

# Theories of International Trade

# 2

## **Unit Highlights:**

- ® The mercantilist Thesis on Trade.
- ® The Theory of Absolute Advantage.
- ® The Theory of Comparative Advantage.
- ® Gains from International Trade.
- ® The Heckscher-Ohlin model.
- ® The Rybezynski Theorem.

© The Stolper-Samuelson Theorem.

## Lesson 1 : Theory of Absolute and Comparative Advantage

### Lesson Objectives

After studying this lesson, you will be able to

- ® know why the mercantilists objected to free trade;
- ® see why absolute advantage makes for beneficial trade;
- ® see why comparative advantage is a yet better basis for trade and
- ® identify the gains from international trade in general.

### The Mercantilist Thesis on Trade

International trade has a long history, evolving through various stages each of which has been marked by debates about the costs and benefits of international trade to the country concerned. One phase known as mercantilism which held sway in the 17th and 18th centuries occupies a central place in this controversy. Not surprisingly, the economic ideas in this phase, as in any other, have been shaped and moulded by the emerging trends in the social and political life in Europe at the close of the medieval age.

The particularistic feudal economy of the Middle Ages slowly gave way to the growth of commerce between large, wealthy and powerful nation states. As kings built their powers by destroying both the particularism of the feudal society and the universalism of the Church's spiritual powers, they began to seek legal and philosophical justifications for their increased royal authority. The kings wanted to use the resources of the state for, in the words of Eli P. Heckscher, "Strengthening the power of the same in competition with other states. While the medieval conception of the object of human effort was the salvation of human souls and while economic liberalism, or *laissez faire*, aimed at the temporal welfare of individuals, mercantilist statesmen and writers saw in the subjects of the state means to an end, and the end was the power of the state itself."

In this view, monetary, protectionist and other economic policies are regarded as instruments for the building up of nation states and for strengthening them against rivals abroad and the remains of medieval particularism at home. An alternative explanation of the rise of mercantilism gives primacy to economic factors. According to this view, the very reason for strengthening the nation states arose from changes in economic structure as reflected in the growing power of commercial capital. As a matter of fact, there are elements of truth in both the views, because the relations between economic organizations and political institutions must be viewed as one of interaction. We are less concerned here about the causes of emergence of mercantilism than about its contents and policy prescription.

What then is the essence of the mercantilist philosophy? Essentially, it advocates that all economic activities should be directed not towards satisfying individual needs and desires, but to increase state power, and so, all the resources of the state should be harnessed to this end. And since state's power depends fundamentally on national wealth, acquisition of wealth should be relentlessly pursued by all possible means. The mercantilists embraced a body of thought which identified wealth with gold and silver. The larger the stock of precious metals like gold and silver, the wealthier the nation state is. The necessary logical step was thought to be strict regulation of economic life by encouraging population growth in order to

In the past, many trade restricting policies were employed as instruments of strengthening the state power.

Acquisition of wealth for increasing state power is to be pursued by all means.

keep wages low, protecting agriculture and industry, keeping the trade balance favourable and so on.

Mercantilists advocated protective tariff to discourage imports.

We are primarily concerned with mercantilist views on trade. The mercantilists encouraged a favourable trade balance because by ensuring larger inflows of silver and gold than outflows it helped stockpiling of these precious metals. And to keep the trade balance as favourable as possible, the value of exports should be maximized and that of imports minimized. They advocated protective tariffs to discourage the imports of luxury items, and import of essential raw materials only were viewed with less concern. In short, the mercantilist policies were all designed and implemented to restrict and regulate international trade which was seen not as a virtue in itself but rather as an instrument of building up a wealthy and powerful nation.

### Three Pertinent Questions Regarding Trade

The mercantilists missed the issues which really mattered in the case of international trade. The economists who subsequently raised and tried to answer these pertinent questions are known as classical economists. Among them were such notables as Adam Smith, David Ricardo and John Stuart Mill. They raised the following three sets of questions:

Important questions of trade concern gains from trade, patterns of trade, and terms of trade.

1. What are the gains from trade, if any? What are the sources of gains from trade and what factors determine the division of these gains among the trading partners? Or, to put it negatively, what is the cost of preventing free trade and of trying to attain self-sufficiency?
2. Should trade prove to be mutually beneficial, what determines the patterns of trade? In other words, which goods should each trading country export and import in order to reap the benefits of trade? And related to this is the question: What factors determine the international allocation of factor of production?
3. What factors determine the terms of trade (i.e. the prices at which goods are sold internationally) at which trade has to take place, if it is to be beneficial to at least one country and harmful to none? Do such price ratios necessarily exist?

Needless to say, these questions form the bedrock of the pure theory of international trade.

### Absolute and Comparative Advantage

The mercantilist ideas about regulating foreign trade by encouraging exports and discouraging imports drew sharp reactions later from economists and political philosophers. Noted among them were John Locke and David Hume. But the most convincing rebuttal came from Adam Smith who epitomized the spirit of individualism, dominant in the mid-eighteenth century. He brilliantly exposed the fallacies of the mercantilist doctrine of regulated trade and demonstrated that free international trade based on international division of labour could benefit all trading partners.

### The Theory of Absolute Advantage

Any theory of international trade must cope with answering two basic questions: (a) what determines the patterns of trade, and (b) who gains from trade. Adam Smith's answer draws on the idea of benefits from voluntary exchange following

specialization based on the division of labour. The shoemaker and the tailor can concentrate on their own lines of production and then exchange each other's goods. This system of specialization and exchange could make both better off than when each made both shoes and shirts. Adam Smith extended this principle of division of labour to nations engaged in international exchange of goods and services. He argued that under certain circumstances, to be elaborated below, two countries could make themselves better off by trading than in isolation. His explanation known as the theory of absolute advantage, though incomplete, is a brilliant exposition of the virtues of free trade.

Free trades argued that often two countries could make themselves better off by trading than in isolation.

It should be understood that the advantages referred to by Adam Smith are based on differences in the cost of production. Under the labour theory of value to which classical economists, including Adam Smith, subscribed, the cost differences translate into price differences in a straightforward fashion. Absolute cost differences then must lead to absolute price differences which form the basis of mutually profitable trade. Costs refer to labour costs of production. This implies that other factors of production such as land and capital are used in some fixed proportion to labour so that their identities could be merged with that of labour (as a single input). Besides, the technology of production is such that for each unit of output of any given good the amount of labour required is fixed irrespective of the level of output. For example, if the unit cost of production of cloth is 5 labour hours when the output of cloth is 10 units, then the unit cost would still be 5 labour-hours when the output is 100, 10,000 or 100,000 units. The constant unit cost assumption applies to goods in the home country as well as the foreign country, but the unit costs can vary across goods and between countries.

In this theory, costs refer to labour cost of production.

Let us now examine how the ratio of unit costs determines the ratio of goods prices within a given country in the absence of trade. Hypothetical data on the costs of production of two goods - cloth and food- in two countries, Thailand and Japan are presented in Table 2.1 below :

Table 2.1

**Labour Costs of Production (Hours)**

Country	1 unit of food	1 unit of cloth
Thailand	15	30
Japan	30	15

It is clear from Table 2.1 that to produce a unit of cloth Thailand requires twice as much labour as to produce a unit of food. Therefore, in isolation (a situation usually known as autarky) one unit of cloth will exchange for two units of food. By analogous reasoning, the autarky price of a unit of food in Japan will be two units of cloth.

Table: 2.2

Country	Price per Unit	
	Food	Cloth
Thailand	$\frac{1}{2}$ unit of cloth	2 units of food
Japan	2 units of cloth	$\frac{1}{2}$ unit of food.

The price of each good in terms of the other in the two countries is shown in Table 2.2. The price of food in Japan is two times as high as in Thailand, while the price of cloth in Thailand is two times as high as in Japan. In other words, food is absolutely cheaper in Thailand and cloth in Japan. We can express the same idea

in symbols. Denoting  $\left(\frac{P_F}{P_C}\right)$  as the relative price of food in terms of cloth and

$\left(\frac{P_C}{P_F}\right)$  as the relative price of cloth in terms of food, we can see that

$$\left(\frac{P_F}{P_C}\right)_{\text{Thailand}} = \frac{1}{2} < \left(\frac{P_F}{P_C}\right)_{\text{Japan}} = 2$$

$$\text{and } \left(\frac{P_C}{P_F}\right)_{\text{Japan}} = \frac{1}{2} < \left(\frac{P_C}{P_F}\right)_{\text{Thailand}} = 2$$

Let us suppose that the two countries can trade at the ratio of 1:1 i.e. 1 unit of food for 1 unit of cloth (which is intermediate between domestic price ratios). Then Japan is better off by exporting cloth to (and importing food from) Thailand. Likewise, Thailand gains by exporting food to Japan and importing cloth from it. Japan enjoys an absolute advantage in the production of cloth, while Thailand has the same advantage in food.

