World Economics Cup 2020

Deep Comprehension

Material I - Market Failure Due to Externalities

Market failure is the economic situation defined by an inefficient distribution of goods and services in the free market. In market failure, the individual incentives for rational behavior do not lead to rational outcomes for the group. There are plenty factors which may lead to market failure. This text will discuss an important one of them: **externality**.

Production Accompanied by an Externality

An **externality** is a cost or benefit that is caused by one economic agent but borne by another. Pollution is a cost caused by a producer but experienced by others—for example, local residents who suffer deteriorated air quality or immediate neighbors who must endure aircraft noise. Externalities can be negative, as in the case of pollution, or positive. For instance, the pursuit of basic science and research (often government sponsored) generates a host of spinoff benefits to others.

The difficulty posed by externalities is that the party producing the externality has no incentive to consider the external effects on the other, affected parties. The general rule is this: 'Left to its own devices, the party in question will act so as to produce too much of a negative externality and too little of a positive externality.' In short, externalities—either positive or negative—are a potential source of **economic inefficiency**.

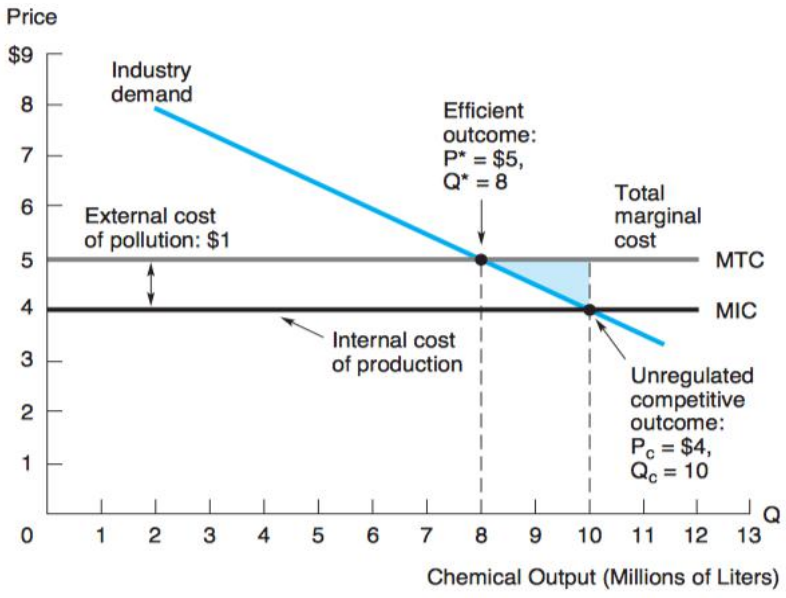


Figure 1.1 Production Accompanied by an Externality

To illustrate the externality problem, consider production of a chemical that generates air pollution as a by-product. Figure 1.1 shows the competitive market supply and demand for the chemical. The market equilibrium occurs at the intersection of demand and supply, here at price $P_C = \$4$ per liter and industry output $Q_C = 10$ million liters. In the absence of any externality, this competitive outcome would be efficient.

Suppose, however, that an externality, pollution, is present. To keep things simple, we assume that a known, fixed amount of pollution—say 1 cubic foot of noxious gas—is generated per liter of chemical produced and that each cubic foot causes $1 in harm.

In Figure 1.1, the $1 external cost associated with pollution is added on top of the chemical industry supply curve, MIC (marginal internal cost), to form the new curve, MTC (marginal total cost). The original supply curve embodies the internal cost of producing the chemical, that is, those borne by producers. This marginal cost is simply $4 per liter. However, the true, full cost of producing the chemical is the sum of all costs per unit, internal and external. Thus, the full cost of expanding output comes to MIC + MEC = $4 + $1 = $5. Figure 1.1 also shows the deadweight loss from the excess production, $Q_C = Q^*$ — the triangular shaded area where marginal benefits to consumers fall below the full marginal costs of supply.

The inefficiency problems associated with externalities are caused by incorrect pricing. The competitive price of $4 reflects only the marginal internal costs of the chemical. But the full marginal cost is higher by the amount of the marginal external cost (here, $1).

Remedying Externalities

The adverse effects of externalities can be ameliorated by a number of means, including **(1) government taxes, standards**, or **(2) permits**, or **(3) monetary payments** between the affected parties established via bargaining or **(4) by the courts**. We will take up each of these approaches in turn.

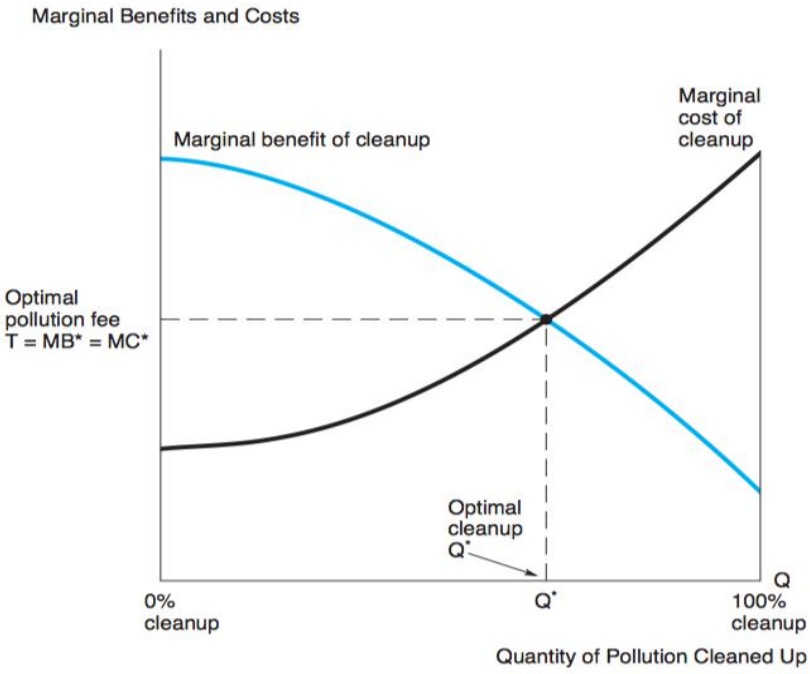


Figure 1.2 Optimal Regulation of an Externality

We already introduced the argument for imposing taxes and fees on the economic agent causing the externality. Let's take a closer look at the benefits and costs of reducing the externality. Figure 1.2 reconsiders pollution cleanup in its own right, separately from its implications for the output of the chemical industry. As with most activities, the marginal cost rises with increasing levels of cleanup. (The cheapest forms of cleanup are undertaken first.) The marginal benefit of cleanup falls as health gains from cleanup (although positive) exhibit diminishing returns. The optimal amount of cleanup occurs at Q*, where MB = MC, well short of complete elimination.

- The government can promote an output Q* through **either pollution fees or quantity standards**. The appropriate fee is set at the value of marginal benefit of pollution reduction. Alternatively, the regulator could attain the same result by mandating Q* as the minimum abatement standard. When the regulator has perfect knowledge of the marginal benefit and cost schedules, either regulatory regime can be used to attain the desired result.

- Another regulatory response to an externality, such as pollution, is the introduction of **transferable emissions permits**. The regulator sets the number of permits to allow the discharge of a fixed total quantity of pollution. However, these permits can be bought and sold freely among firms. One would expect a ready market for these permits to emerge. This is exactly the efficient solution the regulator is seeking. A certain amount of pollution is permitted; the rest is cleaned up at least cost.

Table 1.1 Private Remedies for an Externality

Mill's Action	Mill's Cost	Fishery's Cost
0% cleanup	$0	$100,000
50% cleanup	50,000	30,000
100% cleanup	120,000	0

- When the affected parties are few in number and property rights are clearly defined, externalities can be resolved efficiently by **private payments** without government intervention. A classic example is the case of an upstream mill that releases pollutants into a waterway to the detriment of a downstream fishery. Table 1.1 depicts three abatement actions the mill might take and the resulting costs to each party. Of the three options, 50 percent abatement is the efficient solution because this minimizes the total cost incurred by the parties. How might this result actually come to pass? The Coase theorem (developed by Ronald Coase) provides a simple answer: Bargaining between the affected parties will result in an efficient outcome, regardless of the property-rights assignment. To illustrate, suppose the fishery has the right to clean water. Absent any other agreement, it could demand 100 percent cleanup.

- Another solution to the problem is to give the party harmed by the externality the right to **sue for damages**. If an externality is produced, the injured party brings the case to court and will be awarded monetary damages (from the defendant) equal to the economic cost it suffers. This system of private damages is exactly analogous to an externality tax. The initiator of the externality is made to pay the full external cost of his or her actions. The difference is that the payment is private; it goes to the injured party, not the government. As an illustration, suppose the fishery holds the right to clean water and can sue for full damages.

【Questions】

1. The positive externality is usually not considered as a potential source of economic inefficiency.

A. True.
B. False.

2. According to Table 1.1, the mill's cost-minimizing action is 50 percent cleanup.

A. True.
B. False.

3. The firms with the least cleanup costs are most likely to end up obtaining and using the permits.

A. True.
B. False.

4. Which of the following is NOT a way to eliminate the effect of externalities?

A. setting the number of permits to allow the discharge of a fixed total quantity of pollution.
B. mandating an output as the maximum abatement standard.
C. going to court.
D. promoting an output through quantity standards.

5. According to Table 1.1, which of the following is NOT an option for the mill?

A. 100 percent cleanup at a cost of $120,000.
B. 50 percent cleanup at a cost of $30,000.
C. 0 percent cleanup and damages of $100,000.
D. 100 percent cleanup and no damages paid.

6. Which of the following statements is NOT TRUE regarding Figure 1.1?

A. The demand curve is given by MB = 9 – 0.5Q.
B. The amount of the marginal external cost is $1.
C. The competitive equilibrium, $P_C = \$4$ and $Q_C = 10$ million, is found by setting MB = MTC.
D. The efficient level of output, P* = $5 and Q* = 8 million, satisfies MB = MIC + MEC.

7. Which of the following statements is NOT TRUE regarding Table 1.1?

A. Table 1.1 demonstrates the mutual advantage of an agreement at 50 percent cleanup.
B. The mill saves $50,000 in cleanup costs.
C. The loss to the fishery is only $30,000.

D. A payment of $50,000 from mill to fishery in exchange for the right to 50 percent discharge would be mutually beneficial.

8. In Figure 1.1, the efficient price is actually ____.
A. $5, where P* = MB
B. $5, where P* = MIC
C. $4, where P* = MB
D. $4, where P* = MIC

9. The Coase theorem suggests that private solutions to externality problems
A. can lead to an optimal allocation of resources if private parties can bargain at relatively low cost.
B. result in the efficient outcome under all conditions.
C. will result in the same distribution of wealth no matter how property rights are assigned.
D. will result in different efficiency levels of production, depending crucially on how property rights are assigned.

