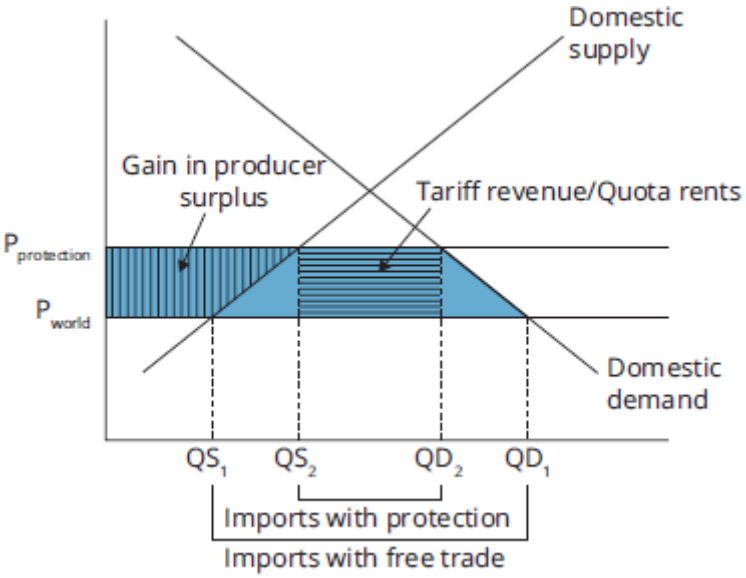
Figure 17.1: Effects of Tariffs and Quotas



In the case of a quota, if the domestic government collects the full value of the import licenses, the result is the same as for a tariff. If the domestic government does not charge for the import licenses, this amount is a gain to those foreign exporters who receive the import licenses under the quota and are termed **quota rents**.

In terms of overall economic gains from trade, the deadweight loss is the amount of lost welfare from the imposition of a quota or tariff. From the viewpoint of the domestic country, the loss in consumer surplus is only partially offset by the gains in domestic producer surplus and the collection of tariff revenue.

If none of the quota rents are captured by the domestic government, the overall welfare loss to the domestic economy is greater by the amount of the quota rents. It is the entire difference between the gain in producer surplus and the loss of consumer surplus.

A **voluntary export restraint (VER)** is just as it sounds. It refers to a voluntary agreement by a government to limit the quantity of a good that can be exported. VERs are another way of protecting the domestic producers in the importing country. They result in a welfare loss to the importing country equal to that of an equivalent quota with no government charge for the import licenses—that is, no capture of the quota rents.

Export subsidies are payments by a government to its country's exporters. Export subsidies benefit producers (exporters) of the good but increase prices and reduce consumer surplus in the exporting country. In a small country, the price will increase by the amount of the subsidy to equal the world price plus the subsidy. In the case of a large exporter of the good, the world price decreases and some benefits from the subsidy accrue to foreign consumers, while foreign producers are negatively affected.

Most of the effects of all four of these protectionist policies are the same. With respect to the domestic (importing) country, import quotas, tariffs, and VERs all do the following:

- Reduce imports
- Increase price
- Decrease consumer surplus
- Increase domestic quantity supplied
- Increase producer surplus

With one exception, all will decrease national welfare. Quotas and tariffs in a large country could increase national welfare under a specific set of assumptions, primarily because for a country that imports a large amount of the good, setting a quota or tariff could reduce the world price for the good.

Capital Restrictions

Some countries impose **capital restrictions** on the flow of financial capital across borders. Restrictions include outright prohibition of investment in the domestic country by foreigners, prohibition of or taxes on the income earned on foreign investments by domestic citizens, prohibition of foreign investments in certain domestic industries, and restrictions on repatriation of earnings of foreign entities operating in a country.

Overall, capital restrictions are thought to decrease economic welfare. However, over the short term, they have helped developing countries avoid the impact of great inflows of foreign capital during periods of optimistic expansion and the impact of large outflows of foreign capital during periods of correction and market unease, or outright panic. Even these short-term benefits may not offset longer-term costs if the country is excluded from international markets for financial capital flows.

LOS 17.c: Explain motivations for and advantages of trading blocs, common markets, and economic unions.

There are various types of agreements among countries with respect to trade policy. The essence of all of them is to reduce trade barriers among the countries. Reductions in trade restrictions among countries have some, by now familiar, positive and negative effects on economic welfare. The positive effects result from increased trade according to comparative advantage, as well as increased competition among firms in member countries. The negative effects result because some firms, some industries, and some groups of workers will see their wealth and incomes decrease. Workers in affected industries may need to learn new skills to get new jobs.

On balance, economic welfare is improved by reducing or eliminating trade restrictions. Note, however, that to the extent that a trade agreement increases trade restrictions on imports from nonmember countries, economic welfare gains are reduced and, in an extreme case, could be outweighed by the costs such restrictions impose. This could result if restrictions on trade with nonmember countries increase a country's (unrestricted) imports from a member that has higher prices than the country's previous imports from a nonmember.

We list these types of agreements, generally referred to as **trading blocs** or **regional trading agreements (RTAs)**, in order of their degrees of integration.

Free Trade Areas

1. All barriers to import and export of goods and services among member countries are removed.

Customs Union

1. All barriers to import and export of goods and services among member countries are removed.
2. All countries adopt a common set of trade restrictions with nonmembers.

Common Market

1. All barriers to import and export of goods and services among the countries are removed.
2. All countries adopt a common set of trade restrictions with nonmembers.
3. All barriers to the movement of labor and capital goods among member countries are removed.

Economic Union

1. All barriers to import and export of goods and services among the countries are removed.
2. All countries adopt a common set of trade restrictions with nonmembers.
3. All barriers to the movement of labor and capital goods among member countries are removed.
4. Member countries establish common institutions and economic policy for the union.

Monetary Union

1. All barriers to import and export of goods and services among the countries are removed.
2. All countries adopt a common set of trade restrictions with nonmembers.
3. All barriers to the movement of labor and capital goods among member countries are removed.
4. Member countries establish common institutions and economic policy for the union.
5. Member countries adopt a single currency.

The North American Free Trade Agreement (NAFTA) is an example of a free trade area, the European Union (EU) is an example of an economic union, and the Eurozone is an example of a monetary union.

MODULE QUIZ 17.1

1. Which of the following effects is *most likely* to occur in a country that increases its openness to international trade?
   A. Increased prices of consumer goods.
   B. Greater specialization in domestic output.

C. Decreased employment in exporting industries.

2. An agreement with another country to limit the volume of goods and services sold to them is *best* described as a:
   A. quota.
   B. voluntary export restraint.
   C. minimum domestic content rule.
3. Which of the following groups would be *most likely* to suffer losses from the imposition of a tariff on steel imports?
   A. Domestic steel producers.
   B. Workers in the domestic auto industry.
   C. Workers in the domestic steel industry.
4. The *most likely* motivation for establishing a trading bloc is to:
   A. increase economic welfare in the member countries.
   B. increase tariff revenue for the member governments.
   C. protect domestic industries in the member economies.
5. In which type of regional trade agreement are economic policies conducted independently by the member countries, while labor and capital are free to move among member countries?
   A. Free trade area.
   B. Common market.
   C. Economic union.

KEY CONCEPTS

LOS 17.a

Free trade among countries increases overall economic welfare. Countries can benefit from trade because one country can specialize in the production of an export good and benefit from economies of scale. Economic welfare can also be increased by greater product variety, more competition, and a more efficient allocation of resources.

Costs of free trade are primarily losses to those in domestic industries that lose business to foreign competition, especially less efficient producers who leave an industry. While other domestic industries will benefit from freer trade policies, unemployment may increase over the period in which workers are retrained for jobs in the expanding industries. Some argue that greater income inequality may result, but overall, the gains from liberalization of trade policies are thought to exceed the costs, so that the winners could conceivably compensate the losers and still be better off.

LOS 17.b

Types of trade restrictions include the following:

- *Tariffs*. These are taxes on imported goods collected by the government.
- *Quotas*. These are limits on the amount of imports allowed over some period.
- *Minimum domestic content*. This is the requirement that some percentage of product content must be from the domestic country.
- *Voluntary export restraints*. A country voluntarily restricts the amount of a good that can be exported, often in the hope of avoiding tariffs or quotas imposed by their trading partners.

Within each importing country, all of these restrictions will tend to do the following:

- Increase prices of imports and decrease quantities of imports
- Increase demand for and quantity supplied of domestically produced goods
- Increase producer's surplus and decrease consumer surplus

Export subsidies decrease export prices and benefit importing countries at the expense of the government of the exporting country.

Restrictions on the flow of financial capital across borders include outright prohibition of investment in the domestic country by foreigners, prohibition of or taxes on the income earned on foreign investments by domestic citizens, prohibition of foreign investments in certain domestic industries, and restrictions on repatriation of earnings of foreign entities operating in a country.

LOS 17.c

Trade agreements, which increase economic welfare by facilitating trade among member countries, take the following forms:

- *Free trade area*. All barriers to the import and export of goods and services among member countries are removed.
- *Customs union*. Member countries *also* adopt a common set of trade restrictions with nonmembers.
- *Common market*. Member countries *also* remove all barriers to the movement of labor and capital goods among members.
- *Economic union*. Member countries *also* establish common institutions and economic policy for the union.
- *Monetary union*. Member countries *also* adopt a single currency to reduce the cost of cross-border trade.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 17.1

1. **B** Openness to international trade increases specialization as production shifts to those products in which domestic producers have a comparative advantage. Greater competition from imports will tend to decrease prices for consumer goods. Increasing international trade is likely to increase profitability and employment in exporting industries, but it may decrease profitability and employment in industries that compete with imported goods. (LOS 17.a)

2. **B** Voluntary export restraints are agreements to limit the volume of goods and services exported to another country. Minimum domestic content rules are limitations imposed by a government on its domestic firms. Import quotas are limitations on imports, not on exports. (LOS 17.b)

3. **B** 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 it ultimately reduces employment in that industry. (LOS 17.b)

4. **A** The motivation for trading blocs is to increase economic welfare in the member countries by eliminating barriers to trade. Joining a trading bloc may have negative consequences for some domestic industries and may decrease tariff revenue for the government. (LOS 17.c)

5. **B** These characteristics describe a common market. In a free trade area, member countries remove restrictions on goods and services and trade with one another but may still restrict movement of labor and capital among member countries. In an economic union, member countries also coordinate their economic policies and institutions. (LOS 17.c)

READING 18

CAPITAL FLOWS AND THE FX MARKET

MODULE 18.1: THE FOREIGN EXCHANGE MARKET

Video covering this content is available online.

LOS 18.a: Describe the foreign exchange market, including its functions and participants, distinguish between nominal and real exchange rates, and calculate and interpret the percentage change in a currency relative to another currency.

Foreign currency markets serve companies and individuals that purchase or sell foreign goods and services denominated in foreign currencies. An even larger market, however, exists for capital flows. Foreign currencies are needed to purchase foreign physical assets as well as foreign financial securities.

Many companies have foreign exchange risk arising from their cross-border transactions. A Japanese company that expects to receive 10 million euros when a transaction is completed in 90 days has yen/euro exchange rate risk as a result. By entering into a **forward currency contract** to sell 10 million euros in 90 days for a specific quantity of yen, the firm can reduce or eliminate the foreign exchange risk associated with the transaction. When a firm takes a position in the foreign exchange market to reduce an existing risk, we say the firm is **hedging** its risk.

Alternatively, when a transaction in the foreign exchange markets increases currency risk, we describe the transaction or position as **speculating**. Investors, companies, and financial institutions, such as banks and investment funds, all regularly enter into speculative foreign currency transactions.

The primary dealers in foreign exchange (FX) and originators of forward FX contracts are large multinational banks. This part of the FX market is often called the **sell side**. On the other hand, the **buy side** consists of the many buyers of foreign currencies and forward FX contracts. These buyers include the following:

- *Corporations* regularly engage in cross-border transactions, purchase and sell foreign currencies as a result, and enter into FX forward contracts to hedge the risk of expected future receipts and payments denominated in foreign currencies.

- *Investment accounts* of many types transact in foreign currencies, hold foreign securities, and may both speculate and hedge with currency derivatives. **Real money accounts** refer to mutual funds, pension funds, insurance companies, and other institutional accounts that do not use derivatives. **Leveraged accounts** refer to the various types of investment firms that use derivatives, including hedge funds, firms that trade for their own accounts, and other trading firms of various types.
- *Governments and government entities*, including sovereign wealth funds and pension funds, acquire foreign exchange for transactional needs, investment, or speculation. Central banks sometimes engage in FX transactions to affect exchange rates in the short term in accordance with government policy.
- The **retail FX market** refers to FX transactions by households and relatively small institutions, and it may be for tourism, cross-border investment, or speculative trading.

Types of Exchange Rates

An **exchange rate** is simply the price or cost of units of one currency in terms of another. In this book we state exchange rates in the form 1.416 USD/EUR, to mean that each euro costs $1.416. If you read the *"/"* as *per*, you will have no trouble with the notation. We say the exchange rate is $1.416 per euro.

PROFESSOR'S NOTE
This is the way exchange rates are quoted in the Level I CFA curriculum. Foreign exchange traders typically use the inverse (an indirect quotation).

In a foreign currency quotation, we have the price of one currency in units of another currency. These are often referred to as the **base currency** and the **price currency**. In the quotation 1.25 USD/EUR, the USD is the price currency and the EUR is the base currency. The price of one euro (base currency) is 1.25 USD (the price currency), so 1.25 is the price of one unit of the base currency in terms of the other. It may help to remember that the euro, in this example, is in the bottom or "base" of the exchange rate given in terms of USD/EUR.

An exchange rate expressed as price currency/base currency is referred to as a **direct quote** from the point of view of an investor in the price currency country and an **indirect quote** from the point of view of an investor in the base currency country. For example, a quote of 1.17 USD/EUR would be a direct quote for a USD-based investor and an indirect quote for a EUR-based investor. Conversely, a quote of 1 / 1.17 = 0.855 EUR/USD would be a direct quote for a EUR-based investor and an indirect quote for a USD-based investor.

The exchange rate at a point in time is referred to as a **nominal exchange rate**. If this rate (price/base) increases, the cost of a unit of the base currency in terms of the price currency has increased, so that the purchasing power of the price currency has decreased. If the USD/EUR exchange rate increases from 1.10 to 1.15, the cost of 100 euros increases from $110 to $115. The purchasing power of the dollar has decreased relative to the euro because the cost of 100 euros' worth of goods to a consumer in the United States has increased over the period.

The purchasing power of one currency relative to another is also affected by changes in the price levels of the two countries. The **real exchange rate** between two currencies refers to the purchasing power of one currency in terms of the amount of goods priced in another currency, relative to an earlier (base) period.

Consider a situation in which the nominal USD/EUR exchange rate is unchanged at 1.00 over a period and the price level in the United States is unchanged, while prices in the Eurozone have increased by 5%. Eurozone goods that cost 100 euros at the beginning of the period cost 105 euros at the end of the period. With the nominal exchange rate unchanged, the purchasing power of the USD in the Eurozone has decreased, because exchanging 100 USD for 100 EUR will now buy only 100 / 105 = 95.2% of the goods 100 EUR could buy at the beginning of the period.

Here is a summary:

- An increase in the *nominal* USD/EUR rate decreases the purchasing power of the USD in the Eurozone (and increases the purchasing power of the EUR in the United States); the *real* USD/EUR exchange rate has increased.
- A decrease in the *nominal* USD/EUR rate increases the purchasing power of the USD in the Eurozone (and decreases the purchasing power of the EUR in the United States); the *real* USD/EUR exchange rate has decreased.
- An increase in the Eurozone price level, relative to the price level in the United States, will increase the *real* USD/EUR exchange rate, decreasing the purchasing power of the USD in the Eurozone (and increasing the purchasing power of the EUR in the United States).
- A decrease in the Eurozone price level, relative to the price level in the United States, will decrease the *real* USD/EUR exchange rate, increasing the purchasing power of the USD in the Eurozone (and decreasing the purchasing power of the EUR in the United States).

The end-of-period real P/B exchange rate can be calculated as follows:

$$\text{real P/B exchange rate} = \text{nominal P/B exchange rate} \times \left(\frac{\text{CPI}_{\text{base currency}}}{\text{CPI}_{\text{price currency}}} \right)$$

where the CPI values are relative to base period values of 100.

We can see from the formula the following:

- An increase (decrease) in the nominal exchange rate over the period increases (decreases) the end-of period real exchange rate, and the purchasing power of the price currency decreases (increases).
- An increase in the price level in the price currency country relative to the price level in the base currency country will decrease the real exchange rate, increasing the purchasing power of the price currency in terms of base country goods.
- Conversely, a decrease in the price level in the price currency country relative to the price level in the base currency country will increase the real exchange rate, decreasing the purchasing power of the price currency in terms of base country goods.

In the following example, we calculate the end-of-period real $/£ exchange rate when the nominal $/£ exchange rate has decreased over the period (which tends to decrease the real exchange rate and increase the purchasing power of the price currency)—and when the price level in the United Kingdom has increased by more than the price level in the United States over the period (which tends to increase the real exchange rate and decrease the purchasing power of the price currency). The relative increase in U.K. prices has reduced the effects of the decrease in the nominal exchange rate on the increase in the purchasing power of the USD.

> **EXAMPLE: Real exchange rate**
>
> At a base period, the CPIs of the United States and United Kingdom are both 100, and the exchange rate is $1.70/£. Three years later, the exchange rate is $1.60/£, and the CPI has risen to 110 in the United States and 112 in the United Kingdom. What is the real exchange rate at the end of the three-year period?
>
> **Answer:**
>
> The real exchange rate is $1.60 / £ × 112 / 110 = $1.629 / £, which means that U.S. goods and services that cost $1.70 at the base period now cost only $1.629 (in real terms) if purchased in the United Kingdom and the real exchange rate, $/£, has fallen. The decrease in the real exchange rate (and the increase in the purchasing power of the USD in terms of U.K. goods) over the period is less than it would have been if the relative prices between the two countries had not changed.

A **spot exchange rate** is the currency exchange rate for immediate delivery, which for most currencies means the exchange of currencies takes place two days after the trade.

A **forward exchange rate** is a currency exchange rate for an exchange to be done in the future. Forward rates are quoted for various future dates (e.g., 30 days, 60 days, 90 days, or one year). A forward is actually an agreement to exchange a specific amount of one currency for a specific amount of another on a future date specified in the forward agreement.

A French firm that will receive 10 million GBP from a British firm six months from now has uncertainty about the amount of euros that payment will be equivalent to six months from now. By entering into a forward agreement covering 10 million GBP at the 6-month forward rate of 1.192 EUR/GBP, the French firm has agreed to exchange 10 million GBP for 11.92 million euros in six months.

Calculating the Percentage Change in the FX Value of a Currency

Consider a USD/EUR exchange rate that has changed from 1.42 to 1.39 USD/EUR. The percentage change in the dollar price of a euro is simply 1.39 / 1.42 − 1 = −0.0211 = −2.11%. Because the dollar price of a euro has fallen, the euro has *depreciated* relative to the dollar, and a euro now buys 2.11% fewer U.S. dollars. It is correct to say that the euro has depreciated by 2.11% relative to the dollar.

On the other hand, it is *not* correct to say that the dollar has appreciated by 2.11%. To calculate the percentage appreciation of the dollar, we need to convert the quotes to EUR/USD. So, our beginning quote of 1.42 USD/EUR becomes 1 / 1.42 = 0.7042 EUR/USD, and our ending quote of 1.39 USD/EUR becomes 1 / 1.39 = 0.7194 EUR/USD. Using these exchange rates, we can calculate the change in the euro price of a dollar as 0.7194 / 0.7042 − 1 = 0.0216 = 2.16%. In this case, it is correct to say that the dollar has appreciated 2.16% with respect to the euro. Note that for the given exchange rate quotes, the percentage appreciation of the dollar is not the same as the percentage depreciation in the euro.

MODULE QUIZ 18.1

1. One year ago, the nominal exchange rate for USD/EUR was 1.300. Since then, the real exchange rate has increased by 3%. This *most likely* implies that:
   A. the nominal exchange rate is less than USD/EUR 1.235.
   B. the purchasing power of the euro has increased approximately 3% in terms of U.S. goods.
   C. inflation in the euro zone was approximately 3% higher than inflation in the United States.
2. Sell-side participants in the foreign exchange market are *most likely* to include:
   A. banks.
   B. hedge funds.
   C. insurance companies.
3. Suppose that the quote for British pounds (GBP) in New York is USD/GBP 1.3110. What is the quote for U.S. dollars (USD) in London (GBP/USD)?
   A. 0.3110.
   B. 0.7628.
   C. 1.3110.
4. The Canadian dollar (CAD) exchange rate with the Japanese yen (JPY) changes from JPY/CAD 75 to JPY/CAD 78. The CAD has:
   A. depreciated by 3.8%, and the JPY has appreciated by 4.0%.
   B. appreciated by 3.8%, and the JPY has depreciated by 4.0%.
   C. appreciated by 4.0%, and the JPY has depreciated by 3.8%.

MODULE 18.2: MANAGING EXCHANGE RATES

Video covering this content is available online.

LOS 18.b: Describe exchange rate regimes and explain the effects of exchange rates on countries' international trade and capital flows.

The IMF categorizes **exchange rate regimes** into the following types, which include two for countries that do not issue their own currencies and seven for countries that issue their own currencies.

Countries That Do Not Have Their Own Currency

A country can use the currency of another country (**formal dollarization**). The country cannot have its own monetary policy, as it does not create money or issue currency.

A country can be a member of a **monetary union** in which several countries use a common currency. Within the European Union, for example, most countries use the euro. While individual countries give up the ability to set domestic monetary policy, they all participate in determining the monetary policy of the European Central Bank.

