Lecture 2b:

Ricardian Model – part 2

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C181 – International Trade

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Ricardian model: part 2

So far we have:

- Solved for autarky equilibrium
- Solved for trade patterns (for given international prices)
- Examined the gains from trade

We still need to:

- Solve for wages
- Solve for prices
- Role of `Terms of trade’

3 Patterns of International Trade

Solving for Wages across Countries

Equilibrium wage:

As before, wage w equals value from one more hour of production

- Home produces Wheat: $w = P_W \cdot MPL_W$
- Foreign produces Cloth: $w^* = P_C \cdot MPL_C^*$

3 Patterns of International Trade

Solving for Wages across Countries

Again about why the Cloth industry disappears in Home:

- Wage in Wheat industry: $w = P_W \cdot MPL_W$:

  Q: How does it compare to $P_C \cdot MPL_C$ in Cloth?

3 Patterns of International Trade

Solving for Wages across Countries

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- Wage in Wheat industry: $w = P_W \cdot MPL_W$:
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- With trade, we now have: $P_W / P_C > MPL_C / MPL_W$

- Hence we obtain that: $w = P_W \cdot MPL_W > P_C \cdot MPL_C$

3 Patterns of International Trade

Solving for Wages across Countries

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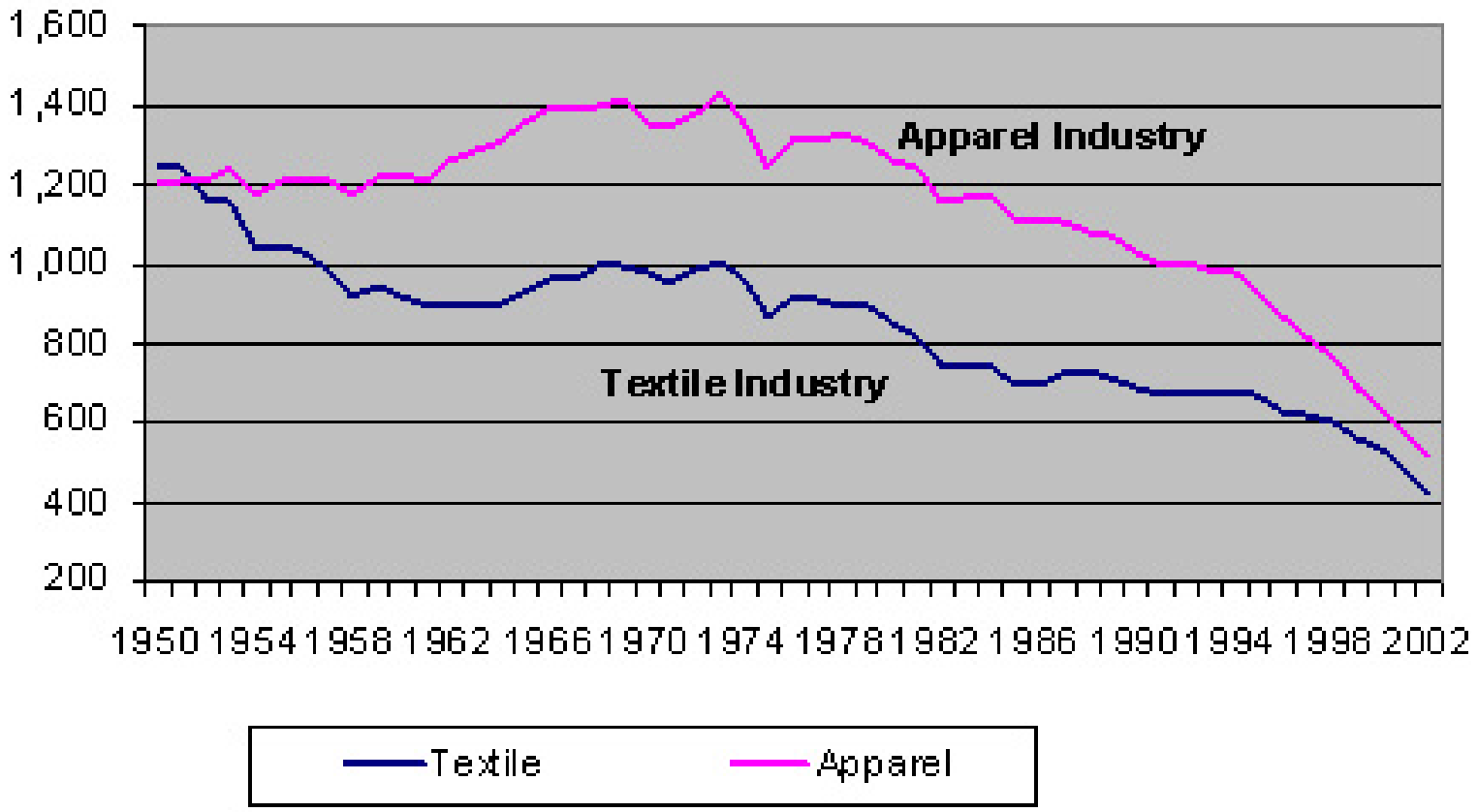
- Hence we obtain that: $w = P_W \cdot MPL_W > P_C \cdot MPL_C$
  and workers all move to the Wheat sector

→ The Cloth industry disappears in Home as long as the relative price of Cloth is lower than in autarky

Example of a disappearing industry

- **Figure I-3.**

U.S. Employment in Textile and Apparel Industries



3 Patterns of International Trade

Solving for Wages across Countries

Same for extinction of Wheat industry in Foreign:

- Wage in Cloth industry: $w^* = P_C \cdot MPL^*_C$
- With trade: $w^* = P_C \cdot MPL^*_C > P_W \cdot MPL^*_W$
  and workers all move to the Cloth sector

→ The Wheat industry disappears in Foreign as long as the relative price of Wheat is lower than in autarky

3 Patterns of International Trade

Which country has the highest wages?

Equilibrium wages:

- Home: $w = P_W \cdot MPL_W$
- Foreign: $w^* = P_C \cdot MPL_C^*$

Easier to compare “real wages”:

i.e. in terms of wheat or in terms of Cloth

3 Patterns of International Trade

Which country has the highest wages?

Equilibrium wages:

- What is Home wage in terms of wheat?

3 Patterns of International Trade

Which country has the highest wages?

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$w/P_W = MPL_W$

- What is Foreign wage in terms of cloth?

3 Patterns of International Trade

Which country has the highest wages?

Equilibrium wages:

- What is Home wage in terms of wheat?

$w/P_W = MPL_W$

- What is Foreign wage in terms of cloth?

