Professor Christiano 362, Winter 2002

Suggested Answers to Midterm

1. (a) the UIP can be derived under the assumption that portfolio managers only compare different assets in terms of their expected rate of return and international financial markets are very efficient. These assumptions imply that if different assets are to be traded, then they must all generate the same expected return. No one would hold an asset with a low expected rate of return. As a result, $(1+R) = (1+R^*)E^e/E$, that is, the return on the domestic asset must equal the expected return on the foreign asset, when the latter is measured in dollar terms. The UIP is just a linear approximation to this relationship.

(b) The return on the foreign bond, represented in US dollars is $(1 + R^*)E'/E$, where E' is the actual exchange rate, three months from now. Although the American investor knows how much foreign currency he/she will have at the end of a year, $(1 + R^*)/E$, he/she does not know how many dollars that will translate into because he/she does not know what E' will be. So, in dollar terms the foreign bond looks risky, whereas the domestic bond is risk-free. The American investor could eliminate that risk by entering the forward market where the price of a unit of foreign currency to be delivered one year from now is F, say. Using the forward market, the dollar return on the foreign asset is $(1 + R^*)F/E$.

(c) Given the derivation above, it should be obvious that E^e is the expected value of the exchange rate one year ahead. This is because the timing of E^e is associated with the date on which R^* pays off. That is one year from now.

(d) To figure this out, draw the tent-shaped diagram with money demand on the right and the UIP relation on the left. Because the jump in M is only temporary, the future value of the exchange rate remains unchanged. So, the UIP relation does not shift. The increase in the money supply drives down R, which then leads to a depreciation of the currency (i.e., rise in E). (e) Now, the UIP relation does shift because E^e rises by 5%. With the shift up in UIP, the initial jump in E is greater than before. Over time, as P rises, M/P falls back to where it was before, restoring the old rate of interest, and putting us at a permanently higher value of the exchange rate.

(f) The exchange rate approaches its long-run value from above because the domestic rate of interest is temporarily lower. During this time, Emust be expected to fall according to the UIP, so that the rates of return on foreign and domestic assets is expected to be the same, when measured in dollar terms.

- 2. Investment corresponds to expenditures by firms on things like factories and equipment. These are expensive items that are expected to produce a rise in revenues eventually and over time. But, they do not generate enough revenues right away to pay for themselves. This is why investment expenditures must be financed by using other people's saving. Private, household saving, S^p , is defined as Y - T - C. Government saving is defined as T - G. Total domestic saving, S, is S = Y - T - C + T - G = Y - C - G. Then, I - S = I - Y + C + G = 50. Thus, domestic investment exceeds domestic saving by 50. Note that 50 also corresponds to the excess of domestic expenditures over domestic production. Thus, there is a trade deficit, with foreigners accumulating 50 in claims against Americans. They have to hold these claims in some form. Most likely, foreigners would convert these claims into interestbearing assets, such as perhaps equity claims. In this way, they supply precisely the funds needed over and above domestic saving, which business managers need to finance their investment.
- 3. (a) The rate of return from 0 to 1 is $(P_1 + D_1)/P_0$. This is risky because, even though the period 1 payoff on the asset is known at the beginning of period 0, P_1 is not known then. When $D_2 = 0$ then we know $P_1 = 0$, i.e., the asset has no value at the end of period 1. As a result, the oneperiod rate of return is D_1/P_0 , something that is known at the time the asset is purchased.

(b) In dollar terms, the one-period rate of return on the asset when D_1 is known is D_1/P_0 . In consumption good terms, the payoff is D_1/P_1^c . The cost is P_0 in dollar terms and so it is P_0/P_0^c in real terms. So, the

real rate of return is $(D_1/P_0)(P_0^c/P_1^c)$. Although the asset is risk-free in nominal terms, it is risky in real terms, to the extent that there is uncertainty in P_1^c .

- 4. Write the money demand equation as $f(R)Y^{\gamma}$. The percent change in this in the long run when R is a constant, is $\gamma \hat{Y}$, where \hat{Y} is the percent change in Y. Then, the money market condition, (2), implies $\hat{M} - \pi = \gamma \hat{Y}$. If the inflation target is π^* then the required amount of money growth is $\pi^* = \hat{M} - \gamma \hat{Y}$. Evidently, the income elasticity of demand is needed to determine what value of \hat{M} is required to achieve an inflation target.
- 5. When R = 0, then bonds and money are perfect substitutes and households are indifferent between the two. When the Fed increases the money supply by purchasing government debt, there is no need for the interest rate to change for people to be happy with the new mix between money and bonds in their portfolios. In our setup, the only way a change in the money stock affects the rate of interest is by changing the interest rate. As a result, the setup predicts that when R = 0, monetary policy has no effect on the rate of interest.
- 6. It is not literally a puzzle for the theory, because the theory requires that the Japanese be *expected* to appreciate when Japanese rates are below US rates. In principle, it is possible that traders have been continually surprised by the persistent depreciation of the Yen that has been observed recently. Still, a sensible person might argue that the persistent depreciation of the yen surely must have convinced traders to start expecting it to continue depreciating. If so, then the behavior of the data is a puzzle from the point of UIP. If traders expect the yen to depreciate, then under UIP Japanese citizens should be holding US assets instead of Japanese assets. In doing this, they would benefit twice: (i) they would be taking advantage of the higher US interest rate and (ii) they could expect to make more money on the round trip through the foreign exchange market, as the dollar appreciates. Perhaps the UIP is actually false, and Japanese citizens understand that most likely they would make money twice using (i) and (ii). But, they are afraid of the risk that they would actually lose money in the

round trip in case they were unlucky and the Yen actually *appreciated* big time.

7. Conjecture that the new interest rate is constant. Then, the money demand equation implies that inflation drops by 1 percentage point. According to PPP, $(E^e - E)/E$ drops by 1 percentage point. (This confirms the conjecture, because it drops to a new, lower level that is constant.) From UIP, the domestic interest rate drops by 1 percentage point. The the fall in the interest rate, the money demand equation implies that M/P jumps to a higher level. This means that at the time of the fall in money growth, P drops. The PPP relation implies that E drops at the same time. So, E and P both drop and then experience a one percentage point drop in their growth rate.