

International Economics

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Chapter 2

World Trade:
An Overview

Preview

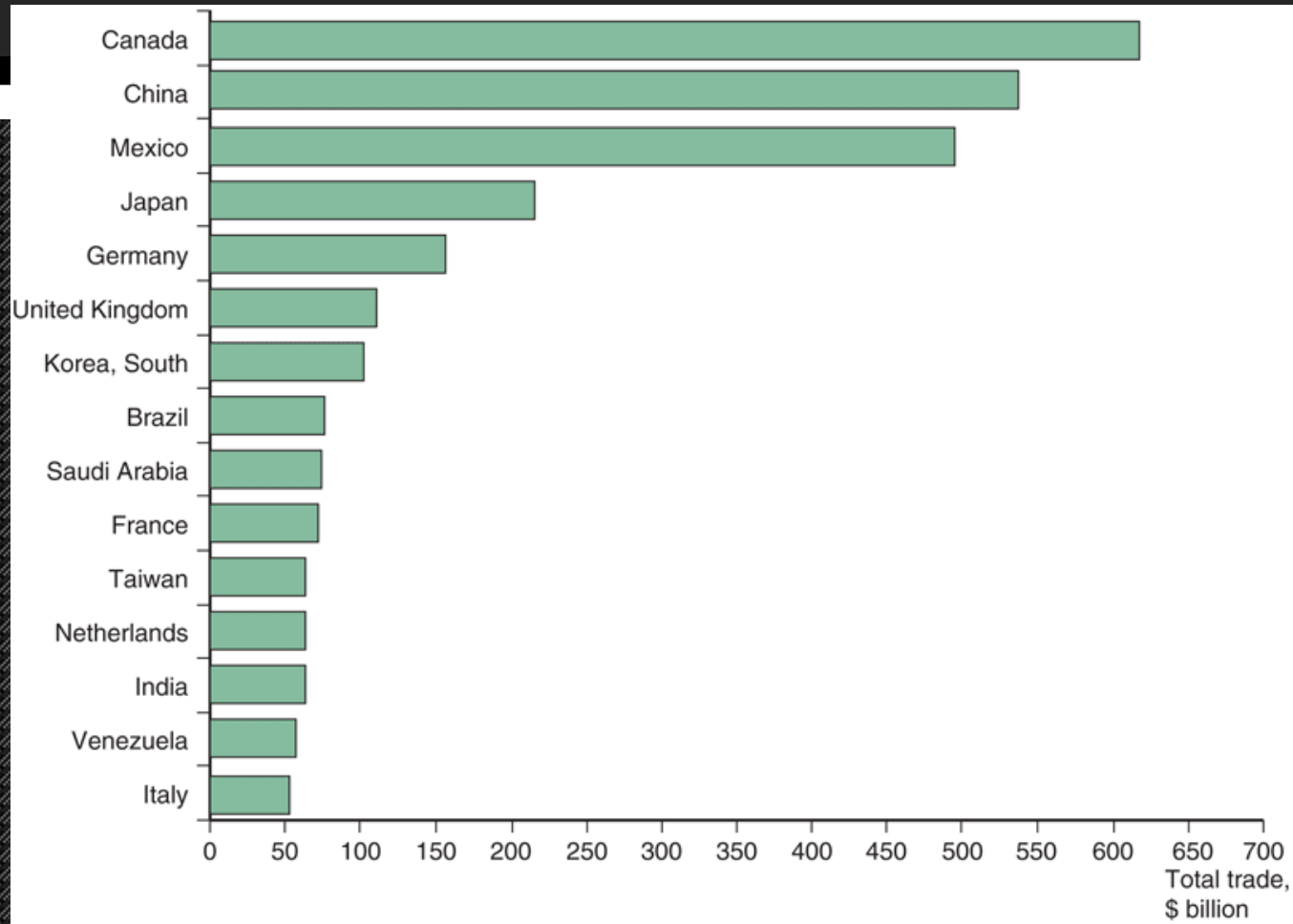
- Largest trading partners of the United States
- Gravity model:
 - influence of an economy's size on trade
 - Distance, barriers, borders and other trade impediments
- Globalization: then and now
- Changing composition of trade
- Service outsourcing

Who Trades with Whom?

More than 50% of world output is sold across national borders.

- The 5 largest trading partners with the U.S. in 2012 were Canada, China, Mexico, Japan, and Germany.
- The largest 15 trading partners with the U.S. accounted for 69% of the value of U.S. trade in 2012.

Fig. 2-1: Total U.S. Trade with Major Partners, 2012

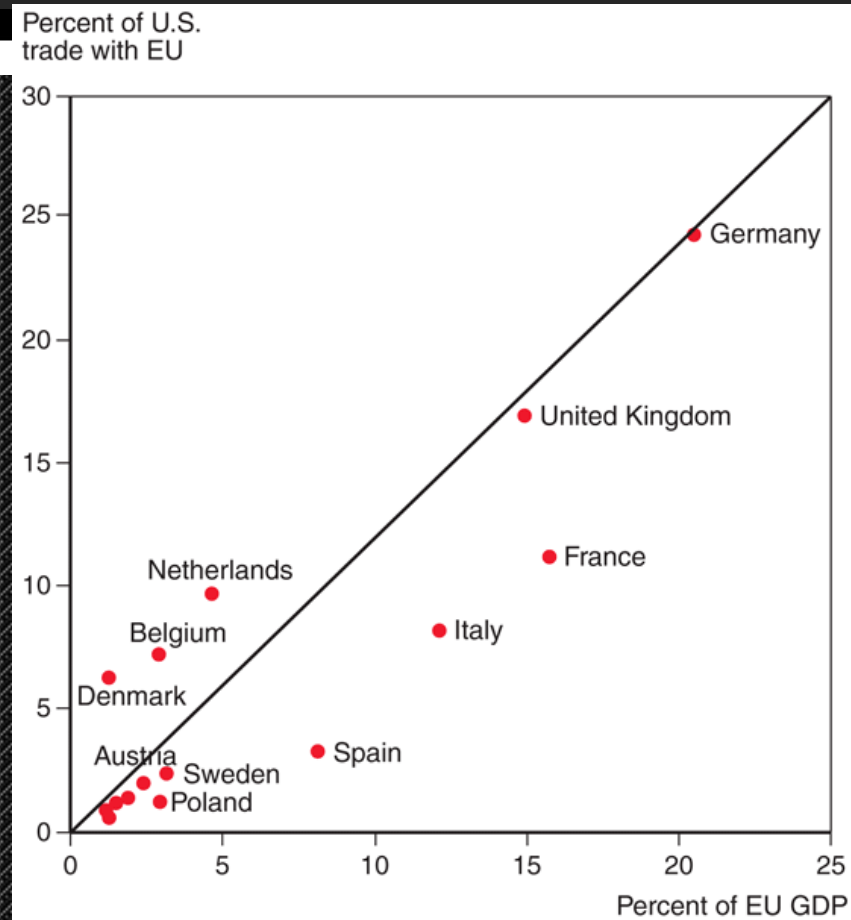


Source: U.S. Department of Commerce.

Size Matters: The Gravity Model

- 3 of the top 10 trading partners with the U.S. in 2012 were also the 3 largest European economies: Germany, the United Kingdom, and France.
- Why does the United States trade more with these European countries than with others?
 - These countries have the largest **gross domestic product (GDP)**, the value of goods and services produced in an economy, in Europe.
 - Each European country's share of U.S. trade with Europe is roughly equal to its share of European GDP.

Fig. 2-2: The Size of European Economies, and the Value of Their Trade with the United States



Source: U.S. Department of Commerce, European Commission.

Size Matters: The Gravity Model (cont.)

- The size of an economy is directly related to the volume of imports and exports.
 - Larger economies produce more goods and services, so they have more to sell in the export market.
 - Larger economies generate more income from the goods and services sold, so they are able to buy more imports.
- Trade between any two countries is larger, the larger is either country.

Size Matters: The Gravity Model (cont.)

- The gravity model assumes that size and distance are important for trade in the following way:

$$T_{ij} = A \times Y_i \times Y_j / D_{ij}$$

where

T_{ij} is the value of trade between country i and country j

A is a constant

Y_i the GDP of country i , Y_j is the GDP of country j

D_{ij} is the distance between country i and country j

- Or more generally

$$T_{ij} = A \times Y_i^a \times Y_j^b / D_{ij}^c$$

where a , b , and c are allowed to differ from 1.

Using the Gravity Model: Looking for Anomalies

- A gravity model fits the data on U.S. trade with European countries well but not perfectly.
- The Netherlands, Belgium and Ireland trade much more with the United States than predicted by a gravity model.
 - Ireland has strong cultural affinity due to common language and history of migration.
 - The Netherlands and Belgium have transport cost advantages due to their location.

Impediments to Trade: Distance, Barriers, and Borders

Other things besides size matter for trade:

1. *Distance* between markets influences transportation costs and therefore the cost of imports and exports.
2. *Cultural affinity*: close cultural ties, such as a common language, usually lead to strong economic ties.
3. *Geography*: ocean harbors and a lack of mountain barriers make transportation and trade easier.
4. *Multinational corporations*: corporations spread across different nations import and export many goods between their divisions.
5. *Borders*: crossing borders involves formalities that take time, often different currencies need to be exchanged, and perhaps monetary costs like tariffs reduce trade.

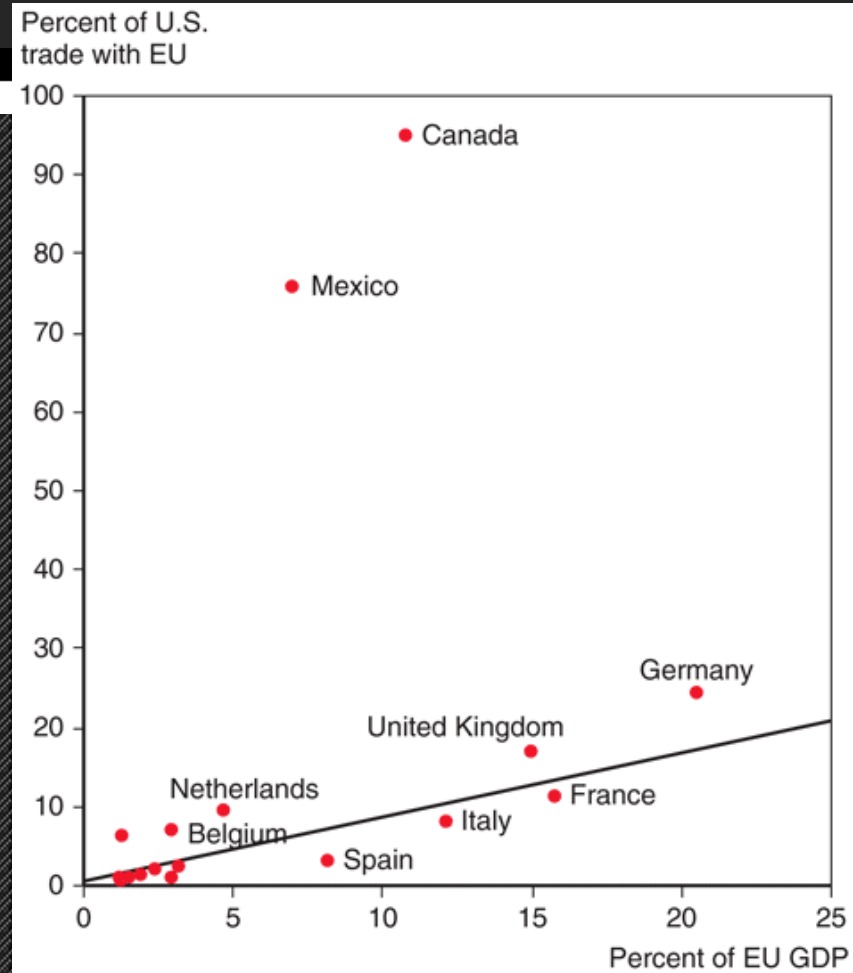
Impediments to Trade: Distance, Barriers, and Borders (cont.)