Countries That Have Their Own Currency

A **currency board arrangement** is an explicit commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate. A notable example of such an arrangement is Hong Kong. In Hong Kong, currency is (and may be) only issued when fully backed by holdings of an equivalent amount of U.S. dollars. The Hong Kong Monetary Authority can earn interest on its U.S. dollar balances. With dollarization, there is no such income, as the income is earned by the U.S. Federal Reserve when it buys interest-bearing assets with the U.S. currency it issues. While the monetary authority gives up the ability to conduct independent monetary policy and essentially imports the inflation rate of the outside currency, there may be some latitude to affect interest rates over the short term.

In a **conventional fixed peg arrangement**, a country pegs its currency within margins of ±1% versus another currency or a basket that includes the currencies of its major trading or financial partners. The monetary authority can maintain exchange rates within the band by purchasing or selling foreign currencies in the foreign exchange markets (*direct intervention*). In addition, the country can use *indirect intervention*, including changes in interest rate policy, regulation of foreign exchange transactions, and convincing people to constrain foreign exchange activity. The monetary authority retains more flexibility to conduct monetary policy than with dollarization, a monetary union, or a currency board. However, changes in policy are constrained by the requirements of the peg.

In a system of pegged exchange rates within horizontal bands or a **target zone**, the permitted fluctuations in currency value relative to another currency or basket of currencies are wider (e.g., ±2%). Compared to a conventional peg, the monetary authority has more policy discretion because the bands are wider.

With a **crawling peg**, the exchange rate is adjusted periodically, typically to adjust for higher inflation versus the currency used in the peg. This is termed a *passive crawling peg* as opposed to an *active crawling peg,* in which a series of exchange rate adjustments over time is announced and implemented. An active crawling peg can influence inflation expectations, adding some predictability to domestic inflation. Monetary policy is restricted in much the same way it is with a fixed peg arrangement.

With **management of exchange rates within crawling bands**, the width of the bands that identify permissible exchange rates is increased over time. This method can be used to transition from a fixed peg to a floating rate when the monetary authority's lack of credibility makes an immediate change to floating rates impractical. Again, the degree of monetary policy flexibility increases with the width of the bands.

With a system of **managed floating exchange rates**, the monetary authority attempts to influence the exchange rate in response to specific indicators such as the balance of payments, inflation rates, or employment without any specific target exchange rate or

predetermined exchange rate path. Intervention may be direct or indirect. Such management of exchange rates may induce trading partners to respond in ways that reduce stability.

When a currency is **independently floating**, the exchange rate is market determined, and foreign exchange market intervention is used only to slow the rate of change and reduce short-term fluctuations—not to keep exchange rates at a target level.

Changes in Exchange Rates

Changes in exchange rates can affect both imports and exports. If the USD/EUR exchange rate decreases, the USD has appreciated relative to the EUR. In this case, the USD prices of imports from the Eurozone have decreased, and it takes more euros to purchase a U.S. good at the new exchange rate. As a result, Eurozone imports from the United States (U.S. exports to the Eurozone) will decrease, and U.S. imports of Eurozone goods (Eurozone exports to the United States) will increase.

The effects on the goods market (imports and exports of merchandise) occur more slowly than the effects on capital flows between countries. This is reflected in a country's **balance of payments**. Essentially, the balance of payments refers to the fact that capital flows must offset any imbalance between the value of a country's exports to and imports from another country.

Consider two countries that have an imbalance between the value of their exports to and imports from another country, such as between China and the United States. Typically, U.S. imports from China have a greater value than U.S. exports to China. We say that the United States has a goods and services **trade deficit** with China and China has a trade surplus with the United States. Capital flows must offset this difference.

Capital flows result primarily from purchases of assets (both physical and financial) in one country by investors or governments in other countries. A large portion of the capital flows between the United States and China are purchases of U.S. debt securities by China. China has a **capital account deficit** that offsets its trade surplus with the United States.

The relation between the balance of trade and capital flows is expressed by the following identity, which was presented in the Economics prerequisite readings:

$$\begin{aligned}&(\text{exports} - \text{imports}) \equiv (\text{private savings} - \text{investment in physical capital})\\&+ (\text{tax revenue} - \text{government spending})\end{aligned}$$

or:

$$(X - M) \equiv (S - I) + (T - G)$$

The intuition is that a trade deficit ($X - M < 0$) means that the right-hand side must also be negative, which implies that total domestic savings (private savings + government savings) are less than domestic investment in physical capital. The additional amount to fund domestic investment must come from foreigners, which results in a surplus in the capital account to offset the deficit in the trade account. Another thing we can see from this identity is that any government deficit not funded by an excess of domestic

saving over domestic investment is consistent with a trade deficit (imports > exports), which is offset by an inflow of foreign capital (a surplus in the capital account).

Capital flows adjust more rapidly than spending, savings, and asset prices, so they are the primary determinant of exchange rates in the short and intermediate term. Trade flows are more important in determining exchange rates in the long term as asset prices and saving/investment decisions adjust over time.

LOS 18.c: Describe common objectives of capital restrictions imposed by governments.

Governments sometimes place restrictions on the flow of investment capital into their country, out of their country, or both. Commonly cited objectives of capital flow restrictions include the following:

- *Reduce the volatility of domestic asset prices.* In times of macroeconomic crisis, capital flows out of the country can drive down asset prices drastically, especially with prices of liquid assets such as stocks and bonds. With no restrictions on inflows or outflows of foreign investment capital, the asset markets of countries with economies that are small relative to the amount of foreign investment can be quite volatile over a country's economic cycle.
- *Maintain fixed exchange rates.* For countries with fixed exchange rate targets, limiting flows of foreign investment capital makes it easier to meet the exchange rate target—and, therefore, to be able to use monetary and fiscal policy to pursue only the economic goals for the domestic economy.
- *Keep domestic interest rates low.* By restricting the outflow of investment capital, countries can keep their domestic interest rates low and manage the domestic economy with monetary policy, as investors cannot pursue higher rates in foreign countries. China is an example of a country with a fixed exchange rate regime where restrictions on capital flows allow policymakers to maintain the target exchange rate as well as to pursue a monetary policy independent of concerns about its effect on currency exchange rates.
- *Protect strategic industries.* Governments sometimes prohibit investment by foreign entities in industries considered to be important for national security, such as the telecommunications and defense industries.

MODULE QUIZ 18.2

1. The monetary authority of the Stoddard Islands will exchange its currency for U.S. dollars at a one-for-one ratio. As a result, the exchange rate of the Stoddard Islands currency with the U.S. dollar is 1.00, and many businesses in the Islands will accept U.S. dollars in transactions. This exchange rate regime is *best* described as:
   A. a fixed peg.
   B. dollarization.
   C. a currency board.

2. Other things equal, which of the following is *most likely* to decrease a country's trade deficit?
   A. Increase the capital account surplus.
   B. Decrease expenditures relative to income.

C. Decrease domestic saving relative to domestic investment.

3. The goal of a government that imposes restrictions on foreign capital flows is *most likely* to:
   A. stimulate domestic interest rates.
   B. decrease domestic asset price volatility.
   C. encourage competition with domestic industries.

KEY CONCEPTS

LOS 18.a

Currency exchange rates are given as the price of one unit of currency in terms of another. A nominal exchange rate of 1.44 USD/EUR is interpreted as $1.44 per euro. We refer to the USD as the price currency and the EUR as the base currency.

An increase (decrease) in an exchange rate represents an appreciation (depreciation) of the base currency relative to the price currency.

A spot exchange rate is the rate for immediate delivery. A forward exchange rate is a rate for exchange of currencies at some future date.

A real exchange rate measures changes in relative purchasing power over time:

$$\text{real exchange rate} = \text{nominal exchange rate} \times \left(\frac{\text{CPI}_{\text{base currency}}}{\text{CPI}_{\text{price currency}}} \right)$$

For a change in an exchange rate, we can calculate the percentage appreciation (price goes up) or depreciation (price goes down) of the base currency. For example, a decrease in the USD/EUR exchange rate from 1.44 to 1.42 represents a depreciation of the EUR relative to the USD of 1.39% (1.42 / 1.44 − 1 = −0.0139) because the value of a euro has fallen 1.39%.

Given the depreciation of the EUR (base currency) of 1.39%, we can calculate the appreciation of the price currency as $\frac{1}{(1 - 0.0139)} - 1 = 0.0141 = 1.41\%$.

The market for foreign exchange is the largest financial market in terms of the value of daily transactions and has various participants, including large multinational banks (the sell side) and corporations, investment fund managers, hedge fund managers, investors, governments, and central banks (the buy side).

Participants in the foreign exchange markets are referred to as hedgers if they enter into transactions that decrease an existing foreign exchange risk, and as speculators if they enter into transactions that increase their foreign exchange risk.

LOS 18.b

Exchange rate regimes for countries that do not have their own currency:

- With *formal dollarization*, a country uses the currency of another country.
- In a *monetary union*, several countries use a common currency.

Exchange rate regimes for countries that have their own currency:

- A *currency board arrangement* is an explicit commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate.
- In a *conventional fixed peg arrangement*, a country pegs its currency within margins of ±1% versus another currency.
- In a system of *pegged exchange rates within horizontal bands* or a *target zone*, the permitted fluctuations in currency value relative to another currency or basket of currencies are wider (e.g., ±2%).
- With a *crawling peg*, the exchange rate is adjusted periodically, typically to adjust for higher inflation versus the currency used in the peg.
- With *management of exchange rates within crawling bands*, the width of the bands that identify permissible exchange rates is increased over time.
- With a system of *managed floating exchange rates*, the monetary authority attempts to influence the exchange rate in response to specific indicators, such as the balance of payments, inflation rates, or employment, without any specific target exchange rate.
- When a currency is *independently floating*, the exchange rate is market determined.

LOS 18.c

Commonly cited objectives of capital flow restrictions include the following:

- Reducing the volatility of domestic asset prices
- Maintaining fixed exchange rates
- Keeping domestic interest rates low and enabling greater independence regarding monetary policy
- Protecting strategic industries from foreign ownership

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 18.1

1. **B** An increase in the real exchange rate USD/EUR (the number of USD per one EUR) means that a euro is worth more in purchasing power (real) terms in the United States. Changes in a real exchange rate depend on the change in the nominal exchange rate relative to the difference in inflation. By itself, a real exchange rate does not indicate the directions or degrees of change in either the nominal exchange rate or the inflation difference. (LOS 18.a)

2. **A** Large multinational banks make up the sell side of the foreign exchange market. The buy side includes corporations, real money and leveraged investment accounts, governments and government entities, and retail purchasers of foreign currencies. (LOS 18.a)

3. **B** 1 / 1.311 = 0.7628 GBP/USD

   (LOS 18.a)

4. **C** The CAD has appreciated because it is worth a larger number of JPY. The percentage appreciation is (78 − 75) / 75 = 4.0%. To calculate the percentage depreciation of the JPY against the CAD, convert the exchange rates to make JPY the base currency: 1 / 75 = 0.0133 CAD/JPY and 1 / 78 = 0.0128 CAD/JPY. Percentage depreciation = (0.0128 − 0.0133) / 0.0133 = −3.8%. (LOS 18.a)

Module Quiz 18.2

1. **C** This exchange rate regime is a currency board arrangement. The country has not formally dollarized because it continues to issue a domestic currency. A conventional fixed peg allows for a small degree of fluctuation around the target exchange rate. (LOS 18.b)

2. **B** An improvement in a trade deficit requires that domestic saving increase relative to domestic investment, which would decrease a capital account surplus. Decreasing expenditures relative to income means domestic savings increase. Decreasing domestic saving relative to domestic investment is consistent with a larger capital account surplus (an increase in net foreign borrowing) and a greater trade deficit. (LOS 18.b)

3. **B** Decreasing the volatility of domestic asset prices may be a goal of a government that imposes capital restrictions. Other typical goals include keeping domestic interest rates low and protecting certain domestic industries, such as the defense industry. (LOS 18.c)

READING 19

EXCHANGE RATE CALCULATIONS

MODULE 19.1: FOREIGN EXCHANGE RATES

Video covering this content is available online.

LOS 19.a: Calculate and interpret currency cross-rates.

A **cross rate** is the exchange rate between two currencies implied by their exchange rates with a common third currency. Cross-rates are necessary when there is no active FX market in a currency pair. The rate must be computed from the exchange rates between each of these two currencies and a third currency, usually the USD or EUR.

Let's assume that we have the following quotations for Mexican pesos and Australian dollars: MXN/USD = 10.70 and USD/AUD = 0.60. The cross rate between Australian dollars and pesos (MXN/AUD) is as follows:

$$\text{MXN/AUD} = \text{USD/AUD} \times \text{MXN/USD} = 0.60 \times 10.70 = 6.42$$

So, our MXN/AUD cross rate is 6.42 pesos per Australian dollar. The key to calculating cross-rates is to note that the basis of the quotations must be such that we get the desired result algebraically. If we had started with an AUD/USD quotation of 1.67, we would have taken the inverse to get the quotation into USD/AUD terms. Another approach is to divide through, as is illustrated in the following example.

EXAMPLE: Cross rate calculation

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

Answer:

The CHF/NZD cross rate is (CHF/USD) / (NZD/USD) = 1.7799 / 2.2529 = 0.7900.

LOS 19.b: Explain the arbitrage relationship between spot and forward exchange rates and interest rates, calculate a forward rate using points or in percentage

terms, and interpret a forward discount or premium.

When currencies are freely traded and forward currency contracts exist, the percentage difference between forward and spot exchange rates is approximately equal to the difference between the two countries' interest rates. This is because there is an arbitrage trade with a riskless profit to be made when this relation does not hold.

We call this a no-arbitrage condition because if it doesn't hold, there is an opportunity to make a profit without risk. The possible arbitrage is as follows: borrow Currency A at Interest Rate A, convert it to Currency B at the spot rate and invest it to earn Interest Rate B, and sell the proceeds from this investment forward at the forward rate to turn it back into Currency A. If the forward rate does not correctly reflect the difference between interest rates, such an arbitrage could generate a profit to the extent that the return from investing Currency B and converting it back to Currency A with a forward contract is greater than the cost of borrowing Currency A for the period.

The no-arbitrage condition requires that "you cannot earn more than your domestic riskless rate of interest by borrowing your domestic currency, converting it to a foreign currency to invest at the foreign riskless rate, and exchanging back to your domestic currency." So:

$$(1 + r_{\text{domestic}}) = \frac{1}{\text{spot}_{d/f}}(1 + r_{\text{foreign}})\,\text{forward}_{d/f}$$

The three terms on the right-hand side are equivalent to units of foreign currency for one unit of the domestic currency, growth if invested at the foreign interest rate, and then exchanged back to domestic currency at the forward rate.

Equivalent relationships are as follows:

$$\frac{\text{forward}_{d/f}}{\text{spot}_{d/f}} = \frac{(1 + r_{\text{domestic}})}{(1 + r_{\text{foreign}})}$$

$$\text{forward}_{d/f} = \frac{(1 + r_{\text{domestic}})}{(1 + r_{\text{foreign}})}\text{spot}_{d/f}$$

$$\text{spot}_{d/f} = \frac{(1 + r_{\text{foreign}})}{(1 + r_{\text{domestic}})}\text{forward}_{d/f}$$

EXAMPLE: Calculating the arbitrage-free forward exchange rate

Consider two currencies, the ABE and the DUB. The spot ABE/DUB exchange rate is 4.5671, the 1-year riskless ABE rate is 5%, and the 1-year riskless DUB rate is 3%. What is the 1-year no-arbitrage forward exchange rate?

Answer:

$$\text{forward}_{A/D} = \text{spot}_{A/D}\left(\frac{1 + r_A}{1 + r_D}\right)$$

$$\text{forward}_{A/D} = 4.5671\left(\frac{1.05}{1.03}\right) = 4.6558_{A/D}$$

Note that the forward rate is greater than the spot rate by 4.6558 / 4.5671 − 1 = 1.94%. This is approximately equal to the interest rate differential of 5% − 3% = 2%. The currency with the higher interest rate must depreciate over time by approximately the amount of the interest rate differential, to prevent arbitrage.

If we are calculating a 30-, 90-, or 180-day forward exchange rate, we need to use interest rates for 30-, 90-, and 180-day periods rather than annual rates. Note that these shorter-term rates are quoted as money market yields.

EXAMPLE: Calculating the arbitrage-free forward exchange rate with 90-day interest rates

The spot ABE/DUB exchange rate is 4.5671, the 90-day riskless ABE rate is 5%, and the 90-day riskless DUB rate is 3%. What is the 90-day forward exchange rate that will prevent arbitrage profits?

Answer:

$$\text{no-arbitrage forward} = 4.5671\left[\frac{1+0.05\left(\frac{90}{360}\right)}{1+0.03\left(\frac{90}{360}\right)}\right] = 4.5671\left(\frac{1.0125}{1.0075}\right)$$
$$= 4.5898 \text{ ABE/DUB}$$

In our previous example, we calculated the no-arbitrage one-year forward ABE/DUB exchange rate as 4.6558. Next, we illustrate the arbitrage profit that could be gained if the forward exchange rate differs from this no-arbitrage rate. Consider a forward rate of 4.6000 so that the depreciation in the ABE is less than that implied by the no-arbitrage relationship. This makes the ABE attractive to a DUB investor who can earn a riskless profit as follows:

- Borrow 1,000 DUB for one year at 3% to purchase ABE and get 4,567.1 ABE.
- Invest the 4,567.1 ABE at the ABE rate of 5% to have 1.05(4,567.1) = 4,795.45 ABE at the end of one year.
- Enter into a currency forward contract to exchange 4,795.45 ABE in one year at the forward rate of 4.6000 ABE/DUB to receive 4,795.45 / 4.6000 = 1,042.49 DUB.

The investor has ended the year with a 4.249% return on his 1,000 DUB investment, which is higher than the 3% 1-year DUB interest rate. After repaying the 1,000 DUB loan plus interest (1,030 DUB), the investor has a profit of 1,042.49 − 1,030 = 12.49 DUB with no risk and no initial out-of-pocket investment (i.e., a pure arbitrage profit).

Arbitrageurs will pursue this opportunity, buying ABE (driving down the spot ABE/DUB exchange rate) and selling ABE forward (driving up the forward ABE/DUB exchange rate), until the interest rate parity relation is restored and arbitrage profits are no longer available.

Note that the no-arbitrage forward exchange rate is approximately proportional to the annual interest rate differential and the time period of the forward contract.

Calculating a Forward Exchange Rate From a Forward Quote in Points or in Percentage Terms

A forward exchange rate quote typically differs from the spot quotation and is expressed in terms of the difference between the spot exchange rate and the forward exchange rate. One way to indicate this is with points. The unit of points is the last decimal place in the spot rate quote. For a spot currency quote to four decimal places, such as 2.3481, each point is 0.0001, or 1/10,000th. A quote of +18.3 points for a 90-day forward exchange rate means that the forward rate is 0.00183 greater than the spot exchange rate.

EXAMPLE: Forward exchange rates in points

The AUD/EUR spot exchange rate is 0.7313 with the 1-year forward rate quoted at +3.5 points. What is the 1-year forward AUD/EUR exchange rate?

Answer:

The forward exchange rate is 0.7313 + 0.00035 = 0.73165.

EXAMPLE: Forward exchange rates in percentage

The AUD/EUR spot rate is quoted at 0.7313, and the 120-day forward exchange rate is given as –0.062%. What is the 120-day forward AUD/EUR exchange rate?

Answer:

The forward exchange rate is 0.7313 (1 – 0.00062) = 0.7308.

While forward rates are typically quoted as forward points, one application where percentage forward quotes are useful is if we are interpreting a forward rate as the expected future spot rate, s_{t+1}. We can write our no-arbitrage relation as follows:

$$\frac{s_{t+1}}{s_t} - 1 = \%\Delta\, s_{t+1} = \frac{r_f - r_d}{1 + r_d}$$

Analysis of capital markets suggests that an increase in a country's interest rate will attract foreign investment, which will lead to appreciation of the domestic currency (spot rate decreases). This is opposite to our conclusion from our no-arbitrage forward rate result that higher domestic rates are associated with a depreciation of the domestic currency. Historically, interest rate differences are poor predictors of future spot rates, although they may be unbiased and tend to get the direction of change correct.

It's best to think of the no-arbitrage forward rate as simply the forward rate at a point in time that prevents currency arbitrage, rather than the expected future spot rate. Our no-arbitrage relation holds at a point in time and does not address the question of how changes in interest rates affect spot exchange rates over time.

Interpreting a Forward Discount or Premium

The **forward discount** or **forward premium** for a currency is calculated relative to the spot exchange rate. The forward discount or premium *for the base currency* is the percentage difference between the forward price and the spot price.

Consider the following spot and forward exchange rates:

USD/EUR spot = $1.312

USD/EUR 90-day forward = $1.320

The (90-day) forward premium or discount on the euro = forward / spot − 1 = 1.320 / 1.312 − 1 = 0.610%. Because this is positive, it is interpreted as a forward premium on the euro of 0.610%. Because we have the forward rate for three months, we could annualize the discount simply by multiplying by 4 (= 12 / 3).

Because the forward quote is greater than the spot quote, it will take more dollars to buy one euro 90 days from now, so the euro is expected to appreciate versus the dollar, and the dollar is expected to depreciate relative to the euro.

If the forward quote were less than the spot quote, the calculated amount would be negative, and we would interpret that as a forward discount for the euro relative to the U.S. dollar.

MODULE QUIZ 19.1

1. Today's spot rate for the Indonesian rupiah (IDR) is IDR/USD 2,400.00, and the New Zealand dollar trades at NZD/USD 1.6000. The NZD/IDR cross rate is:
   A. 0.00067.
   B. 1,492.53.
   C. 3,840.00.

2. The New Zealand dollar (NZD) is trading at USD/NZD 0.3500, and the Swedish krona (SEK) is trading at NZD/SEK 0.3100. The USD/SEK cross rate is:
   A. 0.1085.
   B. 8.8573.
   C. 9.2166.

