Econ 434 Professor Ickes

Fall 2005

Midterm Exam I

Answer Sheet

1. *(20%) Use the two-country model of interest rate determination to examine the implications (what happens to the interest rate and current account balances of each country) of:*

   (a) *current account imbalances caused by a glut of foreign savings*

   brief answer It is useful (but not essential) to start out with $CA_{\text{home}} = CA_{foreign} = 0$ at the initial world interest rate r_0^W. A glut in foreign savings shifts the savings function to S_1^* in figure 1. At the old world interest rate the sum of current account balances is positive, so this cannot be an equilibrium. The world interest rate must fall to r_1^W where we have $CA_{\text{home}} = cd < 0$ in the home country and $CA_{foreign} = ab > 0$ in the foreign country. So r^W falls. Home has current account deficit, foreign has current account surplus.

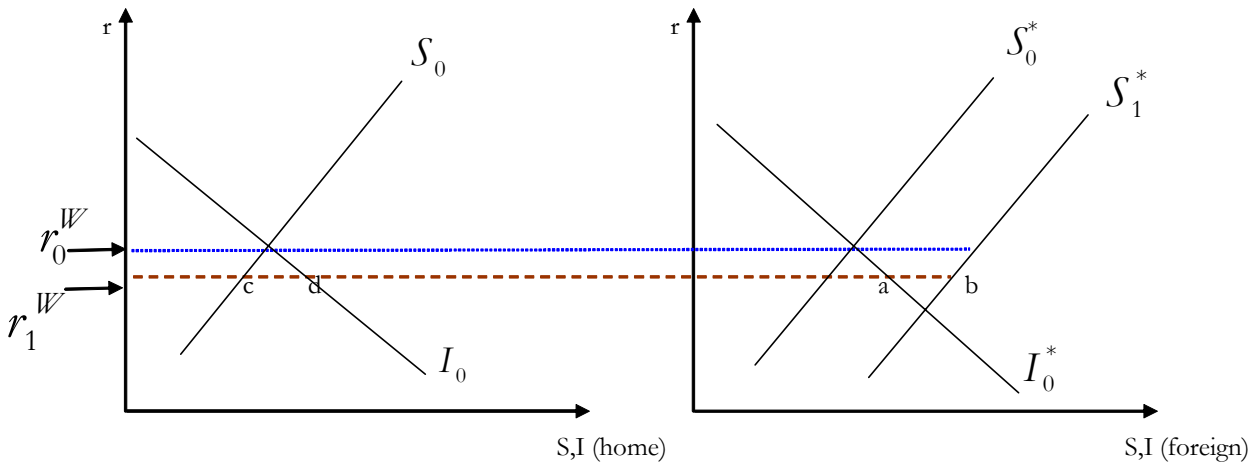

Figure 1: Two-Country Model

   (b) *current account imbalances caused by a decline in domestic savings*

   brief answer We follow the same method as in part (A) but I refrain from drawing the picture. Now it is home savings that shifts to the left. This causes r^W to increase. In the home country $CA_{\text{home}} < 0$, and $CA_{foreign} > 0$ in the foreign country. So the pattern of imbalances is identical to part (a) but the interest rate rises rather than falls.

   (c) *current account imbalances caused by a decline in foreign investment.*

brief answer Again start with the same initial equilibrium. Now it is the foreign investment function that shifts left as in figure 2. Notice that the left panel is the same as in figure 1.And notice again that there is a current account surplus in the foreign country and deficit in the home country. Indeed, I can copy the line from part (a): $CA_{\text{home}} = cd < 0$ in the home country and $CA_{foreign} = ab > 0$ in the foreign country. So r^W falls. The reason I did this is to show that a decline in

