Chapter 4

5. The real wage in Home is 10, while real wage in Foreign is 18. If there is free movement of labor, then workers will migrate from Home to Foreign until the real wage is equal in each country. If 4 workers move from Home to Foreign, then there will be 7 workers employed in each country, earning a real wage of 14 in each country.

   We can find total production by adding up the marginal product of each worker. After trade, total production is 20 + 19 + 18 + 17 + 16 + 15 + 14 = 119 in each country for total world production of 238. Before trade, production in Home was 20 + 19 + 18 = 57. Production in Foreign was 20 + 19 + … + 10 = 165. Total world production before trade was 57 + 165 = 222. Thus, trade increased total output by 16.

   Workers in Home benefit from migration, while workers in Foreign are hurt. Landowners in Home are hurt by migration (their costs rise), while landowners in Foreign benefit.

6. If only 2 workers can move from Home to Foreign, there will be a real wage of 12 in Home and a real wage of 16 in Foreign.

   a. Workers in Foreign are hurt as their wage falls from 18 to 16.

   b. Landowners in Foreign benefit as their costs fall by 2 for each worker employed.

   c. Workers who stay at home benefit as their wage rises from 10 to 12.

   d. Landowners in Home are hurt as their costs rise by 2 for each worker employed.

   e. The workers who do move benefit by seeing their wages rise from 10 to 16.

Chapter 5

1. a. The first step is to compute the opportunity costs of both cloth and food. We are given the following resource constraints:

$a_{KC} = 2$, $a_{LC} = 2$, $a_{KF} = 3$, $a_{LF} = 1$ $L = 2000$; $K = 3{,}000$

Each unit of cloth is produced with 2 units of capital and 2 units of labor. Each unit of food is produced with 3 units of capital and 1 unit of labor. Furthermore, the economy is endowed with 2,000 units of labor and 3,000 units of capital. Given these values, we can define the following resource constraints:

$2Q_C + Q_F \leq 2000$ ➔ Labor constraint

$2Q_C + 3Q_F \leq 3000$ ➔ Capital constraint

Solve these two constraints for the quantity of food produced:

$Q_F \leq 2000 - 2Q_C$

$Q_F \leq 1000 - 2/3Q_C$

This gives us two budget constraints for food production that must *both* be met. The production possibilities frontier traces out these budget constraints for food and cloth production.

Looking at the diagram, we see that production of both food and cloth will take place when the relative price of cloth is between the two opportunity costs of cloth. The opportunity cost of cloth is given by the slopes of the two components of the production possibilities frontier above, 2/3 and 2. When cloth production is low, the economy will be using relatively more labor to produce cloth, and the opportunity cost of cloth is 2/3 a unit of food. However, as cloth production rises, the economy runs scarce on labor and must take capital away from food production, raising the opportunity cost of cloth to 2 units of food.

As long as the relative price of cloth lies between 2/3 and 2 units of food, the economy will produce both goods. If the price of cloth falls below 2/3, then the economy should completely specialize in food production (too low a compensation for producing cloth). If the price of cloth rises above 2, complete specialization in cloth will occur (too low a compensation for producing food).

b. Note the input requirements for each good. One unit of cloth can be produced using 2 units of capital and 2 units of labor. One unit of food is produced using 3 units of capital and 1 unit of labor. In a competitive market, the unit cost of each good must be equal to the output price.

$Q_C = 2K + 2L \rightarrow P_C = 2r + 2w$

$Q_F = 3K + L \rightarrow P_F = 3r + w$

This gives us two equations and two unknowns (r and w). Solve for the factor prices:

$w = P_F - 3r$

$P_C = 2r + 2(P_F - 3r) = 2r + 2P_F - 6r = 2P_F - 4r$

*** $r = (2P_F - P_C)/4$

*** $w = (3P_C - 2P_F)/4$

c. Looking at the two expressions in part (b), we see that an increase in the price of cloth will cause the rental rate of capital to fall and the wage rate to laborers to rise. This makes sense, as cloth is a labor-intensive good. An increase in its price will lead to greater production of cloth and an increase in demand for the factor it uses intensively—labor.

d. The capital stock increases to 4,000. The labor constraint will remain unchanged, keeping the maximum price of cloth at 2 units of food. The new capital constraint is given by:

$2Q_C + 3Q_F \leq 4{,}000$.

