

Learning Objectives

- Use the Ricardian model of technological differences to examine trade patterns.
- Use the above model to examine how both trade and technology affect wages in different countries.
- Use the Heckscher-Ohlin model to examine how relative endowment differences can give rise to trade.
- Use the above model to examine how trade can create income inequality within a country.
- Explore actual economic data, including wage convergence in some countries since World War II, the trade patterns of Canada and the effects on income distribution, the widening income gap in the world, and policies such as foreign aid and alternatives that may narrow the gap.

2.1 Motivation

We now turn to examine two classic international trade models that examine the determinants of trade patterns and income distribution controversies under free trade, the Ricardian model and the Heckscher-Ohlin model.

The Ricardian model stipulates that technological differences can give rise to mutually beneficial trade. A country would export the products in which it has technological advantage and import those in which it has technological disadvantage. The main insight of this model is that as long as countries have different technological levels, wages will not equalize across countries even under absolute free trade. This means while trade amongst developed and developing countries can increase their total surplus, developing countries can enjoy even more gains if they improve their productivity. From developed countries' perspective, having free trade with developing countries would not imply that high wages in developed countries would converge to the low wage levels in developing countries. Technological convergence is required for wage convergence.

The Heckscher-Ohlin (HO) model is another classic trade model. It stipulates that relative abundance in factor inputs explains trade patterns. For example, a country that is relatively labour abundant compared to its trading partners would export products that use mainly labour as input. The main insight of this model is that trade would give rise to income distribution effects. Some factors could gain; some factors could lose. As a result, lump sum transfers from gaining export sectors to losing import-competing sectors are necessary to ensure that everyone gains from trade. This finding echoes what we have discussed in Chapter 1, and it also introduces to us the different reasons and tools of why and how countries intervene in trade, which would be covered in Chapter 3.

2.2 The Ricardian Model of Comparative Advantage

Economist David Ricardo developed the Ricardian model of international trade in the eighteenth century. The main insight of this model is that countries should concentrate on producing goods and services that incur the smallest sacrifice or opportunity cost. If Canada produces one unit of good 1, it must imply that Canada is sacrificing a certain amount of good 2 that it *could have* produced. The workers and machinery that were used to produce good 1 *could have been* used to produce some good 2. The Ricardian model dictates that countries should focus on producing goods and services that require the smallest opportunity cost. For example, if a Canadian worker can produce either 10 pounds of wheat or 2 pairs of shoes in an hour, whereas a Mexican worker can produce either 4 pounds of wheat or 1 pair of shoes in an hour, Canada should focus on producing wheat and Mexico should focus on shoes because the opportunity cost of one pair of shoes for Canada is 5 pounds of wheat and it is only 4 pounds for Mexico. Under free trade, Canada should export wheat and import shoes, whereas the reverse is true for Mexico. Both countries can gain because consumption in both countries can be higher than the autarkic consumption levels.

Model Assumptions

1. One factor of production, labour (L). L earns wages (W);
2. Two goods, good 1 (X_1) and good 2 (X_2);
3. Two countries, Home (H) and Foreign (F);
4. Both industries are perfectly competitive. This implies profit (π) = 0, or price = unit cost;
5. L can move freely across the two industries within a country, but cannot move across countries. Because L can move across X_1 and X_2 freely within H or F, this implies wages in both industries are identical;
6. H and F have the same demands for X_1 and X_2 . Chapter 1 has looked at how demand differences can lead to mutually beneficial trade. Here, we want to look at reasons other than demand differences, and
7. H and F differ in production technology. We want to see how technological differences (or productivity differences of L) can give rise to mutually beneficial trade.

Production Technology

Table 2.1 shows a numerical example of the Ricardian model. Let a_{L1} represent the number of workers (or hours) it takes to produce one unit of X_1 , and a_{L2} be the number of workers it takes to produce one unit of X_2 . Obviously, the lower the a_L , the fewer workers are required to produce one unit of product, so the more productive are the workers. We can tell that H is more productive in producing both products. It takes only one H worker to produce an X_1 , whereas it takes six F workers to produce the same product. H workers are also more productive in producing X_2 , because it takes two workers to produce a unit of X_2 . In contrast, F requires three workers to produce an X_2 .

	X_1	X_2
H	$a_{L1}^H = 1$	$a_{L2}^H = 2$
F	$a_{L1}^F = 6$	$a_{L2}^F = 3$

Table 2.1 Production Technology and Labour Input Requirements

Absolute Advantage (AA)

The concept of absolute advantage (AA) refers to the superior productivity of a country in producing a particular product when compared to another country. To determine which country has AA in producing a product, we compare the levels of a_L 's of a given product across H and F:

→ H: To produce one X_1 , it needs 1 worker.

→ F: To produce one X_1 , it needs 6 workers.

Because it takes fewer workers in H to produce X_1 , we say that H has AA in producing X_1 . We can repeat the exercise for X_2 :

→ H: To produce one X_2 , it needs 2 workers.

→ F: To produce one X_2 , it needs 3 workers.

H has AA in producing X_2 . In this example, H has AA in producing both goods. We can interpret H as a developed country, such as Canada, whereas F is a developing country, such as Mexico. F has absolute disadvantage in producing both goods. The question that we should now ask is whether H has any incentives to trade with F given that for an H worker, H can produce more of both products. H would have incentives to trade only if it has gains from trade. To answer this question, we need the next concept.

Comparative Advantage (CA)

Comparative advantage (CA) is closely related to the concept of opportunity cost or sacrifice. When a worker is producing X_1 , this worker cannot be producing X_2 . This means that for every unit of X_1 produced, a certain amount of X_2 is not produced, or sacrificed. The amount of X_2 not produced is the opportunity cost of producing X_1 .

To find which country has CA in producing a product, we compare the ratios of a_L 's:

→ H: To produce 1 unit of X_1 , it takes 1 worker. This worker could have produced 0.5 unit of X_2 , so the opportunity cost of $X_1 = 0.5X_2$.

→ F: To produce 1 unit of X_1 , it takes 6 workers. These 6 workers could have produced 2 units of X_2 , so the opportunity cost of $X_1 = 2X_2$.

Because H incurs a smaller amount of X_2 sacrificed when the countries produce X_1 , we say that H has CA in X_1 . Of course, we could have begun with looking at X_2 and see how many units of X_1 were sacrificed:

→ H: To produce 1 unit of X_2 , it takes 2 workers. These 2 workers could have produced 2 X_1 , so the opportunity cost of $X_2 = 2X_1$.

