The following is a review of the Economics principles designed to address the learning outcome statements set forth by CFA Institute®. This topic is also covered in:

TRADING WITH THE WORLD

Study Session 6

EXAM FOCUS

You should understand the principle of comparative advantage as that is the basis of the case for free trade. Make sure you understand the difference between the effects of tariffs and the effects of quotas, and how restrictions on trade in general decrease the wealth of a country. Know who gains and who loses from trade restrictions and that trade restrictions are considered to be primarily driven by the political activity of those who stand to gain from specific trade restrictions.

LOS 29.a: Discuss opportunity cost associated with trade, how countries can gain from international trade, how countries determine whether to import, export or produce goods and services, and explain the gains of trade for all parties.

Comparative advantage refers to the lowest *opportunity cost* to produce a product.

The law of comparative advantage holds that *trading partners can be made better off if they specialize* in the production of goods for which they are the low-opportunity-cost producer (have a comparative advantage) and trade for those goods for which they are the high-opportunity-cost producer. A country gains (i.e., it realizes expanded consumption possibilities) from international trade when it *exports* those goods for which it has a comparative advantage and *imports* those goods for which it does *not*.

An example will illustrate the gains from trade in terms of expanded consumption opportunities for two countries. Figures 1 and 2 show the production possibility frontiers (PPF) for two countries, Alton and Borton, for two generic goods, food and machinery.

Figure 1: Production Possibility Frontier for Alton

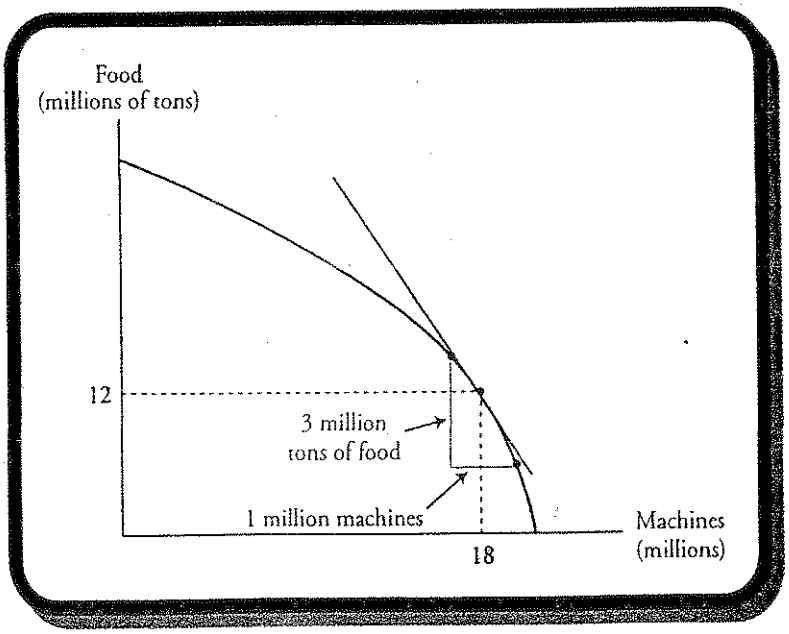
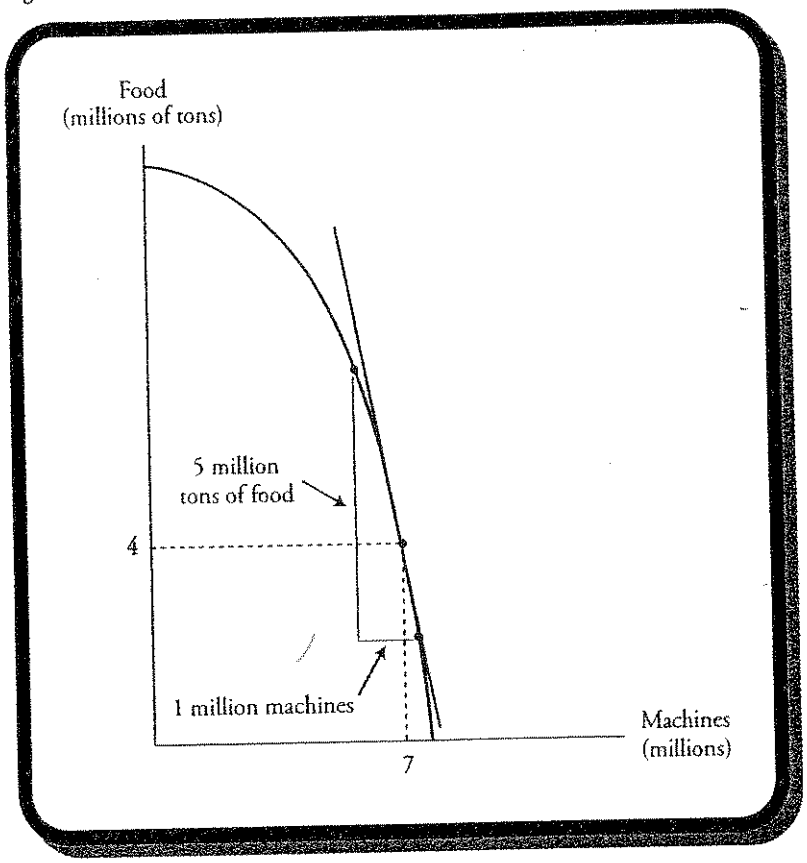


Figure 2: Production Possibility Frontier for Borton



Without trade, Alton chooses to produce 12 million tons of food and 18 million units of machinery, while Borton chooses to produce 4 million tons of food and 7 million machines. The slope of the each country's PPF at its chosen production point represents the opportunity cost of food in terms of machinery. Given their possible production levels of the two goods, the opportunity cost of producing a unit of one good can be expressed in terms of how many units of the other good they must give up to produce it.

For Alton, the opportunity cost of producing another million units of machinery is 3 million tons of food, while for Borton, the opportunity cost of producing another million units of machinery is 5 million tons of food. The opportunity costs of food are simply the reciprocals of these amounts. For Alton, the opportunity cost of producing another million tons of food is 1/3 million units of machinery, and for Borton, the opportunity cost of producing another million tons of food is 1/5 million units of machinery. We say that Alton has a comparative advantage in the production of (the lowest opportunity cost of producing) machinery and that Borton has a comparative advantage in the production of food. If one country has a lower opportunity cost of producing one good, the other country must have a comparative advantage in the production of the other good in our simple example. Next we will show that, as long as their opportunity costs of production differ, trade will allow both countries to consume more than they can without trade.

Since Alton has a comparative advantage in the production of machinery, it will be advantageous for Alton to produce more machinery and to trade with Borton for food. For example, Alton could produce 2 million more units of machinery and 6 million tons less food. Borton could produce 6 million more tons of food and, given that their opportunity cost of a ton of food is 1/5 of a million units of machinery, produce 1.2 million fewer units of machinery.

Professor's Note: I realize these are not realistic trade-offs because the PPFs are curved and we're using the approximate slope (trade-off) at a point. The results would be qualitatively the same if we used 6 tons of food and 1.2 units of

machinery in our examples. Using these smaller amounts, the curvature of the PPF would not be significant, and the slope would be an accurate estimate of the actual trade-off in production.

The table in Figure 3 illustrates the total output of both countries with and without specialization and trade.

Figure 3: Gain From Trade

	Without Trade		With Trade	
	Machinery	Food	Machinery	Food
Alton	18 million	12 million tons	20 million	6 million tons
Borton	7 million	4 million tons	5.8 million	10 million tons
Total	25 million	16 million tons	25.8 million	16 million tons

When each country specializes in the good for which they have a comparative advantage and trades with the other, there are clear gains in our example. Total food production can remain at 20 million tons while the total output of machinery is increased by 0.8 million units. Alton will export machinery, since they are the low (opportunity) cost producer of machinery, and import food from Borton. Borton has a comparative advantage in the production of food, and will export food to Alton and import Alton-produced machinery.

How the gains from specialization and trade will be shared between the two countries is not determined here, but clearly there is a possible exchange that will allow both countries to enjoy a combination of food and machinery that they could not reach on their own without trade. In terms of our PPF graphs, each country can consume at a point *outside* its PPF through specialization and trade. That's the important point here, as long as opportunity costs differ, two countries can both benefit from trade.

LOS 29.b: Compare and contrast tariffs, non-tariff barriers, quotas and VERs with respect to international trade.

Although the gains from trade are very apparent, countries erect barriers to trade, including tariffs and quotas, and sometimes impose voluntary export restraints (VER).

Tariffs

A *tariff* is a tax imposed on imported goods while a *quota* is a limitation on the quantity of goods imported.

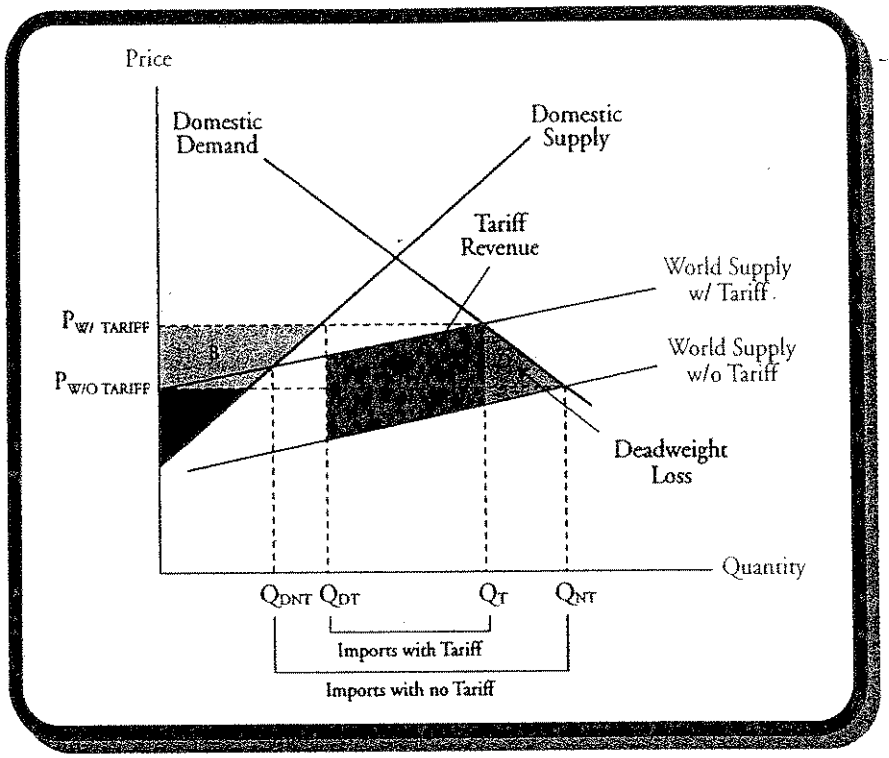
Tariffs benefit domestic producers because the level of imports will be reduced due to an effective increase in the price of the good. For example, if the world price of semiconductors is $40, and domestic producers can only profitably meet domestic semiconductor demand at a price of $45, foreign producers have a comparative advantage. Hence, domestic producers will not be able to compete in their own domestic semiconductor market. However, if the government places a $10 tariff on imported semiconductors, domestic producers will become competitive with foreign producers in the domestic market, and domestic semiconductor production will rise compared to the level of production without tariffs. Tariffs will also benefit the government, because it will collect the $10 tax (tariff) on all foreign semiconductors sold in the domestic market. Even though the government collects tariffs and supposedly uses these funds to increase the welfare of its citizens, domestic consumers still lose. Because the demand curve is downward sloping, the loss in consumer surplus cannot be fully recovered by tax revenue.

Figure 4 shows that if the world price prevails, domestic producers will offer a quantity of Q_{DNT} to the market. At this same price, the total quantity demanded will be relatively high at Q_{NT}. Upon the imposition of a tariff, the quantity supplied to the market by domestic suppliers rises to Q_{DT}, but total quantity demanded falls to Q_T. The amount of goods imported into the domestic economy *prior* to the imposition of the tariff was $Q_{NT} - Q_{DNT}$, but the import quantity shrinks to $Q_T - Q_{DT}$ after the tariff is in place. Since domestic producers are *high-cost suppliers* of this good, we shift domestic production toward goods for which we are the high-cost producer and

away from goods for which we have a comparative advantage. This is one of the key drawbacks of imposing a tariff.

Domestic producers gain by the increase in their producer surplus from A to A + B. The government collects tariff revenue equal to area *C*. However, consumers lose the entire area A + B + C + D due to higher prices and a reduction in consumer surplus. Area *D* can also be thought of as *deadweight loss* or the *efficiency loss* of tariff imposition.

Figure 4: The Impact of Tariffs



Quotas

A quota has an effect very similar to that of a tariff. Under a quota system, importers in the domestic country are given licenses to import specific amounts of a foreign-produced good. The supply of imported goods is reduced, and a lower supply means a higher price domestically. In Figure 4, the imposition of a quota equal to $Q_T - Q_{DT}$ would produce the same equilibrium domestic price and quantity, but with no government tariff revenue. Rather, the area labeled "tariff revenue" will be shared by the importers who are granted portions of the quota amount, because they are allowed to sell their goods at the higher price that results from the imposition of the quota. Clearly, domestic producers also benefit from the quota because competition from foreign producers is limited. The bottom line is that *quotas can be more harmful than tariffs* because the government does not receive any funds from the imposition of quotas; it is the importers who receive the revenue transfer (due to higher prices received for all goods sold under the import license).

Voluntary export restraints (VER) are agreements by exporting countries to voluntarily limit the quantity of goods they will export to an importing country. The primary difference between VERs and quotas is that the gains that accrue to those with import licenses under a quota system are received by the firms in the exporting countries that hold export permits under a VER system. It is probably common that the foreign government officials who determine which exporters get permits find ways to receive some of the value of these licenses.

LOS 29.c: Discuss the advantages and disadvantages of protection for each party, and explain the main reasons for trade restriction.