$w^*/P_C = MPL_C^*$

3 Patterns of International Trade

Clicker question:

What is Home wage in terms of cloth?

a) MPL_C

b) MPL_C^*

c) $(P_W/P_C) \times MPL_W$

d) We cannot tell yet

3 Patterns of International Trade

Clicker question:

What is Foreign wage in terms of Wheat?

a) MPL_W

b) MPL_W^*

c) $(P_C/P_W) \times MPL^*_C$

d) We cannot tell yet

3 Patterns of International Trade

Clicker question:

Answer:

3 Patterns of International Trade

Clicker question:

Answer:

c) To both questions

3 Patterns of International Trade

Wages

Wages are determined by Absolute Advantage:

MPL_W for Home and MPL^*_C for Foreign

➔ **Home wages are higher than Foreign if:**

$P_W .MPL_w > P_C .MPL^*_C$ (wages in dollars)

$MPL_w > (P_C/P_W).MPL^*_C$ (in wheat)

$(P_W/P_C).MPL_W > MPL^*_C$ (in cloth)

[Note: Also depends on relative price P_W/P_C. More on that later, after we solve for the relative price in equilibrium]

Labor Productivity and Wages

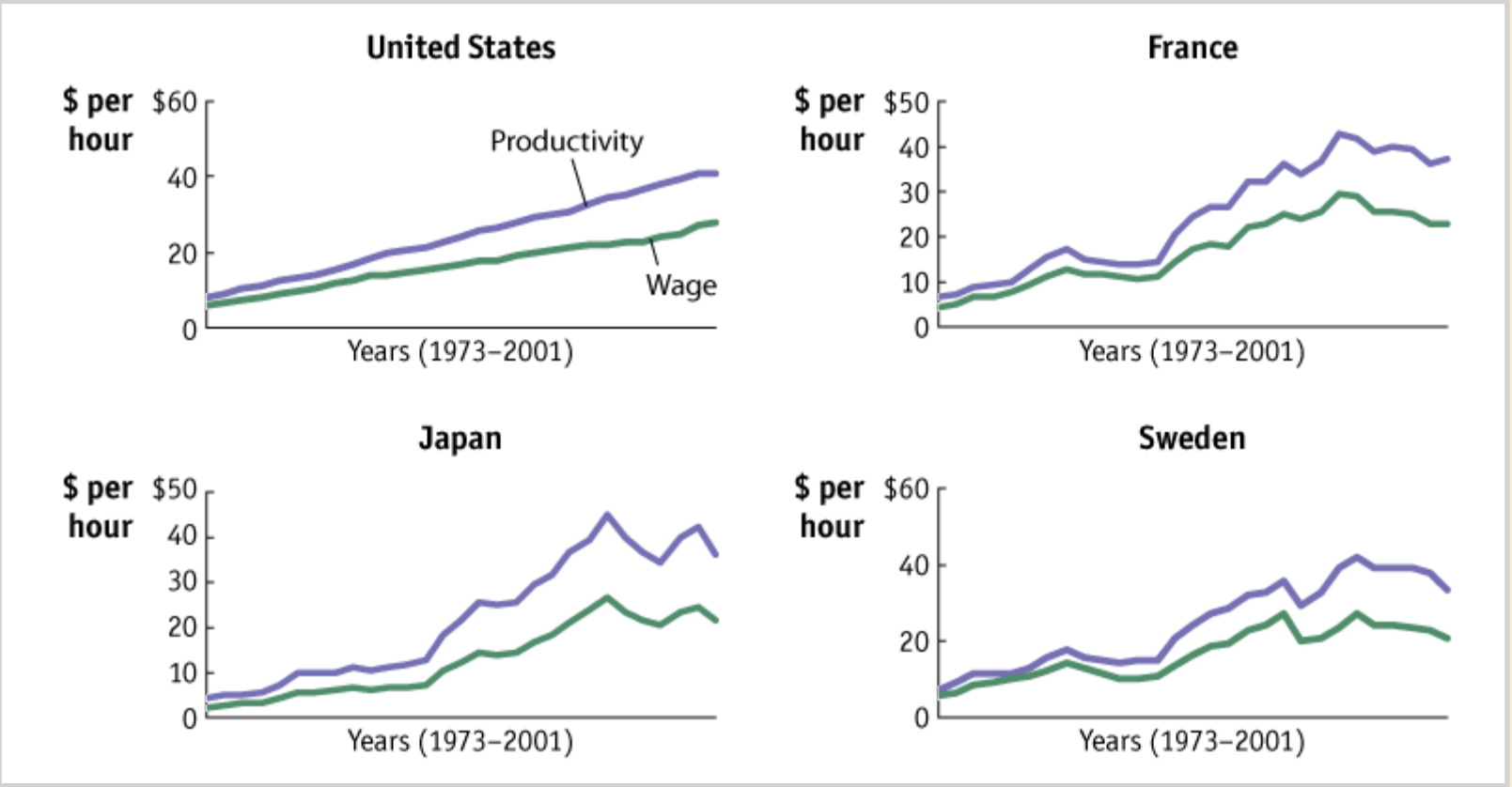
FIGURE 2-7

Labor Productivity and Wages, 2001 Labor productivity is measured by value-added per hour of work and can be compared with the wages paid in manufacturing in various countries.

The general ranking of countries—from highest to lowest—in terms of labor productivity is the same as the ranking in terms of wages: countries with higher labor productivity pay higher wages, just as the Ricardian model predicts.

Labor Productivity and Wages

FIGURE 2-8



Labor Productivity and Wages over Time The trends in labor productivity and wages can also be graphed over time. The general upward movement in labor productivity is matched by upward movements in wages, as predicted by the Ricardian model.

4 Solving for international prices

4 Solving for international prices

Clicker question:

How do we solve for the relative price in the equilibrium with trade?

4 Solving for international prices

Clicker question:

How do we solve for the relative price in the equilibrium with trade?

a) Supply = demand for Wheat in each country

b) Export of Wheat by Home = Import of Wheat by Foreign

c) We need to examine the supply and demand for the world for each commodity separately: Wheat and Cloth

d) We need to examine the trade balance in addition to ensure that supply = demand for each commodity

4 Solving for international prices

Answer:

How do we solve for the relative price in the equilibrium with trade?

4 Solving for international prices

Answer:

How do we solve for the relative price in the equilibrium with trade?

b) Export of Wheat by Home = Import of Wheat by Foreign

We don't need more than one equation:

- If all but one markets are at equilibrium, then the last market is also at equilibrium
- The budget constraint implies that trade is balanced for each country: value of imports = value of exports

4 Solving for international prices

- Equilibrium: prices such as Supply equals Demand

Economists can hardly think without these curves…

- Q: how to draw a Demand curve in our case?
- Q: how to draw a Supply curve in our case?

4 Solving for international prices

1) **"Export supply curve":** amount of Wheat that Home wants to export at various relative prices.

Notes:

- Export supply curve synthesizes Home country export decisions
- Conditional on the relative price of Wheat, no need to know what the Foreign country does.
- This is like "supply curves" in micro: this focuses on the supplier and does not account for consumer behavior

4 Solving for international prices

2) **"Import demand curve":** amount of wheat that Foreign will import at various relative prices.

Notes:

- Import demand curve synthesizes Foreign country import decisions
- Conditional on the relative price of Wheat, no need to know what the Home country does.
- This is like "demand curves" in micro: focuses on the consumer and does not account for producers decisions