→ F: To produce 1 unit of X_2 , it takes 3 workers. These 3 workers could have produced 0.5 X_1 , so the opportunity cost of $X_2 = 0.5X_1$.

Because F incurs a smaller opportunity cost, F has CA in producing X_2 . All together, H has CA in producing X_1 , and F has CA in producing X_2 . Note that, although it is possible for a country to have AA in producing both goods, it is impossible for a country to have CA in producing both goods. This is because if H has CA in producing X_1 such that $X_1 = 0.5X_2$ (which is smaller than F's $X_1 = 2X_2$), then automatically H has comparative disadvantage in producing X_2 because $X_2 = 2X_1$ (which is larger than F's $X_2 = 0.5X_1$). Also note if H has CA in X_1 , it automatically implies that F has CA in X_2 .

Autarky

Given that we have now determined the pattern of AA and CA, we begin with finding the autarkic equilibrium prices for both goods. This idea is similar to solving demand and supply in Chapter 1; however, we need to work with two goods. Under autarky, domestic consumption has to be equal to domestic production in both markets.

We can focus on finding the relative equilibrium price of X_1 relative to X_2 . In economics, we always work with relative price. In reality, we also always think with relative price. The price of a product itself is meaningless to us unless we also have information on the prices of other goods and services. Imagine going to a foreign country, such as Korea, and we only know that the price of a pound of beef is 50,000 Won. The price 50,000 Won tells us nothing. However, if we also know that the price of a can of soda is 1,000 Won, then we know that beef is quite expensive. Specifically, if we buy beef, we forego the opportunity to buy 50 cans of soda. With a given limited income, we always make our buying decisions by comparing relative prices, consciously or subconsciously.

To derive the autarkic equilibrium price ratio P_1/P_2 , we begin with assumption (4) where the industries are perfectly competitive. Perfect competition implies that price is equal to average total cost of production. Let us first focus on H:

→ H: $\pi_1^H = \pi_2^H = 0$ requires the price of the good (P) = unit cost.

→ X_1 : $P_1^H = \text{unit cost} = W_1^H \times a_{L1}^H$, where W_1^H is the wage rate for workers working in industry 1.

→ X_2 : $P_2^H = \text{unit cost} = W_2^H \times a_{L2}^H$, where W_2^H is the wage rate for workers working in industry 2.

We then utilize assumption (5) that says L can move across the two industries freely. Free mobility ensures that L are paid the same wage rate in each industry, so we can drop the subscript that corresponds to the industry, such as $W_1^H = W_2^H = W^H$. The relative price of the two goods becomes:

$$\frac{P_1^H}{P_2^H} = \frac{W_1^H \times a_{L1}^H}{W_2^H \times a_{L2}^H} \rightarrow \frac{P_1^H}{P_2^H} = \frac{a_{L1}^H}{a_{L2}^H} \rightarrow \frac{P_1^H}{P_2^H} = \frac{a_{L1}^H}{a_{L2}^H} = \frac{1}{2} = 0.5$$

This means that X_2 is two times more costly than X_1 . Note that the concept of “costly” is based on the amount of inputs required to produce the goods. Because it takes one worker to produce X_1 and two workers to produce X_2 , all firms are breaking even and all workers are paid the same wage, the price of X_2 has to be two times higher than the price of X_1 . Note that the price ratio is unique, but the levels of the prices are not. Specifically, P_1^H can be any value, but P_2^H will always be twice as high. For convenience’s sake, think of $P_2^H = \$1$, and so that ratio is the price level of X_1 . In this case, $P_1^H = \$0.5$.

Similarly, the relative price of X_1 and X_2 in F is equal to:

$$\frac{P_1^F}{P_2^F} = \frac{W_1^F \times a_{L1}^F}{W_2^F \times a_{L2}^F} = \frac{a_{L1}^F}{a_{L2}^F} = \frac{6}{3} = 2$$

Free Trade

We now let H and F trade with each other. Trade is still free, without import taxes or transportation costs. Opening to trade does not change technology, so the a_L 's remain constant. If both H and F can increase their consumption relative to the autarkic levels, then both countries gain from free trade.

We can utilize various concepts that we have discussed in Chapter 1 to examine free trade characteristics. We can infer the trade pattern from the relative price differences. Recall from Chapter 1 that H's autarkic price was \$2 and F's autarkic price was \$1.5. Under free trade, H imports and F exports at the free trade price of \$1.75. Using the same idea here, H's autarkic price ratio is 0.5 and F's autarkic price ratio is 2. This means H will export X_1 to F and import X_2 from F, and the free trade price ratio is between 0.5 and 2.

$$0.5 < \frac{P_1^{FT}}{P_2^{FT}} < 2$$

In Chapter 1, we examined in detail the changes in total surpluses in both H and F due to free trade. The gains in total surpluses were due to autarkic and free trade price differences. We can adopt the same intuition and apply it here. Therefore, we can also infer that both H and F will gain from FT. Their total surpluses from both industries will increase. We would simply have four graphs of CS, PS and TS.

Production

One main feature of the Ricardian model is that once the countries open to free trade, each country will produce or specialize in one product. A country will specialize in producing the product in which it has comparative advantage. Specifically, H will only produce X_1 and F will only produce X_2 . To illustrate the concept of production specialization, consider the following.

→ Suppose $\frac{P_1^{FT}}{P_2^{FT}} = 1$, which satisfy the condition that the price ratio has to lie in between 0.5 and 2.

→ H: Recall that it takes 1 worker to produce X_1 and 2 workers to produce X_2 . All workers are paid the same W_H ; however, because $P_1^{FT} = P_2^{FT}$, H firms will only produce X_1 because the products sell for the same price and yet X_2 costs twice as many workers.

→ F: Recall that it takes 6 workers to produce X_1 and 3 workers to produce X_2 . All workers are paid the same W_F ; however, because the products sell for the same price and yet X_1 costs twice as many workers, F will only produce X_2 .

Under free trade, each country specializes in producing the product in which it has comparative advantage and imports the other product.

Wages

One of the main controversy or concern that workers in developed countries, such as Canada and the United States, is that free trade with developing countries, such as Mexico and China, would lead to wage convergence across the countries. This would imply a fall in the Canadian wage and a rise in the Mexican wage. This simple Ricardian model sheds some light into this concern.