It is reasonable at this point to ask why trade restrictions are as common as they are, given that free trade appears to offer societal gains to all countries. While trade restrictions have fallen over recent decades, they are still prevalent and significant in such products as sugar, textiles, footwear, meat, and metals, among others.

The primary forces underlying trade restrictions are twofold. Governments like tariff revenue, and domestic producers affected by lower-cost imports use political means to gain protection from foreign competition. In developing countries, the ability to collect income tax revenue is restricted by both the lack of financial records and problems of compliance. This makes tariff revenue an attractive alternative.

In theory, the benefits of free trade could be used to compensate domestic producers that lose as a result of free trade. This, however, is problematic and seldom done. The affected parties, such as domestic steel producers and steel workers or domestic textile manufacturers and textile workers, have a strong incentive to use their votes and political contributions to gain protection in the form of tariffs, quotas, or voluntary export restraints.

A variety of arguments are made for trade restrictions to hide the reality that they are imposed to benefit one group at the expense of the entire economy and its citizens. Whether they are defended on the basis of saving jobs, protecting workers from competition with low-wage countries, temporarily protecting a developing "infant" industry, lower environmental protection standards in exporting countries, or preventing the "exploitation" of less-developed countries, most economists agree that trade restrictions benefit specific groups at the expense of the whole economy.

Some arguments commonly made to support trade restrictions that have some support among economists are:

- *Developing industries (infant industries) should be protected while they get up to world standards of productivity and quality.* There are two problems with this argument. First, the benefits of a developing industry mainly accrue to the firms and workers in those industries and not to the overall population. Second, it is argued that a government subsidy to the industry as it develops would be a much more economically efficient way to gain any benefits that are expected to accrue to the whole economy when the industry becomes globally competitive.
- *Exporters should be prohibited from selling goods abroad at less than production cost (anti-dumping argument).* It is difficult to estimate production costs, and just the fact that a foreign firm sells at a lower price in the export market than in its own domestic market is not evidence of dumping as it is usually defined. Even if a foreign firm managed to drive domestic firms out of business, there could still be foreign competition from other countries, and domestic firms could re-enter the business if the foreign firm subsequently raised prices.
- *Industries associated with national defense should be protected by trade restrictions so they will exist domestically in case of war.* One problem with this argument is that it is hard to find an industry that does not contribute, or cannot potentially contribute, to national defense. From an economic efficiency perspective, it is better for the government to subsidize strategic industries judged essential to national defense directly, rather than impose costs on all domestic consumers by imposing trade restrictions.

Other arguments for trade restrictions that have very little support among economists are:

- *Trade barriers protect jobs.* Part of the popularity of trade restrictions stems from their ability to protect easily identifiable jobs and the high wage levels in these jobs. However, in the long run, trade restrictions cannot protect the *net* number of jobs in the country. The number of jobs protected by import restrictions will be offset by jobs lost in other industries in general (that would sell less because more is spent on higher-priced imported goods) and in the import/export industry. Import/export firms will be unable to sell the overpriced domestic product abroad or import and sell the lower-priced, restricted foreign-made product.
- *Trade restrictions create jobs.* In the short run maybe, but in the long run, no. First of all, trade restrictions prevent your trading partners from developing the purchasing power needed to buy import goods from you,

thus depressing your own export industry. Secondly, the higher price of the protected domestic goods dampens domestic aggregate purchasing power, taking sales away from other domestic products. Finally, the jobs that would have been created in the import industry are never created.

- *Trade with low-wage countries depresses wage rates in high-wage countries.* The belief that trading with low-wage countries depresses wages is based on a misunderstanding of the law of comparative advantage. A high hourly wage does not necessarily mean high per-unit labor costs. Labor productivity must be considered. The worker's skill level, the amount of invested capital, and production methods may produce labor costs per unit of output below those found in low-wage countries. Consider the law of comparative advantage. When each country produces goods for which it has a comparative advantage, both countries will benefit. High-wage countries will have an advantage in high-tech manufacturing, and low-wage countries will have an advantage in labor-intensive goods. When both produce the goods in which they have an advantage, total output and the availability of goods will increase.

In summary, tariffs benefit domestic producers, industry workers, and governments, at the expense of domestic consumers and workers outside the protected industry. Quotas benefit domestic producers, industry workers, and those with import licenses at the expense of domestic consumers and workers outside the protected industry. VERs benefit domestic producers, industry workers, and those with export licenses or the power to grant them at the expense of domestic consumers and workers outside the protected industry.

KEY CONCEPTS

1. If two countries have different opportunity costs of producing goods, each will have a comparative advantage in some goods, and trade will increase the total production and consumption possibilities in both countries, improving economic welfare.
2. International trade will tend to increase domestic supply as imports are available and increase domestic demand because exports will be possible.
3. Tariffs are taxes on imports. Quotas restrict physical amounts of imports by granting import licenses. Voluntary export restraints are agreements by exporting countries to limit exports to an importing country. An exporting country gives export licenses for specific quantities to its exporting firms.
4. Trade barriers reduce the possible consumption for a country's citizens.
5. Tariffs benefit domestic producers, industry workers, and government workers at the expense of domestic consumers.
6. Quotas benefit domestic producers, industry workers, and import license holders at the expense of domestic consumers.
7. Voluntary export restraints benefit domestic producers, industry workers, and export license holders at the expense of domestic consumers.
8. In general, trade restrictions arise from a desire by government for tariff revenue and from economically motivated political activity by the domestic groups who will gain from protection from foreign competition.
9. Of the reasons commonly used to support trade restrictions, national defense arguments and infant industry arguments may have some validity, but the goals of maintaining these industries are likely reached in a more economically efficient manner by direct government subsidy than by imposing costs on all domestic consumers and the entire economy.
10. Other arguments for trade restrictions are not supported by economic theory.

CONCEPT CHECKERS: TRADING WITH THE WORLD

1. Which of the following statements about international trade is *least accurate*? If two countries have different opportunity costs of production for two goods, by engaging in trade:
   A. both countries can increase their total consumption.
   B. each country gains by importing the good for which it has a comparative advantage.
   C. each country can achieve a level of consumption outside its domestic production possibility frontier.
   D. the low opportunity cost producer of each good will export to the high opportunity cost producer of that good.

2. The *least likely* result of import quotas and voluntary export restraints is:
   A. increased revenue for the government.
   B. a decrease in the quantity of imports of the product.
   C. an increase in the domestic price of the product.
   D. a shift in production toward higher-cost suppliers.

3. Which of the following statements about the imposition of trade restrictions has the *most support* among economists?
   A. Trade restrictions are needed to ensure the existence of industries needed for national defense and to protect developing industries until they grow to a competitive size.
   B. Developing industries should be protected until they become competitive and trade restrictions will prevent trade with low-wage countries from depressing the wages of high-wage trading partners.
   C. Restrictions are necessary because trade with low-wage countries depresses wage rates in high-wage countries and to protect industries involved in national defense.
   D. Trade restrictions are necessary to prevent exporters from "dumping" goods abroad at less than their domestic production costs and because developing industries need protection while they get to the point where they can compete on a world scale.

4. Which of the following groups would be *most harmed* by the imposition of a tariff on steel imports?
   A. Domestic steel producers.
   B. The national government.
   C. Workers in the domestic auto industry.
   D. Workers in the domestic steel industry.

ANSWERS – CONCEPT CHECKERS: TRADING WITH THE WORLD

1. B Each country gains by *exporting* the good for which it has a comparative advantage.

2. A Import quotas and voluntary export restraints, unlike tariffs, do not generate tax revenue. The other choices describe effects that result from all trade restrictions, including tariffs, quotas, and VERs.

3. A The case for trade restrictions to ensure the existence of industries producing goods important to national defense and the temporary protection of developing industries have more relative merit than other arguments put forward as reasons for restricting trade. It can be argued, however, that direct subsidies to such industries would be a more efficient way to achieve these ends than restricting trade in these products.

4. C Imposing a tariff on steel imports benefits domestic steel producers and workers by increasing the domestic price of steel, and benefits the national government by increasing tax (tariff) revenue. However, the increase in the domestic price of steel would increase costs in industries that use significant amounts of steel, such as the automobile industry. The resulting increase in the price of automobiles reduces the quantity of automobiles demanded and ultimately reduces employment in that industry.

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INTERNATIONAL FINANCE

Study Session 6

EXAM FOCUS

You need to know the basics of the balance of payments accounts and to understand the factors that can shift the demand for one currency in terms of another. Focus on the fact that an exchange rate is the equilibrium "price" of a currency, why exchange rates can be volatile even with little change in trading volume, and how this volatility can be reduced by central bank intervention. Don't worry too much about purchasing power and interest rate parity here, they are covered in more detail in the two topic reviews that follow.

LOS 30.a: Explain the different components of the Balance of Payments Accounts, the transactions recorded for import and export on the different accounts, and how the three sector balances are related.

Balance-of-payments (BOP) accounting is a method used to keep track of transactions between a country and its international trading partners. It includes government transactions, consumer transactions, and business transactions. The balance-of-payments accounts reflect all payments and liabilities to foreigners and all payments and liabilities from foreigners. The BOP equation is:

current account + capital account + official reserve account = 0

The **current account** measures the exchange of merchandise goods, services, investment income, and unilateral transfers (gifts to and from other nations). The *current account balance* is the net exchange of goods and services, investment income, and unilateral transfers.

The **capital (or financial) account** measures the flow of funds for the principal value of investment into a country from abroad and out of a country due to investment by its citizens in foreign assets. This includes investment in real assets as well as purchases of financial securities. When a country runs a current account deficit (imports more than it exports), one way to make up the difference is to borrow from foreign countries, which leads to a capital account surplus.

The **official settlements account** is where changes in official reserves are recorded. **Official reserves** are funds held by a government in foreign currencies. In 1997, the U.S. ran a current account deficit and a smaller surplus in its capital account. As a result, the U.S. ran a surplus in the reserve account to balance the BOP accounts. A surplus in the official reserve account means that the U.S. traded dollars for foreign currency. These reserve balances are used by the Fed to *intervene* in the foreign exchange markets in an attempt to loosely control exchange rates.

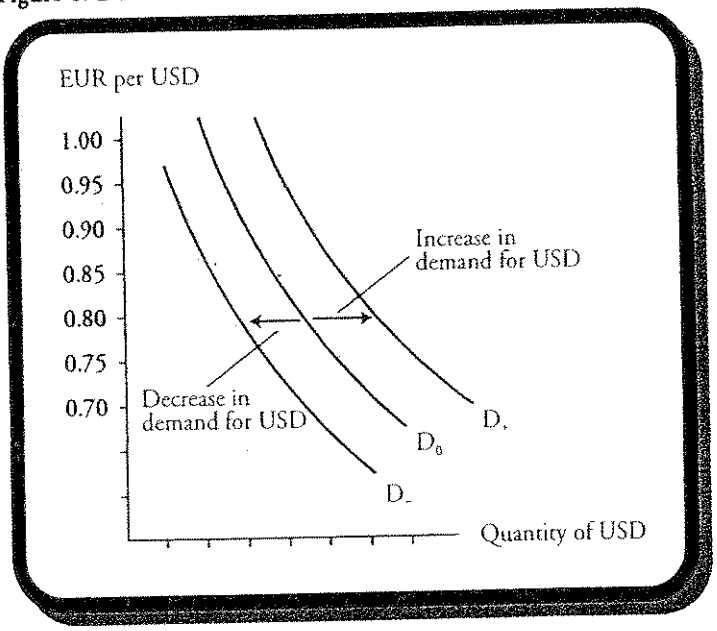
The impact of borrowing to finance a deficit in the current account over time depends on whether the country is borrowing to finance investment or borrowing to finance consumption. If the deficit is the result of borrowing primarily to finance consumption, consumption in the future must be reduced to repay the borrowings. If, on the other hand, the borrowing is primarily to finance investment, then future growth in the economy will provide the means to repay the borrowings without an equal decrease in consumption.

LOS 30.b: Explain the law of demand and the law of supply for foreign exchange, and how changes in demand and supply occur.

Consider the demand for U.S. dollars and for euros. The reason there is a demand by foreigners for U.S. dollars is to purchase U.S. goods or to buy U.S. financial assets (securities) or U.S. real assets (e.g. real estate or factories). We can construct a demand curve for U.S. dollars in terms of euros. As shown in Figure 1, the demand for a country's currency is downward sloping, as it is for any good. The price of dollars expressed in euros is an exchange rate. From the graph in Figure 1, we can see that the quantity of dollars demanded is greater at an exchange rate (price) of 0.85 euros per U.S. dollar than the quantity demanded at an exchange rate of 0.90. At a lower exchange rate in terms of euros per dollar, U.S. goods and assets are relatively cheaper to euro-based consumers and investors, and they will demand a greater quantity of both, leading to an increase in the quantity of dollars demanded to fund these purchases.

Two factors are important determinants of the demand for a currency: the interest rate for deposits in that currency, and expected future exchange rates. Changes in these factors can either increase or decrease the demand for currency as illustrated in Figure 1.

Figure 1: Demand for U.S. Dollars



Investors make investment decisions based on interest rate differentials, the difference between what they can earn on investments in their own currency and what they can earn in other currencies. If the euro rate of interest rises relative to the U.S. dollar rate of interest, U.S. dollar-based investors will find euro investments more attractive, and demand for euros will increase. When a country's interest rates fall relative to those of other countries, demand for that country's currency will fall because the demand for investments denominated in that currency will decrease.

When the exchange rate for a country's currency in terms of another currency rises, we say that the country's currency has *appreciated*. If the price of euros in terms of yen rises from 140 yen per euro (140 ¥/€) to 145 ¥/€, we say that the euro has appreciated relative to the yen. Each euro will now purchase more yen and, in that sense, has become more valuable. When the exchange rate falls, from 140 to 135 ¥/€ for example, we say that the euro has *depreciated* relative to the yen.