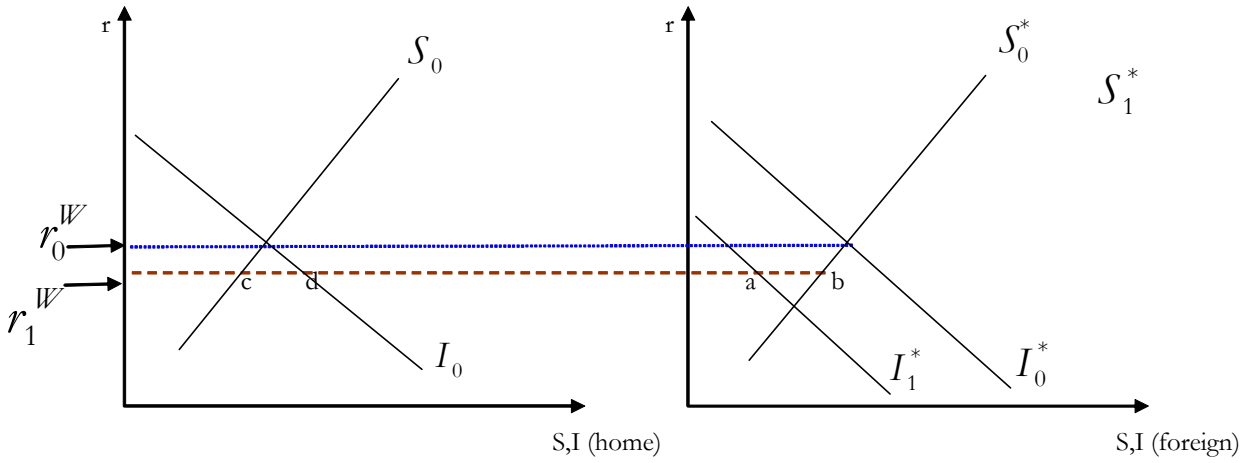

Figure 2: More Two-Country Model

foreign investment or an increase in foreign savings has the same implications for the pattern of current accounts and interest rates.

(d) *current account imbalances caused by a surge in domestic investment.*

brief answer This is going to be like part (b) except now it is domestic investment which shifts to the right. This causes an excess of investment over savings in the home country, and this must cause r^W to increase, which causes the current account balance in the foreign country to rise. Notice that in all four cases we have $CA_{\text{home}} < 0$, and $CA_{foreign} > 0$, the key difference is that in parts (a) and (c) r^W falls, and in parts (b) and (d) it rises.

2. *(30%) Consider the dynamic model of the current account balance. Suppose that initially, the home and foreign country have identical levels of productivity and savings rates. So the transition equation, $k_{t+1} = (1-\alpha)(1-\beta)A_t k_t^{\beta}$, is identical in both countries. Now suppose that the savings rate in the foreign country (α^*) goes up.*

(a) *What happens to the world steady state capital-labor ratio?*

brief answer there was an error in the question. I said the savings rate increases, but I wrote α^* increases. This, however, is the consumption rate, the savings rate is $1-a^*$. We will grade the answer as correct whether you answered according to the prose or the notation. I will give the answer according to the prose. If you answered the question according to the notation, just flip the countries or change up to down.

brief answer It rises. With $1-\alpha^*$ higher, world savings is higher. Recall that world savings depends on the weighted average of savings in each country,$\overline{\alpha} = \frac{N\alpha+N^*\alpha^*}{N+N^*}$ (see page 21 of the current account part one lecture). The transition equation for the world is given by $k_{t+1} = (1-\overline{\alpha})(1-\beta)A_t k_t^{\beta}$, so this shifts up implying a higher steady state world capital-labor ratio.[1]

(b) *What happens (initially and over time) to the current account balance in the home country when α^* rises? What happens (initially and over time) to the current account balance of the foreign country? Which country will experience net capital inflows?*

brief answer Capital will flow in from the foreign country. If it did not the higher savings there would earn a lower rate of return. So the current account balance will fall in the home country. The foreign country will have a current account surplus: their savings will exceed their investment. The net capital inflow will be in the US. Over time the current account deficit in the US will shrink to zero and the trade surplus will equal the interest payments on the net debt. The adjustment follows the pattern of figure 3 (which is more than required for the answer of course).

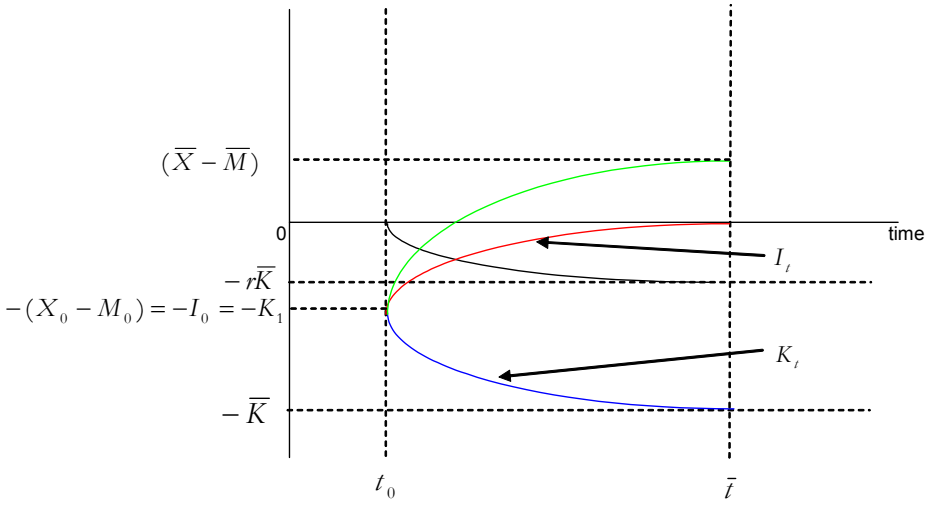

Figure 3: Adjustment to the Steady State

(c) *How does this analysis compare to what would happen, starting in the same initial equilibrium, if (with α^* unchanged) the government in the home country imposed a tax equal to f per worker? Assume that the government wastes the revenue by throwing it in the ocean?*