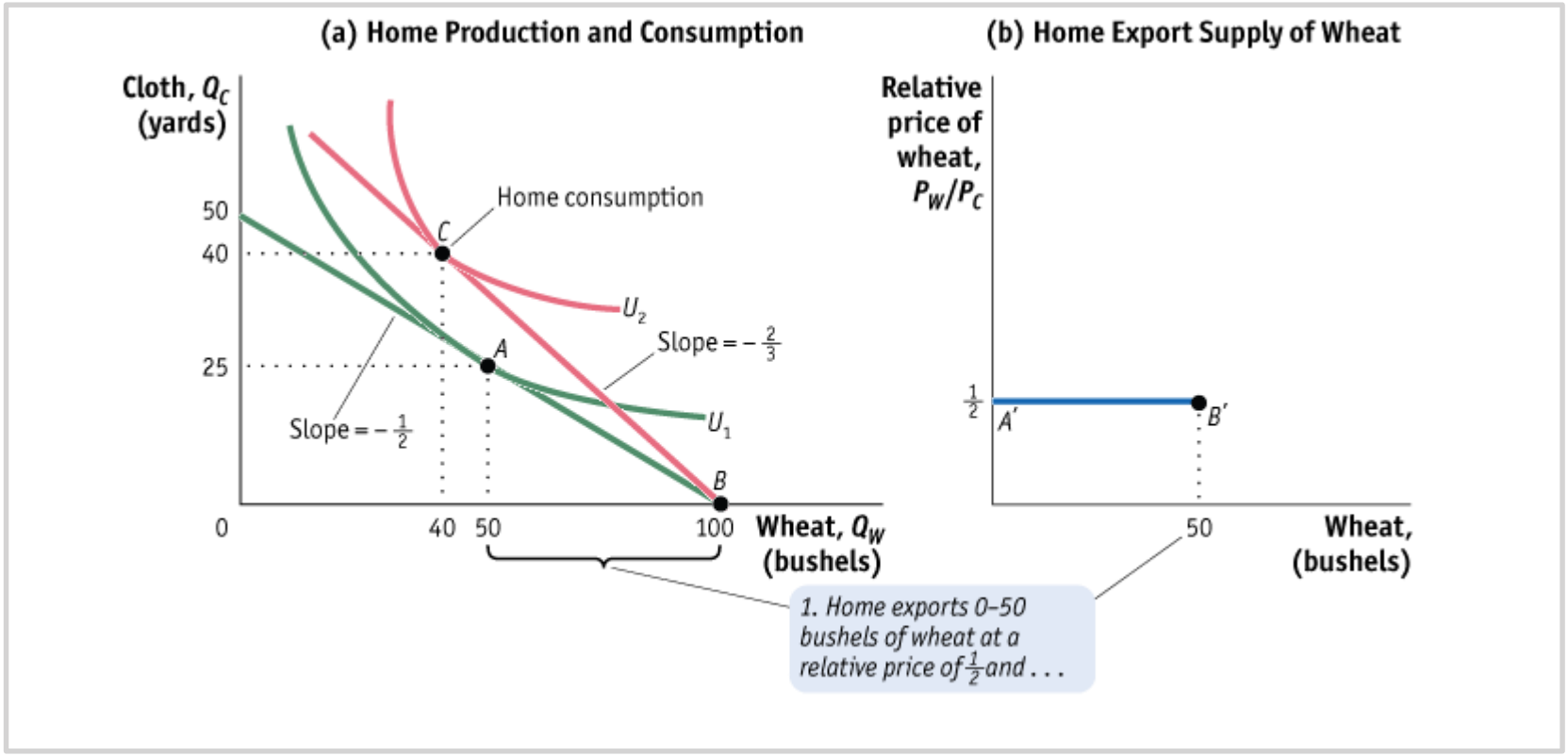
4 Solving for international prices

1) "Export supply curve" for Home:

Exports of wheat = production – consumption by Home

4 Solving for international prices

Home Export Supply Curve

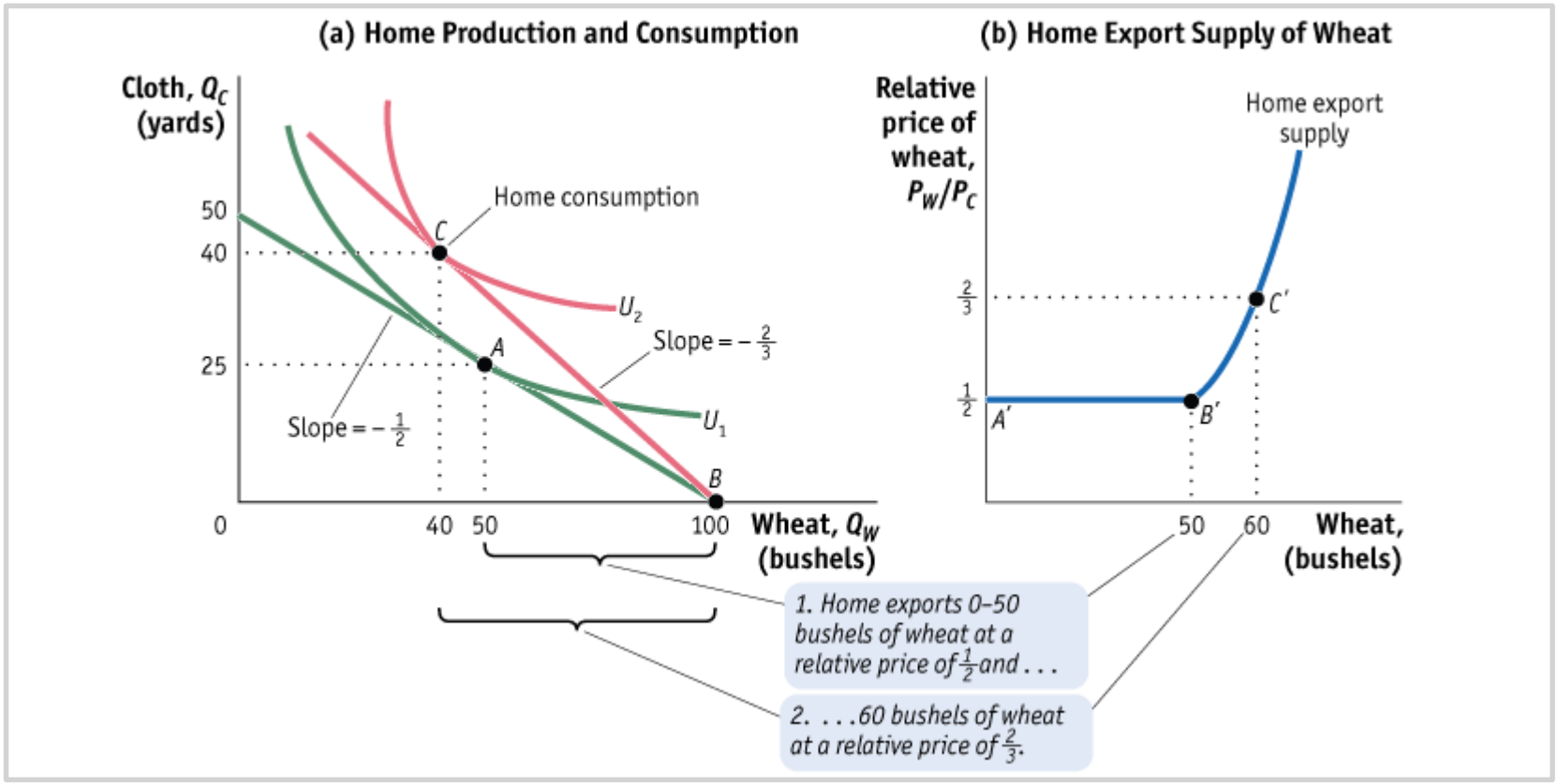


Home Export Supply Panel (a): see earlier slides

Panel b): shows the Home export supply of wheat. When the relative price of wheat is $^1/_2$, Home will export any amount of wheat between 0 and 50 bushels.

4 Solving for international prices

Home Export Supply Curve



Home Export Supply (cont'd) For relative prices above $^1/_2$, Home produces 100 bushels and consumes less than 50 bushels. The higher the price, the lower Home consumption and the larger Home exports.