The second factor that influences demand for a currency is its expected future exchange rate. Other things equal, if a currency is expected to appreciate over time, it is more attractive. Consider a current (spot) exchange rate

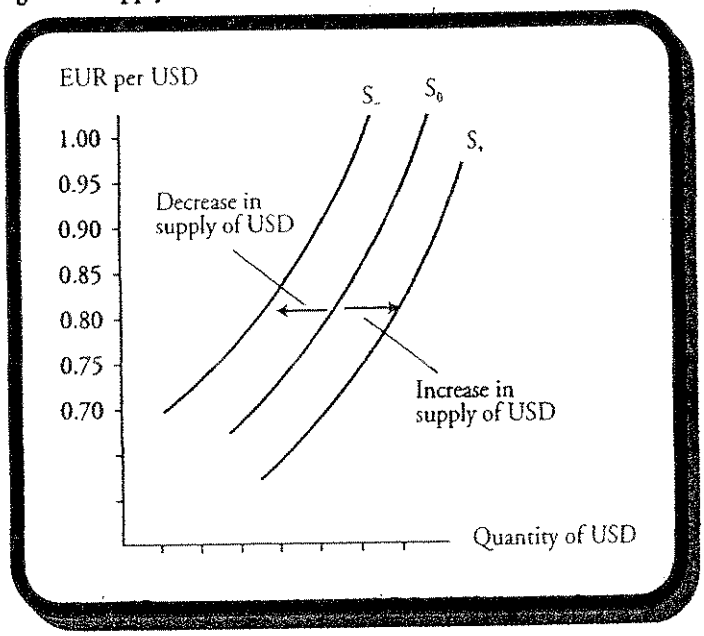
quote of 0.80 €/$ and an initial expectation that the dollar will appreciate so that the exchange rate in one year will be 0.81 €/$. If the expected future exchange rate rises to 0.83 €/$, the expected appreciation in the dollar has increased, and demand for dollars will increase. From the standpoint of a euro-based investor, an investment in U.S. assets is now more attractive because the expected return in euros is not only the expected U.S. interest, but also additional expected gains when dollar investments are converted back to euros at the end of one year. Rather than receiving 0.81 euros for each dollar, investors now expect to receive 0.83 euros for each dollar, making the expected euro return from an investment in dollars almost 2.5% greater than when the expected exchange rate was 0.81 €/$. So, an increase in the expected future exchange rate for a country's currency will increase demand for that currency, and a decrease in the expected future exchange rate will decrease the demand for the currency.

Supply of Foreign Exchange

Typically in microeconomics, the factors that affect the supply of a good (e.g. input costs) are separate from those that affect demand (e.g. tastes, price of substitute goods). In foreign exchange markets this is not the case. When a U.S. dollar-based investor's demand for euros increases, he wants to buy euros, but this also means selling dollars. For this reason, the supply of a currency in foreign exchange markets is driven by the same factors that affect demand: interest rate differentials and the expected future exchange rate.

If the U.S. dollar/euro exchange rate falls from 1.25 $/€ to 1.23 $/€, the euro has depreciated and the dollar has appreciated. This increase in the value (appreciation) of the dollar makes U.S. goods relatively more expensive. Demand for imports from the U.S., and the demand for dollars to purchase those imports, will decrease as we have seen. At the same time, however, the appreciation of the dollar relative to the euro will make imports from the euro zone more attractive to dollar-based consumers. Their demand for euros will increase, which is an increase in the supply of dollars. So an appreciation in a currency (an increase in its exchange rate) will decrease demand for that currency and increase the supply of that currency. For this reason we draw the supply curve for a currency as an upward sloping function of its exchange rate in terms of another currency. We illustrate this in Figure 2, where the supply of dollars is shown as a function of the exchange rate in terms of euros per dollar.

Figure 2: Supply of U.S. Dollars



The same factors that cause shifts in the demand for a currency, interest rate differentials and expected future exchange rates, can also increase or decrease the supply of that currency. These shifts are illustrated in Figure 2. However, the effects are opposite to those on demand. An increase in the U.S. dollar interest rate relative to the

euro interest rate or an increase in the expected future euro-dollar exchange rate will decrease the supply of dollars. A decrease in the U.S. dollar interest rate relative to the euro interest rate or a decrease in the expected future euro-dollar exchange rate will increase the supply of dollars.

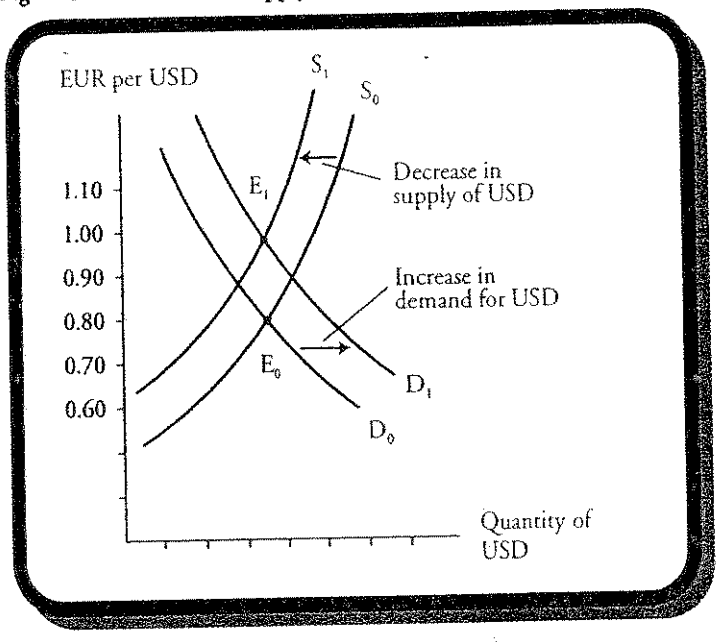
Professor's Note: These supply and demand effects get a bit confusing sometimes. I think you should focus on understanding the effects on demand curves of interest rate differentials and expected future exchange rates. Then, just remember that the effects are all opposite for supply curves.

LOS 30.c: Discuss the influence of supply and demand on the exchange rate, and why exchange rates can be volatile.

In our typical analysis of supply and demand equilibrium, supply and demand are considered independently, as noted previously. Other things equal, an increase (decrease) in demand leads to an increase (decrease) in equilibrium price and an increase (decrease) in equilibrium quantity. An increase or decrease in supply has the opposite effect on equilibrium price and quantity.

Since supply and demand curves for foreign exchange are both affected by the same factors, the adjustment is different. Figure 3 shows the demand and supply for dollars as functions of the euro-dollar exchange rate. Initially, the equilibrium price of a dollar is 0.80 euros, at the intersection of S_0 and D_0. If the exchange rate is lower than this, there is excess demand for dollars and the exchange rate will rise toward equilibrium. If the exchange rate is greater than 0.80 €/$, then there is an excess supply of dollars, and the exchange rate will fall toward the equilibrium rate.

Figure 3: Demand and Supply Shifts in the Foreign Exchange Market



The curves S_1 and D_1 represent the increased demand for and decreased supply of dollars that would result from either an increase in the U.S. dollar interest rate or an increase in the expected future euro-dollar exchange rate. Note that while the new equilibrium euro-dollar exchange rate is higher from both the increase in demand and the decrease in supply, the equilibrium quantity of trading may be very close to the quantity traded prior to the shifts in supply and demand. For this reason, exchange rates may be quite volatile (more so than if supply and demand were independent), even though the quantity of currencies actually exchanged is not.

LOS 30.d: Distinguish between purchasing power and interest rate parity.

The concept of purchasing power parity is based loosely on the idea that the same goods should cost the same in different countries, once we have factored in the current exchange rate. If a barrel of oil costs $70 in the U.S. and the yen/dollar exchange rate is 125, a barrel of oil should cost ¥8,750 (= 125 × 70) in Japan. While differences in transportation costs and some other factors may mean that such a relation need not hold exactly, purchasing power parity is based on the idea that changes in the price levels in the two countries should be reflected in changes in the exchange rate. Consider an example where inflation in the U.S. is greater than inflation in Japan. Since U.S. goods have increased more in price than Japanese goods, they are less attractive at the existing exchange rate. Purchasing power parity requires that the exchange rate adjust (dollar depreciate relative to the yen) so that exchange-rate adjusted goods prices return to the same relation that existed before the changes in the Japanese and U.S. price levels. Another way to state this is that exchange rates will change to reflect differences in inflation between countries. We will have more to say about purchasing power parity later in this study session.

Interest rate parity is the idea that exchange rates must change so that the return on investments with identical risk will be the same in any currency. Another way to say this is that differences in interest rates are equal to differences in expected changes in exchange rates. If the U.S. interest rate is 6% and the U.K interest rate (on British pounds) is 4%, we might think that all U.K. investors would want to convert their pounds to dollars so that they could earn 2% more. The key here is expected future exchange rates. If the dollar is expected to depreciate 2% relative to the pound over the next year, there is no expected gain from investing in dollars rather than pounds. At the end of one year, a U.K.-based investor could have 6% more dollars, but would have to exchange them for pounds at an exchange rate 2% below the current rate. So, rather than having 6% more pounds at the end of one year, a U.K. investor would have 4% more pounds, just as they would have investing in pounds rather than in dollars. This is the meaning of interest rate parity—changes in exchange rates over time should just offset interest rate differences between countries. We will look at interest rate parity in more detail in another topic review as well.

LOS 30.e: Discuss how and why intervention by a central bank in the exchange market may be required.

A central bank can intervene in the foreign exchange market by entering the market as a buyer, increasing the demand for its currency, or as a seller, increasing the supply of its currency. To reduce exchange rate volatility, for example, the U.S. Federal Reserve can buy dollars when the value of a dollar falls and sell dollars when the value of a dollar rises. While a central bank cannot do this indefinitely, if exchange rates are fluctuating due to short-term changes in the supply and demand for its currency, intervention can reduce volatility. True shifts in the supply and demand for a currency that lead to a new equilibrium exchange rate, however, will eventually have their expected effect. Central banks have limited power of intervention in markets because their reserves of both domestic and foreign currency, while they may be large, are in fact, limited.

KEY CONCEPTS

1. The balance of payments relation states that
   current account + capital account + official reserve account = 0.
2. The current account includes international payments for goods and services (net exports), the net income from asset ownership, and net gifts.
3. The capital account includes international payments for the purchase and sales of debt and equity securities and real assets.
4. Official reserve accounts consist of the foreign currencies held by governments.
5. The demand for a country's currency is a downward-sloping function of its exchange rate and is increased by increases in the country's interest rate and by increases in the expected future value of the currency.
6. The supply of a country's currency is an upward-sloping function of its exchange rate and is decreased by increases in the country's interest rate and by increases in the expected future value of the currency.
7. Since the same factors shift currency supply and demand curves, exchange rates can be quite volatile even with relatively stable trading volume.
8. Purchasing power parity refers to the relation between differences between countries' inflation rates and changes in the exchange rates for their currencies.
9. Interest rate parity refers to how differences in interest rates for two currencies are related to changes in their exchange rate over time.
10. Central bank intervention in currency markets (buying or selling their country's currency) can reduce short-term exchange rate volatility but cannot prevent real long-term changes in equilibrium exchange rates.

CONCEPT CHECKERS: INTERNATIONAL FINANCE

1. The current account includes all of the following components EXCEPT:
   A. unilateral transfers.
   B. flow of funds for investment.
   C. payments for goods and services.
   D. investment income.

2. Which of the following equations is CORRECT?
   A. Balance of payments = current account + capital account.
   B. Official settlements account = current account + capital account.
   C. Current account = goods and service balance + official reserves.
   D. Current account + capital account + official settlements account = 0.

3. The Fredonian currency (the fredo) is currently valued at 2.50 per U.S. dollar. Fredo deposit rates are 1% above U.S. dollar deposit rates. All other things equal, which of the following scenarios would decrease demand for the fredo on the foreign exchange markets?

	Fredonia interest rate - U.S. interest rate differential	Expected dollar-per-fredo exchange rate in one year
A.	Increases	Decreases
B.	Increases	Increases
C.	Decreases	Decreases
D.	Decreases	Increases

4. Which of these statements is *most accurate?* Exchange rates can be especially volatile because:
   A. the quantities of currencies traded are volatile.
   B. interest rate differentials determine the demand for currencies.
   C. supply and demand for currencies are affected by the same factors.
   D. the supply of a currency is a function of expected future exchange rates.

5. The theory of interest rate parity suggests that:
   A. exchange rates will change to reflect differences in inflation between countries.
   B. changes in the price levels in two countries should be reflected in changes in the exchange rate.
   C. the same combinations of goods should cost the same in different countries, once we have factored in the current exchange rates.
   D. exchange rates will change so that the return on investments with identical risk will be the same in any currency.

6. A central bank's primary goal when intervening in the foreign exchange markets is typically to:
   A. reduce exchange rate volatility.
   B. increase its foreign currency holdings.
   C. prevent long-term currency depreciation.
   D. offset structural shifts in the demand for the domestic currency.

ANSWERS – CONCEPT CHECKERS: INTERNATIONAL FINANCE

1. **B** The flow of funds for investment in debt and equity is recorded in the capital account. Exchange of investment income, such as interest payments, is a component of the current account, along with goods and services trade and unilateral transfers.

2. **D** The three balance of payments accounts must sum to zero.

3. **C** A decrease in fredo interest rates minus U.S. rates and a decrease in the expected future exchange rate would both decrease demand for the fredo. When a country's interest rates fall relative to those of other countries, demand for that country's currency decreases because demand for investments denominated in that currency will decrease. A decrease in the expected future exchange rate also decreases the demand for a currency.

4. **C** Because shifts in supply and demand are affected by the same factors, exchange rates may be quite volatile even though the quantity of currencies actually exchanged is not.

5. **D** The other three choices describe the concept of purchasing power parity.