We can easily show that trade is mutually beneficial. For example, Thailand can produce a unit of food using 15 hours of labour and export it to Japan obtaining one unit of cloth. To produce one unit of cloth at home Thailand has to spend 30 hours of labour. By spending 15 hours of labour, Thailand can thus get an amount of cloth which would have cost it 30 hours of labour to produce at home. Trade therefore, enables it to save 15 (=30-15) hours of labour which it can then use to produce 1 unit of food (for instance, to make up for the loss of 1 unit in exports). The symmetry of the example ensures that by exporting a unit of cloth to Thailand, using 15 hours of labour, Japan could get 1 unit of food, saving 15 hours of labour which could be used to produce a unit of cloth for domestic consumption. In short what the theory of Absolute Advantage teaches is this :

By exporting the goods in which it has absolute cost advantage and importing the goods in which it had absolute cost disadvantage, a country can make itself better off than in autarky.

### Theory of Comparative Advantage

Perhaps it was relatively easier for Adam Smith to show that if one country enjoys absolute (cost) advantage in one good and another country in a different goods, then both can gain by exporting the goods in which each has absolute advantage (and importing the good in which each has absolute disadvantage). But while this may be a sufficient basis for mutually profitable trade (and a good deal of trade is based on this principle), this is not a necessary condition. If a country has absolute advantage in the production of all goods, profitable trade can still take place, though not always. For trade to be profitable in such a scenario, there must be comparative differences in costs (i.e. comparative advantage) between the two countries in the production of potentially tradable goods. The successful demonstration of this proposition was left to the genius of David Ricardo in the first quarter of the nineteenth century (however, the earliest, though admittedly less elegant, formulation of the principle is attributed to Robert Tarrens (1780-

It is clear that both countries benefit by free trade.

A country can produce all goods at lower unit (labour) costs than the other, and can still gain by trading with the latter.

1874). Interestingly, it remains one of the oldest and still serviceable theories in economics.

What is then, comparative advantage? Let us recall that if a country can produce all goods at lower unit (labour) costs than the other, the former is said to possess absolute advantage in all goods. In this sense, the costs figures given in Table 2.3 indicate, that Thailand has absolute advantage in the production of both food and cloth. The point here is whether there can be a profitable trade in terms of comparative advantage, a concept best understood if expressed in terms of opportunity costs.

A trade on the basis of comparative advantage is profitable.

Table 2.3 : Labour Costs of Production (Hours)

Country	1 unit of food ( $a_{LF}$ )	1 unit of cloth ( $a_{LC}$ )
Thailand	15	18
Japan	40	30

Table 2.4 : Opportunity Costs of Production

Country	1 unit of food ( $a_{LF}/a_{LC}$ )	1 unit of cloth ( $a_{LC}/a_{LF}$ )
Thailand	$15/18 = \frac{5}{6} = .83$	$18/15 = \frac{6}{5} = 1.2$
Japan	$40/30 = \frac{8}{6} = 1.33$	$30/40 = \frac{3.75}{5} = .75$

The opportunity cost of food in terms of cloth is the amount of cloth given up in order to release resources for producing an additional unit of food. The opportunity costs of one good in terms of the other based on labour cost figures of Table 2.3 are shown in Table 2.4. For example, to produce a unit of food in Thailand will require 15 labour hours which, if released from the production of cloth, will entail a sacrifice of  $\frac{5}{6}$  unit of cloth. Table 2.4 also shows that the opportunity cost of food (in terms of cloth) is lower in Thailand than in Japan. On the other hand, the opportunity cost of producing cloth is lower in Japan. And this is so despite the fact that unit (labour) cost of producing food and cloth are both lower in Thailand.

A country is said to have comparative advantage in production of the good in which its opportunity cost of production is lower. Therefore, on the basis of Table 2.4, we can say that Thailand has comparative advantage in food and Japan in cloth (although Japan has absolute advantage in both).

The theory of comparative advantage then asserts that a country will gain by exporting the good in which it has comparative advantage, while importing the good in which it has comparative disadvantage (higher opportunity costs). Note that for the notion of comparative advantage to be meaningful there must be at least two countries and at least two goods.

A country is said to have comparative advantage in production of the good in which its opportunity cost of production is lower.

**Gains from Trade in the Ricardian Model of Comparative Advantage**

It can be easily shown that both the trading countries (here Thailand and Japan) are better off by trade following the lines of specialization indicated by comparative advantage. If Japan can import one unit of food from Thailand at a

Both the trading countries are shown to be better off by trade on the basis of comparative advantage.

price lower than 1.33 units of cloth, it clearly stands to gain. On the other hand, Thailand gains if it can import a unit of cloth at a price lower than 1.2 units of food (Table 2.4). Let us suppose that the international price settles at 1 unit of cloth for 1 unit of food (which is in the range indicated above). Then Japan gains because through trade it gets 1 unit of food by sacrificing 1 unit of cloth, while under autarky it has to give up 1.33 units of cloth to produce and consume one unit of cloth. The additional 0.33 unit of cloth (saved) can be consumed or can be exported to import more food or the country may even choose to consume the same levels of food and cloth as under autarky, while the workers enjoy more leisure. By similar reasoning, it can also be shown that at the given international terms of exchange, Thailand too is better off through trade (exporting food and importing cloth) than in autarky. It gets 1 unit of cloth for 1 unit of food by trade and thus saves 0.2 unit of food which it can dispose of in three ways (or any combination): consuming more food at home, exporting to Japan for more cloth, or allowing the worker more leisure made possible by consuming the autarkic levels of consumption of food and cloth.

The total output of food depends on the amount of cloth, because supply of labour and  $a_{LC}/a_{LF}$  are constant.

### Ricardian Comparative Advantage & the Extent of Specialization

As we have seen, Ricardo assumed constant average and marginal costs of production irrespective of the levels of output (by assuming constant labour productivities for all scales of output). We now want to explore what implication does this assumption have for the extent of specialization in each country, and in the process we will examine Ricardian conclusions diagrammatically. Let  $a_{LF}$  and  $a_{LC}$  be the amount of labour needed to produce a unit of food and a unit of cloth respectively. With a fixed supply of labour,  $L$ , and these input co-efficients, the total output of food ( $Q_F$ ) and of cloth ( $Q_C$ ) are technologically related in the following way :

$$a_{LF} Q_F + a_{LC} Q_C = L$$

$$\text{or, } Q_F = \frac{L}{a_{LF}} - \frac{a_{LC}}{a_{LF}} \cdot Q_C$$

Clearly  $Q_F$  depends linearly on the amount of  $Q_C$  produced, because  $a_{LC}/a_{LF}$  is a constant (by assumption). The relation is diagrammatically expressed in Fig 2.1 by the linear production possibilities curve, AB. The slope of the line indicates constant opportunity cost of one good in terms of the other (considering labour costs only). For example, if  $a_{LC}=18$  and  $a_{LF}=15$ , then to produce every additional unit of cloth the country must sacrifice 1.2 ( $=18 \div 15$ ) units of food. In the absence of trade, therefore, one unit of cloth will exchange for 1.2 units of food in Thailand (see Table 2.4).

Note that with the constant production possibilities curve like AB, the internal (pre-trade) price ratio is solely determined by the slope of the production possibilities curve (i.e by the relative labour productivities in the two goods). The demand (the taste pattern) had no role to play in the relative price determination as long both the goods are consumed. Apparently this sounds odd. In Fig. 2.1 two indifference curves (representing two different taste patterns) are tangent to AB at points R and R'. Clearly, if the taste patterns change, the country may shift the consumption (and production) point from R to R', and the price ratio remains the



same  $\left(\frac{a_{LC}}{a_{LF}} = \frac{OA}{OB}\right)$ . Something changes though. It is the consumption bundle

which changes when taste patterns change. In short, the price ratio is set exclusively by technology and that the role of demand is limited to determination of relative quantities in the consumption bundle : technology determines the price ratio, while the taste pattern determines the relative quantities.