To examine whether wages will converge between H and F, we can begin with our perfect competition assumption. Because each country produces only one product under free trade, we can specify the following:

$$\rightarrow H: P_1 = \text{unit cost} = W^H \times a_{L1}^H, \text{ so } W^H = \frac{P_1^{FT}}{a_{L1}^H}.$$

$$\rightarrow F: P_2 = \text{unit cost} = W^F \times a_{L2}^F, \text{ so } W^F = \frac{P_2^{FT}}{a_{L2}^F}.$$

We can rewrite and find:

$$\frac{W^H}{W^F} = \left(\frac{P_1^{FT}}{a_{L1}^H} \right) / \left(\frac{P_2^{FT}}{a_{L2}^F} \right) \rightarrow \frac{W^H}{W^F} = \left(\frac{P_1^{FT}}{P_2^{FT}} \right) * \left(\frac{a_{L2}^F}{a_{L1}^H} \right)$$

Next, we need to derive a range for the relative wages, similar to the range for the relative free trade price. To do so, we can utilize our previous results that because

$$\left(\frac{P_1^{FT}}{P_2^{FT}} \right) = \left(\frac{a_{L1}^H}{a_{L2}^F} \right) * \left(\frac{W^H}{W^F} \right) \text{ and } 0.5 < \frac{P_1^{FT}}{P_2^{FT}} < 2, \text{ so } 0.5 < \left(\frac{a_{L1}^H}{a_{L2}^F} \right) * \left(\frac{W^H}{W^F} \right) < 2$$

We can simply find

$$0.5 < \left(\frac{1}{3} \right) * \left(\frac{W^H}{W^F} \right) < 2 \rightarrow 1.5 < \left(\frac{W^H}{W^F} \right) < 6$$

In this example, would H's wage rate ever be equal to F's wage rate under free trade? The answer is no. Because the relative wage ratio has to be larger than 1.5 and smaller than 6, this means W^H is at least 50% higher than W^F . This means H's wage rate will never be equal to F's wage rate. If the range were to include 1, that is, the lower bound number is smaller than 1, then H wage rate can be equal to F's wage rate under free trade.

What determines whether the values of the lower and upper bounds? The answer is absolute advantage (AA). Note that the lower bound value 1.5 is actually a_{L2}^F / a_{L1}^H and the upper bound of 6 is a_{L1}^F / a_{L2}^H . Clearly, for the lower bound to be less than 1, we require $a_{L2}^F < a_{L1}^H$. This means that if H has AA in one product and F has AA in the other product, then it is possible for wages to equalize across the countries under free trade. However, if H is a developed country such as Canada that has AA in producing both products, the Canadian wage will remain higher than Mexican wage. Free trade cannot equalize wages; instead, technological improvement in Mexico is necessary. Gains from trade are positive, but to reap even more gains, countries have to improve their own technology. Of course, the communication arising from free trade is likely to stimulate technological transfers.

Weakness of the Ricardian model

Although our simple, one-input Ricardian model can show that wages will not equalize across countries merely because countries trade, the simplicity of having only labour as input does not allow us to examine income distribution issues. The drop in producer surplus that we have seen in Chapter 1 by the import-competing sectors is not present in this model because all workers work in the export sector. Hence, there are no import-competing industries. In reality, some Canadians do work in import-competing industries such as textiles and low-wage, toll-free phone customer services. What happens to these workers? The Ricardian model does not provide an answer. To examine income distribution controversies, we need a model with at least two inputs, workers versus capital owners. This can be examined by using the Heckscher-Ohlin model.

The Ricardian model is most commonly used in studies that focus on technological transfers and learning-by-doing. The simplicity of having one input allows the authors to focus on examining continuous technological developments over time.

2.3 The Heckscher-Ohlin Model of Comparative Advantage

The Heckscher-Ohlin (HO) model was developed by economists Eli Heckscher and Bertil Ohlin in the early 1900s. The HO model relies on countries' differences in relative factor abundance to drive mutually beneficial free trade. Countries are assumed to have identical technology in producing a given product. In the simplest form, the HO model assumes two countries, two goods, and two factors of production or inputs. Once the countries open to trade, it is very likely that both countries would still produce both goods, and hence there would be an import-competing industry in each country. The presence of these industries allows us to examine income redistribution effects arising from trade. The lobbying efforts of these industries will also lead us to examine in Chapter 3 the different types of government interventions that are often used to hinder free trade.

Assumptions

1. Two goods (X_1 and X_2), two factors (labour and capital), two countries (H and F);
2. Identical technology across countries, but differ across goods;
3. Identical demands across countries, but differ across goods;
4. No barriers to trade, free trade;
5. Firms are perfectly competitive, price = unit cost;
6. Factors are mobile across industries but not across countries, and
7. Countries differ in relative labour (L) and capital (K) supplies or endowments. Labour is paid the wage rate (W) and capital owners are paid the rental rate (r).

Relative Factor Endowments

Assumption (7) is the crucial assumption in the HO model. To illustrate its significance, let us consider the following example:

→ H: $L^H = 10$ and $K^H = 30$. This means H has 10 workers and 30 units of capital. The relative capital-to-labour ratio is simply $K^H/L^H = 3$. Each H worker has 3 units of capital to work with.

→ F: $L^F = 50$ and $K^F = 100$. This means F has 50 workers and 100 units of capital. Hence, $K^F/L^F = 2$, which means each F worker has 2 units of capital to work with.

Because $K^H/L^H > K^F/L^F$, we say the H is relatively K abundant compared to F. Of course, this also implies F is relatively L abundant compared to H. Note that we are comparing the endowment ratios, not the levels. This idea is very similar to the concept of comparative advantage. Given that both countries have the same production technology, the comparative advantage of a country arises due to relative factor endowments. Note that even though F has more L and K than H in levels, we still say H is relatively K abundant. This idea is analogous to the concept of absolute advantage.

Production Technology

Having defined relative abundance in factor endowments, the next step is to examine how the endowments are used to produce goods. Following the example above:

→ Let a_{L1} and a_{L2} be the L input requirements for X_1 and X_2 , respectively.

→ Let a_{K1} and a_{K2} be the K input requirements for X_1 and X_2 , respectively.