6. **A** Central banks can reduce exchange rate volatility in the short term through intervention in the foreign exchange market. Longer-term shifts in supply and demand, however, will eventually have their expected effects on exchange rates. Intervention can increase or reduce the central bank's foreign currency holdings, but that would rarely be the central bank's primary objective.

The following is a review of the Economics principles designed to address the learning outcome statements set forth by CFA Institute®. This topic is also covered in:

FOREIGN EXCHANGE

Study Session 6

EXAM FOCUS

No fluff here; you need it all. Take it slow and get a good understanding of direct and indirect quotes, spot rates and spreads, forward rates, forward discounts and premiums, currency cross rates, interest rate parity, and covered interest arbitrage. The probability of this material being tested is very high—approaching certainty.

EXCHANGE RATES AND THE FOREIGN EXCHANGE MARKET

An **exchange rate** is a ratio that describes how many units of one currency you can buy per unit of another currency. Note that an exchange rate is quoted relative to another currency. You *cannot* quote three exchange rates (three currencies) with one ratio.

Professor's Note: As you work through the two foreign exchange material reviews, you will notice that the notation for currency rates is not consistent. For example, for the Japanese yen, you may see the currency symbol, such as ¥, or the three-letter notation, JPY. The U.S. dollar may be shown as USD, $, or U.S. dollar. Be prepared to see various notations on the exam.

Example: Exchange rates

If the Australian dollar (AUD) is trading at 0.60 U.S. dollars ($0.60), each AUD will buy 60 U.S. cents. Remember the following: AUD = $0.60 = 0.60 dollars per AUD. Whatever currency in which the *quote* is made (in this case, $U.S.) belongs in the numerator while the denominator is always *one* unit of the currency you are interested in (in this case the AUD). For instance, $/AUD = 0.60.

Exchange rates between countries are the *inverse* of one another. Thus the U.S. dollar quote in terms of AUD is:

U.S. dollar = 1/0.60 = 1.67 AUD per U.S. dollar

Therefore, if you are given dollars per AUD, you can easily get AUD per dollar by taking the inverse of the original quote.

Example: Transactions with exchange rates

Suppose that you want to buy some Australian beer. The Australian distributor tells you the beer sells for 25 AUD per case. How many U.S. dollars will it cost you to buy one case, given that the AUD exchange rate is $0.60?

Answer:

- You know that the beer is quoted in AUD per case. So the numerator is AUD and the denominator is a case (AUD/case).
- You know that your exchange rate has $ in the numerator and AUD in the denominator ($/AUD).
- You want $ in the numerator and cases in the denominator, so multiply the two together:

$$\left(\frac{25\ \text{AUD}}{\text{case}}\right)\times\left(\frac{0.60\ \$}{\text{AUD}}\right)=\frac{\$15}{\text{case}}$$

The AUDs cancel and you are left with $15 in the numerator and case in the denominator, so the beer costs $15 per case.

Example: Exchange rate appreciation and depreciation

If the AUD moves from $0.60 to $0.70, has the AUD depreciated or appreciated?

Answer:

The AUD has *appreciated*—previously each AUD would only buy 60 cents, whereas now each AUD buys 70 cents. What has the U.S. dollar done in this example? To find out, invert each quote so that you get the U.S. dollar moving from 1/$0.6 = AUD1.67 to 1/$0.7 = AUD1.43. The dollar has *depreciated* in value. It used to buy 1.67 AUD but only buys 1.43 AUD today. Again, always remember what is in the *denominator.*

It is important to note that the *appreciation* of a currency makes that country's goods more *expensive* to residents of other countries while *depreciation* makes a country's goods more *attractive* to foreign buyers. In our Australian beer example above, if we let the AUD depreciate against the U.S. dollar, the U.S. dollar price of the beer will fall.

You must know how to determine whether a currency has depreciated or appreciated over time. As a straightforward example, if the Swiss franc goes from 1.7799 CHF/USD to 1.8100 CHF/USD, the Swiss franc has depreciated relative to the dollar. Why? It is worth less—it now takes more Swiss francs to buy a dollar. This example could have been worded, "If the CHF to USD exchange rate increases from 1.7799 to 1.8100, the Swiss franc has depreciated relative to the U.S. dollar." Don't be confused by the word "increases"—the CHF still depreciated. Focus on the numbers and the logic.

Foreign Exchange Markets

The trading of currencies takes place in foreign exchange markets, which have the primary function of facilitating international trade and investment. Knowledge of the operation and mechanics of these markets is important for a fundamental understanding of international financial management.

The foreign exchange market permits the transfer of purchasing power denominated in one currency for that of another currency. This market is not a physical place but rather an electronically linked network of banks, foreign exchange brokers, and dealers whose function it is to bring together buyers and sellers of foreign exchange. Transactions occur over the phone, telex, or the SWIFT system (Society for Worldwide Interbank Financial Telecommunications).

Participants in the foreign exchange (interbank) market are large commercial banks, foreign exchange brokers, major multinational corporate customers, and central banks. Most of the trading in the U.S. goes through foreign exchange brokers, who match buyers and sellers for a small commission (1/32 of 1%).

Foreign-exchange brokers provide *information*, participant *anonymity*, and *reduced time and effort* (meaning a bank need only deal with one broker rather than contracting several other banks) in trading.

The typical small client gets foreign exchange from a local bank. The local bank in turn gets the exchange from its major correspondent bank, and the major bank gets the exchange from a foreign exchange broker.

The *interbank market* is the wholesale market where the major banks trade with one another. Most currency transactions occur here. The interbank market is generally referred to as the foreign exchange market and is segmented into three separate markets: (1) the spot market, (2) the forward market, and (3) the currency swap market.

LOS 31.a: Define direct and indirect methods of foreign exchange quotations and convert direct (indirect) foreign exchange quotations into indirect (direct) foreign exchange quotations.

Local *nonbank public customer* quotes can be stated as:

- **Direct quotes** are expressed in domestic currency units per foreign currency unit: DC/FC. For example, a direct quote to a U.S. investor for euros might be 1.21 $/€. This represents an exchange rate of $1.21 per euro.
- **Indirect quotes** are expressed as foreign currency unit per domestic currency unit: FC/DC.

To convert a direct quote to an indirect quote, or vice versa, you simply take the reciprocal of the one that you are given. For example, in Japan, a direct quote of 125 ¥/$ is equivalent to an indirect quote of $\left(\frac{1}{125\ ¥/\$}\right) = 0.0080\ \$/¥$. Just use the 1/x key on your calculator to turn the indirect quote 125 ¥/$ into the direct quote of 0.0080 $/¥.

LOS 31.b: Calculate and interpret the spread on a foreign currency quotation and explain how spreads on foreign currency quotations can differ as a result of market conditions, bank/dealer positions, and trading volume.

Banks and other dealers generally do not charge commissions on foreign currency transactions. Instead, they make their profit from the *bid-ask spread.*

- The *bid price* is always listed first. It is the price the *dealer will pay* for FC.
- The *ask price* is always listed second. It is the price at which the *dealer will sell* FC.
- The bid is less than the ask for direct quotes.

Example: Bid-ask spread

Consider the following quotations: The bid of $1.6625\frac{USD}{GBP}$ and the ask of $1.6635\frac{USD}{GBP}$ are listed as USD1.6625 – 35. Calculate the bid-ask spread as a direct quote from the perspective of a British banker.

Answer:

Note that this quote is a direct quote in the U.S. To switch the bid-ask spread to a direct quote from the British perspective $\left(\frac{GBP}{USD}\right)$, which is an indirect quote to a U.S. investor, take the reciprocal of each number.

$$\frac{1}{1.6625\frac{USD}{GBP}} = 0.60150\frac{GBP}{USD}$$

$$\frac{1}{1.6635\frac{USD}{GBP}} = 0.60114\frac{GBP}{USD}$$

Note that buying Currency 1 in terms of units of Currency 2 is equivalent to selling Currency 2 for units of Currency 1. A bid-ask dealer quote using direct exchange rates can be converted to indirect terms by taking the reciprocals, but the ask and the bid are reversed. A direct Canadian dealer quote of

$1.25 - 1.26\left(\text{CDN}/\text{USD}\right)$ for the U.S dollar is equivalent to an indirect Canadian dealer quote of

$\text{USD}\left(\frac{1}{1.26}\right)$ bid and $\text{USD}\left(\frac{1}{1.25}\right)$ ask or USD0.7937 bid and USD0.8000 ask for Canadian dollars, which will be a direct quote for a U.S. dealer.

Spreads are often expressed as a percentage of the ask. For the direct U.S. quote, we get a percentage spread as:

$$\frac{0.80 - 0.7937}{0.80} = 0.0079 = 0.79\%$$

How Spreads Differ as a Result of Market Conditions, Bank/Dealer Positions, and Trading Volume

Market conditions affect currency spreads because the bid-ask spread on foreign currency quotations increases as exchange rate volatility (uncertainty) increases. Larger spreads compensate dealers for the higher risk of dealing in more volatile currencies.

Bank and currency dealer positions do not directly affect the size of foreign currency spreads. If a dealer wants to reduce her holdings, she will usually adjust the midpoint of the spread rather than the absolute size of the spread.

Greater trading volume leads to narrower spreads (and vice versa), just as with equities trading.

LOS 31.c: Calculate and interpret currency cross rates, given two spot exchange quotations involving three currencies.

The **cross rate** is the rate of exchange between two countries, computed from the exchange rates between each of these two countries and a third country. Cross exchange rate calculations are necessary because each currency is quoted against the dollar in the interbank market but currencies are quoted using the direct method against other currencies in local nonbank markets.

As a simple example of calculating a cross rate, consider that spot rates are 0.00833 $/¥ and 148 ¥/€, and we wish to calculate the dollar/euro cross rate. When we multiply $/¥ by 148¥/€, the yen term drops out and we have 0.00833 × 148 = 1.2328 $/€. If the quotes are not given in a form that yields a simple solution for the cross rate to be calculated, the easiest way to proceed is to convert the rates using reciprocals as needed. Consider the following example.

Example: Currency cross rate calculation

If spot rates are 120 ¥/$ and 148 ¥/€, what is the cross rate expressed as €/$?

Answer:

We want our answer expressed as EUR/USD, so we can multiply ¥/$ times €/¥ since $\frac{\text{JPY}}{\text{USD}} \times \frac{\text{EUR}}{\text{JPY}} = \frac{\text{EUR}}{\text{USD}}$.

We take the reciprocal of 148 ¥/€ and get 0.006757 €/¥. We can then multiply 120 × 0.006757 to get 0.8108 €/$.

Since multiplying by the reciprocal of a fraction is equivalent to dividing by the fraction we could also get our answer by taking 120/148 = 0.8108 €/$. The spot rates given show that one euro is worth more yen (148) than one U.S. dollar (120). This tells us that one euro is worth more than one dollar and that our EUR/USD quote of less than one is to be expected.

One more example will further illustrate the technique.

Example: 3-currency cross rate calculation

The spot exchange rate between the Swiss franc (CHF) and the USD is 1.7799 CHF/USD, and the spot exchange rate between the New Zealand dollar (NZD) and the U.S. dollar is 2.2529 NZD/USD. Calculate the CHF/NZD spot rate.

Answer:

In Switzerland, the direct exchange rate is:

$$\frac{1.7799\frac{\text{CHF}}{\text{USD}}}{2.2529\frac{\text{NZD}}{\text{USD}}} = 0.79005\frac{\text{CHF}}{\text{NZD}}$$

Professor's Note: Make sure you can do the calculations described above. Since the LOS says "...cross rates, given two spot exchange quotations..." it is possible that you may have to calculate a cross rate quotation as a bid-ask from bid-ask quotes. Although I believe this is unlikely at Level 1, the following illustrates an intuitive approach you can use if such a problem comes up.

When given two bid-ask spot exchange quotations involving three currencies, we can get the cross rate bid and ask quotations by working through the actual purchase/sale transactions involved. The following example illustrates this.

Example: Bid-ask cross rates

A London dealer gives a spot quotation of 0.583 bid/0.588 ask $\left(\frac{£}{\$}\right)$ for the U.S. dollar. An Australian dealer quotes British pounds at 1.90 bid/1.91 ask $\left(\frac{\text{AUD}}{£}\right)$. Calculate the $\frac{\text{AUD}}{\$}$ bid and ask from the perspective of an Australian dealer.

Answer:

The $\frac{\text{AUD}}{\$}$ ask is based on buying pounds with AUD and buying USD with pounds. We would buy pounds at the $\frac{\text{AUD}}{£}$ ask of AUD1.91$\frac{}{£}$ and each pound would buy one USD at the ask of 0.588. The cost of one USD acquired through these transaction is 1.91 × 0.588 = AUD1.1231, which is the $\frac{\text{AUD}}{\$}$ ask cross rate.

The $\frac{\text{AUD}}{\$}$ bid cross rate is the rate at which an Australian dealer would purchase $U.S. We can construct it by selling $U.S. for pounds at the $\frac{£}{\$}$ bid of 0.583 and selling the 0.583 pounds at the $\frac{\text{AUD}}{£}$ bid of 1.90, which would result in 0.583 × 1.90 = AUD1.1077.

Our bid-ask cross rate quotation is 1.1077 – 1.1231 $^{AUD}/_{\$}$, the rate at which an Australian dealer would buy and sell USD.

Here's another approach to this same example that involves two steps.

1. State the bid-ask quote for the currency you want in the numerator (of your answer) as a direct quote in that currency, and the bid-ask quote for the currency you want in the denominator as an indirect quote.
2. Multiply the (direct) quote for the currency you want in the numerator by the (indirect) quote for the currency you want in the denominator, in such a way as to give the widest bid-ask spread.

For the above problem we have:

	Bid	Ask
AUD/£	1.90	1.91
£/$	0.583	0.588

We now just need to multiply AUD/£ quote times the £/$ quote to get AUD/$.

