A Model of Trade
Introduction

- The standard trade model combines ideas from the Ricardian model and the Heckscher-Ohlin model.
  1. Differences in labor, labor skills, physical capital, land and technology between countries cause productive differences, leading to gains from trade.
  2. These productive differences are represented as differences in production possibility frontiers, which represent the productive capacities of nations.
  3. A country’s PPF determines its relative supply curve.
  4. National relative supply curves determine world relative supply, which along with world relative demand determines an equilibrium under international trade.
Hecksher-Ohlin Model

• Adds another factor of production to the Ricardian set-up – and thereby allows for the possibility that comparative advantage arises from differences in countries resources.

• Key Result: A country will export that commodity which intensively uses its abundant factor.
Assumptions for our new model:

• Two countries – each produce (and consume) two homogeneous goods (food and cloth)
• Each country’s production possibility frontier is a smooth curve (no longer a straight line as was the case in the Ricardian model when we just had one factor of production)
• Perfect competition
• Consumption decisions may be represented as if they were based on the tastes of a single representative individual
The Value of Production

• Recall that when the economy maximizes its production possibilities, the value of output $V$ lies on the PPF.

• $V = P_C Q_C + P_F Q_F$ describes the value of output in a two good model, and when this value is constant the equation’s line is called and isovalue line.

♦ The slope of any equation’s line equals $-\left(\frac{P_C}{P_F}\right)$, and if relative prices change the slope changes.
The Value of Production (cont.)

**Figure 5-1**
Relative Prices Determine the Economy’s Output

An economy whose production possibility frontier is \( TT \) will produce at \( Q \), which is on the highest possible iso-value line.
The Value of Production (cont.)

**Figure 5-2**

**How an Increase in the Relative Price of Cloth Affects Relative Supply**

The isovalue lines become steeper when the relative price of cloth rises from \((P_C/P_F)^1\) to \((P_C/P_F)^2\) (shown by the rotation from \(VV^1\) to \(VV^2\)). As a result, the economy produces more cloth and less food and the equilibrium output shifts from \(Q^1\) to \(Q^2\).
The Value of Consumption

- The value of the economy’s consumption is constrained to equal the value of the economy’s production.
  \[ P_C D_C + P_F D_F = P_C Q_C + P_F Q_F = V \]

- Production choices are determined by the economy’s PPF and the prices of output.

- What determines consumption choices (demand)?
The Value of Consumption (cont.)

• Consumer preferences and prices determine consumption choices.

• Consumer preferences are represented by **indifference curves**: combinations of goods that make consumers equally satisfied (indifferent).
The Value of Consumption (cont.)

**Figure 5-3**
Production, Consumption, and Trade in the Standard Model

The economy produces at point $Q$, where the production possibility frontier is tangent to the highest possible isovalue line. It consumes at point $D$, where that isovalue line is tangent to the highest possible indifference curve. The economy produces more cloth than it consumes and therefore exports cloth; correspondingly, it consumes more food than it produces and therefore imports food.
The Value of Consumption (cont.)

• Indifference curves are downward sloping to represent the fact that if a consumer has more cloth he could have less food and still be equally satisfied.

• Indifference curves farther from the origin represent larger quantities of food and cloth, which should make consumers more satisfied and better off.

• Indifference curves are flatter when moving to the right: the more cloth and the less food that is consumed, the more valuable an extra calorie of food becomes relative to extra cloth.
Prices and the Value of Consumption

- Prices also determine the value of consumption.
  - When the price of cloth rises relative to the price of food, the economy is better off when it exports cloth: a higher indifference curve results.
  - A higher price for cloth exports means that more food can be imported.
  - A higher relative price of cloth will also influence consumption decisions about cloth versus food: a higher relative price of cloth makes consumers willing to buy less cloth and more food.
Prices and the Value of Consumption (cont.)

Figure 5-4

Effects of a Rise in the Relative Price of Cloth

The slope of the isovalue lines is equal to minus the relative price of cloth $P_C/P_F$, so when that relative price rises all isovalue lines become steeper. In particular, the maximum-value line rotates from $VV^1$ to $VV^2$. Production shifts from $Q^1$ to $Q^2$, consumption shifts from $D^1$ to $D^2$. 
Prices and the Value of Consumption (cont.)