3. The spot Swiss franc/British pound (CHF/GBP) exchange rate is 1.3050. In the 180-day forward market, the CHF/GBP exchange rate is −42.5 points. The 180-day forward CHF/GBP exchange rate is *closest* to:
   A. 1.2625.
   B. 1.3008.
   C. 1.3093.

4. The spot rate on the New Zealand dollar (NZD) is NZD/USD 1.4286, and the 180-day forward rate is NZD/USD 1.3889. This difference means:
   A. interest rates are lower in the United States than in New Zealand.
   B. interest rates are higher in the United States than in New Zealand.
   C. it takes more NZD to buy one USD in the forward market than in the spot market.

5. The current spot rate for the British pound (GBP) in terms of U.S. dollars is $1.533 and the 180-day forward rate is $1.508. Relative to the pound, the dollar is trading *closest* to a 180-day forward:
   A. discount of 1.63%.
   B. premium of 1.66%.

C. discount of 1.66%.

6. The annual interest rates in the United States (USD) and Sweden (SEK) are 4% and 7% per year, respectively. If the current spot rate is SEK/USD 9.5238, then the 1-year forward rate in SEK/USD is:
   A. 9.2568.
   B. 9.7985.
   C. 10.2884.

7. The annual risk-free interest rate is 10% in the United States (USD) and 4% in Switzerland (CHF), and the 1-year forward rate is USD/CHF 0.80. Today's USD/CHF spot rate is *closest* to:
   A. 0.7564.
   B. 0.8462.
   C. 0.8888.

KEY CONCEPTS

LOS 19.a

Given two exchange rate quotes for three different currencies, we can calculate a currency cross rate. If the MXN/USD quote is 12.1 and the USD/EUR quote is 1.42, we can calculate the cross rate of MXN/EUR as 12.1 × 1.42 = 17.18.

LOS 19.b

The condition that must be met so that there is no arbitrage opportunity available is as follows:

$$\frac{\text{forward}}{\text{spot}} = \frac{\left(1 + i_{\text{price currency}}\right)}{\left(1 + i_{\text{base currency}}\right)} \text{ so that forward} = \text{spot} \times \frac{\left(1 + i_{\text{price currency}}\right)}{\left(1 + i_{\text{base currency}}\right)}$$

If the spot exchange rate for the euro is 1.25 USD/EUR, the euro interest rate is 4% per year, and the dollar interest rate is 3% per year, the no-arbitrage one-year forward rate can be calculated as follows:

$$1.25 \times (1.03 \,/\, 1.04) = 1.238 \text{ USD/EUR}$$

Points in a foreign currency quotation are in units of the last digit of the quotation. For example, a forward quote of +25.3 when the USD/EUR spot exchange rate is 1.4158 means that the forward exchange rate is 1.4158 + 0.00253 = 1.41833 USD/EUR.

For a forward exchange rate quote given as a percentage, the percentage (change in the spot rate) is calculated as forward / spot − 1. A forward exchange rate quote of +1.787%, when the spot USD/EUR exchange rate is 1.4158, means that the forward exchange rate is 1.4158 (1 + 0.01787) = 1.4411 USD/EUR.

If a forward exchange rate does not correctly reflect the difference between the interest rates for two currencies, an arbitrage opportunity for a riskless profit exists. In this case, borrowing one currency, converting it to the other currency at the spot rate, investing the proceeds for the period, and converting the end-of-period amount back to the borrowed currency at the forward rate will produce more than enough to pay off the initial loan, with the remainder being a riskless profit on the arbitrage transaction.

To calculate a forward premium or discount for the base currency, use the following formula:

$$(\text{forward} / \text{spot}) - 1$$

Forward exchange rates are poor predictors of future exchange rates. Forward exchange rates should be interpreted as simply the no-arbitrage forward rates at a point in time, not as predictors of future spot rates.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 19.1

1. **A** Start with one NZD and exchange for 1 / 1.6 = 0.625 USD. Exchange the USD for 0.625 × 2,400 = 1,500 IDR. We get a cross rate of 1,500 IDR/NZD, or 1 / 1,500 = 0.00067 NZD/IDR. (LOS 19.a)

2. **A** USD/NZD 0.3500 × NZD/SEK 0.3100 = USD/SEK 0.1085. Notice that the NZD term cancels in the multiplication. (LOS 19.a)

3. **B** The 180-day forward exchange rate is 1.3050 − 0.00425 = CHF/GBP 1.30075. (LOS 19.b)

4. **B** Interest rates are higher in the United States than in New Zealand. It takes fewer NZD to buy one USD in the forward market than in the spot market. (LOS 19.b)

5. **B** To calculate a percentage forward premium or discount for the U.S. dollar, we use the dollar to be the base currency. The spot and forward quotes given are U.S. dollars per British pound (USD/GBP), so we must invert them to GBP/USD. The spot GBP/USD price is 1 / 1.533 = 0.6523 and the forward GBP/USD price is 1 / 1.508 = 0.6631. Because the forward price is greater than the spot price, we say the dollar is at a forward premium of 0.6631 / 0.6523 − 1 = 1.66%. Alternatively, we can calculate this premium with the given quotes as spot / forward − 1 to get 1.533 / 1.508 − 1 = 1.66%. (LOS 19.b)

6. **B** The forward rate in SEK/USD is $9.5238\left(\frac{1.07}{1.04}\right) = 9.7985$. Because the SEK interest rate is the higher of the two, the SEK must depreciate approximately 3%. (LOS 19.b)

7. **A** We can solve for the spot rate as follows. With the exchange rates quoted as USD/CHF, the spot is $0.80\left(\frac{1.04}{1.10}\right) = 0.7564$. Because the interest rate is higher in the United States, it should take fewer USD to buy CHF in the spot market. In other words, the USD must be at a forward discount relative to the CHF. (LOS 19.b)

TOPIC QUIZ: ECONOMICS

You have now finished the Economics topic section. Please log into your Schweser online dashboard and take the Topic Quiz on this section. The Topic Quiz provides immediate feedback on how effective your study has been for this material. Questions are more exam-like than typical Module Quiz or QBank questions; a score of less than 70% indicates that your study likely needs improvement. These tests are best taken timed; allow 1.5 minutes per question.

READING 20

ORGANIZATIONAL FORMS, CORPORATE ISSUER FEATURES, AND OWNERSHIP

MODULE 20.1: FEATURES OF CORPORATE ISSUERS

Video covering this content is available online.

LOS 20.a: Compare the organizational forms of businesses.

Organizational forms refer to how businesses are set up from a legal and organizational point of view. Key features of organizational forms include the following:

- Whether the business is a separate legal entity from the owner(s)
- Whether the owners of the business also operate the business, and if not, the nature of the relationship between its owners and operators
- Whether the owners' liability for the actions and debts of the business is limited or unlimited
- The tax treatment of profits or losses from the business
- Access to additional capital to fund expansion and to distribute risk

To understand these features, we can compare them among four commonly used types of business structures: sole proprietorships, general partnerships, limited partnerships, and corporations.

A **sole proprietorship** is a business owned and operated by an individual. Legally, the business is an extension of the owner, who is personally responsible for claims against the business (i.e., unlimited liability) and receives all profits/losses.

Profits are then taxed as personal income of the owner. Sole proprietorships tend to be small in scale because they can only expand within the limits of the individual owner's ability to secure financing.

To do business on a scale that exceeds that of a sole proprietorship, two or more individuals can form a **general partnership**. In this structure, the **partnership agreement** specifies each partner's responsibilities for business operations and their shares of the partnership profits or losses. The agreement may be written, verbal, or even incidental through the actions of the partners. As with a sole proprietorship, the

partners have unlimited liability for claims against the business, and profits from the business allocated to each partner are taxed as personal income.

A **limited partnership** involves two levels of partners. One or more general partners operate the business and have unlimited liability, as in a general partnership, but this structure also has **limited partners** who are liable only for the amount they invest in the partnership (i.e., **limited liability**) and have claims to its profits that are proportionate to their investments. Limited partners typically are not involved in appointing or removing general partners. How the profits are divided among the general and limited partners is specified in the partnership agreement. Because they are responsible for managing the business, the general partners typically receive a larger portion of profits than the limited partners. Profits allocated to the partners are taxed as personal income to each partner. Some jurisdictions allow a **limited liability partnership (LLP)** wherein a general partner is not required, and all the partners are limited partners. In the United States, LLPs are only allowed for providers of professional services such as law, accounting, and so on, and there are restrictions on the number of partners and the amount of equity investment.

The feature that distinguishes a **corporation**, or **limited company**, from the other business structures is that a corporation is a legal entity separate from its owners and managers. In this case, *all* of the corporation's shareholders have limited liability. An owner can lose his entire investment if the company goes bankrupt and the value of his shares goes to zero. Beyond their initial investments, shareholders are not responsible for claims against the corporation. A corporation may, but is not required to, distribute its profits to its owners. Most large firms are corporations because that structure gives them the greatest access to capital, both debt (**borrowed capital**) and equity (**ownership capital**).

Another distinguishing feature of corporations is the separation of its owners and managers. An investor who buys shares of a corporation does not directly influence the company's day-to-day operations. Instead, the owners appoint a **board of directors** that is responsible for hiring the senior managers to operate the company. The board and the managers it hires are responsible for acting in the interests of the shareholders.

A **public corporation** (or a **public limited company**) is one that has shares that are sold to the public and trade in an organized market (stock exchange). A **private limited company** is similar to a public company, but it has a limited number of shareholders and restrictions on transfer of shares.

Depending on the country, a corporation's profits may be subject to **double taxation** if the government taxes companies on their earnings *and* it taxes dividends (which are distributions of earnings to owners) as personal income.

LOS 20.b: Describe key features of corporate issuers.

A corporation's legal identity is separate from that of its owners and is formed by filing an **articles of incorporation** with a regulatory body. As a legal entity, a corporation has many of the rights and responsibilities of an individual, such as the right to hire employees, enter into contracts, borrow and lend money, and so on.

A corporation issues shares to the owners (shareholders), which allows it to raise large amounts of capital. Shareholders have **voting rights** that allow them to elect the board of directors. Shares are easily transferable if they are traded on an exchange. The board of directors may distribute a portion of the company's earnings to the shareholders as **dividends**.

The disadvantage of double taxation of corporate income is less for investors in companies that pay out a smaller fraction of their profits in dividends and reinvest the remaining, as illustrated in the following example.

EXAMPLE: Double taxation of dividends

ABC Corporation has pretax earnings of $10 million and a corporate tax rate of 25%. Shareholders are taxed at 20% on their dividend income. Calculate the effective tax rate if:

(a) 100% of the profits are paid out in dividends, and

(b) 40% of the profits are paid out in dividends.

Answer:

	(a) 100% payout	(b) 40% payout
Earnings before tax	$ 10,000,000	$ 10,000,000
(–) Corporate income tax @ 25%	2,500,000	2,500,000
(=) After-tax income	7,500,000	7,500,000
Dividends	7,500,000	3,000,000
Tax on dividends @ 20%	1,500,000	600,000
Total tax paid	4,000,000	3,100,000
Effective tax rate		
= Total tax / earnings before tax	40%	31%

LOS 20.c: Compare publicly and privately owned corporate issuers.

Most public limited companies are **listed companies**, which means their shares are listed on an exchange, allowing investors to trade shares. A stock exchange is a rules-based open market, providing price and volume transparency. Shareholders in a company can be individuals, other corporations, nonprofits, or government. Shares that are actively traded (i.e., not held by insiders, strategic investors, or sponsors) are called the company's **free float**. Free float is typically expressed as a percentage of total outstanding shares.

Public companies are subject to compliance and reporting requirements. For example, companies are required to file quarterly or annual financial reports with a regulatory body, and to disclose any material changes in the company's business or ownership.

Shares in private limited companies do not trade on an exchange. As a result, their value is not readily observable, and transfer between investors is difficult. Typically,

investors in a private limited company have to wait until the company goes public or is sold to exit their investment. Private companies have fewer regulatory requirements and typically disclose less information than public companies. Also, with fewer investors, private companies can take a longer-term view of the business.

Private companies can raise equity capital through **private placements** of securities. Private placements are typically restricted to **accredited investors** such as corporate and institutional investors or high net worth individuals.

Private companies can become public companies ("go public") in one of three ways: initial public offering, direct listing, or acquisition by a special purpose entity.

- A company can become public by issuing shares in an **initial public offering (IPO)**. To conduct an IPO, the company must meet exchange-specific requirements. Companies typically engage the services of an investment bank to underwrite the issue. Once the shares are listed on an exchange, owners can sell shares, and new owners can buy shares, without dealing directly with the company.
- In a **direct listing**, a stock exchange agrees to list a private company's existing shares. This differs from an IPO in that a direct listing does not raise any new capital for the company, but it has advantages in that it can be done more quickly than an IPO and without involving an underwriter.
- A **special purpose acquisition company (SPAC)** is a corporate structure set up to acquire a private company in the future. The SPAC raises capital through an IPO and puts the funds into a trust that it must use to make an acquisition within a specified time. The acquired company does not have to be identified at the time of the IPO. For this reason, SPACs are also known as "blank check" companies.

Sometimes there can be a benefit to taking an underperforming public company private to restructure it and unlock its potential value. In such a case, an acquirer purchases all the outstanding shares of a public company, and the company is delisted from the exchange. The benefits of going private include a lower regulatory burden and the associated cost savings.

MODULE QUIZ 20.1

1. Which organizational form has the highest degree of separation between the owners and operators of a business?
   A. Corporation.
   B. Limited partnership.
   C. General partnership.

2. A corporation is subject to a corporate income tax of 10%. Shareholders are taxed on dividends at a rate of 15%. Assume that the company pays out all its after-tax profits in dividends. The effective tax rate on the corporation's profit is:
   A. 12.5%.
   B. 23.5%.
   C. 25.0%.

3. A private company can become a public company through a:
   A. private placement.
   B. leveraged buyout.

C. special purpose acquisition company.

KEY CONCEPTS

LOS 20.a

Feature	Sole Proprietorship	General Partnership	Limited Partnership	Corporation
Separate legal entity?	No	No	No	Yes
Managed by	Owner	Partners	GPs	Board and managers
Owner liability	Unlimited	Unlimited	GPs: unlimited LPs: limited	Limited
Access to capital	Limited	Limited	Limited	Virtually unlimited
Taxation of profits	Pass through to owner as personal income	Pass through to owner as personal income	Pass through to owner as personal income	Potential double taxation

LOS 20.b

Corporations incorporate as a separate legal entity by registering with a regulatory body. Owners are shareholders with a limited liability, but profits may be subject to double taxation. Shareholders vote for a board of directors who then hire managers and declare dividend payments to the shareholders.

LOS 20.c

Public limited companies list their shares on a stock exchange for trading. Free float, or actively traded shares, is typically quoted as a fraction of total shares outstanding. Exchange listing requires regulatory compliance and extensive disclosure requirements.

Private companies raise capital in private placements. A private company can become public by issuing shares in an initial public offering, carrying out a direct listing on a stock exchange, or being acquired by a public company, which may be a special purpose acquisition company.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 20.1

1. **A** In a corporation, owners are most often not directly involved in operating the business. Both general partnerships and limited partnerships have general partners who operate the business. (LOS 20.a)

2. **B** The effective tax rate on profits distributed as dividends = 0.10 + 0.15 (1 − 0.10) = 23.5%. Alternatively:

- Starting with a hypothetical $100 of pretax profit, the corporate tax @10% is $10.
- Dividends = after-tax profit = $90. Tax on dividends @ 15% = 0.15 × 90 = $13.50.
- Total tax = 10 + 13.50 = $23.50, or 23.5% of the pretax profit of $100.

(LOS 20.b)

3. **C** An IPO, direct listing, and special purpose acquisition company are methods for a private company to go public. Private placements allow a private company to raise capital but not take it public. Buyouts can result in a public company going private. (LOS 20.c)

READING 21

INVESTORS AND OTHER STAKEHOLDERS

MODULE 21.1: STAKEHOLDERS AND ESG FACTORS

Video covering this content is available online.

LOS 21.a: Compare the financial claims and motivations of lenders and shareholders.

A company's lenders (debtholders) have a legal, contractual claim to the interest and principal payments the company has promised to make. Owners (equity holders) have a residual claim to the company's net assets (i.e., what remains after all other claims have been paid). That is, lenders have a higher priority of claims than equity owners. Because debt is less risky than equity, it is a less costly form of capital.

Both debtholders and equity holders can potentially lose their entire investment if a company fails, but their losses cannot exceed the amounts they have invested. A key difference between debt and equity investments is their upside potential. Regardless of a company's success, the best result debtholders can achieve is to receive the interest and principal payments promised by the company. Equity, on the other hand, has a theoretically unlimited upside if a company succeeds and grows over time.

The value of a company is the sum of the value of its debt and the value of its equity. As the company's value increases (assuming its value is greater than the value of its debt), the value of equity increases with it, while the value of debt is constant (i.e., no upside for debt investors from company growth). If the value of a company is less than the value of its debt, the value of its equity is zero, and the value of its debt is below the promised amount and moves with the value of the company (i.e., debt has downside exposure).

EXAMPLE: Impact of leverage on return on equity (ROE)

A company with revenues of $1,000 and operating expenses of $800 needs to invest $1,000 in assets. The assets can be 100% equity or a mix of 50/50 debt and equity. The interest rate on debt is 10% (assume no taxes). Calculate the ROE under both financing scenarios.

Answer:

	100% Equity	50% Debt, 50% Equity
Revenues	$1,000	$1,000
Cash operating expense	$800	$800
Interest expense	$0	$50
Net income	$200	$150
Equity	$1,000	$500
ROE	20%	30%

As can be seen in the previous example, increasing leverage (and therefore, risk) can increase the return on equity as long as the *expected* rate of return on assets exceeds the cost of debt. If things work out, and the actual return on assets is equal to or exceeds the cost of debt, the equity investors benefit from taking the risk. Debt investors, however, receive only their promised 10% interest (and the return of principal when the debt matures).

EXAMPLE: Impact of a decrease in revenues

Continuing the previous example, calculate the company's ROE if its revenues decrease by 15%, assuming no change in cash operating expenses.

Answer:

	100% Equity	50% Debt, 50% Equity
Revenues	$850	$850
Cash operating expense	$800	$800
Interest expense	$0	$50
Net income	$50	$0
Equity	$1,000	$500
ROE	5%	0%

Assuming no change in cash operating expenses, a 15% decrease in revenues would reduce the ROE to 5% (100% equity scenario) or to 0% (50/50 debt and equity scenario). If the decrease in revenues exceeded 15%, revenues would not have been enough to cover operating expenses, and debt investors would receive less than their promised 10% interest. Again, debt investors have no upside—only potential downside.

Because of the difference in their risk profiles, the interests of debtholders may conflict with the interests of equity holders. Debtholders are primarily concerned with a company's ability to repay its obligations and less concerned with its growth prospects. Equity holders may favor actions that increase a company's potential growth, but also increase its risk level, such as adding financial leverage by issuing new debt. Issuing

additional debt as opposed to equity also prevents **dilution** of shareholders' proportional ownership. A company's existing debtholders may oppose such actions because increasing the company's risk (and the probability of defaulting on its debts) does not increase their expected return. Therefore, debt investors usually limit borrowers' actions by including contractual provisions such as maximum leverage or a minimum interest coverage ratio (known as *covenants*, which we will examine in the Fixed Income topic area) in debt agreements.

LOS 21.b: Describe a company's stakeholder groups and compare their interests.

Under **shareholder theory**, the primary focus of corporate governance is the interests of the firm's shareholders, which is to maximize the market value of the firm's common equity. Under this theory, corporate governance is primarily concerned with the conflict of interest between the firm's managers and its owners (shareholders).

The focus of corporate governance under **stakeholder theory** is broader. It considers conflicts among several groups that have an interest in the activities and performance of the firm.

Stakeholders of a Corporation

Shareholders have a *residual interest* in the corporation, in that they have claim to the net assets of the corporation after all liabilities have been settled. Shareholders have voting rights to elect the board of directors and for other important corporate matters, which gives them control over the firm and its management. They have an interest in ongoing profitability and growth of the firm that will increase the value of their ownership shares.

Lenders can be public or private debtholders. Public debtholders or **bondholders** supply debt capital to the firm and are primarily owners of the firm's outstanding bonds, while **private debtholders** such as banks extend loans, credit facilities, and leases to the firm.

Private debtholders may have access to nonpublic information from company management, which decreases information asymmetry. For this reason, private debtholders are a critical source of financing for small-to-medium-sized businesses. In some cases, private debtholders hold equity in the firm, allowing them to take a more equity-like approach to evaluating the company and potentially making them more amenable to changes in terms of the loans (i.e., covenants). By contrast, bondholders rely only on public information and have little to no influence over an issuer's operations. The interests of both types of lenders are protected to varying degrees by covenants in their debt agreements with the firm.

The **board of directors** is responsible for protecting the interests of shareholders; hiring, firing, and setting the compensation of the firm's senior managers; establishing the strategic direction of the firm; and monitoring the company's financial performance and other aspects of its ongoing activities.

Board members include **inside directors** (e.g., senior executives, founders) and **independent directors** who have no material relationship with the company. While inside directors may have conflicts of interest with shareholders, independent directors may better protect shareholders' interests.

In a **one-tier board structure**, both inside and independent directors serve on a single board. Major stock exchanges specify requirements for director independence, such as that most of the board should comprise independent directors. Other requirements may include diversity of backgrounds and competencies. In continental Europe, boards have a **two-tier structure** in which the independent directors serve on a **supervisory board** that oversees a **management board** comprising inside directors.

Typically, board members are elected for a specified term (e.g., annual). In a **staggered board**, only a fraction of the board is elected each year. This decreases the power of shareholders to enact a major overhaul of the board. Firms with staggered boards justify them as providing continuity and allowing for a longer-term view of company strategy.