- Estimates of the effect of distance from the gravity model predict that a 1% increase in the distance between countries is associated with a decrease in the volume of trade of 0.7% to 1%.
- Besides distance, borders increase the cost and time needed to trade.
- *Trade agreements* between countries are intended to reduce the formalities and tariffs needed to cross borders, and therefore to increase trade.

Impediments to Trade: Distance, Barriers, and Borders (cont.)

- The U.S. signed a free trade agreement with Mexico and Canada in 1994, the North American Free Trade Agreement (NAFTA).
- Because of NAFTA and because Mexico and Canada are close to the U.S., the amount of trade between the U.S. and its northern and southern neighbors as a fraction of GDP is larger than between the U.S. and European countries.
 - Canada's economy is roughly the same size as Spain's (around 10% of EU GDP) but Canada trades as much with the United States as does all of Europe.

Fig. 2-3: Economic Size and Trade with the United States



Source: U.S. Department of Commerce, European Commission.

Impediments to Trade: Distance, Barriers, and Borders (cont.)

- Yet even with a free trade agreement between the U.S. and Canada, which use a common language, the border between these countries still seems to be associated with a reduction in trade.
- Data shows that there is much more trade between pairs of Canadian provinces than between Canadian provinces and U.S. states, even when holding distance constant.
- Estimates indicate that the U.S.-Canadian border deters trade as much as if the countries were 1,500-2,500 miles apart.

Fig. 2-4: Canadian Provinces and U.S. States that Trade with British Columbia

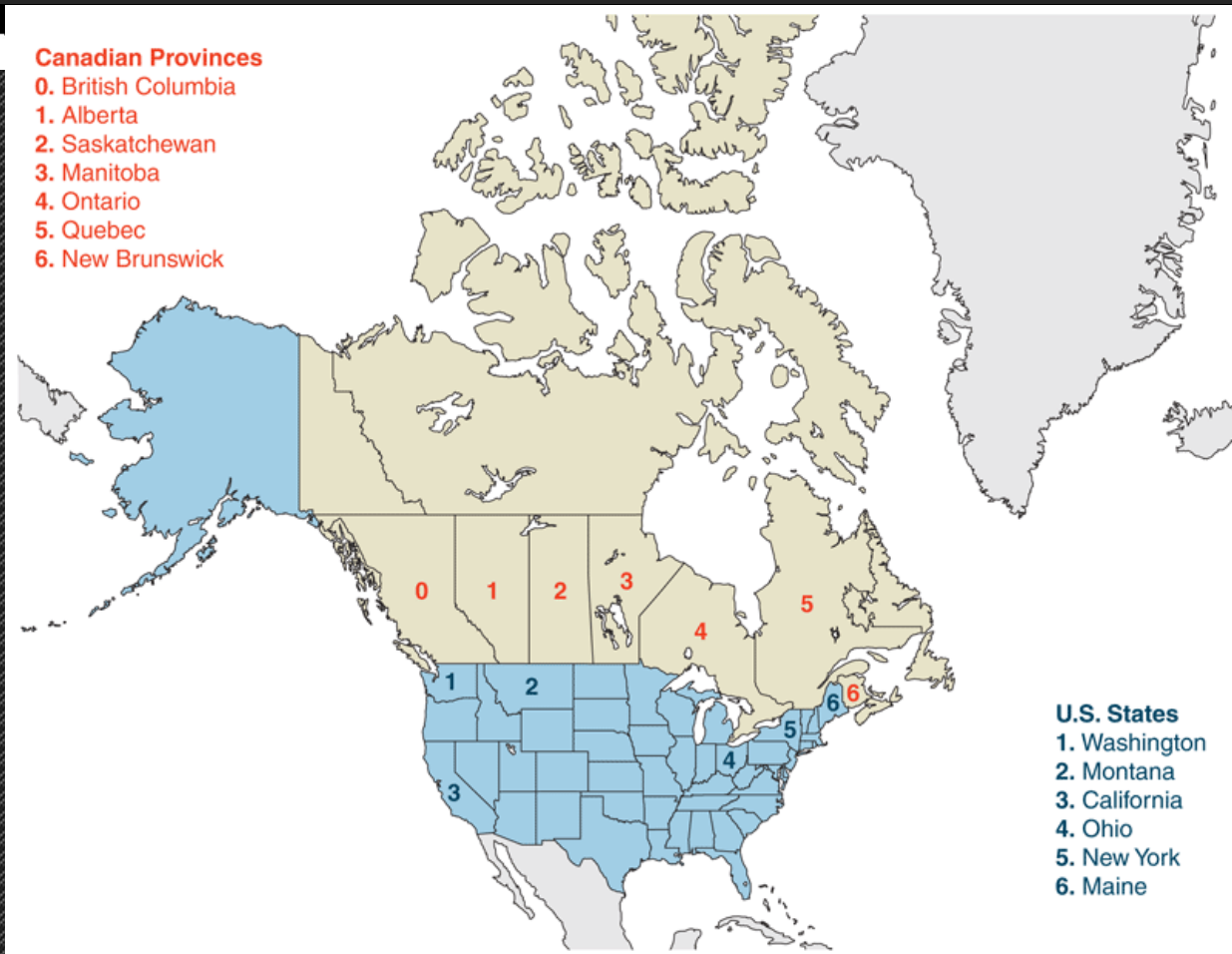


Table 2-1: Trade with British Columbia, as Percent of GDP, 2009

Canadian Province	Trade as Percent of GDP	Trade as Percent of GDP	U.S. State at Similar Distance from British Columbia
Alberta	6.9	2.6	Washington
Saskatchewan	2.4	1.0	Montana
Manitoba	2.0	0.3	California
Ontario	1.9	0.2	Ohio
Quebec	1.4	0.1	New York
New Brunswick	2.3	0.2	Maine

Source: Statistics Canada, US Department of Commerce

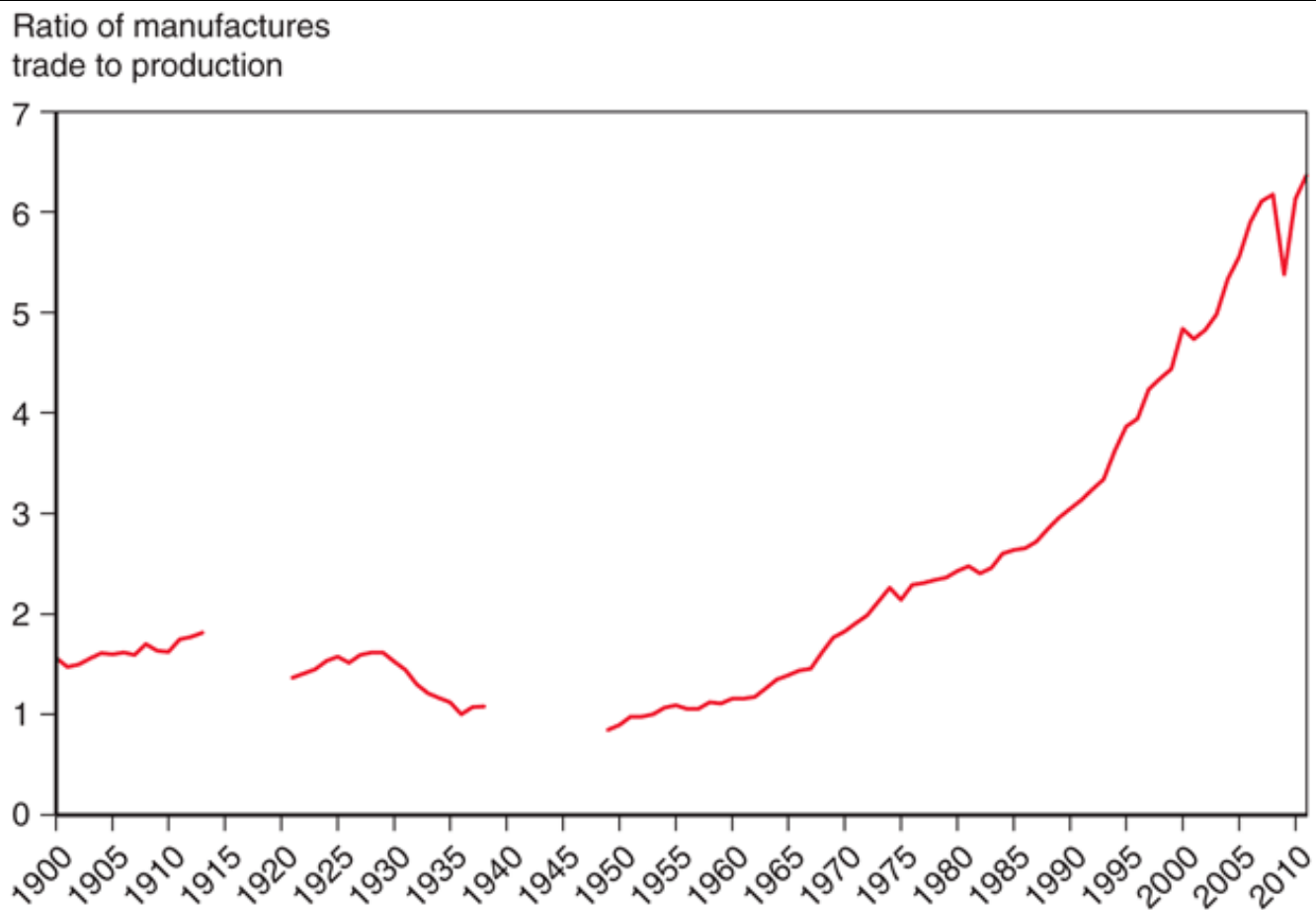
The Changing Pattern of World Trade: Has the World Gotten Smaller?