We do not need superscripts to denote H or F because we have assumed that production technology in producing a given product is identical across countries. We would define relative input intensity requirements in a similar way in which we have defined relative factor endowments. Following the example above:

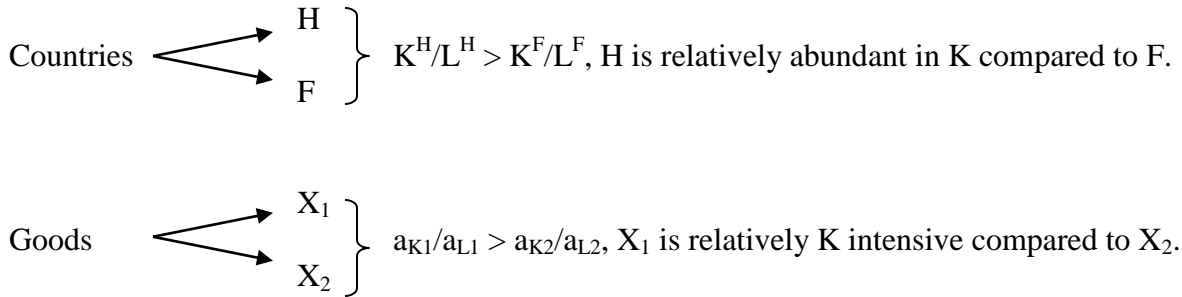
→ Suppose X_1 is produced with 1 L ($a_{L1} = 1$) and 4 K ($a_{K1} = 4$). The input ratio is simply $(a_{K1}/a_{L1}) = 4$. To produce 1 unit of X_1 , it takes 1 worker to operate 4 machines.

→ Suppose X_2 is produced with 2 L ($a_{L2} = 2$) and 6 K ($a_{K2} = 6$). The input ratio is simply $(a_{K2}/a_{L2}) = 3$. To produce 1 unit of X_2 , it takes 2 workers to operate 6 machines.

Because $a_{K1}/a_{L1} > a_{K2}/a_{L2}$, we say that X_1 is the relatively K-intensive good, whereas X_2 is the relatively L-intensive good. Once again, we are comparing the input ratios of the products, not the levels of inputs required. Because we are comparing input ratios, X_2 cannot be both relatively L-intensive and relatively K-intensive, although it does take more workers and machines to produce a unit of X_2 compared to X_1 .

Results

To summarize the characteristics of the HO model, let us clearly show the numerical example that we have just discussed:



Then we have the following three sets of predictions:

1. HO theorem: A country exports the good that uses relatively intensively the factor it has relative abundance and imports the other good. In our example, H exports X_1 and imports X_2 . The reverse is true for F.
2. Factor Price Equalization theorem (FPE): Factor prices will equalize across the countries. This means $W^H = W^F$ and $r^H = r^F$.
3. Stolper-Samuelson theorem (SST): The factor that is used intensively in the export sector will have a real income gain, whereas the other factor that is used intensively in the import-competing sector will have a real income loss. In our example, in H, $\% \Delta r^H > \% \Delta P_1/P_2 > 0$ and $\% \Delta W^H < 0$. In F, $\% \Delta W^F > \% \Delta P_2/P_1 > 0$ and $\% \Delta r^F < 0$.

An Example to Illustrate

Let H = Canada and F = Mexico. By casual observation, we can argue that Canada is relatively more abundant in K compared to Mexico, so Mexico is relatively more abundant in L compared to Canada. Let X_1 = autos, X_2 = clothing, and we can argue sensibly that autos are produced relatively more K-intensively than clothing. Canada's relative capital abundance generates a comparative advantage for Canada in producing autos, which use capital quite intensively. Mexico's relative labour abundance offers Mexico a comparative advantage in producing clothing, which uses a lot of workers.

The HO theorem (result 1) predicts that Canada will export autos and import clothing. Similar to previous discussions, a country exports the product in which it has a comparative advantage and imports the other product. In the HO model, comparative advantage arises from relative factor abundance, rather than labour productivity under the Ricardian model. Under autarky, autos in Canada are cheaper than autos in Mexico because Canada is abundant in capital. In contrast, Canadian clothing is more expensive than Mexican clothing. Hence, utilizing our previous knowledge, we can conclude that the free trade price ratio will be

$$\frac{P_1^H}{P_2^H} < \frac{P_1^{FT}}{P_2^{FT}} < \frac{P_1^F}{P_2^F}$$

With free trade, the FPE theorem (result 2) predicts that wages in Canada and Mexico will equalize $W^C = W^M$ and so would the rental rates $r^C = r^M$. To see intuitively why factor prices will equalize before trade, we can begin with autarkic factor prices. Before trade, because Canada is relatively capital abundant, this implies r^C is quite low. Because Canada is relatively labour scarce, W^C will be quite high. The opposite is true in Mexico. This implies that under autarky,

$$\frac{r^C}{W^C} < \frac{r^M}{W^M}$$

However, once the countries trade, Canada exports autos because autos can command a higher price. Canadian firms will produce more autos. These firms will demand a lot of capital and a few workers because autos are produced capital intensively. This pushes r^C a lot higher and W^C a bit higher. However, these capital and workers must be coming from the clothing industry. Canadians import more Mexican clothing and, hence, production of Canadian clothing will drop. This releases a lot of workers and a bit of capital. This implies W^C will drop a lot and r^C will drop a bit. All together, we will have:

- X_1 auto industry → $r^C \uparrow\uparrow$, $W^C \uparrow$ because autos are K-intensive.
- X_2 clothing industry → $r^C \downarrow$, $W^C \downarrow\downarrow$ because clothing is L-intensive.
- All together for Canada, $r^C \uparrow$ and $W^C \downarrow$.

This means the $\frac{r^C}{W^C}$ will \uparrow . The opposite will be true for Mexico such that $\frac{r^M}{W^M}$ will \downarrow . Eventually, the factor prices will stop changing only when $r^C = r^M$ and $W^C = W^M$. Under free trade,

$$\frac{r^C}{W^C} = \frac{r^M}{W^M}$$

Now that we have established that the nominal factor prices will equalize across countries, we need to examine the *real* income changes of the factors. Because P_1/P_2 must have changed due to trade, we need to look at the relative changes of wages, rental rates, and the goods prices. The SST (result 3) can provide an answer. In Canada, the SST predicts that capital owners will enjoy a real income gain while labour will suffer a real income drop. This means:

- $\% \Delta r^C > \% \Delta \left(\frac{P_1^{FT}}{P_2^{FT}} \right)$, and
- $\% \Delta W^C < 0$.