10. What is the deadweight loss from the excess production?
A. $1
B. $2
C. $4
D. none of the above

11. According to Figure 1.2, after reaching the optimal amount of cleanup, ____.
A. the total benefit of cleanup goes down.
B. there lacks some condition to determine whether the extra benefits are worth the costs.
C. the extra benefits are still worth the costs.
D. the extra benefits are not worth the costs.

12. According to Figure 1.1, the optimal outcome occurs where____.
A. demand equals external cost of pollution
B. demand equals MIC
C. demand equals MTC
D. None of the above

13. In the realistic case of imperfect information, however, externality fees have certain advantages over standards. For example, suppose the regulator is in a good position to estimate the benefits from cleanup but is in the dark about the industry's cost of cleanup. Then, which of the following statements is TRUE?
A. No matter whether the regulator underestimate or overestimate cleanup costs, the standard will be too lax.
B. No matter whether the regulator underestimate or overestimate cleanup costs, the

standard will be too stringent.
C. If the regulator underestimates cleanup costs, the standard will be too lax; if it overestimates these costs, the standard will be too stringent.
D. If the regulator overestimates cleanup costs, the standard will be too lax; if it underestimates these costs, the standard will be too stringent.

14. Please fill in the blanks according to Figure 1.2 and what you learned from this text.

Pollution fees, though also subject to error, allow more flexibility. Suppose the regulator mistakenly sets too low a tax; let's say that T < MB* in Figure 1.2. Since firms clean up only to the point where the marginal cost of doing so equals the tax (MC = T), the result will be relatively little cleanup. The regulator will see that additional cleanup affords a marginal benefit above marginal cost: _____. Thus, it can adjust the tax upward until, by trial and error, the resulting level of cleanup satisfies _____, thereby achieving the social optimum.

A. MB = T > MC; MB* = T = MC*
B. MB > T = MC; MB* = T = MC*
C. MB = T > MC; MB* > T > MC*
D. None of the above

Material II - Factor Intensity, Factor Abundance, and the Shape of the Production Frontier

International trade is an important topic that numerous economists contribute to. One of the fundamental theories in this field, developed by Swedish economist Eli Heckscher and Bertil Ohlin (his student) is the **Heckscher–Ohlin (H-O) theory**. In the two-factor case, it states "A capital-abundant country will export the capital-intensive good, while the labor-abundant country will export the labor-intensive good."

This text is to illustrate two key terms in the H–O theory: **factor intensity** and **factor abundance**, as well as the relationship between factor abundance and the shape of the production frontier of each nation.

Factor Intensity

- In a world of two commodities (X and Y) and two factors (labor and capital), we say that commodity Y is **capital intensive** if the capital–labor ratio used in the production of Y is greater than that used in the production of X.

If we plotted capital (K) along the vertical axis of a graph and labor (L) along the horizontal axis, and production took place along a straight-line ray from the origin, the slope of the line would measure the capital–labor ratio ($\frac{K}{L}$) in the production of the commodity. This is shown in Figure 2.1.

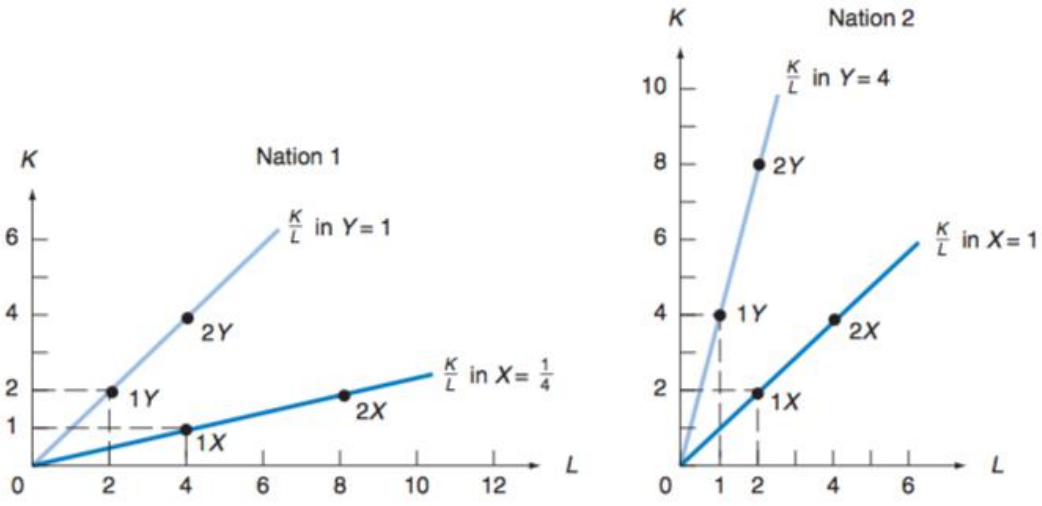


Figure 2.1 Factor Intensities for Commodities X and Y in Nations 1 and 2

Figure 2.1 shows that Nation 1 can produce 1Y with 2K and 2L. With 4K and 4L, Nation 1 can produce 2Y because of constant returns to scale (as assumed). Thus, $\frac{K}{L} = \frac{2}{2} = \frac{4}{4}$ for Y. This is given by the slope of 1 for the ray from the origin for commodity Y in Nation 1 (see the figure). On the other hand, 1K and 4L are required to produce 1X, and 2K and 8L to produce 2X, in Nation 1. Thus, $\frac{K}{L} = \frac{1}{4}$ for X in Nation 1. This is given by the slope of $\frac{1}{4}$ for the ray from the origin for commodity X in Nation 1. Since $\frac{K}{L}$, or the slope of the ray from the origin, is higher for commodity Y than for commodity X, we say that commodity Y is K intensive and commodity X is L intensive in Nation 1.

In Nation 2, $\frac{K}{L}$ (or the slope of the ray) is 4 for Y and 1 for X (see Figure 2.1). Therefore, Y is the K-intensive commodity, and X is the L-intensive commodity in Nation 2 also. This is illustrated by the fact that the ray from the origin for commodity Y is steeper (i.e., has a greater slope) than the ray for commodity X in both nations.

Factor Abundance

There are two ways to define factor abundance.

- One way is in terms of **physical units** (i.e., in terms of the overall amount of capital and labor available to each nation).
- Another way to define factor abundance is in terms of **relative factor prices** (i.e., in terms of the rental price of capital and the price of labor time in each nation).

a) According to the definition in terms of physical units, Nation 2 is capital abundant if the ratio of the total amount of capital to the total amount of labor $(\frac{T_K}{T_L})$ available in Nation 2 is greater than that in Nation 1 (i.e., if $\frac{T_K}{T_L}$ for Nation 2 exceeds $\frac{T_K}{T_L}$ for Nation 1). Note that it is not the absolute amount of capital and labor available in each nation that is important but the ratio of the total amount of capital to the total amount of labor. Thus, Nation 2 can have less capital than Nation 1 and still be the capital-abundant nation if $\frac{T_K}{T_L}$ in Nation 2 exceeds $\frac{T_K}{T_L}$ in Nation 1.

b) According to the definition in terms of factor prices, Nation 2 is capital abundant if the ratio of the rental price of capital to the price of labor time $(\frac{P_K}{P_L})$ is lower in

Nation 2 than in Nation 1 (i.e., if $\frac{P_K}{P_L}$ in Nation 2 is smaller than $\frac{P_K}{P_L}$ in Nation 1). Since the rental price of capital is usually taken to be the interest rate (r) while the price of labor time is the wage rate (w), $\frac{P_K}{P_L} = \frac{r}{w}$. Once again, it is not the absolute level of r that determines whether or not a nation is the K-abundant nation, but $\frac{r}{w}$.

c) The relationship between the two definitions of factor abundance is clear. The definition of factor abundance in terms of physical units considers only the supply of factors. The definition in terms of relative factor prices considers both demand and supply (since we know from principles of economics that the price of a commodity or factor is determined by both demand and supply considerations under perfect competition). Also from principles of economics, we know that the demand for a factor of production is a derived demand—derived from the demand for the final commodity that requires the factor in its production.

Thus, it is the definition in terms of relative factor prices that should be used. That is, a nation is K abundant if the relative price of capital is lower in it than in the other nation. In our case, there is no such contradiction between the two definitions.

Factor Abundance and the Shape of the Production Frontier

Since Nation 2 is the K-abundant nation and commodity Y is the K-intensive commodity, Nation 2 can produce relatively more of commodity Y than Nation 1. On the other hand, since Nation 1 is the L-abundant nation and commodity X is the L-intensive commodity, Nation 1 can produce relatively more of commodity X than Nation 2. This gives a production frontier for Nation 1 that is relatively flatter and wider than the production frontier of Nation 2 (if we measure X along the horizontal axis).

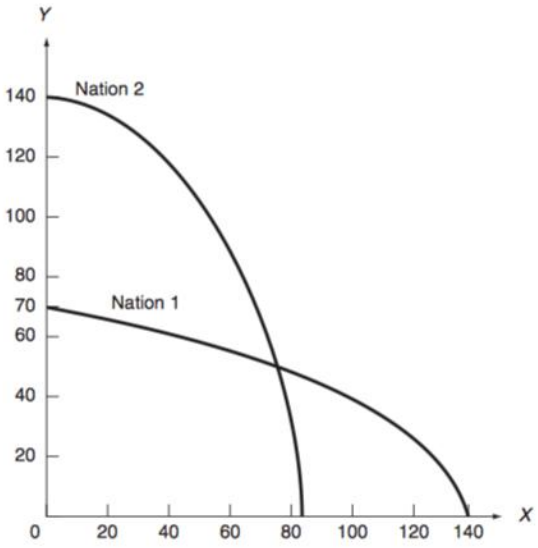


Figure 2.2 The Shape of the Production Frontiers of Nation 1 and Nation 2.

In Figure 2.2, we have plotted the production frontiers of Nation 1 and Nation 2 on the same set of axes. Since Nation 1 is the *L*-abundant nation and commodity *X* is the *L*-intensive commodity, Nation 1's production frontier is skewed toward the horizontal axis, which measures commodity *X*. On the other hand, since Nation 2 is the *K*-abundant nation and commodity *Y* is the *K*-intensive commodity, Nation 2's production frontier is skewed toward the vertical axis measuring commodity *Y*. The production frontiers are plotted on the same set of axes so that the difference in their shape is more clearly evident. For better understanding, we finally provide a case study presenting the relative factor endowments of various countries.

