Problem Set 5
Due: Wednesday, October 20.

Answers

Question 1. (5 points each) True, false or uncertain? Give a brief but careful explanation.
a) A country with a high imports to GDP ratio must be more open than a country with a low exports to GDP ratio.
   UNCERTAIN. Even with a low import share, a country still might be subject to heavy foreign
   competition. If the share of tradeable goods is large, than domestic firms might charge lower prices
   and thus keep their foreign competitors out and the import share low. Still, it can be a substantially
   open economy.
   b) Investors should prefer to buy government bonds from countries where interest rates are high.
   FALSE. You also need the (expected) exchange rate movements.
   c) To go from nominal to real exchange rate movements of the US dollar vs the French franc, the
   only extra information we need is the difference of the two country’s inflation rate.
   TRUE. Using the notation from the textbook, $e = \frac{E P^*}{P}$. So movements in the real exchange rate
   come from movements in $E$ or in $\frac{P^*}{P}$. This latter means the difference in the change of $P$ and $P^*$,
   which is the difference in inflation.
   d) The importance of foreign exchange markets is entirely due to the magnitude of international
   trade transactions.
   FALSE. The daily amount of foreign exchange necessary for trade transactions is less than 10%
   of the entire volume of foreign exchange transactions.
   e) If a country saved a lot in the past, like Kuwait, then its GNP may substantially exceed its
   GDP. However, it is never possible to have a lower GNP than GDP.
   FALSE. Although the first part is right, but the second statement is clearly false: if a country’s
   citizens do not own anything abroad, but a large part of the country’s capital was invested by foreign
   firms, than the country’s GDP will be higher than its GNP. Moreover, the world sum of GDPs and
   GNPs should be equal (plus minus statistical discrepancies), so if one country’s GNP is higher than
   its GDP, there must be at least one country where the opposite holds.

Question 2 (20 points) Current and Capital Accounts
In 2139, the Martians engaged in the following transactions. They sold ice to Jupiter for MCU 20
million (Martian Currency Unit), and to Uranus for MCU 3 million. They bought natural water from
Earth for MCU 10 million, and stardust from Saturn for MCU 12 million. The Interstellar
Committee gave a grant of MCU 5 million to Mars, but also required a membership contribution of
MCU 1 million. Mars lent MCU 10 million to Venus, and a Neptunian firm invested MCU 3 million
on Mars. A Mercurial investment bank bought MCU 5 million of Martian Government Bonds. Martian banks paid MCU 3 million as interest to their Plutonian lenders.

Write the balance of payments for Mars in 2139. What did Martians do with their excess of exports over imports?

**Planet Mars, Balance of Payments, year 2139**

**Current Account**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>20 +3 (ice)</td>
</tr>
<tr>
<td>Imports</td>
<td>10+12 (water and stard.)</td>
</tr>
<tr>
<td>Trade Balance</td>
<td>+1</td>
</tr>
<tr>
<td>Investment income received</td>
<td>0</td>
</tr>
<tr>
<td>Investment income paid</td>
<td>3</td>
</tr>
<tr>
<td>Net investment income</td>
<td>-3</td>
</tr>
<tr>
<td>Transfer payments received</td>
<td>5</td>
</tr>
<tr>
<td>Transfer payments paid</td>
<td>1</td>
</tr>
<tr>
<td>Net transfers received</td>
<td>+4</td>
</tr>
<tr>
<td><strong>Current Account Balance</strong></td>
<td>+2</td>
</tr>
</tbody>
</table>

**Capital Account**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in foreign holdings of Martian assets</td>
<td>3+5 (for. inv. and gov’t bonds)</td>
</tr>
<tr>
<td>Increase in Martian holdings of foreign assets</td>
<td>(loan) 10</td>
</tr>
<tr>
<td>Net increase in foreign holdings (net capital inflow)</td>
<td>-2</td>
</tr>
</tbody>
</table>

The current account surplus came from a trade surplus, positive net transfer inflow, and a smaller net investment income outflow. This was matched up by a net decrease of foreign holdings of Martian assets, which means that the Martians have invested their surpluses “abroad”.

**Question 3 (25 points) Uncovered and Covered Interest Parity**

The US interest rate is 5% today. This is a rate at which you can freely lend or borrow any amount of dollars. The current exchange rate between dollars and German marks is 1 DM=0.7 USD.

a) (5 points) You expect that a year from now, a German mark will worth 0.72 dollars. What is the value of the German interest rate that is consistent with this expectation (i.e., that satisfies the uncovered interest parity condition)? Note: with these numbers given, you should use the exact “zero profit condition”, and not its approximate version.

Starting with 1DM today, I can get 0.7 USD. Investing that in US bonds gives me 0.735 dollars next year. I expect that to buy $\frac{0.735}{0.72} = 1.0208$ DM at that point. The uncovered interest parity condition tells us that this should be the same amount as one would get by investing in German bonds, so the German interest rate should be 2.08%.

b) (10 points) Assume that the actual German interest rate is below that level. Can you suggest a way for making positive expected profits? (Hint: You can lend or borrow dollars at the given US interest rates; and similarly in marks.) Is it a riskless profit opportunity?
The recipe is the following. Borrow 100 German marks at the going rate (they are relatively cheap). That gives you 70 dollars. Invest that in US bonds, so in a year, you will have 73.5 dollars. Change them back to marks, that gives you 102.08 marks. Now you have to repay your loan, but by assumption, your obligation is smaller than 102.08 marks, since the German interest rate is below 2.08%. So you will end up earning a positive profit. The last key step is to do this with 100 million German marks instead...