Senior managers typically receive compensation (remuneration) that is made up of a salary, a bonus based on some measure of company performance, and perks (e.g., expense accounts, use of company planes, special retirement benefits). Their interests can be expected to include continued employment and maximizing the total value of their compensation. Executive bonuses are typically tied to some measure of firm performance, giving senior managers a strong interest in the financial success of the firm.

Other employees are the **human capital** of the company, who provide their labor and skills. Employees also have an interest in the sustainability and success of the firm. They have interests in their rate of pay, opportunities for career advancement, training, and working conditions. Employees may hold equity in the company by participating in employee stock participation plans, which are designed to align their interests with those of the shareholders of the company. In some industries, employees join unions to negotiate the terms of their employment.

Suppliers of resources to the firm have an interest in preserving an ongoing relationship with the firm, in the profitability of their trade with the firm, and in the growth and ongoing stability of the firm. Because suppliers are typically short-term creditors of the firm, they also have an interest in the firm's solvency and ongoing financial strength.

Customers rely on the company to provide a good or service of high quality at a reasonable price. Customers may also have an interest in preserving an ongoing relationship to receive support and after-sale service. Maintaining the good will of customers is critical for the long-term prospects of any company. Customers increasingly care about environmental and social responsibilities of corporations.

Governments rely on corporations for tax revenue, economic growth, social welfare, and employment creation. Regulators have an interest in ensuring compliance with various laws.

LOS 21.c: Describe environmental, social, and governance factors of corporate issuers considered by investors.

Some debt and equity investors who take a stakeholder perspective are interested in evaluating companies' environmental, social, and governance (ESG) factors. This is primarily due to three reasons:

1. Government stakeholders increasingly prioritize climate change and social policies through regulatory changes.
2. ESG factors can have a material impact on companies' results through potential loss of customer good will and financial losses due to fines and judgments. Poor corporate governance may lead to senior managers exploiting shareholders to advance personal interests.
3. Many younger investors increasingly manage their wealth with ESG considerations in mind.

Negative externalities arise when a company or its investors do not bear the full cost of its actions (e.g., environmental damage). Increased government regulations and stakeholder awareness necessitate companies to recognize these costs, either explicitly in their financial statements or implicitly.

Environmental Factors

Environmental factors include company contributions to problems such as climate change, air and water pollution, deforestation, energy efficiency, waste management, or water scarcity. Material environmental factors can have a substantial impact on companies' operations or business models. Industries that are natural resource intensive have a direct impact on the environment, but other industries may have indirect impacts.

With respect to climate change, companies may face **physical risk** of adverse effects on assets or operations if severe weather increases in frequency, as well as **transition risk** as government regulations or consumer choices require switching from high-carbon to low-carbon activities. **Stranded assets** are those that become unviable due to such changes. Poor safety policies or inadequate governance systems increase the risks for adverse events such as oil spills and contamination of groundwater. The costs of penalties, cleanup, litigation, and loss of reputation can be significant risks for a company's investors.

Social Factors

Social factors include the protection of customer privacy and information security, customer satisfaction, employee engagement, diversity and inclusion, labor relations, and community relations. Social factors contribute to a company's image in terms of how it treats its employees, customers, and the communities in which it operates. Taking measures to decrease social risk can reduce a company's costs through higher employee productivity, lower turnover, increased customer loyalty, and less risk of litigation.

Governance

Corporate governance encompasses factors such as the composition of the board and the internal audit committee, executive compensation, bribery and corruption, political contributions, and lobbying. Corporate governance systems should have adequate checks to ensure that managers act ethically, lawfully, and in the interests of shareholders.

Evaluation of ESG Risks

Analysts should identify and measure the ESG-related risks to which a company may be exposed and how they can affect the company's future cash flows. Equity investors bear the brunt of the risk from adverse outcomes. Debt investors have less exposure to adverse events unless they result in losses large enough to bring about default. Not all debtholders are equally exposed to ESG risks. Because some such risks may be delayed (e.g., a coal-fired electricity plant that is currently in compliance may become obsolete in the future), longer-maturity debt investors may have more exposure than short-term debt investors.

MODULE QUIZ 21.1

1. For a company that is financially sound, increasing the company's rate of growth is *most likely* to benefit:
   A. equity holders.
   B. debtholders.
   C. neither debtholders nor equity holders.

2. Which of the following board structures is *most likely* to be preferred by a minority shareholder?
   A. Majority independent and staggered elections.
   B. Majority independent and full board election.
   C. Majority inside and staggered elections.

3. A company decides to shut down a production plant rather than retrofit it to comply with new environmental regulations. This is *best* described as an example of:
   A. governance factors.
   B. social factors.
   C. stranded assets.

KEY CONCEPTS

LOS 21.a

A company's debtholders have a higher priority of claims than its equity holders. Debtholders have a legal claim to the promised interest and principal payments. Equity holders have a residual claim to the company's net assets after debtholders have been paid.

Debt has limited upside potential because the best result for debtholders is to receive the promised principal and interest payments. Equity has theoretically unlimited upside potential. This difference may create conflicts of interest between debtholders and equity holders.

LOS 21.b

The primary stakeholders of a corporation include shareholders, debtholders, the board of directors, senior management, employees, creditors, suppliers, and government. Stakeholder theory postulates that a company needs to balance the interests of all stakeholders.

LOS 21.c

Environmental factors include company contributions to climate change, air and water pollution, deforestation, energy efficiency, waste management, and water scarcity.

Social factors include the protection of customer privacy and information security, customer satisfaction, employee engagement, diversity and inclusion, labor relations, and community relations.

Corporate governance factors include the composition of the board, executive compensation, the internal audit function, bribery and corruption, political contributions, and lobbying.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 21.1

1. **A** If a company is financially sound, it is repaying interest and principal in full and on time. Debtholders have no additional claims to increased company profits. Equity holders benefit from the upside of a company's growth. (LOS 21.a)

2. **B** Minority shareholders prefer independent directors, as they would act in the best interests of the shareholders as opposed to acting in the interests of the management. Full board election would allow the shareholders to vote out the board if it was ineffective. Staggered elections delay changes to the board membership. (LOS 21.b)

3. **C** Stranded assets arise from obsolescence of existing assets that do not conform to new environmental standards. (LOS 21.c)

READING 22

CORPORATE GOVERNANCE: CONFLICTS, MECHANISMS, RISKS, AND BENEFITS

MODULE 22.1: CORPORATE GOVERNANCE

Video covering this content is available online.

LOS 22.a: Describe the principal-agent relationship and conflicts that may arise between stakeholder groups.

When one party hires another to carry out a task, the two parties are said to have a **principal-agent relationship**. In such a relationship a **principal-agent conflict** has the potential to arise, because an agent is hired to act in the interests of the principal, but an agent's interests might not coincide exactly with those of the principal.

For example, consider an insurance agent who is paid a commission on policies written. It would be in the agent's interest to write insurance policies on people or property that are not good risks to maximize commission income. The principal (the owner of the insurance company) does not want to issue policies that are bad risks, as that is a money-losing proposition. Insurance companies mitigate this conflict by imposing underwriting standards for the policies they will issue and by continuing to work only with agents who consistently act in the company's best interest.

Agency costs are the costs of a principal-agent conflict. Agency costs can be direct, such as hiring employees to monitor the agent, or indirect, such as the opportunity cost of lost business.

Conflicts of Interest Between Shareholders and Managers or Directors

In the context of a corporation, shareholders are the principals (owners), and firm management and board members (directors) are their agents. Managers and directors may choose a lower level of business risk than shareholders would. Managers have their employment income tied to the firm and stand to lose it, should the firm fail. Shareholders can diversify their portfolios cheaply, and as such might prefer that individual companies take more risk.

Conflicts may arise if inside directors favor management interests at the expense of shareholder interests, or if directors favor one group of shareholders at the expense of

another. Some conflicts result from **information asymmetry** between shareholders and managers, which refers to the fact that managers have more and better information about the functioning of the firm and its strategic direction than shareholders do. This decreases the ability of shareholders or nonexecutive directors to monitor and evaluate whether managers are acting in the best interests of shareholders. Information asymmetry is more acute for larger companies that operate in many businesses and geographical markets, companies that sell complex products, and companies with lower levels of institutional ownership and free float.

Common principal-agent conflicts arise in the following ways:

- Managers may put in insufficient effort. This leads to poor evaluation of investment opportunities and risks taken, resulting in overall higher total costs.
- Managers getting option grants may want to ratchet up risk because options do not have any downside risk. On the other hand, managers who are compensated primarily with cash may be inadequately motivated to take risk.
- Manager compensation tied to company size creates incentives for *empire building* through poor or unnecessary acquisitions.
- Managers may seek to entrench themselves by taking inadequate risk, mimicking competitors' actions rather than generating original ideas, or engaging in otherwise unprofitable projects that require their specific individual knowledge. Directors, in turn, might seek to entrench themselves by going along with management's decisions instead of questioning them.
- Managers may undertake **self-dealing** by exploiting firm resources for personal benefit.

Conflicts Between Groups of Shareholders

A single shareholder or group of shareholders in a company may hold most of the votes (**controlling shareholders**) and act against the interests of the **minority shareholders**. A controlling shareholder may have concentrated ownership, in that a large proportion of his or her wealth might consist of shares in this company. In this situation a controlling shareholder might want the company to diversify into different businesses to mitigate risk. Minority shareholders, by contrast, might already hold diversified portfolios and do not want the company to squander resources by investing in a less desirable business just to diversify.

Some firms have a **dual-class structure** with different classes of common stock outstanding, some with more voting power than others. This can give a group of shareholders (e.g., the company's founders) effective control of the company even if they have claims to less than 50% of its earnings and assets. CFA Institute advocates against dual-class voting structures because they allow one group of shareholders to further their interests at the expense of other groups.

Conflicts of Interest Between Creditors and Shareholders

Shareholders may prefer more business risk than creditors do because creditors have a limited upside from good results compared to shareholders. Management actions that favor the interests of equity owners over the interests of creditors include issuing new debt that increases the default risk faced by existing debtholders, or increasing dividends at the cost of decreasing company assets as collateral and increasing the risk of default. This potential for conflict is a greater risk for long-term debtholders.

LOS 22.b: Describe corporate governance and mechanisms to manage stakeholder relationships and mitigate associated risks.

Corporate governance is the system of internal controls and procedures by which individual companies are managed. It includes a framework that defines the rights, roles, and responsibilities of various groups within an organization. The objective is to manage and minimize conflicts of interest between stakeholders of the company.

Stakeholder management refers to the management of company relations with stakeholders and is based on having a good understanding of stakeholder interests and maintaining effective communication with stakeholders. With respect to the company's relationship with shareholders, there are standard practices. These practices are required by corporate laws and are similar in many jurisdictions, although there are some differences across countries.

Stakeholders gather information about the company from public reports filed by the company. Public companies release information in annual reports, proxy statements, and public notices. This reporting includes information about the financial performance and standing of the company, related-party transactions, executive remuneration, and governance structure. While reporting requirements for private companies are more limited, these companies typically provide information to their investors directly. Transparency in reporting reduces information asymmetry and allows stakeholders to evaluate whether the company's actions align with their interests.

Shareholder Mechanisms

Corporations typically hold an **annual general meeting** after the end of the firm's fiscal year. At the general meeting, company management provides shareholders with the audited financial statements for the year, addresses the company's performance and significant actions over the period, and answers shareholder questions.

Corporate laws dictate when the annual general meeting must occur and how the meeting must be communicated to shareholders. Typically, anyone owning shares is permitted to attend the annual general meeting, to speak or ask questions, and to vote their shares. A shareholder who does not attend the annual general meeting can vote her shares by **proxy**, meaning she assigns her right to vote to another person who will attend the meeting—often a director, a member of management, or the shareholder's

investment advisor. A proxy may specify the shareholder's vote on specific issues or leave the vote to the discretion of the person to whom the proxy is assigned.

Ordinary resolutions, such as the approval of an auditor and the election of directors, require a simple majority of the votes cast. Other resolutions are addressed at **extraordinary general meetings**, which can be called any time a matter requires a shareholder vote. Examples include amendments to the company's bylaws, a merger or takeover, a shareholder-proposed special board election, or the liquidation of the firm.

Activist shareholders pressure companies in which they hold a significant number of shares for changes they believe will increase shareholder value. They may initiate shareholder lawsuits or seek representation on the board of directors. Other activist tactics include proposing shareholder resolutions for a vote and raising their issues to all shareholders or the public to gain wider support. Hedge funds have engaged increasingly in shareholder activism at firms in which they hold significant stakes.

A shareholder activist group may initiate a **proxy contest**, in which they seek the proxies of shareholders to vote in favor of their alternative proposals, or may make a **tender offer** for enough shares of a company to gain control. Both senior managers and boards of directors can be replaced by shareholders when they believe company performance is poor and would be improved by change. The threat of a **hostile takeover**, one not supported by the company's management, can act as an incentive for company managements and boards to pursue policies better aligned with the interests of shareholders. On the other hand, it might also cause the current management or board to adopt takeover defenses such as staggered board elections or **poison pill** provisions (low-price additional share offerings to current shareholders).

Creditor Mechanisms

When a company issues a bond, it specifies the rights of bondholders and the company's obligations in a legal document called a **bond indenture**. An indenture typically includes **covenants** that may require the company to take certain actions, or restrict it from taking certain actions. A bond can be backed by **collateral**, which is a specific asset pledged against which the bondholders will have a claim if the company defaults on the bond. A financial institution may act as a trustee to monitor the company's compliance with its bond covenants.

Creditor committees may form among bondholders to protect their interests when an issuer experiences financial distress. Some countries require such committees when a company files for bankruptcy. A group of bond investors may form an **ad hoc committee** when a company is struggling to meet its obligations. While the committee does not represent *all* the bondholders, their interests are generally aligned.

Board of Directors and Management Mechanisms

The **board of directors** is elected by shareholders to act in their interests. A board of directors typically has committees made up of board members with particular expertise. These committees report to the board, which retains the overall

responsibility for the various board functions. The following are examples of typical board committees.

An **audit committee** is responsible for the following:

- Oversight of the financial reporting function and implementation of accounting policies
- Effectiveness of the company's internal controls and the internal audit function
- Recommending an independent external auditor and its compensation
- Proposing remedies based on their review of internal and external audits

A **nominating/governance committee** is responsible for the following:

- Oversight of the company's corporate governance code including board elections
- Setting policies for nomination of candidates for board membership
- Implementing the company's code of ethics and policies regarding conflicts of interest
- Monitoring changes in relevant laws and regulations
- Ensuring that the company is in compliance with all applicable laws and regulations, as well as with the company's governance policies

A **compensation committee** or **remuneration committee** recommends to the board the amounts and types of compensation to be paid to directors and senior managers. This committee may also be responsible for oversight of employee benefit plans and evaluation of senior managers. Because managers should not be in a position to evaluate or compensate themselves, a compensation committee should (and in many countries is required to) be composed of independent directors only.

Other committees are industry specific. A risk committee (financial services industry) informs the board about appropriate risk policy and risk tolerance of the organization, and it oversees the enterprise-wide risk management processes of the organization. An investment committee (insurance industry) reviews and reports to the board prudent investment and capital management policies.

The number and size of board committees will depend on the size, complexity, and nature of the business. Regulations often require that firms have audit committees. The composition of a board committee is often based on its function, with audit committees, compensation committees, and governance committees often made up of only nonexecutive or independent directors.

Employee, Customer, and Supplier Mechanisms

Labor laws, employment contracts, and the right to form unions are the primary mechanisms for employees to manage relationships with employers. Some countries have laws that require boards of large companies to include employee representatives. **Employee stock ownership plans (ESOPs)** may help align company and employee interests. For customers and suppliers, contracts tend to be the mechanism through which they manage their relationships with companies. In recent years, customers and

other stakeholders have increasingly used social media as a mechanism to influence company behavior.

Government Mechanisms

Governments enact and enforce regulations that govern companies' actions. They often do so by establishing agencies to regulate industries or sectors such as financial markets, or by monitoring specific issues such as workplace safety and environmental protection. In some countries, regulators develop corporate governance codes that companies must either adopt or explain why they have not done so. In some countries, corporate governance regulations are specified by stock exchanges as part of their listing requirements.

LOS 22.c: Describe potential risks of poor corporate governance and stakeholder management and benefits of effective corporate governance and stakeholder management.

Risks of Poor Governance and Stakeholder Management

When corporate governance is weak, the control functions of audits and board oversight may be weak as well. The risk is that some stakeholders can gain an advantage, to the disadvantage of other stakeholders. Accounting fraud, or simply poor recordkeeping, will have negative implications for company performance and value.

When governance is weak and managers are not monitored, they may serve their own interests by choosing less-than-optimal risk, reducing company value. Without proper monitoring and oversight, management may be given incentive compensation that allows them to pursue their own benefit rather than the company's interests. They may engage in related-party transactions that benefit their friends or family, to the detriment of shareholders.

Poor compliance procedures with respect to regulation and reporting can easily lead to legal and reputational risks. Violating stakeholder rights can lead to stakeholder lawsuits. Failure to comply with government regulations can damage company reputation. Failure to manage creditors' rights well can lead to debt default and bankruptcy.

Benefits of Effective Governance and Stakeholder Management

Effective corporate governance can improve operational efficiency by ensuring that management and board member incentives align their interests well with those of the shareholders. Effective governance implies effective control and monitoring. Just as weak control can lead to abuses, a strong system of controls and compliance with laws and regulations can avoid many legal and regulatory risks.

Formal policies regarding conflicts of interest and related-party transactions can also lead to better operating results. Proper governance with respect to the interests of creditors can reduce the risk of debt default or bankruptcy, thereby reducing the cost of debt financing. Alignment of management interests with those of shareholders leads to better financial performance and greater company value.

MODULE QUIZ 22.1

1. Between which two of a company's stakeholder groups does information asymmetry *most likely* make monitoring more difficult?
   A. Suppliers and customers.
   B. Employees and government.
   C. Managers and shareholders.
2. The theory that deals with conflicts of interest between a company's owners and its creditors is *most appropriately* called:
   A. governance theory.
   B. stakeholder theory.
   C. shareholder theory.
3. Benefits of effective corporate governance and stakeholder management *most likely* include:
   A. reduced risk of default.
   B. more efficient related-party transactions.
   C. greater control exercised by the most interested stakeholders.

KEY CONCEPTS

LOS 22.a

The principal-agent relationship refers to owners employing agents to act in their interests. Conflicts can arise because the agent's incentives may not align with those of the owner or, more generally, because the interests of one group within a corporation are not the same as those of other groups.

LOS 22.b

Corporate governance refers to the internal controls and procedures of a company that delineate the rights and responsibilities of various groups, and how conflicts of interest among the various groups are to be resolved.

Shareholders, creditors, boards of directors, employees, customers, suppliers, and governments have different mechanisms with which to manage their stakeholder relationships with companies.

Proxy voting is the primary shareholder mechanism. Shareholders can remove senior managers and boards of directors if they believe company performance would improve with a change. Activist shareholders may engage in proxy fights or hostile takeovers.

Creditor mechanisms include bond indentures and creditor committees. Employee mechanisms include labor laws and unions. Contracts are the primary mechanism for customers and suppliers. Governments may enact regulations or appoint regulatory agencies.

Duties of a board of directors include the following:

- Selecting senior management, setting their compensation, and evaluating their performance
- Setting the strategic direction for the company
- Approving capital structure changes, significant acquisitions, and large investment expenditures
- Reviewing company performance and implementing any necessary corrective steps
- Planning for continuity of management and the succession of the CEO
- Establishing, monitoring, and overseeing the firm's internal controls and risk management
- Ensuring the quality of the firm's financial reporting and internal audit

LOS 22.c

The risks of poor governance include weak control systems, poor decision-making, legal risk, reputational risk, and default risk. Good corporate governance can improve operational efficiency and performance, reduce default risk, reduce the cost of debt, improve financial performance, and increase firm value.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 22.1

1. **C** Information asymmetry can exist between a company's shareholders and its managers because the company's managers may be much more knowledgeable about the company's functioning and strategic direction. This makes it more difficult for shareholders to monitor the firm's managers and determine whether they are acting in shareholders' interests. (LOS 22.a)

2. **B** Stakeholder theory focuses on the conflicts of interest among owners and several groups that have an interest in a company's activities, including creditors. (LOS 22.b)

3. **A** Reduced risk of default is among the benefits of effective corporate governance. Risks from poor corporate governance include related-party transactions by managers and opportunities for some stakeholder groups to gain an advantage at the expense of others. (LOS 22.c)

READING 23

WORKING CAPITAL AND LIQUIDITY

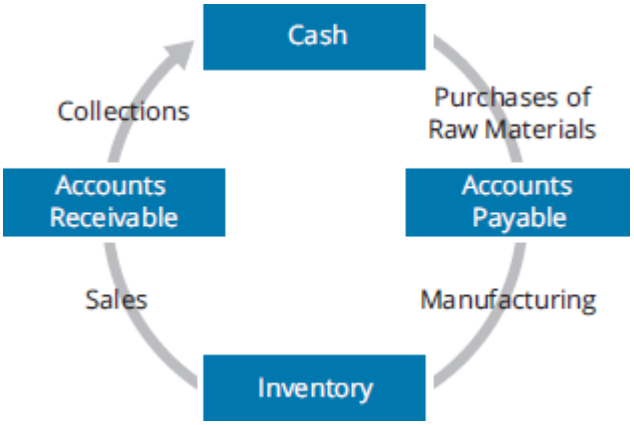
MODULE 23.1: LIQUIDITY MEASURES AND MANAGEMENT

Video covering this content is available online.

LOS 23.a: Explain the cash conversion cycle and compare issuers' cash conversion cycles.

The **cash conversion cycle (CCC)** measures the efficiency of a company's cash flow management. It represents the time it takes for a company to convert its investments in inventory and other resources into cash inflows from sales. In other words, it measures how quickly a company can convert its investments into cash and then use that cash to invest in new opportunities, as shown in Figure 23.1.