- The negative effect of distance on trade according to the gravity models is significant, but has grown smaller over time due to modern transportation and communication.
- Technologies that have increased trade:
 - Wheels, sails, compasses, railroads, telegraph, steam power, automobiles, telephones, airplanes, computers, fax machines, Internet, fiber optics, personal digital assistants, GPS satellites...

The Changing Pattern of World Trade: Has the World Gotten Smaller? (cont.)

- Political factors, such as wars, can change trade patterns much more than innovations in transportation and communication.
- World trade grew rapidly from 1870 to 1913.
 - Then it suffered a sharp decline due to the two world wars and the Great Depression.
 - It started to recover around 1945 but did not recover fully until around 1970.
- Since 1970, world trade as a fraction of world GDP has achieved unprecedented heights.
 - Vertical disintegration of production has contributed to the rise in the value of world trade through extensive cross-shipping of components.

Fig. 2-5: The Fall and Rise of World Trade

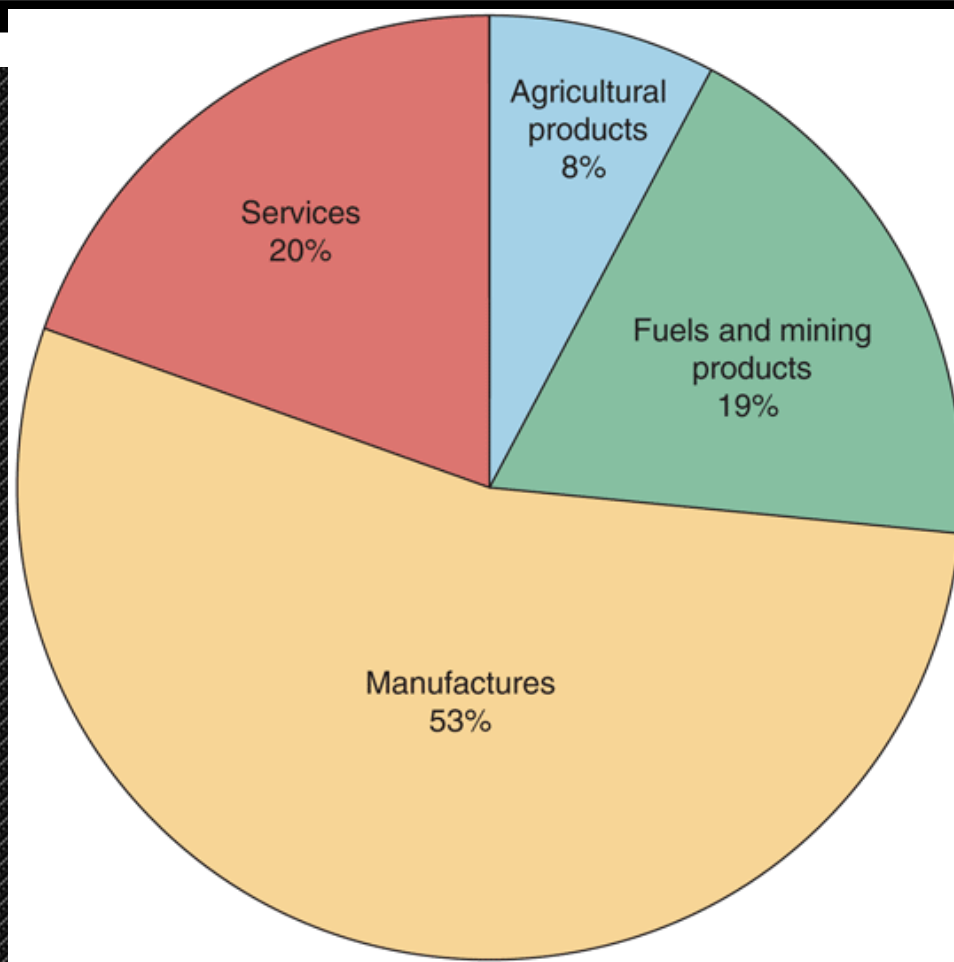


Source: UN Monthly Bulletin of Statistics. World Trade Organization

What Do We Trade?

- What kinds of products do nations trade now, and how does this composition compare to trade in the past?
- Today, most (about 53%) of the volume of trade is in *manufactured products* such as automobiles, computers, and clothing.
 - *Services* such as shipping, insurance, legal fees, and spending by tourists account for about 20% of the volume of trade.
 - *Mineral products* (ex., petroleum, coal, copper) remain an important part of world trade at 19%
 - *Agricultural products* are a relatively small (8%) part of trade.

Fig. 2-6: The Composition of World Trade, 2011



What Do We Trade? (cont.)

- In the past, a large fraction of the volume of trade came from agricultural and mineral products.
 - In 1910, Britain mainly imported agricultural and mineral products, although manufactured products still represented most of the volume of exports.
 - In 1910, the U.S. mainly imported and exported agricultural products and mineral products.
 - In 2002, manufactured products made up most of the volume of imports and exports for both countries.

Table 2-2: Manufactured Goods as a Percent of Merchandise Trade

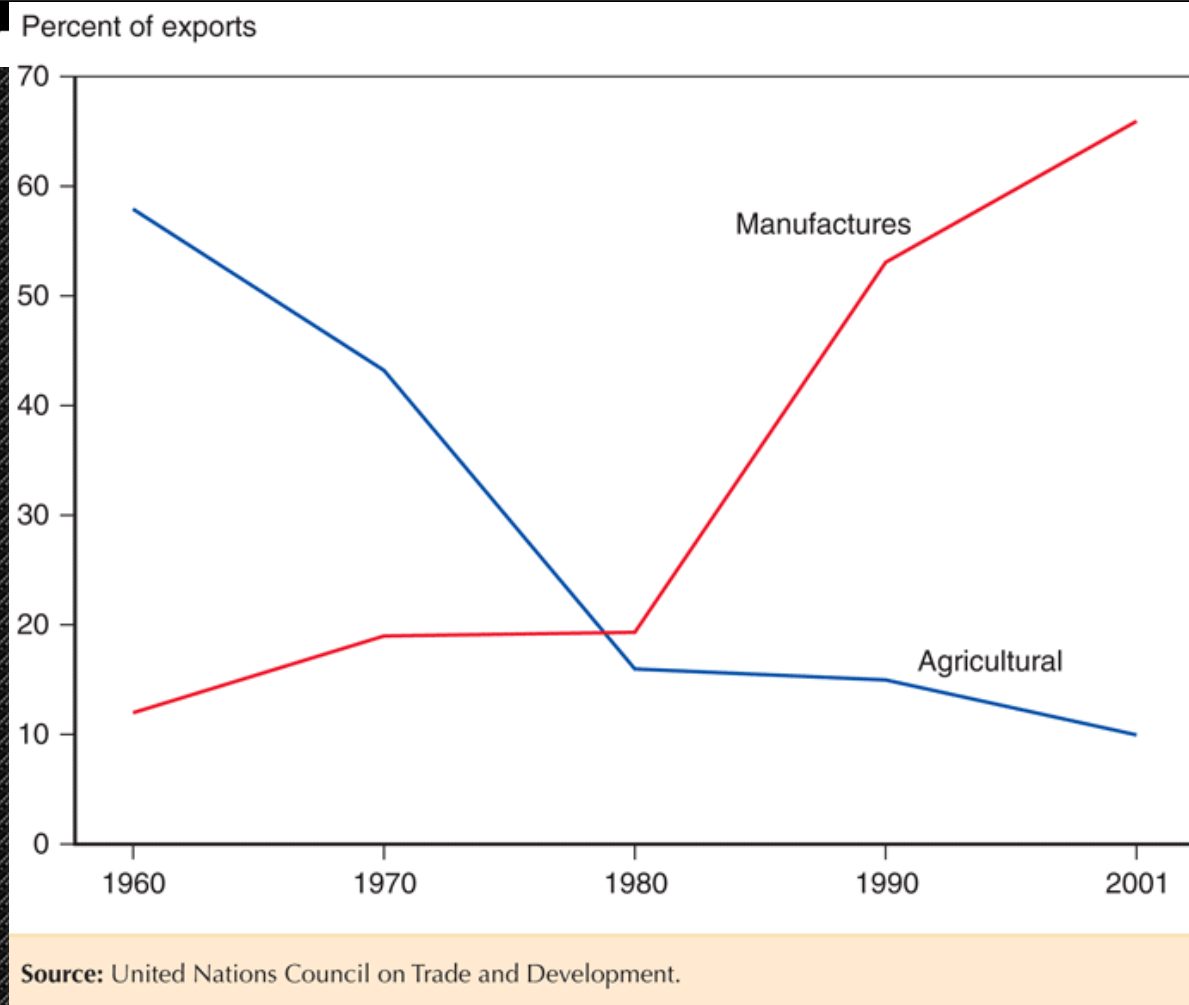
	United Kingdom		United States	
	Exports	Imports	Exports	Imports
1910	75.4	24.5	47.5	40.7
2011	72.1	69.1	65.3	67.2

Source: 1910 data from Simon Kuznets, *Modern Economic Growth: Rate, Structure and Speed*. New Haven: Yale Univ. Press, 1966. 2011 data from World Trade Organization.

What Do We Trade? (cont.)

- Low- and middle-income countries have also changed the composition of their trade.
 - In 2001, about 65% of exports from low- and middle-income countries were manufactured products, and only 10% of exports were agricultural products.
 - In 1960, about 58% of exports from low- and middle-income countries were agricultural products and only 12% of exports were manufactured products.
- More than 90 percent of the exports of China, the largest developing country and a rapidly growing force in world trade, consist of manufactured goods.