• The change in welfare (income) when the price of one good changes relative to the price of another is called the **income effect**.
  - The income effect is represented graphically by shifting the indifference curve.

• The substitution of one good for another when the price of the good changes relative to the other is called the **substitution effect**.
  - This substitution effect is represented graphically by a moving along a given indifference curve.
Welfare and the Terms of Trade

- The **terms of trade** refers to the price of exports relative to the price of imports.
  - When a country exports cloth and the relative price of cloth increases, the terms of trade increase or “improve”.
- Because a higher price for exports means that the country can afford to buy more imports, an increase in the terms of trade increases a country’s welfare.
- A decrease in the terms of trade decreases a country’s welfare.
Determining Relative Prices

• To determine the price of cloth relative to the price food in our model, we again use relative supply and relative demand.
  
  ♦ relative supply considers world supply of cloth relative to that of food at each relative price
  
  ♦ relative demand considers world demand of cloth relative to that of food at each relative price
  
  ♦ In a two country model, world quantities are the sum of quantities from the domestic and foreign countries.
Determining Relative Prices (cont.)

**Figure 5-5**

**World Relative Supply and Demand**

The higher $P_C/P_F$ is, the larger the world supply of cloth relative to food ($RS$) and the lower the world demand for cloth relative to food ($RD$). Equilibrium relative price (here, $(P_C/P_F)^1$) is determined by the intersection of the world relative supply and demand curves.
The Effects of Economic Growth

- Is economic growth in China good for the standard of living in the US?
- Is growth in a country more or less valuable when it is integrated in the world economy?
- The standard trade model gives us precise answers to these questions.
The Effects of Economic Growth (cont.)

- Growth is usually **biased**: it occurs in one sector more than others, causing relative supply to shift.
  - Rapid growth has occurred in US computer industries but relatively little growth has occurred in US textile industries.
  - According to the Ricardian model, technological progress in one sector causes biased growth.
  - According to the Heckscher-Ohlin model, an increase in one factor of production (e.g., an increase in the labor force, arable land, or the capital stock) causes biased growth.
The Effects of Economic Growth (cont.)

Figure 5-6
Biased Growth
Growth is biased when it shifts production possibilities out more toward one good than toward another. In both cases shown the production possibility frontier shifts out from \( TT^1 \) to \( TT^2 \). In case (a) this shift is biased toward cloth, in case (b) toward food.
Rybczynski Effect

• The Rybczynski theorem was developed by the Polish-born English economist Tadeusz Rybczynski (1923-1998).

• Hold relative prices constant and ask what happens when the production possibility frontier shifts outward in a biased fashion (due to the expansion of one factor).

• For example, an increase in the supply of land expands production possibilities disproportionately in the direction of food production (where land is the intensive factor).

• Likewise, an increase in labor would expand the PPF disproportionately in the direction of cloth production (where labor is the intensive factor).
Rybczynski Effect (cont.)

• Biased growth will not only lead to an expansion of production in the sector which most intensively uses the factor that has increased, but it also leads to a contraction in the other sector.

• Example: with an increase in labor the (labor intensive) cloth sector will absorb the new labor as well as additional land (which it takes from the food sector) because with no increase in land, cloth output can only rise if it takes some land from the food sector.
The Effects of Economic Growth (cont.)

• Biased growth and the resulting shift in relative supply causes a change in the terms of trade.
  ♦ Biased growth in the cloth industry (in either the domestic or foreign country) will lower the relative price of cloth and lower the terms of trade for cloth exporters.
  ♦ Biased growth in the food industry (in either the domestic or foreign country) will raise the relative price of cloth and raise the terms of trade for cloth exporters.
The Effects of Economic Growth (cont.)

- Suppose that the domestic country exports cloth and imports food.
- If biased growth occurs in the cloth industry, suppliers are more able and willing to sell cloth relative to food, so that the relative supply curve shifts right to represent an increase in the supply of cloth relative to the supply of food.
- In the new trade equilibrium, the relative quantity of cloth bought and sold increases and the price of cloth relative to the price of food decreases from \( \frac{P_C}{P_F} \) to \( \frac{P_C}{P_F} \).
- If the domestic country exports cloth and imports food, the price of exports relative to the price of imports for the domestic country decreases. In other words, the terms of trade for the domestic country decreases.
The Effects of Economic Growth (cont.)