Solving for Q_F yields:

$Q_F \leq 1333 - 2/3Q_C$.

Thus, the minimum price of cloth is also unchanged at 2/3 units of food. The only difference now is that the production possibilities frontier will have a larger horizontal intercept (if cloth is on the horizontal axis). Compared to Figure 5-1, the new production possibilities frontier will intercept the x-axis at 2,000 instead of 1,500.

e. The actual production point for cloth and food will depend on the relative prices of cloth and food. If we assume that the economy is producing at a point such that all resources are being utilized (point 3 in Figure 5-1), then we can compute the quantities of cloth and food by setting the resource constraints equal to one another:

$Q_F = 1{,}333 - 2/3Q_C = 2{,}000 - 2Q_C.$

$2Q_C - 2/3Q_C = 2{,}000 - 1{,}333.$

$4/3Q_C = 667.$

$Q_C = 500.$

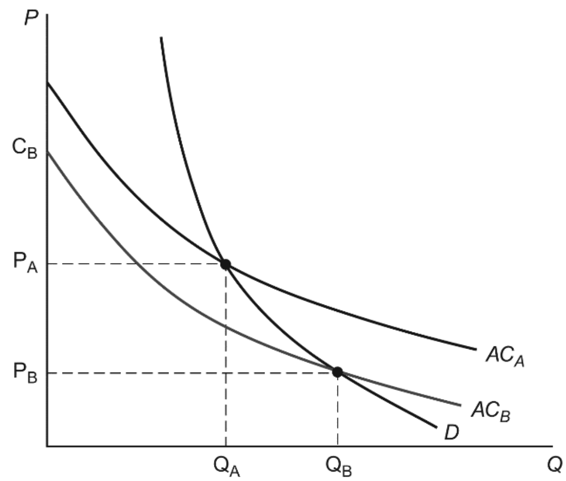
$Q_F = 1{,}333 - 2/3 \times 500 = 1{,}000.$

f. Prior to the expansion of the capital stock, the economy was producing 750 units of cloth and 500 units of food. After the expansion, cloth production *fell* to 500, while food production *increased* to 1,000. This is precisely what the *Rybczynski effect* predicts will happen.

Chapter 7

1. Cases *a* and *d* represent external economies of scale as industry production is concentrated in a just a few locations. The benefits of geographical clustering include a greater variety of specialized services to support industry operations, access to a larger pool of specialized labor, and thicker input markets. Cases *b* and *c* represent internal economies of scale because a single firm/plant is producing the output for the whole industry. As the output of a single firm increases, average costs will fall. This can lead to imperfect competition as it supports a limited number of firms in an industry.

2. This view is flawed in the sense that countries produce more than one good. Trade allows a country to free up resources from a relatively less efficient industry and expand production in industries with more efficient production. With increasing returns, this expansion of production will drive down costs.



There may be a case made for external economies leading to losses from trade, however. Consider the diagram above. Country A is an established producer and produces at quantity Q_A and price P_A. If country B were to enter into the industry, its initial startup cost would be at C_B. Because this is greater than P_A, country B will import this good. However, if country B were to be closed off from trade, then production would be at Q_B and price would be P_B. Thus, trade actually represents a situation worse than autarky for country B and protection may be warranted. However, actually identifying these situations is difficult, and protection may lead to unintended consequences (such as retaliatory tariffs).