4 Solving for international prices

1) "Export supply curve" for Home:

How to get the export supply curve? Four steps:

For each relative price P, we needs to determine:

- **Production**

  (easy: full specialization except for P = Autarky price)

- **Budget line**

  (slope determined by P, going through production)

- **Consumption** as a function of relative price P (point on budget line such that MRS=P, depends on *preferences*)

→ Which finally yields: **Export** = Production - consumption

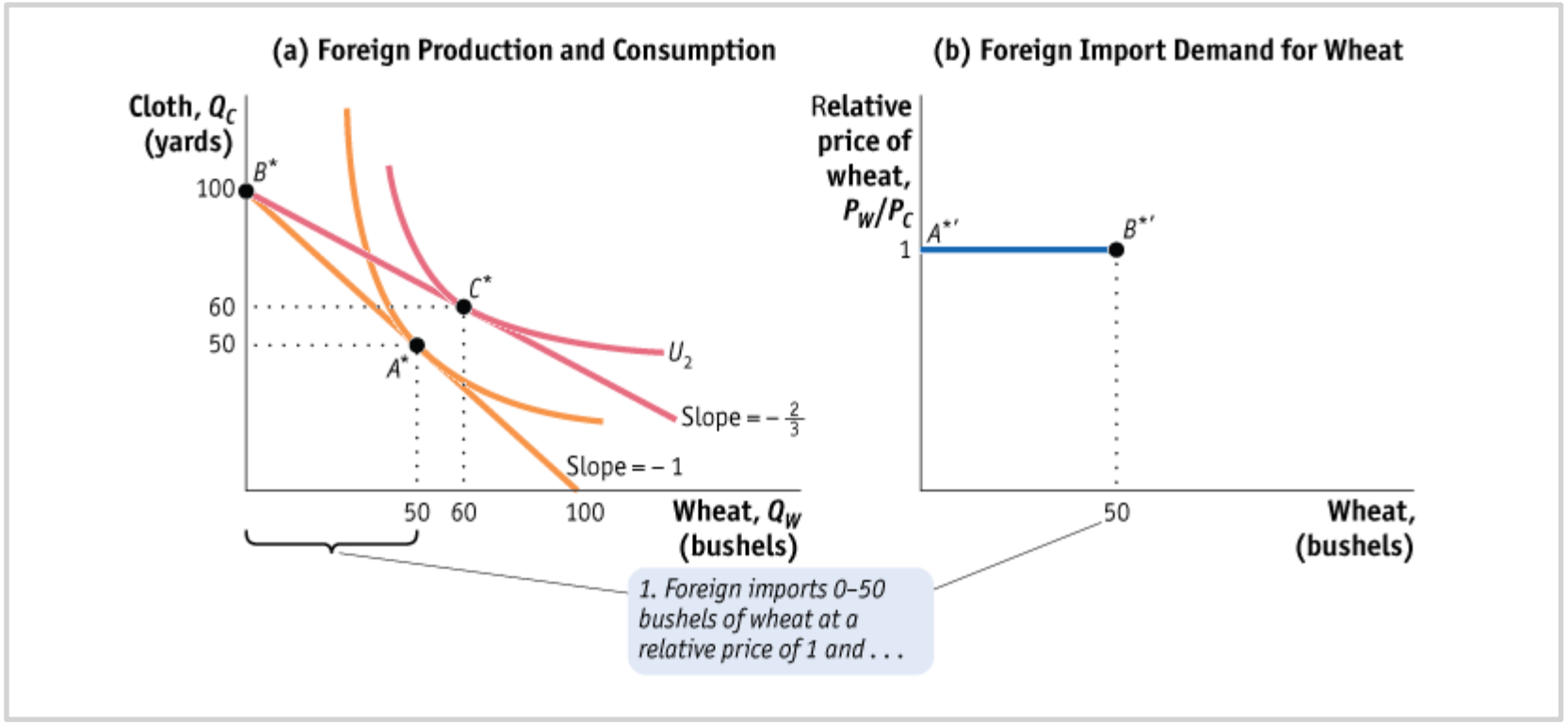
4 Solving for international prices

2) "Import demand curve" for Foreign:

Import of wheat = consumption – production by Foreign

4 Solving for international prices

Foreign Import Demand Curve

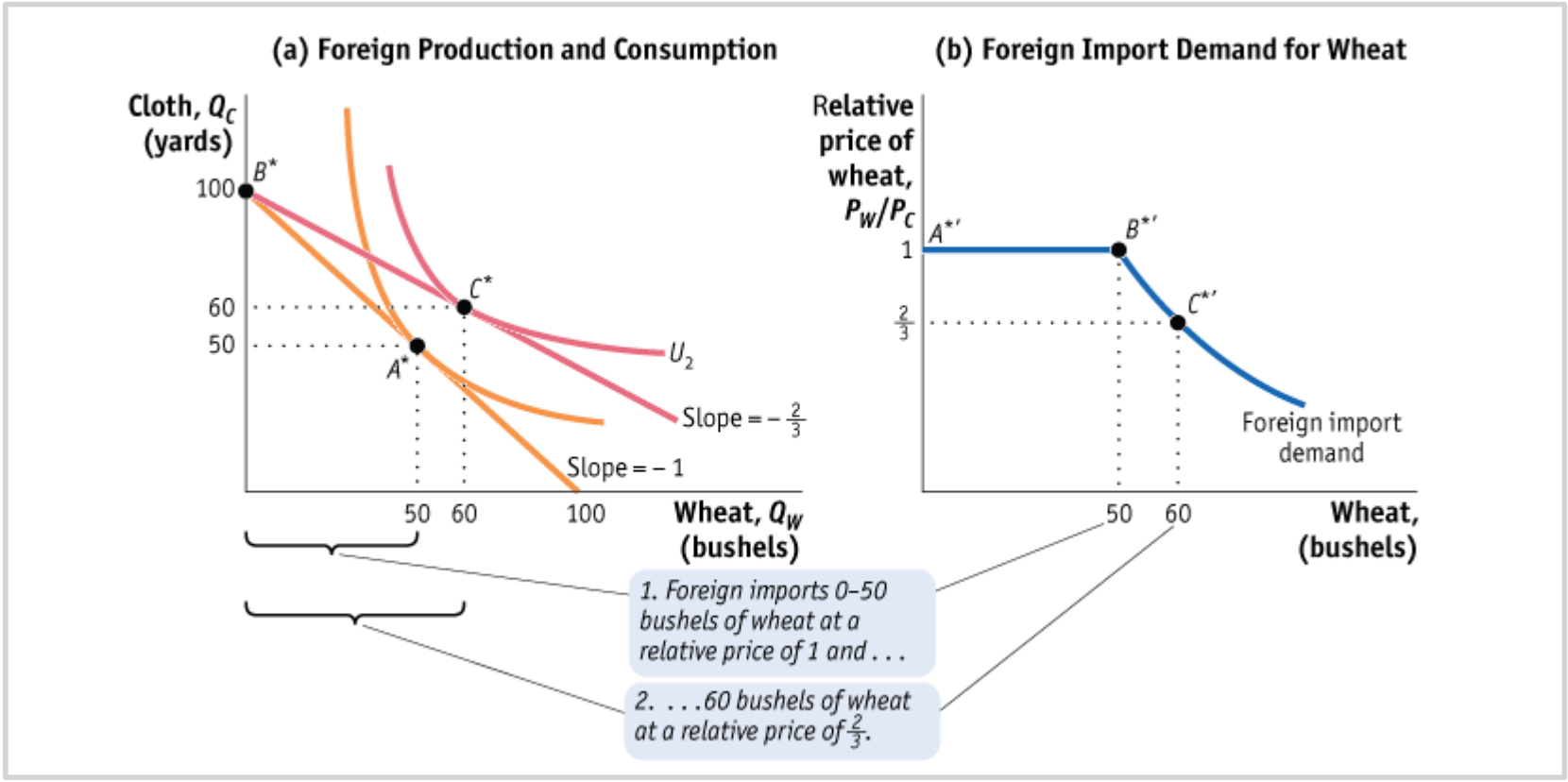


Foreign Import Demand Panel (a) see earlier slides.