The opposite is true in Mexico. Mexican workers will gain in real income but capital owners will lose:

- $\% \Delta W^M > \% \Delta \left(\frac{P_2^{FT}}{P_1^{FT}} \right)$, and
- $\% \Delta r^M < 0$.

We can infer from the SST results why there will always be opposition to free trade. Workers in Canada will suffer a loss in real income, or purchasing power, due to more import competition; however, the gains to the capital owners will be larger than the losses of the workers. To ensure that free trade can benefit everyone, governments need to implement lump-sum income transfer schemes to redistribute income, as discussed in Chapter 1.

Implications of Factor Price Theories

The FPE and SST summarize the effects of free trade on factor prices. Based on these theories, we can also predict how free trade can affect income gaps across countries. In Canada, because it is relatively capital abundant compared to most developing countries, Canadians expect rental rates to rise and wage rates to fall as a result of trade. Because capital owners are more likely to earn higher returns than average workers, the income gap in Canada is expected to rise. Trade could increase income inequality in developed countries such as Canada. In contrast, Mexican capital owners face more competition from Canadian capital-intensive exports, hence rental rates in Mexico are expected to fall. Wages, however, should rise. Free trade is expected to narrow the income gap in developing countries such as Mexico.

Strength of the HO model

The HO model includes two factors of production, and hence we can discuss income distribution effects arising from free trade. The result is that the factor used intensively in the import-competing sector will be opposed to free trade. This factor loses, another factor gains, and so there will be opposition to and support for free trade. Because free trade does increase a country's overall welfare or total surplus, as discussed in Chapter 1, the government needs to implement policies that will help the factors who lose. For example, Trade Assistance Program (TAP) offers re-education funding, extended unemployment benefits, and job search assistance to those who have lost their jobs because of free trade.

Weakness of the HO model

Of course, technology is not likely to be identical across countries and industries can be imperfectly competitive. By incorporating imperfect competition, the models would become much more complicated with game theory, positive economic profits, exit and entry, etc. Numerous economists have looked at such models, and such studies are generally classified as “new” trade theory. These topics are certainly interesting and are explored in more advanced international trade theory textbooks and courses.

Also, recall from Chapter 1 that North American countries and European countries trade mostly with each other. These countries are quite similar in terms of relative factor endowments. In particular, these countries are capital abundant relative to developing countries. According to the HO model, developed countries should trade mainly with developing countries if relative factor endowment differences were the main reasons that drive trade patterns. Obviously, the HO model cannot adequately explain this type of trade. Economic models with product varieties, such as models that incorporate monopolistic competition, can offer alternative explanations for why similar countries trade with each other. Studies have found that the consumers' love of product varieties, such as different brands of cars and electronics, explains such trade. This result is also consistent with our finding in Chapter 1 that Canada engages in intra-industry trade. We import and export different types of cars and electronics because we benefit from having more product varieties. More advanced trade theory courses will explore such topics in detail. In short, the HO model seems to explain why developed and developing countries may trade, but not why countries with similar relative factor abundance would trade.

2.4 Data and Interpretation

Convergence of Real Wages across some Industrialized Countries

The Ricardian model states that workers earn wages that are proportional to their productivity, and that although free trade can increase total surplus, technological improvement is needed for wages to converge across developed and developing countries. The factor price equalization theorem says that if countries have identical technological levels, wages will be equalized across such countries. A handful of countries have significantly improved their technological levels from the post-World War II period to the present. According to the Ricardian model, we expect to observe wage convergence across countries that have similar technological levels. These countries include Japan, a handful of western European countries and Canada. Table 2.2 shows that real wages have indeed converged to similar levels over the years. In 1959, with the US real wage measured as 100, the average real wage in these selected countries was 27% of the US value. In the subsequent decades, these countries have caught up with or even surpassed the technological levels of the US. Consequently, we also observe the average real wage to approach and eventually exceed the US real wage. Education is essential in technological development. International organizations such as the United Nations and the Global Campaign for Education have devoted much attention and effort in increasing the accessibility of education in developing countries.

Real Hourly Wage in Manufacturing Sector of Selected Countries				
Country	1959	1983	2000	2007
Canada	42	57	90	108
Italy	23	42	85	104
France	27	41	91	105
UK	29	35	84	113
Germany	29	56	121	142
Japan	11	24	111	95
Unweighted Average	27	43	97	111
US	100	100	100	100

Table 2.2 The Convergence of Real Wages Across Industrial Countries

Source: *International Economics*, 9th and 10th editions, by Dominick Salvatore, Wiley Publishing, p. 144 and p.148, respectively.

Even though Canada's real wage has caught up with the US' level since World War II, our productivity levels are still lagging a bit behind. The reasons for such gap include our small Canadian population that spreads across a vast geographical area. Our population of approximately 34 million is about 1/10 of the US' size. Our sparsely populated country implies that our communication and delivery efficiency would be hampered, and we are less likely to enjoy economies of scale, learning from doing, and the beneficial positive externality arising from population clusters (imagine computer techs in Silicon Valley). Our harsh Canadian climate also limits the type of industries we could focus on. Another potential explanation has recently been examined by Statistics Canada. It has found that the gap may be due to the low productivity levels of the self-employed Canadians¹. Statistically, when the self-employed Canadians are removed from the equation, the productivity gap disappears. Our lectures and "Forum" will explore this topic further.

¹ <http://www.theglobeandmail.com/report-on-business/economy/economy-lab/daily-mix/productivity-lag-pinned-on-self-employed-canadians/article2113186/>

Do countries trade following the patterns predicted by the HO model, i.e., countries that are relatively abundant in capital export relatively capital-intensive products to relatively labour abundant countries? Even without looking at any new information, we can answer this question with “only to a certain extent”, using the information we have seen in Chapter 1. From Chapter 1, we saw that 70% of the EU’s trade takes place amongst EU countries, and 80% of Canada’s trade is with the US. The EU, Canada and the US are relatively capital abundant countries compared to the rest of the world, and yet they trade mainly with each other. This means that the HO model cannot explain why countries that are similar in relative factor endowments trade so much, but perhaps it can explain why developed and developing countries trade. Other models that incorporate imperfect competition suggest that similar countries trade with each other to gain from product varieties and economies of scale.

