ECON 310 - MACROECONOMIC THEORY

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Chapter 15 - International Trade in Goods and Assets

Topics

- Some Data
- Four Trade Models
  1. Ricardian Trade Model (Comparative Advantage in Labor Productivity)
  2. Specific Factors Model
  3. Factor Proportions Model
  4. The Standard Trade Model (A two-good model of a small open economy)
- Appendix A: A two-period small open economy model: the current account.
- Appendix B: Production, investment, and the current account.

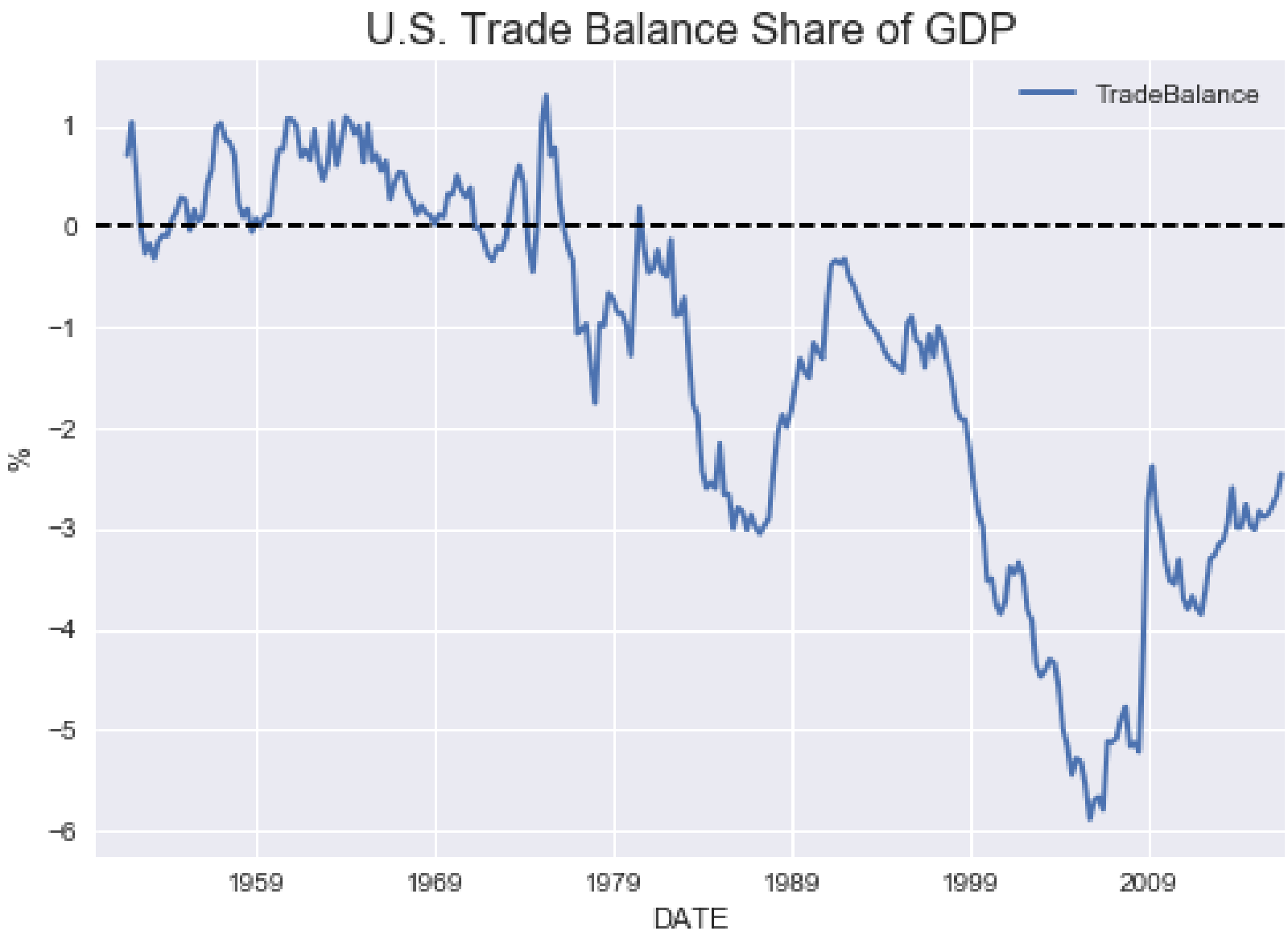
U.S. Trade Data


U.S. Exports and Imports
Exports
Imports
3000000
2500000
2000000
1500000
1000000
500000
0
1959
1969
1979
1989
1999
2009
DATE


U.S. Exports and Imports Shares of GDP
ExportsGDP
ImportsGDP
%
18
16
14
12
10
8
6
4
1959
1969
1979
1989
1999
2009
DATE

Trade Balance or Net Exports

- $NX = Ex - Im$
- $NX < 0 \rightarrow C + I + G > Y$
- $NX > 0 \rightarrow C + I + G < Y$


U.S. Trade Balance Share of GDP
TradeBalance
1
0
−1
−2
−3
−4
−5
−6
%
1959
1969
1979
1989
1999
2009
DATE

How Globalized are we?

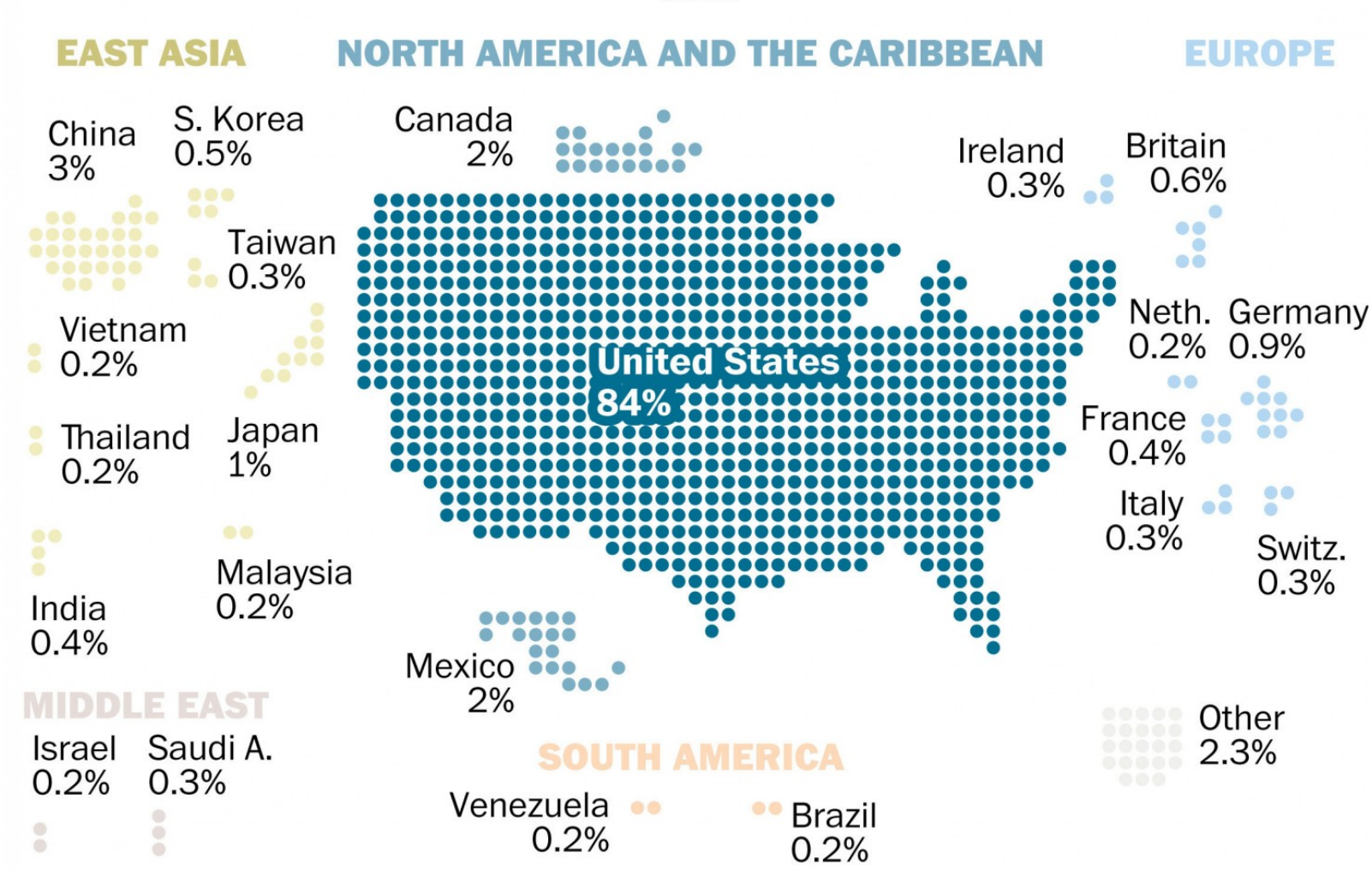
- What percent of purchased output of goods/services is from Mexico?
- What percent of purchased output of goods/services is from China?
- What percent of purchased output of goods/services is from Canada?
- What percent of purchased output of goods/services is from India?

How Globalized are we?

- What is the percentage of (first generation) immigrants from Mexico in the US?
- What is the percentage of (first generation) immigrants from China?
- What is the percentage of (first generation) immigrants from Canada?
- What is the percentage of (first generation) immigrants from India?

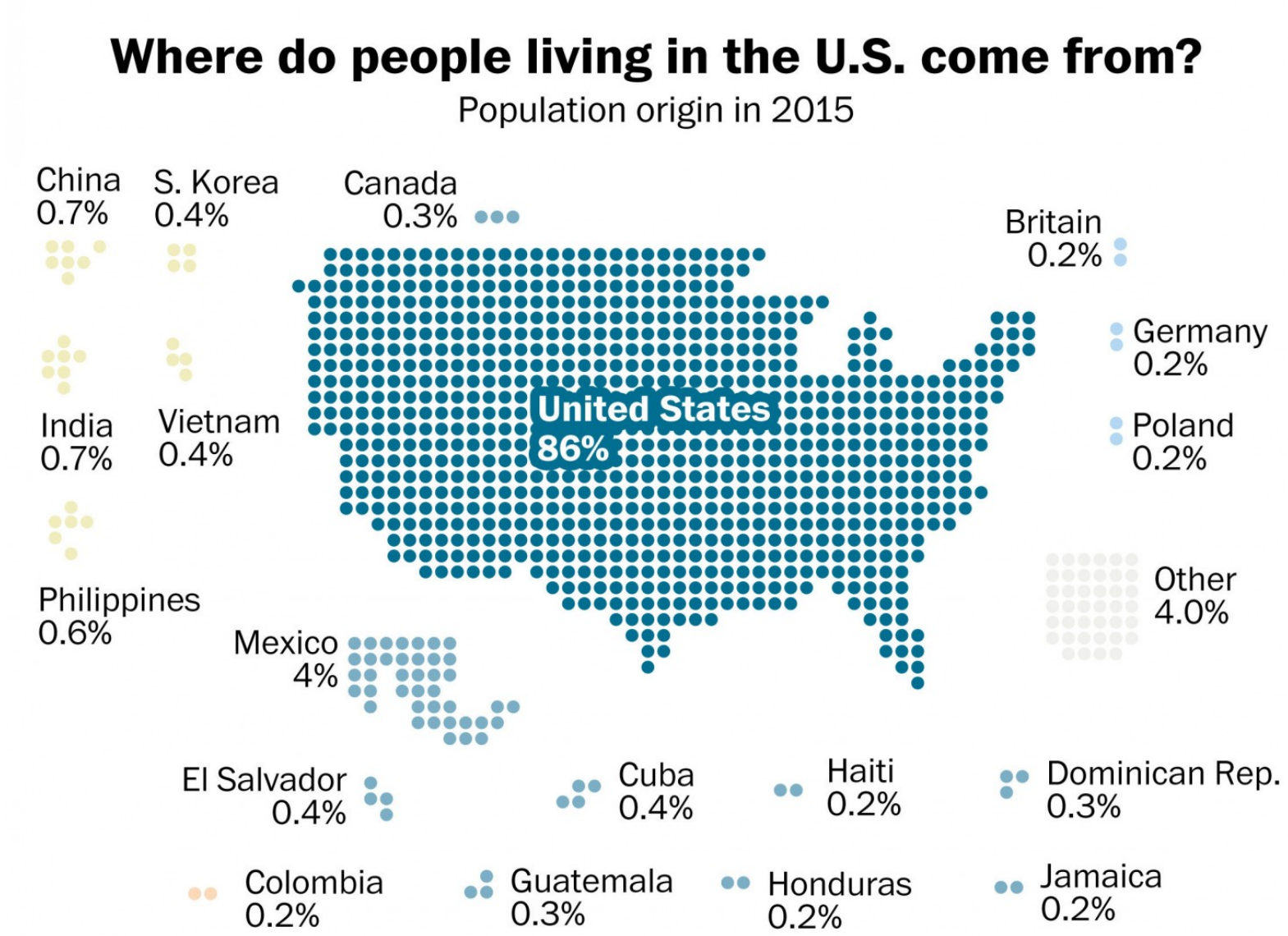
Where does output purchased in the U.S. come from?

Origin of goods and services in 2014



How Globalized are we?

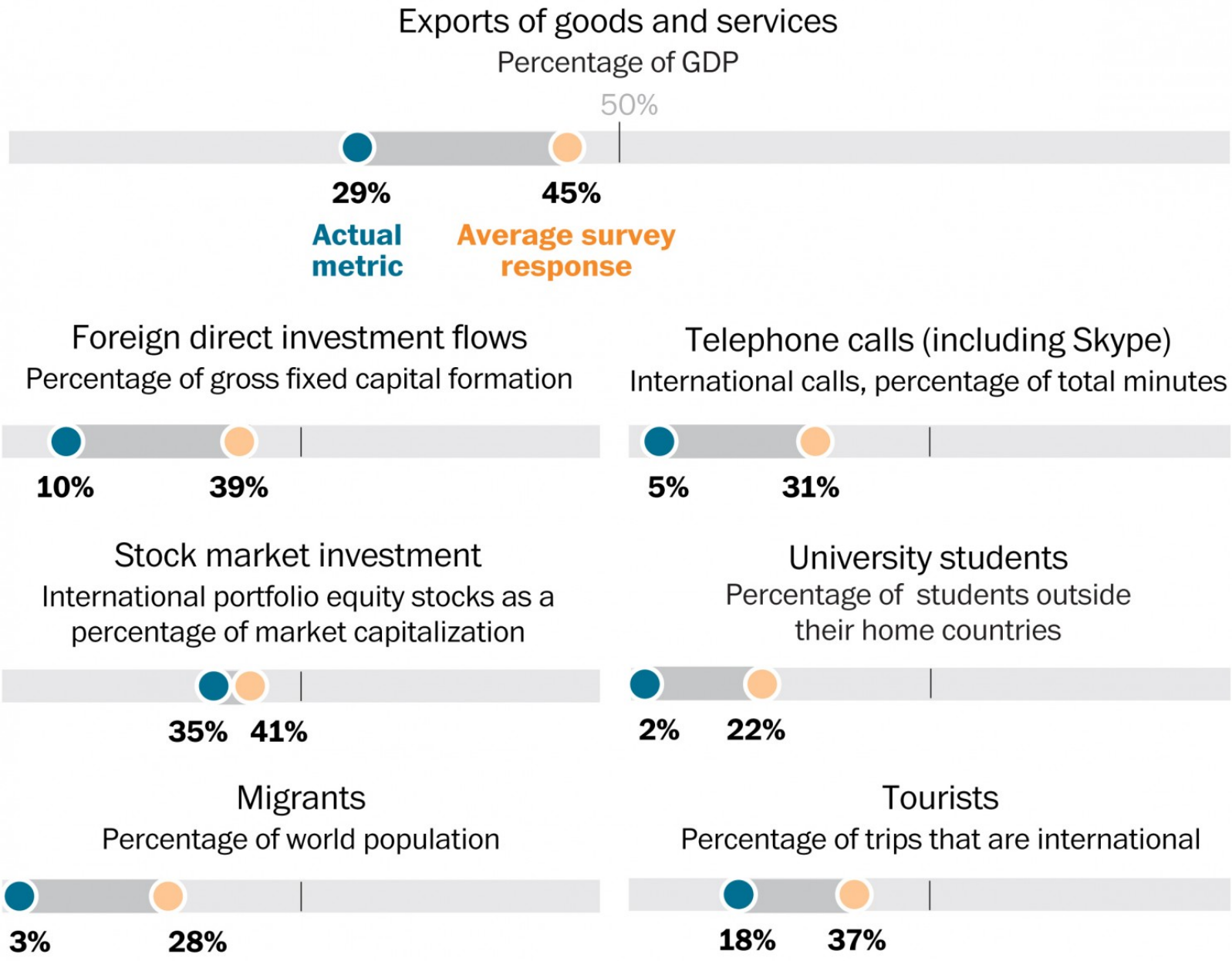
- What percent of purchased output of goods/services is from Mexico?
  - 2%
- What percent of purchased output of goods/services is from China?
  - 3%
- What percent of purchased output of goods/services is from Canada?
  - 2%
- What percent of purchased output of goods/services is from India?
  - 0.4%


Where do people living in the U.S. come from?
Population origin in 2015
China 0.7%
S. Korea 0.4%
Canada 0.3%
Britain 0.2%
Germany 0.2%
Poland 0.2%
United States 86%
India 0.7%
Vietnam 0.4%
Philippines 0.6%
Other 4.0%
Mexico 4%
El Salvador 0.4%
Cuba 0.4%
Haiti 0.2%
Dominican Rep. 0.3%
Colombia 0.2%
Guatemala 0.3%
Honduras 0.2%
Jamaica 0.2%
Totals may not add up to 100 percent because of rounding.
Sources: International Monetary Fund, U.N. Department of Economic and Social Affairs
THE WASHINGTON POST

How Globalized are we?