Panel (b): Foreign import demand for wheat. When the relative price of wheat is 1, Foreign will import any amount of wheat between 0 and 50 bushels.

4 Solving for international prices

Foreign Import Demand Curve



Foreign Import Demand (continued) For relative prices below 1, Foreign imports all its consumption of wheat. It imports more when the price is lower.

4 Solving for international prices

2) "Import demand curve" for Foreign:

How to get the import demand curve? Four steps:

For each relative price P, we needs to determine:

- **Production**

  (easy: full specialization except for P = Autarky price)

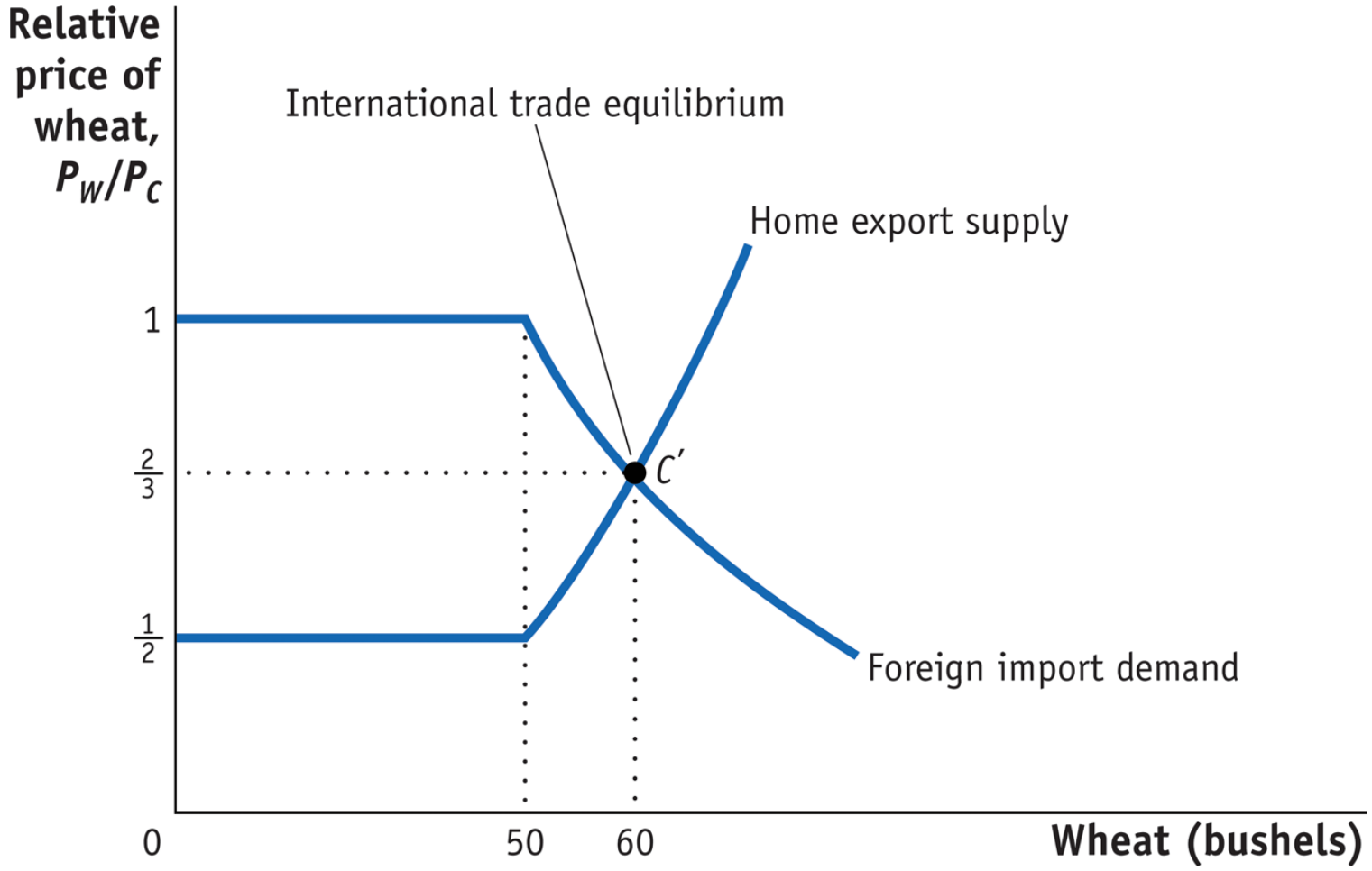
- **Budget line**

  (slope determined by P, going through production)

- **Consumption** as a function of relative price P (point on budget line such that MRS=P, depends on *preferences*)

→ Which finally yields: **Import** = Consumption - Production

International Trade Equilibrium



5 Understanding terms of trade

Further comments on Ricardo:

- What affects welfare gains from trade?
  - Terms of Trade: definition and use
  - Effect of Foreign country size and productivity
  - Examples of worsening terms of trade?

- Trade balance

International Trade Equilibrium

Clicker question:

Whether welfare in Home increases or decreases depends mostly on:

a) Total world population

b) The price of exported goods relative to imported goods

c) The country's "competitiveness" (its absolute advantage)

d) The wage w

International Trade Equilibrium

Answer:

International Trade Equilibrium

Answer:

Whether welfare in Home increases or decreases depends mostly on:

b) The price of exported goods relative to imported goods

5 Understanding terms of trade

The Terms of Trade:

Price of a country's exports divided by the price of its imports.

- TOT for Home: P_W / P_C
- TOT for Foreign: P_C / P_W

5 Understanding terms of trade

Why do **Terms of Trade** matter?

Recall the solution for wages:

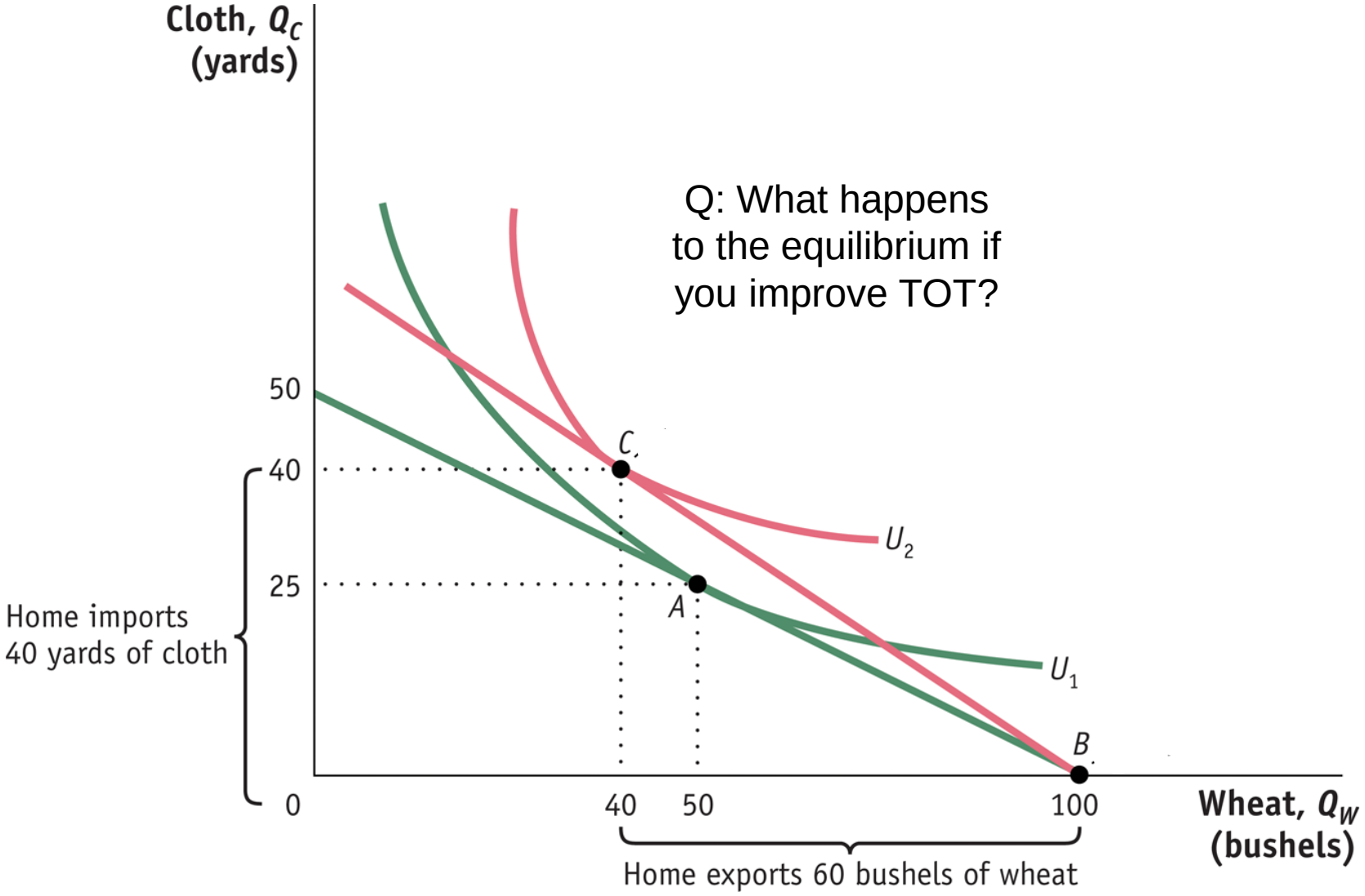
- Home wage measured in Wheat: MPL_w
- Home wage measured in Cloth: $(P_W/P_C) \times MPL_W$

→ Increases with Home's terms of trade

- Foreign wage measured in Cloth: MPL^*_C
- Foreign wage measured in Wheat: $(P_C/P_W) \times MPL^*_C$

→ Increases with Foreign's terms of trade

What happens if the **Terms of Trade** improve?



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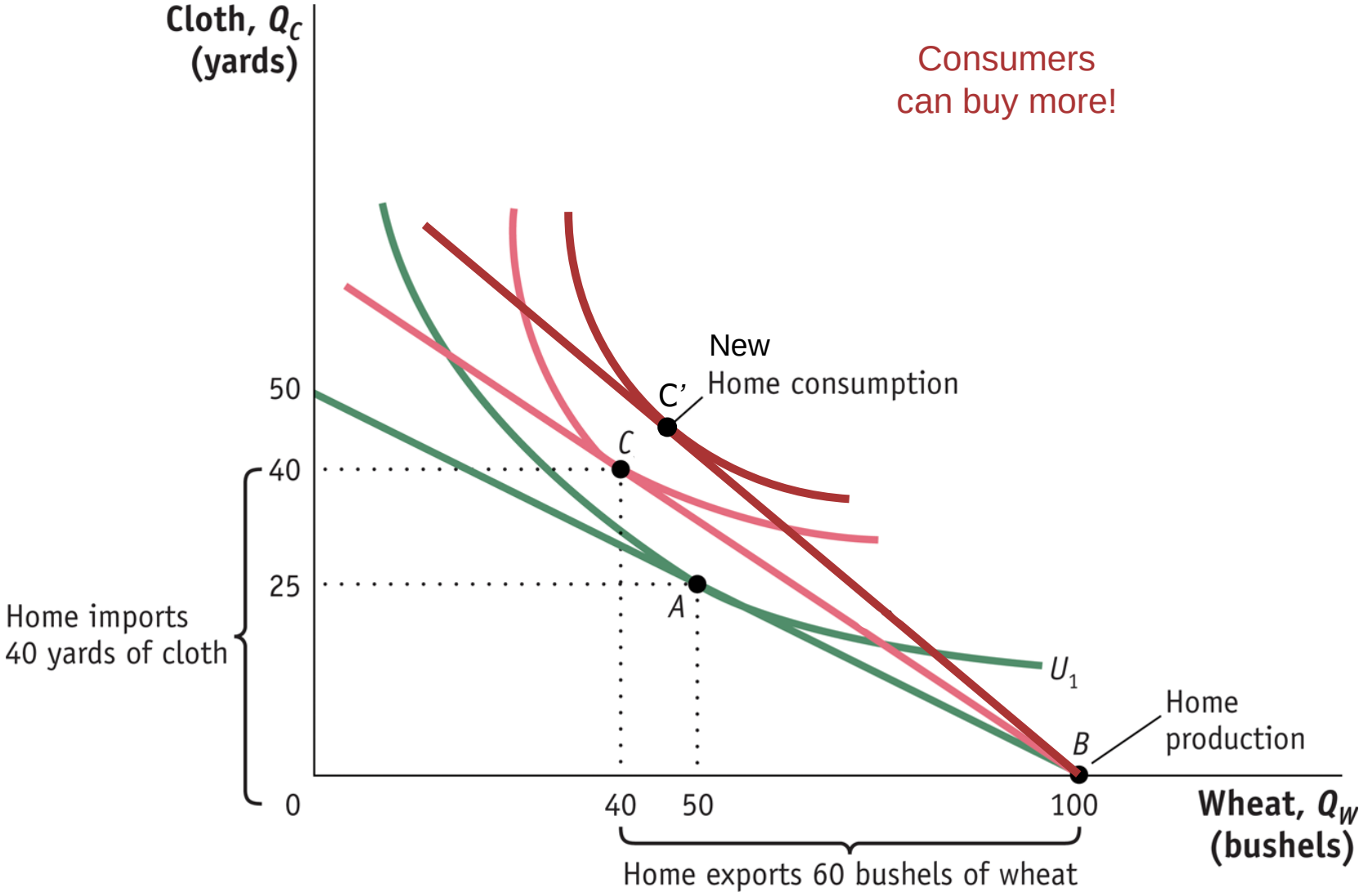


5 Understanding terms of trade

Terms of Trade

Improving the Terms of Trade leads to:

- An upward shift of the budget line
- Consumers are able to reach a higher utility level

5 Understanding terms of trade

Terms of Trade

Q: What determines a change in the Terms of Trade?

5 Understanding terms of trade

Clicker question:

An increase in productivity in Foreign induces:

a) A decrease in welfare in both Home and Foreign

b) An increase in welfare in both Home and Foreign

c) A decrease in welfare in Home and an increase in Foreign

d) An increase in welfare in Home and a decrease in Foreign

e) Ambiguous: It depends

5 Understanding terms of trade

Answers to the first question:

An increase in productivity in Foreign induces:

b) An increase in welfare in both Home and Foreign

5 Understanding terms of trade

Clicker question:

An increase in **population** in Foreign induces:

a) A decrease in welfare in both Home and Foreign

b) An increase in welfare in both Home and Foreign

c) A decrease in welfare in Home and an increase in Foreign

d) An increase in welfare in Home and a decrease in Foreign

e) Ambiguous: It depends

5 Understanding terms of trade

Answers to both questions:

An increase in population in Foreign induces:

d) An increase in welfare in Home and a decrease in Foreign

- For Home: A larger population means a higher import demand curve for Wheat and an improvement of the terms of Trade
- For Foreign: A larger population means smaller gains from trade. Foreign still gains from trade with Home, but gains *less* if population is larger.