To determine if the HO model works, we need three sets of information: measurements of capital-to-labour endowment ratios of different countries, the capital-to-labour input ratios of different products, and the countries that export and import such products. Table 2.3 shows the measurements of capital-to-labour ratios of selected countries. Not surprisingly, Canada, Japan and the US are abundant in capital, while countries such as Chile, India and Bolivia are abundant in labour. Table 2.3 also shows the input ratios of selected products. We can see that machinery and transport equipment are capital-intensive products, while textiles and clothing are labour-intensive products.

Capital-to-Labour Endowment Ratios and Input Ratios of Selected Countries and Products			
Country	K/L Endowment Ratios	Products	K/L Input Ratios
Canada	\$89,652	Transportation Equipment	\$67,846
Japan	\$111,615	Electronic Equipment	\$54,582
US	\$73,282	Industrial Machinery	\$49,949
Chile	\$11,306	Furniture and Fixtures	\$21,735
India	\$5,870	Leather Products	\$12,465
Bolivia	\$5,355	Apparel and Textile Products	\$8,274

Table 2.3 Capital-to-Labour Ratios of Selected Countries and Products²

If the HO model works, we expect Canada to be a net exporter of machinery and equipment, while Chile, India and Bolivia to be net exporters of furniture, leather and textile products. Table 2.4 shows that, on average, these countries do follow these patterns of trade. We mainly export industrial machinery such as nuclear reactors, boilers and automobiles to these countries, and import lamps, raw skin hides and clothing from them. Negative values for net exports mean that Canada is a net importer of the corresponding product. The HO model seems to explain the trade across Canada and some developing countries.

Canada's Net Exports of Selected Products to Selected Countries in 2005-2007 (C\$)			
Products	Chile	India	Bolivia
Transportation Equipment	\$14,967,434	-\$31,669,486	\$1,388,077
Electronic Equipment	\$49,943,730	\$52,794,572	\$1,414,748
Industrial Machinery	\$85,913,074	\$34,836,501	\$14,682,423
Furniture and Fixtures	-\$2,898,223	-\$29,198,175	-\$15,742
Leather Products	-\$608,419	-\$38,503,512	-\$41,891
Apparel and Textile Products	\$4,930,780	-\$527,441,912	-\$32,558

Table 2.4 Canada’s Net Exports of Selected Products with Selected Countries

Source: <http://www.ic.gc.ca/epic/site/tdo-dcd.nsf/en/Home>

² Capital-to-labour endowment ratios are from Penn World Tables, <http://chass.utoronto.ca>, and *International Economics*, D. Salvatore, 10th edition, p. 133, while capital-to-labour input ratios are from the US Department of Commerce, Bureau of the Census, 1992 *Census of Manufactures: General Summary*.

Income Gap Widens within Canada

The Stolper-Samuelson theorem predicts that as a relatively capital abundant country, such as Canada, opens to more trade, it would observe an increase in income gap. High-income earners, such as capital owners, will gain because Canada will produce and export more capital-intensive goods. Low-income earners, such as workers, will face more labour-intensive imports and suffer a decrease in real income. As a result, the income gap will widen within Canada. **Figure 2.1** is an article from *Statistics Canada, The Daily*, published on December 13, 2006. The author found that the income gap in Canada has indeed increased over the past decade; however, the rising gap has not been because of trade, but rather because of various other reasons. The minimum role of trade is perhaps not too surprising, given that the US, which has similar income levels as Canada, is our main trade partner.

Study: Inequality in wealth

The gap between the nation's families with the highest net worth and those with the lowest widened between 1999 and 2005, in part because of gains in the value of housing, a new study shows.

The study, published today in *Perspectives on Labour and Income*, ranked family units into five groups, or quintiles, from the lowest net worth to the highest. Each represented 20%, or one-fifth, of all families.

Between 1999 and 2005, the median net worth of families in the top fifth of the wealth distribution increased by 19%, while the net worth of their counterparts in the bottom fifth remained virtually unchanged.

In 2005, those in the top 20% of the wealth distribution had a median net worth (excluding the value of employer-sponsored pension plans) estimated at \$551,000 (in 2005 dollars). In other words, half of the families in the top 20% of the wealth distribution had net worth more than this figure, and half less. The corresponding numbers were \$465,000 in 1999 and \$336,000 in 1984.

In contrast, the median net worth of the families in the bottom fifth stagnated between 1984 and 2005. In fact, the value of their assets never exceeded the value of their debts during the 1984 to 2005 period.

As a result, the top 20% of families held 75% of total household wealth in 2005, compared to 73% in 1999 and 69% in 1984. The study was based on results of the 1984 Assets and Debts Survey, and the Survey of Financial Security conducted in 1999 and 2005.

Net worth is the amount an individual or family would clear after selling all assets, such as residences, stocks and registered retirement savings plans; and paying off all debts, such as mortgages, car loans and student loans. The terms "net worth" and "wealth" are interchangeable. Families include unattached individuals.

To make the concept of net worth comparable among all three surveys, this study excluded various items from the 1999 and 2005 data since they were not included in the 1984 survey. These were: employer-sponsored pension plans, contents of the home, collectibles and valuables, annuities, and registered retirement income funds. On that basis, the median net worth of all Canadian families in 2005 amounted to about \$84,800, compared with \$74,400 in 1999 and \$67,300 in 1984. Part of the growth in net worth among families in the top 20% of the distribution was fuelled by increases in the value of housing.

In both 1999 and 2005, the vast majority of these families (at least 95%) owned a house. During the six-year period, the median value of their principal residence rose a solid \$75,000, reflecting sharp increases in housing prices. In contrast, the value of holdings on a principal residence changed little among families in the bottom 20%. At most, 6% of these families owned a house during this time.

The growing inequality in net worth during the past six years followed an increase in inequality in family after-tax income that occurred during the 1990s. This suggests that growing income dispersion over the last decade also contributed to the increase in concentration of wealth.

The study also showed that population aging was not a factor behind the growth in wealth inequality between 1984 and 2005. In fact, it found that wealth concentration would have risen even more had the age structure of the population remained constant over time.

While the median wealth of families and unattached individuals rose 26% between 1984 and 2005, it fell substantially among families in which the major income recipient was aged 25 to 34.