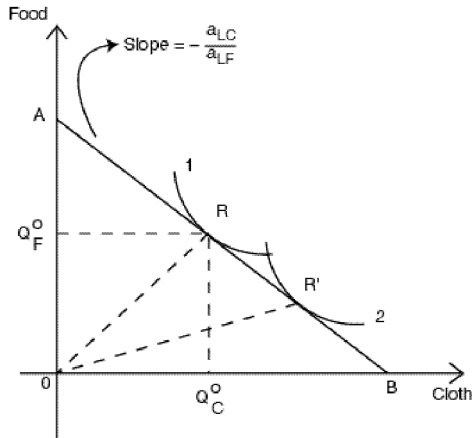


Fig. 2.1

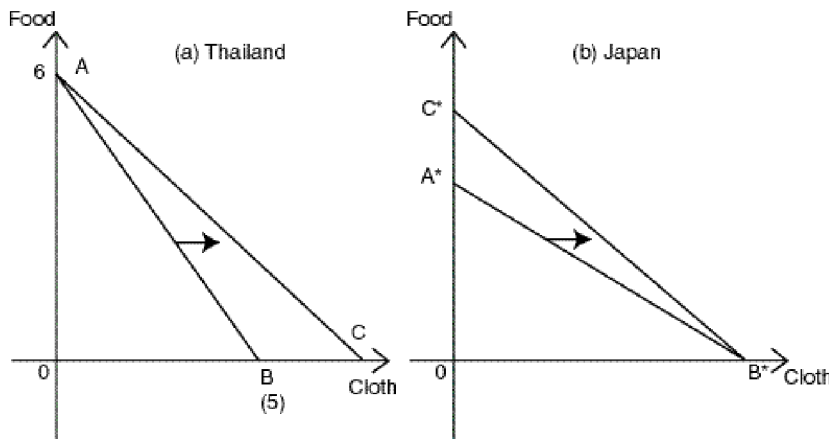


Fig. 2.2

Figure 2.2 is designed to show that difference in technologies (i.e. difference in labour productivities) between the two countries can give rise to potentials for mutually beneficial trade and particularly to show that trade will usually lead to complete specialization of production of the commodity in which the country enjoys comparative advantage. AB and A\*B\* are pre-trade production possibilities curves for Thailand and Japan respectively. In conformity with the opportunity cost data shown in Table 2.4, the lines in Fig 2.2 are so drawn that  $\frac{OA}{OB} > \frac{OA^*}{OB^*}$ .

Trade will usually lead to complete specialization of the commodity in which the country enjoys comparative advantage.

to reflect the fact that cloth is cheaper in Japan, while food is cheaper in Thailand (because  $\frac{OB}{OA} < \frac{OB^*}{OA^*}$ ).

As stated before, there exists an opportunity for mutually beneficial trade, if Thailand exports food and Japan exports cloth. But at what price? Clearly the price of cloth should be somewhere between absolute values of slopes of the two linear production possibilities curves (AB and A\*B\*), i.e. between  $\left| \frac{OA}{OB} \right|$  and  $\left| \frac{OA^*}{OB^*} \right|$ . The Ricardian model does not offer any mechanism for unique price determination. But whatever price is established in equilibrium, it must exhibit two features: (i) the relative equilibrium price of cloth (and so also the equilibrium price of food) must be the same in the two countries, and (ii) it should be such that the value of exports of each country at the price must be matched by the value of imports from the other.

Free trade makes both countries better off, by expanding the consumption opportunity sets of both.

To see diagrammatically that comparative cost difference can lead to mutually profitable trade, let us go back to Fig. 2.2. In each country, the production and consumption possibilities before trade are the same (only what is produced can be consumed). After trade, the consumption possibilities set gets larger, though the sets of production possibilities remain unaltered. For example if the equilibrium price ratio is 1:1, then the consumption possibilities set for Thailand is  $\Delta AOC$  rather than  $\Delta AOB$  (and  $\Delta AOC$  is larger than  $\Delta AOB$ ). Similarly the consumption possibilities set for Japan after trade is given by  $\Delta B^*OC^*$  which is larger than  $\Delta B^*OA^*$ , representing pre-trade consumption possibilities. Not surprisingly, free trade can make both countries better off, because of the expansion of the consumption opportunity sets. But while the technology difference may not lead to complete specialization in consumption, it may do so in production. Usually Thailand will completely specialize in the production of food (consuming cloth from imports only) and Japan in cloth (meeting need for food entirely from imports), because not doing so amounts to giving up an opportunity for betterment. As we shall see later, the only exception to the conclusion of complete specialization and the Ricardian assumptions to the situation is when one of the two trading countries is much larger than the other.

## Questions for Review

MCQ's (Tick (✓) the correct [most appv.] answer)

1. The Mercantilists
  - A. rejected all trade and advocated a closed economy
  - B. encouraged exports and discouraged imports
  - C. wanted to make the country wealth
  - D. both B and C
  - E. None of the above.
2. Trade will take place between two countries if-
  - A. comparative costs differ between them
  - B. price differ between them
  - C. A and B being true, they fail to settle on the terms of exchange
  - D. A and B being true, they agree on the terms of exchange
  - None of the above.
3. In the Ricardian theory of comparative advantage the relative price of two goods within a country determined
  - A. solely by technology
  - B. solely by taste patterns
  - C. partly by taste patterns
  - D. all of the above.
4. In the Ricardian theory,
  - A. the average cost (AC) equals marginal cost (MC)
  - B.  $AC > MC$
  - C.  $AC < MC$
  - D. we have usually complete specialization
  - E. A & D.
5. In the post-trade equilibrium, the relative equilibrium price will be equal in the two countries. Therefore,
  - A. trade will cease until price change for one reason or another
  - B. trade will continue
  - C. trade will be balanced
  - D. Both B & C
  - E. None.

### Broad Questions :

1. Briefly discuss the mercantilist thesis on trade.
2. Discuss the theory of absolute advantage and point out its limitations.
3. Country A and country B both produce food and cloth. A has comparative advantage in cloth. Does it imply that B has comparative advantage in food? Demonstrate with an example.

### Short Questions

1. The Mercantilists wanted to make the state as powerful (in terms of wealth) as possible. Why? Was wealth a means to an end, or an end in itself?
2. What are the three pertinent questions regarding trade? Briefly explain.
3. "Absolute advantage is a sufficient condition for profitable trade, but it is not a necessary condition." Do you agree? why?
4. "The Ricardian theory seems strange, because it explains price formation without ever considering the demand conditions." Do you agree?
5. Explain why trade enables each country to expand its consumption opportunity sets.

Answer : 1.D 2.D 3.A 4.E 5.D

## Lesson 2 : Comparative Advantage Theory: Additional issues

### Lesson Objectives:

After studying this lesson, you will able to

- ® see that the comparative costs theory can be recast in monetary terms;
- ® see how the relative size influences the extant of specialization and
- ® apply the theory of comparative advantage to increasing opportunity costs situations.

### Ricardian Comparative Advantage in Terms of Money

Ricardian conclusion about the trade patterns can be restated in monetary terms too. In fact, in the two country, two-goods and one-factor world of Ricardo, national currencies do not matter. Assume that the wage rate per hour is 20 bahts in Thailand and 100 yens in Japan. Then the labour costs of production stated in Table 2.3 can be expressed in monetary terms as shown in Table 2.5 :

Table 2.5 : Money Costs of Production

Country	Cost of 1 unit of food	Cost of 1 unit of cloth
Thailand	300 (bahts)	360 (bahts)
Japan	4000 (yens)	3000 (yens)

Clearly 1 unit of cloth in Thailand must exchange for 1.2 units of food as stated before (Table 2.4). Other relative costs shown in Table 2.4 are also unaffected by the introduction of money. Therefore, the conclusion about the directions or patterns of trade are unchanged too. Before trade food is cheaper in Thailand, while cloth is cheaper in Japan, and so Thailand should export food and Japan cloth.

Thailand is better off by exporting food and Japan by exporting cloth.

To see more clearly that Thailand is better off by exporting food at the prices shown in Table 2.5, assume a Thai businessman with 3,600 bahts. With this amount, he can buy 12 ( $=3,600 \div 300$ ) units of food in Thailand and sell them in Japan for 48,000 ( $=12 \times 4000$ ) which he can then use to buy 16 ( $=48,000 \div 3000$ ) units of cloth in Japan. These 16 units of cloth, when sold in Thailand, will bring him 5,760 ( $=16 \times 360$ ) bahts. Since he started with 3,600 bahts, he gains a profit of 2,160 ( $=5,760 - 3,600$ ) bahts at the end of the series of transactions. This possibility of gaining by arbitrage shows that Thailand can gain by selling food to Japan, buying cloth from it in exchange. It is left as an exercise to show that Japan too can reap similar gains by exporting cloth to Thailand and importing food from it, and that the levels of wages assumed for the illustration above do not really matter. The conclusions hold irrespective of the wage levels assumed. For wages, it is sufficient to assume that as long as both goods are produced in the country all workers employ in the production of the two goods get the same money wage (perfect labour mobility).