To get the widest possible quote, we multiply the bids to get the bid and the asks to get the ask, and have:

AUD/$ bid = 1.90 × 0.583 = 1.1077 and AUD/$ ask = 1.91 × 0.588 = 1.1231

LOS 31.d: Distinguish between the spot and forward markets for foreign exchange.

Spot markets refer to transactions that call for immediate delivery of the currency. In practice, the settlement period is two business days after the trade date.

Forward markets are for an exchange of currencies that will occur in the future. Both parties to the transaction agree to exchange one currency for another at a specific future date. Forward contracts are typically for transactions 30, 60, or 90 days in the future, although the contracts can be written for any period. There is no option involved in the contract; both parties to a forward currency contract are obligated to execute the specified transaction in the future.

A firm that has a foreign-currency-denominated obligation in 60 days can remove any uncertainty about the cost of the obligation in its home currency by entering into a forward contract to buy the required amount of foreign currency 60 days from now (at the 60-day forward rate). The forward exchange rate in the contract will reflect the expected movement of exchange rates over the next 60 days so that the forward rate may be greater than or less than the current spot rate. Note that the current spot rate is not locked in by entering a forward contract, unless the expectation is that the exchange rate will be the same 60 days from now so that the forward and spot rates are the same.

Example: Foreign currency forward transactions.

A U.S. firm is obligated to make a future payment of CHF100,000 in 60 days. To manage its exchange rate risk, the firm contracts to buy the Swiss franc 60 days in the future at 1.7530 CHF/USD. The current exchange rate is 1.7799 CHF/USD. (Note this is the indirect method of quoting exchange rates.)

Part 1: How much would the U.S. firm gain or lose on its commitment if, at the time of payment, the exchange rate fell below the 1.7530 Swiss francs to the dollar forward rate to 1.6556 Swiss francs to the dollar? What is the net impact on the firm?

Answer:

Without the forward contract, the firm *would have lost* (100,000 / 1.7530 – 100,000 / 1.6556) = – USD3,356.00 on its commitment. Fortunately, the firm gets to buy the Swiss franc at 1.7530 CHF/USD rather than at the 1.6556 rate in effect at the time the payment must be made. The actual loss on the commitment is exactly offset by the gain on the forward contract. The forward contract has locked in the price (in $) that the firm will pay for CHF in the future. Fluctuations in the actual spot rate in 60 days do not affect the (net) cost of CHF at contract expiration.

Part 2: Keeping in mind the information from Part 1 of this example, how much would the U.S. firm gain or lose on its commitment if at the time of payment the exchange rate had risen to 1.8250 CHF, and what is the net impact on the firm?

Answer:

Without the forward contract, the firm *would have gained* (100,000 / 1.7530 – 100,000 / 1.8250) = +USD2,250.55 by being able to pay off its commitment with cheap Swiss francs. Unfortunately, the firm must buy the Swiss francs at 1.7530 CHF/USD. Thus the gain on the commitment is exactly offset by the loss on the forward contract.

You should learn three things from this example:

- The gain or loss on the forward contract is unrelated to the current spot rate, 1.7799 CHF/USD.
- The gain or loss on the forward contract exactly offsets the loss or gain on the dollar cost of the original commitment. Note that gains and losses are measured *relative to the forward contract rate*, not the initial spot rate.
- The forward contract is not an option contract. Both parties (the firm and the bank) must perform on the agreed contract.

LOS 31.e: Calculate and interpret the spread on a forward foreign currency quotation and explain how spreads on forward foreign currency quotations can differ as a result of market conditions, bank/dealer positions, trading volume, and maturity/length of contract.

Consider a 6-month forward exchange rate quote from a U.S. currency dealer of 1.63843 – 1.64073 USD/GBP. This means that the dealer will commit today to buy pounds for 1.63843 dollars in six months or sell pounds in six months for 1.64073 dollars.

As with spot rates, the forward foreign currency spread is the difference between the bid and the ask quotes.

Example: Forward bid-ask spread

Assume that the USD/GBP 6-month forward rate is quoted at a bid of 1.63843 and an ask of 1.64073. From a U.S. dealer's perspective, calculate the bid-ask spread.

Answer:

In this case, the spread is simply 0.0023 USD/GBP = 1.64073 – 1.63843.

Forward Spreads and Market Conditions, Bank/Dealer Positions, Trading Volume, and Maturity/Length of Contract

Just as with spot market foreign currency spreads, spreads in the forward foreign currency market increase with greater exchange rate volatility and decrease when trading volume is higher. Spreads tend to increase with the term of the forward contract, and forward currency spreads are typically greater than spot currency spreads.

LOS 31.f: Calculate and interpret a forward discount or premium and express it as an annualized rate.

Professor's Note: Your life will be a lot easier on the exam if you make sure all of your quotes are in domestic currency over foreign currency (DC/FC) when using these formulas. If you work in FC/DC, a premium is a negative number, and your confusion factor will rise significantly!

A foreign currency is at a **forward discount** if the forward rate *expressed in domestic currency units* is less than the spot rate. Foreign currency units will be *cheaper* in the future.

forward discount = forward rate – spot rate = negative number

A foreign currency is at a **forward premium** if the forward rate *expressed in domestic currency units* is greater than the spot rate. Foreign currency units will be more expensive in the future.

forward premium = forward rate – spot rate = positive number

The **forward premium or discount** is frequently stated as an annualized percentage using the following formula:

$$\left(\begin{matrix}\text{forward premium}\\ \text{or discount}\end{matrix}\right)=\left(\frac{\text{forward rate}-\text{spot rate}}{\text{spot rate}}\right)\left(\frac{360}{\text{number of forward contract days}}\right)$$

Example: Annualized forward rate premium and discount

Assume the 90-day forward rate for the NZD is USD0.4439 and the spot rate is USD0.4315. Determine if the NZD is trading at a premium or discount to the USD. Calculate the annualized premium or discount.

Answer:

Since it takes more dollars to buy the NZD in the forward market relative to the spot, the NZD is trading at a *premium* to the dollar.

$$(\text{forward premium})=\left(\frac{0.4439-0.4315}{0.4315}\right)\left(\frac{360}{90}\right)=0.1149 \text{ or } 11.49\%$$

- *Note:* Later in this topic review, the term [(forward rate – spot rate) / spot rate] will be called the *forward differential*. This is just the forward premium stated as a percentage of the spot rate.
- *Another note:* The forward and spot rates in this equation are direct quotes, DC/FC.
- *Yet another note:* The bid-ask spread on forward contracts will *widen* with increases in currency volatility or contract maturity.

LOS 31.g: Explain interest rate parity and illustrate covered interest arbitrage.

The only difference between exchanging currencies in the spot market and exchanging currencies in the forward market is the timing of the transaction, where time is represented by interest rates. Covered interest rate parity, or simply **interest rate parity** (IRP), shows that there is a relationship between the spot and forward exchange rates and the domestic (r_D) and foreign (r_F) interest rates in the countries represented. Covered interest rate parity holds because investors will take advantage of interest rate differentials to move funds between countries where spot and forward exchange rates are not in balance. Covered means that the currency exposure in the foreign investment is hedged or "covered" by a forward contract.

IRP is approximated by equating the difference between the domestic interest rate and the foreign interest rate to the forward premium or discount. That is:

interest differential ≈ forward differential

Restating this relationship in more familiar terms gives:

$$(r_D - r_F) \approx \left(\frac{\text{forward exchange rate} - \text{spot exchange rate}}{\text{spot exchange rate}} \right)$$

where the forward and spot exchange rates are expressed as DC/FC.

When the above condition prevails, equilibrium exists in the international money markets.

You should also know that the exact IRP equation using direct quotes is:

$$\frac{\text{forward}}{\text{spot}} = \left(\frac{1 + r_D}{1 + r_F} \right)$$

Professor's Note: If this equity does not hold, an arbitrage opportunity exists. To remember this formula, note that when the forward and spot rates are expressed as direct quotes (DC/FC), right-hand side of the equation also has the domestic (interest rate) in the numerator and the foreign (interest rate) in the denominator. If we expressed the forward and spot rates as indirect quotes (FC/DC), then the right-hand side of the equation would have the foreign (interest rate) in the numerator and the domestic (interest rate) in the denominator. So it's either domestic over foreign for everything, or foreign over domestic for everything.

IRP ensures that the return on a hedged (covered) foreign investment will just equal the domestic interest rate of investments of identical risk. When this happens, there are no arbitrage possibilities, and the difference between the domestic interest rate and the hedged foreign rate (called the covered interest differential) is zero.

Example: Covered interest rate parity

Suppose you can invest in NZD at 5.127%, or you can invest in Swiss francs at 5.5%. You are a resident of New Zealand, and the current spot rate is 0.79005 NZD/CHF. Calculate the 1-year forward rate expressed in NZD/CHF.

Answer:

$$\text{forward (DC/FC)} = \text{spot (DC/FC)} \left(\frac{1 + r_D}{1 + r_F} \right) = 0.79005 \left(\frac{1.05127}{1.05500} \right) = 0.78726$$

Covered Interest Arbitrage

Covered interest arbitrage is a trading strategy that exploits currency positions when the interest rate parity equation is not satisfied. You can check for an arbitrage opportunity by using the *covered interest differential.* The covered interest differential says that the domestic interest rate should be the same as the hedged foreign interest rate. More specifically, the difference between the domestic interest rate and the hedged foreign rate should be *zero.* The covered interest differential can be viewed by rewriting IRP in the following way:

$$1 + r_D = \frac{(1 + r_F)(\text{forward rate})}{\text{spot rate}}$$

The left-hand side of the equation is the domestic interest rate, while the right-hand side is the hedged foreign rate (the foreign rate expressed in domestic terms). Arbitrage will prevent this relationship from getting out of line. To preclude arbitrage, the left-hand side minus the right-hand side should equal zero. Hence, the *covered interest differential* can be written as:

$$(1 + r_D) - \left(\frac{(1 + r_F)(\text{forward rate})}{\text{spot rate}}\right) = \text{covered interest differential}$$

For example, if the domestic interest rate is less than the hedged foreign interest rate, an arbitrageur will borrow in the domestic cash market, buy foreign currency at the spot rate, and enter into a forward contract, granting him the ability to convert the foreign funds back to domestic funds at some future date. The foreign funds are invested at the foreign interest rate until the forward contract expires, at which time the arbitrageur will convert the proceeds from the foreign investment back into the domestic currency via the forward contract. This results in an arbitrage (riskless) profit with no net investment.

Professor's Note: This parity relationship can seem complex but you must learn it; this important concept will come up in other contexts at Level 1 and subsequent levels. Consider an extreme example: the U.S. interest rate is 5% and the Mexican interest rate is 25%. Why can't a U.S. investor make a 25% return by investing in pesos at the Mexican risk-free rate?

The intuition here is that he can't because the Mexican peso will depreciate; he can have 25% more pesos at the end of one year but (if interest rate parity holds) he will be able to exchange these pesos for only 5% more dollars than he started with. The peso must depreciate. The exact calculation is $\frac{1 + r_d}{1 + r_f} - 1 = \frac{1.05}{1.25} - 1 = -16\%$. *For interest rate parity to hold, the forward exchange rate for the peso (quoted in USD/peso) must be 16% less than the spot exchange rate. The peso is expected to depreciate 16% relative to the dollar over the next year. If a dollar currently buys 10 pesos (1 peso = 0.10 USD), he has 12.5 pesos at the end of the year. The peso value in USD falls to 0.10 × 0.84 = 0.084 (a depreciation of 16%), the ending value is 12.5 × 0.084 = 1.05 USD, the same ending result as if he had invested the $1 at the U.S. interest rate of 5%. The parity relation is:* $\frac{1.05}{1.25} = \frac{0.084}{0.10}$; *if the forward peso rate is greater than 0.084 USD, a dollar-based investor can earn more than 5% by investing in pesos; if the forward peso rate is less than 0.084 USD, a peso-based investor can earn more than 25% by investing in dollars. When you can create an example like this with different numbers and work through it, you have mastered interest rate parity and covered interest arbitrage.*

Example: Identifying covered interest arbitrage opportunities

Assume you are a New Zealand investor and have 1,000 NZD. You can invest in NZD at 5.127%, or invest in Swiss francs at 5.5%. The current spot rate is 0.79005 NZD/CHF, and the forward rate is 0.78726 NZD/CHF.

Determine if there are any arbitrage opportunities.

Answer:

Let's insert the numbers and see if interest rate parity holds.

$$\frac{0.78726}{0.79005} = \frac{1.05127}{1.05500}$$

No arbitrage is available.

To verify this, work through the following steps:

- Convert your 1,000 NZD to Swiss francs at the spot rate.

$$\left(\frac{1{,}000 \text{ NZD}}{0.79005 \frac{\text{NZD}}{\text{CHF}}}\right) = 1{,}265.74 \text{ CHF}$$

- Invest your Swiss francs at 5.5% in Switzerland. At year-end you will have:

$$1{,}265.74 \text{ CHF} \times 1.055 = 1{,}335.36 \text{ CHF}$$

- Simultaneously enter into a 1-year forward contract to convert Swiss francs back to NZD at the forward rate of 0.78726 NZD/CHF.
- When the Swiss franc investment matures, collect the interest and principal (1,335.36 CHF) and convert it back to NZD:

$$1{,}335.36 \text{ CHF} \times \left(0.78726 \frac{\text{NZD}}{\text{CHF}}\right) = 1{,}051.28 \text{ NZD}$$

- If you had invested the NZD directly in New Zealand, you would have at year-end:

$$1{,}000 \text{ NZD} \times 1.05127 = 1{,}051.27 \text{ NZD}$$

- While there is a modest rounding error, there is no arbitrage opportunity here.