Figure 23.1: Cash Conversion Cycle



The CCC is calculated by adding the number of days it takes for a company to sell its inventory (**days of inventory on hand**), the number of days it takes for the company to collect payment from its customers (**days sales outstanding**), and the number of days it takes for the company to pay its suppliers (**days payable outstanding**).

$$\text{cash conversion cycle} = \text{days of inventory on hand} + \text{days sales outstanding} - \text{days payables outstanding}$$

PROFESSOR'S NOTE

The calculation of DOH, DSO, and DPO is covered in our Financial Statement Analysis reading on Financial Analysis Techniques.

A lower CCC is generally better as it indicates that a company can generate cash quickly and efficiently, meaning that less of the company's capital is devoted to working capital. A high CCC may indicate that a company is taking longer to convert its investments into cash, which could lead to cash flow problems and potentially limit the company's ability to invest in growth opportunities.

A company can decrease its CCC by decreasing its inventories and receivables or by increasing (extending) its payables. However, each of these has potential disadvantages:

- Reduced inventories of raw materials may create production bottlenecks due to supply chain disruptions. Reduced inventories of finished foods may mean an inability to meet spikes in customer demand.
- Reducing or tightening credit to customers may result in lost sales.
- We can think of accounts payable as an implicit source of credit from suppliers (as opposed to explicit sources such as bank loans). Suppliers offer payment terms in the form *a/b net c*, which means a percentage discount of *a* if the invoice is paid within *b* days, otherwise full payment is due within *c* days. Forgoing the discount for prompt payment amounts to borrowing money from the supplier for (c – b) days, at an effective annual rate we can calculate as follows:

  $$\text{EAR of supplier financing} = \left(1 + \frac{a}{1-a}\right)^{\left(\frac{365}{c-b}\right)} - 1$$

  where:
  a = percent discount
  b = days until discount expires
  c = days until full payment is due

  Often, the company could find a lower EAR by borrowing from their lenders as opposed to forgoing the discount.

EXAMPLE: EAR of supplier financing

A supplier offers 2/10 net 30 terms. The bank interest rate is 8%. Which source of financing should the company prefer?

Answer:

Financing is for 30 − 10 = 20 days.

EAR of supplier financing = $(1 + 0.02 / 0.98)^{(365/20)} - 1 = 0.446$, or 44.6%.

The cost of implicit supplier financing is much higher than the cost of explicit bank financing. The company should borrow from its bank at 8% to pay the invoice within 10 days.

Cash conversion cycles vary by industry. For example, pharmaceutical companies have long CCCs because they maintain inventories of high-margin drugs to meet unexpected surges in demand. By contrast, airlines have low CCCs because most of their sales are prepaid and they do not keep significant inventories. Analysts should use the CCC to

compare companies within the same industry, or to track a company's performance over time.

In addition to the CCC, overall levels of working capital can indicate how efficiently a company manages its liquidity. To compare companies of different sizes, analysts calculate working capital as a proportion of sales. Because the ratio varies by industry, care should be taken to compare firms in similar lines of business. **Total working capital** is current assets less current liabilities. Analysts often prefer to measure **net working capital**, using only operating current assets and operating current liabilities, because it is closely linked to the CCC:

$$\text{total working capital} = \text{current assets} - \text{current liabilities}$$

$$\text{net working capital} = \text{current assets (except cash and marketable securities)} - \text{current liabilities (excluding short-term and current debt)}$$

LOS 23.b: Explain liquidity and compare issuers' liquidity levels.

For an asset, **liquidity** refers to its nearness to cash. For a liability, liquidity refers to its nearness to settlement. Assets that can be quickly converted to cash (e.g., marketable securities) are considered highly liquid.

Inventory is less liquid than accounts receivable. Inventory may need processing before a sale, and once sold, inventory might be converted to accounts receivable, which needs to be collected to convert into cash.

For a corporate issuer, liquidity refers to availability of cash and other liquid assets to meet its short-term obligations. **Primary liquidity sources** include cash and marketable securities on hand, bank borrowings, and cash generated from the business. Long-term solvency of a company depends on its ability to generate sufficient cash from its business to service its liabilities. Analysts evaluate a company's liquidity management primarily by reviewing its statement of cash flows.

Companies generally rely on primary sources of liquidity. However, if needed, the company can rely on **secondary liquidity sources**, such as the following:

- Cash saved by suspending dividends to shareholders
- Delaying or reducing capital investments
- Selling assets
- Issuing additional equity
- Restructuring debt to extend its maturity
- Bankruptcy protection filing, which suspends the need to service the liabilities

Using secondary liquidity sources sends negative signals to the market, and they are generally more costly than primary liquidity sources.

A company's cash conversion cycle may vary by time of the year (i.e., seasonality) and as business conditions change (e.g., a sudden dip in demand for a company's product will increase inventory and increase DOH). Cash and marketable securities serve as a buffer to meet the company's obligations when there is a deviation from the normal

CCC. This excess cash has a cost because it represents capital not invested in the business, but inadequate liquidity can result in having to rely on higher-cost secondary sources.

EXAMPLE: Cost of liquidity

Drake Corporation has a sudden need for liquidity to meet its payroll at the end of the week. The company's sources of liquidity and their costs are as shown here.

Source	$ Fair Market Value ($000s)	Liquidation Cost (%)
Cash and marketable securities	100	0
Inventory and receivables	200	15
Empty warehouse	300	30
Total	600	

Calculate the total proceeds from all sources, and the cost of liquidity in dollars and in percentage.

Answer:

The cost of liquidity is the discount to fair market value for which an asset is sold due to the need for immediate liquidity, rather than waiting for the normal time it takes to sell the asset.

Source	Fair Market Value ($000s)	Liquidation Cost		Net Proceeds
Cash and marketable securities	$100	0%	$0	$100
Inventory and receivables	$200	15%	$30	$170
Empty warehouse	$300	30%	$90	$210
Total	$600		$120	$480

The cost of liquidity = $120,000, or 120 / 600 = 20%.

Factors Affecting Liquidity

An increase in the CCC reduces an issuer's liquidity. The CCC can increase due to drags or pulls on liquidity. A **drag on liquidity** occurs when cash inflows lag. This can occur when excess inventory builds up or inventory becomes obsolete (DOH increases), or when collections are slow or receivables become uncollectible (DSO increases). A **pull on liquidity** occurs when cash outflows accelerate. This can occur when suppliers reduce credit lines or demand faster payments (DPO decreases).

Liquidity Ratios

The **current ratio** is the ratio of current assets to current liabilities. A current ratio greater than 1 indicates that the company has sufficient current assets to meet its current liabilities.

$$\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

Not all current assets are equally liquid. Because inventory is the least liquid current asset, the **quick ratio** excludes inventory from current assets and is a more stringent metric of liquidity.

$$\text{quick ratio} = \frac{(\text{cash and marketable securities} + \text{accounts receivable})}{\text{current liabilities}}$$

Finally, the **cash ratio** excludes both inventory and accounts receivables and is the most stringent measure of liquidity.

$$\text{cash ratio} = \frac{\text{cash and marketable securities}}{\text{current liabilities}}$$

EXAMPLE: Liquidity ratios

The following information is available for Drake Corporation for the past two years:

Current Assets	20X1 ($000s)	20X2 ($000s)
Cash and marketable securities	$ 98	$ 54
Accounts receivable	$ 120	$ 110
Inventory	$ 190	$ 310
Prepaid accounts	$ 24	$ 18
Current Liabilities		
Accounts payable	$ 85	$ 100
Accrued expenses	$ 34	$ 39
Short-term notes payable	$ 98	$ 145

Calculate Drake's current ratio, quick ratio, and cash ratio for each of the two years and comment on the trend in the ratios.

Answer:

Current ratio = current assets / current liabilities

Current ratio (20X1) = (98 + 120 + 190 + 24) / (85 + 34 + 98) = 1.99

Current ratio (20X2) = (54 + 110 + 310 + 18) / (100 + 39 + 145) = 1.73

Quick ratio = cash and marketable securities + accounts receivable / current liabilities

Quick ratio (20X1) = (98 + 120) / (85 + 34 + 98) = 1.00

Quick ratio (20X1) = (54 + 110) / (100 + 39 + 145) = 0.58

Cash ratio = cash and marketable securities / current liabilities

Cash ratio (20X1) = 98 / (85 + 34 + 98) = 0.45

Cash ratio (20X2) = 54 / (100 + 39 + 145) = 0.19

All three ratios are declining year-over-year from 20X1 to 20X2, indicating that Drake's liquidity is worsening.

LOS 23.c: Describe issuers' objectives and compare methods for managing working capital and liquidity.

Working capital management seeks to maximize firm profits while ensuring that sufficient liquidity is available to maintain the firm's operations and meet its obligations. Firms may choose to hold more short-term assets (which offer lower rates of return) to ensure that sufficient cash is available to service its obligations. The firm can also choose to finance its working capital using short-term loans, which are cheaper than sources such as long-term debt and equity. However, the firm must consider the risk of being able to roll over short-term debt at a reasonable cost.

In analyzing different approaches to working capital management, it is important to control for size differences between companies. We do this by calculating companies' relative amounts of long-term versus short-term assets as a proportion of sales.

A conservative approach to working capital management is for the company to hold higher amounts of short-term assets (relative to long-term assets) and finance the working capital using longer-term sources, such as long-term debt and equity. Benefits of a conservative approach include using more permanent capital with less need for rolling over; greater flexibility during market disruptions; and a high probability of meeting short-term obligations. However, the conservative approach results in higher costs and lower profitability. Additionally, long-term lenders may impose operational constraints such as a minimum interest coverage ratio.

An aggressive approach would be to hold relatively lower levels of short-term assets and finance working capital using short-term debt. The benefit of an aggressive approach is lower costs, but its risks are failing to meet business obligations and vulnerability to market disruptions.

A moderate approach seeks to find a middle ground. Permanent current assets are funded using long-term sources of capital, while variable (seasonal) current assets are funded using short-term sources.

Short-Term Liquidity Sources

Firms should maintain a variety of alternative sources and evaluate the costs of each source, while securing sources ahead of time to meet spikes in liquidity needs.

Factors that affect a firm's approach to short-term funding include the following:

- Company size (smaller firms have limited options)
- Creditworthiness (which affects the interest rate on loans as well as operational restrictions imposed)
- Legal systems (developed economies with well-defined protections for lenders offer more funding alternatives)
- Regulatory concerns (firms in regulated industries, such as banks and utilities, have restrictions on funding sources as well as amounts raised)
- Underlying assets (that serve as collateral on loans)

MODULE QUIZ 23.1

1. Compared to its industry peers, a company with a shorter cash conversion cycle *most likely*:
   A. has more inventory.
   B. has less accounts receivable.
   C. pays its suppliers more promptly.
2. A company receives an invoice of $150,000 for machine tools with terms of "1.5/15 net 40." The cost to the company of delaying payment of this receivable is *most* appropriately described as $2,250 for the use of:
   A. $150,000 for 40 days.
   B. $150,000 for 25 days.
   C. $147,750 for 25 days.
3. Which of the following actions is *most likely* to increase liquidity for a corporation?
   A. Selling inventory at a discount of 5%.
   B. Availing of a discount of 10% by paying accounts payable early.
   C. Extending customers' credit terms from 90 days to 120 days.
4. Which of the following is *least likely* a primary source of liquidity?
   A. Borrowings from banks.
   B. Cash flow from operations.
   C. Delaying capital expenditures.
5. Which of the following *most likely* represents conservative working capital management?
   A. Decreasing inventory on hand to reduce insurance costs.
   B. Financing an increase in receivables by increasing long-term borrowing.
   C. Selling marketable securities and using the proceeds to acquire real estate.

KEY CONCEPTS

LOS 23.a

The cash conversion cycle (CCC) represents the time it takes for a company to convert its investments in inventory and other resources into cash inflows from sales. The CCC increases with an increase in days of inventory on hand (DOH), days sales outstanding (DSO), and decreases with an increase in days payable outstanding (DPO).

$$CCC = DOH + DSO - DPO$$

$$\text{Total working capital} = \text{current assets} - \text{current liabilities}$$

$$\text{Net working capital} = \text{current assets (except cash and marketable securities)} - \text{current liabilities (excluding short-term and current debt)}$$

LOS 23.b

Primary liquidity sources include cash and marketable securities on hand, bank borrowings, and cash generated from the business. Secondary sources of liquidity include forgoing dividends, delaying capital investments, selling assets, issuing equity, restructuring debt, and bankruptcy protection filing. Using secondary liquidity sources sends a negative signal to the market and incurs a cost of liquidity.

A drag on liquidity occurs when cash inflows lag (DOH or DSO increases), while a pull on liquidity occurs when cash outflows accelerate (DPO decreases).

Measures of a company's short-term liquidity include:

- Current ratio = current assets / current liabilities.
- Quick ratio = (cash + marketable securities + receivables) / current liabilities.
- Cash ratio = (cash + marketable securities) / current liabilities.

LOS 23.c

A conservative approach to working capital management involves high levels of current assets financed with long-term debt and equity. Compared to a more aggressive approach, a conservative approach provides more liquidity and involves less financial risk, but has higher financing costs and reduces returns.

An aggressive approach to working capital management involves lower levels of current assets and financing working capital needs with short-term debt. Compared to a more conservative approach, an aggressive approach typically has lower financing costs and results in higher returns, but decreases liquidity and increases financial risk.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 23.1

1. **B** CCC = DOH + DSO − DPO. A company with a shorter CCC would have lower DOH (lower amount of cash tied in inventory), lower DSO (lower amount of cash tied in accounts receivables), or higher DSO (increased use of supplier credit). (LOS 23.a)

2. **C** The terms indicate that the company can pay $150,000(1 – 0.015) = $147,750 on day 15 (after the invoice date) or pay $150,000 on day 40—effectively gaining the use of $147,750 for 25 days at a cost of $2,250. (LOS 23.a)

3. **A** Liquidity can be increased by reducing inventory. Extending repayment times would increase DSO, reducing liquidity. Paying suppliers earlier decreases DPO, thus reducing liquidity. (LOS 23.b)

4. **C** Primary sources of liquidity include cash and marketable securities on hand, bank borrowings, and cash generated from the business. Delaying capital expenditure is a secondary source of liquidity. (LOS 23.b)

5. **B** Financing an increase in a current asset with long-term borrowing is an example of conservative working capital management. The other choices describe decreases in current assets and therefore more likely represent aggressive working capital management. (LOS 23.c)

READING 24

CAPITAL INVESTMENTS AND CAPITAL ALLOCATION

MODULE 24.1: CAPITAL INVESTMENTS AND PROJECT MEASURES

Video covering this content is available online.

LOS 24.a: Describe types of capital investments.

The four types of capital investments include going concern projects, regulatory/compliance projects, expansion projects, and other projects.

- **Going concern projects** may be needed to maintain the business or reduce costs. Projects that maintain the business do not require detailed analysis. The only issues are whether the existing operations should continue and, if so, whether existing procedures or processes should be maintained. Projects to improve efficiency may involve determining if equipment that is obsolete, but still usable, should be replaced. To reduce financing risk, companies often use a **match funding** approach, financing projects with capital sources that are consistent with the project life. Analysts often use a company's annual depreciation expense as an estimate of the capital investment it needs for going concern projects.
- **Regulatory/compliance projects** may be required by a government agency or insurance company and often involve safety-related or environmental concerns. These projects typically generate little to no revenue and require the company to evaluate alternative ways of carrying out the projects.
- **Expansion projects** grow the business and require a complex decision-making process that includes forecasting future demand. Expansion projects can involve entering new markets or introducing new products within the same market. A detailed analysis including forecasting revenues and expenses is required.
- Other projects, such as new investments outside a company's existing lines of business, also entail a complex decision-making process with detailed analysis due to the uncertainty involved. Other projects are often similar to startups that explore a new technology or business idea. These projects can also involve buying out an existing company in a new industry, which involve risks that include overpaying.

LOS 24.b: Describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and

contrast their use in capital allocation.

The **capital allocation process** is identifying and evaluating capital projects (i.e., projects where the cash flows to the firm will be received over a period longer than a year). Any corporate decisions with an impact on future earnings can be examined using this framework. Decisions about buying a new machine, expanding business into another geographic area, moving the corporate headquarters to Cleveland, or replacing a delivery truck, to name a few, can be examined using a capital allocation analysis.

For a number of good reasons, capital allocation may be the most important responsibility that a financial manager has. First, because a capital allocation decision often involves the purchase of costly long-term assets with lives of many years, the decisions made may determine the future success of the firm. Second, the principles underlying the capital allocation process also apply to other corporate decisions, such as working capital management and making strategic mergers and acquisitions. Finally, making good capital allocation decisions is consistent with management's primary goal of maximizing shareholder value.

The capital allocation process has four administrative steps:

Step 1: Idea generation. The most important step in the capital allocation process is generating good project ideas. Ideas can come from a number of sources, including senior management, functional divisions, employees, or sources outside the company.

Step 2: Analyzing project proposals. Because the decision to accept or reject a capital project is based on the project's expected future cash flows, a cash flow forecast must be made for each project to determine its expected profitability.

Step 3: Create the firm-wide capital budget. Firms must prioritize profitable projects according to the timing of the project's cash flows, available company resources, and the company's overall strategic plan. Many projects that are attractive individually may not make sense strategically.

Step 4: Monitoring decisions and conducting a post-audit. It is important to follow up on all capital allocation decisions. An analyst should compare the actual results to the projected results, and project managers should explain why projections did or did not match actual performance. Because the capital allocation process is only as good as the estimates of the inputs into the model used to forecast cash flows, a post-audit should be used to identify systematic errors in the forecasting process and improve company operations.

Net Present Value (NPV)

Net present value (NPV) is the sum of the present values of all the expected incremental cash flows if a project is undertaken. The discount rate used is the firm's cost of capital, adjusted for the risk level of the project. For a normal project, with an initial cash outflow followed by a series of expected after-tax cash inflows, the NPV is the present value of the expected inflows minus the initial cost of the project.

$$NPV = CF_0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \ldots + \frac{CF_n}{(1+k)^n} = \sum_{t=0}^{n} \frac{CF_t}{(1+k)^t}$$

where:

CF_0 = initial investment outlay (a negative cash flow)

CF_t = after-tax cash flow at time *t* (can be positive or negative)

k = required rate of return for project

A positive NPV project is expected to increase shareholder wealth, a negative NPV project is expected to decrease shareholder wealth, and a zero NPV project has no expected effect on shareholder wealth.

For *independent* projects, the *NPV decision rule* is simply to accept any project with a positive NPV and to reject any project with a negative NPV.

EXAMPLE: Net present value

Using the project cash flows presented in Figure 24.1, calculate the NPV of the project and determine whether it should be accepted or rejected. Assume that the cost of capital is 9%.

Figure 24.1: Expected Net After-Tax Cash Flows

Year	Cash Flow
0	–$100
1	25
2	50
3	75

Answer:

$$NPV = -100 + \frac{25}{1.09} + \frac{50}{(1.09)^2} + \frac{75}{(1.09)^3} = 22.93$$

The project has a positive NPV, so it should be accepted.

You may calculate NPV directly by using the cash flow (CF) keys on your calculator. The process is illustrated in Figure 24.2.

Figure 24.2: Calculating NPV With the TI BA II Plus™

Keystrokes	Explanation	Display
[CF] [2nd] [CLR WORK]	Clear memory registers	CF0 = 0.0000
100 [+/−] [ENTER]	Initial cash outlay	CF0 = −100.0000
[↓] 25 [ENTER]	Period 1 cash flow	C01 = 25.0000
[↓]	Frequency of cash flow 1	F01 = 1.0000
[↓] 50 [ENTER]	Period 2 cash flow	C02 = 50.0000
[↓]	Frequency of cash flow 2	F02 = 1.0000
[↓] 75 [ENTER]	Period 3 cash flow	C03 = 75.0000
[↓]	Frequency of cash flow 3	F03 = 1.0000
[NPV] 9 [ENTER]	9% discount rate	I = 9.0000
[↓] [CPT]	Calculate NPV	NPV = 22.9335

Internal Rate of Return (IRR)

For a normal project, the **internal rate of return (IRR)** is the discount rate that makes the present value of the expected incremental after-tax cash inflows just equal to the initial cost of the project. More generally, the IRR is the discount rate that makes the present value of a project's estimated cash inflows equal to the present value of the project's estimated cash outflows. That is, IRR is the discount rate that makes the following relationship hold:

$$\text{PV inflows} = \text{PV outflows}$$

The IRR is also the discount rate for which the NPV of a project is equal to zero:

$$\text{NPV} = 0 = \text{CF}_0 + \frac{\text{CF}_1}{(1+\text{IRR})^1} + \frac{\text{CF}_2}{(1+\text{IRR})^2} + \ldots + \frac{\text{CF}_n}{(1+\text{IRR})^n} = \sum_{t=0}^{n} \frac{\text{CF}_t}{(1+\text{IRR})^t}$$

IRR decision rule: If IRR is greater than the required rate of return, accept the project. If IRR is less than the required rate of return, reject the project.

The required rate of return for a given project is usually the firm's cost of capital. However, a project analyst may adjust the required rate of return above or below the firm's cost of capital to account for differences between the project's risk and the average risk of all of the firm's projects (which is reflected in the firm's current cost of capital).

For this reason, the minimum IRR above which a project will be accepted is often referred to as the **hurdle rate**. Projects with IRRs above this rate will be accepted, while those with IRRs below this rate will not be accepted.

EXAMPLE: Internal rate of return

Continuing with the cash flows presented in Figure 24.1 for the previous example, calculate the IRR of the project and determine whether it should be accepted or rejected. Assume that the required rate of return is 9%.

Answer:

$$0 = -100 + \frac{25}{(1+\text{IRR})} + \frac{50}{(1+\text{IRR})^2} + \frac{75}{(1+\text{IRR})^3}$$

The cash flows should be entered as in Figure 24.2 (if you haven't changed or cleared them, they are still there from the previous calculation of NPV).

