## Chapter 11 Review Questions

1. Explain why the theory of purchasing power parity is often referred to as the law of one price.

Purchasing Power Parity (PPP) is referred to as the law of one price because the determination of the exchange rate implies that similar tradable goods cost the same regardless of where they are purchased.

If the price of domestic and foreign tradable goods were P and P^* respectively, then the cost of foreign goods in domestic currency terms would be $E\,P^*$ where E is the nominal exchange rate. The law of one price thus states that exchange rates are determined so that $P = EP^*$. PPP is upheld by arbitrage in the goods market which acts to close any international price differences (arbitrage is the simultaneous act of selling the good where it is expensive and buying it where it is cheap- making a riskless trading profit- these trades though enact price changes that close the arbitrage opportunity). Therefore deviations from the law of one price can only exist temporarily.
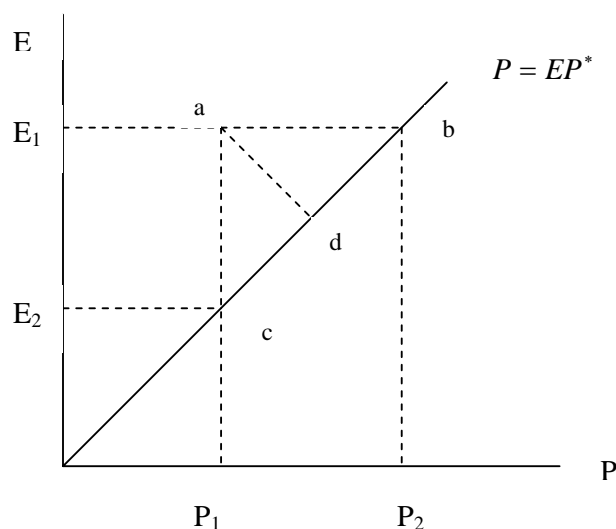

At point a: $EP^* > P$, so domestic goods are cheaper than foreign goods. There are three possible paths that can restore the law of one price.

a to b: increased demand for domestic goods raises prices to P_2 (price adjustment), $P_2 = E_1P^*$.
a to c: increased relative demand for sterling to purchase cheaper domestic goods sees an exchange rate appreciation E_1 to E_2 (exchange rate adjustment) so that $P_1 = E_2P^*$.
a to d: a mixture of both price and exchange rate adjustments.
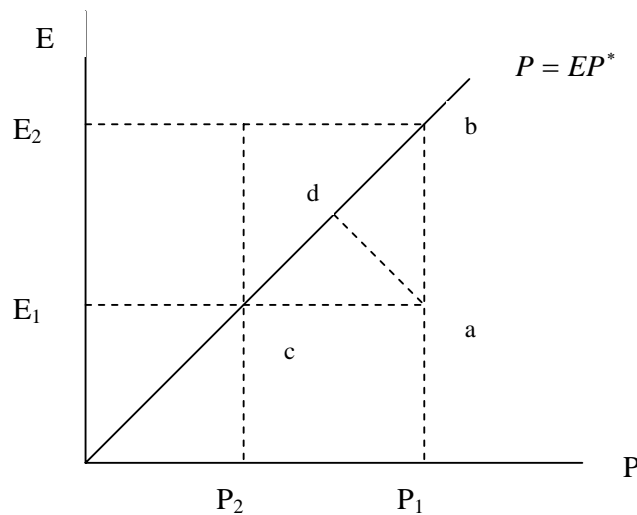
Alternatively, consider the case where at point a, $EP^* < P$ domestic prices are higher than those overseas in terms of the same currency. There are again three paths that can restore the law of one price.

a to c: falling demand for domestic goods reduces prices to P_2 (price adjustment), so that $P_2 = E_1P^*$.
a to b: Falling demand for sterling to purchase domestic goods sees a depreciation of the domestic currency E_1 to E_2 depreciation (exchange rate adjustment), $P_1 = E_2P^*$.
a to d: a mixture of both price and exchange rate adjustments

Exchange rate adjustment is normally considered to be stronger than price adjustment. This is primarily because international currency markets are more competitive than domestic goods markets, so prices respond much faster to changes in demand.