5 Understanding terms of trade

Terms of Trade

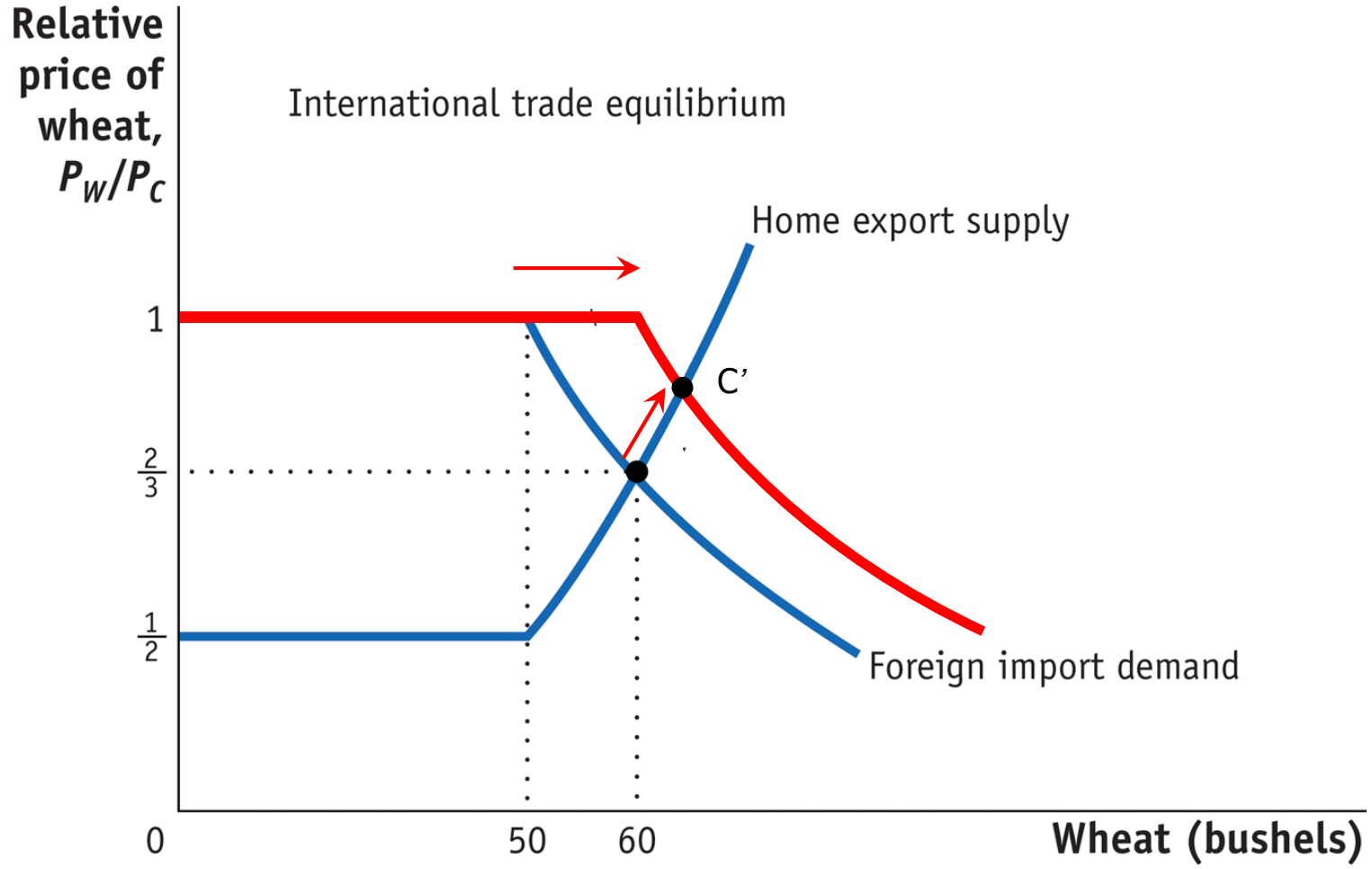
Q: What determines a change in the Terms of Trade?

A shift of the Import demand curve:

… Which could be driven by:

- An increase in the size of the Foreign country
- An increase in the productivity of Foreign workers

Effect of an increase in Foreign size or productivity



5 Understanding terms of trade

Through Terms of Trade:

- Larger gains from trade with *bigger* countries
- Larger gains from trade with more *productive* countries

Reciprocity:

- *Smaller* countries gain more from trade
- *Less* productive countries gain more from trade

	Percentage Changes in the Case of Mobile Labor					
	Baseline to Zero Gravity			Baseline to Doubled Trade		
Country	Welfare	Mfg. Prices	Mfg. Labor	Welfare	Mfg. Prices	Mfg. Labor
Australia	21.1	−156.7	153.2	2.3	−17.1	−16.8
Austria	21.6	−160.3	141.5	2.8	−20.9	41.1
Belgium	18.5	−137.2	69.6	2.5	−18.6	68.8
Canada	18.7	−139.0	11.4	1.9	−14.3	3.9
Denmark	20.7	−153.9	156.9	2.9	−21.5	72.6
Finland	21.7	−160.7	172.1	2.8	−20.9	44.3
France	18.7	−138.3	−7.0	2.3	−16.8	15.5
Germany	17.3	−128.7	−50.4	1.9	−14.3	12.9
Greece	24.1	−178.6	256.5	3.3	−24.8	29.6
Italy	18.9	−140.3	6.8	2.2	−16.1	5.7
Japan	16.6	−123.5	−59.8	0.9	−6.7	−24.4
Netherlands	18.5	−137.6	67.3	2.5	−18.5	65.6
New Zealand	22.2	−164.4	301.4	2.8	−20.5	50.2
Norway	21.7	−161.0	195.2	3.1	−22.9	69.3
Portugal	22.3	−165.3	237.4	3.1	−22.8	67.3
Spain	20.9	−155.0	77.5	2.4	−18.0	−4.4
Sweden	20.0	−148.3	118.8	2.7	−19.7	55.4
United Kingdom	18.2	−134.8	3.3	2.2	−16.4	28.5
United States	16.1	−119.1	−105.1	1.2	−9.0	−26.2

Notes: All percentage changes are calculated as $100\ln(x'/x)$ where x' is the outcome under lower geographic barriers and x is the outcome in the baseline.

5 Understanding terms of trade

Misconceptions from “Pop Internationalism” (Krugman)

Misconception:

- In our globalized world, “Competitiveness” is key to gain from trade

What we learn from Ricardo:

- All countries can gain from trade even if productivity is low
- In fact, less productive countries gain more from trade

5 Understanding terms of trade

Terms of Trade

Q: Can the Terms of Trade worsen?

- Not compared to autarky
- But gains from trade may be eroded by a decrease in foreign demand

5 Understanding terms of trade

Terms of Trade

Q: Examples of worsening Terms of Trade?

Illustration: The Terms of Trade for Primary Commodities

Prebisch and Singer's hypothesis:

Primary commodity prices to decline over time?