- What is the percentage of (first generation) immigrants from Mexico in the US?
  - 4%
- What is the percentage of (first generation) immigrants from China?
  - 0.7%
- What is the percentage of (first generation) immigrants from Canada?
  - 0.3%
- What is the percentage of (first generation) immigrants from India?
  - 0.7%

How globalized do Americans think the world is in terms of ...



Source: Pankaj Ghemawat and Steven A. Altman, "DHL Global Connectedness Index 2016"

1. Ricardian Trade Model

Benefits from Specialization and Trade

- **Self-sufficiency** or **Autarky**
  - If a nation produced everything it consumed, it would not depend on any other nation for its livelihood
- However, countries (overall) are better off if they specialize in the production of some products and trade some of them to other countries
- Specialization and trade are concepts based on the principle of opportunity cost

Benefits from Specialization I

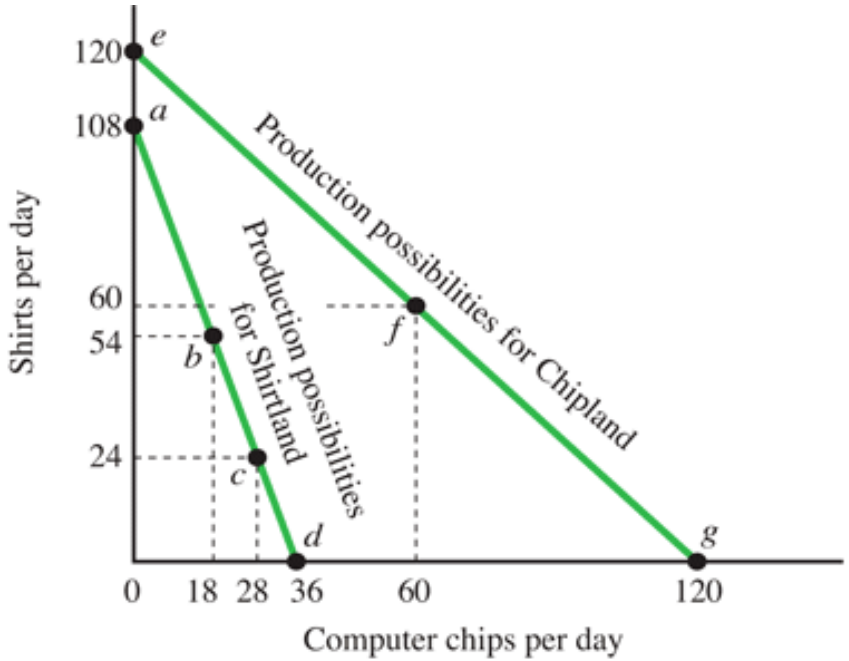
TABLE 18.1 Output and Opportunity Cost

	Quantity Produced Per Day	Opportunity Cost of Shirts	Opportunity Cost of Chips
Shirtland	108 shirts 36 chips	1/3 chip	3 shirts
Chipland	120 shirts 120 chip	1 chip	1 shirt

Benefits from Specialization II

- The production possibilities curve shows the combination of two goods that can be produced with a nation's resources
  - For Chipland, the trade-off between the two goods is one-to-one
  - For Shirtland, the trade-off is three shirts for every computer chip
- In the absence of trade (autarky),
  - Shirtland can pick point (c) $\rightarrow$ 28 chips and 24 shirts—and
  - Chipland can pick point (f) $\rightarrow$ 60 chips and 60 shirts

Benefits from Specialization III



Shirtland Possibilities

Point	Shirts	Chips
a	108	0
b	54	18
c	24	28
d	0	36

Chipland Possibilities

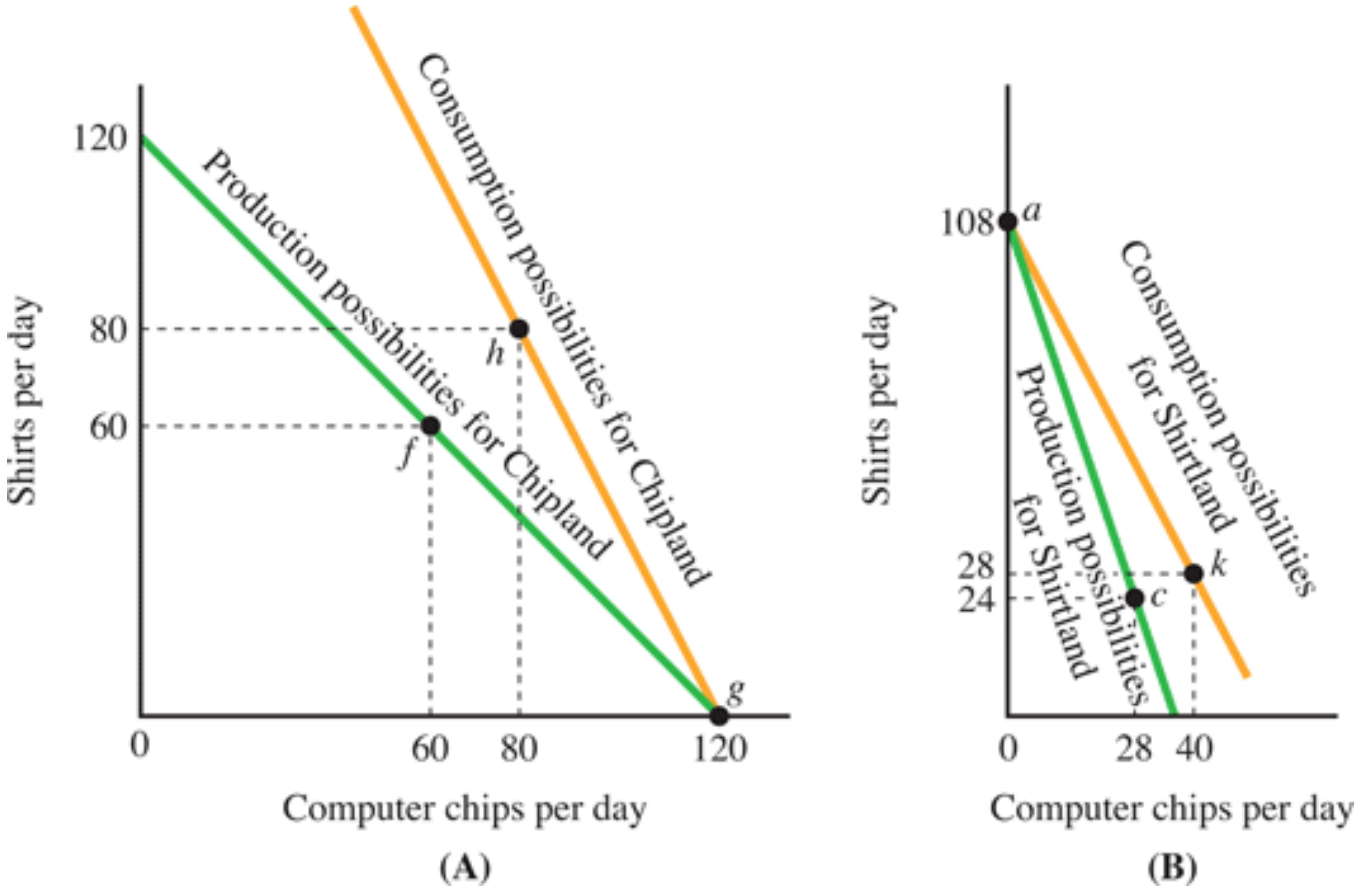
Point	Shirts	Chips
e	120	0
f	60	60
g	0	120

Benefits from Specialization IV

- **Terms of Trade (TOT)**
  - The rate at which units of one product can be exchanged for units of another product
  - $\text{TOT} = \frac{P_{Export-Good}}{P_{Import-Good}}$

Benefits from Specialization V

- The consumption possibilities curve shows the combinations of computer chips and shirts that can be consumed if **each country specializes** and **trades**



Benefits from Specialization VI

- Each consumption possibilities curve lies above the nation's production possibilities curves, meaning that each nation has more options about how much to consume under specialization and trade

- Given the **terms of trade**:
  - Chipland can exchange 40 of its 120 chips for 80 shirts, leading to point (h)
  - At (h), Chipland can consume 80 chips and 80 shirts
  - Shirtland can exchange 80 of its 108 shirts for 40 chips, leading to point (k) on its consumption possibilities curve
  - Shirtland can consume 28 shirts and 40 chips

Comparative Advantage and the Terms of Trade

- The nation with the **lower opportunity cost** has a comparative advantage in producing that good
- Chipland has a comparative advantage in the production of chips because it sacrifices fewer shirts to produce one chip
  - Chipland should therefore produce chips
- Shirtland has a comparative advantage in the production of shirts because it sacrifices fewer chips to produce one shirt
  - Shirtland should therefore produce shirts
- The **terms of trade** are the rate at which two goods will be exchanged
- The consumption possibilities curve shows the combinations of two goods that a nation can consume when it specializes in producing one good and trades with another nation

Empirical Evidence on the Ricardian Model I

- Yes
  - 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.
- But
  - Model predicts extreme degree of specialization $\rightarrow$don't see this in data
  - Assumes away effects of trade on distribution of income within the country $\rightarrow$ trade is always good
  - No role for differences in resources among countries as cause of trade (everything is in relative labor productivity)
  - Neglects economies of scale as reasons for trade between countries with similar productivities

The Employment Effects of Free Trade

- In our example, some people in both nations will be harmed by free trade
- In Chipland, for example, people in the shirt industry will lose their jobs when the shirt industry disappears
- Some workers can "easily" move into the expanding computer-chip industry, but others will be unable to make the move and will be forced to accept lower-paying jobs or face unemployment
- In the U.S. higher skilled workers are more mobile and able to switch to a new industry

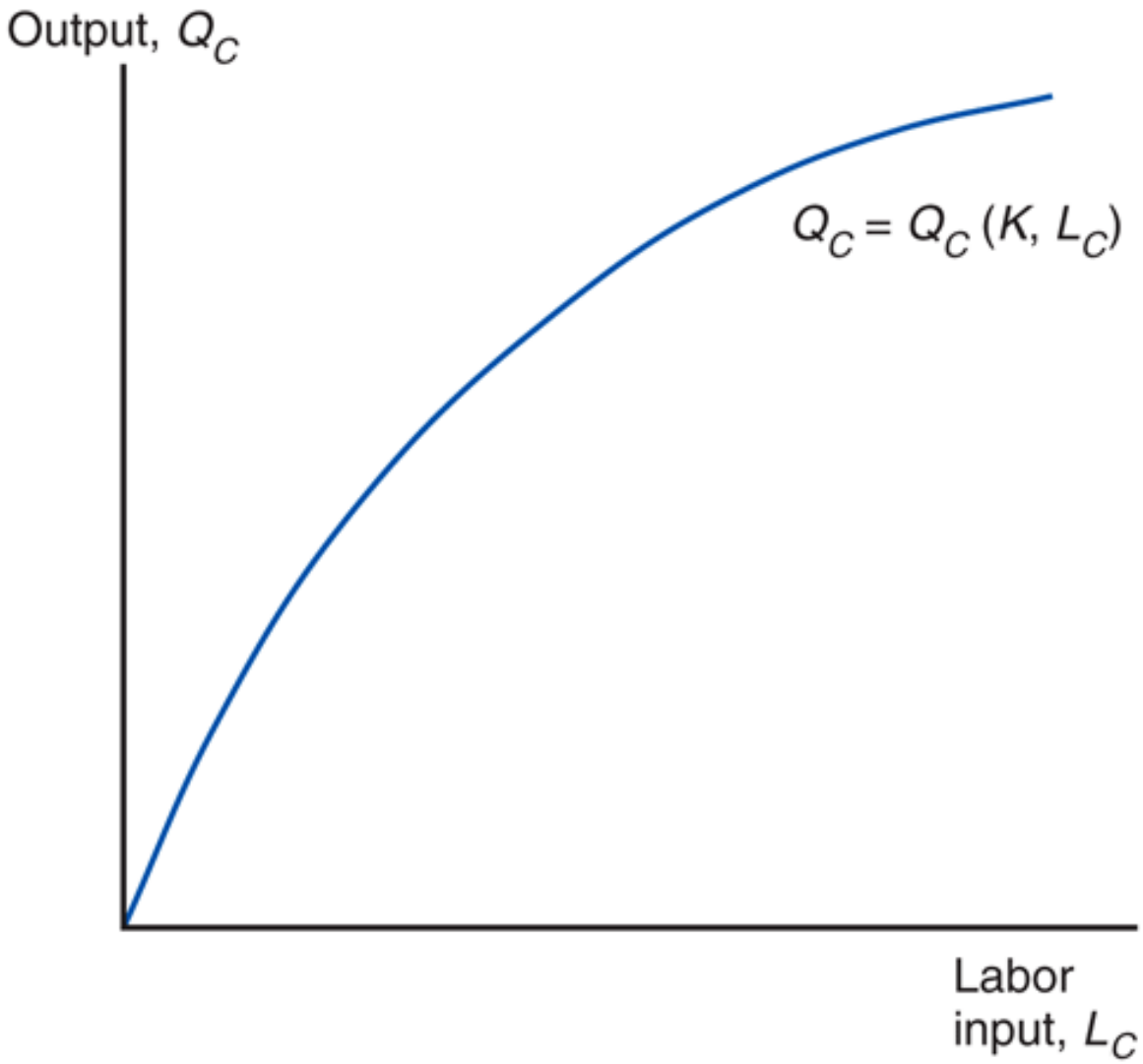
2. Specific Factors Model

Summary I

- Cloth produced using capital (K)and labor (L_c)(but not land).
- Food produced using land (T) and labor (L_F)(but not capital).
- Labor is a mobile factor that can move between sectors: $L_c + L_F = L$
- Land and capital are both specific factors used only in the production of one good.

$$Q_c = Q_c(K, L_c),$$
$$Q_F = Q_F(T, L_F),$$

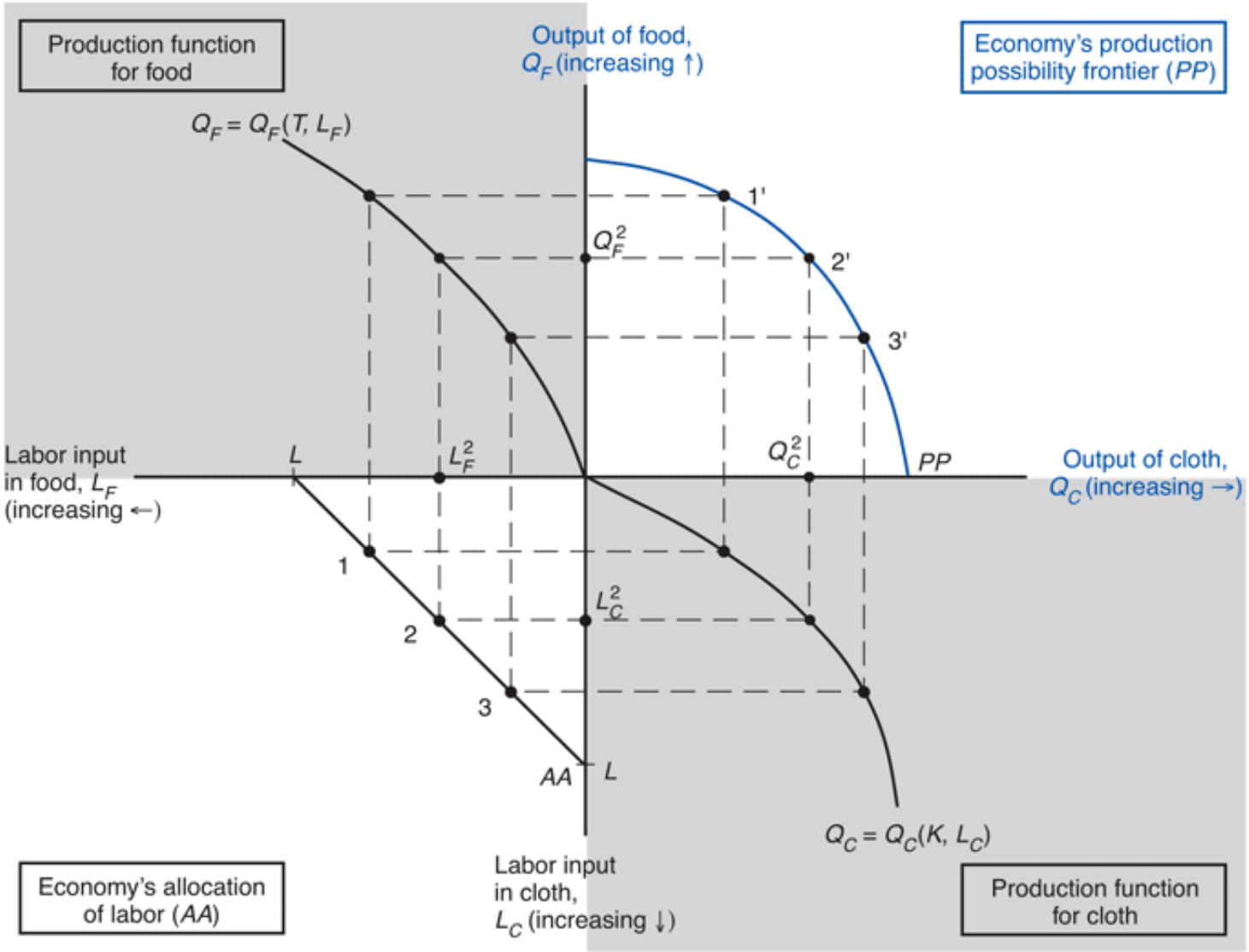
Summary II



Summary III

- The shape of the production function reflects the law of diminishing marginal returns.
  - Adding one worker to the production process (without increasing the amount of capital) means that each worker has less capital to work with.
  - Therefore, each additional unit of labor adds less output than the last.