So here's the deal: The interest rate is 5.127% in New Zealand and 5.5% in Switzerland. To prevent arbitrage, the forward discount *should be* approximately 5.127% – 5.5% = –0.373%. (Remember that the *interest differential* is *approximately* equal to the forward premium.) You can invest NZD in New Zealand at 5.127%; *or* you can take those NZD, convert them into Swiss francs at the current spot rate, invest them in Switzerland at 5.5% and simultaneously enter into a forward contract to sell Swiss francs for NZD at today's forward rate. The hedged return from investing in Switzerland is the 5.5% return from your investment minus the 0.373% loss on your currency hedge (this is the 0.373% Swiss franc forward discount—it takes more Swiss francs to buy a NZD in the forward market than in the spot market). This is the same as the 5.127% return you can earn in New Zealand.

Example: Covered interest arbitrage opportunities

The forward rate between GBP and U.S. dollars is 0.7327 GBP/USD, and the current spot rate is 0.7045 GBP/USD. The U.K. interest rate is 6.056%, and the U.S. rate is 5.95%. Assume you can borrow GBP1,000 or the equivalent in USD and that you live in the U.K. Is there an arbitrage opportunity? If so, how would you take advantage of it?

Answer:

First check to see if arbitrage is possible.

$$\frac{0.7327}{0.7045} > \frac{1.06056}{1.0595}$$

So an arbitrage opportunity exists because the interest rate parity condition is not met.

Second, determine whether to borrow domestically or in the foreign market.

Since the left-hand side is "too high," we know that the forward exchange rate is greater than the forward exchange rate for parity. This means the forward price of USD is too high in GBP. We know from this that we do not want to hold GBP and buy (overpriced) USD in the future. The profitable arbitrage must be based on holding USD.

To arbitrage:

- Borrow GBP1,000 at 6.056%. At year-end you must pay back:

$$1{,}000 \text{ GBP} \times 1.06056 = \text{GBP}1{,}060.56$$

- Convert the borrowed pounds to dollars:

$$\left(\frac{1{,}000 \text{ GBP}}{0.7045 \frac{\text{GBP}}{\text{USD}}} \right) = 1{,}419.45 \text{ USD}$$

- Lend out the USD1,419.45 in the U.S. at 5.95%. At year-end you will have:

$$1{,}419.45 \text{ USD} \times 1.0595 = 1{,}503.91 \text{ USD}$$

- Simultaneously, enter into a 1-year forward contract to convert USD back to GBP at the forward rate of 0.7327 GBP/USD.

- When the USD investment matures, collect the interest and principal (1,503.91 USD) and convert it back to GBP:

$$1{,}503.91 \text{ USD} \times \left(0.7327 \frac{\text{GBP}}{\text{USD}} \right) = 1{,}101.91 \text{ GBP}$$

- After you pay off your GBP1,000 loan and interest for GBP1,060.56, you will have GBP41.35 left over.

So it is profitable to borrow money in the U.K. and make a hedged loan in the U.S. You will continue to do this until the money markets (interest rates) and exchange rates adjust and interest rate parity holds.

Example (continued): Another perspective on covered interest arbitrage

Let's do this example again, looking at things from a slightly different perspective. Recall that the purpose of interest rate parity is to keep the hedged foreign interest rate (the foreign rate expressed in domestic terms) equal to the domestic interest rate. Since this *must* be the case, recall that we rewrote IRP by setting the domestic rate equal to the hedged foreign rate:

$$1{,}503.91 \text{ USD} \times \left(0.7327 \frac{\text{GBP}}{\text{USD}}\right) = 1{,}101.91 \text{ GBP}$$

If we put the data from the previous example into this relationship, we get the following:

$$1.06056 \neq 1.0595\text{USD}\left(\frac{0.7327\text{GBP}}{0.7045\text{USD}}\right) = 1.1019\text{GBP}$$

We find that the domestic rate is 6.056%, whereas the hedged foreign rate is 10.19% (multiplying the foreign interest rate by F/S serves to *lock-in* the foreign rate in domestic terms). Your goal here is to *borrow at the low rate* and *lend at the high rate*. Hence, your arbitrage procedure is to borrow pounds, convert these pounds into dollars at today's spot rate, lend these dollars in the U.S., and simultaneously enter into a forward contract to sell dollars for pounds. Through this procedure, you will have an arbitrage profit.

KEY CONCEPTS

1. Direct foreign exchange quotations are in domestic currency per unit (or 100 units) of foreign currency and indirect quotations are in the foreign currency per unit of the domestic currency.
2. The difference between the bid and ask prices for foreign currency is the spread, sometimes expressed as a percentage of the ask price.
3. Foreign currency spreads increase with exchange rate volatility and decrease with increased trading volume, but the size of the spread is not dependent on dealer positions in the market.
4. The reciprocals of the bid and ask as a direct quote are an indirect quote, but viewed from the foreign country the bid and ask are reversed.
5. The exchange rates of two countries with a third can be used to obtain a cross rate (of exchange) between the two countries.
6. Forward foreign exchange rates are for currency to be exchanged at a future date while spot rates are for immediate delivery.
7. Forward foreign exchange rates have a bid-ask spread calculated as for spot rates.
8. The forward contract price is said to be at a forward premium (discount) for a currency if the direct quote of the forward rate is higher (lower) than the spot rate.
9. A forward premium or discount is often stated as an annualized percentage of the spot rate as:

$$\left(\frac{\text{forward rate}}{\text{spot rate}} - 1\right)\left(\frac{360}{\text{term in days}}\right)$$

10. Interest rate parity equates forward premiums or discounts to interest rate differentials between countries by the relation:

$$\frac{\text{forward}\left(\frac{DC}{FC}\right)}{\text{spot}\left(\frac{DC}{FC}\right)} = \frac{1 + r_{domestic}}{1 + r_{foreign}}$$

11. When interest rate parity does not hold, there is a profitable arbitrage either from lending a currency that has a forward rate above the parity value or borrowing a currency that has a forward rate below the parity value.

CONCEPT CHECKERS: FOREIGN EXCHANGE

1. The spot and 30-day forward rates for the Australian dollar (AUD) are USD0.3075 and USD0.3120, respectively. The AUD is selling at a forward:
   A. discount of USD0.0045.
   B. premium of USD0.0045.
   C. rate of USD0.3075.
   D. neither a premium nor a discount.

2. Suppose that the quote for British pounds (GBP) in New York is 1.3110 USD/GBP. What is the quote for U.S. dollars (USD) in London (GBP/USD)?
   A. 1.3110.
   B. 0.3110.
   C. 0.7628.
   D. 0.2372.

3. The interest rates in the U.S. (USD) and Sweden (SEK) are 4% and 7% per year, respectively. If the current spot rate is 9.5238 SEK/USD, then the 1-year forward rate in SEK/USD from the perspective of a U.S. investor is:
   A. 9.2568 SEK/USD.
   B. 10.2884 SEK/USD.
   C. 10.1905 SEK/USD.
   D. 9.7985 SEK/USD.

4. Interest rates are 10% in the U.S. and 4% in Switzerland (CHF), respectively, and the 1-year forward rate is USD0.80/CHF. If interest rate parity holds, today's spot rate:
   A. cannot be determined using the above information.
   B. must be 0.8462 USD/CHF.
   C. must be 0.7564 USD/CHF.
   D. must be 0.8888 USD/CHF.

5. The spot rate on the New Zealand dollar (NZD) is 1.4286 NZD/USD, and the 180-day forward rate is 1.3889 NZD/USD. This difference means:
   A. interest rates must be lower in the U.S. than in New Zealand.
   B. interest rates must be higher in the U.S. than in New Zealand.
   C. the NZD is expected to depreciate.
   D. the dollar is expected to appreciate.

6. Today's spot rate for the Indonesian rupiah (IDR) is 2,400 IDR/USD, and the New Zealand dollar trades at 1.60 NZD/USD. The NZD/IDR cross rate is:
   A. 0.00067 NZD/IDR.
   B. 1,492.53 NZD/IDR.
   C. 3,840 NZD/IDR.
   D. 0.00015 NZD/IDR.

7. An American wants to buy six cases of champagne. Each case costs 390 SEK. If the SEK/USD exchange rate is 6.90, what is the USD cost of the champagne?
   A. USD2,340.00.
   B. USD56.52.
   C. USD241.50.
   D. USD339.13.

8. Today's spot USD/NZD ask exchange rate is 0.6010, and the bid is 0.6000. The percentage spread on the USD is:
   A. 0.6600%.
   B. 0.1664%.
   C. 6.0010%.
   D. 1.5151%.

9. Suppose that the spot rate for the dollar is 0.7102 USD/CHF. Swiss and U.S. interest rates are 7.6% and 5.2%, respectively. If the 1-year forward rate is 0.7200 USD/CHF, a U.S. investor could earn an arbitrage profit per dollar invested of:
   A. USD0.0000.
   B. USD0.7200.
   C. USD1.0908.
   D. USD0.0388.

10. The NZD is trading at 0.3500 USD/NZD and the SEK is trading at 0.3100 NZD/SEK. The USD/SEK exchange rate is:
   A. 0.1129 USD/SEK.
   B. 9.2166 USD/SEK.
   C. 0.1085 USD/SEK.
   D. 0.1050 USD/SEK.

11. Suppose that the quote for GBP in New York is 1.7574–84 USD/GBP. The equivalent quote for U.S. dollars in London would be:
   A. 0.5687–90 GBP/USD.
   B. 0.5690–87 GBP/USD.
   C. 1.7574+09 GBP/USD.
   D. 1.7584–09 GBP/USD.

12. Assuming no transaction costs, if a U.S. investor can make risk-free profits by borrowing the Japanese yen, then:
   A. the hedged Japanese interest rate is low relative to the U.S. interest rate.
   B. $1 + r_D < \frac{(1+r_F)(\text{forward rate})}{\text{spot rate}}$.
   C. the U.S. interest rate is low relative to the hedged Japanese interest rate.
   D. the interest rate differential is approximately equal to the forward premium.

13. Assume the Philippine peso is at a 1-year forward discount of 1.25% to the Thai baht and that Thailand's 1-year interest rate is at 3.00%. If a Thai investor has no arbitrage opportunities, the Philippine interest rate is *closest* to:
   A. 3.10%.
   B. 4.25%.
   C. 1.76%.
   D. 1.25%.

14. The bid-ask quote for yen (JPY) in London $\left(\frac{£}{JPY}\right)$ is 0.0050 – 0.00504. In New York, the bid-ask quote for British pounds $\left(\frac{\$}{£}\right)$ is 1.671 – 1.678. What is the $\left(\frac{USD}{JPY}\right)$ ask as a cross rate?

A. 0.008390.
B. 0.008457.
C. 0.008422.
D. 0.008355.

ANSWERS – CONCEPT CHECKERS: FOREIGN EXCHANGE

1. B USD0.3120 – USD0.3075 = USD0.0045 premium.

2. C 0.7628 = 1/1.311

3. D The formula is as follows: $\text{forward (DC/FC)} = \text{spot (DC/FC)}\left(\frac{1+r_{domestic}}{1+r_{foreign}}\right)$. Since our quotes are in foreign/domestic instead of domestic over foreign, it may be easier for us to express interest rate parity in FC/DC terms as follows: $\text{forward (FC/DC)} = \text{spot (FC/DC)}\left(\frac{1+r_{foreign}}{1+r_{domestic}}\right)$. Hence, the forward rate in SEK/USD is $9.7985 = 9.5238\left(\frac{1.07}{1.04}\right)$. Since it takes more SEK to buy a USD in the forward market, the forward SEK is depreciating relative to the USD. The forward SEK must be depreciating because the Swedish interest rate exceeds the U.S. rate, and the purpose of interest rate parity is to keep the hedged foreign rate equal to the domestic rate. You can either invest in the U.S. at 4% or in Sweden at 7%. When you lock in your Swedish lendings by selling SEK forward, you *must* face a loss of 3% on this forward currency trade.

4. C We can solve interest rate parity for the spot rate as follows:

$$\text{spot (DC/FC)} = \text{forward (DC/FC)}\left(\frac{1+r_{foreign}}{1+r_{domestic}}\right)$$

Hence, spot is $0.7564 = 0.80\left(\frac{1.04}{1.10}\right)$. Since the interest rate is higher in the U.S., it should take fewer USD to buy CHF in the spot market. In other words, the forward USD must be depreciating relative to the spot.

5. B Interest rates are higher in the U.S. than in New Zealand. It should take fewer NZD to buy a USD in the forward market as the forward NZD appreciates.

6. A (1.60 NZD/USD) / (2,400 IDR/USD) = 0.00067 NZD/IDR

7. D Total SEK cost = 390 × 6 = 2,340 SEK. Invert the quote = 1 / 6.9 = 0.1449 USD/SEK.

Total dollar cost = 0.1449 USD/SEK × 2,340 SEK = USD339.13.

8. B The USD percent spread = $\frac{0.6010 - 0.6000}{0.6010}(100) = 0.1664\%$.

9. D To determine any arbitrage opportunities, you should first examine the interest rate parity relationship:

$$(1 + r_D) < \frac{(1+r_F)(\text{forward rate})}{\text{spot rate}}$$

$$1.052 < \frac{(1.076)(0.72)}{0.7102} = 1.0908$$

By viewing this relation, we find that the investor will want to borrow in the U.S. and lend in Switzerland.

Today:
- Borrow USD1 at 5.2%. (You will owe $1 × 1.052 = $1.052 at the end of the year.)
- Exchange $1 borrowed and buy CHF = $1/0.7102 = 1.408 CHF at spot rate.
- Lend the purchased CHF at the Swiss rate (you will receive 1.408 CHF × 1.076 = 1.5150 in one year).
- Purchase a forward contract to sell the 1.5150 CHF and buy $1.098 USD (1.5150 CHF × 0.7200 USD/CHF = 1.0908 USD) to pay off the loan.

In one year:
- Close the Swiss savings account. Proceeds: (1.408)(1.076) = 1.5150 CHF.
- Use the proceeds of the savings account to purchase USD1.0908 at the prespecified forward rate (1.515 CHF × 0.72 USD/CHF).
- Pay off the loan. Money needed = USD1 × 1.052 = USD1.052.
- Riskless profit = USD1.0908 – USD1.052 = USD0.0388.