Case Study: Relative Factor Endowments of Various Countries

Table 2.1 Factor Endowments of Various Countries as a Percentage of the World Total in 2006

Country	(1) Arable Land	(2) Physical Capital	(3) R&D Scientists	(4) Highly Skilled Labor	(5) Medium-Skilled Labor	(6) Unskilled Labor	(7) GDP
United States	12.2%	22.0%	24.1%	22.2%	7.5%	0.4%	21.9%
Japan	0.3	14.1	12.3	10.3	4.2	0.2	7.0
Germany	0.8	6.8	4.9	4.4	3.3	0.5	4.5
United Kingdom	0.4	2.8	3.2	3.4	2.2	0.1	3.4
France	1.3	4.4	3.5	3.1	1.9	0.1	3.3
Italy	0.5	3.5	1.4	1.5	2.3	0.3	2.8
Canada	3.2	3.0	2.2	3.1	0.9	0.1	2.0
China	10.1	11.1	21.1	5.9	25.6	24.9	10.2
India	11.2	4.9	1.6	5.9	9.2	21.7	4.5
Russia	8.5	2.3	8.1	2.8	6.6	0.1	3.0
Brazil	4.2	2.9	1.5	2.6	3.2	2.9	2.7
Korea	0.1	3.3	3.5	2.6	1.7	1.3	1.7
Mexico	1.8	2.0	0.8	3.2	1.5	0.2	2.1
Rest of the World	45.4	16.7	11.7	29.0	28.4	47.2	30.7
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Author's calculations on data from: World Bank, OECD, and United Nations Data Bank.

Table 2.1 gives the share of the world's resource endowments of (1) land, (2) physical capital, (3) research and development (R&D) scientists, (4) highly skilled labor, (5) medium-skilled labor, and (6) unskilled labor, as well as the share of world GDP, for most of the leading developed and developing countries in 2006 (more recent data were not available for all resource endowments). Arable land is the general resource to produce agricultural products; physical capital refers to machinery, factories, and other nonhuman means of production; R&D scientists refers to the most highly skilled labor with more than tertiary (college) education and used to produce the most highly technological products; highly skilled labor is labor that has completed tertiary or college education; unskilled labor is labor that has no education beyond primary education. A nation is broadly defined as having a relative abundance of those factors for which its share of the world availability of that factor exceeds the nation's share of world output (GDP in terms of purchasing power).

【Questions】

15. The production frontier of Nation 1 is flatter and wider than the production frontier of Nation 2. One of the reasons is that commodity X is the L-intensive commodity.

A. True.
B. False.

16. According to Table 2.1, Italy has a relative abundance in physical capital.

A. True.

B. False.

17. In terms of factor prices, *r* may be higher in Nation 2 than in Nation 1, but Nation 2 will still be the *L*-abundant nation if $\frac{r}{w}$ is lower there than in Nation 1.

A. True.
B. False.

18. Which of the following statements is TRUE in our case?
A. Nation 2 is *L*-abundant and Nation 1 is *K*-abundant only in terms of physical units.
B. Nation 2 is *L*-abundant and Nation 1 is *K*-abundant only in terms of relative factor prices.
C. Nation 2 is *L*-abundant and Nation 1 is *K*-abundant in terms of both definitions.
D. Nation 2 is *K*-abundant and Nation 1 is *L*-abundant in terms of both definitions.

19. The capital–labor ratio $(\frac{K}{L})$ equals ___ for commodity *Y* and $\frac{K}{L}$ equals ___ for commodity *X*.
A. 2; 1/4
B. 1; 1/4
C. 2; 1/2
D. 1; 1/2

20. Which of the following statements is NOT TRUE regarding the Shape of the Production Frontiers of both nations?
A. Nation 1's production frontier is skewed toward the horizontal axis measuring commodity *X*.
B. Nation 2's production frontier is skewed toward the vertical axis measuring commodity *Y*.
C. Nation 1 can produce relatively more of commodity *Y* than Nation 2.
D. When measuring *X* along the horizontal axis, the production frontier for Nation 1 is relatively flatter and wider than the production frontier of Nation 2.

21. In terms of physical units, Nation 2 is capital abundant if ____.
A. $\frac{T_K}{T_L}$ for Nation 2 is larger than $\frac{T_K}{T_L}$ for Nation 1
B. $\frac{T_K}{T_L}$ for Nation 1 is smaller than $\frac{T_K}{T_L}$ for Nation 2
C. $\frac{T_K}{T_L}$ for Nation 1 is smaller than $\frac{T_K}{T_L}$ for Nation 2
D. None of the above

22. Which of the following determines whether or not a nation is the K-abundant nation?

A. $\frac{T_K}{T_L}$

B. $\frac{P_K}{P_L}$

C. r

D. $\frac{r}{w}$

23. According to Table 2.1, which of the following countries does NOT seem to have any relative abundance in broadly defined factors, compared with other developed countries?

A. The UK
B. Germany
C. Japan
D. Italy

24. The definition in terms of ___ considers demand of factors.

A. physical units
B. relative factor prices
C. both physical units and relative factor prices
D. None of the above

25. According to Figure 2.1, commodity *Y* is the *K*-intensive commodity, and commodity *X* is the *L*-intensive commodity in _____.

A. only Nation 1
B. only Nation 2
C. both Nation 1 and Nation 2
D. neither Nation 1 nor Nation 2

26. According to Table 2.1, which of the following expectations regarding US is mostly likely to be WRONG?

A. We would expect the United States to have a net export surplus or comparative advantage in the most highly technological goods that are intensive in R&D scientists and highly skilled labor
B. We would expect the United States to have a comparative advantage in agricultural and other land and natural resource-intensive products
C. We would expect the United States to be more or less neutral in capital-intensive goods
D. We would expect the United States to have a comparative disadvantage in all types of goods produced with medium-skilled and unskilled labor

27. We denote capital–labor ratio as $\frac{K}{L}$. Then, in a world of only two commodities (*X* and *Y*) and two factors (labor and capital), we say that commodity *Y* is capital

intensive if

A. $K_X/L_X > K_Y/L_Y$
B. $K_Y/L_Y > K_X/L_X$
C. $K_X/L_Y > K_Y/L_X$
D. $K_Y/L_X > K_X/L_Y$

28. According to Table 2.1, which of the following statements is NOT TRUE?

A. Russia is relatively abundant in arable land, R&D scientists, and medium-skilled labor
B. Brazil has a relative abundance in all but R&D scientists and highly skilled labor
C. Korea has a relative abundance in physical capital, R&D scientists, and highly skilled labor
D. Mexico is relatively abundant in R&D scientists.

Material III - The Basis for and the Gains from Trade under Constant Costs

In the absence of trade, a nation can only consume the commodities that it produces. Which combination of commodities the nation actually chooses to produce and consume depends on the people's tastes, or demand considerations.

Illustration of the Gains from Trade

In the absence of trade, the United States might choose to produce and consume combination A (90W and 60C) on its production possibility frontier (see Figure 3.1), and the United Kingdom might choose combination A′ (40W and 40C).

With trade possible, the United States would specialize in the production of wheat and produce at point B (180W and 0C) on its production possibility frontier. If the United States then exchanges 70W for 70C with the United Kingdom, it ends up consuming 110W and 70C, and the United Kingdom ends up consuming 70W and 50C.

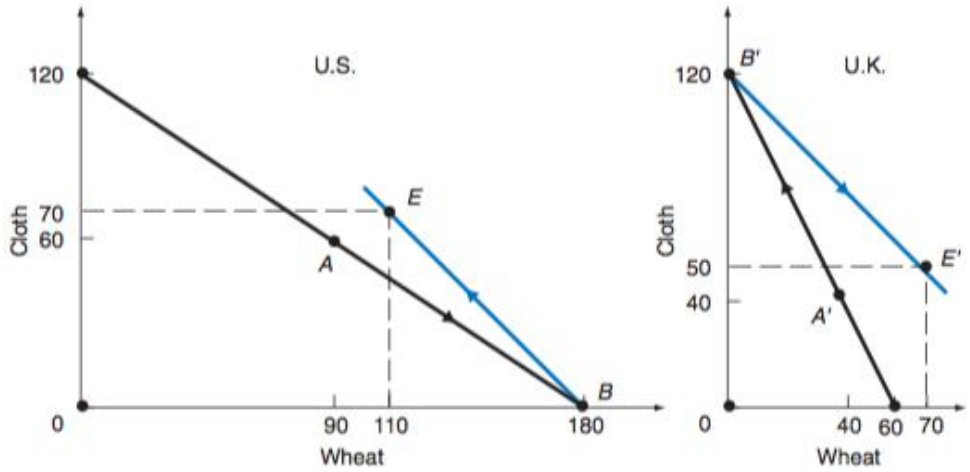


Figure 3.1 The Gains from Trade.

The increased consumption of both wheat and cloth in both nations was made possible by the increased output that resulted as each nation specialized in the production of the commodity of its comparative advantage. That is, in the absence of trade, the United States produced 90W and the United Kingdom 40W, for a total of 130W. With specialization in production and trade, 180W are produced all in the United States. Similarly, in the absence of trade, the United States produced 60C and the United Kingdom 40C, for a total of 100C.

It is this increase in output of 50W and 20C resulting from specialization in

production that is shared by the United States and the United Kingdom and represents their gains from trade. In the absence of trade, the United States would not specialize in the production of wheat because it also wanted to consume some cloth.

Relative Commodity Prices with Trade

We can gain a deeper understanding of our trade model by using the supply and demand curves for wheat and cloth shown in Figure 3.2. Figure 3.2 will also help us see how the equilibrium-relative commodity price with specialization in production and trade is determined.

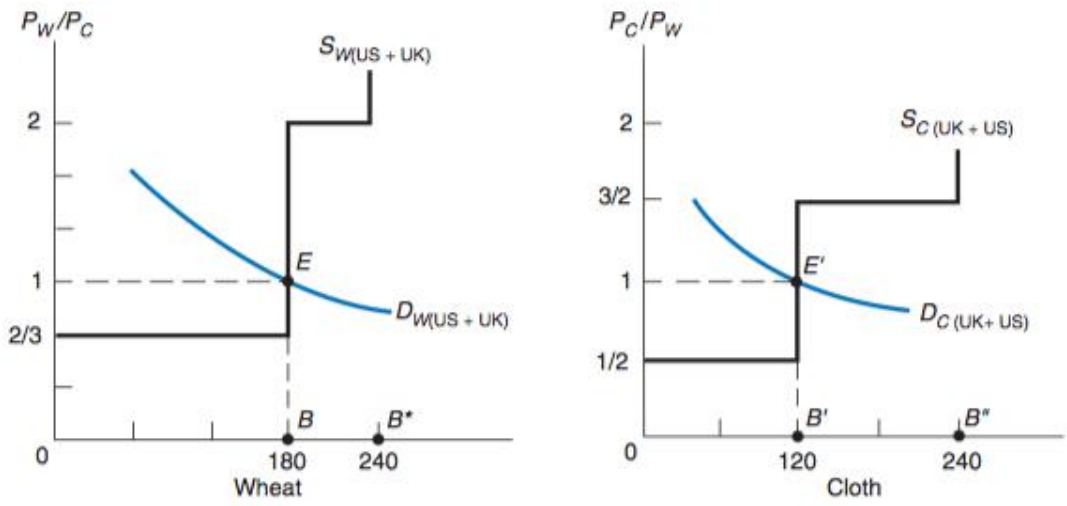


Figure 3.2 Equilibrium-Relative Commodity Prices with Demand and Supply.