Fig. 2-7: The Changing Composition of Developing-Country Exports



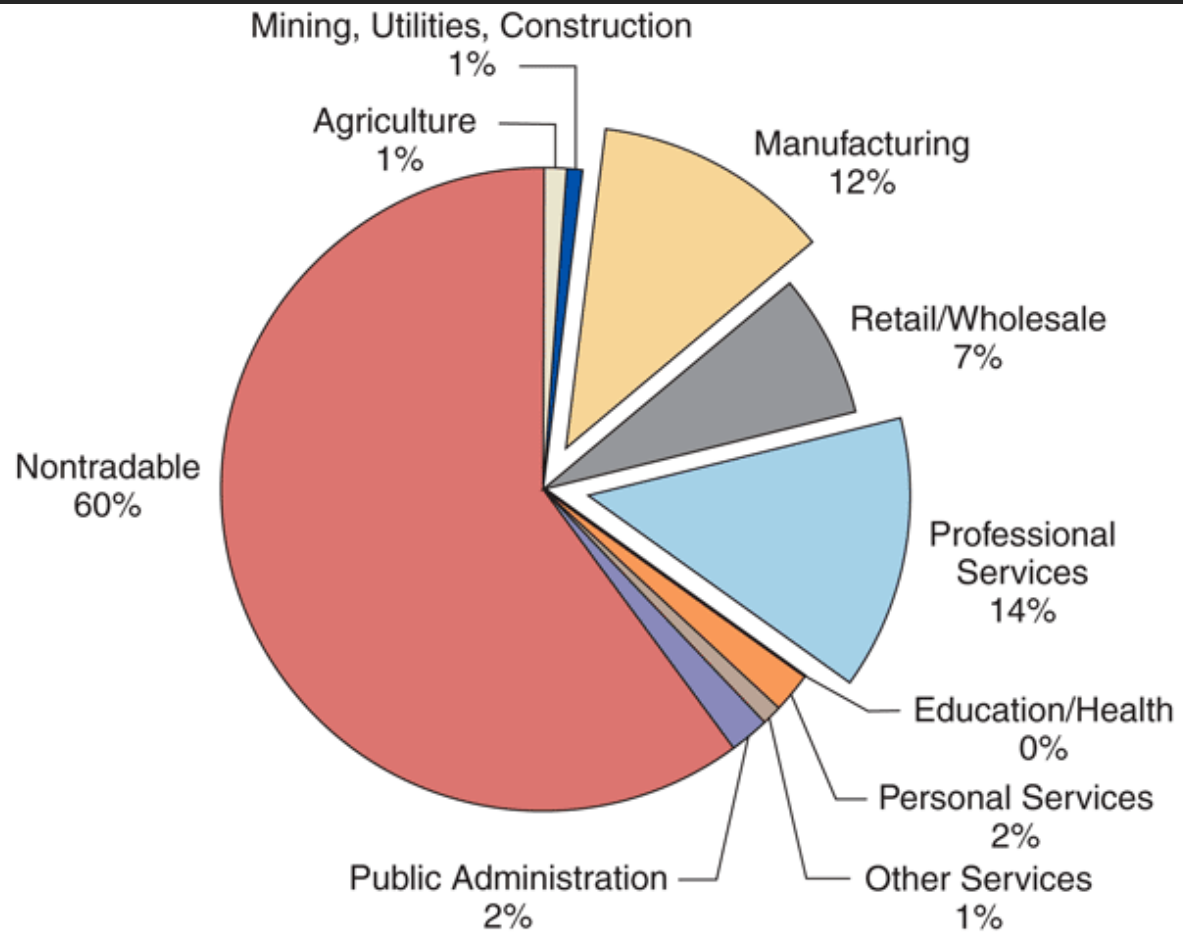
Service Outsourcing

- **Service outsourcing (or offshoring)** occurs when a firm that provides services moves its operations to a foreign location.
 - Service outsourcing can occur for services that can be transmitted electronically.
 - A firm may move its customer service centers whose telephone calls can be transmitted electronically to a foreign location.
 - Other services may not lend themselves to being performed remotely.

Service Outsourcing (cont.)

- Service outsourcing is currently not a significant part of trade.
 - Some jobs are “tradable” and thus have the *potential* to be outsourced.
 - Most jobs (about 60%) need to be done close to the customer, making them nontradable.

Fig. 2-8: Tradable Industries' Share of Employment



Source: J. Bradford Jensen and Lori G. Kletzer, "Tradable Services: Understanding the Scope and Impact of Services Outsourcing," Peterson Institute of Economics Working Paper 09-09, May 2005.

Summary

1. The 5 largest trading partners with the U.S. are Canada, China, Mexico, Japan, and Germany.
2. The largest economies in the EU undertake the largest fraction of the total trade between the EU and the U.S.
3. The gravity model predicts that the volume of trade is directly related to the GDP of each trading partner and is inversely related to the distance between them.

Summary (cont.)

4. Besides size and distance, culture, geography, multinational corporations, and the existence of borders influence trade.
5. Modern transportation and communication have increased trade, but political factors have influenced trade more in history.
6. Today, most trade is in manufactured goods, while historically agricultural and mineral products made up most of trade.

Chapter 3

Labor Productivity
and Comparative Advantage: The Ricardian Model

Preview

- Opportunity costs and comparative advantage
- A one-factor Ricardian model
- Production possibilities
- Gains from trade
- Wages and trade
- Misconceptions about comparative advantage
- Transportation costs and non-traded goods
- Empirical evidence

Introduction

- Theories of why trade occurs:
 - Differences across countries in labor, labor skills, physical capital, natural resources, and technology
 - Economies of scale (larger scale of production is more efficient)

Introduction (cont.)

- Sources of differences across countries that lead to gains from trade:
 - The Ricardian model (Econ/Trade Chapter 3) examines differences in the *productivity of labor* (due to differences in *technology*) between countries.
 - The Heckscher-Ohlin model (Econ/Trade Chapter 4) examines differences in *labor, labor skills, physical capital, land, or other factors of production* between countries.

Comparative Advantage and Opportunity Cost

- The Ricardian model uses the concepts of *opportunity cost* and *comparative advantage*.
- The opportunity cost of producing something measures the cost of not being able to produce something else with the resources used.

Comparative Advantage and Opportunity Cost (cont.)

- For example, a limited number of workers could produce either roses or computers.
 - The opportunity cost of producing computers is the amount of roses not produced.
 - The opportunity cost of producing roses is the amount of computers not produced.

Comparative Advantage and Opportunity Cost (cont.)

- Suppose that in the United States 10 million roses could be produced with the same resources as 100,000 computers.
- Suppose that in Colombia 10 million roses could be produced with the same resources as 30,000 computers.
- Colombia has a lower opportunity cost of producing roses: has to stop producing fewer computers.

Comparative Advantage and Opportunity Cost (cont.)

- A country has a **comparative advantage** in producing a good if the opportunity cost of producing that good is lower in the country than in other countries.
 - The United States has a comparative advantage in computer production.
 - Colombia has a comparative advantage in rose production.

Comparative Advantage and Opportunity Cost (cont.)

- Suppose initially that Colombia produces computers and the United States produces roses, and that both countries want to consume computers and roses.
- Can both countries be made better off?

Table 3-1: Hypothetical Changes in Production

	Million Roses	Thousand Computers
United States	-10	+100
Colombia	+10	-30
Total	0	+70

Comparative Advantage and Trade

- When countries specialize in production in which they have a comparative advantage, more goods and services can be produced and consumed.
 - Have the United States stop growing roses and use those resources to make 100,000 computers instead. Have Colombia stop making 30,000 computers and grow roses instead.
 - If produce goods in which have a comparative advantage (the United States produces computers and Colombia roses), they could still consume the same 10 million roses, but could consume $100,000 - 30,000 = 70,000$ more computers.

A One-Factor Ricardian Model

- The simple example with roses and computers explains the intuition behind the Ricardian model.
- We formalize these ideas by constructing a one-factor Ricardian model using the following assumptions:

A One-Factor Ricardian Model (cont.)

1. Labor is the only factor of production.
2. Labor productivity varies across countries due to differences in technology, but labor productivity in each country is constant.
3. The supply of labor in each country is constant.

A One-Factor Ricardian Model (cont.)

4. Two goods: wine and cheese.
5. Competition allows workers to be paid a wage equal to the value of what they produce, and allows them to work in the industry that pays the highest wage.
6. Two countries: home and foreign.

A One-Factor Ricardian Model (cont.)

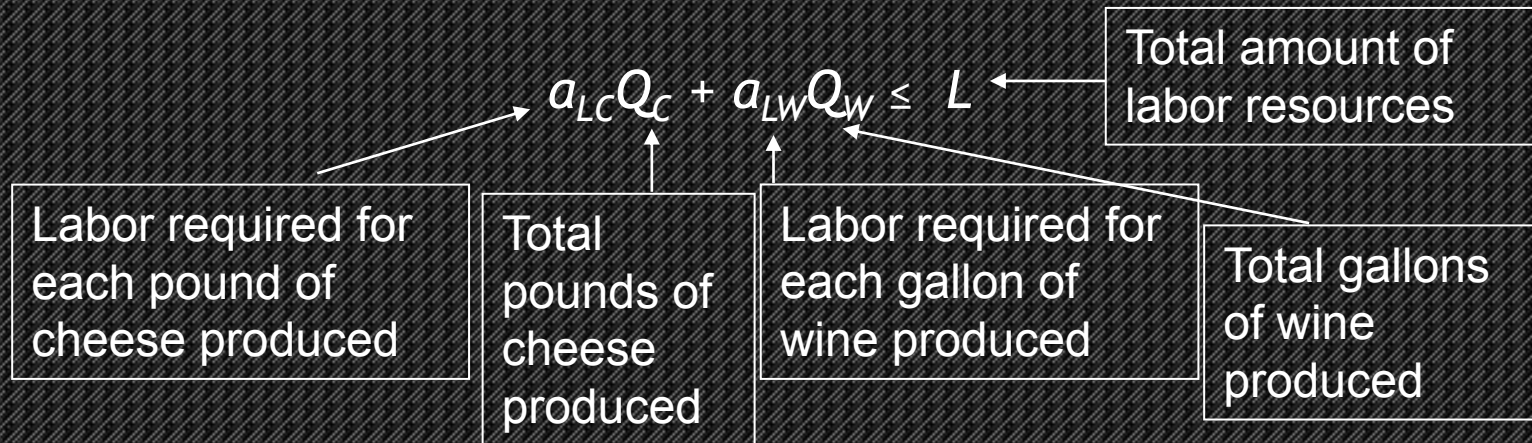
- A unit labor requirement indicates the constant number of hours of labor required to produce one unit of output.
 - a_{LC} is the unit labor requirement for cheese in the home country. For example, $a_{LC} = 1$ means that 1 hour of labor produces one pound of cheese in the home country.
 - a_{LW} is the unit labor requirement for wine in the home country. For example, $a_{LW} = 2$ means that 2 hours of labor produces one gallon of wine in the home country.
- A high unit labor requirement means low labor productivity.

A One-Factor Ricardian Model (cont.)

- Labor supply L indicates the total number of hours worked in the home country (a constant number).
- Cheese production Q_C indicates how many pounds of cheese are produced.
- Wine production Q_W indicates how many gallons of wine are produced.