10. C 0.3500 USD/NZD × 0.3100 NZD/SEK = 0.1085 USD/SEK. Notice that the NZD cancels in the multiplication.

11. A Invert the quotes: 1/1.7574 = 0.5690 and 1/1.7584 = 0.5687. Remember, when you invert a quote, the ask becomes the bid for the other currency and vice versa. So the quote is 0.5687–90 GBP/USD in London.

12. A Stating that an investor can make risk-free profits is just another way of saying that arbitrage opportunities exist. This choice is equivalent to saying that the domestic (U.S.) rate is high relative to the hedged foreign rate, or $1 + r_D > \frac{(1+r_F)(\text{forward rate})}{\text{spot rate}}$. The other statements are false (note that choices B and C are the same). If the U.S. interest rate is low relative to the Japanese hedged interest rate, a U.S. investor could earn risk-free profits by borrowing domestic. When the interest rate differential is approximately equal to the forward premium, interest rate parity holds, and there are *no* arbitrage profits.

13. B If there are no arbitrage opportunities, IRP holds, and the interest rate differential is equal to the forward differential, or $r_d - r_f = -0.0125$, $0.030 - r_f = -0.0125$, $r_f = 0.0425 = 4.25\%$.

14. B To buy a JPY with USD, we buy a pound at the New York ask of $1.678. We can use that pound to buy $\frac{1}{0.00504} = 198.41$ JPY in London. The cost of each JPY in USD is $1.678/198.41 = 0.008457$.

The following is a review of the Economics principles designed to address the learning outcome statements set forth by CFA Institute®. This topic is also covered in:

FOREIGN EXCHANGE PARITY RELATIONS

Study Session 6

EXAM FOCUS

This review focuses on the balance-of-payments accounts and the factors that influence exchange rates between countries. Concentrate your efforts on understanding the components of the current account and the financial account. If a country's imports exceed exports (current account deficit), then the difference must be made up by investment by foreigners in the physical or financial assets of the country. You should be able to explain both absolute and relative purchasing power parity and how fixed and pegged exchange rate systems differ. Finally, understand the effects of monetary and fiscal policy on the current account and financial account. Try to grasp the analytical arguments about how monetary and fiscal policy affect the balance-of-payments accounts through their effects on inflation, incomes, and real interest rates.

Professor's Note: A previous review referred to the capital account, which is also called the financial account. The terms are interchangeable.

LOS 32.a: Explain how exchange rates are determined in a flexible or floating exchange rate system.

Exchange rates are determined by supply and demand in a flexible exchange rate system (also called a floating exchange rate system). If there is an excess demand for U.S. dollars by Australians at the current exchange rate, they will sell AUD and buy U.S. dollars. This will cause the U.S. dollar to appreciate relative to the AUD. Intuitively, when might this happen? Australians would create an excess demand for U.S. dollars if they desired to increase their *imports* of U.S. goods. In order to buy U.S. goods, Australians need U.S. dollars. Hence, the value of the U.S. dollar rises relative to the AUD.

LOS 32.b: Explain the role of each component of the balance-of-payments accounts.

Balance-of-payments (BOP) accounting is a method used to keep track of transactions between a country and its international trading partners. It includes government transactions, consumer transactions, and business transactions. The balance-of-payments accounts reflect all payments and liabilities to foreigners and all payments and obligations received from foreigners. The BOP equation is:

$$\text{current account} + \text{financial account} + \text{official reserve account} = 0$$

The **current account** measures the exchange of merchandise goods, the exchange of services, the exchange of investment income, and unilateral transfers (gifts to and from other nations). The *balance on current account* summarizes the balance on goods and services, the exchange of investment income, and unilateral transfers. All other factors constant, a deficit balance on a country's current account implies that there is an excess supply of its currency in foreign exchange markets. Hence, its currency should depreciate (decline in value).

The **financial (capital) account** measures the flow of funds for debt and equity investment into and out of the country. All other factors constant, a surplus balance in a country's financial account implies that there is an excess demand for assets denominated in its currency. Hence, its currency should appreciate.

Official reserve account transactions are funds held at the *International Monetary Fund* (IMF) in the form of gold, other foreign currencies, and special drawing rights at the IMF. In 1997, the U.S. ran a current account deficit and a smaller surplus in its capital account. As a result, the U.S. ran a surplus in the reserve account to

balance the BOP account. These reserve balances are used by the Fed to *intervene* in the foreign-exchange markets in an attempt to loosely control exchange rates.

Professor's Note: For the exam, assume that the official reserve account is equal to zero (or fixed). Then, if you are given (or you determine) a change in the current account, say a decrease, you know that the financial account must change in the opposite direction, or increase. The current account measures exports minus imports, while the financial account measures the flow of capital transactions. If a country imports more than it exports, the difference must be made up by foreign investment (i.e., an increase in the financial account).

LOS 32.c: Explain how current account deficits or surpluses and financial account deficits or surpluses affect an economy.

Is a nation's current account balance a good measure of its economic health? No, there is no law, economic or political, which states that the current account must be positive to indicate economic health. Unlike running a *budget deficit* in which a person or institution spends more than it makes, running a deficit in the current account balance simply means a country imports more than it exports, and a country can do this for a long time. Also, countries that run current account deficits tend to run financial account surpluses so that they offset each other. Is an inflow of capital bad? No, if the capital is being invested in such a way as to enhance the productive capacity of the country. Is a current account surplus and financial account deficit an indication of economic strength? No, particularly if this occurs because there are few good investment opportunities in the country to attract investment and there are more attractive investment opportunities abroad.

LOS 32.d: Describe the factors that cause a nation's currency to appreciate or depreciate.

There are *three major factors* that cause a country's currency to appreciate or depreciate relative to another's.

- **Differences in income growth** among nations will cause nations with the highest income growth to demand more imported goods. The heightened demand for imports will increase demand for foreign currencies, appreciating the foreign currencies relative to the domestic currency.
- **Differences in inflation rates** will cause the residents of the country with the highest inflation rate to demand more imported (cheaper) goods. For example, if prices in the U.S. are rising twice as fast as in Australia, U.S. citizens will increase their demand for Australian goods (because Australian goods are now cheaper relative to domestic goods). If a country's inflation rate is higher than its trading partners', the demand for the country's currency will be low, and the currency will depreciate.
- **Differences in real interest rates** will cause a flow of capital into those countries with the highest available *real* rates of interest. Therefore, there will be an increased demand for those currencies, and they will appreciate relative to the currencies of countries whose available real rate of return is low.

Figure 1 summarizes the factors that cause a nation's currency to appreciate or depreciate.

Figure 1: Factors That Affect Currency Movements

*Factors**	*Lower*	*Higher*
Income growth rate	Appreciation	Depreciation
Inflation rate	Appreciation	Depreciation
Domestic real interest rate	Depreciation	Appreciation

* relative to trading partners.

LOS 32.e: Explain how monetary and fiscal policies affect the exchange rate and balance-of-payments components.

Exchange rate effects. Since monetary and fiscal policies affect income growth, inflation, and real interest rates, they will also influence exchange rates. The monetary and fiscal policy effects on exchange rates discussed below are only relevant in a system of flexible (floating) exchange rates.

An unanticipated shift to an expansionary monetary policy will lead to more rapid economic growth, an accelerated inflation rate, and lower real interest rates. The rapid economic growth stimulates imports, the higher inflation rate makes domestic products more expensive, which reduces exports, and the low real interest rate reduces foreign investment. Each of these factors increases the demand for foreign currencies relative to the domestic currency, causing the domestic currency to *depreciate*. Given an unanticipated shift to a restrictive monetary policy, the opposite occurs.

An unanticipated shift to a more restrictive fiscal policy will result in budget surpluses. The reduced aggregate demand causes an economic slowdown and lower inflation. These factors discourage imports and encourage exports, resulting in appreciation of the domestic currency. However, budget surpluses suggest that government borrowing declines, which reduces real rates and causes investment funds to flow out of the country. As a result, the domestic currency tends to depreciate. Thus, the results are conflicting. However, since financial capital is mobile, the effect of the interest rate change generally dominates in the short run, leading to short-run depreciation. Given an unanticipated shift to an expansionary fiscal policy, appreciation occurs.

BOP component effects. Monetary and fiscal policy can also affect the current and financial accounts through their impact on income, inflation, and real interest rates.

An unanticipated shift to an expansionary monetary policy will lead to higher income, an accelerated inflation rate, and lower real interest rates. The higher income and higher domestic prices stimulate imports and discourage exports, causing the current account balance to move toward deficit. The lower real interest rate discourages foreign and domestic investment at home, moving the financial account toward deficit. At the same time, the value of the domestic currency declines because of the earlier shift to imports. Now, however, the depreciation in the domestic currency encourages exports and discourages imports. This more than offsets the movement toward deficit in the current account. Thus, the impact of an unanticipated shift to an expansionary monetary policy will be a shift toward a deficit in the financial account and a shift toward surplus in the current account. An unanticipated shift to a more restrictive monetary policy produces opposite effects.

An expansionary change in fiscal policy (to a larger budget deficit) will cause an increase in aggregate demand and an increase in domestic interest rates (due to crowding out). The increased aggregate demand encourages imports, which moves the current account toward deficit. Meanwhile, the higher interest rates attract foreign investment and discourage domestic investment from leaving the country. Thus, the financial account will move toward surplus. An unanticipated shift to a budget surplus would produce opposite results.

Figure 2 summarizes the impacts of expansionary monetary and fiscal policy on currency rates, the current account, and the financial account. The impacts of restrictive policy are the reverse.

Figure 2: Impacts of Expansionary Monetary and Fiscal Policy

Policy	*Currency*	*Current Account*	*Financial Account*
Monetary policy	Depreciation	Surplus	Deficit
Fiscal policy	Appreciation	Deficit	Surplus

Professor's Note: Here's where the "trick" about assuming that the BOP official reserve account is fixed comes in handy. As long as you know the impact on the current account, you know the impact on the financial account is the opposite.

LOS 32.f: Describe a fixed exchange rate and a pegged exchange rate system.

Up until now, we have been dealing with flexible exchange rate systems. There are two other exchange rate systems that may also occur: a fixed exchange rate system and a pegged exchange rate system.

A **fixed exchange rate system** has a set rate of exchange and is supported by giving up discretion in monetary policy. Some countries fix their exchange rates to other currencies, such as the U.S. dollar, and sacrifice independent monetary policy. For example, Panama, Hong Kong, and the U.S. have a unified currency. The non-U.S. countries accomplish this through the use of a *currency board*, which has the power to create domestic currency only in exchange for a specific quantity of U.S. dollars they hold in bonds and other liquid assets. The currency board promises to redeem the domestic currency at the fixed exchange rate into dollars.

The EU has a similar system with the 11 countries that have joined the system using the euro as the unified currency. The distinguishing characteristic of a fixed-rate, unified currency system is the existence of only one central bank that can increase or decrease the money supply. A country that imports more than it exports under this system will find a net decrease in the money supply, which should lead to downward pressure on prices. Lower prices should reverse the export-import relationship until the country's exports begin to exceed its imports.

A **pegged exchange rate system** involves a commitment of a country to use fiscal and monetary policy to maintain the country's exchange rate within a narrow band relative to another (stronger) currency or to a bundle of currencies. This type of system requires a country to use its monetary policy to maintain the desired exchange rate.

LOS 32.g: Discuss absolute purchasing power parity and relative purchasing power parity.

The *law of one price* states that identical goods should have the same price in all locations. For instance, a pair of designer jeans should cost the same in New York and London after adjusting for the exchange rate. The potential for arbitrage profits is the basis for the law of one price. If widgets cost less in New York than in Paris, an enterprising individual will buy widgets in New York and sell them in Paris until the price differential disappears. The law of one price does not hold in practice due to the effects of tariffs and transportation costs.

Instead of focusing on individual products, **absolute PPP** compares the average price of goods between countries. Absolute PPP only requires that the law of one price is correct *on average*.

So, according to absolute PPP, the ratio of the weighted average of the prices of all goods in two economies should equal the exchange rate. In practice, such weighted averages are never calculated and, even if the law of one price held for every good in the two economies, absolute PPP might not hold. This could be the case, since the weights of the various goods in the two economies may not be the same. Absolute PPP is not used in practice to predict exchange rate movements, and the weighted-average price of all goods in an economy is not calculated in any event.

Relative PPP

The practical measure of the change in a country's price level is a price index, such as the CPI or the GDP deflator. Either can be used to calculate the inflation rate based on a particular "basket" of goods and services. **Relative purchasing power parity** is based on a relation between exchange rate movements and differences in inflation rates between two countries. Simply put, if (over a 1-year period) Country A has a 6% inflation rate and Country B has a 4% inflation rate, then Country A's currency should *depreciate* by approximately 2% relative to Country B's currency over the period. Relative PPP states that changes in exchange rates should exactly offset any inflation differential between the two countries.

We can express the relative PPP relationship (over one period) as:

$$\frac{\text{expected exchange rate at time 1}}{\text{spot exchange rate at time 0}} = \frac{1 + \text{domestic inflation}}{1 + \text{foreign inflation}}$$

where the spot exchange rates are expressed as direct quotes (DC/FC). Note that if the exchange rates are quoted as indirect rates (FC/DC) then the right-hand side of the equation must be inverted with foreign inflation in the numerator.

Professor's Note: To remember this formula, note that if the exchange rates are expressed as DC/FC, then the right-hand side of relative PPP is domestic/foreign as well, and vice versa! This is essentially the same formula we had for IRP, with interest rates replaced by inflation rates and the forward exchange rate replaced by the expected future spot rate.

Let's do the calculation for our 6% and 4% inflation rates example. Assume domestic inflation is 4%, foreign inflation is 6%, and initially each foreign currency unit is priced at 2 domestic currency units. We want to find the expected future spot exchange rate consistent with relative PPP.