Summary IV



- Why is the production possibilities frontier curved?

Summary V

- Diminishing returns to labor in each sector cause the opportunity cost to rise when an economy produces more of a good.
- Opportunity cost of cloth in terms of food is the slope of the production possibilities frontier – the slope becomes steeper as an economy produces more cloth.

- Opportunity cost of producing one more yard of cloth is MPL_F/MPL_C pounds of food.
  - To produce one more yard of cloth, you need $1/MPL_C$ hours of labor.
  - To free up one hour of labor, you must reduce output of food by MPL_F pounds.
  - To produce less food and more cloth, employ less in food and more in cloth. The marginal product of labor in food rises and the marginal product of labor in cloth falls, so MPL_F/MPL_C rises.

Prices, Wages Labor Allocation I

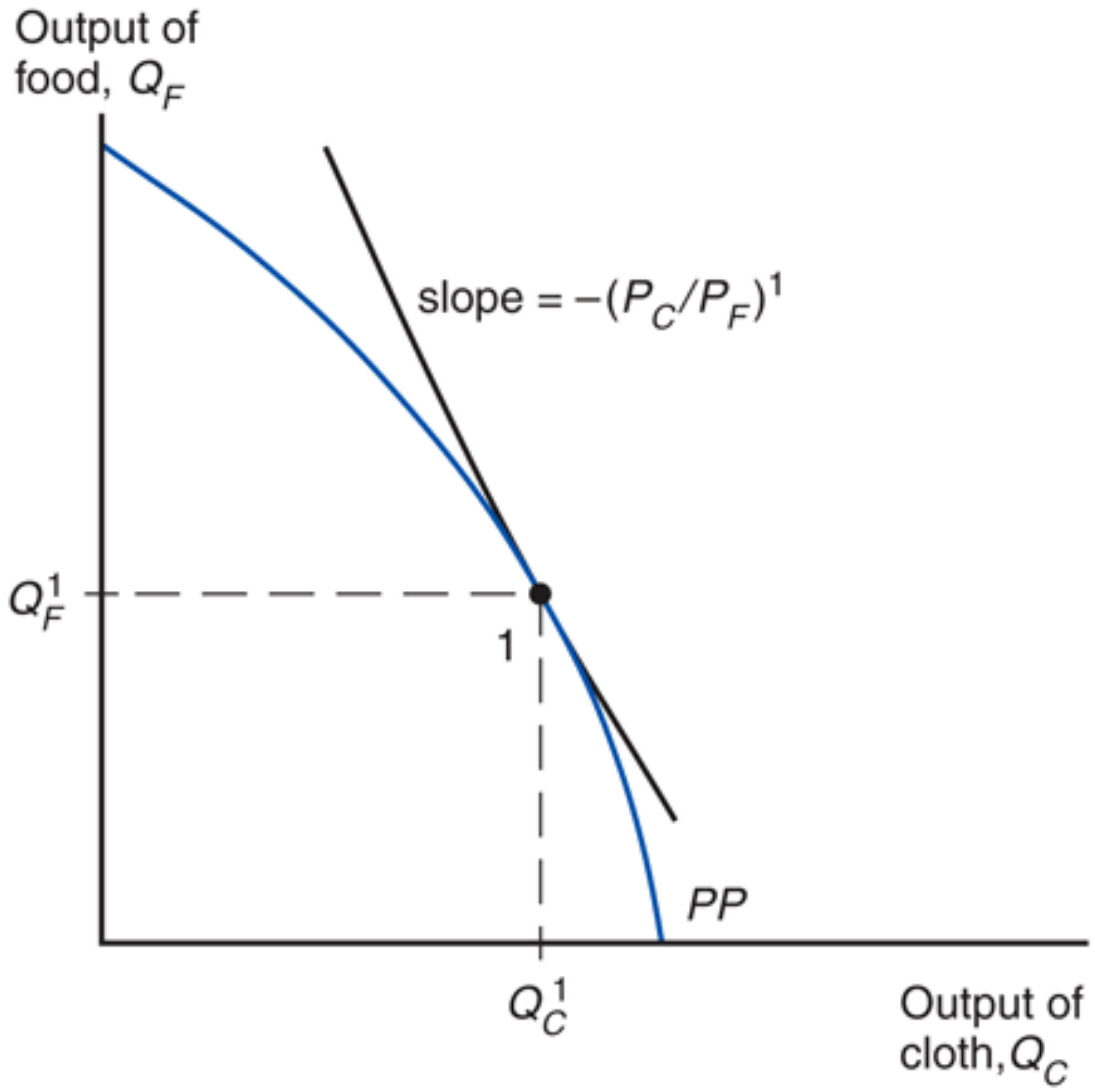
- How much labor is employed in each sector?
  - Need to look at supply and demand in the labor market.
- Demand for labor:
  - In each sector, employers will maximize profits by demanding labor up to the point where the value produced by an additional hour equals the marginal cost of employing a worker for that hour.

$$MPL_C \times P_C = w,$$
$$MPL_F \times P_F = w,$$

- The two sectors must pay the same wage because labor can move between sectors.

$$-\frac{MPL_F}{MPL_C} = -\frac{P_C}{P_F}$$

Prices, Wages Labor Allocation II



Example with Cobb-Douglas Functions I

- Assume the following production functions for the cloth and food sector

$$Y_C = A_C \times K^{\alpha} \times L_C^{1-\alpha},$$
$$Y_F = A_F \times T^{\alpha} \times L_F^{1-\alpha},$$

- Optimality condition is

$$p_F (1-\alpha) A_F \times T^{\alpha} \times L_F^{-\alpha} = p_C (1-\alpha) A_C \times K^{\alpha} \times L_C^{-\alpha} = w$$

- We next solve for optimal labor in the food sector and use the total time endowment relationship

$$L_F + L_C = 1$$

Example with Cobb-Douglas Functions II

- From the optimality condition we have

$$p_F (1-\alpha) A_F \times T^{\alpha} \times L_F^{-\alpha} = p_C (1-\alpha) A_C \times K^{\alpha} \times L_C^{-\alpha}$$

$$\rightarrow \frac{p_F A_F T^{\alpha}}{p_C A_C K^{\alpha}} \times L_F^{-\alpha} = \left(\frac{L_c}{1 - L_F} \right)^{-\alpha},$$

$$\rightarrow \frac{p_F A_F T^{\alpha}}{p_C A_C K^{\alpha}} \times (1 - L_F)^{\alpha} = L_F^{\alpha},$$

$$\rightarrow \left[\frac{p_F A_F T^{\alpha}}{p_C A_C K^{\alpha}} \right]^{\frac{1}{\alpha}} \times (1 - L_F) = L_F,$$

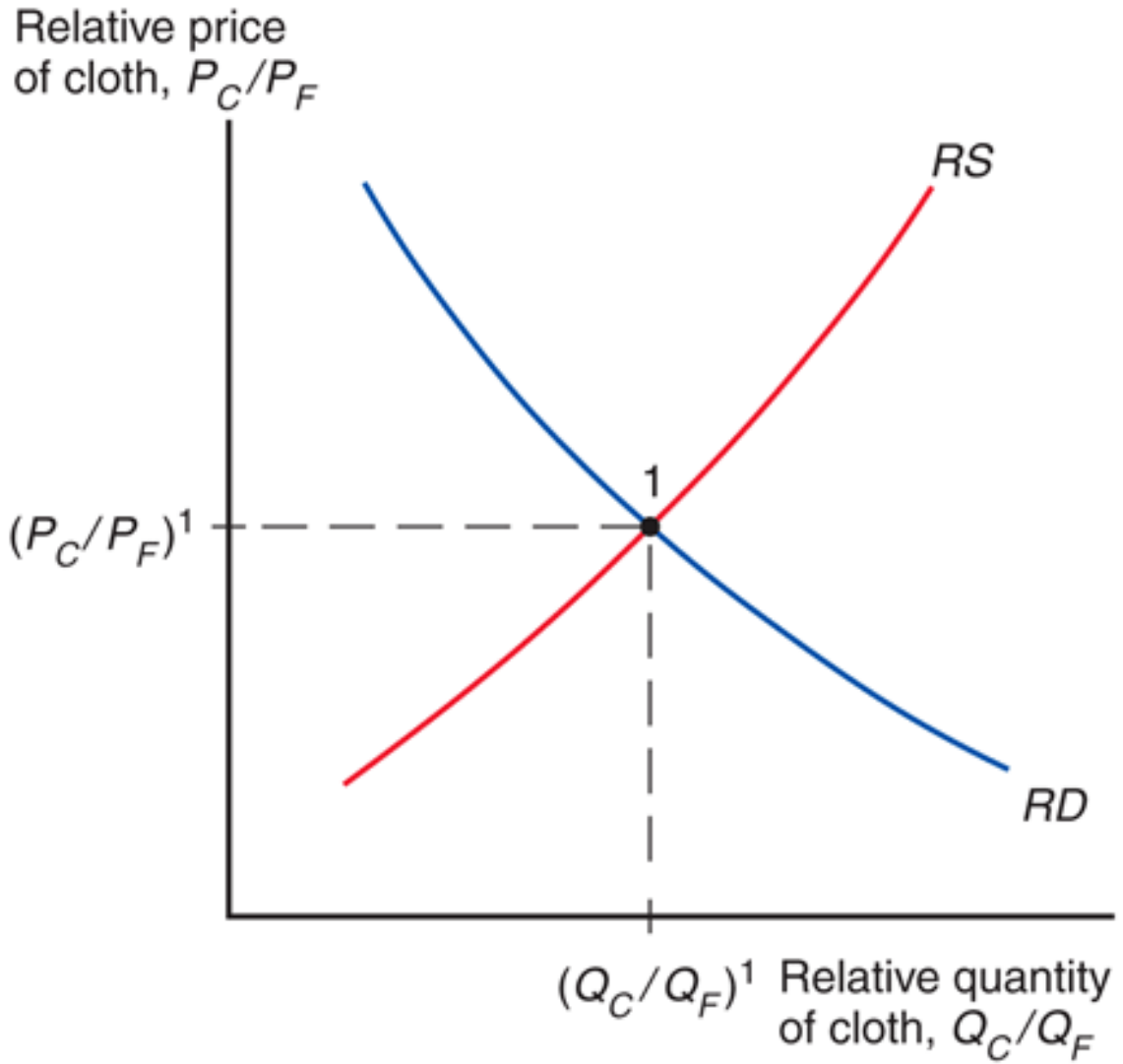
$$\rightarrow \left[\frac{p_F A_F T^{\alpha}}{p_C A_C K^{\alpha}} \right]^{\frac{1}{\alpha}} - \left[\frac{p_F A_F T^{\alpha}}{p_C A_C K^{\alpha}} \right]^{\frac{1}{\alpha}} L_F = L_F,$$

$$\rightarrow L_F^* = \frac{\left[\frac{p_F A_F T^{\alpha}}{p_C A_C K^{\alpha}} \right]^{\frac{1}{\alpha}}}{\left[\frac{p_F A_F T^{\alpha}}{p_C A_C K^{\alpha}} \right]^{\frac{1}{\alpha}} + 1}.$$

- If A_F, A_C, p_F, p_C, T, K and α are given, we get L_F^* and we can then

Relative Supply and Relative Demand

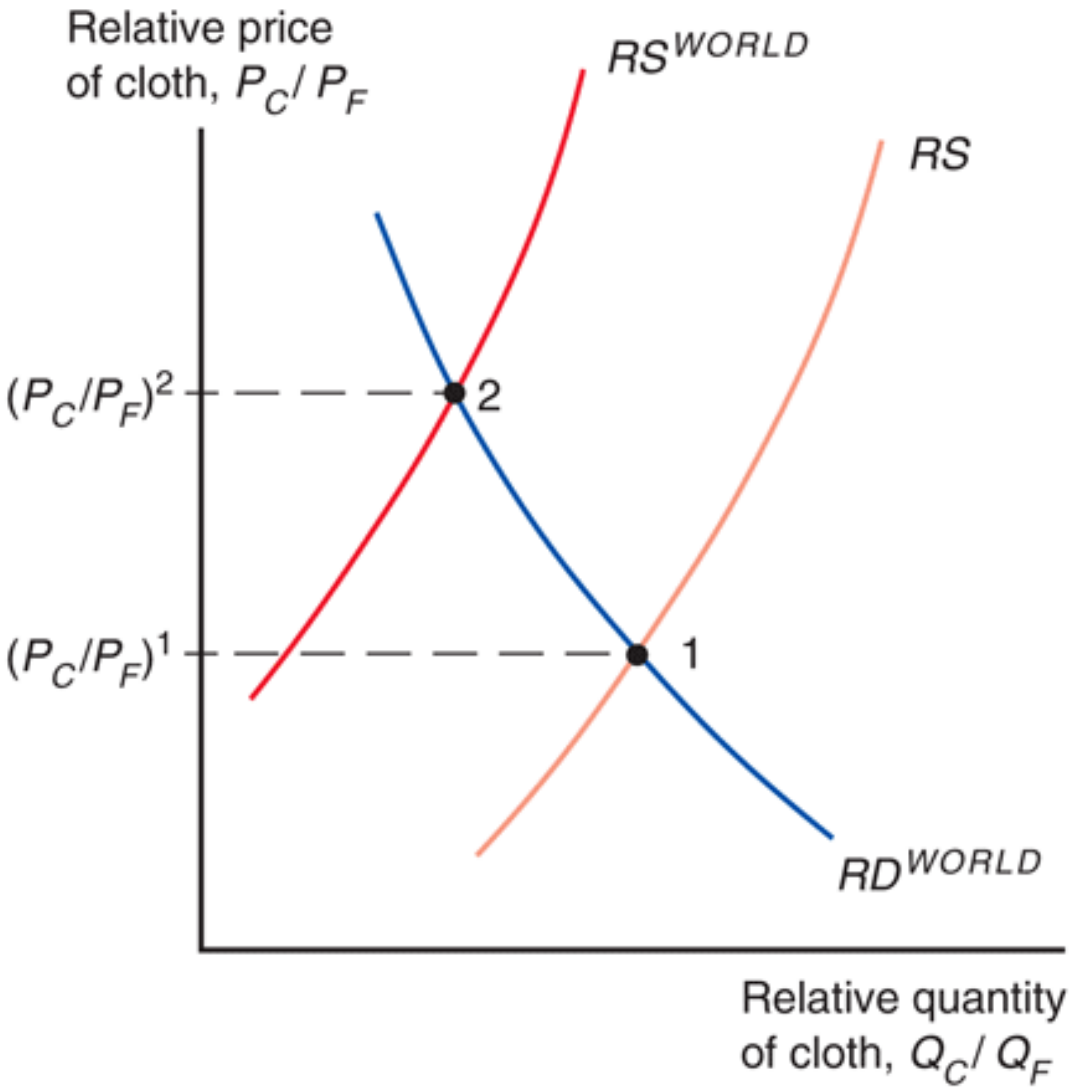
- If both prices increase at the same rate, nothing happens since the relative price $\frac{P_C}{P_F}$ stays constant



International Trade in Specific Factor Model I

- The relative price of cloth prior to trade is determined by the intersection of the economy's relative supply of cloth and its relative demand.
- Free trade relative price of cloth is determined by the intersection of world relative supply of cloth and world relative demand.
- Opening up to **trade increases the relative price** of cloth in an economy whose relative supply of cloth is larger than for the world as a whole.