In the left panel of Figure 3.2, $S_{W(US+UK)}$ is the combined supply curve of wheat of the United States and the United Kingdom if both countries used all of their resources to produce only wheat. Distance 0B =180W represents the maximum quantity of wheat that the United States could produce with complete specialization in wheat production at the constant opportunity cost of $P_W/P_C = 2/3$. Distance BB$*$ = 60W is the maximum quantity of wheat that the United Kingdom could produce at the constant opportunity cost of $P_W/P_C = 2$. Thus, 240W is the maximum combined total quantity of wheat that the United States and the United Kingdom could produce if both nations used all of their resources to produce wheat. As a result, the $S_{W(US+UK)}$ curve is vertical at 240W.

Suppose that, with trade, the combined demand curve for cloth of the United States and the United Kingdom is $D_{W(US+UK)}$, as shown in the left panel of Figure 3.2. $D_{W(US+UK)}$ intersects $S_{W(US+UK)}$ at point E, determining the equilibrium quantity of

180W and the equilibrium relative price of $P_W/P_C = 1$ with trade (the same as in the left panel of Figure 3.1). Note that, with trade, wheat is produced only in the United States, and the United States specializes completely in the production of wheat.

We can do the same for cloth. In the right panel of Figure 3.2, $S_{C(US+UK)}$ is the combined supply curve of cloth of the United Kingdom and the United States if both countries used all of their resources to produce only cloth. The United Kingdom can produce a maximum of 120C = 0B′ at the constant $P_C/P_W = 1/2$ and the United States can produce a maximum of another 120C = B′B″.

Suppose that, with trade, the combined demand for cloth of the United Kingdom and the United States is $D_{C(US+UK)}$, as shown in the right panel of Figure 3.2. $D_{C(US+UK)}$ intersects $S_{C(US+UK)}$ at point E′, determining the equilibrium quantity of 120C and the equilibrium-relative price of $P_C/P_W = P_W/P_C = 1$ (the same as in the right panel of Figure 3.1). Note that, with trade, cloth is produced only in the United Kingdom, and the United Kingdom specializes completely in the production of cloth.

Finally, note that with complete specialization in production in both countries, the equilibrium-relative commodity price of each commodity is between the pre-trade relative commodity price in each nation (see both panels of Figure 3.2). However, if in the left panel of Figure 3.2 $D_{W(US+UK)}$ were lower and intersected $S_{W(US+UK)}$ between points 0 and B on the horizontal portion of $S_{W(US+UK)}$ at $P_W/P_C = 2/3$, trade would take place at the pre-trade relative commodity price of wheat of $P_W/P_C = 2/3$ in the United States and the United Kingdom would receive all the gains from trade. This would occur if the United Kingdom were a small country that specialized completely in the production of cloth and the United States were larger and did not specialize completely in the production of wheat. This is known as the small-country case and shows the “importance of being unimportant.”

【Questions】

29. With trade possible, the United Kingdom would specialize in the production of cloth and produce 40W and 80C.

A. True

B. False

30. In the absence of trade, the United Kingdom would not specialize in the production of cloth in the absence of trade because it also wanted to consume

some wheat.
A. True
B. False

31. According to Figure 3.1, the United States can produce a maximum of another 120C at the constant $P_C/P_W = 3/2$.
A. True
B. False

32. In our text, with specialization in production and trade, 120C are produced ____.
A. all in the United States
B. all in the United Kingdom
C. partly in the United States and partly in the United Kingdom
D. None of the above

33. With trade possible, the United States would specialize in the production of wheat because of:
A. its diminishing marginal utility
B. its economics of scale
C. its absolute advantage
D. its comparative advantage

34. According to Figure 3.1, if the United States then exchanges 70W for 70C with the United Kingdom, it ends up consuming at ___, and the United Kingdom ends up consuming at ____.
A. point E; point E′
B. point E′; point E
C. point E′; point E′
D. point E; point E

35. In the left panel and right panel of Figure 3.1, P_W/P_C equals to ___ and ___ respectively.
A. 7/11; 1
B. 2/3; 2
C. 1; 2
D. None of the above

36. In the left panel of Figure 3.2, if $D_{W(US+UK)}$ shifted up by one-third, the United States will produce ___ wheat and the United Kingdom will produce ___ cloth.
A. 120W; 60C
B. 150W; 60C
C. 150W; 90C
D. 180W; 120C

37. The benefit of being a small nation (in out text, the United Kingdom) is not without cost since the small nation faces the risk of ___.

A. a reduction in supply for the only commodity it produces.
B. a reduction in demand for the only commodity it produces.
C. the large nation specializing in producing the same commodity
D. the large nation specializing in producing some other commodity

38. What would happen if $D_{W(US+UK)}$ intersected the horizontal portion of $S_{W(US+UK)}$ at $P_W/P_C = 2/3$ and 120W in the left panel of Figure 3.2?

A. The United States would be specializing completely in the production of wheat.
B. The United States would be exchanging 30C for 20W with the United Kingdom.
C. The United Kingdom would be specializing completely in the production of cloth
D. The United Kingdom would be exchanging 30C for 20W with the United States.

39. What would Figure 3.2 imply for specialization in production and the distribution in the gains from trade between the two nations?

A. The United Kingdom receives all of the gains from trade.
B. The United States receives all of the gains from trade.
C. Both the United Kingdom and the United States receives part of the gains from trade.
D. None of the above.

40. In the left panel of Figure 3.2, if $D_{W(US+UK)}$ shifted up by one-third, the equilibrium-relative commodity price of wheat would be ___.

A. 4/3
B. 3/4
C. 3/2
D. 2/3

41. If the United States then exchanges 70W for 70C with the United Kingdom, the United States gains ____ from trade.

A. 20W and 20C
B. 20W and 10C
C. 30W and 10C
D. 30W and 20C

42. When there is no trade, what is the relationship between the nation's production possibility frontier and its consumption frontier?

A. The nation's production possibility frontier also represents its consumption frontier.
B. The nation's production possibility frontier lies above its consumption frontier.

C. The nation’s production possibility frontier lies below its consumption frontier.
D. None of the above

Material IV - A Glance at the Balance Sheet

Every public company is required to produce four financial statements: the balance sheet, the income statement, the statement of cash flows, and the statement of stockholders' equity. These financial statements provide investors and creditors with an overview of the firm's financial performance. In this text, we take a close look at the content of the balance sheet.

The Balance Sheet

The balance sheet, or statement of financial position, lists the firm's assets and liabilities, providing a snapshot of the firm's financial position at a given point in time. Table 4.1 shows the balance sheet for a fictitious company, Global Conglomerate Corporation. Notice that the balance sheet is divided into two parts ("sides"), with the assets on the left side and the liabilities on the right. The assets list the cash, inventory, property, plant, and equipment, and other investments the company has made; the liabilities show the firm's obligations to creditors. Also shown with liabilities on the right side of the balance sheet is the stockholders' equity. Stockholders' equity, the difference between the firm's assets and liabilities, is an accounting measure of the firm's net worth.

Table 4.1 Global Conglomerate Corporation Balance Sheet for 2012 and 2011

GLOBAL CONGLOMERATE CORPORATION

Consolidated Balance Sheet
Year Ended December 31 (in $ million)

Assets	2012	2011	Liabilities and Stockholders' Equity	2012	2011
Current Assets			**Current Liabilities**		
Cash	21.2	19.5	Accounts payable	29.2	24.5
Accounts receivable	18.5	13.2	Notes payable/short-term debt	3.5	3.2
Inventories	15.3	14.3	Current maturities of long-term debt	13.3	12.3
Other current assets	2.0	1.0	Other current liabilities	2.0	4.0
Total current assets	57.0	48.0	Total current liabilities	48.0	44.0
Long-Term Assets			**Long-Term Liabilities**		
Land	22.2	20.7	Long-term debt	99.9	76.3
Buildings	36.5	30.5	Capital lease obligations	—	—
Equipment	39.7	33.2	Total debt	99.9	76.3
Less accumulated depreciation	(18.7)	(17.5)	Deferred taxes	7.6	7.4
Net property, plant, and equipment	79.7	66.9	Other long-term liabilities	—	—
Goodwill and intangible assets	20.0	20.0	Total long-term liabilities	107.5	83.7
Other long-term assets	21.0	14.0	**Total Liabilities**	155.5	127.7
Total long-term assets	120.7	100.9	**Stockholders' Equity**	22.2	21.2
Total Assets	177.7	148.9	**Total Liabilities and Stockholders' Equity**	177.7	148.9

The assets on the left side show how the firm uses its capital (its investments), and the right side summarizes the sources of capital, or how a firm raises the money it needs.

Because of the way stockholders' equity is calculated, the left and right sides must balance:

The Balance Sheet Identity

Assets = Liabilities + Stockholders' Equity

In Table 4.1, total assets for 2012 ($177.7 million) are equal to total liabilities ($155.5 million) plus stockholders' equity ($22.2 million).

Let's examine Global's assets, liabilities, and stockholders' equity in more detail.

Assets

In Table 4.1, Global's assets are divided into current and long-term assets. We discuss each in turn.

Current Assets. Current assets are either cash or assets that could be converted into cash within one year. This category includes the following:

a) **Cash and other marketable securities**, which are short-term, low-risk investments that can be easily sold and converted to cash (such as money market investments like government debt that matures within a year);
b) **Accounts receivable**, which are amounts owed to the firm by customers who have purchased goods or services on credit;
c) **Inventories**, which are composed of raw materials as well as work-in-progress and finished goods;
d) **Other current assets**, which is a catch-all category that includes items such as prepaid expenses (such as rent or insurance paid in advance).

Long-Term Assets.

a) The first category of long-term assets is **net property, plant, and equipment**. These include assets such as real estate or machinery that produce tangible benefits for more than one year. If Global spends $2 million on new equipment, this $2 million will be included with property, plant, and equipment on the balance sheet.
b) Because equipment tends to wear out or become obsolete over time, Global will reduce the value recorded for this equipment each year by deducting a depreciation expense. An **asset's accumulated depreciation** is the total amount deducted over its life. The firm reduces the value of fixed assets (other than land) over time according to a depreciation schedule that depends on the asset's life span. Depreciation is not an actual cash expense that the firm pays; it is a way of recognizing that buildings and equipment wear out and thus become less valuable the older they get. The book value of an asset, which is the value shown in the firm's financial statements, is equal to its acquisition cost less accumulated

depreciation. Net property, plant, and equipment shows the book value of these assets.

c) When a firm acquires another company, it will acquire a set of **tangible assets** (such as inventory or property, plant, and equipment) that will then be included on its balance sheet. In many cases, however, the firm may pay more for the company than the total book value of the assets it acquires. In this case, the difference between the price paid for the company and the book value assigned to its tangible assets is recorded separately as goodwill and intangible assets. If the firm assesses that the value of these intangible assets declined over time, it will reduce the amount listed on the balance sheet by an amortization or impairment charge that captures the change in value of the acquired assets. Like depreciation, amortization is not an actual cash expense.

d) **Other long-term assets** can include such items as property not used in business operations, start-up costs in connection with a new business, investments in long-term securities, and property held for sale. The sum of all the firms' assets is the total assets at the bottom of the left side of the balance sheet in Table 4.1.