Recall that the country with the higher inflation rate will see its currency depreciate. We expect the foreign currency to depreciate by 6 – 4 = 2%, relative to the domestic currency. This means that the price of a foreign currency unit (expressed in domestic currency units) will *decrease* by approximately 2%. It will decrease from 2 to $2 \times 0.98 = 1.96$ DC/FC.

Now let's use the exact relation to get the expected future spot rate under relative PPP based on these assumptions. Rearranging the relative PPP relation, we get:

$$\text{expected exchange rate at time 1} = \text{exchange rate at time 0} \times \left[\frac{1 + \text{domestic inflation}}{1 + \text{foreign inflation}}\right]$$

and we can solve for the expected exchange rate at time 1 as:

$$2 \times \frac{1.04}{1.06} = 1.9623 \text{ DC/FC}$$

Since we know that the currency with the higher inflation rate is expected to depreciate, we can see that we have applied the relation correctly because the value of a foreign currency unit is expected to decrease from 2 to 1.9623 domestic currency units. Given an indirect quote of 0.5 foreign currency units per domestic currency unit, we could calculate the expected future spot exchange rate as $0.5 \times \frac{1.06}{1.04} = 0.5096$ (more FC per DC unit indicates a depreciation of the FC).

Relative PPP is a theory, and while it tends to hold in the long run, violations of the relative PPP relation in the short run are common in real markets. With covered interest rate parity, we noted that arbitrage will move forward exchange rates to levels consistent with our parity relation. There is no arbitrage available to force the PPP relation to hold; the question is whether the relation can be used to predict future exchange rate movements (how well the relation predicts future spot rates).

The following example illustrates using the relative PPP relation to calculate the expected spot exchange rate more than one period in the future.

Example: Relative PPP

Suppose that the current spot quote for the Australian dollar is 0.20 USD/AUD. Also, annual Australian inflation is expected to be 10%, while annual U.S. inflation is expected to be 5%. Calculate the expected future spot rate in two years under relative PPP.

Answer:

$$\text{expected future exchange rate}_2 = 0.20\left[\frac{1.05}{1.10}\right]^2 = 0.1822 \text{USD/AUD}$$

This example illustrates that to keep the relative cost of goods and services the same across borders, countries with higher rates of expected inflation should see their currencies depreciate. This is precisely what has happened in this example. Today it takes USD0.20 to buy each AUD. However, since prices are expected to rise faster in Australia relative to the U.S., it should only take USD0.1822 to buy each AUD two years from now. In a relative PPP world, the relative cost of Australian widgets to a U.S. purchaser will be constant after adjusting for exchange rates.

Closing Remarks on Purchasing Power Parity

Empirical evidence suggests that purchasing power parity does not hold, at least in the short run. That means exchange rates tend to change by amounts that differ from those implied by the inflation differentials. For example, suppose annual inflation for 2004 is 4% in the U.S. and 1% in Japan. Relative PPP would predict that the USD should have *depreciated* by 3% during the year. However, suppose that the USD actually *appreciates* by 2%. We would conclude that the USD is overvalued in relation to relative PPP. In other words, the USD is above its "fundamental" value.

Empirical research also suggests that relative PPP *does* tend to hold more closely over the longer term. Currencies that become overvalued or undervalued in relation to PPP over time tend to eventually revert to the long-term level predicted by relative PPP. That means relative PPP is somewhat useful in exchange rate determination in the short run because currencies that are overvalued relative to their PPP-determined fundamental value will tend to depreciate, while undervalued currencies will tend to appreciate. However, the adjustment period can sometimes be quite long (i.e., several years).

Professor's Note: It appears that we've made two contradictory statements: relative PPP doesn't hold in the short run, but it is useful in exchange rate determination. The key to understanding this LOS is to recognize that because relative PPP tends to hold in the long run, exchange rates that deviate from fundamental value in the short run tend to revert to the level predicted by relative PPP in the long run. We can use this fact to make short-run predictions: overvalued currencies will depreciate over time, while undervalued currencies will appreciate.

Absolute purchasing power parity is of little use in determining exchange rates. In order to directly compare the prices of goods and services between two countries, we would need to have identical individual goods and services to establish the validity of the law of one price. However, goods consumed are rarely identical between various countries. In reality, differences in taxes, transportation and labor costs, rents, and government controls (e.g., tariffs) between countries provide complexities that prevent direct comparison. Therefore, it's difficult (if not impossible) to confirm absolute PPP and to determine whether the exchange rates are under- or overvalued according to the theory of absolute PPP.

KEY CONCEPTS

1. Supply and demand determine the exchange rates in flexible (or floating) exchange rate systems; there is supply of and demand for every currency in the foreign exchange market.
2. The balance of payments is given by the equation:
   current account balance + financial account balance + official reserve account balance = 0.
   The current account includes the exchange of goods, services, and investment income, while the financial account includes payments for securities, direct investment, and bank deposits.
3. A current account deficit simply means that a country imports more than it exports and if offset by a surplus in the financial account, a deficit in the current account can continue for a long period with no apparent problem.
4. Three major factors cause a country's currency to appreciate or depreciate:
   - The growth rate of income relative to trading partners (high growth → depreciation).
   - The rate of inflation relative to trading partners (high inflation → depreciation).
   - Domestic real interest rates relative to those of other countries (high real rates → appreciation).
5. An unanticipated shift to an expansionary monetary policy causes higher income, accelerated inflation, and lower real interest rates, leading to currency depreciation, a current account surplus, and a financial account deficit, while restrictive monetary policy has the opposite effect.
6. An unanticipated shift to expansionary fiscal policy (a larger budget deficit) causes currency appreciation, a current account deficit, and a financial account surplus, while restrictive fiscal policy has the opposite effect.
7. A fixed exchange rate system exists when a country fixes its exchange rate to the currency of another country; a pegged exchange rate system involves a commitment to use fiscal and monetary policy to maintain the country's exchange rate within a narrow band relative to another currency.
8. Under absolute PPP, the average price of all goods should be the same across borders after adjustment has been made for exchange rates.
9. Relative PPP depends on the inflation rates in two countries:

$$\text{expected future exchange rate}_t = \text{spot rate} \times \left[\frac{1+\text{inflation}_{\text{domestic}}}{1+\text{inflation}_{\text{foreign}}}\right]^t$$

   where the spot and expected exchange rates are direct quotes (DC/FC).

CONCEPT CHECKERS: FOREIGN EXCHANGE PARITY RELATIONS

1. If the U.S. dollar was quoted at AUD1.73 yesterday and today the U.S. dollar is trading at AUD1.80, the U.S. dollar has:
   A. appreciated, and will purchase less Australian goods.
   B. depreciated, and will purchase less Australian goods.
   C. appreciated, and will purchase more Australian goods.
   D. depreciated, and will purchase more Australian goods.

2. A country's currency will *appreciate* when its:
   A. imports rise in relation to its exports.
   B. current account moves from surplus to deficit.
   C. exports rise in relation to its imports.
   D. capital account is in surplus but not changing.

3. A country's currency will *depreciate* after:
   A. its income is growing slowly relative to the rest of the world.
   B. its inflation rate is lower than that of its trading partners.
   C. the real interest rate is lower than real rates in other countries.
   D. the monetary policy of the country becomes more restrictive.

4. If there were an unexpected decline in the growth rate of the money supply:
   A. real interest rates, output, and prices would fall, causing the dollar to depreciate.
   B. real interest rates would rise, causing an appreciation of the dollar.
   C. nothing would happen to exchange rates in the short run.
   D. real interest rates, output, and prices would rise, causing the dollar to appreciate.

5. The current account balance reflects the exchange of:
   A. merchandise only.
   B. goods and services only.
   C. goods, services, and investment income.
   D. goods, services, investment income, and unilateral transfers.

6. If the current account is in surplus, the *sum* of the financial account and official reserve transactions must be:
   A. in deficit.
   B. in surplus.
   C. equal to zero.
   D. non-negative.

7. In a flexible exchange rate system, the value of a currency is determined by the:
   A. amount of gold held in reserve.
   B. country's currency board.
   C. supply and demand for the country's currency in the foreign exchange markets.
   D. World Bank at its weekly executive-committee meeting.

8. Which of the following would be the *most likely* negative consequence for a country that ran a current account deficit for ten consecutive years?
   A. Hyperinflation.
   B. Rapid economic growth.
   C. High real interest rates.
   D. There would be no negative consequences.

9. Relative purchasing power parity:
   A. does not hold in the short run or the long run.
   B. tends to hold in both the short run and long run.
   C. tends to hold in the short run but not the long run.
   D. tends to hold in the long run but not the short run.

10. Assume that the current spot rate of exchange between the U.S. dollar (USD) and the euro (EUR) is EUR1.2500 per USD. The U.S inflation rate is expected to be 5% and the inflation rate in Europe is expected to be 4%. If relative purchasing power parity holds, the expected exchange rate three years from today is *closest* to:
   A. EUR1.0000.
   B. EUR1.2146.
   C. EUR1.2381.
   D. EUR1.2864.

ANSWERS – CONCEPT CHECKERS: FOREIGN EXCHANGE PARITY RELATIONS

1. C If it took AUD1.73 to buy one U.S. dollar yesterday and today it takes AUD1.80 to buy one U.S. dollar, the dollar has appreciated and will purchase more Australian goods.

2. C A country's currency will appreciate after its exports rise in relation to its imports. An increase in exports means that other countries are buying the country's currency, which increases its value.

3. C A country's currency will depreciate when the real interest rate is lower than real rates in other countries. With a lower real interest rate, foreign investors will not buy the country's currency to invest.

4. B If there were an unexpected decline in the growth rate of the money supply, real interest rates would rise, causing an appreciation of the dollar.

5. D The current account balance reflects the exchange of merchandise, services, investment income, and unilateral transfers.

6. A The balance-of-payments equation is:

   current account + financial account + official reserve account = 0

   So, if the current account balance is in surplus, the sum of the other two accounts must reflect a deficit in order for the sum of all three to be zero.

7. C In a flexible exchange rate system, currency value is determined by the supply of and demand for the country's currency. Anything that affects the supply of or demand for the country's currency will affect the exchange rate.

8. D A current account deficit simply means that a country imports more than it exports. There is no reason that this should have a negative effect on the country's economy. If it persists, it is an indication that the country's financial assets have been willingly purchased to maintain the balance of payments.

9. D Relative PPP is a poor predictor of short-run exchange rate movements. However, purchasing power tends to converge to parity and relative PPP tends to hold in the long run.

10. B $EUR1.2500 \times \left[\frac{1.04}{1.05}\right]^3 = EUR1.2146$

    The higher expected rate of inflation in the U.S. should cause the USD to depreciate over the 3-year period. According to relative PPP, the expected depreciation is that which would make the relative cost of goods and services between the U.S. and Euroland the same at the end of the period after adjusting for inflation.

FORMULAS

$$\text{price elasticity of demand} = \frac{\text{percent change in quantity demanded}}{\text{percent change in price}} = \frac{\%\Delta Q}{\%\Delta P}$$

$$\text{where: percent change} = \frac{\text{change in value}}{\text{average value}} = \frac{\text{ending value} - \text{beginning value}}{\left(\frac{\text{ending value} + \text{beginning value}}{2}\right)}$$

$$\text{cross elasticity of demand} = \frac{\text{percent change in quantity demanded}}{\text{percent change in price of substitute or complement}}$$

$$\text{income elasticity of demand} = \frac{\text{percent change in quantity demanded}}{\text{percent change in income}}$$

$$\text{price elasticity of supply} = \frac{\text{percent change in quantity supplied}}{\text{percent change in price}} = \frac{\%\Delta Q}{\%\Delta P}$$

$$\text{total cost} = \text{total fixed cost} + \text{total variable cost}$$

$$\text{marginal cost} = \frac{\text{change in total cost}}{\text{change in output}}, \text{ or } MC = \frac{\Delta TC}{\Delta Q}$$

$$\text{average fixed cost} = TFC / Q$$

$$\text{average variable cost} = TVC / Q$$

$$\text{average total cost} = AFC + AVC$$

$$\text{unemployment rate} = \frac{\text{number of unemployed}}{\text{labor force}} \times 100$$

$$\text{labor force participation rate} = \frac{\text{labor force}}{\text{working-age population}} \times 100$$

$$\text{employment-to-population ratio} = \frac{\text{number of employed}}{\text{working-age population}} \times 100$$

$$CPI = \frac{\text{cost of basket at current prices}}{\text{cost of basket at base period prices}} \times 100$$

$$\text{inflation rate} = \frac{\text{current price level} - \text{year-ago price level}}{\text{year-ago price level}} \times 100$$

aggregate demand = consumption + investment + government spending + net exports

potential deposit expansion multiplier = 1 / (required reserve ratio)

potential increase in money supply = potential deposit expansion multiplier × increase in excess reserves

equation of exchange:

$$\text{money supply} \times \text{velocity} = \text{GDP} = \text{price} \times \text{real output}$$

quantity theory of money:

$$\text{price} = \frac{MV}{Y}$$

balance of payments:

current account + capital account + official reserve account = 0

$$\left(\begin{array}{c}\text{forward premium} \\ \text{or discount}\end{array}\right) = \left(\frac{\text{forward rate} - \text{spot rate}}{\text{spot rate}}\right)\left(\frac{360}{\text{number of forward contract days}}\right)$$

interest rate parity using direct quotes:

$$\frac{\text{forward}}{\text{spot}} = \left(\frac{1 + r_D}{1 + r_F}\right)$$

$$\text{covered interest differential} = (1 + r_D) - \left(\frac{(1 + r_F)(\text{forward rate})}{\text{spot rate}}\right)$$

purchasing power parity:

$$\text{expected exchange rate at time 1} = \text{exchange rate at time 0} \times \left[\frac{1 + \text{domestic inflation}}{1 + \text{foreign inflation}}\right]$$

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Notes