International Trade in Specific Factor Model II



International Trade in Specific Factor Model III

- Gains from trade
  - Without trade, the economy's output of a good must equal its consumption $D_F = Q_F$
  - International trade allows the mix of cloth and food consumed to differ from the mix produced.
  - The country cannot spend more than it earns→spending = earnings from selling production:

$$\overbrace{P_C \times D_C + P_F \times D_F}^{\text{Demand in \$}} = \overbrace{P_C \times Q_C + P_F \times Q_F}^{\text{Sold Production in \$}},$$

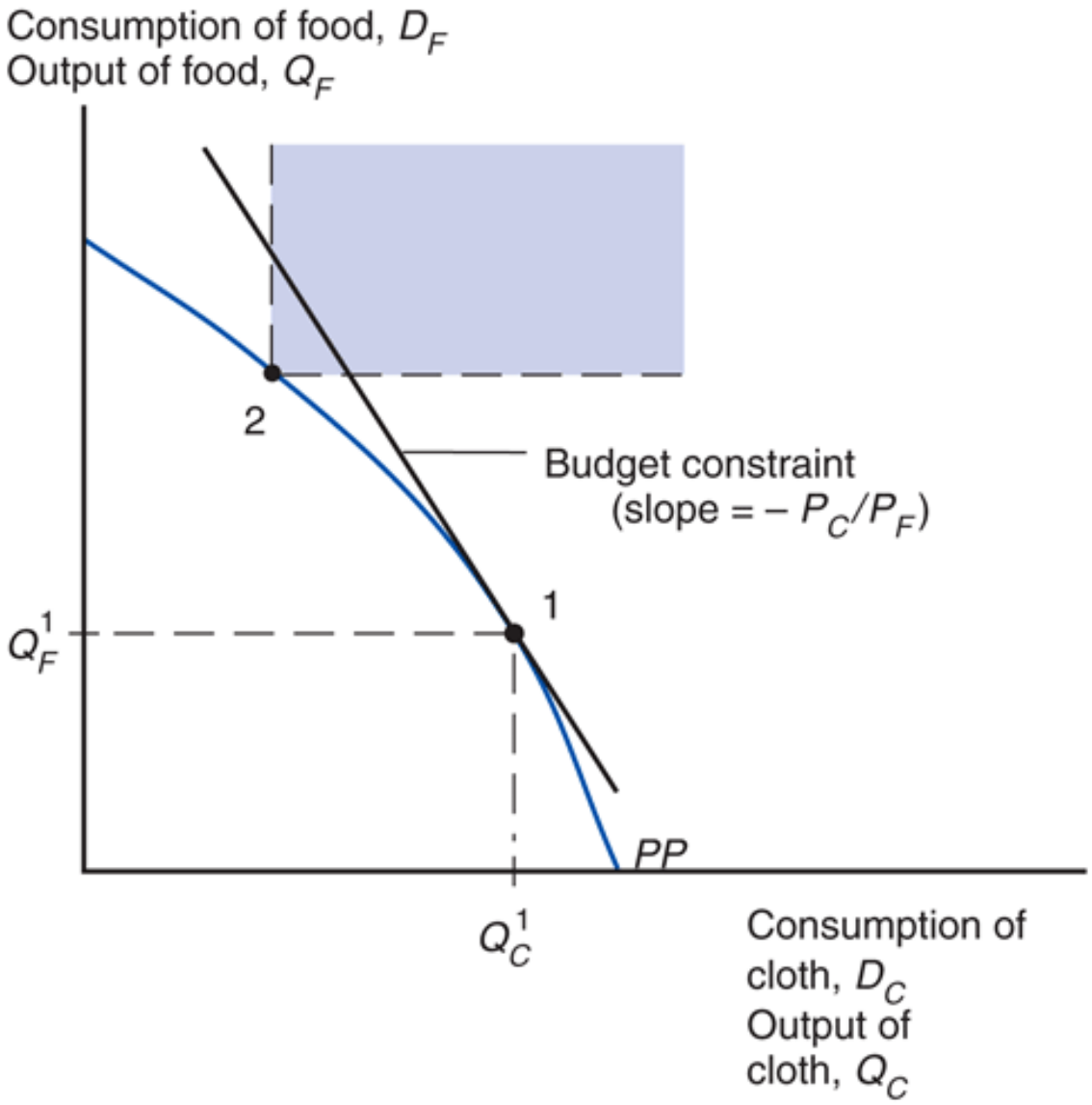
  - where D_C and D_F are **domestic consumption** (demand) of cloth and food and
  - Q_C and Q_F is domestic production of cloth and food
- The economy as a whole gains from trade
  - It imports an amount of food equal to the relative price of cloth times the amount of cloth exported:

$$D_F - Q_F = (P_C/P_F) \times (Q_C - D_C)$$

International Trade in Specific Factor Model IV

- It is able to afford amounts of cloth and food that the country is not able to produce itself.
- The budget constraint with trade lies above the production possibilities frontier

International Trade in Specific Factor Model V



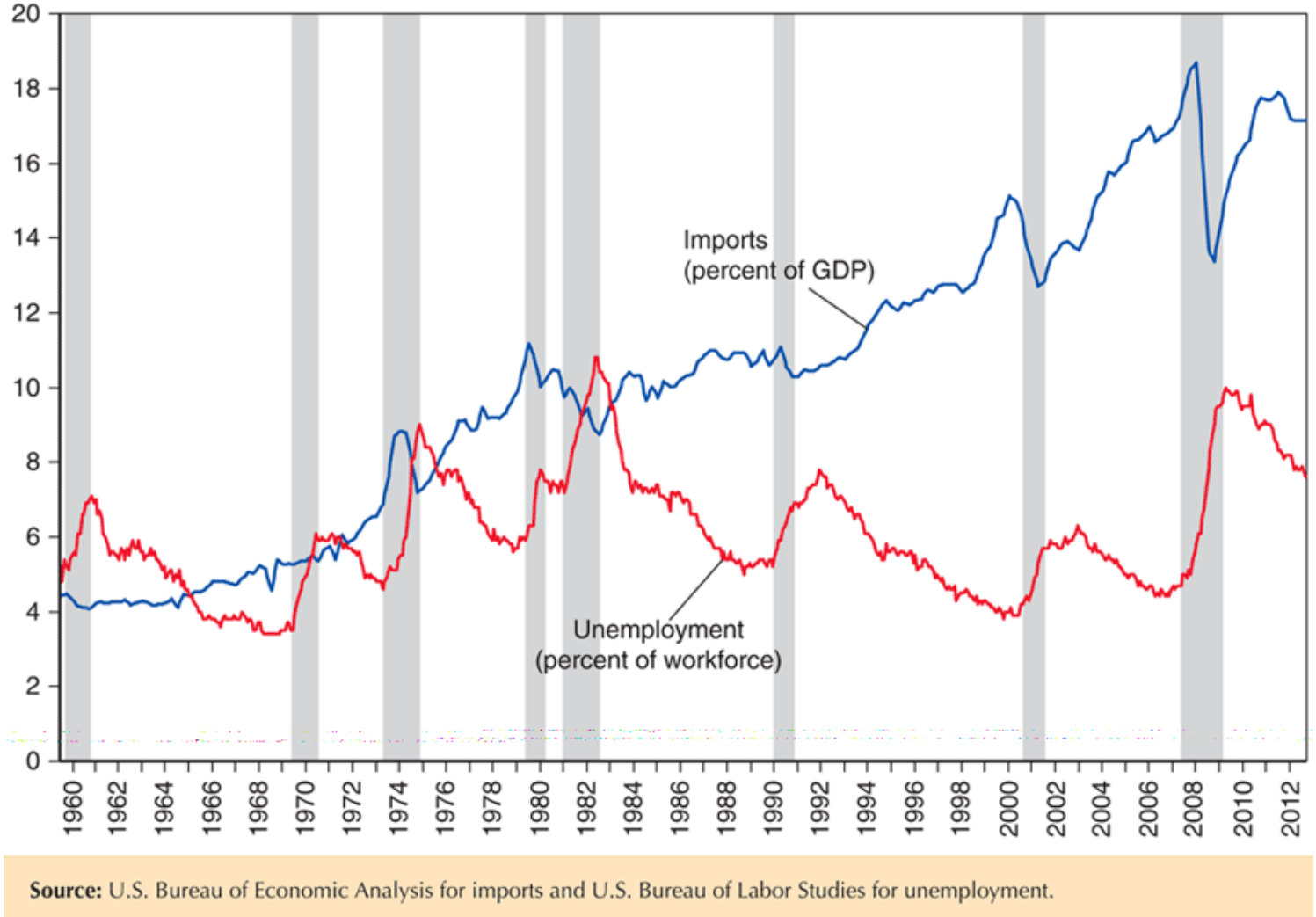
International Trade in Specific Factor Model VI

- International trade shifts the relative price of cloth to food, so factor prices change.
  - Trade benefits the factor that is specific to the export sector of each country, but hurts the factor that is specific to the import-competing sectors.
  - Trade has ambiguous effects on mobile factors.
  - Trade benefits a country by expanding choices.
- Possible to redistribute income so that everyone gains from trade.
  - Those who gain from trade could compensate those who lose and still be better off themselves.
  - That everyone could gain from trade does not mean that they actually do – redistribution usually hard to implement.
- Trade often produces losers as well as winners.
  - Optimal trade policy must weigh one group's gain against another's loss.
  - Some groups may need special treatment because they are already relatively poor (e.g., shoe and garment workers in the United States).
  - Most economists strongly favor free trade.

International Trade in Specific Factor Model VII

- Typically, those who gain from trade are a much less concentrated, informed, and organized group than those who lose.
  - Example: Consumers and producers in the U.S. sugar industry, respectively Governments usually provide a "safety net" of income support to cushion the losses to groups hurt by trade (or other changes).
- Trade shifts jobs from import-competing to export sector $\rightarrow$ see Kletzer (2004)
  - Process not instantaneous – some workers will be unemployed as they look for new jobs.
  - How much unemployment can be traced back to trade?
  - From 2001 to 2010, **only about 2%** of involuntary displacements stemmed from import competition or plants moved overseas
  - **No obvious correlation** between unemployment rate and imports relative to GDP for the U.S.
  - Unemployment is primarily a macroeconomic problem that rises during recessions.

International Trade in Specific Factor Model VIII



Source: U.S. Bureau of Economic Analysis for imports and U.S. Bureau of Labor Studies for unemployment.

- The best way to reduce unemployment $\rightarrow$ adopt macroeconomic policies to help the economy recover, not trade protectionism

3. Factor Proportion Model (Heckscher-Ohlin Model)

Summary I

- The Heckscher-Ohlin theory argues that trade occurs due to differences in labor, labor skills, physical capital, capital, or other factors of production across countries.
- Countries have different relative abundance of factors of production.
- Production processes use factors of production with different relative intensity.
- The Model
  - Two countries: home and foreign.
  - Two goods: cloth and food.
  - Two factors of production: labor and capital.
  - The mix of labor and capital used varies across goods.
    - cloth is capital intensive
    - food is labor intensive
  - The supply of labor and capital in each country is constant and varies across countries
    - home is labor abundant

Summary II

- foreign is labor scarce

- In the long run, both labor and capital can move across sectors, equalizing their returns (wage and rental rate) across sectors.

Result of Heckscher-Ohlin Model I

- Like the Ricardian model, the Heckscher-Ohlin model predicts a convergence of relative prices with trade.
- With trade, the relative price of cloth rises in the relatively labor abundant (home) country and falls in the relatively labor scarce (foreign) country.
- Relative prices and the pattern of trade:
  - In Home, the rise in the relative price of cloth leads to a rise in the relative production of cloth and a fall in relative consumption of cloth.
  - Home becomes an exporter of cloth and an importer of food.
  - The decline in the relative price of cloth in Foreign leads it to become an importer of cloth and an exporter of food.
- **Heckscher-Ohlin theorem:** The country that is abundant in a factor, exports the good whose production is intensive in that factor.
- This result generalizes to a correlation: Countries tend to export goods whose production is intensive in factors with which the countries are abundantly endowed.

Trade and Income Distribution in Heckscher-Ohlin Model I

- Changes in relative prices can affect the earnings of labor and capital.
  - A rise in the price of cloth raises the purchasing power of labor in terms of both goods while lowering the purchasing power of capital in terms of both goods.
  - A rise in the price of food has the reverse effect.
- Thus, international trade can affect the distribution of income, even in the long run:
  - Owners of a country's abundant factors gain from trade, but owners of a country's scarce factors lose.
  - Factors of production that are used intensively by the import-competing industry are hurt by the opening of trade – regardless of the industry in which they are employed.
- Compared with the rest of the world, the United States is abundantly endowed with highly skilled labor while low-skilled labor is correspondingly scarce.

Trade and Income Distribution in Heckscher-Ohlin Model II

- International trade has the potential to make low-skilled workers in the United States worse off - not just temporarily, but on a sustained basis.

- Changes in income distribution occur with every economic change, not only international trade.
  - Changes in technology, changes in consumer preferences, exhaustion of resources and discovery of new ones all affect income distribution.
  - Economists put most of the blame on technological change and the resulting premium paid on education as the major cause of increasing income inequality in the US.
  - It would be better to compensate the losers from trade (or any economic change) than prohibit trade.
  - The economy as a whole does benefit from trade.
- There is a political bias in trade politics:
  - potential losers from trade are better politically organized than the winners from trade.

Trade and Income Distribution in Heckscher-Ohlin Model III

- Losses are usually concentrated among a few, but gains are usually dispersed among many.
- Each of you pays about \$8/year to restrict imports of sugar, and the total cost of this policy is about \$2 billion/year.
- The benefits of this program total about \$1 billion, but this amount goes to relatively few sugar producers.

- Over the last 40 years, countries like South Korea, Mexico, and China have exported to the U.S. goods intensive in unskilled labor (ex., clothing, shoes, toys, assembled goods).
  - At the same time, income inequality has increased in the U.S., as wages of unskilled workers have grown slowly compared to those of skilled workers.
  - Did the former trend cause the latter trend?

Heckscher-Ohlin Predictions I

- Owners of relatively abundant factors will gain from trade and owners of relatively scarce factors will lose from trade $\rightarrow$ little evidence
  1. According to the model, a change in the distribution of income occurs through changes in output prices
     - but there is no evidence of a change in the prices of skill-intensive goods relative to prices of unskilled-intensive goods.
  2. According to the model, wages of unskilled workers should increase in unskilled labor abundant countries relative to wages of skilled labor
     - but in some cases the reverse has occurred: Wages of skilled labor have increased more rapidly in Mexico than wages of unskilled labor.
     - But compared to the U.S. and Canada, Mexico is supposed to be abundant in unskilled workers.
  3. Even if the model were exactly correct, trade is a small fraction of the U.S. economy, so its effects on U.S. prices and wages prices should be small.
     - The majority view of trade economists is that the villain is not trade but rather new production technologies that put a greater emphasis on worker skills (such as the widespread introduction of computers and other advanced technologies in the workplace).

Heckscher-Ohlin Predictions II

- Trade likely has been an indirect contributor to increases in wage inequality, by accelerating the process of technological change.
  - Firms that begin to export may upgrade to more skill-intensive production technologies.
  - Trade liberalization can then generate widespread technological change by inducing a large proportion of firms to make such technology-upgrade choices.
  - Breaking up the production process across countries can increase the relative demand for skilled workers in developed countries similar to skill-biased technological change.

4. Standard Trade Model: A 2-Goods Model of a Small Open Economy

A Two-Good Model of a Small Open Economy I

- Standard trade model is a general model that includes Ricardian, specific factors, and Heckscher-Ohlin models as special cases.
  - Two goods, food (F) and cloth (C).
  - Each country's PPF is a smooth curve.
  - Differences in labor services, labor skills, physical capital, land, and technology between countries cause differences in production possibility frontiers.
- A country's PPF determines its relative supply function.
  - National relative supply functions determine a world relative supply function, which along with world relative demand determines the equilibrium under international trade.

Production Possibilities and Relative Supply I

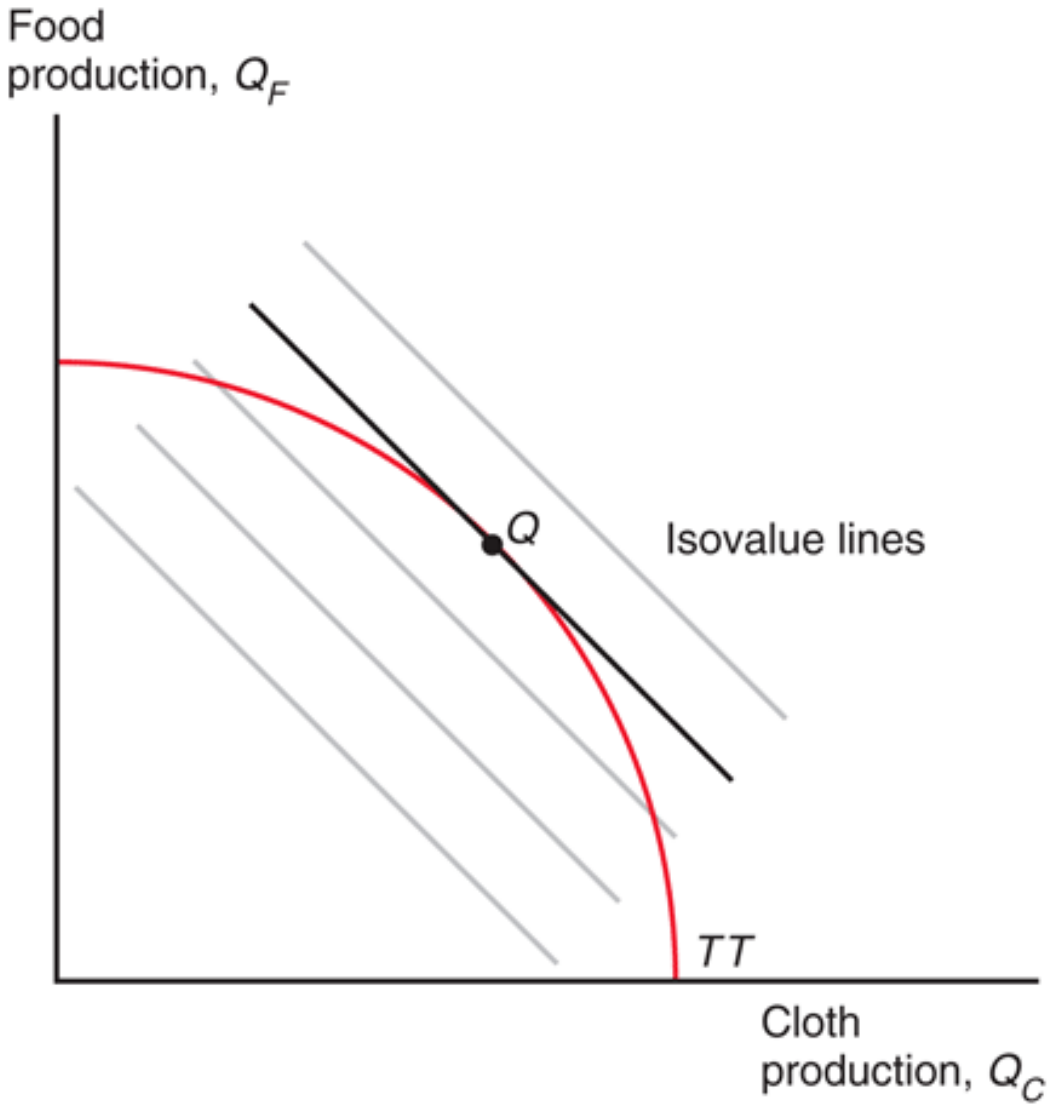
- What a country produces depends on the relative price of cloth to food P_C/P_F.
- An economy chooses its production of cloth Q_C and food Q_F to maximize the value of its output

$$V = P_C \times Q_C + P_F \times Q_F,$$

given the prices of cloth and food.