### Irrelevance of Size and Taste Differences

Neither the difference in the size of the country (i.e. the size of the labour force) nor in taste patterns between countries is a sufficient basis for trade in the

Ricardian scheme. The really crucial factor is the difference in technologies. Let us see why the size and taste differences don't really matter, as long as the technology (represented by the labour productions) remains the same. As we have seen, taste differences play no role in price formation, their only role being determination of relative quantities consumed. The size of the labour force determines the position of the production possibility curves of the two countries. If the technology is the same, their slope will be the same, and therefore price differences will not emerge. We can then say that technology differences lead to cost difference irrespective of similarity or otherwise of tastes and size of the countries concerned. But this statement should be carefully interpreted. If one of the two countries are uniformly superior to the other in technology, relative cost differences will not appear. To see why, suppose that Thailand can produce a unit of output of either commodity with 20% fewer labour hours that would be required in Japan. For simplicity assume that Japan and Thailand have labour force of the same size. Then the production possibilities curve for Thailand will be uniformly outward by 20% (compared to that for Japan), but there will be no difference in their slopes. Therefore, the effect of 20% superiority is like that of having a 20% larger labour force in Thailand with the same labour productivity in the two countries. Pre-trade relative price being the same, there is no opportunity to gain from trade.

**Relative Size of Countries and the Extent of Specialization**

We have just seen why the relative sizes of the countries (measured in terms of relative sizes of the labour force) do not influence the patterns of trade. It should be emphasized however that while the relative size is irrelevant for trade patterns, it is not so for determining the international terms of exchange, i.e. the terms of trade. If one country is much larger than the other, the international price may not lie strictly between the cost ratios in each country. It could be that the equilibrium terms of trade will be identical to those prevailing in the larger country before trade, implying that the larger country derives no benefit from free trade (though the smaller country does). 'Bigness' is then not necessarily a boon; and in fact, the opposite may be true in the field of international trade.

The relative size is irrelevant for explaining trade patterns, but not so for terms of exchange.

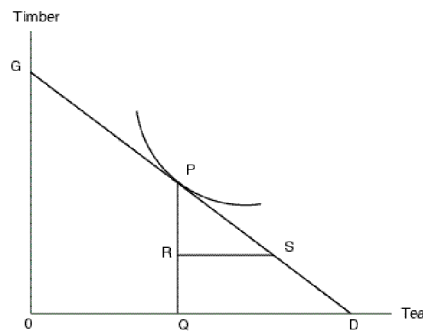


Fig 2.3

When can this happen? Consider two countries, India and Nepal. India has comparative advantage in the production of tea, while Nepal has this advantage in timber. India being a very big country compared to Nepal, it cannot hope to meet all its demand for timber through imports from Nepal (assume that there are only two countries in the world, India and Nepal). Therefore, India must produce along with tea perhaps a large quantity of timber too. But then the price of timber must reflect the costs of production at home which implies that the international price

which will prevail is the pre-trade relative price in India. In Fig. 2.3, the slope of the line GD reflects the pre-trade and post-trade relative price of tea in India. At the consumption point (P), India's demand for timber is PQ, of which only PR can be obtained from Nepal. The rest (RQ) must be produced domestically. Therefore, India produces at S (rather than at D under complete specialization) and consumes at P. The result is incomplete specialization in Tea, a consequence of (its) relative size.

### Comparative Advantage under a More General Theory of Production

We have shown that a country enjoys comparative advantage in the Ricardian sense, if its relative opportunity costs of production is lower than that of the other country in a certain commodity. The opportunity costs were, however, calculated on the basis of labour costs alone, because the classical economists believed in the labour theory of value. Furthermore, the labour costs of production of a unit of any commodity was constant over the entire range of output. As a result, output of a commodity could be expanded at a constant opportunity cost.

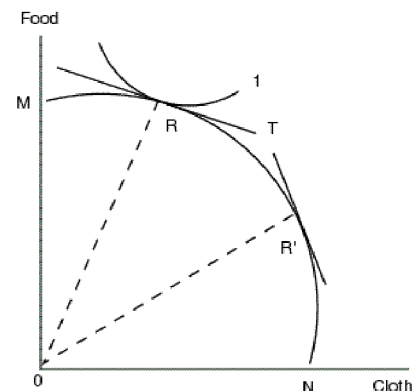
Ricardian theory is robust: it is valid even when non-labour costs are included.

The dependence of the classical notion of comparative advantage on the labour theory of value as well as (on) the assumption of constant opportunity costs in a major drawback. Labour theory of value is too restrictive, while the constant opportunity cost assumption is empirically questionable. Therefore, it is important to ask: Does the basic conclusion of the Ricardian theory of comparative advantage remain valid, even after the notion of Ricardian opportunity cost is replaced by a more general notion in which non-labour factors of production are explicitly taken into account and factor substitution is allowed? Fortunately, the answer is 'yes', because in the 1930s Gottfried Haberler has shown that the principal prediction of the Ricardian theory about trade patterns stands unaffected even when production takes place under increasing opportunity costs with many factors of production cooperating. Despite the changed assumption about the nature of production processes, it is still true that a country will export the commodity in which it has a comparative advantage and import the one in which it has a comparative disadvantage.

The marginal rate of transformation is opportunity cost of cloth in terms of food.

Recall that the opportunity cost of cloth (in terms of food) is the amount of food that must be given up in order to produce an additional unit of cloth (When all factors of production are fully and efficiently employed in the production of either or both the goods). When the units of food sacrificed for an additional unit of cloth go on increasing as the amount of cloth production increases, we have a situation of increasing opportunity costs. In this case, the production possibilities curve will be concave to the origin as shown by MN in Fig. 2.4.

The (absolute) slope of MN at any point shows the rate at which food can be transformed into cloth in the technological sense. This rate is called the marginal rate of transformation (MRT) in production. For example, the (absolute) slope of MN is greater at R' than at R, indicating that more food needs to be sacrificed to increase cloth production at R' than at R. In other words, the marginal rate of transformation (which is nothing but the opportunity cost of cloth



in terms of food) increases as we move downward along MN from M to N.

Fig. 2.4.

Note that the marginal rate of transformation is equal the ratio of marginal costs which is in turn equal to the commodity price ratio ( $P_C/P_F$ ). This can be easily demonstrated. Under perfect competition, the profit maximizing producer will produce at a level where the cost of production of a commodity is equal to its price. Therefore, the marginal cost of food ( $MC_F$ ) is equal to its price ( $P_F$ ). Similar, the marginal cost of cloth ( $MC_C$ ) is also equal to its price ( $P_C$ ). Combining the two, we can say that

$$\frac{P_C}{P_F} = \frac{MC_C}{MC_F}$$

In the absence of trade, production can take place at any point on the production possibilities curve, MN. The precise point will depend on the prevailing relative price of cloth (in terms of food). In the international trade theory, a country's consumption preferences are usually represented by a set of social indifference curves. These are but theoretical constructs to describe the society's preference ranking over various combination of goods. In Fig. 2.4, the curve labelled 1 is such an indifference curve which has been drawn as tangent to MN at R. At this point the slope of the production possibilities curve (MN) and the social indifference curve 1 are equal (indicated by the common slope of the line T). We can, therefore, say that by producing and consuming the bundle shown by point R, the country is maximizing its social welfare. The distinguishing feature of the point R is that here the marginal rate of transformation in production is equal to the marginal rate of substitution in consumption, and each is equal to the price ratio ( $P_C/P_F$ ).

We can immediately note one difference of the above analysis from the Ricardian explanation of pretrade domestic price ratio. When the opportunity costs vary as the output mix changes, we can no longer (as we did in the Ricardian model) derive a unique relative pre-trade price ratio from the slope of the production possibilities curve alone. Now the taste pattern (demand conditions) too has a role to play. In this model, both the demand (social indifference curves) and the supply (the production possibilities curve) conditions jointly determine the price ratio and the relative quantities of production and consumption. Secondly, unlike in the Ricardian explanation, taste differences might be responsible for price differences between countries and hence could be the cause of trade in their own rights.