Production Possibilities

- The production possibility frontier (PPF) of an economy shows the *maximum* amount of a goods that can be produced for a fixed amount of resources.
- The production possibility frontier of the home economy is:



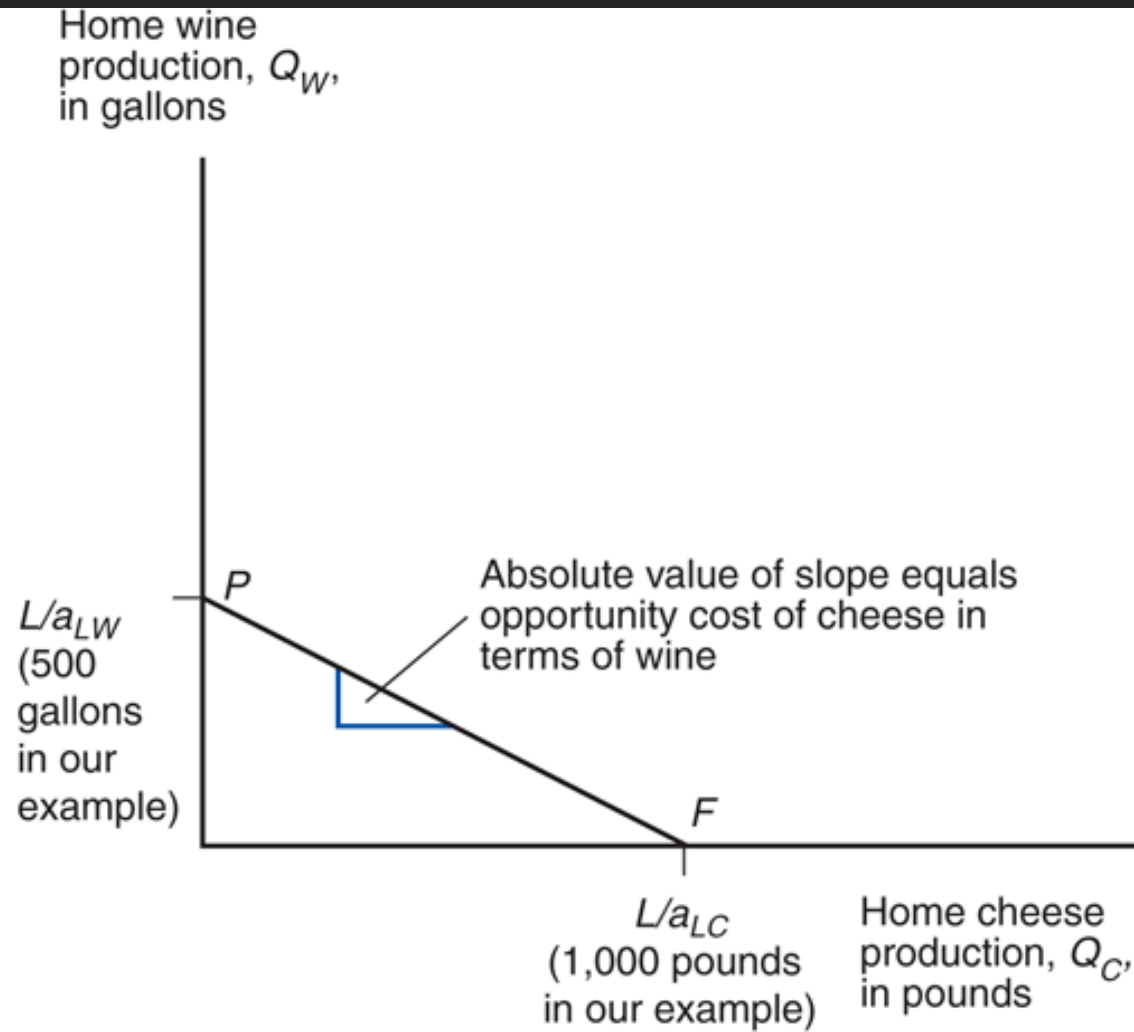
Production Possibilities (cont.)

- Maximum home cheese production is $Q_C = L/a_{LC}$ when $Q_W = 0$.
- Maximum home wine production is $Q_W = L/a_{LW}$ when $Q_C = 0$.

Production Possibilities (cont.)

- For example, suppose that the economy's labor supply is 1,000 hours.
- The PPF equation $a_{LC}Q_C + a_{LW}Q_W \leq L$ becomes $Q_C + 2Q_W \leq 1,000$.
- Maximum cheese production is 1,000 pounds.
- Maximum wine production is 500 gallons.

Fig. 3-1: Home's Production Possibility Frontier



Production Possibilities (cont.)

- The opportunity cost of cheese is how many gallons of wine Home must stop producing in order to make one more pound of cheese:

$$a_{LC} / a_{LW}$$

- This cost is constant because the unit labor requirements are both constant.
- The opportunity cost of cheese appears as the absolute value of the slope of the PPF.

$$Q_W = L/a_{LW} - (a_{LC} / a_{LW})Q_C$$

Production Possibilities (cont.)

- Producing an additional pound of cheese requires a_{LC} hours of labor.
- *Each* hour devoted to cheese production could have been used instead to produce an amount of wine equal to
 - 1 hour / (a_{LW} hours/gallon of wine)
 - = $(1/a_{LW})$ gallons of wine

Production Possibilities (cont.)

- For example, if 1 hour of labor is moved to cheese production, that additional hour could have produced
 $1 \text{ hour} / (2 \text{ hours/gallon of wine})$
 $= \frac{1}{2} \text{ gallon of wine.}$
- Opportunity cost of producing one pound of cheese is $\frac{1}{2}$ gallon of wine not produced.

Relative Prices, Wages, and Supply

- Let P_C be the price of cheese and P_W be the price of wine.
- Due to competition,
 - hourly wages of cheese makers equal the value of the cheese produced in an hour: P_C / a_{LC}
 - hourly wages of wine makers equal the value of the wine produced in an hour: P_W / a_{LW}
- Workers will choose to work in the industry that pays the higher wage.

Relative Prices, Wages, and Supply (cont.)

- If the price of cheese relative to the price of wine exceeds the opportunity cost of producing cheese $P_C / P_W > a_{LC} / a_{LW}$,
 - Then the wage in cheese will exceed the wage in wine $w_C = P_C / a_{LC} > P_W / a_{LW} = w_W$
 - So workers will make only cheese (the economy specializes in cheese production).

Relative Prices, Wages, and Supply (cont.)

- If the price of cheese relative to the price of wine is less than the opportunity cost of producing cheese $P_C / P_W < a_{LC} / a_{LW}$,
 - then the wage in cheese will be less than the wage in wine $P_C / a_{LC} < P_W / a_{LW}$
 - so workers will make only wine (the economy specializes in wine production).

Production, Prices, and Wages

- If the price of cheese relative to the price of wine equals the opportunity cost of producing cheese $P_C / P_W = a_{LC} / a_{LW}$,
 - then the wage in cheese equals the wage in wine $P_C / a_{LC} = P_W / a_{LW}$
 - so workers will be willing to make both wine and cheese.

Production, Prices, and Wages (cont.)

- For example, suppose cheese sells for $P_C = \$4/\text{pound}$ and wine sells for $P_W = \$7/\text{gallon}$.
 - Wage paid producing cheese is $P_C / a_{LC} = (\$4/\text{pound})(1 \text{ pound}/\text{hour}) = \$4/\text{hour}$.
 - Wage paid producing wine is $P_W / a_{LW} = (\$7/\text{gallon})(1/2 \text{ gallon}/\text{hour}) = \$3.50/\text{hour}$.
- Workers would be willing to make only cheese (the relative price of cheese $4/7$ exceeds the opportunity cost of cheese of $1/2$).

Production, Prices, and Wages (cont.)

- If the price of cheese drops to $P_C = \$3/\text{pound}$:
 - Wage paid producing cheese drops to $P_C / a_{LC} = (\$3/\text{pound})(1 \text{ pound}/\text{hour}) = \$3/\text{hour}$.
 - Wage paid producing wine is still $\$3.50/\text{hour}$ if price of wine is still $\$7/\text{gallon}$.
 - Now workers would be willing to make only wine (the relative price of cheese $3/7$ is now less than the opportunity cost of cheese of $1/2$).

Production, Prices, and Wages (cont.)

- If the home country wants to consume both wine and cheese (in the absence of international trade), relative prices must adjust so that wages are equal in the wine and cheese industries.
 - If $P_C / a_{LC} = P_W / a_{LW}$ workers will not care whether they work in the cheese industry or the wine industry, so that production of both goods can occur.
 - Production (and consumption) of both goods occurs when the relative price of a good equals the opportunity cost of producing that good:

$$P_C / P_W = a_{LC} / a_{LW}$$

Trade in the Ricardian Model

- If the home country is more efficient in wine and cheese production, then it has an *absolute advantage* in all production:

- its unit labor requirements for wine and cheese production are lower than those in the foreign country

$$a_{LC} < a_{LC}^* \text{ and } a_{LW} < a_{LW}^*$$

where “*” notates foreign country variables

Trade in the Ricardian Model (cont.)

- A country can be more efficient in producing both goods, but it will have a comparative advantage in only one good.
- Even if a country is the most (or least) efficient producer of all goods, it still can benefit from trade.

Trade in the Ricardian Model (cont.)

- Suppose that the home country has a comparative advantage in cheese production: its opportunity cost of producing cheese is lower than in the foreign country.

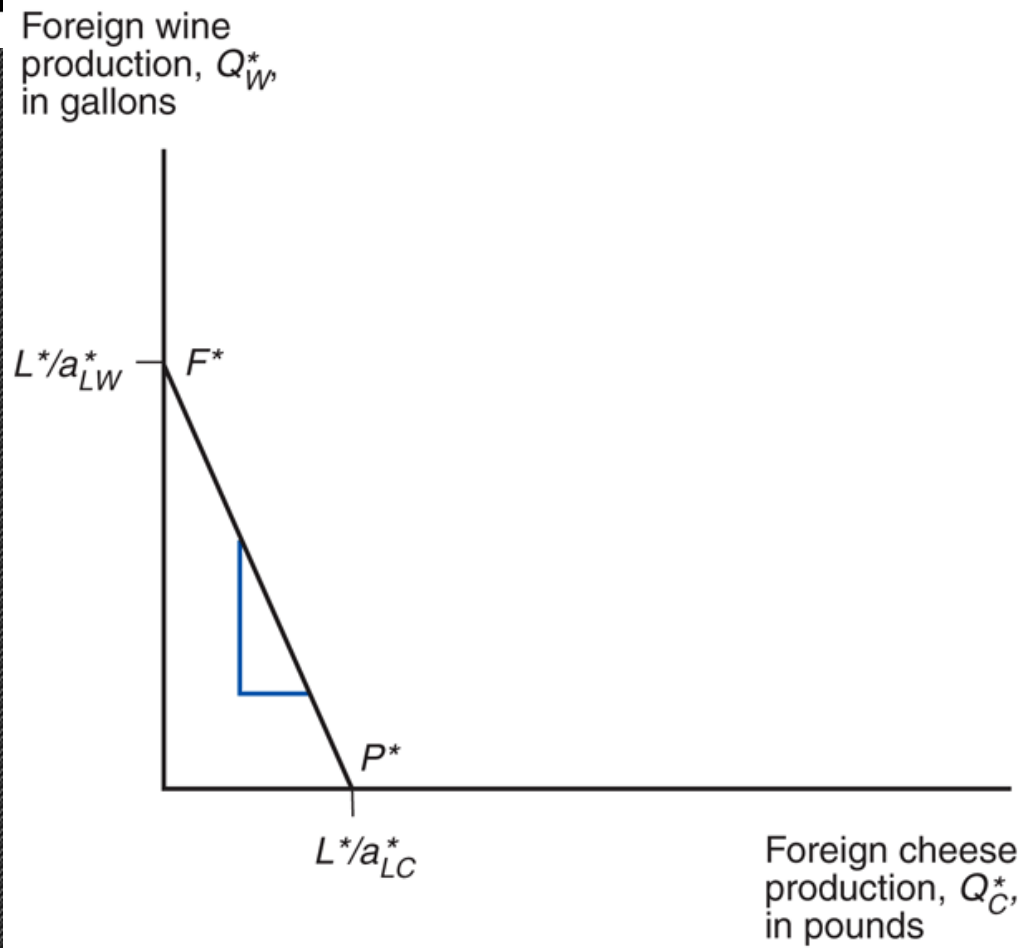
$$a_{LC} / a_{LW} < a_{LC}^* / a_{LW}^*$$

- When the home country increases cheese production, it reduces wine production less than the foreign country would.