Liabilities

We now examine the liabilities shown on the right side of the balance sheet, which are divided into current and long-term liabilities.

Current Liabilities. Liabilities that will be satisfied within one year are known as current liabilities. They include the following:

a) **Accounts payable**, the amounts owed to suppliers for products or services purchased with credit;

b) **Short-term debt** or notes payable, and current maturities of long-term debt, which are all repayments of debt that will occur within the next year;

c) **Items such as salary or taxes** that are owed but have not yet been paid, and deferred or unearned revenue, which is revenue that has been received for products that have not yet been delivered.

The difference between current assets and current liabilities is the firm's net working capital, the capital available in the short term to run the business. Firms with low (or negative) net working capital may face a shortage of funds unless they generate sufficient cash from their ongoing activities.

Long-Term Liabilities. Long-term liabilities are liabilities that extend beyond one year. We describe the main types as follows:

a) **Long-term debt** is any loan or debt obligation with a maturity of more than a year. When a firm needs to raise funds to purchase an asset or make an investment, it may borrow those funds through a long-term loan.

b) **Capital leases** are long-term lease contracts that obligate the firm to make regular

lease payments in exchange for use of an asset. They allow a firm to gain use of an asset by leasing it from the asset's owner. For example, a firm may lease a building to serve as its corporate headquarters.

c) **Deferred taxes** are taxes that are owed but have not yet been paid. Firms generally keep two sets of financial statements: one for financial reporting and one for tax purposes. Occasionally, the rules for the two types of statements differ. Deferred tax liabilities generally arise when the firm's financial income exceeds its income for tax purposes. Because deferred taxes will eventually be paid, they appear as a liability on the balance sheet.

Stockholders' Equity

The sum of the **current liabilities** and **long-term liabilities** is total liabilities. The difference between the firm's assets and liabilities is the stockholders' equity; it is also called the **book value of equity**. As we stated earlier, it is an accounting measure of the net worth of the firm.

Ideally, the balance sheet would provide us with an accurate assessment of the true value of the firm's equity. Unfortunately, this is unlikely to be the case. First, many of the assets listed on the balance sheet are valued based on their historical cost rather than their true value today. A second, and probably more important, problem is that many of the firm's valuable assets are not captured on the balance sheet.

Thus, we need to introduce the concept of **Market Value of Equity**. For the reasons cited above, the book value of equity is an inaccurate assessment of the actual value of the firm's equity. Successful firms are often able to borrow in excess of the book value of their assets because creditors recognize that the market value of the assets is far higher than the book value. Thus, it is not surprising that the book value of equity will often differ substantially from the amount investors are willing to pay for the equity. The total market value of a firm's equity equals the number of shares outstanding times the firm's market price per share:

Market Value of Equity = Shares outstanding × Market price per share

The market value of equity is often referred to as the company's market capitalization (or "market cap"). The market value of a stock does not depend on the historical cost of the firm's assets; instead, it depends on what investors expect those assets to produce in the future.

【Questions】

43. Start-up costs in connection with a new business should be included in the category of Other Long-term Assets.
A. True.
B. False.

44. Accounts payable is usually listed in the category of Current Assets.
A. True.
B. False.

45. The book value of equity can often accurately assess the actual value of the firm's equity.
A. True.
B. False.

46. ____ is a measure of the firm's net worth.
A. Assets
B. Liabilities
C. Stockholders' Equity
D. All of the above

47. Which of the following formulas is TRUE?
A. Current Assets= Current Liabilities + Stockholders' Equity
B. Total Debt= Total Long-term Liabilities – Deferred Taxes
C. Long-term Assets= Land + Buildings + Equipment – Accumulated Depreciation
D. Long-term Debt= Total Assets - Stockholders' Equity – Current Liabilities

48. For Global Conglomerate Corporation, which indicator is higher in 2011 than in 2012?
A. Accounts receivable
B. Goodwill and Intangible assets
C. Short-Term debt
D. None of the above

49. Which of the following can NOT be included in Current Assets?
A. Government debt which will mature in twelve months
B. Financial derivatives
C. Prepaid rent
D. Work-in-progress goods

50. Which of the following statements regarding depreciation is NOT TRUE?
A. The firm reduces the value of fixed assets over time according to a depreciation

schedule that depends on the asset's life span.
B. There appears no actual cash expense paid by the company in depreciation.
C. The acquisition cost and accumulated depreciation together make up the book value of an asset.
D. None of the above

51. How much is Global Conglomerate Corporation's net working capital totaled in 2012?
A. $9 million
B. $10 million
C. $11 million
D. None of the above

52. Which of the following often arises when the firm's financial income surpasses its income due to some taxation-related purposes?
A. Stockholders' equity
B. Capital leases
C. Long-term debt
D. Deferred taxes

53. If Global has 3.6 million shares outstanding, and these shares are trading for a price of $14 per share, how many times are investors willing to pay the amount Global's shares which are "worth" according to their book value?
A. 3.23
B. 3.27
C. 3.35
D. None of the above

54. Which of the following statements is TRUE?
A. If the firm assesses that the value of these intangible assets declined over time, it will increase the amount listed on the balance sheet by an amortization or impairment charge.
B. In most of the cases, many of the assets listed on the balance sheet are valued based on their true value today rather than their historical cost.
C. Property held for sale is usually included in the category of tangible assets.
D. Items such as salary or taxes that are owed but have not yet been paid are usually included in current liabilities.

55. Global paid some money in 2010 for a firm whose tangible assets had a book value of $5 million. The remaining appears as goodwill and intangible assets in Table 4.1. How much does Global pay in 2010?
A. $20 million
B. $25 million
C. $26 million

D. None of the above

56. Assuming other items constant, which of the following movements is NOT TRUE in a balance sheet?

A. The decrease of Short-term debt leads to the increase of Total Assets.
B. The increase of Long-term debt leads to the increase of Total Liabilities.
C. The decrease of accumulated depreciation leads to the increase of Long-Term Assets.
D. The increase of Stockholders' Equity leads to the decrease of Total Liabilities.

57. We now introduce a new concept: **Enterprise Value**. Its formula is as follows:

Enterprise Value = Market Value of Equity + Debt – Cash

What is Global's enterprise value in 2012?

A. $142.1 million
B. $145.9 million
C. $147.6 million
D. None of the above

Material V - Equity vs Debt Financing

The relative proportions of debt, equity, and other securities that a firm has outstanding constitute its capital structure. When corporations raise funds from outside investors, they must choose which type of security to issue. The most common choices are financing through equity alone and financing through a combination of debt and equity.

Financing a Firm with Equity

Consider an entrepreneur with the following investment opportunity. For an initial investment of $800 this year, a project will generate cash flows of either $1400 or $900 next year. The cash flows depend on whether the economy is strong or weak, respectively. Both scenarios are equally likely, and are shown in Table 5.1.

Table 5.1 The Project Cash Flows

Date 0	Date 1	
	Strong Economy	Weak Economy
−$800	$1400	$900

Because the project cash flows depend on the overall economy, they contain market risk. As a result, investors demand a risk premium. The current risk-free interest rate is 5%, and suppose that given the market risk of the investment the appropriate risk premium is 10%.

What is the NPV (net present value) of this investment opportunity? Given a risk-free interest rate of 5% and a risk premium of 10%, the cost of capital for this project is 15%. Because the expected cash flow in one year is 1/2 ($1400) + 1/2 ($900) = $1150, we get NPV = -$800 + $1150/1.15. Thus, the investment has a positive NPV.

The entrepreneur can raise $1000 by selling the equity in the firm. After paying the investment cost of $800, the entrepreneur can keep the remaining $200—the project's NPV—as a profit. In other words, the project's NPV represents the value to the initial owners of the firm (in this case, the entrepreneur) created by the project.

Table 5.2 Cash Flows and Returns for Unlevered Equity

	Date 0	Date 1: Cash Flows		Date 1: Returns	
	Initial Value	Strong Economy	Weak Economy	Strong Economy	Weak Economy
Unlevered equity	$1000	$1400	$900	40%	−10%

Equity in a firm with no debt is called **unlevered equity**. Because there is no debt, the date 1 cash flows of the unlevered equity are equal to those of the project. Given equity's initial value of $1000, shareholders' returns are either 40% or -10%, as

shown in Table 5.2.

■ Financing a Firm with Debt and Equity

Financing the firm exclusively with equity is not the entrepreneur's only option. She can also raise part of the initial capital using debt. Suppose she decides to borrow $500 initially, in addition to selling equity. Because the project's cash flow will always be enough to repay the debt, the debt is risk free. Thus, the firm can borrow at the risk-free interest rate of 5%, and it will owe the debt holders 500 x 1.05 = $525 in one year.

Table 5.3 Values and Cash Flows for Debt and Equity of the Levered Firm

	Date 0	Date 1: Cash Flows	
	Initial Value	Strong Economy	Weak Economy
Debt	$500	$525	$525
Levered equity	$E = ?$	$875	$375
Firm	$1000	$1400	$900

Equity in a firm that also has debt outstanding is called **levered equity**. Promised payments to debt holders must be made before any payments to equity holders are distributed. Given the firm's $525 debt obligation, the shareholders will receive only $1400 - $525 = $875 if the economy is strong and $900 - $525 = $375 if the economy is weak. Table 5.3 shows the cash flows of the debt, the levered equity, and the total cash flows of the firm. She will raise a total of $1000 by issuing both debt and levered equity, just as she did with unlevered equity alone.

The Effect of Leverage on Risk and Return

Modigliani and Miller's conclusion went against the common view, which stated that even with perfect capital markets, leverage would affect a firm's value. In particular, it was thought that the value of the levered equity would exceed $500, because the present value of its expected cash flow at 15% is

$$\frac{0.5(\$875) + 0.5(\$375)}{1.15} = \$543$$

The reason this logic is not correct is that leverage increases the risk of the equity of a firm. Therefore, it is inappropriate to discount the cash flows of levered equity at the same discount rate of 15% that we used for unlevered equity. Investors in levered equity require a higher expected return to compensate for its increased risk.