With the TI calculator, the IRR can be calculated with [IRR] [CPT] to get 19.4377%.

The project should be accepted because its IRR is greater than the 9% required rate of return.

A project has a **conventional cash flow pattern** if the sign on the cash flows changes only once, with one or more cash outflows followed by one or more cash inflows. An **unconventional cash flow pattern** has more than one sign change. For example, a project might have an initial investment outflow, a series of cash inflows, and a cash outflow for asset retirement costs at the end of the project's life. Another example of unconventional cash flow is when the time intervals between cash flows differ, for example if the first cash flow occurs 1 year after project inception while the second cash flow occurs 1.5 years after the first. Spreadsheet software is most suitable for calculating NPV and IRR with unconventional cash flows.

Relative Advantages and Disadvantages of the NPV and IRR Methods

A key advantage of NPV is that it is a direct measure of the expected increase in the value of the firm. In theory, a positive NPV project should cause a proportionate increase in a company's stock price.

A key advantage of IRR is that it measures profitability as a percentage, showing the return on each dollar invested. The IRR provides information on the margin of safety that the NPV does not. From the IRR, we can tell how much below the IRR (estimated return) the actual project return could fall, in percentage terms, before the project becomes uneconomic (has a negative NPV).

The *disadvantages* of the IRR method are:

- It assumes that project's cash flows are reinvested at the IRR while NPV assumes that those cash flows are reinvested at the project's required rate of return. It is more realistic to assume the latter.
- For multiple sign changes, a project may have multiple IRRs that are difficult to interpret.

Return on Invested Capital

One way to examine whether a company is creating value for its shareholders is to compare the return on the company's investment in assets to its cost of capital. A company's **return on invested capital (ROIC)**, or simply **return on capital**, is defined

as its **net operating profit after tax (NOPAT)**, or simply after-tax operating profit, divided by the average book value of its total capital over the period:

$$\text{return on invested capital} = \frac{\text{net operating profit after tax}}{\text{average book value of invested capital}}$$

After-tax operating profit is net income plus after-tax interest expense. We use this because we want to measure the return to all sources of capital (both debt and equity). Invested capital includes long-term debt and equity, but excludes working capital.

We can rewrite the ROIC equation as:

$$\text{ROIC} = \left(\frac{\text{NOPAT}}{\text{Average Invested Capital}}\right) = \left(\frac{\text{NOPAT}}{\text{Sales}}\right) \times \left(\frac{\text{Sales}}{\text{Average Invested Capital}}\right)$$

We refer to the ratio of after-tax operating profit to sales as *operating margin after tax*, and we refer to the ratio of sales to invested capital as *capital turnover* or *asset turnover*. This means that ROIC is the product of operating margin after-tax and invested capital turnover. A company can increase its ROIC by improving its operating margin or by increasing its capital turnover.

Analysts compare ROIC to investors' required rate of return. In this context, the required rate of return is a blended rate for both debt and equity. If ROIC is greater than the required rate, the firm is adding value over time.

One attraction of ROIC is that it is based on accounting data, which are available to outside investors. While NPV and IRR are project-specific, ROIC is for the firm as a whole. ROIC is more relevant for outside investors because they typically cannot invest in a firm's individual projects.

There are three concerns with using ROIC:

1. Because accounting treatments differ, ROIC may not be comparable across companies.
2. ROIC is backward-looking and can be volatile from year to year.
3. Because ROIC is for the whole company, it may let profitable projects and good decisions mask unprofitable projects and poor decisions.

MODULE QUIZ 24.1

1. Which of the following is *most likely* a going concern project?
   A. Opening a retail outlet in a new region.
   B. Acquiring and merging with a supplier to secure a source for a key component.
   C. Purchasing a new model of a factory machine that will decrease unit production costs.
2. In the capital allocation process, a post-audit is used to:
   A. improve cash flow forecasts and stimulate management to improve operations and bring results into line with forecasts.
   B. improve cash flow forecasts and eliminate potentially profitable but risky projects.
   C. stimulate management to improve operations, bring results into line with forecasts, and eliminate potentially profitable but risky projects.
3. A company is considering the purchase of a copier that costs $5,000. Assume a required rate of return of 10% and the following cash flow schedule:
   - Year 1: $3,000.

- Year 2: $2,000.
- Year 3: $2,000.

The project's NPV is *closest* to:

A. −$309.
B. +$883.
C. +$1,523.

MODULE 24.2: CAPITAL ALLOCATION PRINCIPLES AND REAL OPTIONS

Video covering this content is available online.

LOS 24.c: Describe principles of capital allocation and common capital allocation pitfalls.

Principles of Capital Allocation

The capital allocation process involves the following key principles:

- *Decisions are based on after-tax cash flows, not accounting income*. Accounting income is based on accruals and does not consider the timing of cash flows. The impact of taxes must be considered when analyzing all capital allocation projects. Firm value is based on cash flows firms get to keep, not those they send to the government. Any tax savings from non-cash tax deductions, such as depreciation and amortization, should also be included in the analysis.
- *Incremental cash flows only*. Incremental cash flows are those that change if the project is undertaken. **Sunk costs** are costs that cannot be avoided even if the project is not undertaken. Because these costs are not affected by the accept/reject decision, they should not be included in the analysis. An example of a sunk cost is a consulting fee paid to a marketing research firm to estimate demand for a new product before making a decision on the project. Project analysis should consider the cash flow impact on other parts of the business. A negative effect, called cannibalization, occurs when a new project replaces sales from an existing product. An example of cannibalization is when a soft drink company introduces a diet version of an existing beverage. A positive externality exists when doing the project would have a positive effect on sales of a firm's other product lines.
- *The timing of cash flows is important*. Capital allocation decisions account for the time value of money, which means that cash flows received earlier are worth more than cash flows to be received later.

Common mistakes managers make when evaluating capital projects have two categories: cognitive errors (calculation errors) and behavioral biases (errors of judgment).

Cognitive Errors

- *Poor forecasting.* Examples include incorrectly allocating overhead costs or neglecting to anticipate how competitors will respond to a project.

- *Not considering the cost of internal funds.* Often, the cost of internally generated funds is not accounted for (it should be same as cost of equity because those funds would have been paid as dividends if not for the project). Companies that have an aversion to paying dividends are potentially using the retained earnings to fund poor projects.
- *Incorrectly accounting for inflation*. Firms can analyze projects either in nominal or real terms. An analysis based on real cash flows must also use a real discount rate.

Behavioral Biases

- *Pet projects of senior management*. Projects that have the personal backing of influential members of senior management may contain overly optimistic projections that make the project appear more profitable than it really is. In addition, the project might not be subjected to the same level of scrutiny as other projects.
- *Inertia in setting the entire capital budget*. Capital budgets for many companies are similar from one year to the next. This indicates anchoring of capital budgets to the prior year rather than appropriately considering what opportunities exist every year. In a company with a culture of maximizing shareholder value, managers will return excess funds to shareholders whenever there is a lack of positive NPV projects and make a case for expanding the budget when there are multiple positive NPV opportunities. Analysts should watch for companies with static or rising capital budgets coupled with declining returns as a sign of this bias.
- *Basing investment decisions on EPS or ROE*. Managers whose incentive compensation is tied to increasing EPS or ROE may avoid positive long-term NPV investments that are expected to reduce EPS or ROE in the short run.
- *Failure to generate alternative investment ideas*. Generating investment ideas is a crucial step in the capital allocation process. However, once a manager comes up with a "good" idea, he or she may go with it rather than searching for an idea that is "better."

LOS 24.d: Describe types of real options relevant to capital investments.

Real options are future actions that a firm can take, given that they invest in a project today. Real options are similar to financial options (put and call options) in that they give the option holder the right, but not the obligation, to take a future action. The value of real options could enhance a project's NPV. Options never have negative values because if, in the future, the specified action will have a negative value, the option holder will not take the action (i.e., not exercise the option).

Types of real options include the following:

- **Timing options** allow a company to delay making an investment because it expects to have better information in the future.
- **Abandonment options** allow management to abandon a project if the present value of the incremental cash flows from exiting a project exceeds the present value of the incremental cash flows from continuing the project.

- **Expansion options** or **growth options** allow a company to make additional investments in future projects if the company decides they will create value.
- **Flexibility options** give managers choices regarding the operational aspects of a project. The two main forms are price-setting and production-flexibility options.
  - **Price-setting options** allow the company to change the price of a product. For example, the company may raise prices if demand for a product is high in order to benefit from that demand without increasing production.
  - **Production-flexibility options** may include paying workers overtime, using different materials as inputs, or producing a different variety of product.
- **Fundamental options** are projects that are options themselves because the payoffs depend on the price of an underlying asset. For example, the payoff for a copper mine is dependent on the market price for copper. If copper prices are low, it may not make sense to open a copper mine, but if copper prices are high, opening the copper mine could be very profitable. The operator has the option to close the mine when prices are low and open it when prices are high.

One way companies can include real options in their project analysis is to estimate their value and add it to the NPV (while subtracting any extra cost to acquire the real option). This can incorporate available techniques such as option pricing models or decision trees. Another approach is to simply consider the NPV without real options to be the project's minimum value.

MODULE QUIZ 24.2

1. Which of the following statements concerning the principles underlying the capital allocation process is *most accurate*?
   A. Cash flows should include tax benefits of non-cash expense deductions.
   B. The net income for a project is essential for making a correct capital allocation decision.
   C. Cash flows should be project specific, ignoring sunk costs and impacts on other parts of the business.
2. A manufacturer of clothes washing machines decides to add matching clothes dryers to its product line. In this case, it is *most likely* important in the project analysis to consider:
   A. sunk costs.
   B. negative impact on other parts of the business.
   C. positive impact on other parts of the business.
3. An analyst is estimating the NPV of a project to introduce a new spicier version of its well-known barbeque sauce into its product line. A cost that should *most likely* be excluded from his analysis is:
   A. $200,000 to develop a recipe for the new sauce.
   B. $100,000 for a marketing survey that was conducted to determine demand for a spicier sauce.
   C. a $150,000 decrease in sales of its current sauce as some current customers switch to the spicier sauce.
4. Albert Duffy, a project manager at Crane Plastics, is considering taking on a new capital project. When presenting the project, Duffy shows members of Crane's executive management team that, because the company has the ability to have employees work overtime, the project makes sense. The project Duffy is taking on would be *best* described as having a(n):

A. flexibility option.
B. expansion option.
C. fundamental option.

KEY CONCEPTS

LOS 24.a

Capital investments include going concern projects to maintain a business or to reduce costs, required regulatory/compliance projects, expansion projects, and other projects that increase the size and scope of a company.

LOS 24.b

Capital allocation is the process of evaluating capital projects (i.e., projects with cash flows over a period longer than one year).

Steps of the capital allocation process are: (1) generate investment ideas; (2) analyze project ideas; (3) create a firm-wide capital budget; and (4) monitor decisions and conduct a post-audit.

NPV is the sum of the present values of a project's expected cash flows and represents the change in firm value from undertaking a project. Positive NPV projects should be undertaken, but negative NPV projects should not because they are expected to decrease the value of the firm.

An IRR is the discount rate at which the present values of a project's expected cash inflows and cash outflows are equal (i.e., the discount rate for which the NPV of a project is zero). A project for which the IRR is greater (less) than the appropriate discount rate for the project will have an NPV that is positive (negative) and should be accepted (not accepted).

Return on invested capital can be compared to a company's required rate of return to indicate whether the company has increased or decreased firm value over time.

LOS 24.c

Capital allocation decisions should be based on after-tax cash flows, ignore sunk costs, and capture any spillover effects on other parts of the business. Timing of cash flows is important.

Common mistakes in the capital allocation process include the following:

- Having overly optimistic assumptions for pet projects of senior management
- Basing long-term investment decisions on short-term EPS or ROE considerations
- Poor cash flow estimation, misestimating overhead costs, and improper accounting for inflation
- Not accounting for cost of internally generated funds in the estimate of required rate of return
- Static capital budgets without regard to actual investment opportunities
- Failure to generate alternative investment ideas

LOS 24.d

Real options allow managers to make future decisions that change the value of capital allocation decisions made today.

- Timing options allow a company to delay making an investment.
- Abandonment options allow management to abandon a project if the present value of the incremental cash flows from exiting a project exceeds the present value of the incremental cash flows from continuing a project.
- Expansion options allow a company to make additional investments in a project if doing so creates value.
- Flexibility options give managers choices regarding the operational aspects of a project. The two main forms are price-setting and production-flexibility options.
- Fundamental options are projects that are options themselves because the payoffs depend on the price of an underlying asset.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 24.1

1. **C** Going concern projects are those to maintain the business or to increase the efficiency of existing operations. The other two projects are business growth investments that increase the size of the company. (LOS 24.a)

2. **A** A post-audit identifies what went right and what went wrong. It is used to improve forecasting and operations. (LOS 24.b)

3. **B** $CF_0 = -5{,}000$; $CF_1 = 3{,}000$; $CF_2 = 2{,}000$; $CF_3 = 2{,}000$; I / Y = 10; NPV = \$883. (LOS 24.b)

Module Quiz 24.2

1. **A** Cash flows should be after-tax and include any tax savings from non-cash deductions (e.g., depreciation and amortization). While sunk costs should be ignored, the impact on other parts of the business (positive or negative) should be accounted for by adjusting cash flows. Accounting net income, which includes non-cash expenses, is irrelevant. Incremental cash flows are essential for making correct capital allocation decisions. (LOS 24.c)

2. **C** It is quite possible that offering a matching dryer will increase sales of their washers because some consumers will prefer a matching set. The increased sales of their washers is a positive impact, and those incremental profits should be considered in the analysis. A negative impact on another part of the business would be a consideration if introducing dryers could be expected to decrease washer sales. Sunk costs should not be considered in project analysis. (LOS 24.c)

3. **B** The cost of the marketing survey should not be included because it is a sunk cost; it will be incurred whether they decide to do the project or not. The decrease in

sales of their current sauce if the spicier version is introduced (cannibalization) should be considered in the analysis. The cost of recipe development should be included because it will only be incurred if they decide to go ahead with the introduction of the new spicier sauce. (LOS 24.c)

4. **A** The project described has production flexibility regarding the level of production. Other flexibility options might be to produce a different product or to use different inputs at some future date. Including the value of real options can improve the NPV estimates for individual projects. (LOS 24.d)

READING 25

CAPITAL STRUCTURE

MODULE 25.1: WEIGHTED-AVERAGE COST OF CAPITAL

Video covering this content is available online.

LOS 25.a: Calculate and interpret the weighted-average cost of capital for a company.

An issuer's **weighted-average cost of capital (WACC)** is a blended rate that includes its cost of debt and equity:

$$\text{WACC} = [\text{weight of debt} \times \text{pretax cost of debt} \times (1 - \text{tax rate})] + (\text{weight of equity} \times \text{cost of equity})$$

The cost of debt is lower than the cost of equity because debt has priority of claims over equity. Because most jurisdictions allow tax deductions for corporate interest expense, we adjust the pretax cost of debt to its after-tax value in the WACC formula.

The weights for debt and equity can be target weights or market value weights. Analysts often estimate a company's target weights based on book value of debt and equity. Market value weights are appropriate for estimating the current opportunity cost of capital as they reflect current market conditions.

> **EXAMPLE: WACC**
>
> ABC, Inc.'s, capital structure is 50% debt and 50% equity. ABC's cost of debt is 8%, while the cost of equity is 11%. ABC's corporate tax rate is 30%. Calculate the WACC for ABC.
>
> **Answer:**
>
> $$\text{WACC} = [0.50 \times 0.08 \times (1 - 0.30)] + (0.50 \times 0.11) = 0.083, \text{ or } 8.3\%$$

LOS 25.b: Explain factors affecting capital structure and the weighted-average cost of capital.

Capital structures vary considerably among companies. Typically a company will target a capital structure that minimizes its WACC, while also considering the nature of

its assets (i.e., long-lived or shorter-term) when choosing the duration of its financing sources.

We may view factors that affect capital structures as those that determine a company's capacity to service debt. These factors may be internal or external to a firm. Internal factors include the characteristics of the business or industry, a company's life cycle stage, a company's existing debt level, and the corporate tax rate. External factors include market and business cycle conditions, regulation, and industry norms.

Company characteristics that influence the proportion of debt in a company's capital structure include the following:

- *Growth and stability of revenue.* High growth of revenue or stability of significant revenue suggest a continuing ability to service debt.
- *Growth and predictability of cash flow.* Growing cash flow increases the ability to service debt. Significant and stable cash flows indicate a continuing ability to service debt.
- *Amount of business risk*. More business risk (operational risk and demand risk) means greater variability of earnings and cash flows, which decreases the ability to service debt.
- *Amount and liquidity of company assets.* Assets can be pledged as collateral to make a company's debt more attractive. When assets are more liquid (easier to turn into cash, values more stable), they can be pledged more readily.
- *Cost and availability of debt financing.* Companies find debt relatively more attractive when the cost of debt is lower and investors are more willing to lend to the company.

In general, the more stable, predictable, and recurring are a company's revenues and cash flows, the higher proportion of debt it can have in its capital structure. With this in mind, we can say, other things equal:

- Companies in noncyclical industries are better able to support high proportions of debt than companies in cyclical industries.
- Companies with low fixed operating costs as a proportion of total costs (i.e., low operating leverage) are better able to support high proportions of debt than companies with high fixed costs.
- Companies with subscription-based revenue models are better able to support high proportions of debt than companies with pay-per-use revenue models.

The types of assets companies use to generate revenues also affect their ability to issue and service debt. For example, creditors tend to view tangible assets as better collateral than intangible assets, especially when those assets can be sold for cash, if necessary, without losing significant value (i.e., are more liquid) or are more readily substituted for similar assets (i.e., are more fungible). A company that owns its productive assets outright as opposed to using assets owned by others (such as a franchise model) has more collateral, which improves access to debt financing and reduces borrowing costs.

In addition to the types of assets, other issuer-specific conditions include the levels of existing debt and volatility of revenues and earnings. High levels of debt or high

volatility of earnings indicates a lower ability to issue additional debt. Leverage (e.g., debt-to-equity or debt-to-operating profit) and coverage ratios (e.g., interest coverage = EBIT / interest expense) are used for analyzing debt capacity.

We can see the effects of these various factors on the debt-to-equity ratios of companies at different stages of their company's life cycle. Consider the following three stages:

1. *Start-up stage.* Sales are just beginning, and operating earnings and cash flows tend to be low or negative. Business risk is relatively high. Company debt is quite risky and, if issued, would require high interest rates. Assets, both accounts receivable and fixed assets, typically are low; therefore, they are not available as collateral for debt. For these reasons, start-up companies are financed almost exclusively with equity. In some cases, high-growth companies with rapidly rising stock prices may find it possible to issue **convertible debt**, which allows the company to use a lower-cost source of capital and avoid immediate dilution of existing shareholders' interests. Leasing assets is another source of debt financing available to companies in this stage of the life cycle.
2. *Growth stage.* Revenue and cash flow are rising, and business risk is somewhat reduced. Debt financing cost is somewhat reduced (i.e., usage is conservative), and investors may be willing to lend to the company, often with the loans secured by fixed assets or accounts receivable.
3. *Mature stage.* In this stage, revenue growth is slowing and business risk is much lower. Cash flow is significant and relatively stable. Debt financing, including unsecured debt, is widely available at a relatively low cost.

The cost of capital is also influenced by top-down factors. Top-down factors are macroeconomic factors that affect the benchmark interest rate (e.g., U.S. Treasury rate) and credit spreads to benchmark rates. These include inflation, the real GDP growth rate, monetary policy, and exchange rates. In business cycle downturns, debt investors demand greater yield spreads to benchmark bonds from corporate borrowers to compensate them for the increased risk of default. This is especially true for companies in cyclical industries. Some industries may be favorably affected by the economic environment. For example, oil industry profitability is linked to oil prices, and spreads for issuers in the industry tend to narrow when oil prices rise.

MODULE QUIZ 25.1

1. Alpaca's capital structure is 60% debt with an interest rate of 6%. Alpaca's cost of equity is 12%, and the corporate tax rate is 15%. Alpaca's WACC is *closest* to:
   A. 6.3%.
   B. 7.9%.
   C. 9.7%.

2. A company is *most likely* to be financed only by equity during its:
   A. start-up stage.
   B. growth stage.

C. mature stage.

MODULE 25.2: CAPITAL STRUCTURE THEORIES

Video covering this content is available online.

LOS 25.c: Explain the Modigliani–Miller propositions regarding capital structure.

MM Proposition I (No Taxes): Capital Structure Irrelevance

In 1958, Nobel laureates Franco Modigliani and Merton Miller (we will refer to them as MM) published their seminal work on capital structure theory. In it, MM demonstrate that under certain assumptions, the value of a firm is unaffected by its capital structure. This result is referred to as MM I. The assumptions that lead to MM I are as follows:

- *Capital markets are perfectly competitive*. There are no transactions costs, taxes, or bankruptcy costs.
- *Investors have homogeneous expectations*. They have the same expectations with respect to cash flows generated by the firm.
- *There is riskless borrowing and lending*. Investors can borrow and lend at the risk-free rate.
- *There are no agency costs*. There are no conflicts of interest between managers and shareholders.
- *Investment decisions are unaffected by financing decisions*. Operating income is independent of how the firm is financed.

Intuitively, we can explain MM I in terms of a pie. MM I essentially concludes that the amount of pie available (value of the firm) does not depend on how it is sliced (the capital structure). The value of a firm does not change depending on how the claims to its earnings are divided. This idea is illustrated in Figure 25.1.