  - The slope of an isovalue line equals $-(P_C/P_F)$
  - Produce at point where PPF is tangent to isovalue line.

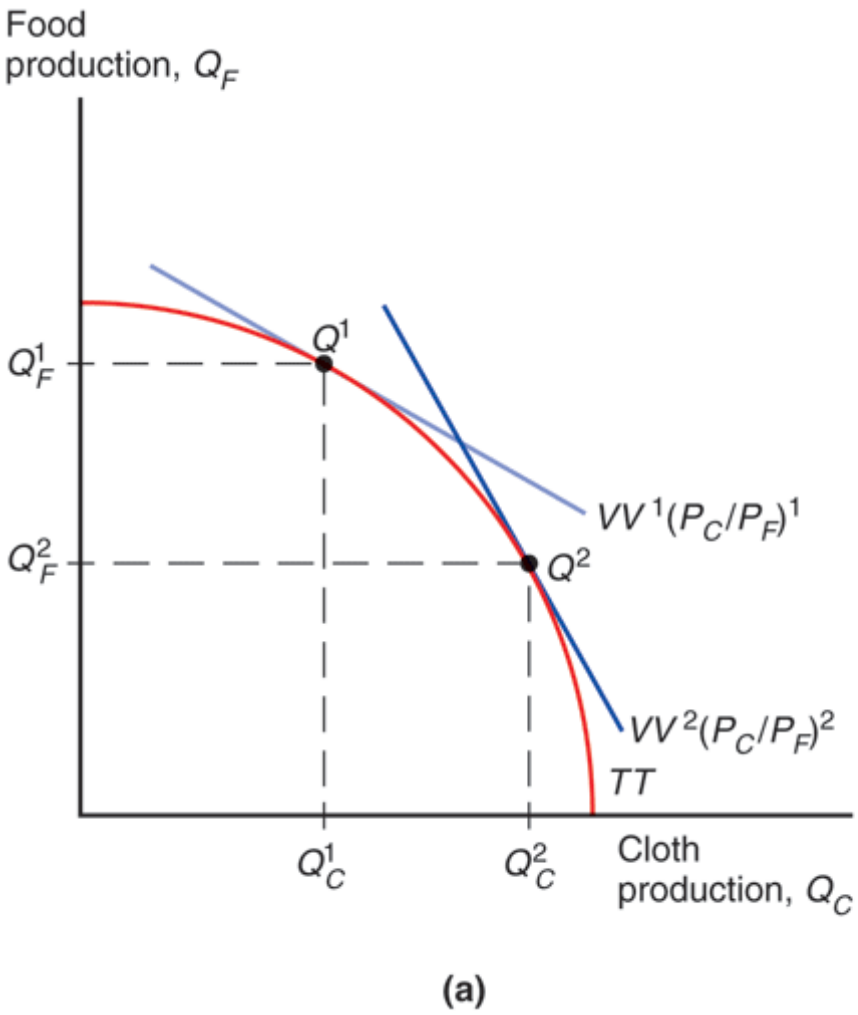
Production Possibilities and Relative Supply II

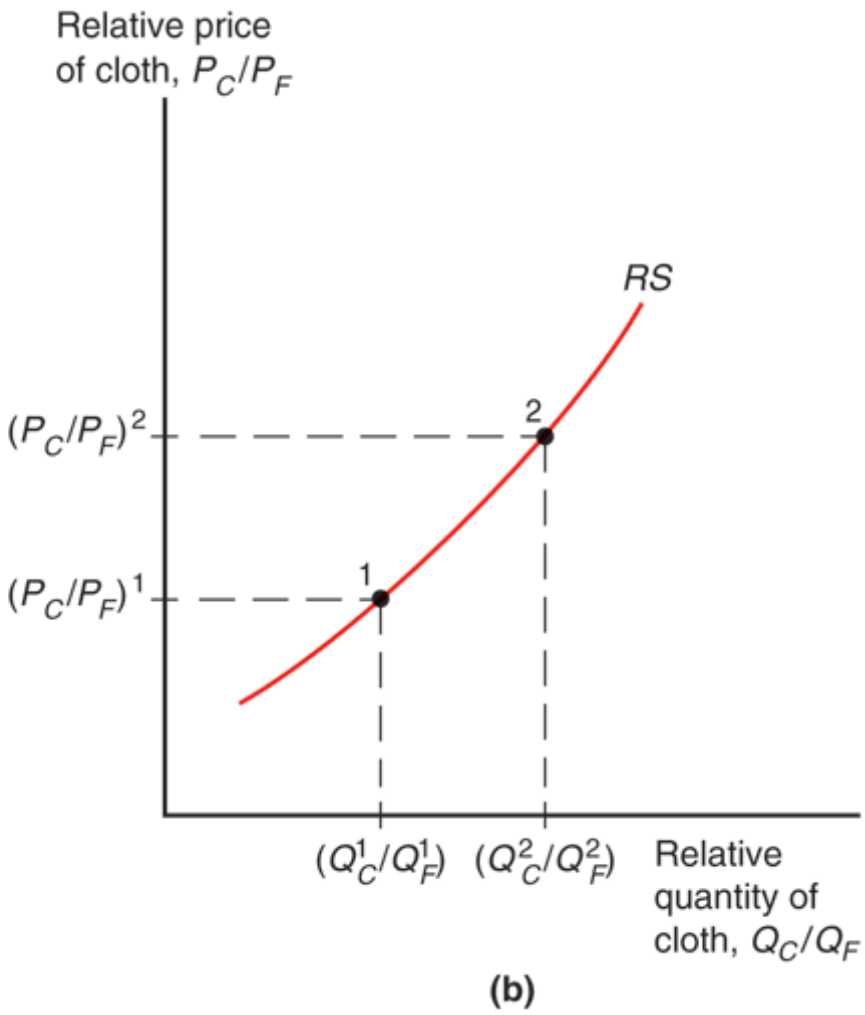


Production Possibilities and Relative Supply III

- Relative prices and relative supply:
  - An increase in the price of cloth relative to food P_C/P_F makes the isovalue line steeper.
  - Production shifts from point Q^1 to point Q^2.
  - Supply of cloth relative to food Q_C/Q_F rises.
  - Relative supply of cloth to food increases with the relative price of cloth to food.

Production Possibilities and Relative Supply IV





Relative Prices and Demand I

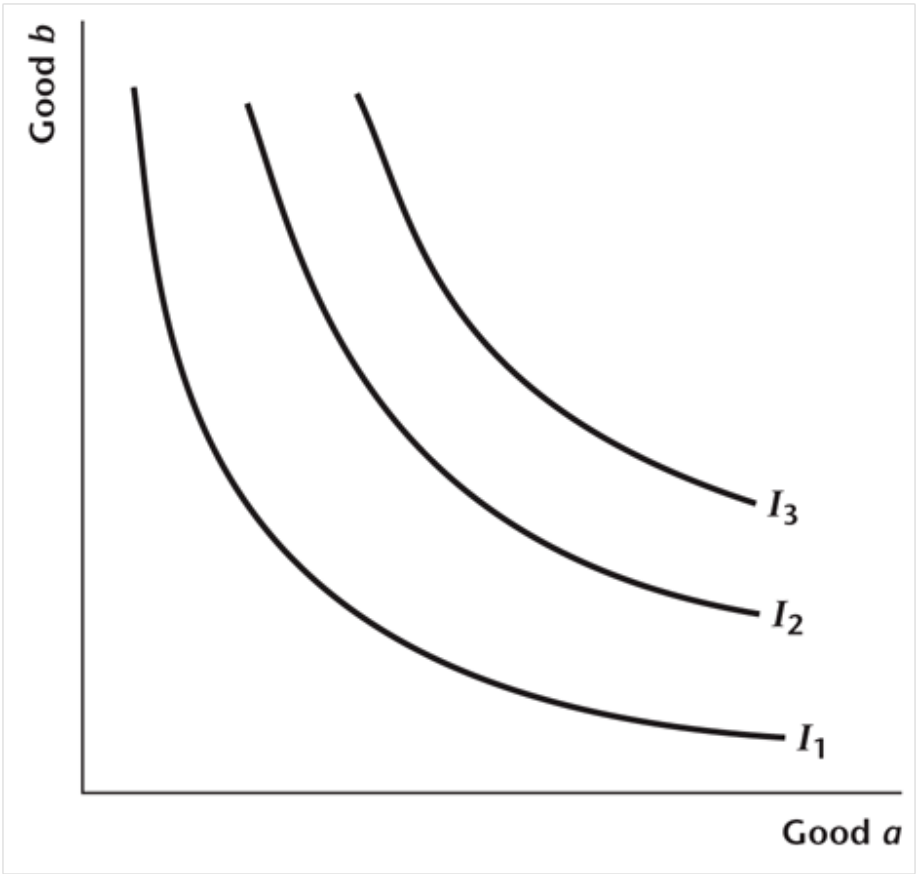
- The value of the economy's consumption must equal the value of the economy's production.

$$P_C \times D_C + P_F \times D_F = P_C \times Q_C + P_F \times Q_F = V$$

- Assume that the economy's consumption decisions may be represented as if they were based on the tastes of a single representative consumer.
- An indifference curve represents combinations of cloth and food that leave the consumer equally well off (indifferent).
- Indifference curves
  - are downward sloping $\rightarrow$ if you have less cloth, then you must have more food to be equally satisfied.
  - ICs that lie farther from the origin make consumers more satisfied $\rightarrow$ they prefer having more of both goods.
  - ICs become flatter when they move to the right $\rightarrow$ with more cloth and less food, an extra yard of cloth becomes less valuable in terms of how many calories of food you are willing to give up for it.

Relative Prices and Demand II

Figure 1: Indifference Curves of the Representative Consumer in the SOE



- Consumption choice is based on preferences and relative price of goods:

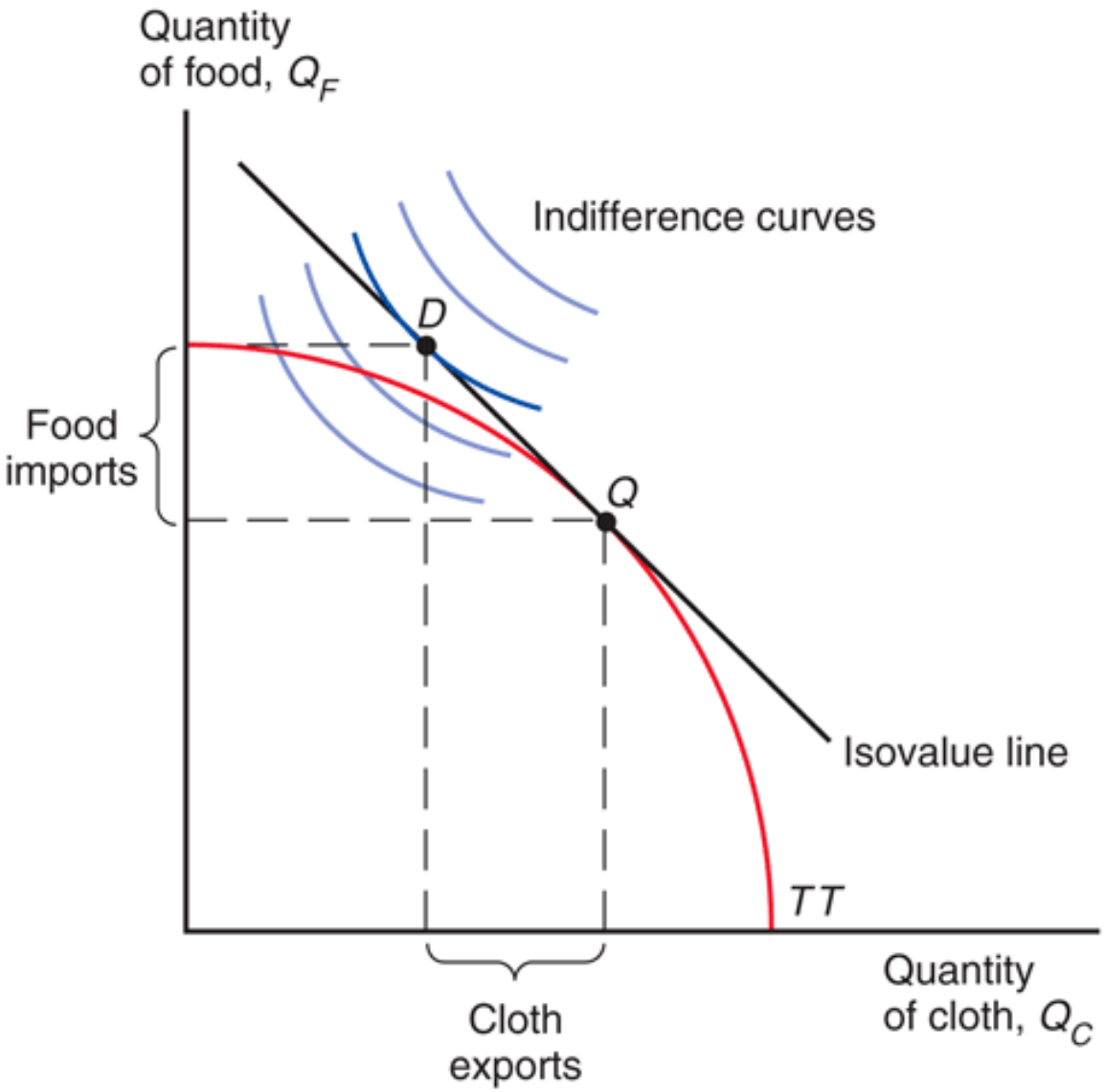
Relative Prices and Demand III

- Consume at point (D) where the isovalue line is tangent to the indifference curve.
- For consumers: in equilibrium the consumer maximizes when his or her marginal rate of substitution equals the relative price of the two goods.

$$-MRS_{C,F} = -\frac{\left(\frac{\partial u(D_C,D_F)}{\partial D_C}\right)}{\left(\frac{\partial u(D_C,D_F)}{\partial D_F}\right)} = -\left(\frac{P_C}{P_F}\right) = -TOT$$

- **Economy exports cloth** — the quantity of cloth produced exceeds the quantity of cloth consumed — and imports food.

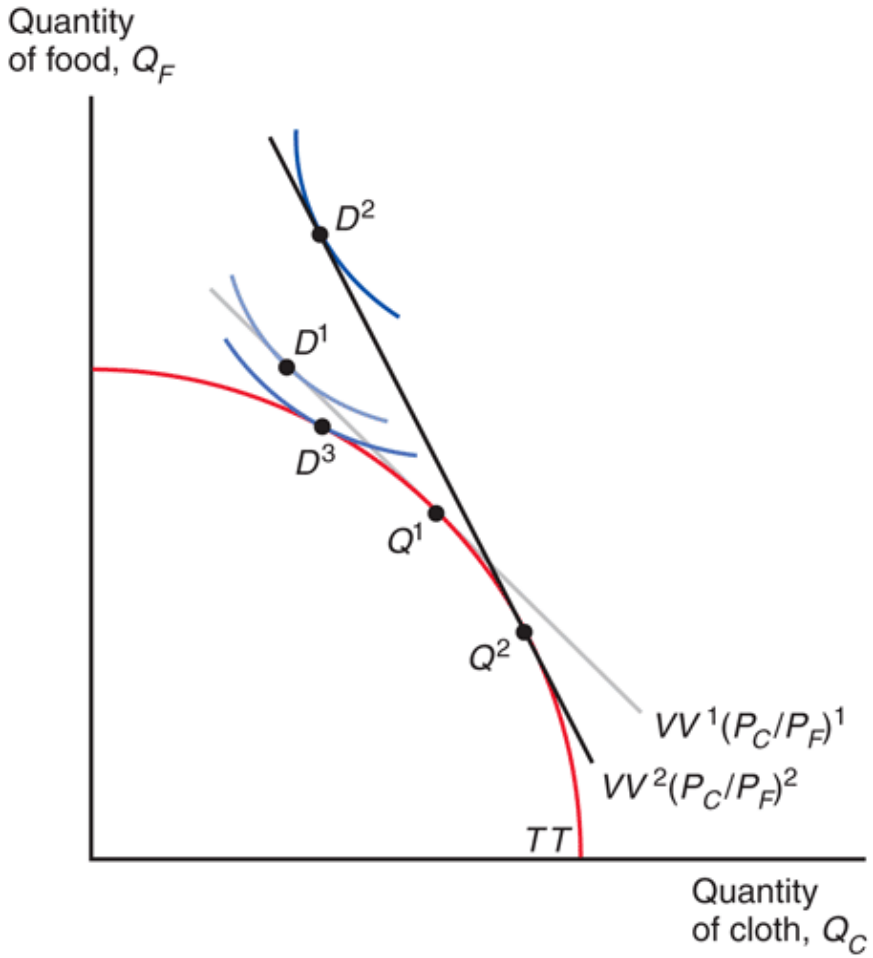
Relative Prices and Demand IV



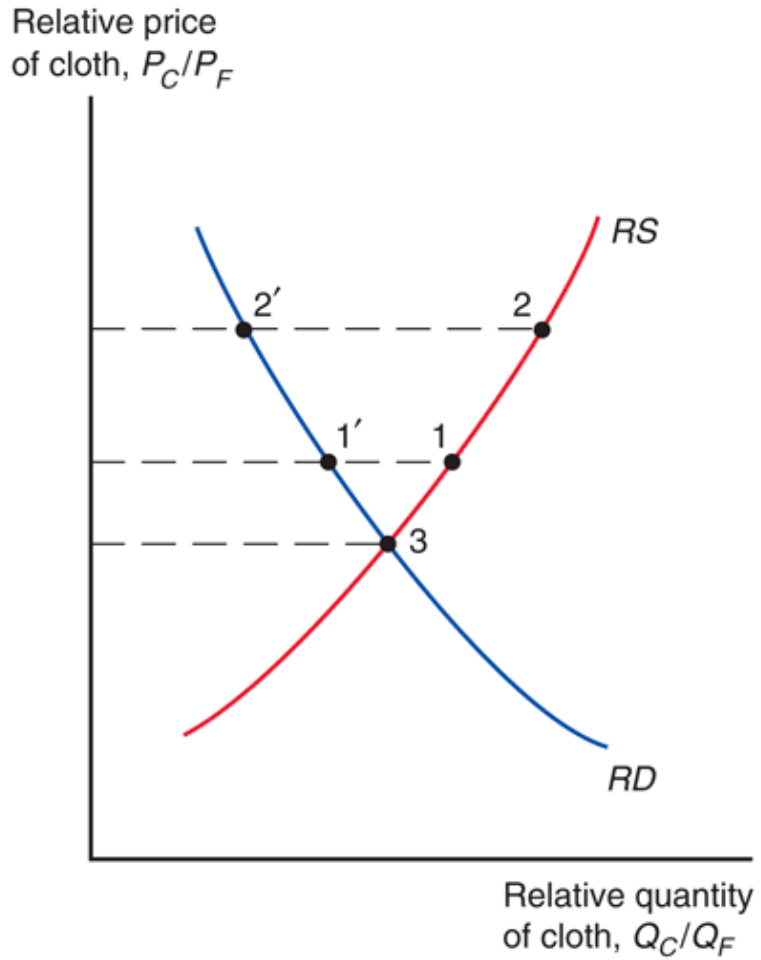
Relative Prices and Demand V

- Relative prices and relative demand
  - An increase in the relative price of cloth P_C/P_F causes consumption choice to shift from point (D^1) to (D^2).
  - Demand for cloth relative to food D_C/D_F falls.
  - Relative demand for cloth to food falls as the relative price of cloth to food rises.