Table 5.4 Returns to Equity with and without Leverage

	Date 0	Date 1: Cash Flows		Date 1: Returns		
	Initial Value	Strong Economy	Weak Economy	Strong Economy	Weak Economy	Expected Return
Debt	$500	$525	$525	5%	5%	5%
Levered equity	$500	$875	$375	75%	−25%	25%
Unlevered equity	$1000	$1400	$900	40%	−10%	15%

Table 5.4 compares the equity returns if the entrepreneur chooses unlevered equity financing with the case in which she borrows $500 and raises an additional $500 using levered equity. Note that the returns to equity holders are very different with and without leverage. Unlevered equity has a return of either 40% or -10%, for an expected return of 15%. But levered equity has higher risk, with a return of either 75% or -25%. To compensate for this risk, levered equity holders receive a higher expected return of 25%.

Table 5.5 Systematic Risk and Risk Premiums for Debt, Unlevered Equity, and Levered Equity

	Return Sensitivity (Systematic Risk)	Risk Premium
	$\Delta R = R(\text{strong}) - R(\text{weak})$	$E[R] - r_f$
Debt	5% − 5% = 0%	5% − 5% = 0%
Unlevered equity	40% − (−10%) = 50%	15% − 5% = 10%
Levered equity	75% − (−25%) = 100%	25% − 5% = 20%

We can evaluate the relationship between risk and return more formally by computing the sensitivity of each security's return to the systematic risk of the economy. (In our simple two-state example, this sensitivity determines the security's beta) Table 5.5 shows the return sensitivity and the risk premium for each security.

To summarize, in the case of perfect capital markets, if the firm is 100% equity financed, the equity holders will require a 15% expected return. If the firm is financed 50% with debt and 50% with equity, the debt holders will receive a lower return of 5%, while the levered equity holders will require a higher expected return of 25% because of their increased risk. As this example shows, leverage increases the risk of equity even when there is no risk that the firm will default. Thus, while debt may be cheaper when considered on its own, it raises the cost of capital for equity. Considering both sources of capital together, the firm's average cost of capital with leverage is 0.5 (5%) + 0.5 (25%) = 15%, the same as for the unlevered firm.

【Questions】

58. Under levered equity method, promised payments to debt holders may be made after any payments to equity holders are distributed.

A. True.

B. False.

59. Since the project cash flows often depend on the condition of economy, they are very likely to bear some market risk.
A. True.
B. False.

60. Financing the firm with only equity is usually the firm's only choice.
A. True.
B. False.

61. According to Table 5.1, assuming the economy being strong or weak is equally likely, what is the net present value for the firm at Date 1?
A. $250
B. $200
C. $150
D. $100

62. Equity in a firm without debt is called ____.
A. unlevered equity
B. levered equity
C. risk-free equity
D. shareholders' equity

63. If this project is financed using equity alone, the investors would be willing to pay ____ for the firm's shares.
A. $1150
B. $1000
C. $900
D. $800

64. According to Table 5.2, given equity's initial value of $800, keeping all other numbers unchanged, shareholders' returns are either ___ or ____.
A. 40%; -10%
B. 45%; - 2.5%
C. 60%; 7.5%
D. 75%; 12.5%

65. The strong and weak economy outcomes are equally likely, so the expected return on the unlevered equity is ____.
A. 40%
B. 15%
C. -10%
D. None of the above

66. Since the cash flows of the debt and equity sum to the cash flows of the project,

by the Law of One Price, the combined values of debt and equity must be $1000. Therefore, according to Table 5.3, if the value of the debt is $500, the value of the levered equity must be ____.

A. $1000
B. $875
C. $525
D. $500

67. The cash flows of levered equity are smaller than those of unlevered equity. However, the fact that the equity is less valuable with leverage does not mean that the entrepreneur is worse off. Thus, which of the following statements is TRUE?

A. The firm will prefer financing with equity only.
B. The firm will prefer financing with debt and equity.
C. The firm will be indifferent between these two choices for the firm's capital structure.
D. None of the above

68. According to Modigliani and Miller's conclusion, which of the following is TRUE?

A. Only with imperfect capital markets, leverage would not affect a firm's value.
B. With perfect capital markets, leverage would affect a firm's value.
C. With perfect capital markets, leverage would not affect a firm's value.
D. None of the above.

69. According to Table 5.4, for levered equity holder, what is his premium?

A. 10%
B. 15%
C. 25%
D. -25%

70. Which of the following statements is NOT TRUE according to Table 5.5?

A. Because the debt's return bears systematic risk, its risk premium is zero.
B. Levered equity has twice the systematic risk of unlevered equity.
C. Levered equity holders receive twice the risk premium.
D. The risk premium for unlevered equity is 10%.

71. Suppose the entrepreneur borrows only $200 when financing the project. According to Modigliani and Miller, what should the value of the equity be?

A. $200
B. $800
C. $1000
D. None of the above

72. We still suppose the entrepreneur borrows $200 when financing the project. What

is the expected return next year? (We give the same assumption as in the text, which is, for an initial investment of $800 this year, a project will generate cash flows of either $1400 or $900 next year. Given a risk-free interest rate of 5% and a risk premium of 10%.)

A. 12.5%
B. 15%
C. 17.5%
D. 20%

Material VI - Risk and Risk Aversion in Portfolio Theory

This text introduces two themes in portfolio theory, all centering on risk. The first is the basic tenet that investors avoid risk and demand a reward for engaging in risky investments. The reward is taken as a risk premium, the difference between the expected rate of return and that available on alternative risk-free investments. The second theme allows us to quantify investors' personal trade-offs between portfolio risk and expected return. To do this we introduce the utility function, which assumes that investors can assign a welfare or "utility" score to any investment portfolio depending on its risk and return.

Risk with Simple Prospects

The presence of risk means that more than one outcome is possible. A simple prospect is an investment opportunity in which a certain initial wealth is placed at risk, and there are only two possible outcomes. For the sake of simplicity, it is useful to elucidate some basic concepts using simple prospects.

Take as an example initial wealth, W, of \$100,000, and assume two possible results. With a probability $p = .6$, the favorable outcome will occur, leading to final wealth, $W_1 = \$150{,}000$. Otherwise, with probability $1 - p = .4$, a less favorable outcome, $W_2 = \$80{,}000$, will occur. We can represent the simple prospect using an event tree:

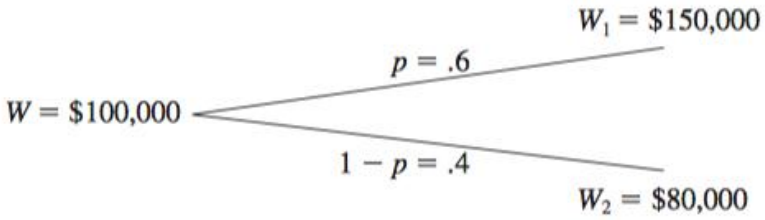


Figure 6.1 The Event Tree of an Example Initial Wealth of \$100,000

Suppose an investor is offered an investment portfolio with a payoff in 1 year described by such a simple prospect. How can you evaluate this portfolio?

First, try to summarize it using descriptive statistics. For instance, the mean or expected end-of-year wealth, denoted $E(W)$, is

$$E(W) = pW_1 + (1 - p)W_2 = (.6 \times 150{,}000) + (.4 \times 80{,}000) = \$122{,}000$$

The expected profit on the \$100,000 investment portfolio is \$22,000 (=\$122,000 - \$100,000). The variance, σ^2, of the portfolio's payoff is calculated as the expected value of the squared deviation of each possible outcome from the mean:

$$\sigma^2 = p[W_1 - E(W)]^2 + (1-p)[W_2 - E(W)]^2$$
$$= .6 \times (150{,}000 - 122{,}000)^2 + .4 \times (80{,}000 - 122{,}000)^2$$
$$= \$1{,}176{,}000{,}000$$

The standard deviation, σ, which is the square root of the variance, is therefore $34,292.86.

Let us suppose Treasury bills are one alternative to the risky portfolio. Suppose that at the time of the decision, a 1-year T-bill offers a rate of return of 5%; $100,000 can be invested to yield a sure profit of $5,000. We can now draw the decision tree.

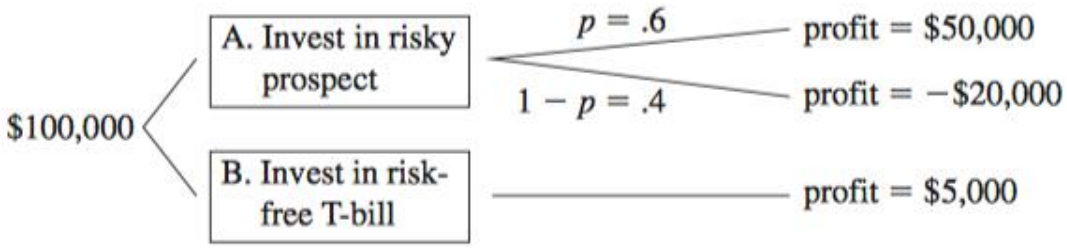


Figure 6.2 The Event Tree of a 1-year T-bill of $100,000

Earlier we showed the expected profit on the prospect to be $22,000. Therefore, the expected marginal, or incremental, profit of the risky portfolio over investing in safe T-bills is:

$22,000 - $5,000 = $17,000

meaning that one can earn a risk premium of $17,000 as compensation for the risk of the investment.

The question of whether a given risk premium provides adequate compensation for an investment's risk is age-old. Indeed, one of the central concerns of finance theory is the measurement of risk and the determination of the risk premiums that investors can expect of risky assets in well-functioning capital markets.

Risk Aversion and Utility Values

We have discussed risk with simple prospects and how risk premiums bear on speculation. A prospect that has a zero risk premium is called a fair game.

- **Risk averse.** Investors who are risk averse reject investment portfolios that are fair games or worse. Risk-averse investors are willing to consider only risk-free or speculative prospects with positive risk premia. Loosely speaking, a risk-averse investor "penalizes" the expected rate of return of a risky portfolio by a certain percentage (or penalizes the expected profit by a dollar amount) to

account for the risk involved. The greater the risk, the larger the penalty. One might wonder why we assume risk aversion as fundamental. We believe that most investors would accept this view from simple introspection.

- **Risk-neutral.** In contrast to risk-averse investors, risk-neutral investors judge risky prospects solely by their expected rates of return. The level of risk is irrelevant to the risk-neutral investor, meaning that there is no penalization for risk. For this investor a portfolio's certainty equivalent rate is simply its expected rate of return.

- **Risk-loving.** A risk lover is willing to engage in fair games and gambles; this investor adjusts the expected return upward to take into account the "fun" of confronting the prospect's risk. Risk lovers will always take a fair game because their upward adjustment of utility for risk gives the fair game a certainty equivalent that exceeds the alternative of the risk-free investment.