**Comparative Advantage Under Increasing Opportunity Costs**

We have just explained how the domestic price ratio is determined under the increasing (opportunity) cost situation. We have also seen that in this price formation both demand and supply factor, play their respective roles. Now if the supply and demand conditions before trade in the two countries are such that pre-trade price ratios differ between them, then a basis for mutually profitable trade exists. If, for example, the relative price of cloth is lower in Japan than in Thailand before trade, Japan has comparative advantage in cloth. But the fact of the relative price of cloth being higher in Thailand implies that the relative price of food is lower in Thailand and so it has comparative advantage in food. If the trade pattern follows the dictates of comparative advantage both the countries should gain as explained below with the of Fig. 2.5.

Both the demand and the supply conditions jointly determine the price ratio and the relative quantities of production and consumption.

If trade pattern follows comparative advantage then both the countries are better off than before.

In panel (a) of Fig 2.5, the common production and consumption point in pre-trade equilibrium for Thailand is shown by point E. The corresponding equilibrium point for Japan is E\* (panel (b) of Fig 2.5). The common slope of Thailand's production possibilities curve (MN) and one of its social indifference curve 1 at E is different from the corresponding common slope at E\* (tangent lines have not been drawn). In fact, the tangent line at E will be steeper than that at E\*. This means that the pre-trade equilibrium price of cloth is higher in Thailand than in Japan. Alternatively we can say that before trade food is cheaper in Thailand than in Japan. The law of comparative advantage would dictate that Japan exports cloth and Thailand food. But we are yet to examine whether this trade pattern can make both the countries better off than before trade.

Both Thailand and Japan will in fact, be better off if they can trade with each other at a price ratio falling in a range whose limits are set by the (absolute) slopes of the tangents at E and E\*. Let us suppose that the slope at E is such that 1 unit of cloth exchanges for 6 units of food (i.e. the relative price of cloth  $P_C/P_F$  is 6). Therefore Thailand has to sacrifice 6 units of food for a unit of cloth. We make a corresponding assumption about the pre-trade cloth price in Japan. Specifically we assume that in pre-trade equilibrium one unit of cloth exchanges for 2 units of food in Japan. In other words, in equilibrium Japan is willing (and able) to sacrifice 2 units of food for a unit of cloth. If we denote the relative price of cloth by  $P_C/P_F$ , then on the basis of the above, we can write

$$\left[ \frac{P_C}{P_F} = 6 \right]_{\text{Thailand}} > \left[ \frac{P_C}{P_F} = 2 \right]_{\text{Japan}}$$

If trade begins, Thailand will export food and Japan cloth. As the trade flows continue, the relative price of cloth in Thailand will tend to fall (the relative price of food tends to rise). Resources in Thailand will, therefore, be withdrawn from the production of cloth and used in the production of more food. This is a natural response of profit maximizing producers to changing relative prices. The opposite happens in Japan. Trade tends to increase the relative price of cloth (because it exports cloth decreasing domestic cloth supply and imports food augmenting domestic food availability). This makes cloth production more profitable at the margin than before. Resources are reallocated such that some of the resources engaged in food production are now used for increasing cloth production.

This tendency of the relative price of cloth to change under the impact of trade flows will continue until the price is the same in both countries and trade is balanced (the values of each country's exports and imports are equal). Let us suppose that the equilibrium international price ratio is such that 1 unit of cloth exchanges for 5 units of food (note that this is in between the pre-trade price ratios). In Fig. 2.5, the common international price ratio is shown by the common (absolute) slope of line KG (Thailand) and K\*G\* (Japan). The production point in Thailand has shifted from E (before trade) to Q (after trade); it has increased the production of food in which it has comparative advantage and decreased the production of cloth in which it has comparative disadvantage. The opposite must have happened in Japan. Its production point shifts from E\* (before trade) to R\* (after trade), thus increasing the production of cloth in which it enjoys comparative advantage.

This tendency of the relative price of cloth to change under the impact of trade flows will continue until the price is the same in both the countries and the trade is balanced.



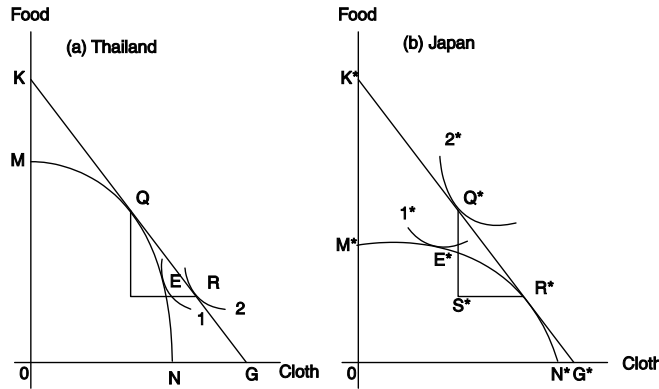


Fig. 2.5

It is easy to see that both countries gain because trade opens up the possibility for each country to trade at a price ratio different from that prevailing in each country before trade. The total gain for each can be split into two components, namely, the consumption gain (due to reallocation of consumption alone) and the production gain (due to reallocation of production alone). Take the case of Thailand. Even if there were no scope for reallocation of production after trade (i.e. if production were kept frozen at E), it can gain by trading at the international price indicated by line KG. To see how, imagine a line parallel to KG which passes through the point E. The line will represent new consumption possibilities opened up for Thailand even though production is fixed at E. It should be clear from the diagram that Thailand can reach a higher level of social welfare than attained at E simply by reallocation of consumption to a point on the new consumption frontier. This represents the consumption gain. Production gain arises from the possibility of production reallocation according to comparative (cost) advantage. If production reallocation is possible and production shifts from E to Q, the consumption opportunity line now becomes KG (which is further out from the line imaged above). This represents a larger consumption opportunity set. The welfare level attained now is indicated by social indifference curve 2 (point R). The increase in welfare in this second step is the production gain. The total gain in welfare is represented by the climb from social indifference curve 1 to 2. It is now easy to see that the other country (Japan) also gains from trade by moving from a lower social indifference curve 1\* to a higher one (2\*).

In summary, we can say that under the increasing cost situation also, the trade pattern can be explained as in the simple Ricardian model in terms of comparative advantage.

Haberler has aptly remarked, the principle of comparative advantage remains valid as an explanation of the trade patterns in the same way as "a building remains after the scaffolding, having served its purpose, is removed." The building remains, but some of its old features are gone; trade no longer leads to complete specialization and the price ratio is no longer dictated by technology alone.

The welfare level is indicated by social indifference curve.

The principle of comparative advantage remains valid as an explanation of the trade patterns, even under increasing opportunity costs.

### Questions for Review

MCQ's (Tick the correct [or the most nearly correct] answer)

1. As long as both goods are produced in the country after trade (constant costs) workers in a country will receive the same money wage in the two activities. This is due to-
  - A. free labour mobility across countries
  - B. some labour mobility within a grain country
  - C. perfect labour mobility within a country
  - D. all of the above.
2. In the Ricardian Scheme, the sufficient basis for trade is
  - A. differences in technologies
  - B. differences in taste
  - C. differences in size
  - D. all of the above.
3. If one of the two countries is uniformly superior in technology than the other, then
  - A. there will be no cost difference and hence no trade
  - B. there will be usual cost difference and hence trade
  - C. relative prices will differ despite the absence of cost difference
  - D. None of the above.
4. If two countries differ in size, speciation
  - A. is always complete
  - B. is never complete
  - C. can sometimes be partial
  - D. all of the above.
5. The comparative cost theory can be shown to be
  - A. valid when costs are seen as constant opportunity costs involving factors other than labour.
  - B. not valid under conditions of (A), if opportunity costs are rising.
  - C. valid even where opportunity costs are rising in situations of many factor, including labour.
  - D. both A & C.

### Short Questions

1. "If two countries have the same Ricardian technology, the difference in the size of the labour force in the two countries will not influence their pre-trade price ratios." Do you agree? Explain.
2. Intuitively explain why in the 2 country, 2 goods and one factor world of Ricardo national currencies do not matter.
3. Following Ricardian comparative advantage will often, but not always, lead to complete specialization in production. It is true? Why is the qualification necessary?

### Questions:

1. Discuss the Ricardian comparative cost theory when costs are measured in terms of money.
2. What are the technical conditions that might keep trading nations from complete specialization in the production of which they have initial comparative advantage? Illustrate.
3. Discuss the theory of comparative advantage under increasing opportunity costs.

Answer: 1.C, 2.A, 3.A, 4.C, 5.D

## Lesson 3 : The Heckscher Ohlin Model and Related Theorems

### Lesson Objectives:

**After studying this lesson, you will be able to**

- Ⓜ explain the Heckscher-Ohlin model;
- Ⓜ explain the Rybczynski theorem;
- Ⓜ appreciate the Stolper Samuelson theorem and
- Ⓜ understand the Factor Price Equalization theorem.