Chapter 8

7. With internal economies of scale, there is imperfect competition, and firms set marginal revenue equal to marginal cost. Unlike the case of perfectly competitive markets, under monopoly, marginal revenue is not equal to price. Marginal revenue is always less than price under imperfectly competitive markets because to sell an extra unit of output, the firm must lower the price of all units, not just the marginal one. Furthermore, if internal economies of scale are driven by large fixed costs, then setting price equal to marginal cost would actually lead to negative profit for a firm that needs to set price above marginal cost to cover its fixed costs.

8. To solve this problem, we need to first find the equilibrium number of firms in the three country integrated market by setting average cost equal to price across all markets. We do this by first noting that average cost can be written as $AC = (nF/S) + c$ and price can be written as $P = c + (1/bn)$, where n is the number of firms, F is the fixed cost, S is the market size, c is the marginal cost, and b is a constant. Setting the average cost equal to price yields the following expression:

$(nF/S) + c = c + (1/bn)$.

$n^2 = (1/b) \times S/F$.

$n = [(1/b) \times S/F]^{1/2}$.

The numerical problem in the chapter gives us the following values:

$F = 750{,}000{,}000$.

$S_{Home} = 900{,}000$, $S_{Foreign} = 1{,}600{,}000$, $S_{Country\,3} = 3{,}750{,}000$.

$c = 5{,}000$.

$b = 1/30{,}000$.

Now compute the total market size as the sum of the market sizes in Home, Foreign, and Country 3:

$S = S_{Home} + S_{Foreign} + S_{Country\,3} = 900{,}000 + 1{,}600{,}000 + 3{,}750{,}000 = 6{,}250{,}000$.

Now plug in these values to solve for n:

$n = [30{,}000 \times 6{,}250{,}000/750{,}000{,}000]^{1/2} = 15.8$.

As we cannot have 0.8 firms enter into a market, we know that there will only be 15 firms that enter this market (the 16th firm knows that it cannot earn positive profits and will not enter). Once we know n, then solving for Q and P is straightforward:

$Q = S/n = 6{,}250{,}000/15 = 416{,}667$.

$P = c + (1/bn) = 5{,}000 + 30{,}000/15 = 7000$.

This price is lower than that charged when there were only two countries in the market.

3. We are given the following information (with all dollar amounts in thousands):

$F = 5{,}000{,}000{,}000$.

$c = 17{,}000$.

$S_{US} = 300{,}000{,}000$ $S_{EU} = 533{,}000{,}000$.

$P = c + (1/bn) = 17{,}000 + (150/n)$.

a. The condition we derived in Problem 2 was $n = [(1/b) \times S/F]$. Looking at the price equation above, we see that $1/b = 150$. Plug in the relevant parameters to solve for the equilibrium number of firms in the United States and the European Union:

$n_{US} = [150 \times 300{,}000{,}000/5000{,}000{,}000]^{1/2} = [9]^{1/2} = 3$

$n_{EU} = [150 \times 533{,}000{,}000/5000{,}000{,}000]^{1/2} = [16]^{1/2} = 4$

b. Without trade, there will be different prices in Europe and the United States:

$P_{US} = 17{,}000 + (150/3) = 17{,}050$

$P_{EU} = 17{,}000 + (150/4) = 17{,}037.5$

c. After trade, the new market size is $S = 300{,}000{,}000 + 533{,}000{,}000 = 833{,}000{,}000$

Simply plug this new market size into the equilibrium number of firms expression from part (a):