The law of one price also establishes that the real exchange rate (R) is constant in the long run.

I.e. if $P = EP^*$, then $R = EP^*/P = 1$.

2. According to PPP what would happen to the exchange rate under the following circumstances.

a. An increase in the overseas money supply

If the quantity theory of money holds true then changes in the money supply have a directly proportional impact on the price level.

$$\%\Delta M^* = \%\Delta P^*$$

According to the theory of PPP the exchange rate is determined so that $P = EP^*$.

Hence: $\%\Delta E \approx \%\Delta P - \%\Delta P^*$, this is the relative PPP condition.

The domestic exchange will appreciate in roughly the same proportion as the overseas increase in the money supply.

$$\%\Delta M^* = \%\Delta P^* = -\%\Delta E$$

b. A reduction in the margins on domestic goods prices

If domestic prices are set as a mark up over domestic marginal costs, $P = (1 + \mu)MC$ then changes in this margin will have a direct impact on the domestic price level.

Given that the exchange rate is defined by the ratio of domestic and overseas price levels $E = \dfrac{P}{P^*}$ then $\%\Delta P = \%\Delta E$. The domestic exchange rate will again appreciate.

c. What would happen to the real exchange rate in each instance?

The real exchange rate is defined as the ratio of foreign to domestic prices when both are expressed in the same currency:

$$R = \frac{EP^*}{P}$$

Therefore, the change in the real exchange rate can be approximated as follows:

$$\frac{\Delta R}{R} \approx \frac{\Delta E}{E} + \frac{\Delta P^*}{P^*} - \frac{\Delta P}{P}$$

In part a. the increase in foreign prices is offset by an appreciation in the exchange rate leaving the real exchange rate unchanged.

$$\frac{\Delta P^*}{P^*} = -\frac{\Delta E}{E}$$

$$\frac{\Delta E}{E} + \frac{\Delta P^*}{P^*} = 0 \text{ hence } \frac{\Delta R}{R} = 0,$$

In part b, the fall in domestic prices is offset by a nominal appreciation, again leaving the exchange rate unchanged.

$$\frac{\Delta P}{P} = \frac{\Delta E}{E}$$

$$\frac{\Delta E}{E} - \frac{\Delta P}{P} = 0 \text{ hence } \frac{\Delta R}{R} = 0$$

This confirms that PPP theory predicts a constant long run real exchange rate.

3. The domestic interest rate falls, so that it stands 3% below the overseas' interest rate. This interest differential is expected to remain for one year. According to the theory of uncovered interest parity, what would be the effect on the domestic exchange rate?

The effect of a temporary 3% interest differential $\left(r - r^* = -3\% \right)$ on the path of the exchange rate can be shown using demand and supply analysis.

Initially foreign bonds offer higher interest rates. Therefore, domestic consumers switch to foreign bonds and foreign investors repatriate funds. As a result the demand for foreign currency rises and the supply of foreign currency falls.
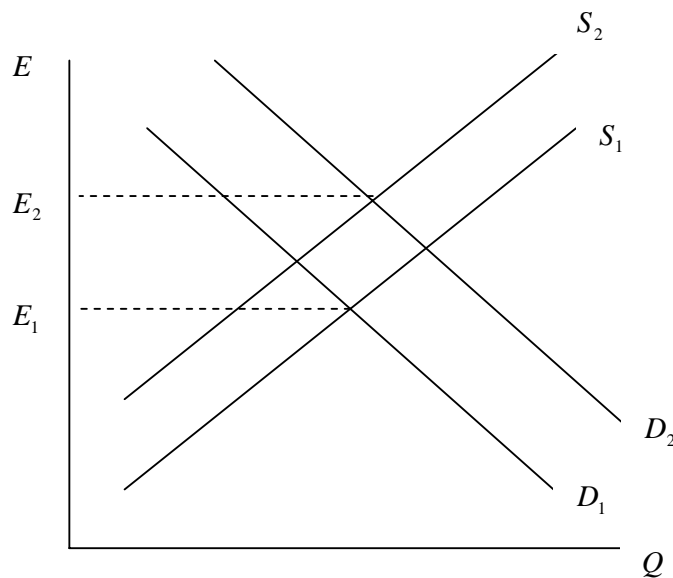
The domestic currency then depreciates $\left(E_1 \rightarrow E_2 \right)$ - i.e. the price of foreign currency relative to domestic currency rises.