Trade in the Ricardian Model (cont.)

- Since the slope of the PPF indicates the opportunity cost of cheese in terms of wine, Foreign's PPF is steeper than Home's.
 - To produce one pound of cheese, must stop producing more gallons of wine in Foreign than in Home.

Fig. 3-2: Foreign's Production Possibility Frontier



Trade in the Ricardian Model (cont.)

- Before any trade occurs, the relative price of cheese to wine reflects the opportunity cost of cheese in terms of wine in each country.
- In the absence of any trade, the relative price of cheese to wine will be higher in Foreign than in Home if Foreign has the higher opportunity cost of cheese.
- It will be profitable to ship cheese from Home to Foreign (and wine from Foreign to Home) - where does the relative price of cheese to wine settle?

Trade in the Ricardian Model (cont.)

- To see how all countries can benefit from trade, need to find relative prices when trade exists.
- First calculate the world **relative supply** of cheese: the quantity of cheese supplied by all countries relative to the quantity of wine supplied by all countries

$$RS = (Q_C + Q_C^*) / (Q_W + Q_W^*)$$

Relative Supply and Relative Demand

- If the relative price of cheese falls below the opportunity cost of cheese in both countries $P_C / P_W < a_{LC} / a_{LW} < a_{LC}^* / a_{LW}^*$,
 - no cheese would be produced.
 - domestic and foreign workers would be willing to produce only wine (where wage is higher).

Relative Supply and Relative Demand (cont.)

- When the relative price of cheese equals the opportunity cost in the home country $P_C / P_W = a_{LC} / a_{LW} < a_{LC}^* / a_{LW}^*$,
 - domestic workers are indifferent about producing wine or cheese (wage when producing wine same as wage when producing cheese).
 - foreign workers produce only wine.

Relative Supply and Relative Demand (cont.)

- when the relative price of cheese settles strictly in between the opportunity costs of cheese $a_{LC} / a_{LW} < P_c / P_w < a^*_{LC} / a^*_{LW}$,
 - domestic workers produce only cheese (where their wages are higher).
 - foreign workers still produce only wine (where their wages are higher).
 - world relative supply of cheese equals Home's maximum cheese production divided by Foreign's maximum wine production $(L / a_{LC}) / (L^* / a^*_{LW})$.

Relative Supply and Relative Demand (cont.)

- when the relative price of cheese equals the opportunity cost in the foreign country

$$a_{LC} / a_{LW} < P_C / P_W = a_{LC}^* / a_{LW}^*,$$

- foreign workers are indifferent about producing wine or cheese (wage when producing wine same as wage when producing cheese).
- domestic workers produce only cheese.

Relative Supply and Relative Demand (cont.)

- If the relative price of cheese rises above the opportunity cost of cheese in both countries

$$a_{LC} / a_{LW} < a^*_{LC} / a^*_{LW} < P_C / P_W,$$

- no wine is produced.
- home and foreign workers are willing to produce only cheese (where wage is higher).

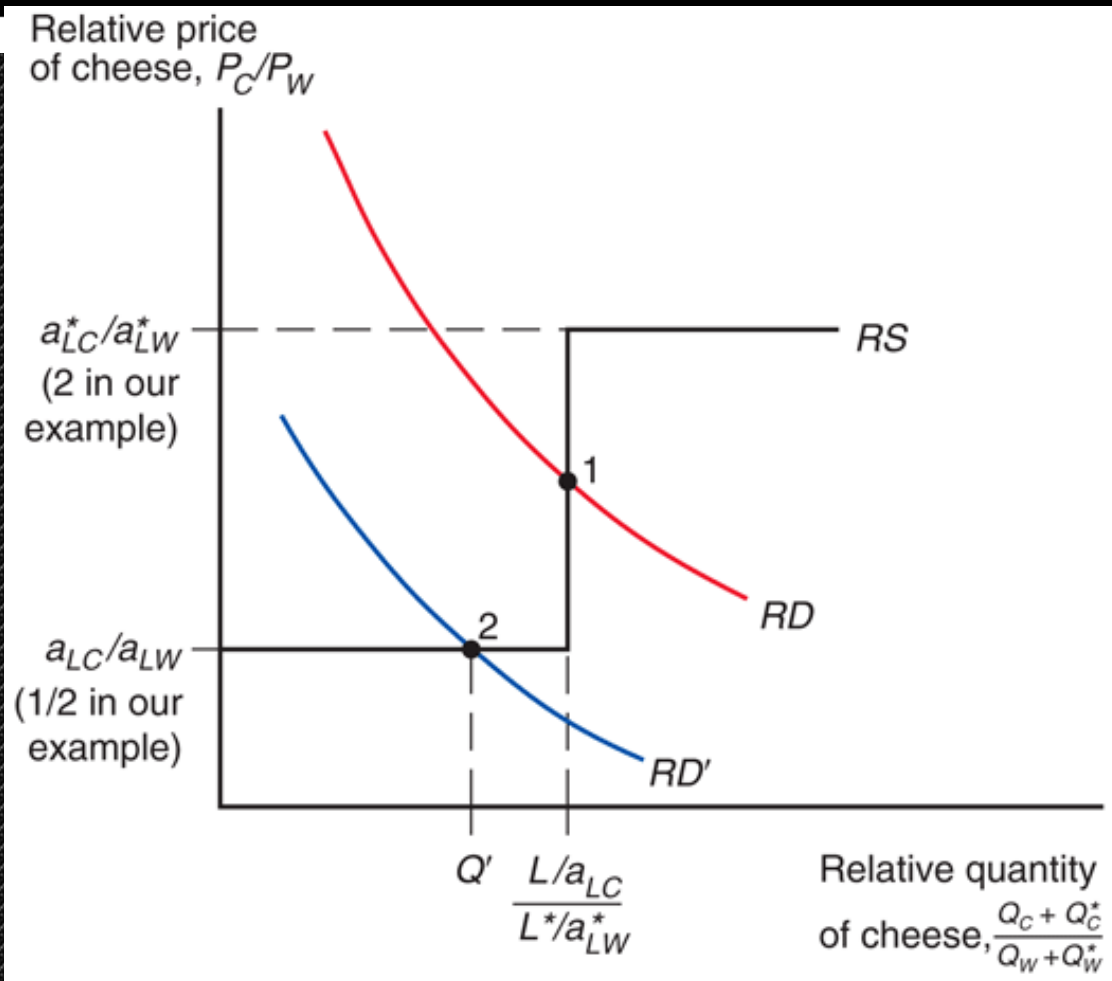
Relative Supply and Relative Demand (cont.)

- World relative supply is a step function:
 - First step at relative price of cheese equal to Home's opportunity cost a_{LC} / a_{LW} , which equals 1/2 in the example.
 - Jumps when world relative supply of cheese equals Home's maximum cheese production divided by Foreign's maximum wine production $(L / a_{LC}) / (L^* / a_{LW}^*)$, which equals 1 in the example.
 - Second step at relative price of cheese equal to Foreign's opportunity cost a_{LC}^* / a_{LW}^* , which equals 2 in the example.

Relative Supply and Relative Demand (cont.)

- Relative demand of cheese is the quantity of cheese demanded in all countries relative to the quantity of wine demanded in all countries.
- As the price of cheese relative to the price of wine rises, consumers in all countries will tend to purchase less cheese and more wine so that the relative quantity demanded of cheese falls.

Fig. 3-3: World Relative Supply and Demand



Gains from Trade

- Gains from trade come from specializing in the type of production which uses resources most efficiently, and using the income generated from that production to buy the goods and services that countries desire.
 - where “using resources most efficiently” means producing a good in which a country has a comparative advantage.

Gains from Trade (cont.)

- Domestic workers earn a higher income from cheese production because the relative price of cheese increases with trade.
- Foreign workers earn a higher income from wine production because the relative price of cheese decreases with trade (making cheese cheaper) and the relative price of wine increases with trade.