(a) Cloth-biased growth

Figure 5-7
Growth and Relative Supply
Growth biased toward cloth shifts the RS curve to the right (a), while growth biased toward food shifts it to the left (b).
The Effects of Economic Growth (cont.)

- Again suppose that the domestic country exports cloth and imports food.
- If biased growth occurs in the food industry, suppliers are more able and willing to sell food relative to cloth, so that the relative supply curve shifts left to represent a decrease in the supply of cloth relative to the supply of food.
- In the new trade equilibrium, the relative quantity of food bought and sold increases (and the relative quantity of cloth bought and sold decreases) and the price of cloth relative to the price of food increases from \( \frac{P_C}{P_F} \)\(_1 \) to \( \frac{P_C}{P_F} \)\(_2 \).
- If the domestic country exports cloth and imports food, the price of exports relative to the price of imports for the domestic country increases. In other words, the terms of trade for the domestic country increases.
The Effects of Economic Growth (cont.)

(b) Food-biased growth

Figure 5-7
Growth and Relative Supply
Growth biased toward cloth shifts the $RS$ curve to the right (a), while growth biased toward food shifts it to the left (b).
The Effects of Economic Growth (cont.)

- **Export-biased growth** is growth that expands a country’s PPF disproportionally in production of that country’s exports.
  - Biased growth in the food industry in the foreign country is export-biased growth for the foreign country.

- **Import-biased growth** is growth that expands a country’s PPF disproportionally in production of that country’s imports.
  - Biased growth in cloth production in the foreign country is import-biased growth for the foreign country.
The Effects of Economic Growth (cont.)

- Export-biased growth reduces a country’s terms of trade, generally reducing its welfare and increasing the welfare of foreign countries.

- Import-biased growth increases a country’s terms of trade, generally increasing its welfare and decreasing the welfare of foreign countries.
Has Growth in Asia Reduced the Welfare of High Income Countries?

- The standard trade model predicts that *import* biased growth in China reduces the US terms of trade and the standard of living in the US.
  - Import biased growth for China would occur in sectors that compete with US exports.

- But this prediction is not supported by data: there should be negative changes in the terms of trade for the US and other high income countries.
  - In fact, the terms of trade for high income countries have been positive and negative for developing Asian countries.
Has Growth in Asia Reduced the Welfare of High Income Countries? (cont.)

<table>
<thead>
<tr>
<th>TABLE 5-1</th>
<th>Average Annual Percent Changes in Terms of Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced economies</td>
<td>0.8</td>
</tr>
<tr>
<td>Developing Asia</td>
<td>−0.4</td>
</tr>
</tbody>
</table>
The Effects of International Transfers of Income

• Transfers of income sometimes occur from one country to another.
  ♦ War reparations or foreign aid may influence demand for traded goods and therefore relative demand.
  ♦ International loans may also influence relative demand in the short run, before the loan is paid back.

• How do transfers of income across countries affect relative demand and the terms of trade?
The Effects of International Transfers of Income (cont.)

• If the domestic country generates national income for transfers by
  ♦ increasing the price of imports to reduce their purchases and by decreasing the price of exports to increase their sales,
  ♦ the relative demand curve should shift left and the terms of trade would fall.
The Effects of International Transfers of Income (cont.)

**Figure 5-8**

**Effects of a Transfer on the Terms of Trade**

If Home has a higher marginal propensity to spend on cloth than Foreign, a transfer of income by Home to Foreign shifts the $RD$ curve left from $RD^1$ to $RD^2$, reducing the equilibrium relative price of cloth.

![Graph showing the effects of a transfer on the terms of trade](image)
The Effects of International Transfers of Income (cont.)

• But after the transfer of income from the domestic country,
  ♦ demand for foreign goods could fall in the domestic country and demand for domestic goods could rise in the foreign country,
  ♦ so the relative demand curve might not shift left and the terms of trade might not fall.
The Effects of International Transfers of Income (cont.)