In one year's time the interest differential disappears. The rise in domestic interest rates reverses the demand and supply shifts seen before and as a result the exchange rate returns to its original position.
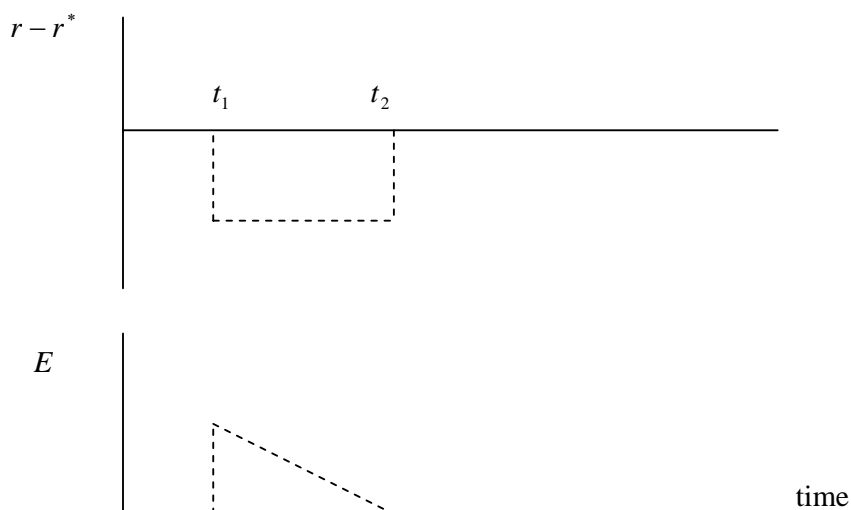
How much is the initial depreciation?

The answer is 3% due to uncovered interest parity (UIP). The returns from holding foreign assets consist of the interest they pay plus the capital gains or losses made when converting these gains back into domestic currency. The capital gains/losses arise from a depreciation/appreciation in the domestic currency whilst the investor held foreign assets.

If the depreciation is greater than 3%, say 4%, then the return on foreign bonds relative to domestic bonds is 3% - 4% = -1%. In this case it pays to switch back into the domestic currency so it appreciates.

If depreciation is less than 3%, say 2%, then excess return on foreign bonds are 3%-2% =1%. As a result the domestic currency depreciates further because investors still face a positive incentive to switch from domestic to foreign assets.

Only if there is a depreciation of 3% is there no pressure for the exchange rate to change further. The movement in the exchange rate acts to equalise the returns on financial assets regardless of which currency they are expressed in. Because financial markets are considered to be large and competitive, arbitrage ensures that UIP holds in the short run. Otherwise unexploited arbitrage opportunities will exist.