$n = [150 \times 833{,}000{,}000/5000{,}000{,}000]^{1/2} = [25]^{1/2} = 5$

$P = 17{,}000 + (150/5) = 17{,}030$

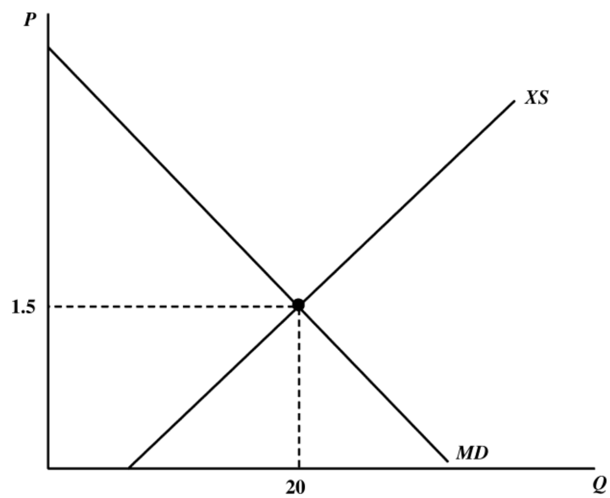
d. U.S. prices are lower in part (c) because of internal economies of scale. After trade, total world automobile production is produced by only 5 firms as compared to 7 firms before trade (3 in the United States, 4 in the European Union). These 5 firms each produce a larger quantity than the 3 U.S. firms did before trade. Because average costs fall as the quantity of production rises, the price of an automobile will fall as average production per firm rises. As a result, U.S. consumers benefit from free trade through lower prices.

Chapter 9

1. The import demand equation, MD, is found by subtracting the Home supply equation from the Home demand equation. This results in $MD = 80 - 40 \times P$. Without trade, domestic prices and quantities adjust such that import demand is 0. Thus, the price in the absence of trade is 2.

2. a. Foreign's export supply curve, *XS*, is $XS = -40 + 40 \times P$. In the absence of trade, the price is 1.

   b. When trade occurs, export supply is equal to import demand, $XS = MD$. Thus, using the equations from Problems 1 and 2a, $P = 1.50$, and the volume of trade is 20.



3. a. The new *MD* curve is $80 - 40 \times (P + t)$ where t is the specific tariff rate, equal to 0.5. (*Note*: In solving these problems, you should be careful about whether a specific tariff or *ad valorem* tariff is imposed. With an *ad valorem* tariff, the *MD* equation would be expressed as $MD = 80 - 40 \times (1 + t)P$. The equation for the export supply curve by the foreign country is unchanged.

   $MD = XS$

   $80 - 40 \times (P + 0.5) = 40P - 40$

   $80 - 20 - 40P = 40P - 40$

   $80P = 100$

$P^{World} = 1.25$

$P^{Home} = P^{World} + t = 1.25 + 0.5 = 1.75$

Trade $= MD = XS = (40 \times 1.25) - 40 = 10$

$D^{Home} = 100 - (20 \times 1.75) = 65$

$S^{Home} = 20 + (20 \times 1.75) = 55$

$D^{Foreign} = 80 - (20 \times 1.25) = 55$

$S^{Foreign} = 40 + (20 \times 1.25) = 65$

b. and c. The welfare of the Home country is best studied using the combined numerical and graphical solutions presented below in Figure 9-1.

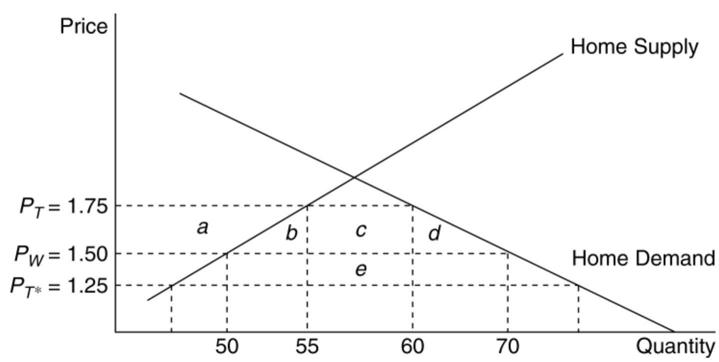


Figure 9-1. (In the figure, the quantity demanded at price 1.75 should be 65 instead of 60)

where the areas in the figure are:

a. $55(1.75 - 1.50) - 0.5(55 - 50)(1.75 - 1.50) = 13.125$

b. $0.5(55 - 50)(1.75 - 1.50) = 0.625$

c. $(65 - 55)(1.75 - 1.50) = 2.50$

d. $0.5(70 - 65)(1.75 - 1.50) = 0.625$

e. $(65 - 55)(1.50 - 1.25) = 2.50$

Consumer surplus change: $-(a + b + c + d) = -16.875$. Producer surplus change: $a = 13.125$. Government revenue change: $c + e = 5$. Efficiency losses $b + d$ are exceeded by terms of trade gain e. (*Note*: In the calculations for the *a*, *b*, and *d* areas, a figure of 0.5 shows up. This is because we are measuring the area of a triangle, which is one-half of the area of the rectangle defined by the product of the horizontal and vertical sides.)

