Intermediate Macroeconomics 311, Professor Larry Christiano
Homework 6, due May 8, 2000, 2 PM
SOLUTION

QUESTION 1 (ex. 5 page 360 in Blanchard)

a) 9,615.38*(1+i)=10,000 i=.04 (4%)
12,698.1*(1+i^*)=13,333 i^*=.05 (5%)

b)
$$i = i^* + \frac{E^e - E}{E}$$
$$E^e = (i - i^* + 1)E = .99 * .95 = .94$$

c) If the dollar is expected to depreciate against the DM, it means that $\frac{E^e - E}{E} > 0$. Since the interest rate on German bonds is bigger than the interest rate on US bonds this, would make German bonds even more attractive.

d) The realized return from holding the US bond is simply the nominal interest rate i=.04. The return, in dollars, from buying the German bond is:
$$i^* + \frac{E^e_{t+1} - E_t}{E_t} = .05 + \frac{.90 - .95}{.95} = -.002$$
i.e. a loss of 0.2%.

e) The difference in returns found in d) is consistent with the UIP.
The UIP states that, ex-ante, the agents **expect** the domestic bond and the foreign bond to deliver the same return, measured in domestic currency. Ex-post, when the uncertainty about the exchange rate is realized, the **actual** returns will be in general different.

Assume that the exchange rate can take only one of two values at t+1, E_{t+1}=.9 with probability .5 and E_{t+1}=.98 with probability .5. This is consistent with the expected exchange rate computed in b), since E^e=.5*.9+.5*.98=.94. If at t+1 the exchange rate turns out to be .9, the return on the investment in German bonds is -0.2% as computed in d). If the exchange rate at t+1 is .98, the return on the investment in German bonds is 8.2%. Hence the expected return is .5*8.2+.5*(-0.2) = 4%, the same as the return on an investment in US bonds. No matter what will be the exchange rate at t+1, the actual return will not be equal to the expected return.

QUESTION 2 (ex. 6 page 360 in Blanchard)

a) Consider the following two options:

1- use 1US$ to buy one US bond, which pays a gross nominal interest rate of (1+i);

2- use 1 US$ to get 1/E DM; buy 1/E German bonds, which pay a gross nominal interest rate of (1+i^*); sell (at date t) the proceedings at the forward exchange rate F.

For ruling out arbitrage the return on the two operations described above has to be the same. While the arbitrage argument that gives the UIP involves that the agents are facing an exchange rate risk, since they do not know E at t+1, in the operation described above everything is known at t, and the agents are "covered" against the exchange rate risk. The following equation, where the left-hand side is the return from operation 1 above, and the right-hand side is the return from 2, is a formal statement of the no-arbitrage argument:

$$(1+i) = (1+i^*)\frac{F}{E} = (1+i^*)\left(\frac{F}{E} - 1 + 1\right) = (1+i^*)\left(\frac{F-E}{E} + 1\right) = 1 + i^* + \frac{F-E}{E} + i^*\frac{F-E}{E}$$

The last term. $i^*\frac{F-E}{E}$, is close to 0.

So the Covered Interest Parity (CIP) condition can be approximated by $i = i^* + \frac{F-E}{E}$.

b) If the CIP and the UIP both hold, this implies that the forward exchange rate is equal to the expected spot rate:

$F=E^e=.94$

c) Suppose F>.94. From the equation derived in a), the left hand side will now be larger than the right-hand side.
I can borrow 1 US$ at the interest rate i, use it to buy DM marks, and buy a German bond. At the same time I can sell DM forward, so that at t+1 I will have the (1+i) US$ I need to pay back my debt, and I will be left with some extra profit. Since I can make profits borrowing 1 US$, I can make 1,000 bigger a profit by borrowing 1,000 US$, and everybody else on the market can do the same. This implies that, given the interest rates and the spot exchange rate, there is an excess demand for US$ forward. This will make the US$ to appreciate forward, i.e. F will decrease, to the point where all the profit opportunities have been arbitraged away and the CIP holds with equality.
An analog argument works for the case F<.94.

d) Surprises in the exchange rate do not affect the return of a covered operation, since all the terms are know at date t, including the forward exchange rate.