Relative Prices and Demand VI



(a) Production and Consumption



(b) Relative Supply and Demand

Relative Prices and Demand VII

- An economy that exports cloth is better off when the price of cloth rises relative to the price of food:
  - the isovalue line becomes steeper and a higher indifference curve can be reached.
  - A higher relative price of cloth means that more calories of food can be imported for every yard of cloth exported.
- If the economy cannot trade:
  - The relative price of cloth to food is determined by the intersection of relative demand and relative supply for that country.
  - Consume and produce at point D^3 where the indifference curve is tangent to the production possibilities frontier.

Welfare Effects of Changes in the Terms of Trade I

- The terms of trade refers to the price of exports relative to the price of imports.

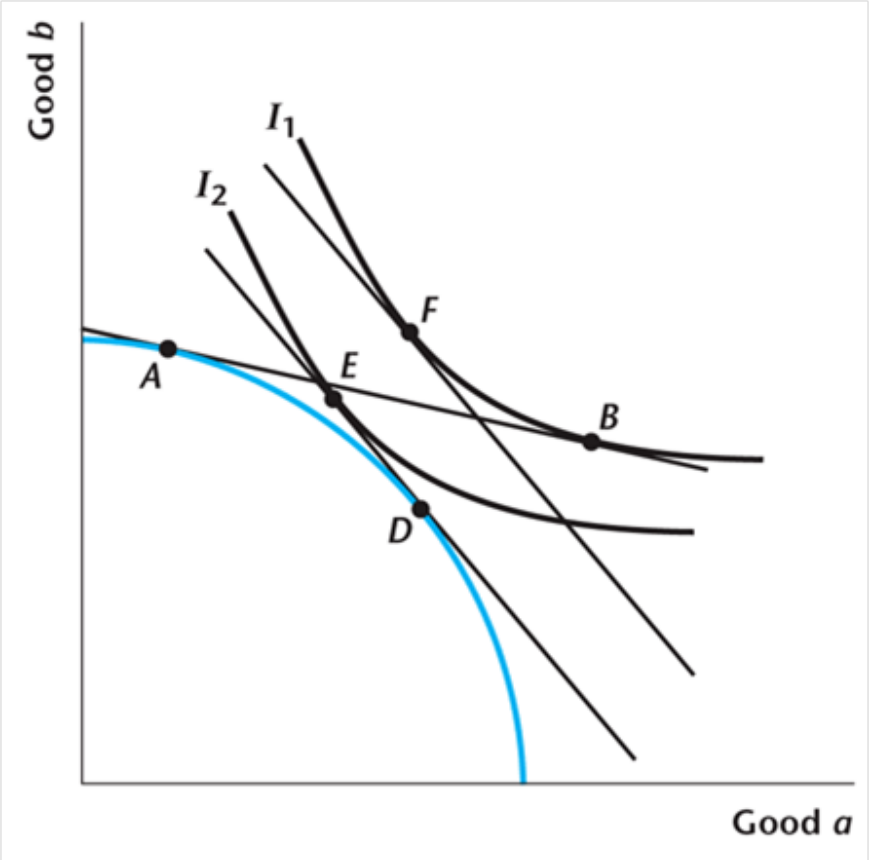
$$TOT = \frac{P_{Exp}}{P_{Imp}}$$

  - When a country exports cloth and the relative price of cloth increases, the terms of trade rise: $\frac{P_C}{P_F} \uparrow$

- Because a higher relative 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 decline in the terms of trade decreases a country's welfare.

An Decrease in the TOT: $\downarrow \frac{P_b}{P_a}$ or $\uparrow \frac{P_a}{P_b}$

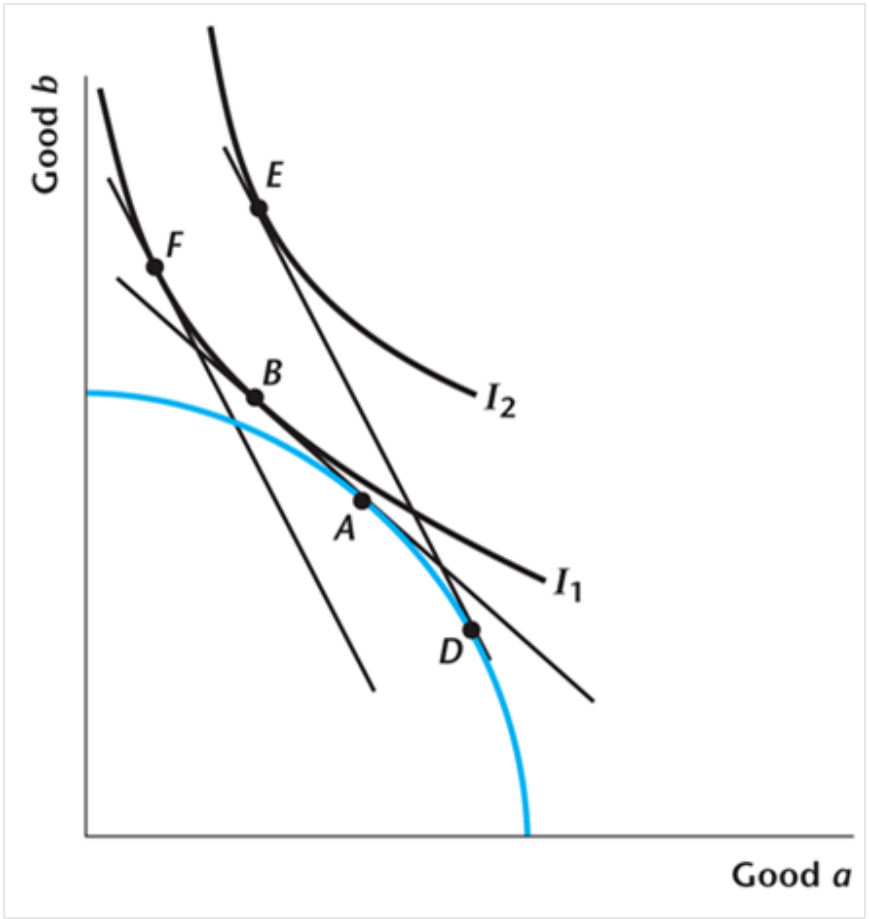
Figure 2: Good (a) is initially imported and (b) is initially exported



Note: Produce (A) and consume (B)

An Increase in the TOT: $\uparrow \frac{P_a}{P_b}$

Figure 3: Good (a) is initially exported and (b) is initially imported



Note: Produce (A) and consume (B)

Determining Relative Prices I

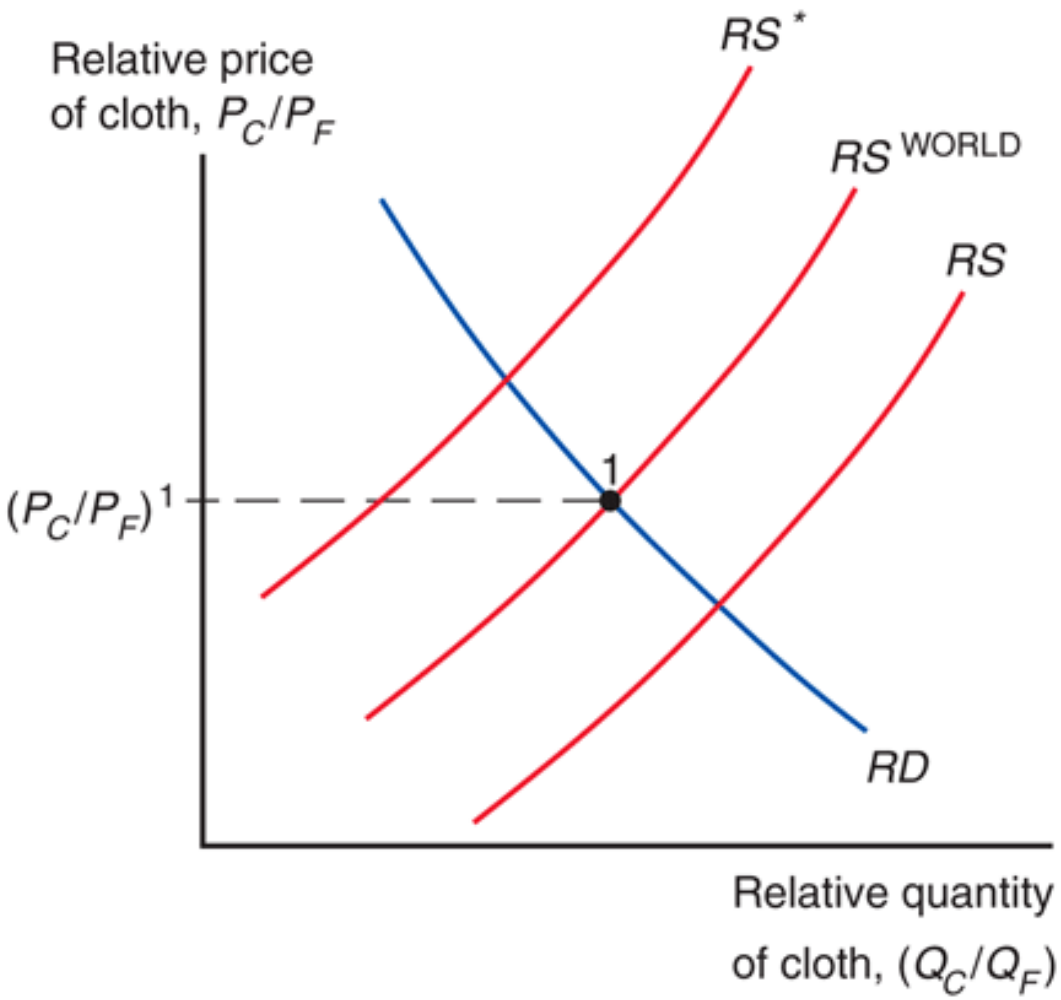
- To determine the price of cloth relative to the price food, use relative supply and relative demand.
  - World supply of cloth relative to food at each relative price.

$$\frac{(Q_C + Q_C^*)}{(Q_F + Q_F^*)}$$

  - World demand for cloth relative to food at each relative price.

$$\frac{(D_C + D_C^*)}{(D_F + D_F^*)}$$

Determining Relative Prices II



(a) Relative Supply and Demand

Determining Relative Prices III

- Relative price determines the slope of the "Budget Constraints" of Home and Foreign

$$P_C \times Q_C + P_F \times Q_F = P_C \times D_C + P_F \times D_F$$
$$\rightarrow \frac{P_C}{P_F} \times Q_C + Q_F = \frac{P_C}{P_F} \times D_C + D_F,$$
$$\rightarrow TOT_{C,F} \times Q_C + Q_F = TOT_{C,F} \times D_C + D_F,$$

where

$$TOT_{C,F} = \frac{P_C}{P_F}$$

- Extreme point if Home only consumed cloth:

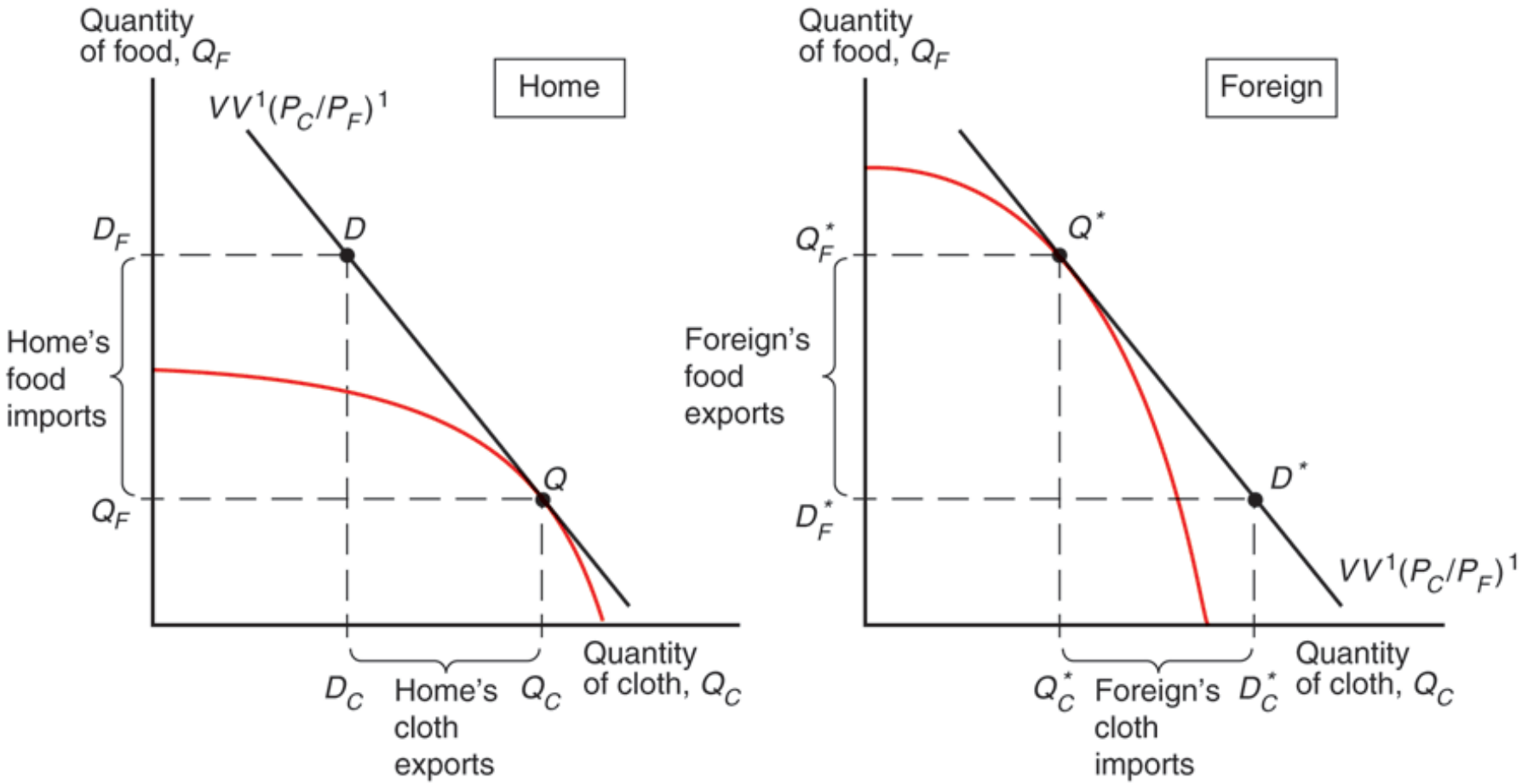
$$D_C = \overbrace{\frac{P_F}{P_C} Q_F}^{\text{export all food and import cloth}} + \overbrace{Q_C}^{\text{own cloth prodcution}}$$

Determining Relative Prices IV

- Extreme point if Home only consumed food:

$$D_F = \overbrace{\frac{P_C}{P_F} Q_C}^{\text{export all cloth and import food}} + \overbrace{Q_F}^{\text{own food production}}$$