In 2005, these families and individuals had median wealth holdings of \$13,400, much lower than \$27,000 in 1984 and \$17,400 in 1999. This decline was due mainly to the fact that cumulative earnings of young men (the sum of earnings they receive over several years) fell substantially between the 1970s and 1990s.

Between 1994 and 2004, these cumulative earnings averaged roughly \$267,000, compared with \$330,000 accumulated between 1973 and 1983. In contrast, cumulative earnings of young women increased about \$10,000 from \$166,000 to \$177,000 during these periods.

Three factors were behind the decline among young men. First, they now stay in school longer than their counterparts did during the mid-1970s. This reduces the number of years during which they receive significant wages. Second, once out of school, they are less likely to have a full-time, and therefore relatively well-paid, job than in the past. Third, those who did work on a full-year, full-time basis earned less annually during much of the 1990s than their counterparts did previously.

Increases in student loan debt played a minor role. One reason is that student debt is carried mainly by post-secondary graduates, who represent only a fraction of young individuals. In fact, average amounts owed on student loans rose by a modest \$3,300 between 1984 and 2005.

Figure 2.1 Widening Income Gap within Canada

Source: <http://www.statcan.ca>

Income Inequality Widens Across Countries

As we have seen in Chapter 1, world trade values have been increasing over the past few decades. Trade theory predicts that economic growth or total surplus should rise as a result of more trade. We should expect improvement in real income and a narrowing income gap across developed and developing countries. The reality, however, is the opposite. The number of countries that meets the criteria as “least developed countries” - those with a per capita income of less than US\$900 per year and with scarce investment in health, nutrition and education - has increased from 25 to 49 between 1971 and 2001³.

According to Lant Prichett, *Journal of Economic Perspectives*, Summer 1997 issue, the per capita income in developed countries, such as the US and the United Kingdom, was roughly nine times that of developing countries in 1870. In 1990, per capita income in the US has risen to more than 45 times of Chad or Ethiopia per capita income. Prichett also calculated that per capita income in the world’s 17 richest countries was 2.4 times that of all other countries in 1870. By 1990, the same group of richest countries was 4.5 times as rich as the rest.

This gap is still widening. **Table 2.5** shows the average per capita income measured on the basis of purchasing power for the richest and poorest 10 countries in the world. In 2001, per capita income in the richest 10 countries was 69 times that of the poorest 10 countries. This ratio peaked at 78 in 2007 when the developed countries were enjoying the inflated housing market and banking sector economic boom. In 2009-10, this ratio dropped back 71, similar to the levels in 2001-2. We can conclude that, on average, the richest countries earn about 75 times the income of the poorest countries. Of course, the least developed countries lag behind in economic growth due to various reasons including political uncertainties and natural calamities such as droughts and floods. The question is what can be done to reduce this gap.

GDP per Capita (Purchasing-Power-Parity Based) for Top and Bottom 10 countries (in 2005 International \$)										
Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
World	7,964	8,075	8,257	8,562	8,840	9,184	9,552	9,699	9,527	9,889
Luxembourg	61,857	63,725	63,930	65,800	68,320	70,582	74,114	73,849	69,856	71,162
Singapore	36,573	37,776	40,101	43,260	45,374	47,804	49,877	47,995	46,211	51,969
Norway	44,294	44,711	44,899	46,359	47,306	47,996	48,800	48,557	47,264	46,926
United States	39,602	39,944	40,588	41,653	42,534	43,257	43,660	43,250	41,735	42,642
Hong Kong SAR, China	29,713	30,127	31,094	33,464	35,678	37,938	39,961	40,579	39,353	41,714
Switzerland	34,892	34,782	34,457	35,088	35,784	36,851	37,854	38,086	36,893	37,441
Netherlands	34,081	33,890	33,844	34,481	35,104	36,238	37,577	38,135	36,454	36,915
Austria	31,737	32,098	32,219	32,809	33,377	34,373	35,576	36,193	34,668	35,266
Canada	32,694	33,349	33,640	34,344	35,033	35,651	36,074	35,895	34,567	35,243
Ireland	33,687	35,292	36,254	37,234	38,623	39,720	41,025	38,954	35,733	35,184
Average	37,913	38,570	39,103	40,449	41,713	43,041	44,452	44,149	42,273	43,446
Mozambique	551	584	603	634	670	710	743	776	807	845
Timor-Leste	732	719	687	684	700	642	677	753	792	832
Malawi	618	612	629	646	645	675	693	731	762	791
Sierra Leone	483	588	612	628	647	671	695	716	723	742
Central African Republic	754	738	671	667	672	686	698	700	698	708
Niger	618	615	625	604	610	623	622	652	622	653
Eritrea	672	664	620	604	596	570	560	490	494	490
Liberia	476	484	328	331	338	350	365	372	371	376
Burundi	354	361	347	353	346	353	355	360	362	366
Congo, Dem. Rep.	248	249	256	265	274	279	289	298	298	311
Average	551	561	538	542	550	556	570	585	593	611
Ratio	69	69	73	75	76	77	78	76	71	71

Table 2.5 Widening Per Capita GDP in Richest and Poorest Countries, 2001-2010
Source: <http://search.worldbank.org/data?qterm=gdp%20per%20capita&language=EN>

³ http://www.cbc.ca/world/story/2001/05/14/unpoverty_nc_010514.html.

Potential Solutions to Widening Income Gap

1. Foreign Aid

The first *possible* answer is increase in foreign aid. The United Nations published a report that shows that if developed countries increase monetary aid to the world's poorest countries, world poverty can be halved within 10 years. **Figure 2.2** is an article from CBC News that summarizes this report's main findings. In 1970, developed countries have pledged to offer 0.7% of their GDP per year as international aid, but most countries have fallen short of their promises, including Canada.

Rich nations can halve world poverty within 10 years: UN

Last Updated Mon, 17 Jan 2005 13:04:08 EST [CBC News](http://www.cbc.ca)

UNITED NATIONS - Tens of millions of people can be saved and more than 500 million people can escape poverty if rich countries keep their word to increase development aid to the world's poorest countries, a United Nations-sponsored report said Monday.

"We have the opportunity in the coming decade to cut world poverty by half," the 3,000-page report said.