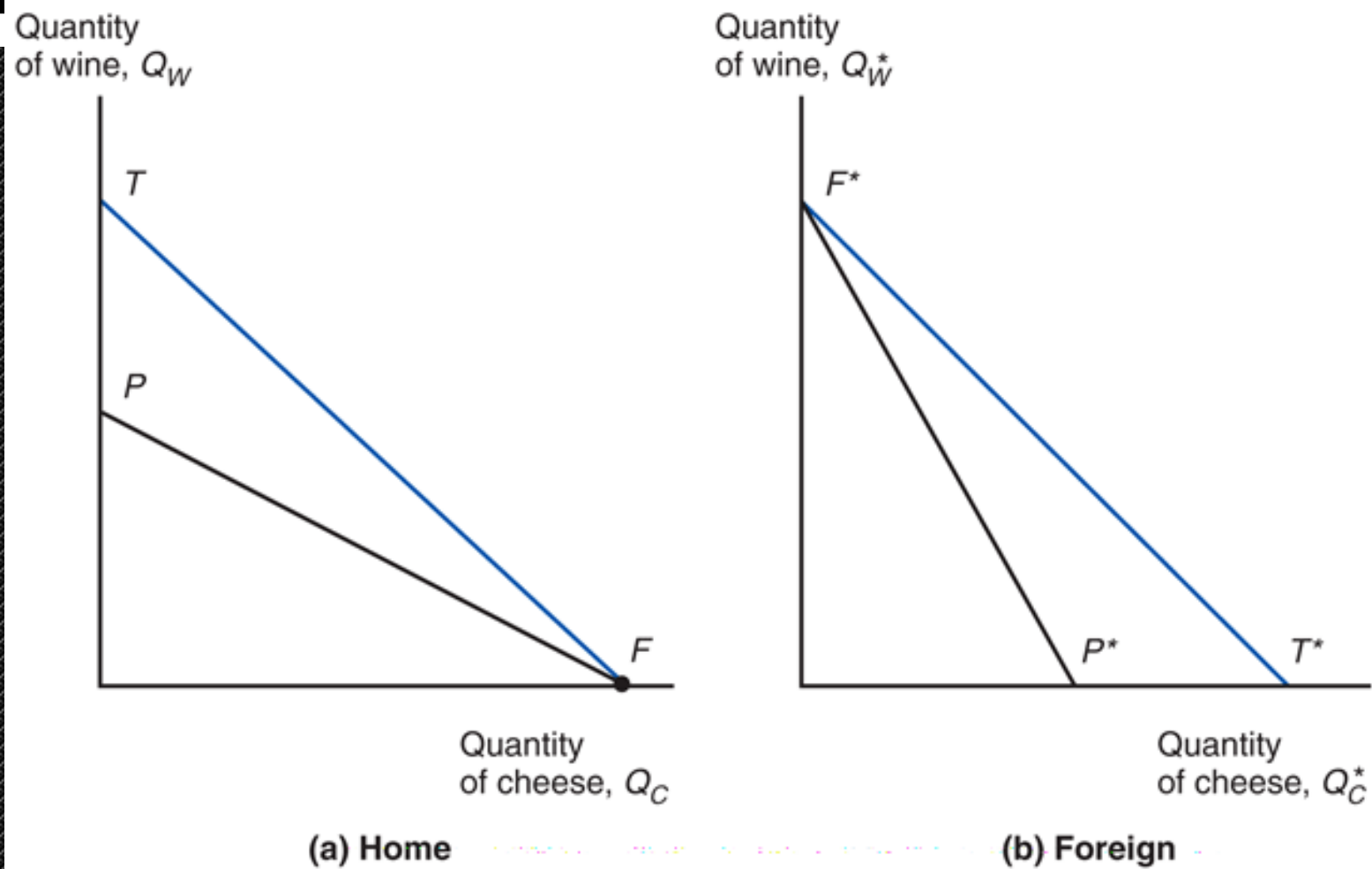
Gains from Trade (cont.)

- Think of trade as an indirect method of production that converts cheese into wine or vice versa.
- Without trade, a country has to allocate resources to produce all of the goods that it wants to consume.
- With trade, a country can specialize its production and exchange for the mix of goods that it wants to consume.

Gains from Trade (cont.)

- Consumption possibilities expand beyond the production possibility frontier when trade is allowed.
- With trade, consumption in each country is expanded because world production is expanded when each country specializes in producing the good in which it has a comparative advantage.

Fig. 3-4: Trade Expands Consumption Possibilities



A Numerical Example

Unit labor requirements for home and foreign countries

	Cheese	Wine
Home	$a_{LC} = 1$ hour/lb	$a_{LW} = 2$ hours/gallon
Foreign	$a^*_{LC} = 6$ hours/lb	$a^*_{LW} = 3$ hours/gallon

- What is the home country's opportunity cost of producing cheese? $a_{LC} / a_{LW} = 1/2$, to produce one pound of cheese, stop producing $1/2$ gallon of wine.

A Numerical Example (cont.)

- The home country is more efficient in both industries, but has a comparative advantage only in cheese production.

$$1/2 = a_{LC} / a_{LW} < a_{LC}^* / a_{LW}^* = 2$$

- The foreign country is less efficient in both industries, but has a comparative advantage in wine production.

A Numerical Example (cont.)

- With trade, the equilibrium relative price of cheese to wine settles between the two opportunity costs of cheese.
- Suppose that the intersection of RS and RD occurs at $P_C / P_W = 1$ so one pound of cheese trades for one gallon of wine.
- Trade causes the relative price of cheese to rise in the home country and fall in foreign.

A Numerical Example (cont.)

- With trade, the foreign country can buy one pound of cheese for $P_C / P_W =$ one gallon of wine,
 - instead of stopping production of $a_{LC}^* / a_{LW}^* = 2$ gallons of wine to free up enough labor to produce one pound of cheese in the absence of trade.
 - Suppose $L^* = 3,000$. The foreign country can trade its 1,000 gallons maximum production of wine for 1,000 pounds of cheese, instead of the 500 pounds of cheese it could produce itself.

A Numerical Example (cont.)

- With trade, the home country can buy one gallon of wine for $P_W / P_C =$ one pound of cheese,
 - instead of stopping production of $a_{LW} / a_{LC} =$ two pounds of cheese to free up enough labor to produce one gallon of wine in the absence of trade.
- The home country can trade its 1,000 pounds maximum production of cheese for 1,000 gallons of wine, instead of the 500 gallons of wine it could produce itself.

Relative Wages

- **Relative wages** are the wages of the home country relative to the wages in the foreign country.
- Productivity (technological) differences determine relative wage differences across countries.
- The home wage relative to the foreign wage will settle in between the ratio of how much better Home is at making cheese and how much better it is at making wine compared to Foreign.
- Relative wages cause Home to have a cost advantage in only cheese and Foreign to have a cost advantage in only wine.

Relative Wages (cont.)

- Suppose that $P_C = \$12/\text{pound}$ and $P_W = \$12/\text{gallon}$.
- Since domestic workers specialize in cheese production after trade, their hourly wages will be
$$P_C/a_{LC} = \$12/1 = \$12$$
- Since foreign workers specialize in wine production after trade, their hourly wages will be
$$P_W/a_{LW}^* = \$12/3 = \$4$$
- The relative wage of domestic workers is therefore
$$\$12/\$4 = 3$$

Relative Wages (cont.)

- The relative wage lies between the ratio of the productivities in each industry.
 - The home country is $6/1 = 6$ times as productive in cheese production, but only $3/2 = 1.5$ times as productive in wine production.
 - The home country has a wage 3 times higher than the foreign country.

Relative Wages (cont.)

- These relationships imply that both countries have a *cost advantage* in production.
 - High wages can be offset by high productivity.
 - Low productivity can be offset by low wages.
- In the home economy, producing one pound of cheese costs \$12 (one worker paid \$12/hr) but would have cost \$24 (six paid \$4/hr) in Foreign.
- In the foreign economy, producing one gallon of wine costs \$12 (three workers paid \$4/hr) but would have cost \$24 (two paid \$12/hr) in Home.

Relative Wages (cont.)

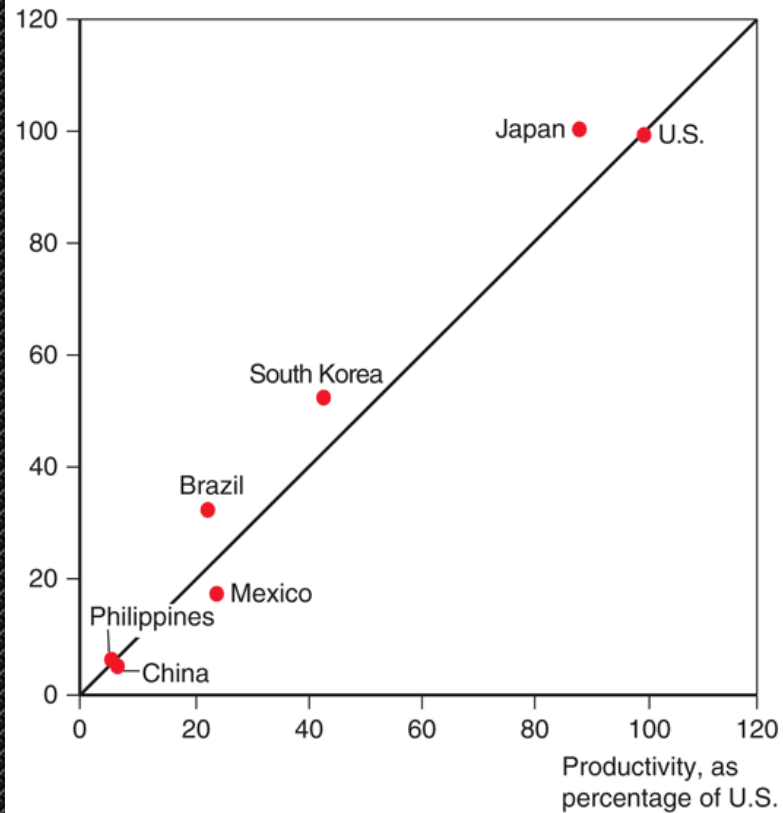
- Because foreign workers have a wage that is only $1/3$ the wage of domestic workers, they are able to attain a cost advantage in wine production, despite low productivity.
- Because domestic workers have a productivity that is 6 times that of foreign workers in cheese production, they are able to attain a cost advantage in cheese production, despite high wages.

Do Wages Reflect Productivity?

- Do relative wages reflect relative productivities of the two countries?
- Evidence shows that low wages are associated with low productivity.
 - Wage of most countries relative to the U.S. is similar to their productivity relative to the U.S.

Productivity and Wages

Hourly wage, as
percentage of U.S.



Source: International Monetary Fund, Bureau of Labor Statistics, and The Conference Board.

Do Wages Reflect Productivity? (cont.)

- Other evidence shows that wages rise as productivity rises.
 - As recently as 1975, wages in South Korea were only 5% of those of the United States.
 - As South Korea's labor productivity rose (to about half of the U.S. level by 2007), so did its wages.

Misconceptions about Comparative Advantage

1. Free trade is beneficial only if a country is more productive than foreign countries.
 - But even an unproductive country benefits from free trade by avoiding the high costs for goods that it would otherwise have to produce domestically.
 - High costs derive from inefficient use of resources.
 - The benefits of free trade do not depend on absolute advantage, rather they depend on comparative advantage: specializing in industries that use resources most efficiently.

Misconceptions about Comparative Advantage (cont.)

2. Free trade with countries that pay low wages hurts high wage countries.

- While trade may reduce wages for *some* workers, thereby affecting the distribution of income within a country, trade benefits consumers and other workers.
- Consumers benefit because they can purchase goods more cheaply.
- Producers/workers benefit by earning a higher income in the industries that use resources more efficiently, allowing them to earn higher prices and wages.

Misconceptions about Comparative Advantage (cont.)

3. Free trade exploits less productive countries whose workers make low wages.

- While labor standards in some countries are less than exemplary compared to Western standards, they are so with or without trade.
- Are high wages and safe labor practices alternatives to trade? Deeper poverty and exploitation may result without export production.
- Consumers benefit from free trade by having access to cheaply (efficiently) produced goods.
- Producers/workers benefit from having higher profits/wages—higher compared to the alternative.

Comparative Advantage with Many Goods

- Suppose now there are N goods produced, indexed by $i = 1, 2, \dots, N$.
- The home country's unit labor requirement for good i is a_{Li} , and the corresponding foreign unit labor requirement is a_{Li}^* .
- Goods will be produced wherever cheapest to produce them.

Comparative Advantage with Many Goods (cont.)