• How much does demand for domestic goods increase in the foreign country when it receives a transfer of income from the domestic country?

♦ If the foreign country has a higher marginal propensity to spend on its own goods than on imports, demand for its own goods will rise more than demand for imports from the domestic country.
The Effects of International Transfers of Income (cont.)

• How much does demand for foreign goods decrease in the domestic country when it reduces its income through a transfer?
  ♦ If the domestic country has a higher marginal propensity to spend on its own goods than on imports, demand for its own goods will fall more than demand for imports from the foreign country.

• If each country has a higher marginal propensity to spend on its own products, the relative demand curve would shift left after a transfer of income from the domestic country.
The “Transfer Problem”

• In general:
  ♦ A transfer worsens the donor’s terms of trade if the donor has a higher mpc (marginal propensity to consume) on its export good than the recipient (Keynes’ argument).
  ♦ If the donor has a lower mpc on its export than the recipient, the donor’s terms of trade improves (Ohlin’s argument).
The Effects of International Transfers of Income (cont.)

• In fact, countries spend most of their (marginal) income on their own products.
  ♦ Americans spend only 11% of national income on imports and 89% on domestically produced goods.

• Transportation costs, tariffs, and other barriers cause domestic residents to favor domestic goods.

• This suggests that the relative demand curve will shift left with a transfer of income, decreasing the terms of trade for the donor nation.
The Effects of International Transfers of Income (cont.)

• In addition, the existence of non-traded goods and services may cause relative supply shifts that reinforce the decrease in the terms of trade for a donor country.
  ♦ Industries that produce non-traded goods and services compete for resources with industries that produce traded goods.
  ♦ A transfer of income from a donor country will reduce demand for and production of non-traded goods in the donor country, so that these resources can be used in its export sector.
The Effects of International Transfers of Income (cont.)

- The supply of exports relative to imports in the donor country increases, reducing the terms of trade for the donor country.

- A transfer of income from a donor country will increase demand for and production of non-traded goods in foreign countries, so that fewer resources can be used in its export sector.

- The supply of exports relative to imports in the foreign country decreases, reducing the terms of trade for the donor country.
Import Tariffs and Export Subsidies

- **Import tariffs** are taxes levied on imports.
- **Export subsidies** are payments given to domestic producers that export.
- Both policies influence the terms of trade and therefore national welfare.
Import Tariffs and Export Subsidies (cont.)

• Import tariffs and export subsidies drive a wedge between prices in world markets (or external prices) and prices in domestic markets (or internal prices).

• The terms of trade refers to the relative value of a country’s exports and a country’s imports.
  ♦ Since exports and imports are traded in world markets, the terms of trade measures external prices.
Import Tariffs and Distribution of Income Across Countries

• If the domestic country imposes a tariff on food imports, the price of food relative to price cloth that domestic citizens face is higher.
  ♦ Likewise, the price of cloth relative to the price of food that domestic consumers and producers pay is lower.
  ♦ Domestic producers will receive a lower relative price of cloth, and therefore will be more willing to switch to food production: the relative supply curve will shift.
  ♦ Domestic consumers will pay a lower relative price of cloth, and therefore be more willing to switch to cloth consumption: the relative demand curve will shift.
Import Tariffs and Distribution of Income Across Countries (cont.)

**Figure 5-9**

**Effects of a Tariff on the Terms of Trade**

An import tariff imposed by Home both reduces the relative supply of cloth (from $RS^1$ to $RS^2$) and increases the relative demand (from $RD^1$ to $RD^2$). As a result, the relative price of cloth must rise.
Import Tariffs and Distribution of Income Across Countries (cont.)

• When the domestic country imposes an import tariff, the terms of trade increases and the welfare of the country may increase.

• The magnitude of this effect depends on the size of the domestic country relative to the world economy.
  ◆ If the country is small part of the world economy, its tariff (or subsidy) policies will not have much effect on world relative supply and demand, and thus on the terms of trade.
  ◆ But for large countries, a tariff rate that maximizes national welfare at the expense of foreign countries may exist.
Export Subsidies and Distribution of Income Across Countries

• If the domestic country imposes a subsidy on cloth exports, the price of cloth relative to price food that *domestic citizens* face is higher.
  