Figure 25.1: MM Capital Structure Irrelevance Proposition

Consider why the pie analogy holds. The operating earnings (EBIT) of a firm are available to providers of capital. In a company with no debt, all of the operating earnings are available to equity holders, and the value of the company is the discounted present value of these earnings, with a discount rate that depends on the risk of

(uncertainty about) earnings. If a company is financed partly by debt and partly by equity, operating earnings are divided between debtholders and equity holders. If one entity purchased all the debt and all the equity of the firm, it would be entitled to all of the EBIT of the firm, so the total value of its holdings must equal the value of an all-equity firm—which also has a claim to all the operating earnings of the firm. Under the assumption that operating earnings are unaffected by financing decisions, the total value of debt and equity will be unaffected by the proportions of debt and equity in a firm's capital structure.

MM Proposition II: Cost of Equity and Leverage

MM's second proposition (MM II) is framed in terms of a firm's cost of capital, rather than firm value. Based on the same assumptions as MM I, MM II states that the cost of equity increases linearly as a company increases its proportion of debt financing. The cash flows promised to bondholders have priority, so that equity holders receive the remaining cash flows after the claims of debtholders have been met. Because the cash flows promised to debtholders are more certain (less risky) than the residual cash flows promised to equity holders, the cost of debt will be less than the cost of equity. The greater the amount of debt in a firm's capital structure, the more uncertain are the residual cash flows to equity holders. MM II tells us that as companies increase the proportion of debt financing, the risk of the cash flows to equity holders increases, which increases the cost of equity.

The conclusion of MM II is that the decrease in financing costs from using a larger proportion of (lower-cost) debt is just offset by the increase in the cost of equity, resulting in no change in the firm's WACC.

Given MM II (that the value of the firm, and therefore its WACC, is unaffected by changes in the proportion of debt financing), we can state the relation that must hold between a company's debt-to-equity ratio and its cost of equity:

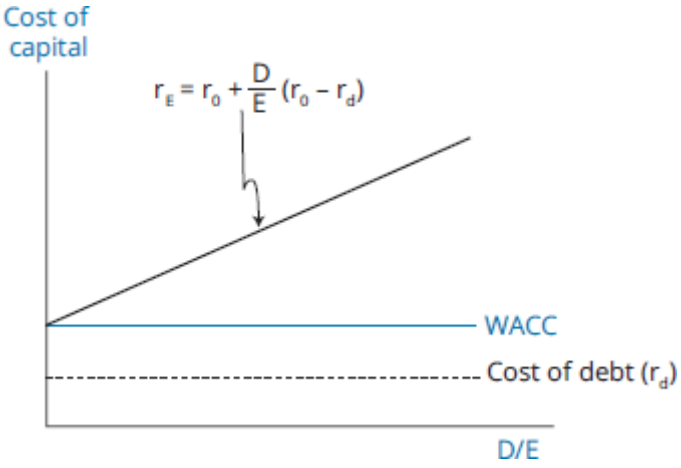
$$r_e = r_0 + \frac{D}{E}(r_0 - r_d)$$

where:

r_e = cost of equity
r_0 = cost of equity with no debt (all equity)
r_d = cost of debt
$\frac{D}{E}$ = debt-to-equity ratio

As leverage (the debt-to-equity ratio) increases, the cost of equity increases, but the cost of debt and WACC are unchanged. This relationship between the cost of equity financing and the debt-to-equity ratio is illustrated in Figure 25.2.

Figure 25.2: MM Proposition II (No Taxes)



MM II is consistent with MM I; if the benefits of greater use of lower-cost debt financing are just offset by the increased cost of equity, the proportions of debt versus equity in the firm's capital structure do not affect the firm's overall cost of capital or the value of the firm.

MM With Taxes: Value Is Maximized at 100% Debt

As is often done in theoretical work, MM started with several simplifying assumptions. The next step is to examine the effects of relaxing some of those assumptions. Here, we examine the MM propositions under the assumptions that earnings are taxed and that interest payments to debtholders are tax deductible. Under the tax code of most countries, interest payments are a pretax expense and are therefore tax deductible, while dividends paid to equity holders are not tax deductible.

This differential tax treatment encourages firms to use debt financing because debt provides a **tax shield** that adds value to the company. The tax shield is equal to the tax rate multiplied by the amount of debt in the capital structure. In other words, the value of a levered firm is equal to the value of an unlevered firm plus the value of the tax shield provided by debt financing.

To continue our analogy of a pie, with the introduction of taxes, the government gets a slice of the pie. When debt financing is used, the government's slice of the pie is smaller, so that the amount of pie available to debt and equity holders is greater. The use of debt reduces taxes due to deductibility of interest expense giving rise to debt tax shield. If a firm were 100% financed with debt, the taxes avoided would be at a maximum, and the after-tax cash flows of the firm (size of the pie) would be maximized. The conclusion of *MM I with taxes* is that the value of the firm is maximized with 100% debt financing.

If we assume a positive tax rate, the formula to solve for return on equity can be used to illustrate *MM II with taxes*:

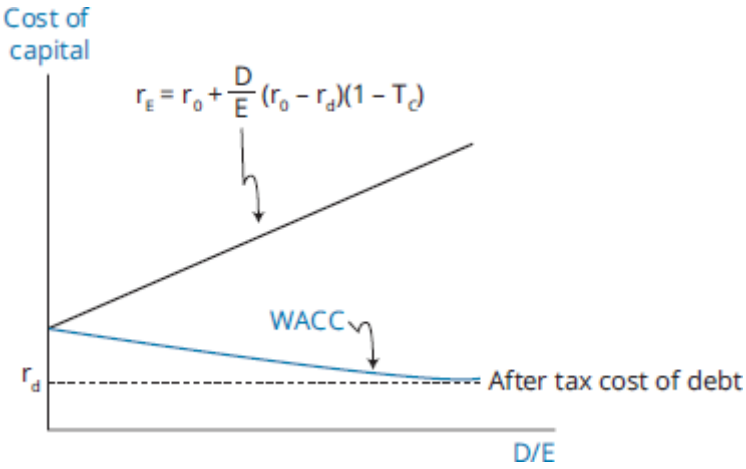
$$r_e = r_0 + \frac{D}{E}(r_0 - r_d)(1 - T_C)$$

where:

T_C = tax rate

Figure 25.3 illustrates that the tax shield provided by debt causes the WACC to decline as leverage increases. The value of the firm is maximized at the point where the WACC is minimized, which is 100% debt.

Figure 25.3: MM Proposition II (With Taxes)



In practice, we do not find that companies finance their assets with 100% debt, or close to it. MM suggested that differential investor tax rates on dividends and interest income could explain differences in capital structures.

Current theory suggests that differences in value-maximizing choices of how much financial leverage to use are the result of additional costs of using debt financing that we have not yet considered—we assumed that there are no bankruptcy costs. However, we can expect these costs, also called the **costs of financial distress**, to increase at higher levels of debt financing. Costs of financial distress are the increased costs a company faces when earnings decline to the point where the firm has trouble paying its fixed financing costs (interest on debt). The expected costs of financial distress for a firm have two components:

1. *Costs of financial distress and bankruptcy* can be direct or indirect. Direct costs of financial distress include the cash expenses associated with the bankruptcy, such as legal fees and administrative fees. Indirect costs include foregone investment opportunities and the costs that result from losing the trust of customers, creditors, suppliers, and employees. Additionally, during periods of financial distress, conflicts of interest between managers (who represent equity owners) and debtholders impose additional costs, referred to as the **agency costs of debt**.
2. *The probability of financial distress* is related to the firm's use of operating and financial leverage. In general, higher amounts of financial leverage increase the probability of financial distress (higher probability that cash flows will fall to an amount that is insufficient to make their promised debt payments). Other factors to consider include the quality of a firm's management and the company's corporate governance structure. Lower-quality management and poor corporate governance lead to a higher probability of financial distress.

Higher expected costs of financial distress tend to discourage companies from using large proportions of debt in their capital structures, all else equal. The expected costs of financial distress shrink our pie as the proportion of debt financing is increased.

LOS 25.d: Describe optimal and target capital structures.

Static Tradeoff Theory

The **static tradeoff theory** seeks to balance the costs of financial distress with the tax shield benefits from using debt. There is an amount of debt financing at which the increase in the value of the tax shield from additional borrowing is exceeded by the value reduction of higher expected costs of financial distress. This point represents the **optimal capital structure** for a firm, where the WACC is minimized and the value of the firm is maximized.

Accounting for the costs of financial distress, the expression for the value of a levered firm becomes the following:

$$V_L = V_U + (t \times \text{debt}) - \text{PV (costs of financial distress)}$$

We illustrate this relationship in Figure 25.4.

Figure 25.4: Static Tradeoff Theory: Cost of Capital vs. Capital Structure

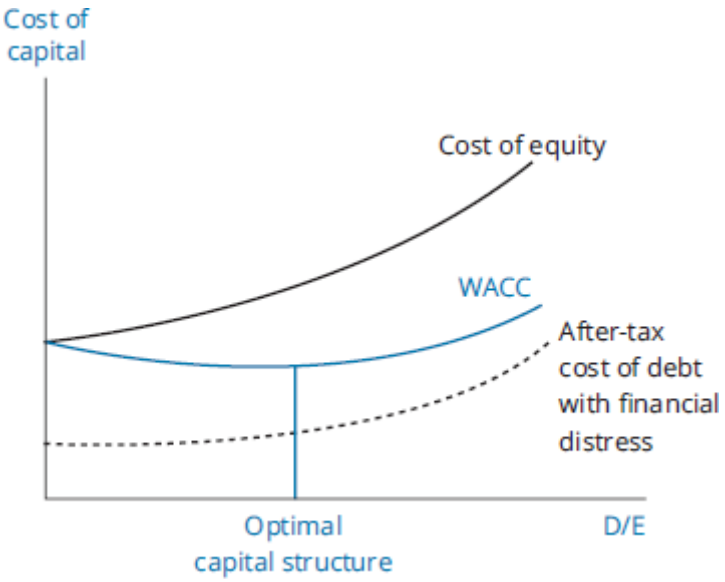
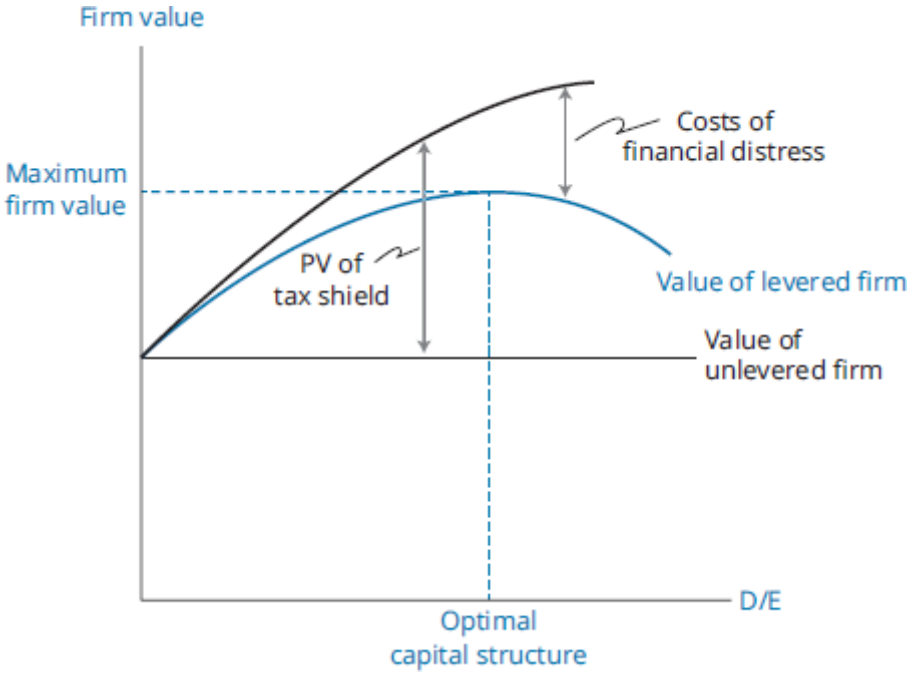


Figure 25.5 illustrates the tradeoff between firm value and capital structure. Note that each firm's optimal capital structure depends on its business risk (operating risk and sales risk), tax rate, corporate governance, industry influences, and other factors.

Figure 25.5: Static Tradeoff Theory: Firm Value vs. Capital Structure



To summarize:

- *MM's propositions with no taxes* or costs of financial distress are that a company's capital structure is irrelevant because its WACC and its value (the discounted present value of its operating earnings) are unchanged by changes in capital structure.
- *MM's propositions with taxes but without costs of financial distress* are that a company's WACC is minimized and its value is maximized with 100% debt.
- *Static tradeoff theory* indicates that firm value initially increases (and WACC decreases) with additional debt financing, but company value decreases at some point when the increase in the expected value of financial distress outweighs the tax benefits of additional debt.

Target capital structure is the capital structure that a firm seeks to achieve on average over time to maximize firm value. That is, it reflects management's beliefs about its optimal capital structure as well as other internal and external factors.

For analysis, the weights to use when estimating a firm's WACC should be based on its target capital structure, the proportions (based on market values) of debt, preferred stock, and equity that the firm expects to achieve over time. An analyst may use management's stated target proportions of equity and debt; however, most firms do not provide these.

In the absence of stated capital structure weights, an external analyst must estimate a firm's target capital structure. Alternatives for estimating target capital structure include the following:

- An analyst may simply use the firm's current capital structure (based on market values) as the best indication of its target capital structure.

- If there has been a noticeable trend in the firm's capital structure, an analyst may incorporate this trend into her estimate of the firm's target.
- An analyst may use the average capital structure weights for a firm's industry.

In contrast with independent analysts, company managers often focus on book values of debt and equity. Reasons book values may be appropriate for internal analysis include:

- Short-term fluctuations in the market values of debt and equity do not really affect a company's appropriate level of debt.
- While market values reflect the perspectives of investors in a company, management's perspective has more to do with how the company needs to deploy its capital to projects.
- Credit rating agencies use book values in their measures of credit quality. Managers may make capital structure decisions with these measures in mind.

In practice, a firm's actual capital structure tends to fluctuate around the target capital structure. Market fluctuations, especially in the market value of a firm's equity, may cause the firm's capital structure to vary from the target. Management may choose to exploit opportunities in a specific financing source. For example, a temporary rise in the firm's stock price may create a good opportunity to issue additional equity, which would result in a higher percentage of equity than the target. Also, external capital is raised in minimum-size lots; hence, adherence to precise weights may not be possible.

Costs of asymmetric information arise from the fact that managers typically have more information about a company's prospects and future performance than owners or creditors. Firms with complex products or little transparency in financial statements tend to have higher costs of asymmetric information, which result in higher required returns on both debt and equity capital.

Because shareholders and creditors are aware that asymmetric information problems exist, these investors look for management behavior that signals what knowledge or opinions management may have about the firm's prospects. For example, taking on the commitment to make fixed interest payments through debt financing sends a signal that management is confident in the firm's ability to make these payments in the future. By contrast, issuing equity is typically viewed as a negative signal that managers believe a firm's stock is overvalued. The cost of asymmetric information increases with the proportion of equity in the capital structure.

Agency costs of equity are related to conflicts of interest between managers and owners. Managers who do not have a stake in the company do not bear the costs associated with excessive compensation or taking on too much (or too little) risk. Because shareholders are aware of this conflict, they take steps to reduce these costs. The result is called the **net agency cost of equity**. Net agency costs of equity have three components:

1. *Monitoring costs* are associated with supervising management and include the expenses of reporting to shareholders and paying the board of directors. Strong corporate governance systems reduce monitoring costs.

2. *Bonding costs* relate to assuring shareholders that the managers are working in the shareholders' best interest. Examples of bonding costs include premiums for insurance to guarantee performance and implicit costs associated with noncompete agreements.
3. *Residual losses* may occur even with adequate monitoring and bonding provisions because such provisions do not provide a perfect guarantee.

According to the **free cash flow hypothesis**, the use of debt forces managers to be disciplined with regard to how they spend cash because they have less free cash flow to use for their own benefit. It follows that greater amounts of financial leverage tend to reduce agency costs.

Pecking order theory, based on asymmetric information, is related to the signals that management sends to investors through its financing choices. According to pecking order theory, managers prefer to make financing choices that are least likely to send negative signals to investors. Financing choices under pecking order theory follow a hierarchy based on visibility to investors. Internally generated capital is most preferred, debt is the next-best choice, and external equity is the least preferred financing option. Pecking order theory implies that the capital structure is a by-product of individual financing decisions.

MODULE QUIZ 25.2

1. A company's optimal capital structure:
   A. maximizes firm value and minimizes the weighted-average cost of capital.
   B. minimizes the interest rate on debt and maximizes expected earnings per share.
   C. maximizes expected earnings per share and maximizes the price per share of common stock.
2. Which of the following statements regarding Modigliani and Miller's Proposition II with no taxes is *most accurate*?
   A. A firm's cost of debt financing increases as a firm's financial leverage increases.
   B. A firm's weighted-average cost of capital is not affected by its choice of capital structure.
   C. A firm's cost of equity financing increases as the proportion equity in a firm's capital structure is increased.
3. To determine their target capital structures in practice, it is *least likely* that firms will:
   A. use the book value of their debt to make financing decisions.
   B. match the maturities of their debt issues to specific firm investments.
   C. determine an optimal capital structure based on the expected costs of financial distress.
4. The pecking order theory of financial structure decisions:
   A. is based on information asymmetry.
   B. suggests that debt is the first choice for financing an investment of significant size.
   C. suggests that debt is the riskiest and least preferred source of financing.

KEY CONCEPTS

LOS 25.a

WACC = [weight of debt × pretax cost of debt × (1 − tax rate)] + (weight of equity × cost of equity)

LOS 25.b

Capital structures vary among companies. Internal factors that affect capital structures include the characteristics of the business, the company's existing debt level, their corporate tax rate, and the company's life cycle stage. External factors include market and business cycle conditions.

A company's ability to issue debt is greater with predictable cash flows sufficient to make required debt payments, and with liquid tangible assets that the company can pledge as collateral for debt.

New companies with few assets and negative or uncertain cash flows will use little to no debt. Growth companies with positive cash flows and decreasing business risk may use lower levels of debt. Mature companies with predictable cash flows tend to use significantly more debt.

LOS 25.c

MM's propositions with no taxes are that a company's capital structure is irrelevant, because its WACC and firm value (the discounted present value of its operating earnings) are unchanged by changes in capital structure.

MM's propositions with taxes are that a company's WACC is minimized and its value is maximized with 100% debt financing.

LOS 25.d

Static tradeoff theory adds the expected costs of financial distress to the model. It indicates that firm value initially increases (and WACC decreases) with additional debt financing, but that company value decreases at some point with additional debt as the increase in the expected costs of financial distress outweigh the increase in tax benefits from additional debt.

In practice, a company's capital structure will fluctuate around the target due to management's exploitation of market opportunities and market value fluctuations (especially of equity) over time.

Pecking order theory is based on information asymmetry between firm management and investors and suggests that management's choice of financing method signals their beliefs about firm value. The theory concludes that retained earnings are the most preferred source of funds, followed by debt financing, and then issuing new equity.

Under the free cash flow hypothesis, the agency costs of equity, which arise because management and shareholders may have conflicting interests, are reduced by increased debt issuance.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 25.1

1. **B** Weight of equity = 1 − 0.60 = 0.40, or 40%. WACC = [0.60 × 0.06 × (1 − 0.15)] + (0.4 × 0.12) = 7.86.

   (LOS 25.a)

2. **A** During the start-up stage, a firm is unlikely to have positive earnings and cash flows or significant assets that can be pledged as debt collateral, so firms in this stage are typically financed by equity only. (LOS 25.b)

Module Quiz 25.2

1. **A** The optimal capital structure minimizes the firm's WACC and maximizes the firm's value (stock price). (LOS 25.c)

2. **B** MM's Proposition II (with no taxes) states that capital structure is irrelevant because the decrease in a firm's WACC from additional debt financing is just offset by the increase in WACC from a decrease in equity financing. The cost of debt is held constant, and the cost of equity financing increases as the proportion of *debt* in the capital structure is increased. (LOS 25.c)

3. **C** While it is a useful theoretical concept, in practice, determining an optimal capital structure based on the cost savings of debt and the expected costs of financial distress is not feasible. Because debt rating companies often use book values of debt, firms often use book values of debt when choosing financing sources. It is common for firms to match debt maturities to the economic lives of specific investments. (LOS 25.d)

4. **A** Pecking order theory is based on information asymmetry and the resulting signals that different financing choices send to investors. It suggests that retained earnings are the first choice for financing an investment, and issuing new equity is the least preferred choice. (LOS 25.d)

READING 26

BUSINESS MODELS

MODULE 26.1: BUSINESS MODEL FEATURES AND TYPES

Video covering this content is available online.

LOS 26.a: Describe key features of business models.

A successful firm must provide a product or service, find customers, deliver the product or service, and make a profit. A **business model** explains how a firm either does or proposes to do this.

"How we will provide it, sell it, and make a profit" is clearly an oversimplification, but this is the essence of a business model. In practice, the answers to these questions have many facets. Here, we present a framework that incorporates some of the complexities involved. It involves answering the questions of *who, what, how, where,* and *how much.*

A business model should do the following:

- *Identify the firm's potential customers (who),* how they are acquired, the cost of customer acquisition, and how the company will monitor and maintain customer satisfaction. Potential customers can be defined in innumerable ways, ranging from every consumer within a geographic area, to dog owners, to only the home country's military in the case of a weapon. This characterization of customer groups is called **segmenting**.
- *Describe the key assets and suppliers of the firm (how).* Key assets may be, for example, a patent, software, or skilled employees. Key suppliers may be a battery manufacturer for an electric vehicle company, a lithium miner for a battery maker, or a supplier of large excavation machinery for a lithium miner.
- *Describe the firm's product or service (what),* how it meets a need for its potential customers, and what differentiates its products from those of competitors (e.g., low price, premium quality, innovative features).
- *Explain how the firm will sell its product or service (where)*, such as online, physical location, direct mail, trade shows, or through sales representatives; whether the firm will sell directly to the buyers (**direct sales**) or use intermediaries such as wholesalers, retailers, agents, or franchisees; and how the firm will deliver its product or service. The answers to these questions comprise a firm's **channel strategy**. A strategy that includes both digital and physical channels, such as internet sales with delivery at a physical location, is referred to as an **omnichannel strategy**.