### The Heckscher-Ohlin Model

Neither David Ricardo nor other classical economists provided any clear-out answer to the question : What is the ultimate determinant of comparative advantage? Ricardo emphasized differences in technology, but there was no explicit explanation of why such differences should arise, except implying indirectly that they might be due to climatic differences between countries.

As we have seen before, even though two countries can differ (in the Ricardian model) in respect of taste, technology and size of the productive labour force, Ricardo found only the technological differences crucial for trade, the other two being irrelevant, if the technologies did not differ. By adding more factors of production, the Heckscher-Ohlin model brings to the fore a fourth kind of difference, namely, that the proportions in which two countries are endowed with various factors of production can vary. Two noted Swedish economists, Eli Heckscher (1879-1952) and Bertil Ohlin (1899-1979) emphasized these differences in factor proportions in their explanation of comparative advantage and trade. Their ideas revolve around two key assumptions :

- (i) Production of different goods require different factor proportions ; and
- (ii) Countries vary in respect of their endowed factor abundance.

According to the Heckscher-Ohlin theory, countries usually export those goods that use their abundant factors intensively. For this reason, the Heckscher-Ohlin theory is also called the factor-proportions theory. Its plausibility is almost immediate when we see that labour abundant countries like Korea and Taiwan export footwear, textiles and sugar (labour-intensive goods), while the land abundant countries like Australia, Canada and Argentina export meat, wheat, and wool (land-intensive products).

### Assumptions of the Heckscher-Ohlin (H-O) Model

Like all models (because they need abstractions), the H-O model too is based on several simplifying assumptions, not all of which are required for the validity of all the propositions of the general H-O model. These are:

1. 2x2x2 assumption: There are two countries (America and Britain) each having two homogeneous factors of production (capital and labour) and producing two goods (cloth and steel). This is why the model is also referred to as the 2x2x2 model.

According to the Heckscher-Ohlin theory, countries usually export those goods that use their abundant factors intensively.

2. Technology and the nature of production function: The two goods are produced with identical production technologies in each country. Moreover, the production functions exhibit constant returns to scale. This implies that a proportionate increase in all inputs will lead to the same proportionate increase in all output. The production function in the two countries being identical, this will ensure that the producer of a commodity in the two countries will use exactly the same quantities of labour and capital for a unit of the commodity, if they face the same factor price ratio.
3. Strong factor intensity: One commodity (cloth) is always labour-intensive compared to the other (say, steel). This means that whatever the wage-rental ratio, cloth uses more labour per unit of capital than steel. This assumption is needed to rule out any possibility of factor-intensity reversal, which is particularly damaging to H-O conclusions. Factor intensity reversal occurs when, for example, cloth is labour-intensive at lower wage-rental ratios, but become capital-intensive at high wage rental ratios.
4. Perfect Competition: All commodity and factor prices are determined in perfectly competitive markets.
5. Factor mobility : For the law of one price to prevail, it is assumed that all factors are absolutely free to move between industries of the same country. By contrast factors are assumed to be completely immobile between countries.
6. Tastes : Tastes are required to be largely similar, but they need not be identical.
7. Free trade : Trade between nations is free from all artificial interferences like tariffs, quotas and exchange control.
8. Transportation costs : These are assumed to be zero. Because of this assumption, trade can lead to the equality of relative commodity prices between nations.

Trade can lead to the equality of relative commodity prices between nations.

**Meaning of Factor Intensity and Factor abundance**

Assume that two goods, cloth and steel, are produced in each country by one technique alone. For instance, a unit of cloth requires 8 units of labour and 2 units of capital, while a unit of steel requires 2 units of labour and 8 units of capital. These input requirement data are presented in Table 2.6.

**Table 2.6**

Commodity	Input per unit of output		Capital Labour (K/L)
	Capital (K)	Labour (L)	
Cloth	2	8	$2 \div 8 = \frac{1}{4}$
Steel	8	2	$8 \div 2 = 4$

Perfect competition will drive the producer of each good to select only one input ratio (one technique) for any given level of output.

Clearly the capital-labour ratio in the production of cloth is lower than in the production of steel ( $\frac{1}{4} < 4$ ). Since there is only one process by which each good can be produced, we can unambiguously say that steel is more capital-intensive than cloth. Or equivalently, cloth is more labour-intensive than steel.

A difficulty may apparently arise if cloth and steel can be produced using many possible techniques (e.g., along a smooth isoquant). But even here we can apply

the standard definition used above, if we assume competitive import markets. Perfect competition will drive the producer of each good to select only one input ratio (one technique) for any given level of output. This will be the one that minimizes the cost of producing that level of output. Then by comparing the two input ratios, it is easy to say which one is more capital-intensive than the other.

On the other hand, the ranking of countries in terms of factor abundance can be done on the basis of physical or economic criterion. By the physical criterion, America is said to be capital abundant (labour-scare) if it has (i.e.. endowed with) more capital per unit of labour (i.e. less labour per unit of capital) than Britain. Evidently, the physical definition concentrates solely on the supply side, ignoring any influence emanating from the demand for factor inputs. In contrast, the economic criterion takes into account both the demand and supply side influences in the definition of factor abundance. By the economic criterion, America is capital abundance if its autarkic (equilibrium) wage-rental ratio is higher than that in Britain, while Britain is labour-abundant, if its autarkic (pre-trade) wage-rental ratio is lower than in America. Since under perfect competition input prices are determined by the interaction of demand and supply, it is clear that the economic criterion takes into account both demand and supply side factors.

Is it possible that the two criteria will lead to contradictory ranking ? Could it happen that Britain is labour-abundant by the physical criterion, while capital-abundant by the economic criterion ? Assume that Britain has more labour per unit of capital. Then, by physical definition, it is a labour abundant country. Now suppose that the people of Britain have a very strong preference for the labour-intensive good (cloth). In this case, it is quite possible that the strong demand for labour (derived from the demand for labour-intensive cloth) will lead to a higher wage-rental ratio in Britain (before trade). Then Britain would be dubbed as a capital-abundant (labour-scare) country by economic criterion.

Such an anomaly is ruled out by the H-O assumption that in the two countries tastes are largely similar, so that the demand bias will not reverse the factor abundance ranking derived from the physical definition. Either definition will lead to consistent ranking. Finally, do not be confused by terms like factor-intensity and factor abundance. As should be clear by now, the former is used to rank commodities and the latter to rank countries. The former is a statement about technological difference between commodities, while the latter is a statement about factor endowment differences between countries.

**Major Propositions of the Heckscher-Ohlin Model**

The essence of the H-O model can be summarized in the following four theorems

1. The Heckscher-Ohlin Theorem
2. The Factor Price Equalization Theorem
3. The Stolper Samuelson Theorem
4. The Rybczynski Theorem

**Rybczynski Theorem**

We deal with this theorem first because of its importance in the demonstration of the Heckscher-Ohlin theorem. The theorem derived by Rybczynski in 1955 highlights the uneven effect of growth in one factor on the composition of commodity outputs. It says:

Ranking in terms of factor abundance : Physical vs. economic criterion.

If the supply of a factor increases, the output of the good in which it is intensively used must expand.

If the input coefficient of production are given and full employment of all factors is to be ensured, than an increase in the supply of one factor of production must raise the output of the commodity that uses the expanded factor intensively and lower the output of the other commodity which uses the non-expanded factor intensively.

Suppose that a unit of cloth requires 2 units of capital (K) and 4 units of labour (L), while a unit of steel requires 4 units of capital and 2 units of labour (steel is more capital-intensive less than cloth, or to say the same thing, cloth is more labour-intensive than steel). Also assume that the country (Britain) is endowed with 80 units of capital and 120 units of labour.

If the country had unlimited amount of capital, it could produce a maximum of 60 units ( $120 \div 2$ ) of steel or a maximum of 30 units ( $120 \div 4$ ) of cloth, by using its entire labour resources (120 units). Alternatively, by using some labour in cloth and the rest in steel it could produce any combination of cloth and steel shown by various points on the line AB (such as 25 units of cloth and 10 units of steel) in Fig. 2.6.

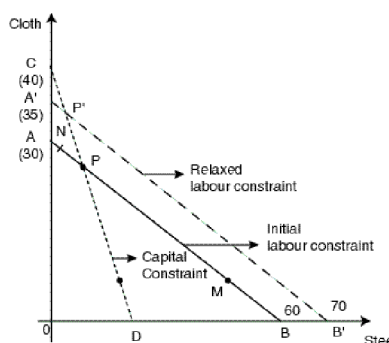


Fig. 2.6

Both labour and capital constraints are exactly satisfied only at a point. With some excess capacity, we have a kinky production possibilities frontier.