Determining Relative Prices V

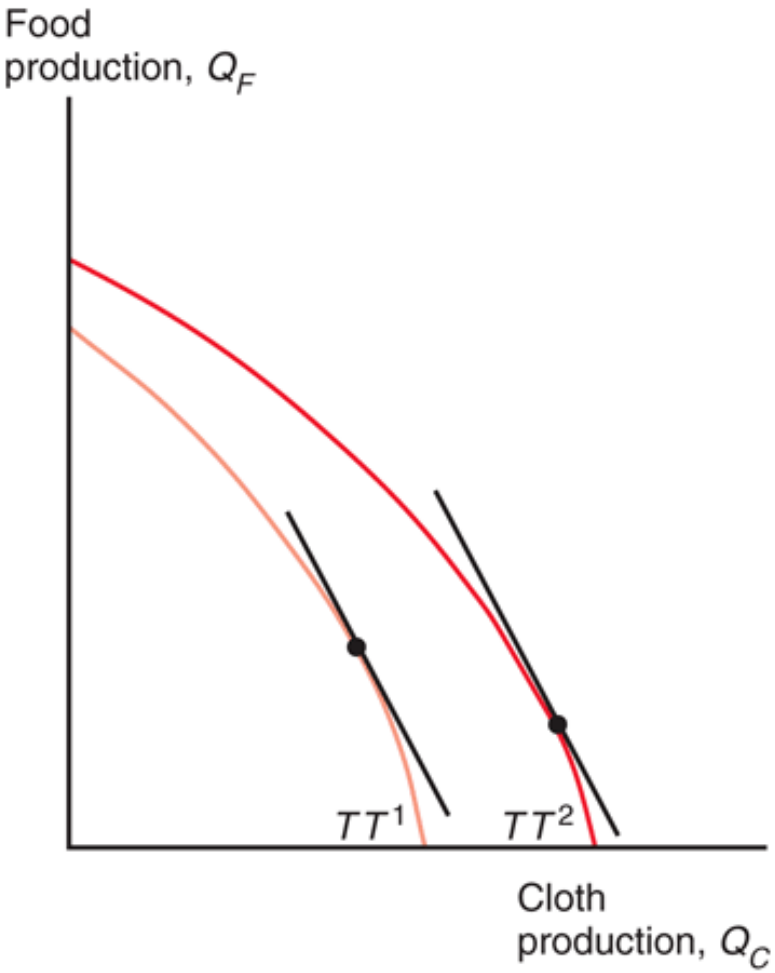


(b) Production, Consumption, and Trade

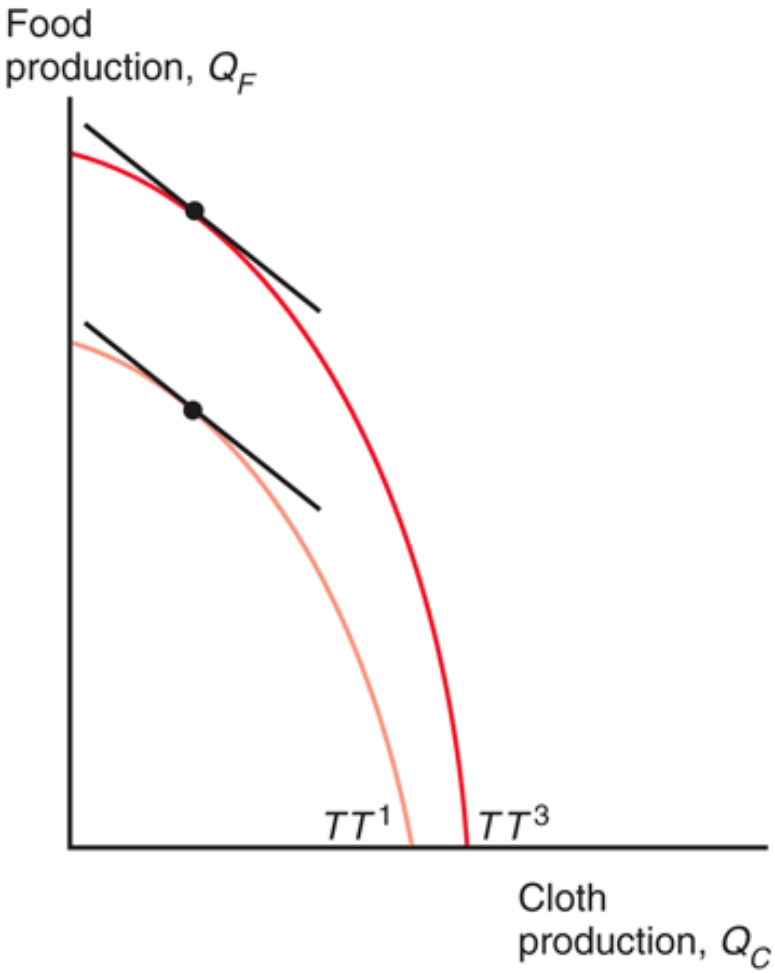
The Effects of Economic Growth I

- Is economic growth in China good for the standard of living in the U.S.?
- 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.
- Growth is usually biased:
  - it occurs in one sector more than others, causing relative supply to change.
  - Rapid growth has occurred in U.S. computer industries but relatively little growth has occurred in U.S. textile industries.
  - In the Ricardian model, **technological progress** in one sector causes biased growth.
  - In the Heckscher-Ohlin model, an **increase in one factor** of production causes biased growth.

The Effects of Economic Growth II

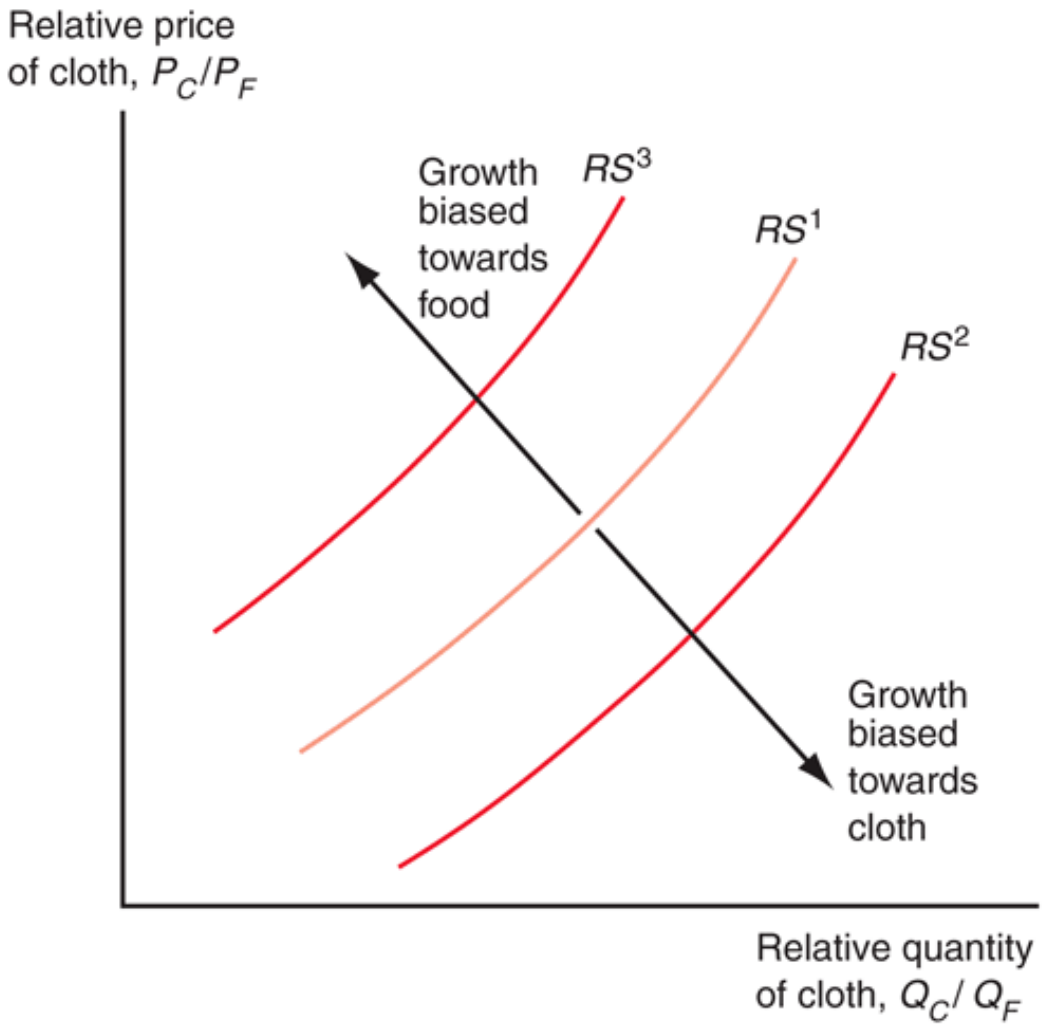


(a) Growth biased toward cloth



(b) Growth biased toward food

The Effects of Economic Growth III

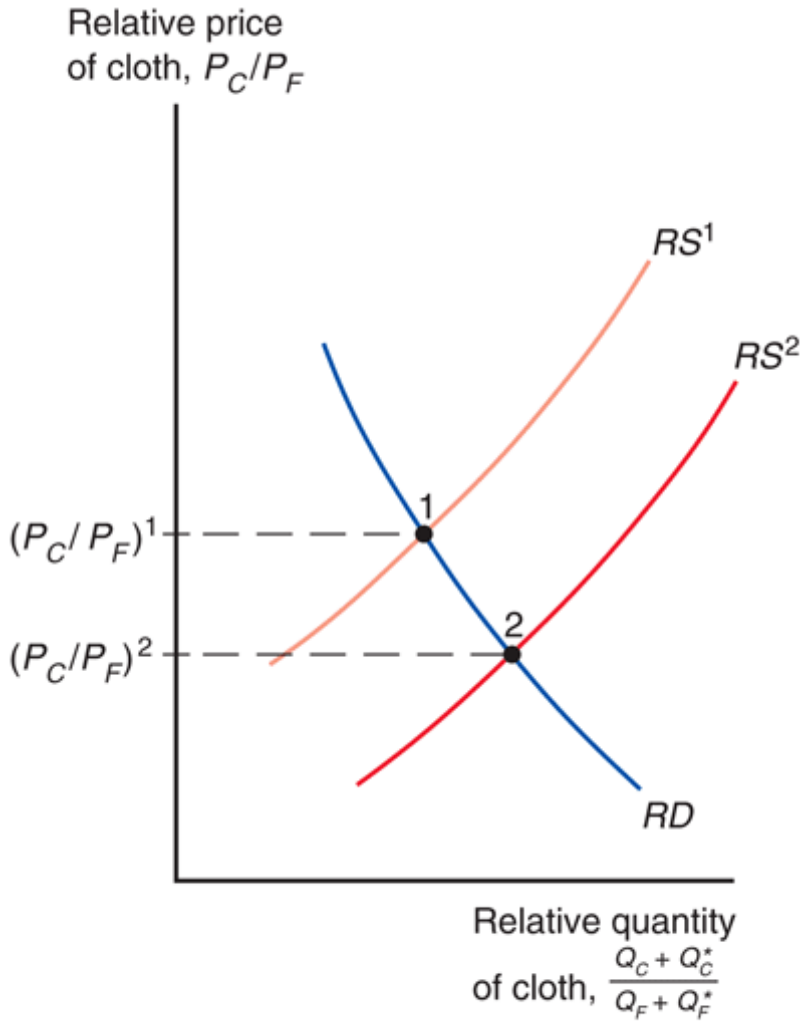


(c) Effects of biased growth on relative supply

The Effects of Economic Growth IV

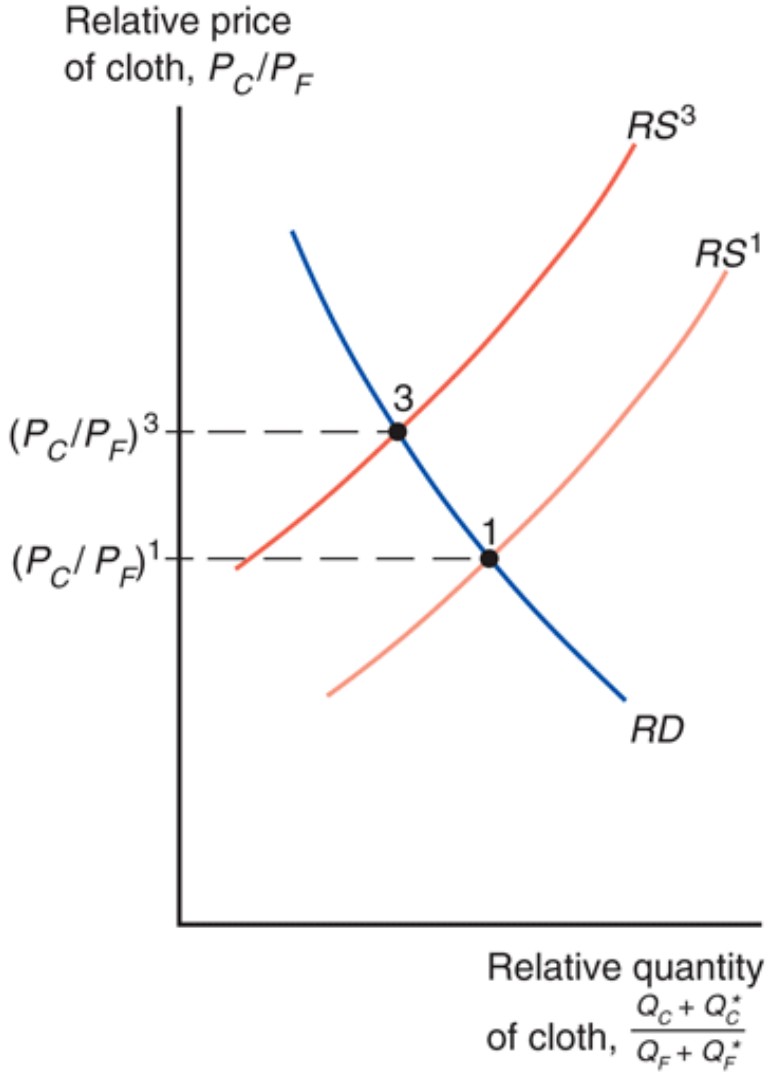
- Biased growth and the resulting change in relative supply causes a change in the terms of trade.
  - Biased growth in the cloth industry (in either the home or foreign country) will lower the price of cloth relative to the price of food and lower the terms of trade for cloth exporters.
  - Biased growth in the food industry (in either the home or foreign country) will raise the price of cloth relative to the price of food and raise the terms of trade for cloth exporters.
- Suppose that the home country exports cloth and imports food.

The Effects of Economic Growth V



(a) Cloth-biased growth

The Effects of Economic Growth VI



(b) Food-biased growth

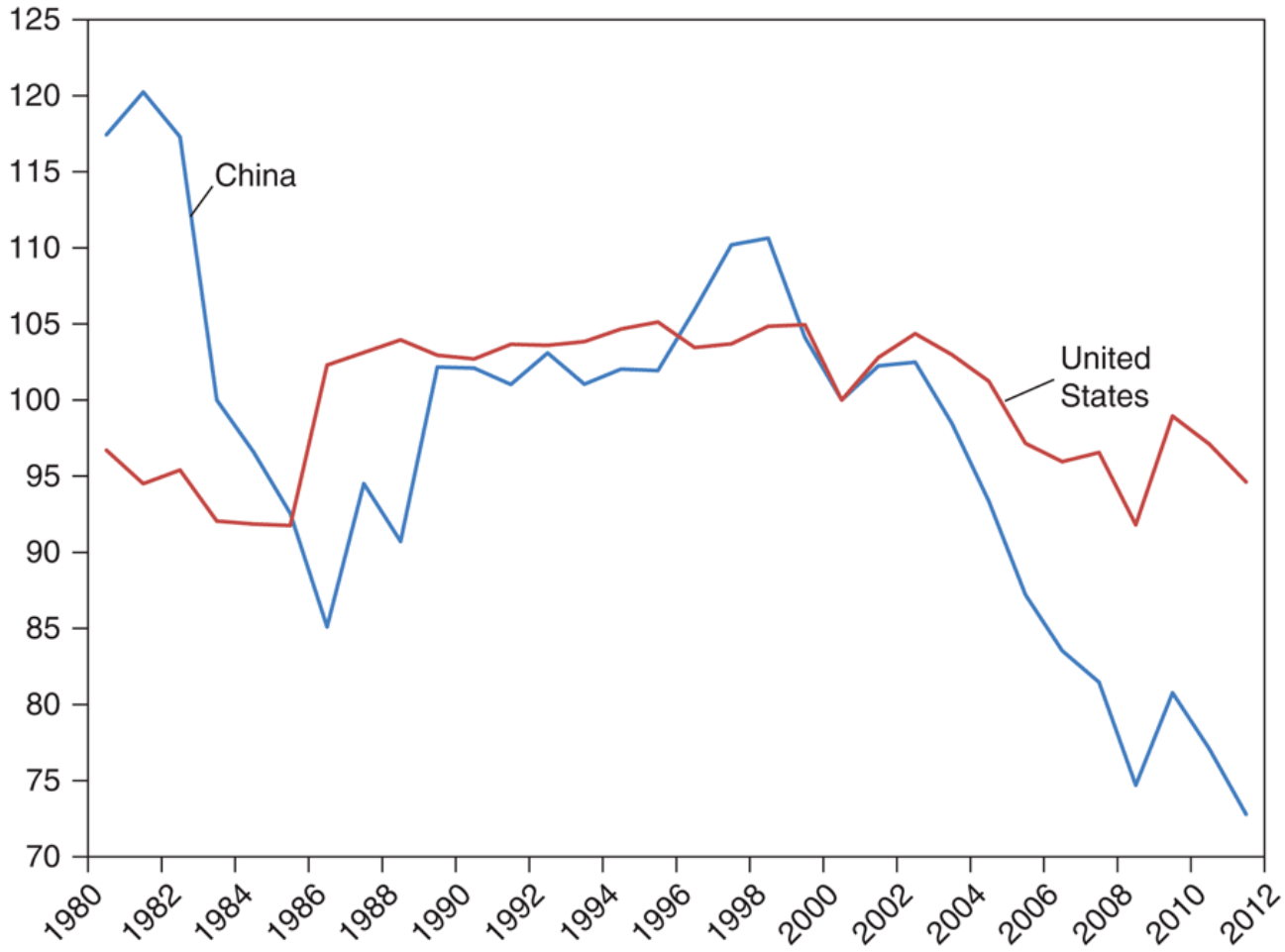
The Effects of Economic Growth VII

- **Export-biased growth** is growth that expands a country's production possibilities disproportionately in that country's export sector.
  - Biased growth in the food industry in the foreign country is export-biased growth for the foreign country.
  - Export-biased growth $\downarrow$ **terms of trade**, $\downarrow$ welfare and $\uparrow$ welfare of foreign countries.
- **Import-biased growth** is growth that expands a country's production possibilities disproportionately in that country's import sector.
  - Biased growth in cloth production in the foreign country is import-biased growth for the foreign country.
  - Import-biased growth $\uparrow$ a country's **terms of trade**, $\uparrow$ welfare and $\downarrow$ the welfare of foreign countries.