- Let w represent the wage rate in the home country and w^* represent the wage rate in the foreign country.
 - If $wa_{L1} < w^*a_{L1}^*$ then only the home country will produce good 1, since total wage payments are less there.
 - Or equivalently, if $a_{L1}^*/a_{L1} > w/w^*$, if the relative productivity of a country in producing a good is higher than the relative wage, then the good will be produced in that country.

Table 3-2: Home and Foreign Unit Labor Requirements

Good	Home Unit Labor Requirement a_{Li}	Foreign Unit Labor Requirement (a_{Li}^*)	Relative Home Productivity Advantage (a_{Li}^*/a_{Li})
Apples	1	10	10
Bananas	5	40	8
Caviar	3	12	4
Dates	6	12	2
Enchiladas	12	9	0.75

Comparative Advantage with Many Goods (cont.)

- Suppose there are 5 goods produced in the world: apples, bananas, caviar, dates, and enchiladas.
- If $w/w^* = 3$, the home country will produce apples, bananas, and caviar, while the foreign country will produce dates and enchiladas.
 - The relative productivities of the home country in producing apples, bananas, and caviar are higher than the relative wage.

Comparative Advantage with Many Goods (cont.)

- If each country specializes in goods that use resources productively and trades the products for those that it wants to consume, then each benefits.
 - If a country tries to produce all goods for itself, resources are “wasted”.
- The home country has high productivity in apples, bananas, and caviar that give it a cost advantage, despite its high wage.
- The foreign country has low wages that give it a cost advantage, despite its low productivity in date production.

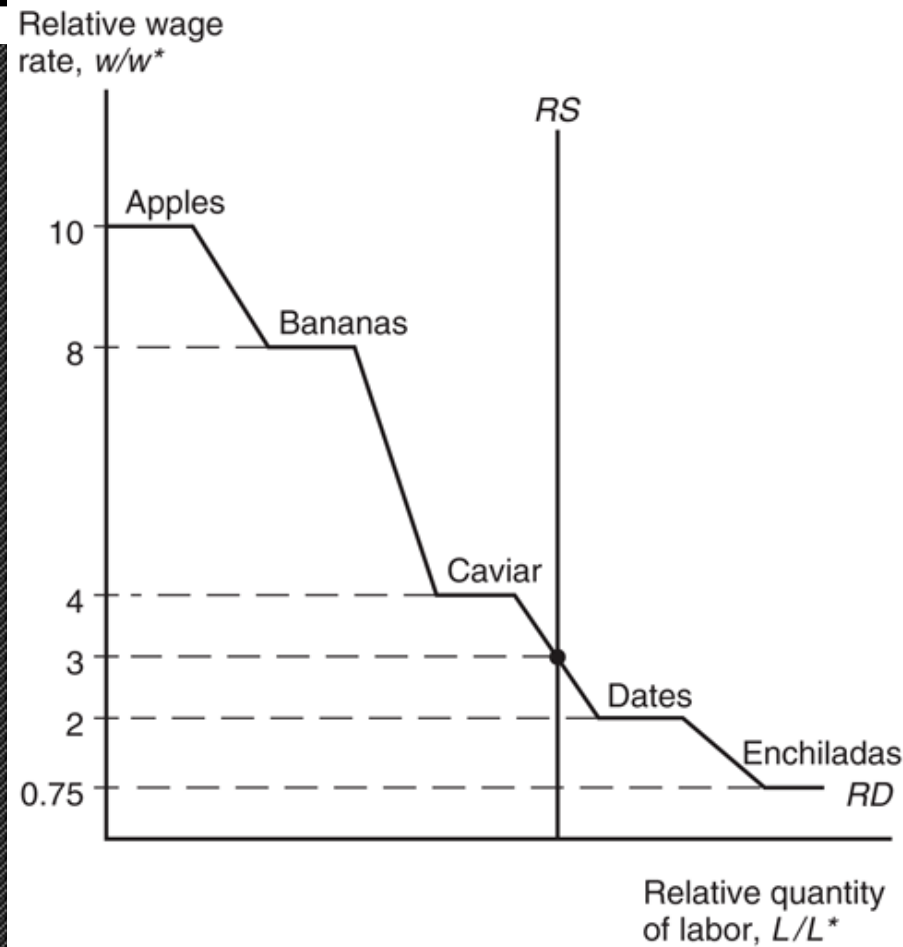
Comparative Advantage with Many Goods (cont.)

- How is the relative wage determined?
- By the relative supply of and relative (derived) demand for labor services.
- The relative (derived) demand for home labor services falls when w/w^* rises. As domestic labor services become more expensive relative to foreign labor services,
 - goods produced in the home country become more expensive, and demand for these goods and the labor services to produce them falls.
 - fewer goods will be produced in the home country, further reducing the demand for domestic labor services.

Comparative Advantage with Many Goods (cont.)

- Suppose w/w^* increases from 3 to 3.99:
 - The home country would produce apples, bananas, and caviar, but the demand for these goods and the labor to produce them would fall as the relative wage rises.
- Suppose w/w^* increases from 3.99 to 4.01:
 - Caviar is now too expensive to produce in the home country, so the caviar industry moves to the foreign country, causing a discrete (abrupt) drop in the demand for domestic labor services.
- Consider similar effects as w/w^* rises from 0.75 to 10.

Fig. 3-5: Determination of Relative Wages



Comparative Advantage with Many Goods (cont.)

- Finally, suppose that relative supply of labor is independent of w/w^* and is fixed at an amount determined by the populations in the home and foreign countries.

Transportation Costs and Non-traded Goods

- The Ricardian model predicts that countries completely specialize in production.
- But this rarely happens for three main reasons:
 1. More than one factor of production reduces the tendency of specialization (Econ/Trade Chapters 4-5).
 2. Protectionism (Econ/Trade Chapters 9-12).
 3. Transportation costs reduce or prevent trade, which may cause each country to produce the same good or service.

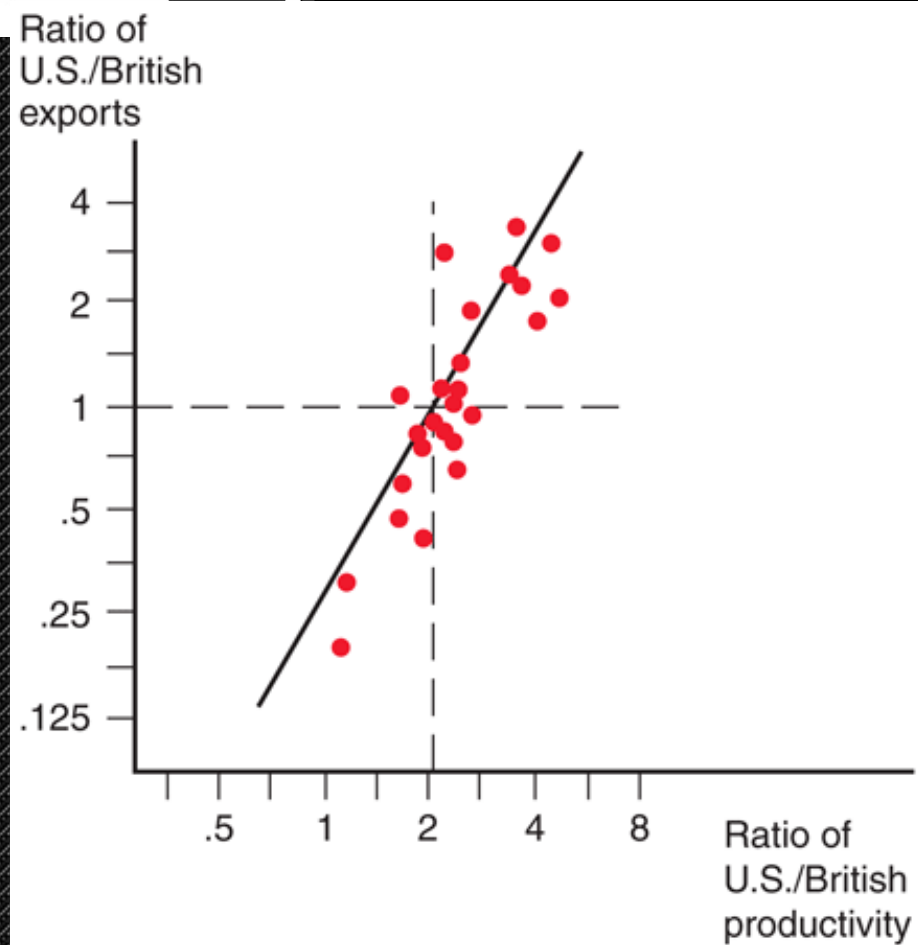
Transportation Costs and Non-traded Goods (cont.)

- Nontraded goods and services (ex., haircuts and auto repairs) exist due to high transport costs.
 - Countries tend to spend a large fraction of national income on nontraded goods and services.
 - This fact has implications for the gravity model and for models that consider how income transfers across countries affect trade.

Empirical Evidence

- Do countries export those goods in which their productivity is relatively high?
- The ratio of U.S. to British exports in 1951 compared to the ratio of U.S. to British labor productivity in 26 manufacturing industries suggests yes.
- At this time the U.S. had an absolute advantage in *all* 26 industries, yet the ratio of exports was low in the least productive sectors of the U.S.

Fig. 3-6: Productivity and Exports



Empirical Evidence (cont.)

- A very poor country like Bangladesh can have comparative advantage in clothing despite being less productive in clothing than other countries such as China because it is even less productive compared to China in other sectors.
 - Productivity (output per worker) in Bangladesh is only 28 percent of China's on average.
 - In apparel, productivity in Bangladesh was about 77 percent of China's, creating strong comparative advantage in apparel for Bangladesh.

Table 3-3: Bangladesh versus China, 2011

	Bangladeshi Output per Worker as % of China	Bangladeshi exports as % of China
All industries	28.5	1.0
Apparel	77	15.5

Source: McKinsey and Company, “Bangladesh’s ready-made garments industry: The challenge of growth,” 2012; UN Monthly Bulletin of Statistics.

Empirical Evidence (cont.)

- The main implications of the Ricardian model are well supported by empirical evidence:
 - productivity differences play an important role in international trade
 - comparative advantage (not absolute advantage) matters for trade

Summary

1. Differences in the productivity of labor across countries generate comparative advantage.
2. A country has a comparative advantage in producing a good when its opportunity cost of producing that good is lower than in other countries.

Summary (cont.)

3. Countries export goods in which they have a comparative advantage - high productivity *or* low wages give countries a cost advantage.
4. With trade, the relative price settles in between what the relative prices were in each country before trade.

Summary (cont.)

5. Trade benefits all countries due to the relative price of the exported good rising: income for workers who produce exports rises, and imported goods become less expensive.
6. Empirical evidence supports trade based on comparative advantage, although transportation costs and other factors prevent complete specialization in production.