In other words, the line AB summarizes the production possibilities facing the country when it has 120 units of labour and an unlimited amount of capital.

If, on the other hand, the country had unlimited supply of labour, then, by using all of its capital, it could produce a maximum of 20 units ( $=80 \div 4$ ) of steel or a maximum of 40 units ( $=80 \div 2$ ) units of cloth. By allocating some of its capital to steel and the remainder to cloth, it could produce any combination of steel and cloth (such as 20 units of cloth and 10 units of steel) shown by points on the line CD (Fig. 2.6). The line CD, therefore, represents the production possibilities for the country if it had unlimited supply of labour and 80 units of capital.

We know however, that the country's supplies of capital and labour are limited (to 80 units of capital and 120 units of labour). Because of these limitations, its actual production possibilities will be limited to points on the kinky line APD in Fig. 2.6. Production cannot proceed along the labour constraint AB beyond AP because of capital shortage. Similarly the output combination in the CP segment of the capital constraint are unattainable because of labour shortage. But note that while all combinations on APD are feasible, the only combination that ensures full employment of available labours and capital is given by the point P (the point of intersection of the two constraints).

To appreciate this observation, consider point M on the capital constraint line CD. If the production of steel is expanded (and that of cloth is reduced) from P to M, capital released from cloth production can be fully employed in expanded steel

production, but not all labour (released from cloth production). Some labour will remain unemployed as can be seen from the fact M lies below the labour constraint frontier AB. By analogous reasoning, at point N labour is fully employed (being on the labour constraint), but some capital is unemployed (N is inside the capital constraint border CD). Since M and N have been picked up arbitrarily, we can say that along PB some workers are unemployed (wage rate falls to zero) and along AP some capital is unemployed (the rental rate drops to zero) ; only at P there is full employment (with positive rewards to both factors). The full employment output of steel is  $(20/3)$  units and that of cloth  $(80/3)$  units.

The relevance of the above for the demonstration of the Rybczynski theorem should now be clear. Suppose that the supply of labour goes up to 140 units (an increase of 20 units), while the stock of capital is fixed at 80 units. As a result, the labour constraint frontier AB shifts outward to A'B' (the capital constraint frontier CD is unaffected). The new production possibilities frontier is now given by the kinky line A'P'D. The previous labour constraint made output combinations on the capital constraint segment CP unattainable. With its relaxation PP' segment becomes part of the feasible region. The full employment point now shifts from P to P'. How have the full employment outputs of steel and cloth changed following the growth of the labour supply ? At P', steel output is  $10/3$  units and the cloth output  $100/3$  units. We see that the output of cloth (the labour intensive product) has increased  $(\frac{100}{3} > \frac{80}{3})$ , while that of steel (the capital-intensive product) has fallen (from  $\frac{20}{3}$  to  $\frac{10}{3}$  units). This is what the Rybczynski theorem asserts.

Let us see why this result must follow. The labour force has expanded and there is no change in technique (cloth remains relatively labour intensive). Therefore, the labour-intensive clothing industry can expand only if it obtained capital (and labour) from the other sector of the economy, because the overall supply of capital is fixed. Therefore, to ensure full employment, production of steel has to fall.

**The Heckscher-Ohlin Theorem**

It simply says that a country exports the commodity that uses intensively its abundant factor. Which is the abundant factor ? We have argued before that under the assumption of similarity of tastes between countries, it does not matter whether we use the physical or economic criterion to define factor abundance. Here we prefer to use the physical definition because it fits in nicely with what the Rybczynski theorem has to say.

But let us first clearly see what bias factor abundance imparts to the relative shapes of the production possibilities frontier of the countries concerned. Suppose that initially America and Britain have the same physical amounts of labour and capital (200 units of capital and 100 units of labour). Besides they share the same technologies in steel and cloth (cloth is more labour intensive than steel). The factor proportion in the two countries is the same, and the production possibilities frontier (PPF) of one country will be identical with that of the other (the general shape being like APD in Fig. 2.6). Now assume that America's capital stock grows to 300 units, while Britain's labour supply increases to 300 units. The factor-proportions are now unequal:

$$\left(\frac{\text{Capital}}{\text{labour}}\right) \text{ America} > \left(\frac{\text{Capital}}{\text{labour}}\right) \text{ Britain}$$

To ensure full employment, production of steel has to fall.

That a country exports the commodity that uses intensively its abundant factor is demonstrated here.

because  $\frac{300}{100} > \frac{200}{300}$ . As a result of this change, the PPF of America will be skewed along the steel axis (steel is capital intensive), while the PPF of Britain will bulge in the direction of the cloth axis (the labour intensive good). This in turn means that America will produce a large proportion of steel relative to cloth than Britain. In other words,

$$\left(\frac{\text{Output of Steel}}{\text{output of cloth}}\right)_{\text{America}} > \left(\frac{\text{Output of Steel}}{\text{output of cloth}}\right)_{\text{Britain}}$$

We are now all set to illustrate the Heckscher-Ohlin theorem. In Fig. 2.7 we have drawn the production possibilities frontiers (PPF's) of America and Britain as smooth bowed out curves rather than lines with kinks (as in Fig. 2.6). This reflects the assumption of constant returns to scale technologies with infinite techniques of production which can be used (ensuring full employment) to produce steel and cloth in each country. We continue to assume that steel is relatively more capital intensive than cloth. Given this and the assumption that America possesses more capital per unit of labour (as endowment) than Britain give rise to the shapes of the PPF's drawn in Fig 2.7. The PPF of America (T\*G\*) is bulged toward the (horizontal) steel axis, while that of Britain (TG) towards the (vertical) cloth axis for reasons explained before.

The two countries taste patterns have been represented by two sets of serial indifference curves.

In line with the H-O assumption, the two countries' taste patterns have been represented by the same set of social indifference curves 1, 2 and 3. Before trade, Britain produces and consumes at R, while America at R\*. If tangents were drawn at R and R\*, the one at R would be steeper than the one at R\*, indicating that the autarkic equilibrium price of steel (in terms of cloth) is higher in Britain, while the price of steel (in terms of cloth) is lower in America. In other words, the capital intensive good (steel) is cheaper in America (the capital abundant country), while the labour-intensive good (cloth) is cheaper in Britain (the labour abundant country). Therefore, the labour abundant country will export the labour-intensive good, and the capital-abundant country will export the capital-intensive good, which is exactly what the Heckscher-Ohlin theorem asserts.

For both countries specialization is incomplete.

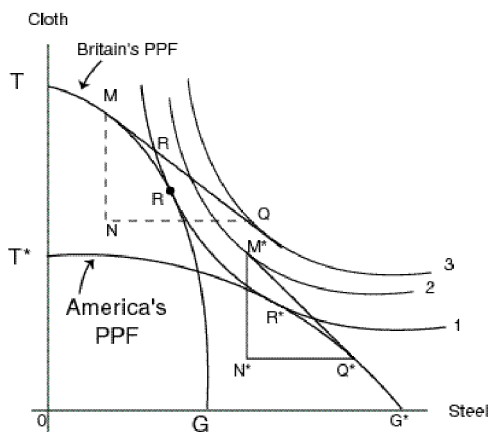


Fig 2.7

With free trade, the price of steel goes up in America, and falls in Britain. This tendency must continue until the price of steel (in terms of cloth) is the same in both. In Fig 2.7, the equilibrium terms of trade is given by the (common) slope of parallel lines MQ and M\*Q\*. The production point in Britain shifts from R to M



(specializes in cloth) and that of America from  $R^*$  to  $Q^*$  (specializes in steel). In both cases, specialization is incomplete. By trade both countries make themselves better off than under autarky. With specialization and trade Britain moves to social indifference curve 3 and America to 2 (both starting from social indifference curve 1)

**The Stolper-Samuelson Theorem**

An increase in the relative price of a commodity increases the real return to the factor used intensively in its production, says the theorem. There is more to the proposition than may be readily apparent. Suppose that the price of cloth rises and cloth is labour intensive. What the theorem asserts is that wages will rise by a proportionately greater extent than the price of cloth. A week's wage should buy not only more cloth but also more steel than before so that workers are better off in the real sense because of the fact that wages rise more than any commodity's price. This message of the theorem would seem to support a policy of protection for the import competing labour-intensive industry if the intention is to protect the interests of specific groups of workers employed there (though the country as a whole may lose by trade restriction).