Written by 265 experts, the report, entitled Investing in Development, says countries must double annual aid to \$135 billion US in 2006, rising to \$195 billion US by 2015. The report says rich countries should have no problem doling out the funds. Such aid "pales beside the wealth of high income countries – and the world's military budget of \$900 billion a year," according to the report.

At the Millennium Summit in 2000, world leaders set goals to fight poverty and hunger by 2015. Those goals included halving the number of people living on a dollar a day, achieving universal primary education, and halting and reversing the spread of HIV/AIDS and malaria. If the millennium goals are achieved by 2015, "more than 500 million people will be lifted out of extreme poverty. More than 300 million will no longer suffer from hunger ... Hundreds of millions more women and girls will go to school," the report said. "If the goals are not met, millions will die who would otherwise live."

In 1970, the world's nations agreed to provide 0.7 per cent of their gross national income for development assistance. Only Denmark, Luxembourg, the Netherlands, Norway and Sweden have met or surpassed the commitment.

The U.S spends about 0.15 per cent of its GDP on development aid. Canada contributes about \$3 billion Cdn a year to foreign aid, amounting to 0.3 per cent of the GDP.

The report said those countries accused of human rights abuses, including Belarus, North Korea and Zimbabwe, should not receive large-scale aid.

Figure 2.2 Halving World Poverty by Increasing Foreign Aid

Source: <http://www.cbc.ca>

The United Nations Millennium Poverty Summit aims to cut global poverty rates by half, increase access to elementary education in least developed countries, cut infant mortality rates, combat HIV/AIDS, amongst other goals⁴. By 2010, the interim report card shows that very few of such goals have been reached or much progress has been made⁵. Unfortunately, these goals seem to have been sidelined by the global recession in 2009-10. In fact, various developed countries have cut their foreign aid in times of economic downturns⁶.

A question that we should ask is even if foreign aid does increase to the recommended levels, would world poverty be halved? Some studies have found evidence to the contrary. The Fraser Institute published a report that claims foreign aid perpetuates poverty and leaves poorest countries to rely on hand-outs⁷. In addition, international development aid agency ActionAid claims that out of the \$3.74 billion that Canada offers in aid, around \$1 billion is paid to western consultants and administrators⁸. These topics will be explored further in our lectures and "Forum".

⁴ <http://www.endpoverty2015.org>

⁵ <http://www.cbc.ca/news/world/story/2010/09/20/un-millennium-development-goals.html>

⁶ <http://www.ft.com/intl/cms/s/0/252d3680-1d8b-11de-9eb3-00144feabdc0.html#axzz1aytgY1QS>

⁷ http://www.fraserinstitute.org/files/PDFs/students_learning/2007_Contest_Javorsky.pdf

⁸ <http://www.cbc.ca/world/story/2006/07/26/cda-foreignaid.html>

2. Micro-finance Projects

So if aid is insufficient and may be inefficient, then what are some alternative approaches to alleviating world poverty? One possible answer is through micro-credit lending schemes, such as the idea of 2006 Nobel Peace Prize winner Muhammad Yunus and his Grameen Bank. Micro-credit refers to lending small amounts of money to individuals even when they do not have collateral. These individuals would not have qualified for traditional bank loans, but they have the experience and ideas to expand their businesses. Rather than having them stuck in the vicious cycle of poverty, small loans are lent to them with the faith that they would make good use of their loans. The loan repayment rate has been impressive, in excess of 95%. While there have been successes and examples of failures, this direct approach seems to have made positive differences in the lives of many individuals. The lectures and the “Forum” will explore this topic further, as well as similar organizations such as Kiva and Concordia’s Micro-Finance Initiative project.

3. Increase the Degree of Economic Freedom

Another answer is not through micro-loans and international aid, but rather the availability of economic freedom to the countries’ population. The Heritage Foundation and the Wall Street Journal jointly publish a proxy for economic freedom called “index of economic freedom.” The index covers 179 countries across 10 specific freedoms such as trade freedom, business freedom, investment freedom, and property rights. The main insight of this index is that countries that rank high (low) in economic freedom are also countries that have been experiencing high (low) economic growth. **Table 2.6** shows the rankings of the top and bottom 10 countries for the year 2011. It appears that by simply offering people the freedom to make their own economic decisions, such as production, import and export, economies tend to improve significantly. However, we need to be careful with concluding that economic freedom equals economic prosperity. Economic freedom is beneficial only if the countries are also ready to handle the economic responsibilities that accompany the freedom. Otherwise, as we have discussed in previous pages, the freedom may serve to exacerbate existing market inefficiencies and problems rather than resolve them.

Rank	Country or Economy	2011 Overall Score	Business Freedom	Trade Freedom	Fiscal Freedom	Gov't Spending	Monetary Freedom	Investment Freedom	Financial Freedom	Property Rights	Freedom from Corruption	Labor Freedom
1	Hong Kong	90	99	90	93	90	87	90	90	90	82	86
2	Singapore	87	98	90	91	91	86	75	60	90	92	98
3	Australia	82	90	84	61	65	85	80	90	90	87	92
4	New Zealand	82	100	87	65	49	85	80	80	95	94	89
5	Switzerland	82	80	90	68	69	84	80	80	90	90	88
6	Canada	81	96	88	78	53	79	75	80	90	87	82
7	Ireland	79	92	88	72	47	81	90	70	90	80	77
8	Denmark	79	100	88	43	20	81	90	90	90	93	92
9	United States	78	91	86	68	55	77	75	70	85	75	96
10	Bahrain	78	77	83	100	80	74	75	80	60	51	97
170	Timor-Leste	43	44	73	65	NA	78	30	20	20	22	76
171	Iran	42	69	45	81	76	61	0	10	10	18	51
172	D. R. of Congo	41	38	63	73	85	47	15	20	10	19	37
173	Libya	39	20	85	80	45	71	10	20	10	25	20
174	Burma	38	20	72	82	98	57	0	10	5	14	20
175	Venezuela	38	48	61	75	65	47	5	20	5	19	31
176	Eritrea	37	18	69	73	31	46	0	20	10	26	73
177	Cuba	28	10	62	49	NA	72	0	10	10	44	20
178	Zimbabwe	22	32	45	70	NA	0	0	10	5	22	37
179	North Korea	1	0	0	0	NA	0	0	0	5	5	0

Table 2.6 Index of Economic Freedom for Top 10 and Bottom 10 Countries, 2011

Source: <http://www.heritage.org/research/features/index>