Therefore, $\dfrac{\Delta E^e}{E} = r - r^*$, the expected change in the interest rate is equal to the difference between domestic and foreign interest rates.
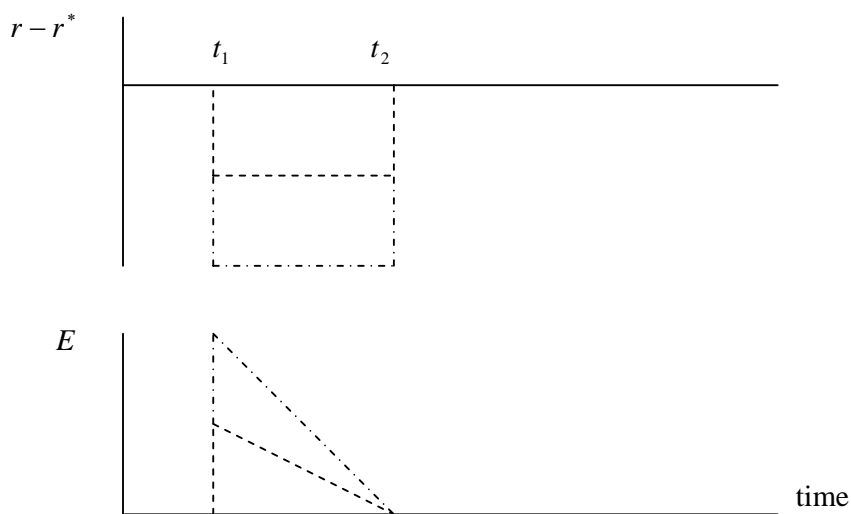
What if?

a) If the interest differential was 6%

Quite simply the initial depreciation of the domestic currency would be 6%. From UIP, the expected change in the exchange rate would be a 6% appreciation.

$$\frac{\Delta E^e}{E} = r - r^*,$$

hence for a 6% appreciation to exist there must be an initial 6% depreciation.


b) the 3% interest differential lasted for 2 years

This would also produce an initial depreciation of approximately 6%. This is because UIP holds in each period. Therefore, for the first year a 3% interest differential creates an expectation of a 3% appreciation. The same will situation will occur in the second period. Therefore, over the cause of two years foreign bonds will pay roughly 6% more in interest, but the 6% appreciation in the domestic exchange rate over the same period creates capital losses equal to this interest rate premium.

If the initial exchange rate depreciation was less than 6%, then the expected appreciation would be less than 6% and hence the capital losses from holding foreign bonds would not offset the interest rate premium. Consequently it would be profitable to switch from domestic to foreign bonds which would lead to an exchange rate depreciation.

If the initial depreciation were greater than 7%, then capital losses from holding foreign bonds exceed the interest rate gain. There is a movement into domestic bonds

and the exchange rate appreciates. Only at an initial depreciation of 6% does the currency market remain in equilibrium.
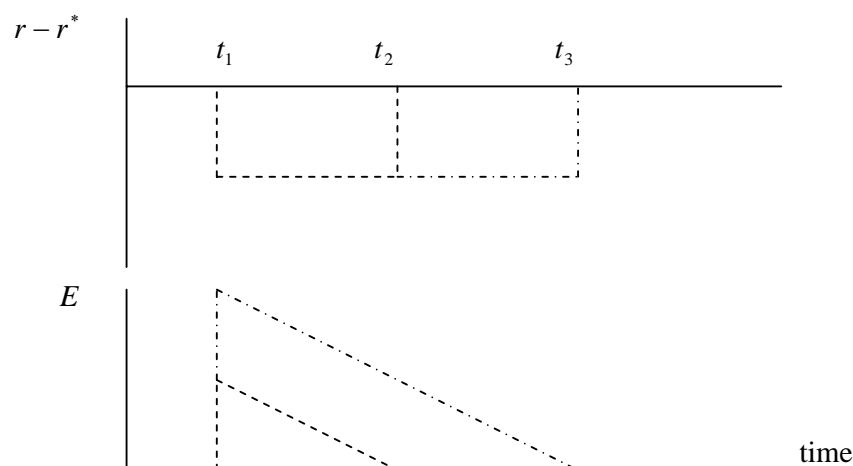
c) There was a 5% risk premium attached to domestic bonds

From UIP you might deduce that $r - r^* = 5\%$, hence the domestic exchange rate will appreciate by 5%. However, the 5% premium on domestic bonds simply represents the compensation for holding riskier assets- perhaps because the risk of default is greater. Therefore, in risk-adjusted terms interest rates remain the same as the overseas' rate, so there would be no movement in the exchange rate.