An increase in the relative price of a commodity increases the real return to the factor used intensively in its production.

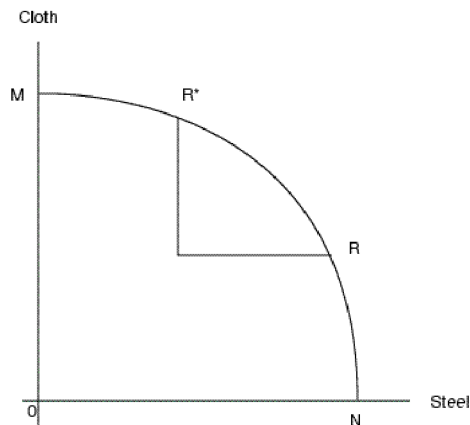


Fig 2.8

Suppose that in Fig. 2.8 R is the post-trade equilibrium production point for a 'small' country (say, Nepal). If it imposes tariffs on cloth import the relative price of cloth will go up. This will make the production of cloth more profitable. Assume that when all adjustment have taken place, the new production point is  $R^*$  (cloth industry expands at the cost of the steel industry). But cloth is more labour-intensive than steel. This means that the contracting steel industry releases fewer workers per unit of capital (or more capital per worker) than the expanding cloth industry can absorb. The result will be an excess demand for labour (which will cause wages to rise) accompanied by an excess supply of capital (which will lower the capital rental rate). From this, can we jump to the conclusion that real wages of workers will rise and the real rental rate for capital will fall? We need to be careful, because we have to take into account the fact that price of cloth is higher and that of steel lower. It turns out that the wage rate rises more than in proportion to the rise in the price of cloth, while the rental rate falls by a larger percentage than the fall in the price of steel. This is what has been called the magnifying effect. This effect allows us to assert unambiguously that the tariff can make workers better off and the capital owners worse off.

Tariffs can make workers better off!

Movement of goods across frontiers may lead to equalization of real factor returns between countries.

But what happens to factor intensity ? As the price of labour rises relative to the rental rate, both cloth and steel industries substitute capital for labour (both become more capital intensive). And this happens despite the fact that overall factor supplies remain fixed.

It should be noted that the Stolper-Samuelson theorem does not depend for its validity on the Heckscher-Ohlin theorem or the factor-price equalisation theorem because it does not involve any comparison between countries.

### The Factor Price Equalization Theorem

This theorem claims that movement of goods across frontiers leads to equalization of real factor returns between countries, despite the fact that factors cannot physically move between countries. This conclusion is remarkable because of its implication that factors do indeed migrate (as it were) indirectly through free movement of goods.

To appreciate how this important result is arrived at, we first explain an important proposition regarding the relationship between factor and commodity price ratios. According to this, the relative price of the labor-intensive goods (cloth) and the wage rental ratio ( $w/r$ ) move in the same direction. Its rationale is explained below with the help of Fig 2.9. Two unit isoquants (one for steel, the other for cloth) have been shown to be tangent to the iso-cost line AB at S (for steel) and C (for cloth).

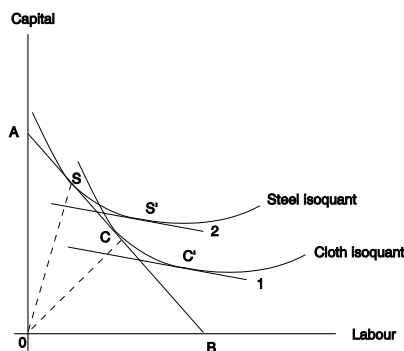


Fig 2.9

The relative price of labour intensive goods and the wage-rental ratio move in the same direction.

Cloth is relatively more labour intensive when optimum input bundles are compared. Lines 1 and 2 are parallel and flatter than AB. So they represent a lower wage-rental ratio than does AB. When the wage-rental ratio falls, the cost-minimizing input bundles become S' (for steel) and C' (for cloth). But line 2 is further out than line 1, implying that unit costs of cloth is now lower than the unit cost of steel (previously they were equal, made so by choosing appropriate unit of steel and cloth). This supports the proposition that as the wage rental ratio falls, the unit cost of the labour intensive good falls too. Since, in long run equilibrium under perfect competition, unit cost equals price, we can also say that relative price of the labour intensive goods and the wage rental ratio move in the same direction.

The relationship established above between the relative price of cloth and the wage-rental ratio is summarized in the curve PW in Fig. 2.10, where the horizontal axis represents the wage-rental ratio and vertical axis shows the relative price of cloth (in terms of steel).

The positive slope of the curve follows from the proposition that the relative price of the labour-intensive good (here cloth) moves in the same direction as the wage-rental ratio.

This fundamental relationship must be the same in Britain and America because of the fact for each good they face the same production technology. The two countries' trade pattern is determined by their pre-trade price differences. These differences are not due to differences in tastes or technologies, but to the differences in factor proportion, according to the H-O theorem. As trade proceeds the price differentials tend to disappear, and are completely eliminated in equilibrium.

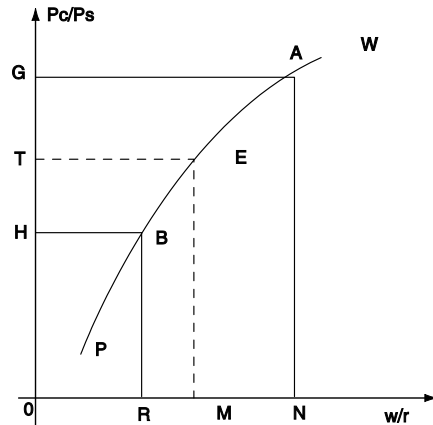


Fig 2.10

In terms of Fig 2.10, before trade America operates at point A and Britain at B on the curve PW. In the post-trade equilibrium each country operates at point (say) E. Now for any commodity price ratio shown along the vertical axis (Fig 2.10) we can always trade off the corresponding (w/r) ratio, provided that at the given price ratio a country produces positive amount both the commodities. Therefore, in equilibrium (post-trade) each country faces the common relative price (OT) and the common wage-rental ratio (OM).

The next logical question is ; if the two countries face the same commodity and factor price ratio in the post-trade equilibrium, will the real wage and the real rental rate be the same in both the countries? Given the assumptions of the H-O model, the answer is yes. Let us see why? The real factor return is equal to the marginal physical productivity of the factor concerned. Now since the production function exhibits constant returns to scale (by assumption), the marginal physical product of each is a function of capital-labour ratio alone (it does not depend on absolute amounts of capital and labour). Moreover, the capital labour ratio of each industry is completely determined, given the identical wage-rental ratio. Therefore, since the production functions are identical between countries, the equalization of wage-rental ratio necessarily equalizes America's marginal physical products of capital and labour to their corresponding marginal products in Britain.

The real factor return is equal to the marginal physical productivity of the factor concerned.

## Questions for Review

MCQ's (tick the correct answer)

1. H-O theorem assumes that
  - A. production of different goods require the same factor proportion.
  - B. countries do not vary in terms to their endowed factors.
  - C. production of different goods require different factor proportions
  - D. None of the above.
2. The possibility of factor intensity reversal
  - A. totally invalidate the conclusions of the H-O model can.
  - B. partially invalidate the conclusions of the H-O model
  - C. lead the H-O model to generate Ricardian conclusions.
  - D. can do none of the above.
3. Factor intensity is used to
  - A. rank countries
  - B. rank commodities
  - C. rank both
  - D. rank none.
4. If the supply of one factor rises, the output of the good using it intensely must rise too. This follows from
  - A. Rybczynski theorem
  - B. Stolper-Samuelson theorem
  - C. H-O theorem
  - D. None.
5. A tariff can sometimes make worker better off. This conclusion can be established by-
  - A. H-O theorem
  - B. Stolper-Samuelson theorem
  - C. Rybczynski theorem
  - D. None.

## Short Questions

1. What is meant by factor intensity?
2. How would you judge whether a country is labour or capital abundant? Can you arrive at an unambiguous conclusion?
3. What is the technology assumption in the H-O model? How does it compare with similar assumption in the Ricardian model? Do you find the difference puzzling?
4. Why is one likely to be confused by the terms like factor intensity and factor abundance?
5. Do you think factor price equalization obviates the need for factor mobility? Give reasons.

## Essay type Questions

1. Describe the Heckscher-Ohlin model.
2. Explain the Rybczynski theorem of international trade.
3. Explain the Stolper-Samuelson theorem of international trade.
4. Briefly discuss the Factor Price Equalization theorem.

**Answer:** 1.C, 2.A, 3.B, 4.A, 5.B