  ♦ Domestic producers will receive a higher relative price of cloth, and therefore will be more willing to switch to cloth production: the relative supply curve will shift.

  ♦ Domestic consumers will pay a higher relative price of cloth, and therefore be more willing to switch to food consumption: the relative demand curve will shift.
Export Subsidies and Distribution of Income Across Countries (cont.)

**Figure 5-10**

Effects of a Subsidy on the Terms of Trade

An export subsidy’s effects are the reverse of those of a tariff. Relative supply of cloth rises, while relative demand falls. Home’s terms of trade decline as the relative price of cloth falls from \((P_C/P_F)^1\) to \((P_C/P_F)^2\).
Export Subsidies and Distribution of Income Across Countries (cont.)

• When the domestic country imposes an export subsidy, the terms of trade decreases and the welfare of the country decreases to the benefit of the foreign country.
Import Tariffs, Export Subsidies and Distribution of Income Across Countries

• The two country, two good model predicts that
  ♦ an import tariff by the domestic country can increase domestic welfare at the expense of the foreign country.
  ♦ an export subsidy by the domestic country reduces domestic welfare to the benefit of the foreign country.
Import Tariffs and Export Subsidies in Other Countries

• But we have ignored the effects of tariffs and subsidies that occur in a world with many countries and many goods:
  
  ♦ A foreign country may subsidize the export of a good that the US also exports, which will reduce its price in world markets and decrease the terms of trade for the US.
    • The EU subsidizes agricultural exports, which reduce the price that American farmers receive for their goods in world markets.
  
  ♦ A foreign country may put a tariff on an imported good that the US also imports, which will reduce its price in world markets and increase the terms of trade for the US.
Import Tariffs and Export Subsidies in Other Countries (cont.)

- Export subsidies by foreign countries on goods that
  - the US imports *reduce the world price of US imports* and increase the US terms of trade.
  - the US also exports *reduce the world price of US exports* and decrease the US terms of trade.

- Import tariffs by foreign countries on goods that
  - the US exports *reduce the world price of US exports* and decrease the US terms of trade.
  - the US also imports *reduce the world price of US imports* and increase the US terms of trade.
Import Tariffs and Export Subsidies

• Export subsidies on a good *decrease the relative world price* of that good by increasing relative supply of that good and decreasing relative demand of that good.

• Import tariffs on a good *decrease the relative world price* of that good (and increase the relative world price of other goods) by increasing the relative supply of that good and decreasing the relative demand of that good.
Import Tariffs, Export Subsidies and Distribution of Income Within a Country

• Because of changes in relative prices, import tariffs and export subsidies have effects on income distribution among producers within a country.
Import Tariffs, Export Subsidies and Distribution of Income Within a Country (cont.)

- Generally, a domestic import tariff increases income for domestic import-competing producers by allowing the price of their goods to rise to match increased import prices, and it shifts resources away from the export sector.

- Generally, a domestic export subsidy increases income for domestic exporters, and it shifts resources away from the import-competing sector.
Summary

1. A change in relative prices, say due to trade, causes an income effect and a substitution effect.

2. The terms of trade refers to the price of exports relative to the price of imports in world markets.

3. Export-biased growth reduces a country’s terms of trade, generally reducing its welfare and increasing the welfare of foreign countries.

4. Import-biased growth increases a country’s terms of trade, generally increasing its welfare and decreasing the welfare of foreign countries.
Summary (cont.)

5. The effect of international transfers of income depend on the marginal propensity to spend on domestic goods, but generally the relative demand curve of donor will shift left leading to a decrease in the donor’s terms of trade.

6. When the domestic country imposes an import tariff, the terms of trade increases and the welfare of the country may increase.
Summary (cont.)

7. When the domestic country imposes an export subsidy, the terms of trade decreases and the welfare of the country decreases.

8. Generally, a domestic import tariff increases income for domestic import-competing producers and shifts resources away from the export sector.

9. Generally, a domestic export subsidy increases income for domestic exporters and shifts resources away from the import-competing sector.