brief answer There is one key difference. Now the world capital-labor ratio will fall. The pattern of current accounts and net capital flows will be identical, however. The transition equation for the home country is now $k_{t+1} = (1-\alpha)(1-\beta)A_t k_t^{\beta} - f$. In a closed economy k would fall, raising the rate of return. In the open economy capital will flow from the foreign country to the home country attracted by higher returns.

[1] If you solve for the steady-state capital-labor ratio you get $\overline{k} = [(1-\alpha)(1-\beta)A_t]^{\frac{1}{1-\beta}}$. so if $(1-a^*)$ increases, $\overline{k}$ increases.

Of course the world k must fall because the resources are thrown away. The dynamic picture, however, is exactly as in figure 3.

3. *(25%) We can define the real exchange rate as* $Q = \frac{SP^*}{P}$*, where* S *is the dollar price of foreign currency and* P^* *is the foreign price level. Explain how would* Q *change if:*

   (a) *World demand shifted towards US produced goods.*

   brief answer This is directly from page 14-15 of the current account lecture part two. The shift in demand at current exchange rates would cause an excess demand for US goods, since the supply has not changed. To restore equilibrium the relative price of US goods must rise relative to foreign goods; hence, Q must fall, and the dollar has appreciated in real terms. In other words, the purchasing power of the dollar has increased relative to foreign goods

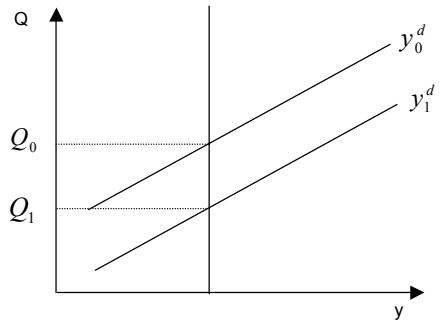

Figure 4: An Increase in the Demand for Domestic Goods

   (b) *US government spending increased.*

   brief answer The answer is identical to part (a) since government spending is essentially on non-traded goods. The governments buys goods at home more than abroad (we buy some Kuwaiti oil but most government spending is on domestic goods and services). The relative price of US goods must thus rise.

   (c) *A technological shock increased US output relative to world output.*

   brief answer This is taken directly from page 15 of the current account lecture part two: Suppose that there is a relative technological shock that increases the efficiency of US output relative to foreign output. With given stocks of capital and labor US output rises. Hence, at unchanged world demand there is an excess supply of US output. Why? This positive supply shock raises US income (wealth), but not all of the increase in income is spent on domestic goods. Some will be spent on foreign goods. Hence, the increase in the demand for US goods will be less than the supply. To restore equilibrium the relative price of US goods must fall; in other words, Q must rise, and the dollar must fall in real terms. This real depreciation of the dollar (or real appreciation of the foreign currency, say the DM) means that the purchasing power of the foreign currency has increased. Thus relative productivity

growth causes the real exchange rate to appreciate and the real value of the currency to depreciate. We have figure 5. Notice that if all the increase is spent on domestic goods (no imports) then the demand for US goods increases as much as the supply and there is no change in Q.

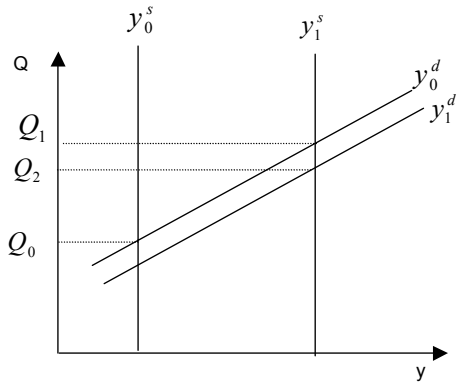

Figure 5: A change in relative supply

(d) *Under what conditions would Q be invariant (unrelated) to any of the factors in parts a through c? Explain.*

brief answer If there were no non-traded goods then the real exchange rate would not change. None of these phenomena would effect the relative price of US goods, since US and foreign goods would have the same price!

4. *(25%) If a country currently has negative net foreign assets what does the intertemporal budget constraint imply about the future? Explain.*

brief answer It means that the present value of the sum of future trade surpluses must be positive. The constraint is just

$$(1+r)K_t^f = \sum_{s=t}^{t+T} \left(\frac{1}{1+r}\right)^{s-t} [C_s + I_s + G_s - Y_s]$$

so if we have negative net foreign assets the LHS is negative, which means that the RHS must be negative. The term in the brackets is the trade deficit (net imports). So this means that the present value of all future trade deficits must be negative, or the present value of all future trade surpluses must be positive. And of course it must equal the value of the initial net debt.