We can formalize the notion of a risk-penalty system. To do so, we will assume that each investor can assign a welfare, or utility, score to competing investment portfolios based on the expected return and risk of those portfolios. The utility score may be viewed as a means of ranking portfolios. Higher utility values are assigned to portfolios with more attractive risk-return profiles. Portfolios receive higher utility scores for higher expected returns and lower scores for higher volatility. Many particular "scoring" systems are legitimate. One reasonable function that is commonly employed by financial theorists and the AIMR (Association of Investment Management and Research) assigns a portfolio with expected return E(r) and variance of returns σ^2 the following utility score:

$$U = E(r) - .005A\sigma^2 \qquad (6.1)$$

where U is the utility value and A is an index of the investor's risk aversion. The factor of .005 is a scaling convention that allows us to express the expected return and standard deviation in equation 6.1 as percentages rather than decimals.

Equation 6.1 is consistent with the notion that utility is enhanced by high expected returns and diminished by high risk. The extent to which variance lowers utility depends on A, the investor's degree of risk aversion. More risk-averse investors (who have the larger As) penalize risky investments more severely. Investors choosing among competing investment portfolios will select the one providing the highest utility level.

Notice in equation 6.1 that the utility provided by a risk-free portfolio is simply the rate of return on the portfolio, because there is no penalization for risk. This provides us with a convenient benchmark for evaluating portfolios.

We can depict the individual's trade-off between risk and return by plotting the characteristics of potential investment portfolios that the individual would view as equally attractive on a graph with axes measuring the expected value and standard deviation of portfolio returns. Figure 6.3 plots the characteristics of one portfolio.

Portfolio P, which has expected return $E(r_P)$ and standard deviation σ_P, is preferred by risk-averse investors to any portfolio in quadrant IV because it has an expected return equal to or greater than any portfolio in that quadrant and a standard deviation equal to or smaller than any portfolio in that quadrant. Conversely, any portfolio in quadrant I is preferable to portfolio P because its expected return is equal to or greater than P's and its standard deviation is equal to or smaller than P's.

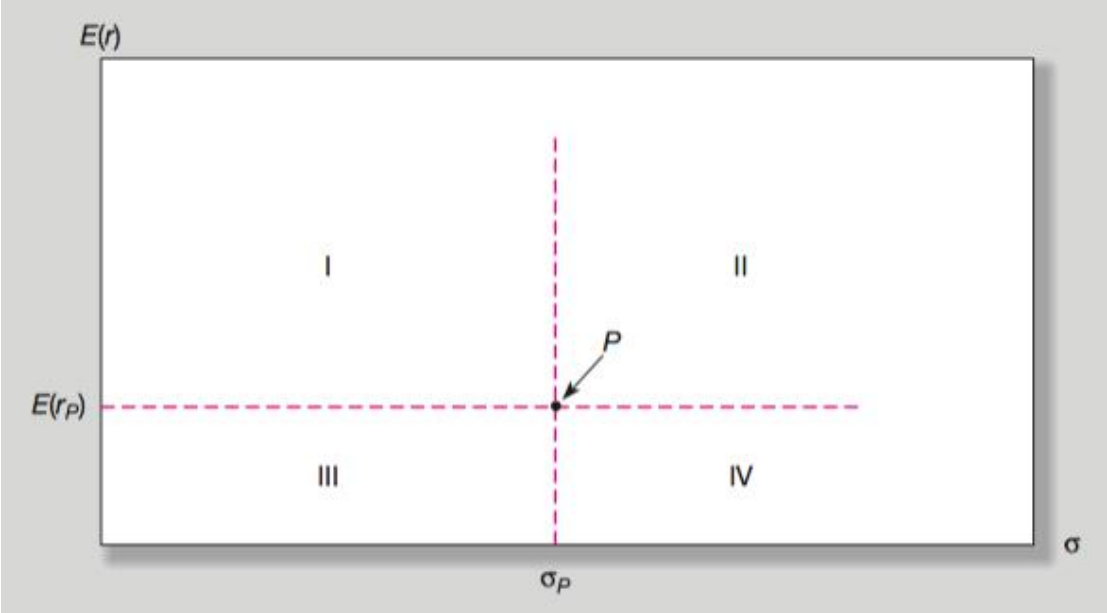


Figure 6.3 The trade-off between risk and return of a potential investment portfolio

This is the mean-standard deviation, or equivalently, mean-variance (M-V) criterion. It can be stated as: portfolio A dominates portfolio B if

$$E(r_A) \geq E(r_B) \text{ and } \sigma_B \geq \sigma_A$$

and at least one inequality is strict (rules out the equality).

In the expected return–standard deviation plane in Figure 6.3, the preferred direction is northwest, because in this direction we simultaneously increase the expected return and decrease the variance of the rate of return. This means that any portfolio that lies northwest of P is superior to P.

【Questions】

73. A risk-loving investor usually penalizes the expected rate of return of a risky portfolio by some percentage to calculate the risk involved.
A. True.
B. False.

74. In order to measure the trade-off between risk and return, usually we first need to calculate the expected value and standard deviation of portfolio returns.
A. True.
B. False.

75. Lower utility values are assigned to portfolios with less attractive risk-return profiles.
A. True.
B. False.

76. Suppose an investor invested 10,000 Euro in a portfolio at the beginning of 2020. The portfolio has probability of 40% obtaining 8,000 and probability of 60% obtaining 12,000 at the end of 2020. What is his expected annual return?
A. 10,000
B. 10,400
C. 10,800
D. None of the above

77. Utility is enhanced by ___ expected returns and diminished by ___ risk.
A. high; low
B. low; high
C. high; high
D. low; low

78. For a risk-loving investor, which quadrant will he mostly likely choose his portfolio from?
A. Quadrant I
B. Quadrant II
C. Quadrant III
D. Quadrant IV

79. A fair game is a prospect with ___ risk premium.
A. fair
B. positive
C. negative
D. zero

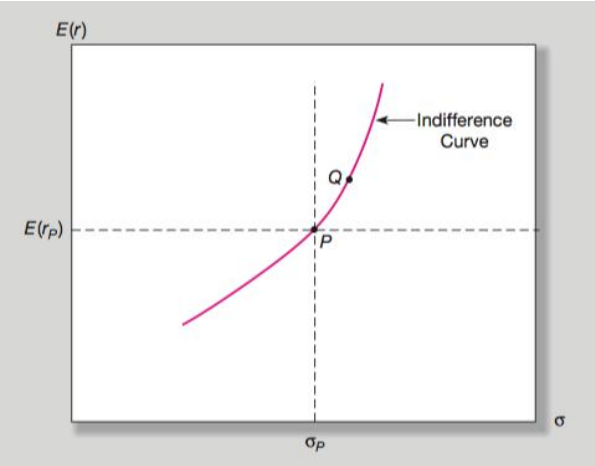
80. We have now a portfolio with expected return of 15%, variance of returns of 0.25, and $A = 4$. What is the utility value of this portfolio?

A. 0.125
B. 0.145
C. 0.150
D. 0.165

81. We can assume that any investor who prefers more wealth to less would like to choose portfolio A if

A. $E(r_A) = E(r_B)$ and $\sigma_B = \sigma_A$
B. $E(r_A) > E(r_B)$ and $\sigma_B < \sigma_A$
C. $E(r_A) \geq E(r_B)$ and $\sigma_B = \sigma_A$
D. $E(r_A) \leq E(r_B)$ and $\sigma_B < \sigma_A$

82. Which portfolio will the investor prefer according to the following figure?



A. Portfolio P
B. Portfolio Q
C. The investor treats P and Q equally
D. Need more information to know.

83. In Figure 6.3, in which quadrant the portfolio is always preferred compared with portfolio P?

A. Quadrant I
B. Quadrant II
C. Quadrant III
D. Quadrant IV

84. What is the risk premium of the risky portfolio in terms of rate of return rather than dollars?

A. 5%
B. 12%

C. 17%
D. 22%

85. A portfolio has an expected rate of return of 20% and standard deviation of 20%. Bills offer a sure rate of return of 7%. Which investment alternative will be chosen by an investor whose $A = 4$? What if $A = 8$?
A. The bills; the bills
B. The bills; the risky portfolio
C. The risky portfolio; the risky portfolio
D. The risky portfolio; the bills

86. Which of the following assets will risk-averse investors not likely to invest in?
A. fair games
B. risk-free assets
C. speculative prospects with positive risk premia
D. bills

Material VII - The Demand for Insurance in Healthy Economy

Health insurance underlies any discussion of the health economy. This text presents a classic model to consider the fundamental demand decisions regarding insurance.

How Much Insurance?

Suppose a middle aged woman called Elizabeth's expected utility involves her wealth when ill, with a probability of 0.10, or when healthy, with a probability of 0.90. If ill, her wealth will fall from $20,000 to $10,000.

We address Elizabeth's optimal purchase using marginal benefits and marginal costs. Consider first a policy that provides insurance covering losses up to $500. Although Elizabeth might find it hard to justify buying a $500 insurance policy when she will lose $10,000 if she falls ill, it is a useful place to start.

The goal of maximizing total net benefits provides the framework for understanding her health insurance choice. She benefits from health insurance only when she is ill and receives the insurance benefit payments. She still pays the insurance premiums when ill, but gains financially net of those premiums. When well only the premium applies to her, and this is a net cost.

Due to the diminishing marginal utility of wealth, the marginal costs when well will rise as when she purchases additional insurance. At the end, Elizabeth will buy insurance so that the marginal benefits of the last dollar spent equal the marginal costs.

Suppose she must pay a 20 percent premium ($100) for her insurance, or $2 for every $10 of coverage that she purchases. The following worksheet describes her wealth if she gets sick.

Table 7.1 Insurance Worksheet

	Original wealth	$20,000
less	Loss	$10,000
	Remainder	$10,000
plus	Insurance	500
	Sum	$10,500
less	Premium	100
or	**New** wealth	$10,400

For the initial coverage, Elizabeth's wealth if well is $20,000 less the $100 premium, or $19,900. Her marginal benefit from the $500 from insurance is the expected marginal utility that the additional $400 ($500 minus the $100 premium) brings. Her marginal cost is the expected marginal utility that the $100 premium costs. We describe these benefits and costs in Figure 7.1.

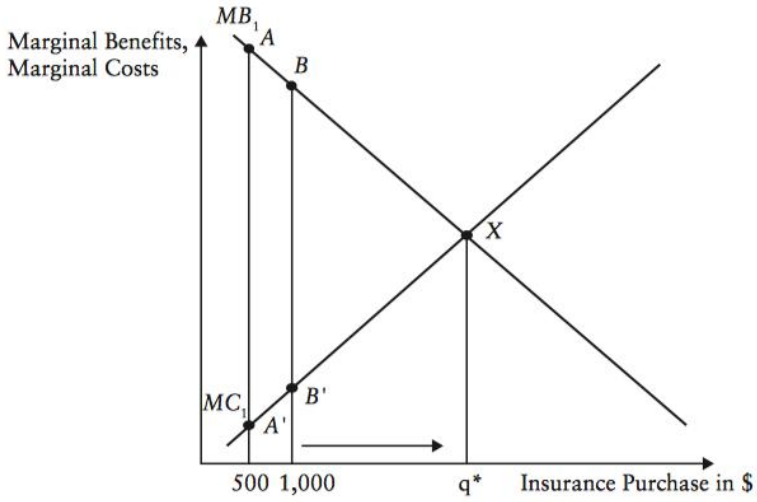


Figure 7.1 The Optimal Amount of Insurance

Should Elizabeth increase her coverage from $500 to $1,000? She must again compare the marginal benefits of this next $500 increment to its marginal costs. Because Elizabeth is slightly wealthier than before, if ill (starting at $10,400 rather than $10,000) the marginal utility from an additional $400 of wealth (calculated as before) will be slightly smaller than from the first $400. Hence, the marginal benefits from the second $500 insurance increment will be slightly smaller than for the first $500 increment.