4. Using the same solution methodology as in Problem 3, when the Home country is very small relative to the Foreign country, its effects on the terms of trade are expected to be much smaller. The small country is much more likely to be hurt by its imposition of a tariff. Indeed, this intuition is shown in this problem. The free trade equilibrium is now at the price $1.09 and the trade volume is now 36.40.

   With the imposition of a tariff of 0.5 by Home, the new world price is $1.045, the internal Home price is $1.545, Home demand is 69.10 units, Home supply is 50.90, and the volume of trade is 18.20. When Home is relatively small, the effect of a tariff on world price is smaller than when Home is relatively large. When Foreign and Home were closer in size, a tariff of 0.5 by Home lowered world price by 25%, whereas in this case the same tariff lowers world price by about 5%. The internal Home price is now closer to the free trade price plus t than when Home was relatively large. In this case, the government revenues from the tariff equal 9.10, the consumer surplus loss is 33.51, and the producer surplus gain is 21.089. The distortionary losses associated with the tariff (areas $b + d$) sum to 4.14 and the terms of trade gain (e) is 0.819. Clearly, in this small country example, the distortionary losses from the tariff swamp the terms of trade gains. The general lesson is that the smaller the economy, the larger the losses from a tariff because the terms of trade gains are smaller.

5. The effective rate of protection (*ERP*) is defined as $(V_t - V_w)/V_w$, where V_t is the value added under protection and V_w is the value added under free trade. We define value added as the difference between the price of the final good and the price of components. So, V_w = \$200 − \$100 = \$100. With a 50% tariff on bicycles (and a 0% tariff on components), V_t = (\$200 × 1.5) − \$100 = \$300 − \$100 = \$200. Therefore, the *ERP* = (200 − 100)/100 = 100%.

6. The effective rate of protection takes into consideration the costs of imported intermediate goods. Here, 55% of the cost can be imported, suggesting with no distortion, Home value added would be 45%. A 15% increase in the price of ethanol, though, means Home value added could be as high as 60% (45% Home value added under free trade +15% increase in the price of ethanol). Effective rate of protection = $(V_t - V_w)/V_w$, where V_t is the value added in the presence of trade policies, and V_w is

the value added without trade distortions. In this case, we have $(60 - 45)/45 = 33\%$ effective rate of protection.

7. We first use Foreign's export supply and Home's import demand curves to determine the new world price. The Foreign supply of exports curve, with a Foreign subsidy of 0.5 per unit, becomes $XS = -40 + 40(1 + 0.5) \times P$. The equilibrium world price is 1.2, and the internal Foreign price is 1.8. The volume of trade is 32. The Foreign demand and supply curves are used to determine the costs and benefits of the subsidy. Construct a diagram similar to that in the text and calculate the area of the various polygons. The government must provide $(1.8 - 1.2) \times 32 = 19.2$ units of output to support the subsidy. Foreign producer surplus rises due to the subsidy by the amount of 15.3 units of output. Foreign consumer surplus falls due to the higher price by 7.5 units of the good. Thus, the net loss to Foreign due to the subsidy is $7.5 + 19.2 - 15.3 = 11.4$ units of output. Home consumers and producers face an internal price of 1.2 as a result of the subsidy. Home consumers surplus rises by $70 \times 0.3 + 0.5 \quad (6 \times 0.3) = 21.9$, while Home producer surplus falls by $44 \times 0.3 + 0.5(6 \times 0.3) = 14.1$, for a net gain of 7.8 units of output.