Has the Growth of Newly Industrializing Countries Hurt Advanced Nations?

- The standard trade model predicts that import-biased growth in China would occur in sectors that compete with U.S. exports and reduce the U.S. terms of trade.
- But the data indicates that changes in the U.S. terms of trade have been small with no clear trend over the last few decades.
- The terms of trade for China have deteriorated over the past decade, suggesting their recent growth may have been export-biased.

Terms of Trade for the United States and China (1980–2011, 2000 = 100)



Source: World Development Indicators, World Bank.

Import Tariffs and Export Subsidies: Simultaneous Shifts in RS and RD

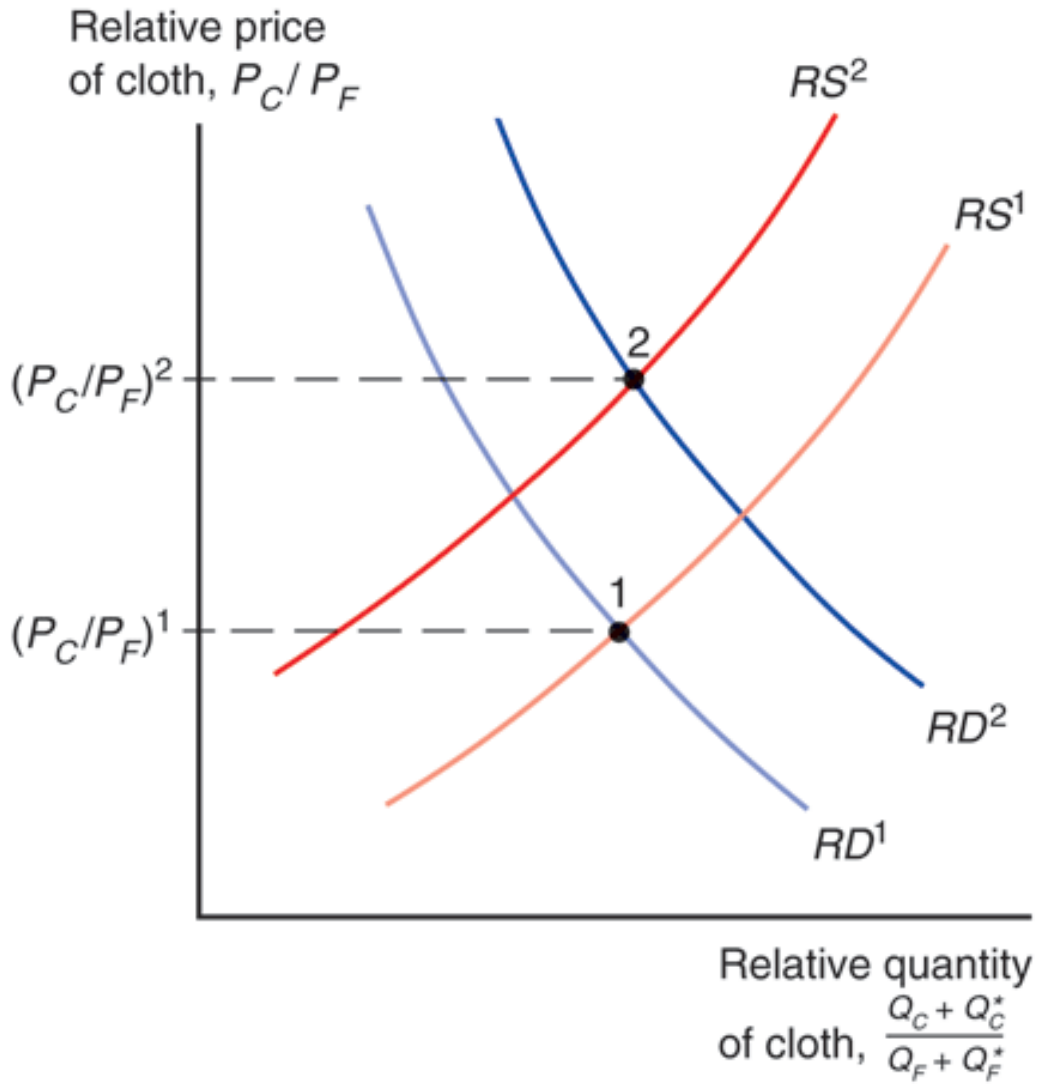
- Import tariffs are taxes levied on imports.
- Export subsidies are payments given to domestic producers that export.
- Both policies influence the terms of trade and therefore national welfare.
- Import tariffs and export subsidies drive a wedge between prices in world markets and prices in domestic markets.

Relative Price and Supply Effects of a Tariff I

- If the home country imposes a tariff on food imports, the price of food relative to the price of cloth rises for domestic consumers.
- Likewise, the price of cloth relative to the price of food falls for domestic consumers.
  - Domestic producers will receive a lower relative price of cloth, and therefore will be more willing to switch to food production: relative supply of cloth will decrease.
  - Domestic consumers will pay a lower relative price for cloth, and therefore will be more willing to switch to cloth consumption: relative demand for cloth will increase.

Relative Price and Supply Effects of a Tariff II

Figure 4: Effects of Food Tariff on TOT



Relative Price and Supply Effects of a Tariff III

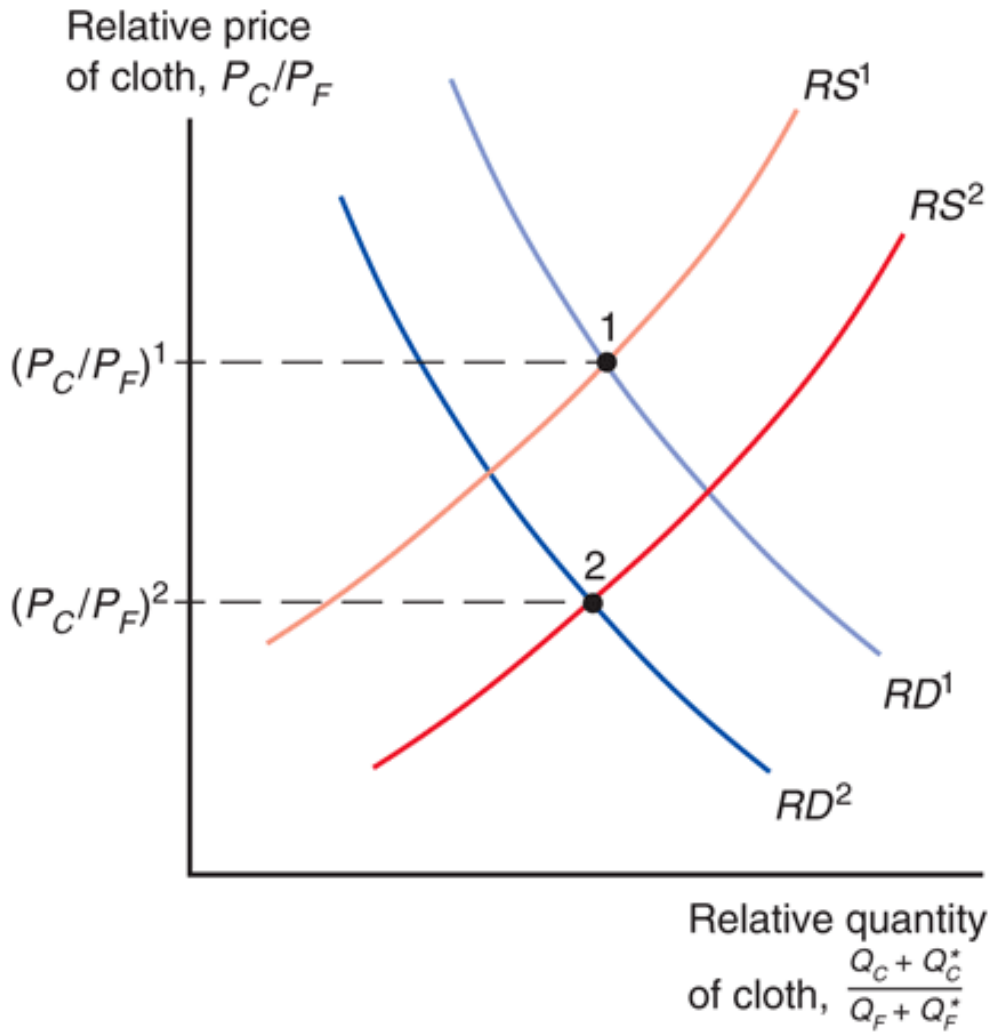
- When the home country imposes an import tariff, the TOT $\uparrow$ and the welfare of the country may increase.
  - The magnitude of this effect depends on the size of the home country relative to the world economy.
  - If the country is a small part of the world economy, its tariff (or subsidy) policies will not have much effect on world relative supply and demand, and thus on the terms of trade.
  - But for large countries, a tariff may maximize national welfare at the expense of foreign countries.

Effects of an Export Subsidy I

- If the home country imposes a subsidy on cloth exports, the price of cloth relative to the price of food rises for domestic consumers.
  - Domestic producers will receive a higher relative price of cloth when they export, and therefore will be more willing to switch to cloth production $\rightarrow$ relative supply of cloth will increase.
  - Domestic consumers must pay a higher relative price of cloth to producers, and therefore will be more willing to switch to food consumption $\rightarrow$ relative demand for cloth will decrease.

Effects of an Export Subsidy II

Figure 5: Effects of Cloth Subsidy on TOT



Effects of an Export Subsidy III

- When the home country imposes an export subsidy, the TOT $\downarrow$ and the welfare of the country $\downarrow$ to the benefit of the foreign country.

Implications of the Standard Trade Model I

- The standard trade model predicts that
  - an import tariff by the home country can $\uparrow$ domestic welfare at the expense of the foreign country.
  - an export subsidy by the home country $\downarrow$ domestic welfare to the benefit of the foreign country.
- Additional effects of tariffs and subsidies that can occur in a world with many countries and many goods:
  - A foreign country may subsidize the export of a good that the U.S. also exports, which will reduce the price for the U.S. in world markets and decrease its terms of trade.
    - 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 U.S. also imports, which will reduce the price for the U.S. in world markets and increase its terms of trade.
- Export subsidies by foreign countries on goods that

Implications of the Standard Trade Model II

  - the U.S. imports reduce the world price of U.S. imports and increase the terms of trade for the U.S.
  - the U.S. also exports reduce the world price of U.S. exports and decrease the terms of trade for the U.S.
- Import tariffs by foreign countries on goods that
  - the U.S. exports reduce the world price of U.S. exports and decrease the terms of trade for the U.S.
  - the U.S. also imports reduce the world price of U.S. imports and increase the terms of trade for the U.S.
- 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.

Implications of the Standard Trade Model I

- The standard trade model predicts that
  - an import tariff by the home country can $\uparrow$ domestic welfare at the expense of the foreign country.
  - an export subsidy by the home country $\downarrow$ domestic welfare to the benefit of the foreign country.
- Additional effects of tariffs and subsidies that can occur in a world with many countries and many goods:
  - A foreign country may subsidize the export of a good that the U.S. also exports, which will reduce the price for the U.S. in world markets and decrease its terms of trade.
    - 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 U.S. also imports, which will reduce the price for the U.S. in world markets and increase its terms of trade.
- Export subsidies by foreign countries on goods that

Implications of the Standard Trade Model II

  - the U.S. imports reduce the world price of U.S. imports and increase the terms of trade for the U.S.
  - the U.S. also exports reduce the world price of U.S. exports and decrease the terms of trade for the U.S.
- Import tariffs by foreign countries on goods that
  - the U.S. exports reduce the world price of U.S. exports and decrease the terms of trade for the U.S.
  - the U.S. also imports reduce the world price of U.S. imports and increase the terms of trade for the U.S.
- 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.

Appendix: Solving the Household Problem

Household Problem

- The household maximized utility subject to the budget constraint:

$$\max_{\{D_C, D_F\}} u(D_C, D_F)$$

$$s.t.$$

$$\overbrace{P_C \times D_C + P_F \times D_F}^{\text{Spending on consumption}} = \overbrace{P_C \times Q_C + P_F \times Q_F}^{\text{Income from production}}$$

- We can solve this in three ways:

1. Think About It Method I

"Extra utility bang per buck spent":

$$\frac{MU_C}{P_C} = \frac{MU_F}{P_F}$$

needs to be equal across sectors $\rightarrow$otherwise cannot be optimal outcome!
Rewrite this **optimality condition** as

$$-MRS_{C,F} = -\frac{MU_C}{MU_F} = -\left(\frac{P_C}{P_F}\right)$$

or

$$-MRS_{C,F} = -\frac{\overbrace{\left(\frac{\partial u(D_C, D_F)}{\partial D_C}\right)}^{MU_C}}{\underbrace{\left(\frac{\partial u(D_C, D_F)}{\partial D_F}\right)}_{MU_F}} = -\overbrace{\left(\frac{P_C}{P_F}\right)}^{TOT}.$$

2. Lagrangian Method I

The Lagrangian is

$$L(D_C, D_F, \lambda) = u(D_C, D_F) + \lambda(P_C \times Q_C + P_F \times Q_F - P_C \times D_C - P_F \times D_F),$$

then derive the first order conditions

$$\frac{\partial L(D_C, D_F, \lambda)}{\partial D_C} = \left(\frac{\partial u(D_C, D_F)}{\partial D_C}\right) - \lambda P_C = 0,$$
$$\frac{\partial L(D_C, D_F, \lambda)}{\partial D_F} = \left(\frac{\partial u(D_C, D_F)}{\partial D_F}\right) - \lambda P_F = 0.$$

2. Lagrangian Method II

Substituting λ from the first equation $\lambda = \left[\frac{\left(\frac{\partial u(D_C, D_F)}{\partial D_C}\right)}{P_C}\right]$ into the second, results in

$$\left(\frac{\partial u(D_C, D_F)}{\partial D_F}\right) - \left[\frac{\left(\frac{\partial u(D_C, D_F)}{\partial D_C}\right)}{P_C}\right] P_F = 0,$$

$$\rightarrow \left(\frac{\partial u(D_C, D_F)}{\partial D_F}\right) = \left[\frac{\left(\frac{\partial u(D_C, D_F)}{\partial D_C}\right)}{P_C}\right] P_F,$$

$$\rightarrow \frac{P_C}{P_F} = \frac{\left(\frac{\partial u(D_C, D_F)}{\partial D_C}\right)}{\left(\frac{\partial u(D_C, D_F)}{\partial D_F}\right)}.$$

Adding the minus signs on both sides, you have the same expression as in method 1.

3. Substituting the Budget Constraint Method I

"Substitute out" either D_C or D_F from the budget constraint and plug it into utility, so that the utility is only a function of one variable. I use D_F but you could also use D_C. From budget constraint we have

$$\overbrace{P_C \times D_C + P_F \times D_F}^{\text{Spending on consumption}} = \overbrace{P_C \times Q_C + P_F \times Q_F}^{\text{Income from production}},$$

$$\rightarrow P_F \times D_F = P_C \times Q_C + P_F \times Q_F - P_C \times D_C,$$

$$\rightarrow D_F = \left(\frac{P_C \times Q_C + P_F \times Q_F}{P_F}\right) - \left(\frac{P_C}{P_F}\right) \times D_C.$$

Plug this into the utility and maximize w.r.t. the only remaining choice variable D_C

$$\max_{\{D_C\}} u\left(D_C, \overbrace{\left(\frac{P_C \times Q_C + P_F \times Q_F}{P_F}\right) - \left(\frac{P_C}{P_F}\right) \times D_C}^{D_F}\right)$$

3. Substituting the Budget Constraint Method II

which results in only one first order condition:

$$\partial D_C : \frac{\partial u(D_C, D_F)}{\partial D_C} + \frac{\partial u(D_C, D_F)}{\partial D_F} \times \overbrace{\left(-\left(\frac{P_C}{P_F}\right)\right)}^{\text{inner derivative (see chain-rule)}} = 0.$$

Rearrange this to get

$$\begin{aligned}
&\rightarrow \frac{\partial u(D_C, D_F)}{\partial D_C} - \frac{\partial u(D_C, D_F)}{\partial D_F} \times \left(\frac{P_C}{P_F}\right) = 0, \\
&\rightarrow \frac{\partial u(D_C, D_F)}{\partial D_C} = \frac{\partial u(D_C, D_F)}{\partial D_F} \times \left(\frac{P_C}{P_F}\right), \\
&\rightarrow \frac{\left(\frac{\partial u(D_C, D_F)}{\partial D_C}\right)}{\left(\frac{\partial u(D_C, D_F)}{\partial D_F}\right)} = \frac{P_C}{P_F}, \\
&\rightarrow MRS_{C,F} \equiv \frac{MU_C}{MU_F} = \frac{P_C}{P_F}.
\end{aligned}$$

References I

Kletzer, Lori G. 2004. "Trade-related Job Loss and Wage Insurance: A Synthetic Review." *Review of International Economics* 12(5):724–748.