Firms that sell to other businesses are said to be **B2B** (business to business) firms, while firms that sell to consumers are said to be **B2C** (business to consumer) firms.

- *Explain its pricing strategy (how much)* and why buyers will pay that price for its product, given the competitive landscape of the market.

Pricing Strategies

Companies with undifferentiated products, called **commodity producers**, are price takers (e.g., oil and gas, home loans). Industries with few competitors or highly differentiated products enjoy pricing power (e.g., patented drugs). Companies may be able to charge a premium price by including services or features that are valued by customers.

Price discrimination refers to setting different prices for different customers or identifiable groups of customers. Common examples are **tiered pricing** (based on volume of purchases); **dynamic pricing** (depending on the time of day or day of the week), such as peak and off-peak pricing and low-priced airline tickets for very early or very late flights; **value-based pricing** (e.g., a new drug that offers a marginally better protection compared to existing drugs); and **auction pricing** (e.g., eBay).

Pricing models for multiple products include the following:

- **Bundling.** Where multiple products are complimentary (e.g., a furnished apartment), bundling the products may be a profitable strategy.
- **Razors-and-blades.** A company may find it profitable to sell a piece of equipment for a relatively low price (low margins) and make profits by selling a consumable used with the equipment. Printers and ink cartridges, and an e-reader and e-books are common examples.
- **Add-on pricing.** Options or add-ons priced with high margins are added to the product after the purchase decision has been made. An example is the many pricey options that may be offered after a customer has decided to purchase an automobile.

Other pricing models include the following:

- **Penetration pricing.** A company offers a product at low margins or even at a loss for a period of time to grow market share and achieve greater scale of operations. Netflix followed this strategy to grow its subscriber base rapidly.
- **Freemium pricing.** Offer a product with basic functionality at no cost, but sell or unlock other functionality for a fee. Video game makers have used this strategy to encourage wide usage and then profit on sales of greater functionality (e.g., upgraded weapons).
- **Hidden revenue.** Online content may be "free" but generate revenue through ads. For example, an internet search is free to the user while the search engine's revenue comes from selling user data.

Models that offer alternatives to outright purchases include the following:

- **Subscription model.** Microsoft's model for software has changed from selling the software to a subscription (paying monthly for access) to their Office suite of

software.

- **Licensing and franchising.** For a biotech company that has developed a new and effective drug, it may be most profitable to license the production of the drug to an established drug maker with a large sales force and established distribution channels, rather than developing those resources itself for the single drug. A franchisee typically is permitted to sell in a specific area and pays a percentage of sales to the franchisor, which provides some level of product and marketing support.

Value Proposition and Value Chain

A firm's **value proposition** refers to how customers will value the characteristics of the product or service, given the competing products and their prices. How the firm executes its value proposition is referred to as its **value chain**. A firm's value chain comprises the assets of the firm and how its organization will add value and exploit the firm's competitive advantage. The value chain encompasses the quality of the product, its functionality, service that is included, the sale process, and pricing relative to the competition.

In his 1985 book *Competitive Advantage,* Michael Porter presents five activities (value chain analysis) in which firms should strive to execute well:

1. Inbound logistics
2. Operations
3. Outbound logistics
4. Marketing
5. Sales and service

LOS 26.b: Describe various types of business models.

Conventional business models tend to be industry-specific. Examples include those followed by natural resource producers, manufacturers, distributors, retailers, banks, brokers, service providers, and software. Other business models include the following:

- *Private label manufacturers or contract manufacturers*. Companies produce products for others to market under their own brand name (e.g., Costco's Kirkland-branded products).
- *Licensing agreements*. A company brand is used by another company on its products for a fee, such as a lunch box branded with a Marvel character.
- *Value-added resellers*. They offer such things as installation, service, support, or customization for complex equipment.

Innovations in business models often occur due to new entrants sometimes bringing new technology into the industry to challenge the incumbents. Examples include pricing of software as a service (SaaS), ultra-low-cost airlines, and discount brokers.

Network effects refer to the increase in the value of a network as its user base grows. Examples of this include WhatsApp, eBay, and Facebook. Network effects support an initial strategy of penetration pricing. Network effects capitalize on both size and

scope. Some networks are two-sided or multi-sided—such as Airbnb, which has a multitude of hosts and guests.

Crowdsourcing models benefit from user contributions—content in the case of Wikipedia, traffic conditions and events in the case of Waze, and product improvements or new applications in the case of open-source software.

MODULE QUIZ 26.1

1. A business model is *least likely* to include details about a company's:
   A. largest customers.
   B. workforce characteristics.
   C. revenue and expense estimates.
2. A pricing strategy of offering a basic product at no cost, and unlocking other functionality for a fee, is *most accurately* called:
   A. optional products.
   B. freemium pricing.
   C. subscription pricing.
3. A start-up business provides consumers with professional chefs at home. For its business model to work, the company needs a sufficient number of chefs available to their customers when they have a need. Similarly, sufficient demand from customers is needed to keep the chefs interested in making themselves available. Which of the following is the company's business model *most likely* reliant on?
   A. Licensing.
   B. Bundling.
   C. Network effects.

KEY CONCEPTS

LOS 26.a

A business model should identify a firm's potential customers, describe its products or services and explain how it will sell them, describe its key assets and suppliers, and explain its pricing strategy.

A value proposition refers to how a firm's customers will value the characteristics of the product or service. A value chain refers to how a firm executes its value proposition.

LOS 26.b

Apart from industry-specific conventional business models, other business models include private label manufacturers, value-added resellers, and licensing agreements.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 26.1

1. **C** Detailed forecasts of revenue in expenses would be in a financial plan, but typically not in a business model. A firm's largest customers and information

about its workforce and its value are likely elements of a business model. (LOS 26.a)

2. **B** Freemium pricing offers a product with basic functionality at no cost, but sells or unlocks other functionality for a fee. Optional products involve selling additional products after a purchase decision is made. (LOS 26.a)

3. **C** Network effects refer to the increase in the value of the business as its user base grows. In this instance, the network is two-sided; a sufficient number of customers and service providers are needed for the business to succeed. (LOS 26.b)

TOPIC QUIZ: CORPORATE ISSUERS

You have now finished the Corporate Issuers topic section. Please log into your Schweser online dashboard and take the Topic Quiz on this section. The Topic Quiz provides immediate feedback on how effective your study has been for this material. Questions are more exam-like than typical Module Quiz or QBank questions; a score of less than 70% indicates that your study likely needs improvement. These tests are best taken timed; allow 1.5 minutes per question.

FORMULAS

Quantitative Methods

$$FV = PV\,(1 + r)^t$$

$$PV = \frac{FV}{(1 + r)^t} = FV(1 + r)^{-t}$$

where:

r = interest rate per compounding period
t = number of compounding periods

continuous compounding:

$$FV = PV \times e^{rt}$$

$$PV = FV \times e^{-rt}$$

$$\text{PV of a perpetuity} = \frac{\text{payment}}{r}$$

$$\text{annuity payment} = \frac{r \times PV}{1 - (1 + r)^{-t}}$$

where:

r = interest rate per period
t = number of periods
PV = present value (principal)

$$\text{constant growth dividend discount model: } V_0 = \frac{D_1}{k_e - g_c}$$

$$\text{required rate of return: } k_e = \frac{D_1}{V_0} + g_c$$

$$\text{implied growth rate: } g_c = k_e - \frac{D_1}{V_0}$$

$$\text{sample mean: } \overline{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

$$\text{range} = \text{maximum value} - \text{minimum value}$$

$$\text{mean absolute deviation} = \frac{\sum_{i=1}^{n} |X_i - \overline{X}|}{n}$$

$$\text{sample variance: } s^2 = \frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n - 1}$$

$$\text{sample standard deviation: } s = \sqrt{\frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n - 1}}$$

$$\text{coefficient of variation} = \frac{s_x}{\overline{X}} = \frac{\text{standard deviation of x}}{\text{average value of x}}$$

target downside deviation:

$$s_{target} = \sqrt{\frac{\sum_{\text{all } X_i < B}^{n} (X_i - B)^2}{n - 1}}$$

where B = target value

sample covariance:

$$s_{X,Y} = \frac{\sum_{i=1}^{n} \left\{ \left[X_i - \overline{X} \right] \left[Y_i - \overline{Y} \right] \right\}}{n - 1}$$

where:

X_i = an observation of variable X
Y_i = an observation of variable Y
$\overline{X}$ = mean of variable X
$\overline{Y}$ = mean of variable Y
n = number of periods

correlation coefficient: $\rho_{XY} = \frac{s_{XY}}{s_X s_Y}$

Bayes' formula: $P(I \mid O) = \frac{P(O \mid I)}{P(O)} \times P(I)$

slope coefficient for a simple linear regression: $\hat{b}_1 = \frac{cov_{XY}}{\sigma_X^2}$

intercept term for a simple linear regression:

$$\hat{b}_0 = \overline{Y} - \hat{b}_1 \overline{X}$$

where:
$\overline{Y}$ = mean of Y
$\overline{X}$ = mean of X

total sum of squares (SST): $SST = \sum_{i=1}^{n} (Y_i - \overline{Y})^2$

sum of squares regression (SSR): $SSR = \sum_{i=1}^{n} (\hat{Y}_i - \overline{Y})^2$

sum of squared errors (SSE): $SSE = \sum_{i=1}^{n} (Y_i - \hat{Y})^2$

coefficient of determination: $R^2 = SSR / SST$

F-statistic:

$$F = \frac{MSR}{MSE} = \frac{SSR/k}{SSE/n - k - 1}$$

where:

MSR = mean regression sum of squares
MSE = mean squared error

Economics

$$\text{real P/B exchange rate} = \text{nominal P/B exchange rate} \times \left(\frac{\text{CPI}_{\text{base currency}}}{\text{CPI}_{\text{price currency}}}\right)$$

$$\text{arbitrage-free forward exchange rate relationship: } \frac{\text{forward}_{d/f}}{\text{spot}_{d/f}} = \frac{(1 + r_{\text{domestic}})}{(1 + r_{\text{foreign}})}$$

Corporate Issuers

$$\begin{aligned}\text{cash conversion cycle} = {} & \text{days of inventory on hand} + \text{days sales outstanding} \\ & - \text{days payables outstanding}\end{aligned}$$

$$\text{Cost of supplier financing} = \left(1 + \frac{a}{1-a}\right)^{\left(\frac{365}{c-b}\right)} - 1$$

where:
a = percent discount
b = days until discount expires
c = days until full payment is due

$$\text{total working capital} = \text{current assets} - \text{current liabilities}$$

$$\begin{aligned}\text{net working capital} = {} & \text{current assets (except cash and marketable securities)} \\ & - \text{current liabilities (excluding short-term and current debt)}\end{aligned}$$

$$\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

$$\text{quick ratio} = \frac{(\text{cash and marketable securities} + \text{accounts receivable})}{\text{current liabilities}}$$

$$\text{cash ratio} = \frac{\text{cash and marketable securities}}{\text{current liabilities}}$$

Net present value (NPV):

$$\text{NPV} = \text{CF}_0 + \frac{\text{CF}_1}{(1+k)^1} + \frac{\text{CF}_2}{(1+k)^2} + \ldots + \frac{\text{CF}_n}{(1+k)^n} = \sum_{t=0}^{n} \frac{\text{CF}_t}{(1+k)^t}$$

where:

CF_0 = initial investment outlay

CF_t = after-tax cash flow at time t

k = required rate of return

$$\text{return on invested capital} = \frac{\text{net operating profit after tax}}{\text{average book value of total capital}}$$

APPENDICES

APPENDIX A: AREAS UNDER THE NORMAL CURVE

Most of the examples in this book have used one version of the *z*-table to find the area under the normal curve. This table provides the cumulative probabilities (or the area under the entire curve to left of the z-value).

Probability Example

Assume that the annual earnings per share (EPS) for a large sample of firms is normally distributed with a mean of $5.00 and a standard deviation of $1.50. What is the approximate probability of an observed EPS value falling between $3.00 and $7.25?

If $EPS = x = \$7.25$, then $z = (x - \mu)/\sigma = (\$7.25 - \$5.00)/\$1.50 = +1.50$

If $EPS = x = \$3.00$, then $z = (x - \mu)/\sigma = (\$3.00 - \$5.00)/\$1.50 = -1.33$

Solving Using the Cumulative *Z*-Table

For z-value of 1.50: Use the row headed 1.5 and the column headed 0 to find the value 0.9332. This represents the area under the curve to the left of the critical value 1.50.

For z-value of −1.33: Use the row headed 1.3 and the column headed 3 to find the value 0.9082. This represents the area under the curve to the left of the critical value +1.33. The area to the left of −1.33 is 1 − 0.9082 = 0.0918.

The area between these critical values is 0.9332 − 0.0918 = 0.8414, or 84.14%.

Hypothesis Testing—One-Tailed Test Example

A sample of a stock's returns on 36 nonconsecutive days results in a mean return of 2.0%. Assume the population standard deviation is 20.0%. Can we say with 95% confidence that the mean return is greater than 0%?

$H_0: \mu \leq 0.0\%$, $H_a: \mu > 0.0\%$. The test statistic = *z*-statistic

$$= \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} = (2.0 - 0.0) / (20.0 / 6) = 0.60$$

The significance level = 1.0 − 0.95 = 0.05, or 5%. Because we are interested in a return greater than 0.0%, this is a one-tailed test.

Using the Cumulative *Z*-Table

Because this is a one-tailed test with an alpha of 0.05, we need to find the value 0.95 in the cumulative *z*-table. The closest value is 0.9505, with a corresponding critical *z*-value of 1.65. Because the test statistic is less than the critical value, we fail to reject H_0.

Hypothesis Testing—Two-Tailed Test Example

Using the same assumptions as before, suppose that the analyst now wants to determine if he can say with 99% confidence that the stock's return is not equal to 0.0%.

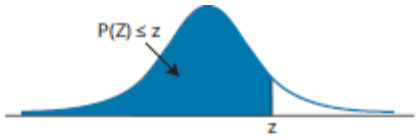
H_0: μ = 0.0%, H_a: μ ≠ 0.0%. The test statistic (*z*-value) = (2.0 − 0.0) / (20.0 / 6) = 0.60. The significance level = 1.0 − 0.99 = 0.01, or 1%. Because we are interested in whether or not the stock return is nonzero, this is a two-tailed test.

Using the Cumulative *Z*-Table

Because this is a two-tailed test with an alpha of 0.01, there is a 0.005 rejection region in both tails. Thus, we need to find the value 0.995 (1.0 − 0.005) in the table. The closest value is 0.9951, which corresponds to a critical *z*-value of 2.58. Because the test statistic is less than the critical value, we fail to reject H_0 and conclude that the stock's return equals 0.0%.

CUMULATIVE *Z*-TABLE

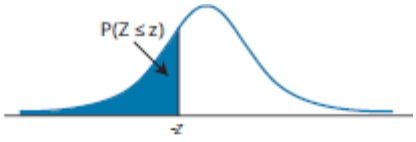
Standard Normal Distribution



$P(Z \leq z) = N(z)$ for $z \geq 0$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

Standard Normal Distribution



$P(Z \leq z) = N(z)$ for $z \geq 0$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
–0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
–0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
–0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
–0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
–0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
–0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
–0.7	0.2420	0.2389	0.2358	0.2327	0.2297	0.2266	0.2236	0.2207	0.2177	0.2148
–0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
–0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
–1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
–1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
–1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1057	0.1038	0.1020	0.1003	0.0985
–1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
–1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
–1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
–1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
–1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
–1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
–1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
–2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
–2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
–2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
–2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
–2.4	0.0082	0.0080	0.0078	0.0076	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
–2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
–2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
–2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
–2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
–2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
–3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010

APPENDIX B: STUDENT'S *t*-DISTRIBUTION

Level of Significance for One-Tailed Test						
df	**0.100**	**0.050**	**0.025**	**0.01**	**0.005**	**0.0005**

Level of Significance for Two-Tailed Test						
df	**0.20**	**0.10**	**0.05**	**0.02**	**0.01**	**0.001**
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.599
3	1.638	2.353	3.182	4.541	5.841	12.294
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.869
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.408
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.768
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.291

APPENDIX C: *F*-TABLE AT 5% (UPPER TAIL)

F-Table, Critical Values, 5% in Upper Tail

Degrees of freedom for the numerator along top row

Degrees of freedom for the denominator along side row

	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40
1	161	200	216	225	230	234	237	239	241	242	244	246	248	249	250	251
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.5	19.5	19.5
3	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	6.01	2.94	2.90	2.86	2.83
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39

APPENDIX D: *F*-TABLE AT 2.5% (UPPER TAIL)

F-Table, Critical Values, 2.5% in Upper Tails

Degrees of freedom for the numerator along top row

Degrees of freedom for the denominator along side row

	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40
1	648	799	864	900	922	937	948	957	963	969	977	985	993	997	1001	1006
2	38.51	39.00	39.17	39.25	39.30	39.33	39.36	39.37	39.39	39.40	39.41	39.43	39.45	39.46	39.46	39.47
3	17.44	16.04	15.44	15.10	14.88	14.73	14.62	14.54	14.47	14.42	14.34	14.25	14.17	14.12	14.08	14.04
4	12.22	10.65	9.98	9.60	9.36	9.20	9.07	8.98	8.90	8.84	8.75	8.66	8.56	8.51	8.46	8.41
5	10.01	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68	6.62	6.52	6.43	6.33	6.28	6.23	6.18
6	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.37	5.27	5.17	5.12	5.07	5.01
7	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.82	4.76	4.67	4.57	4.47	4.41	4.36	4.31
8	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.20	4.10	4.00	3.95	3.89	3.84
9	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.87	3.77	3.67	3.61	3.56	3.51
10	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.62	3.52	3.42	3.37	3.31	3.26
11	6.72	5.26	4.63	4.28	4.04	3.88	3.76	3.66	3.59	3.53	3.43	3.33	3.23	3.17	3.12	3.06
12	6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.44	3.37	3.28	3.18	3.07	3.02	2.96	2.91
13	6.41	4.97	4.35	4.00	3.77	3.60	3.48	3.39	3.31	3.25	3.15	3.05	2.95	2.89	2.84	2.78
14	6.30	4.86	4.24	3.89	3.66	3.50	3.38	3.29	3.21	3.15	3.05	2.95	2.84	2.79	2.73	2.67
15	6.20	4.77	4.15	3.80	3.58	3.41	3.29	3.20	3.12	3.06	2.96	2.86	2.76	2.70	2.64	2.59
16	6.12	4.69	4.08	3.73	3.50	3.34	3.22	3.12	3.05	2.99	2.89	2.79	2.68	2.63	2.57	2.51
17	6.04	4.62	4.01	3.66	3.44	3.28	3.16	3.06	2.98	2.92	2.82	2.72	2.62	2.56	2.50	2.44
18	5.98	4.56	3.95	3.61	3.38	3.22	3.10	3.01	2.93	2.87	2.77	2.67	2.56	2.50	2.44	2.38
19	5.92	4.51	3.90	3.56	3.33	3.17	3.05	2.96	2.88	2.82	2.72	2.62	2.51	2.45	2.39	2.33
20	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84	2.77	2.68	2.57	2.46	2.41	2.35	2.29
21	5.83	4.42	3.82	3.48	3.25	3.09	2.97	2.87	2.80	2.73	2.64	2.53	2.42	2.37	2.31	2.25
22	5.79	4.38	3.78	3.44	3.22	3.05	2.93	2.84	2.76	2.70	2.60	2.50	2.39	2.33	2.27	2.21
23	5.75	4.35	3.75	3.41	3.18	3.02	2.90	2.81	2.73	2.67	2.57	2.47	2.36	2.30	2.24	2.18
24	5.72	4.32	3.72	3.38	3.15	2.99	2.87	2.78	2.70	2.64	2.54	2.44	2.33	2.27	2.21	2.15
25	5.69	4.29	3.69	3.35	3.13	2.97	2.85	2.75	2.68	2.61	2.51	2.41	2.30	2.24	2.18	2.12
30	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.57	2.51	2.41	2.31	2.20	2.14	2.07	2.01
40	5.42	4.05	3.46	3.13	2.90	2.74	2.62	2.53	2.45	2.39	2.29	2.18	2.07	2.01	1.94	1.88
60	5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33	2.27	2.17	2.06	1.94	1.88	1.82	1.74
120	5.15	3.80	3.23	2.89	2.67	2.52	2.39	2.30	2.22	2.16	2.05	1.94	1.82	1.76	1.69	1.61
∞	5.02	3.69	3.12	2.79	2.57	2.41	2.29	2.19	2.11	2.05	1.94	1.83	1.71	1.64	1.57	1.48

APPENDIX E: CHI-SQUARED TABLE

Values of χ^2 (Degrees of Freedom, Level of Significance)

Probability in Right Tail

Degrees of Freedom	0.99	0.975	0.95	0.9	0.1	0.05	0.025	0.01	0.005
1	0.000157	0.000982	0.003932	0.0158	2.706	3.841	5.024	6.635	7.879
2	0.020100	0.050636	0.102586	0.2107	4.605	5.991	7.378	9.210	10.597
3	0.1148	0.2158	0.3518	0.5844	6.251	7.815	9.348	11.345	12.838
4	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.554	0.831	1.145	1.610	9.236	11.070	12.832	15.086	16.750
6	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.647	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	4.107	5.009	5.892	7.041	19.812	22.362	24.736	27.688	29.819
14	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.558
25	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	12.878	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.994
29	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.335
30	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
50	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
80	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
100	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.170

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