$$\% \Delta E = \frac{\Delta E}{E} = r - \mu - r^* = 0 \text{ if } r - r^* = 5\% \text{ but the risk premium } \mu = 5\% .$$

4. In the Financial Times, you notice that interest rates in the UK are 6 percent, whereas in the US they are currently only 3 percent. A friend has proposed a 'get rich quick' scheme where you borrow from the US banks and reinvest in UK banks, and make a profit on the difference in interest rates. Is this plan likely to work?

According to the predictions of uncovered interest parity (UIP) this won't work. In order to exercise this plan it is necessary to borrow from the US bank in US dollars and convert the funds into British pounds in order to deposit them in UK banks. This transaction will lead to a change in the exchange rate that will offset the interest differential.

According to UIP, over the period in which $r - r^* = 3\%$ the US dollar will appreciate by 3% relative to the British pound. Therefore, paying back the US dollar loan will require 3% more British pounds- completely offsetting the interest premium. As soon

as the interest differential arises the British pound will appreciate by 3% against the US dollar, creating the expectation of a subsequent 3% depreciation.

Profits can only be made if you are exceptionally quick to spot the differential and can act on it before it is arbitraged away. It is assumed that financial markets are very competitive and highly liquid, so competing investors can react vigorously to profit from any arbitrage opportunity. However, their actions act to close the profits by moving prices towards equilibrium. Therefore, the exchange rate would be expected to jump almost instantly- but for the very early movers there is a chance that these transactions can be undertaken before the exchange rate has moved sufficiently. In this case there are profits to be made.

5. Under what conditions will devaluation in the exchange rate improve the current account?

The necessary condition is that the Marshall-Lerner condition is satisfied. That is the sum of the price elasticities of exports and imports sum to greater than unity.

An exchange rate depreciation raises the costs of imports in domestic currency terms as $\uparrow E \Rightarrow \uparrow (EP^*)$. It also lowers the cost of domestic goods in terms of foreign currency $\uparrow E \Rightarrow \downarrow (P/E)$. In terms of the balance of trade this has two effects:

Substitution: as domestic goods become cheaper relative to foreign goods in world markets, imports will fall and exports rise. This will improve the balance of trade.

Terms of trade: The rise in the price of imported goods raises lowers the terms of trade- so each imported good now costs more. This effect deteriorates the balance of trade.

For devaluation to improve the balance of trade, it must be the case that the substitution effect outweighs the terms of trade effect. Therefore, changes in the terms of trade must elicit sufficient substitution from foreign to domestic goods. This is most likely to happen when imported and exported goods are price elastic, so demand is relatively sensitive to price changes. This is the essential principal behind the Marshall-Lerner condition.

The Marshall-Lerner condition is most likely to be satisfied in the long run, rather than the short run. Due to the time involved in undertaking search, price elasticities of demand are likely to be larger in the longer run. This gives rise to a J-curve type effect in the trade balance following a depreciation.

In the short run imports and exports are relatively price inelastic, so a devaluation sees the terms of trade effect dominate and the trade balance deteriorates. However, over time the price elasticities rise and the devaluation starts to create sufficient substitution to improve the trade balance.

The Marshall-Lerner condition is considered a necessary but not sufficient condition. Sufficient conditions would also take into effect the following:

- Absorption effects: a rise in net exports raises domestic income, some of which is then spent on imports.

- Pricing to market: firms may alter the mark up on their products to prevent exchange rates from altering their prices in international markets.

- Real wage resistance: an increase in import prices raises the overall price level in the economy and reduces the real wage of households. If workers push for higher nominal wages to maintain the value of the real wage, then this will feed through into the prices of domestic goods altering the international terms of trade.

More advanced problems

6. 'Purchasing power parity (PPP) is a long run theory of the exchange rate' Discuss.