Similarly, because if well she is a little less wealthy than before, an additional $100 in premiums will cost a little more in foregone (marginal) utility of wealth than the first increment at point B′. Thus, her marginal cost curve, MC_1 is upward sloping.

Continuing, we see that Elizabeth will adjust amount of insurance q that she

purchases to the point at which the marginal benefits equal the marginal cost. The quantity, q*, at which they are equal (point X) is Elizabeth's optimum insurance purchase. The x-axis of Figure 7.2 is drawn to scale, and it shows that q* is approximately $3,000.

Changes in Premium

How will her insurance decision change if premiums change, that is insurers raise the prices for the product they sell? Consider first the impact of a higher premium, say 25 percent rather than the 20 percent used earlier. With the 25 percent premium ($125), Elizabeth faces the following calculation for the starting $500 policy:

Table 7.2 Insurance Worksheet—Higher Premium Wealth If Ill

	Original wealth	$20,000
less	Loss	$10,000
	Remainder	$10,000
plus	Insurance	500
	Sum	$10,500
less	*New premium*	125
or	**New** wealth	$10,375

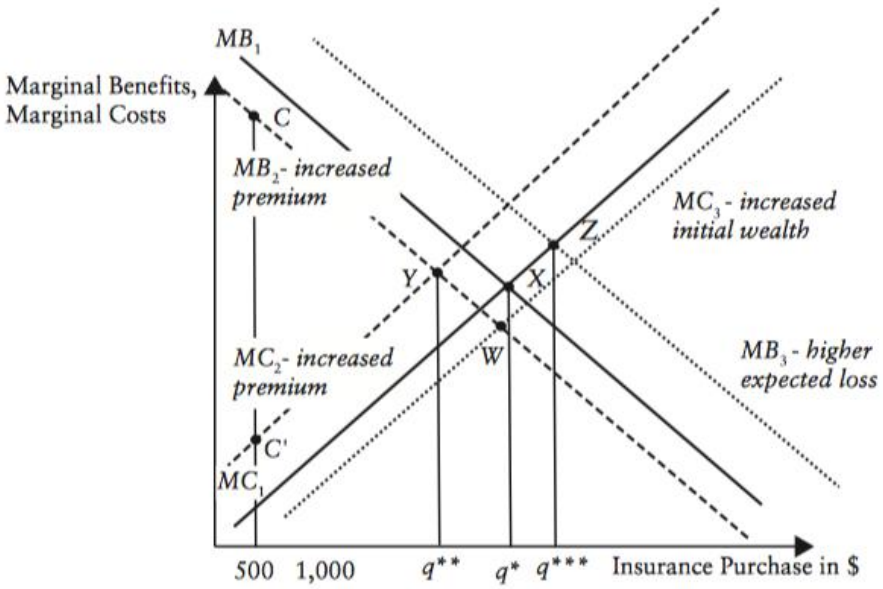


Figure 7.2 Changes in the Optimal Amount of Insurance

If she stays well, her wealth is $20,000 less the $125 premium, or $19,875. Look now at Figure 7.2. Elizabeth's marginal benefit from the $500 from insurance is now $375 rather than the previous value of $400, so point C lies on curve MB_2 below the previous marginal benefit curve, MB_1. We can fill in additional points on this curve, which reflects the higher premium.

Similarly, Elizabeth's marginal cost is the expected marginal utility that the new premium costs her. Again, we can fill in additional points on this curve and find the intersection of MB_2 and MC_2 at point Y. The resulting analysis suggests that consumers react rationally to higher premiums by reducing their optimum coverage from q* to q**.

【Questions】

87. When Elizabeth is well, the marginal benefits will increase as she purchases additional insurance coverage.
A. True.
B. False.

88. According to Figure 7.1, Elizabeth's marginal benefit curve, MB_1, is downward sloping, with her new marginal benefit at point B.
A. True.
B. False.

89. If premiums change, Elizabeth's marginal cost is the expected marginal utility that the $125 premium costs her.
A. True.
B. False.

90. For Elizabeth, the marginal utility from an additional $400 of wealth is _____ from the first $400.
A. slightly smaller than
B. slightly larger than
C. equal to
D. None of the above

91. If Elizabeth is averse to risk:
A. marginal benefit < marginal cost
B. marginal benefit > marginal cost
C. marginal benefit = marginal cost
D. marginal benefit and marginal cost cannot be compared

92. Why will the marginal benefits decline as Elizabeth purchases additional insurance coverage?
A. Normative economies
B. An increasing marginal product of labor
C. Economies of scale
D. Law of diminishing marginal utility

93. How will Elizabeth's marginal benefit change if premiums change?
A. $125 less
B. $125 more
C. $25 more
D. $25 less

94. According to Figure 7.1, Point X refers to Elizabeth's wealth if ___.
A. healthy
B. ill
C. either healthy or ill
D. None of the above

95. According to Figure 7.2, Elizabeth's marginal cost exceeds the previous cost in terms of foregone utility, so point C lies on ___.
A. curve MC_1
B. curve MC_2
C. curve MC_3
D. curve MB_1

96. Suppose Elizabeth expected to lose $15,000 if ill. Consider again the first $500 of insurance coverage. She must pay a premium ($100) for her insurance. Then her new wealth is ____.
A. $5,000
B. $5,400
C. $5,500
D. None of the above

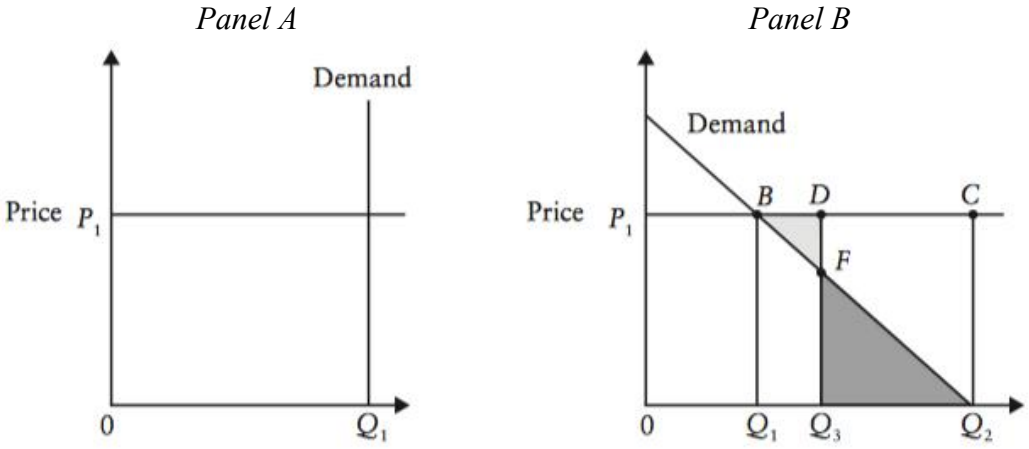
97. In our example, the purchase fall is from about $3,000 to ____.
A. $1,300
B. $1,800
C. $2,300
D. $2,800

98. Please fill in the blanks according to Table 7.1 and Table 7.2. Consider a change in initial wealth.

Insurance Worksheet—Increased Wealth		
Wealth If Ill		
	Increased wealth	$_____
less	Loss	
	Remainder	
plus	Insurance	
	Sum	
less	Premium	
or	**New** wealth	$15,400

A. $25,000
B. $21,000
C. $20,000
D. $18,000

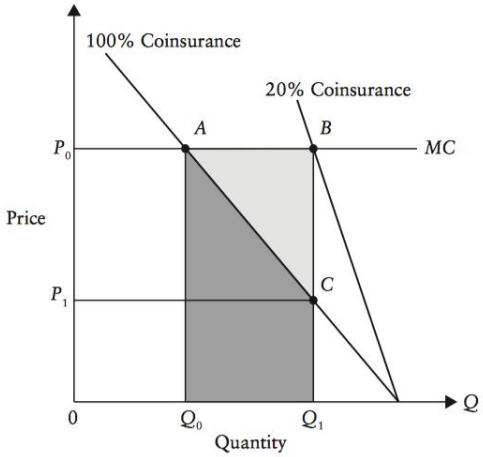
99. Suppose Elizabeth faces the same probability 0.5 that she will either not be sick or contract an illness that requires medical care. Due perhaps to a family history, Elizabeth fears that she will contract Type 1 diabetes—if so, without insulin she will die. In the below figure, panel A shows that her demand for insulin is ____, and panel B shows that her demand for insulin is ___.



A. elastic; inelastic
B. inelastic; elastic
C. inelastic; inelastic as well
D. None of the above

100. The following figure shows **health care demand with insurance**. Elizabeth pays only a small fraction of the bill, say, at a 20 percent coinsurance rate. This leads to a new equilibrium quantity demanded Q_1. The cost of bringing services to market has remained the same, P_0. Services valued at P_0Q_0 are now being

provided. Thus, the incremental amount spent is _____.



A. rectangle ABQ_1Q_0
B. rectangle ACQ_1Q_0
C. triangle ABC
D. None of the above

WORLD ECONOMICS CUP

Answer Keys

1. B
2. A
3. B
4. B
5. B
6. C
7. B
8. A
9. C
10. A
11. D
12. C
13. D
14. B
15. A
16. A
17. B
18. D
19. B
20. C
21. A
22. B
23. A
24. B
25. C
26. B
27. B
28. D
29. B
30. A
31. A
32. B
33. D
34. A
35. B
36. D
37. B
38. C
39. A
40. A
41. B
42. A
43. A
44. B
45. B
46. C
47. B
48. D
49. B
50. C
51. A
52. D
53. D
54. D
55. B
56. A
57. B
58. B
59. A
60. B
61. B
62. A
63. B
64. D
65. B
66. D
67. C
68. C
69. A
70. A
71. B
72. C
73. B
74. A
75. A
76. B
77. C
78. B
79. D
80. B
81. C
82. C
83. A
84. D
85. D
86. A
87. B
88. A
89. A
90. A
91. B
92. D
93. D
94. B
95. B
96. B
97. C
98. A
99. B
100. A