multiplier  $1 / (1 - c_1 - I_1 + m)$ : a higher propensity to import makes US fiscal policy less effective, and this is because the increase in public spending is partially spent on Canadian products. This effect was analyzed in part 3).

A higher propensity to export in Canada makes fiscal policy more effective: an increase in  $G$  increases US demand, and thus Canadian exports, which are US imports. A higher propensity to export in the US also makes fiscal policy more efficient, as the increase in US demand, that leads to an increase in Canadian demand, increases US exports more strongly. Thus increases in the propensity to export are good for the efficiency of fiscal policy, but increases in the propensity to import are bad. This is different than in question 3), where exports did not matter. They matter now, as the effect on Canada's GDP of US fiscal policy is taken into account.

- 6) What is the impact of Canadian fiscal policy on US GDP? How does the degree of openness impact the effectiveness of fiscal policy? Interpret, and compare with your answers from part 2).

*The impact of Canadian fiscal policy on US GDP again has two parts, and import multiplier and an export multiplier.*

$$dY/dG^* = x / [(1 - c_1 - I_1 + m)(1 - c_1^* - I_1^* + m^*) - x x^*]$$

*The impact of Canadian fiscal policy on US GDP is thus positive. This is reminiscent of the findings in part 2). An increase in the propensity to import lowers the impact of Canada's fiscal policy on the US, whereas an increase in the propensity to export increases the impact of Canada's fiscal policy on the US.*

## **Question 2:**

Assume that a country has a fixed exchange rate.

- 1) What are the implications of this exchange rate policy for the domestic interest rate?

*The domestic interest rate equals the world interest rate.*

- 2) In an IS-LM diagram, show the effects of an expansionary monetary policy for this economy. Explain. What are the capital flows implied by this policy? What happens to the trade deficit?

*See pp. 428-429 in Blanchard.*

- 3) In an IS-LM diagram, show the effects of an expansionary fiscal policy. Explain. What are the capital flows implied by this policy? What happens to the trade deficit?

*See pp. 429-430 in Blanchard.*

- 4) How would your answers change if the country had flexible exchange rate policy?

*See pp. 423-425 in Blanchard.*