There are various points to make:

The law of one price is driven by arbitrage in the good market- this however is reliant on households successfully searching for the cheapest goods prices. Because this search takes time- it is likely that deviations from the law of one price might be persistent.

The evidence tends to suggest that in the short run exchange rates are more volatile than prices- whereas PPP theory argues that they should share a common variance. It therefore appears to be the case that short run exchange rates react to more than just relative prices.

The Dornbusch model of overshooting is one possible explanation (see the response to question 7 below). This model is consistent with PPP holding in the long run, but in the short run exchange rates are driven by uncovered interest parity (UIP). Given that financial markets are likely to be larger, more liquid and more competitive, it is easy to justify that UIP will have more validity as a model of exchange rate determination in the short run.

7. What factors account for high exchange rate volatility in the short run?

Empirical evidence suggests that in the short run exchange rates are more volatile than prices. One explanation, according to the Dornbusch overshooting model, is that exchange rates over-react to changes in the money supply when prices are rigid.

The Dornbusch model works by exploring the interaction between the UIP and PPP theories of exchange rate determination. If there is an increase in the money supply then from the Quantity Theory of Money there is a proportional change in the price level. $\%\Delta M = \%\Delta P$. In this case there is no change in the real money supply and interest rates remain constant:

$$\frac{M_1}{P_1} = \frac{M_2}{P_2}, \quad \Delta r = 0$$

$$M_1^s(M_1/P_1) \qquad M_2^s(M_2/P_1)$$

r

r_1

r_2

$$M^D(r,Y)$$

$$M^d, M^s$$
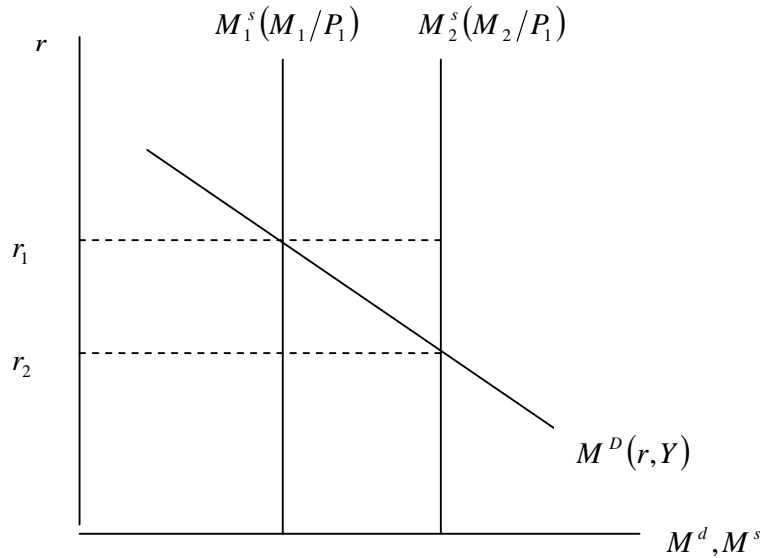
Then according to PPP, $\%\Delta P = \%\Delta E$, hence prices and exchange rates exhibit the same degree of volatility.

However, suppose that in the short run prices adjust slowly so that the Quantity Theory of Money does not hold.

$$\%\Delta M > \%\Delta P$$

As a result a nominal expansion in the money supply also leads to a real expansion, putting downward pressure on equilibrium interest rates in the money market.

$$\frac{M_1}{P_1} < \frac{M_2}{P_1}, \quad \Delta r = r_2 - r_1 < 0$$

From UIP, there is now an expectation of exchange rate appreciation $\%\Delta E^e = r - r^*$.

In the long run though prices are assumed to fully adjust, so the real money supply will fall, interest rates rise, and the exchange rate will depreciate in view of the higher price level and the predictions of PPP.