However, this is not a riskless profit: if your expectations turn out to be incorrect, and a year from now, 1 DM is 0.75 USD, than you will have only $\frac{73.5}{0.75} = 98.0$ marks. That is less than your original amount, let alone the interest you must pay. This is why the uncovered interest parity condition is sometime called the risky no arbitrage condition.

c) (10 points) Suppose that you have access to the forward market in foreign exchange. This means that you can agree to buy or sell currencies one year from now at a predetermined price, called the forward rate. So you can, for example, buy dollars today, invest in US bonds, and exchange your future proceeds at a currently predetermined price. Assuming that the German interest rate is 3%, what is the forward rate consistent with zero profits in such transactions? If the rate is different from that value, is there a way to earn positive profits without any risk? Note: just like in part a), use the exact condition, not its approximate version.

Starting with 1DM, I get 0.7 USD. So I will have 0.735 a year from now. Selling that future dollars at a rate of $F$, I will have $0.735 \times F$ marks a year from now. That should be equal to $1.03$ (investing the 1 DM in German bonds), so $F = \frac{0.735}{1.03} = .71359$.

Suppose the rate is, say, below that. Then you borrow 100 marks, get 70 dollars for that, 73.5 in a year, and you agree already today to sell that amount for $73.5 / F$ marks. By assumption, that is more than 103, so you can repay your loan and keep the rest of the money. If the rate is above that level, then you have to borrow in dollars and do the investment in marks. In both cases, your profit is positive under all circumstances, so it is a riskless profit opportunity. This is why the uncovered interest parity condition is sometimes called the riskless no arbitrage condition.

As the failure of the covered interest parity would enable investors to earn positive amount without any risk, it is reasonable to assume that these arbitrage opportunities are eliminated quite soon, meaning that the forward rates (and/or the interest rates) quickly adjust to their levels consistent with covered interest parity. This is actually the case with data. For the uncovered interest parity, however, neither the argument nor the evidence is this supportive.

**Question 4 (30 points) The Goods Market in an Open Economy**

Consider our aggregate demand equation:

$$Z = C(Y - T) + I(Y, r) + G + NX$$

Write $NX = X - \varepsilon Q$ ($\varepsilon$ is the real exchange rate).

a) (5 points) What are the units of Q here?

Since $Z$ is measured in units of 'average US production mix', and $\varepsilon$ has units of (assuming foreign means German) $\frac{DM}{US \ times \ average \ German \ product}$, $Q$ is measured in units of average German (foreign) production mix.

If demand were given in nominal term, and $\varepsilon$ replaced by $E$, the nominal exchange rate, then $Q$ would be measured in foreign currency. If you indicated clearly that you were using this assumption, partial credit (3).was given.

b) (10 points) How should X respond to changes in $\varepsilon$, $Y$ and $Y^*$ (foreign output)? How about Q? Explain.

There is no strong reason for X responding to Y directly. If $Y^*$ goes up, meaning that foreigners are wealthier, then part of their increased demand will fall on our goods, so exports go up. If $\varepsilon$ increases, it means that our goods are becoming cheaper, so foreigners can allow themselves to buy more from us, X goes up.
As our exports do not respond directly to changes in our income, nor do imports to foreign income. When $Y$ increases, we have more income, and part of our increased demand falls on foreign goods, so $Q$ increases. If $\varepsilon$ rises, then foreign goods are relatively more expensive for us, so we can afford less of them, hence $Q$ decreases.

We can summarize all these as $X = X(Y^*, \varepsilon)$, $Q = Q(Y, \varepsilon)$, with $X_{Y^*} > 0$, $X_\varepsilon > 0$, $Q_Y > 0$, $Q_\varepsilon < 0$.

c) (5 points) What happens to $NX$ as $\varepsilon$ increases?

Start from $NX = X - \varepsilon Q$. If $\varepsilon$ rises, then $X$ goes up, $Q$ goes down. However, we have the extra term $\varepsilon$ as well: so the change in $\varepsilon Q$ is ambiguous, hence the response of $NX$ is ambiguous.

d) (10 points) Suppose that the goods market is initially in equilibrium, so $Y = Z$. Assuming that $\varepsilon$ and $Y^*$ are fixed, consider an increase in $G$. What happens to the trade balance (i.e., $NX$)? (Hint: use graphs or words, not algebra.)

When $G$ increases, that shifts the $Z$ line up (in the $Z$-$Y$ diagram). Going through the multiplier, that increases $Y$. An increase in $Y$ raises imports, leaves exports unchanged, so $NX$ goes down, the trade balance worsens. The conclusion is that a budget deficit is likely to induce a trade deficit as well.

Note: With $NX$ going down, the $Z$ line actually moves back towards its original position. Cannot it by accident ”overshoot” and go below its original level? The answer is no: suppose the final output level is below the original. Then $NX$ is higher than originally, $G$ is higher than initially, so $Y$ should also be higher. Consequently, the trade balance worsening can at most completely undo the increase in $G$, but it cannot ”more than undo” it.