Why does the intertemporal budget constraint imply only weak restrictions on the current account? Explain. What does weak mean in this context?

brief answer The budget constraint does not say when the trade balance must go into surplus. It only says that sometime in the future it must go. There are many (infinitely) many paths for the trade balance that would satisfy this constraint. It is interesting to know that the trade balance must eventually go to surplus, but we want to know more. It is weak because it tells us nothing about how soon this must happen, or how long we can postpone adjustment.

An alternative notion of sustainability concerns changes in the ratio of net foreign assets to GDP (which we denote k_t^f). Explain this notion and why it is more informative.

brief answer The numerator is what we owe and the denominator is a measure of our ability to pay. So it is natural to think that if this ratio is stable that our ability to finance the debt is stable.

Using this notion, answer the following:

a. *How do future movements in the path of the trade balance effect sustainability? Explain.*

brief answer If the trade balance improves that improves sustainability. The trade deficit represents the current additions to net debt so obiously an improvement will help. The trade surplus is the equivalent of repayments of the debt. An improvement in the path of the trade balance can be thought of as a faster pace of repayment of debt. Kind of like paying off a mortgage faster.

b. *How does an increase in the rate of interest effect sustainability? Explain.*

brief answer If r rises the burden of debt will grow faster. The change in k depends on two factors: the trade balance itself since this adds to debt as in (a) and the legacy effect. That is, even if the trade balance is zero the stock of debt will still grow because of interest on the debt. So if the interest rate rises, net debt will grow faster, everything else held constant. Hence, a rise in the interest rate makes any current account deficit less sustainable.

c. *How does an increase in the rate of growth of income effect sustainability? Explain.*

brief answer It increases sustainability. The rate of growth of income is the rate of change of the denominator. It it rises then the ability to pay is growing faster so we can repay any debts more easily.

d. *Suppose that the rate of return on gross foreign assets (A) exceeds the rate of interest on gross foreign liabilities (L). What implications does this have for sustainability? Explain. Can an economy reasonably rely on this effect for an indefinite period of time? Explain.*

brief answer If $r_A > r_L$ we may be earning positive interest income. Whether we do or not also depends on how large is L relative to A. If we are, then this will enhance sustainability. Net foreign assets (K_t^f) are just equal to assets less liabilities, so $K_t^f = A_t - L_t$. Hence, net interest payments are $rK_t^f = r_A A - r_L L$.So if $r_A > r_L$ net interest payments will be reduced if A is not too much smaller than L, enhancing the sustainability of the deficit. But it is not reasonable to rely on this indefinitely. A large source of these gains is the capital gain due to unexpected currency depreciation. Since our assets are typically valued in foreign currency an unexpected depreciation makes the dollar value of these assets rise. But our liabilities are in dollars, so there is no impact. The problem is that if foreigners expect the dollar to depreciate they will charge a higher price of lending to us, wiping out this source of gain. In general, if our net debt gets so large than our ability to repay is doubted foreigners will want to be compensated for lending to us and r_L will rise.

extra note Here is a simple way to see how the size of the net debt effects this exhorbitant privelege. Bigger net debt means that L rises relative to A. We know that $rK_t^f = r_A A - r_L L$. So for this to be positive implies:

$$\begin{aligned} r_A A - r_L L &= r_A(A-L) + (r_A - r_L)L \\ &= r_A K_t^f + (r_A - r_L)L > 0 \end{aligned}$$

So,

$$(r_A - r_L)L > -r_A K_t^f$$

or

$$\frac{r_A - r_L}{r_A} > -\frac{K_t^f}{L} = -\frac{A-L}{L}$$

or

$$1 - \frac{r_L}{r_A} > -\frac{K_t^f}{L} = -\frac{A-L}{L} \tag{1}$$

Since $r_A > r_L$ by assumption this means that $1 - \frac{r_L}{r_A} > 0$. Now suppose that $r_A = .06$ and $r_L = .04$. Then $1 - \frac{r_L}{r_A} = 1 - \frac{2}{3} = 33\%$. What about the left hand side. In the US gross liabilities are approximately equal to GDP, so $L \approx Y$, hence $\frac{K_t^f}{L} \approx k_t^f$ which we know is currently -26%. Thus condition (1) is satisfies since $0.33 > -(-0.26)$. But suppose that net debt was 40% of gdp. Then condition (1) is no longer satisfied and we are earning negative net interest income. The problem is that even though the rate of return on assets is higher than liabilities we have too few assets relative to liabilities.