When prices adjust slowly, the interaction of UIP and PPP though creates a situation where an expansion in the money supply leads to a short run expectation of appreciation, but a long run depreciation. The only way these two facets can be

reconciled is if the exchange rate over depreciates its long run level in the short run. Therefore, $\%\Delta P < \%\Delta E$ as the empirical evidence indicates.

(A)

M

M_2

M_1

t_0

(C)

r

r_1

r_2

t_0 t_1

(B)

P

P_1

P_2

t_0 t_1

(D)

E

E_O

E_2

E_1

t_0 t_1
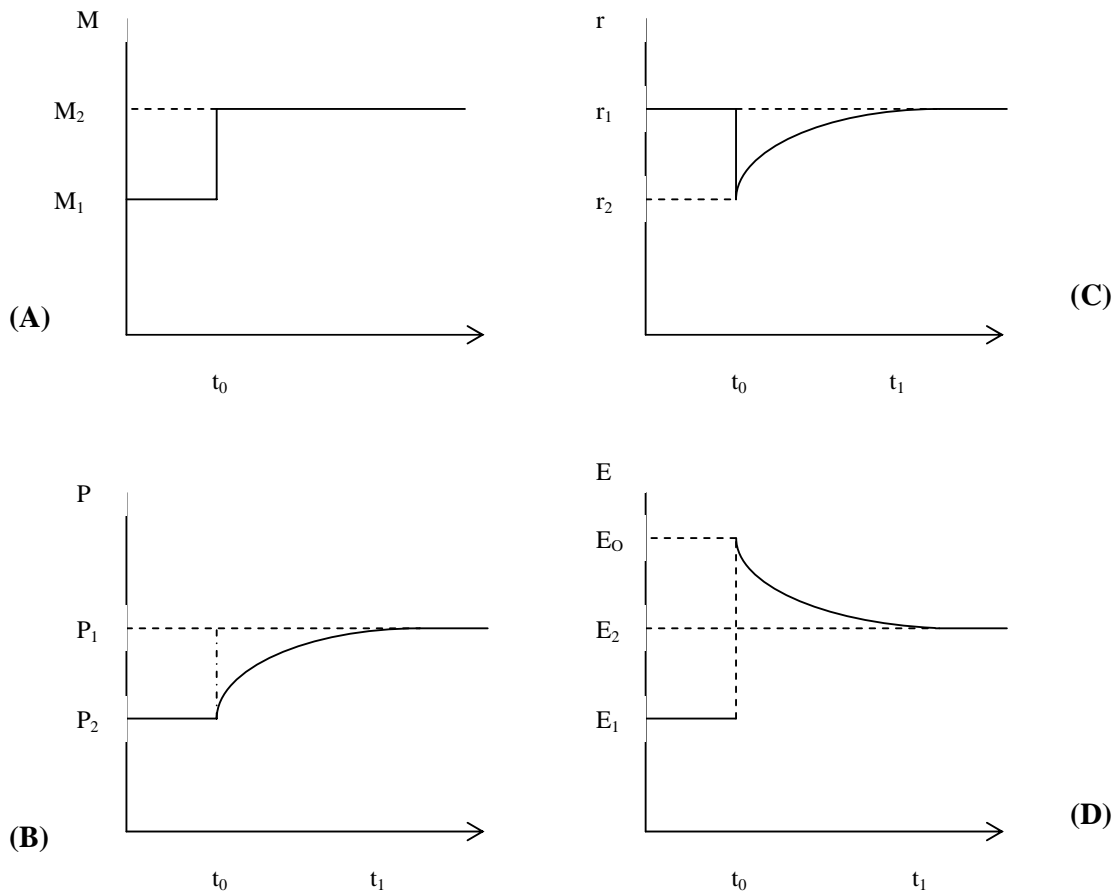
Another reason why exchange rates over short horizons may be volatile is because of the linkage between currency markets and equity markets. Interest bearing bonds are not the only financial assets that investors can purchase. However, because equity prices are far more volatile than bond yields, some of the observed volatility in financial markets may be transmitted into exchange rates.