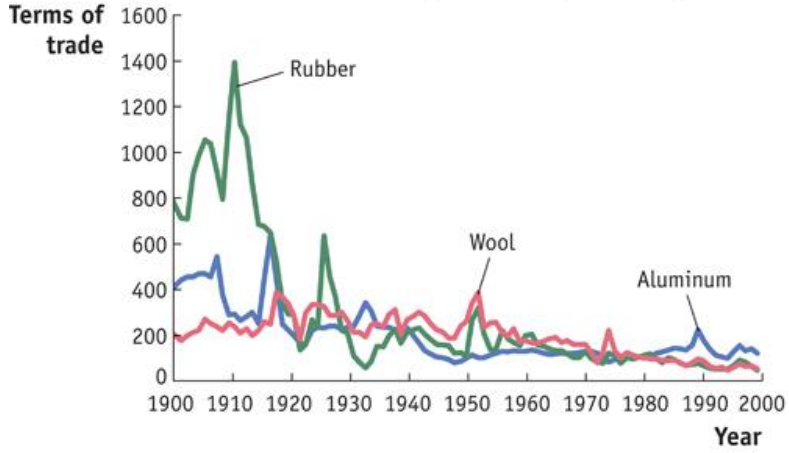
- As countries become richer, they spend a smaller share of their income on food
- For mineral products, industrialized countries continually find substitutes in the production of manufactured products.
- **But:** technological progress in manufactured goods can lead to an increase in demand for primary commodities

5 Understanding terms of trade

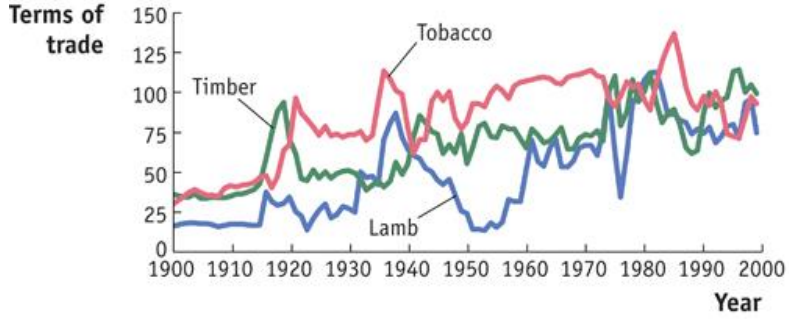
Question:

Do commodity prices tend to decrease or increase?

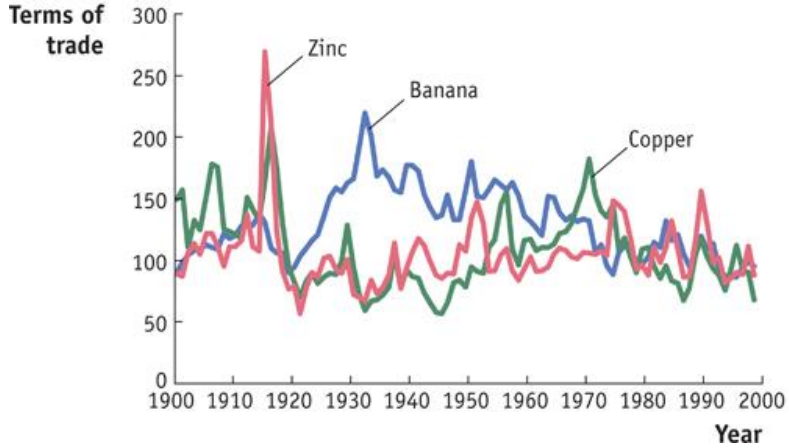
(a) Relative Price of Primary Products (decreasing over time)



(b) Relative Price of Primary Products (increasing over time)



(c) Relative Price of Primary Products (no trend over time)



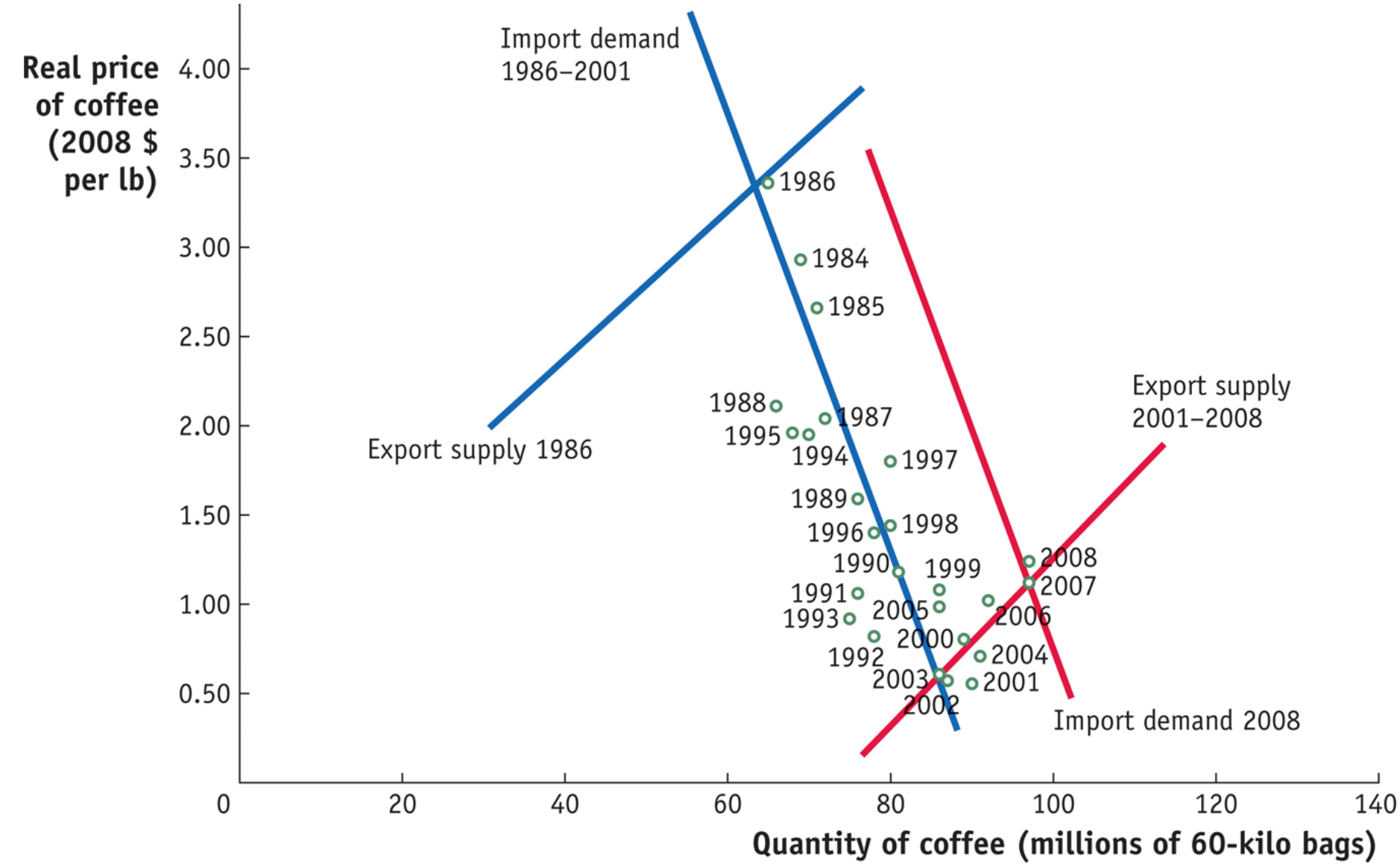

Real price of coffee (2008 $ per lb)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0
20
40
60
80
100
120
140
Quantity of coffee (millions of 60-kilo bags)
Import demand 1986–2001
Export supply 1986
Export supply 2001–2008
Import demand 2008
1986
1984
1985
1988
1987
1995
1994
1997
1989
1996
1998
1990
1999
2008
2007
1991
2005
2006
1993
2000
2004
1992
2003
2001
2002

Illustration: The Terms of Trade for Primary Commodities

Do commodity prices tend to decrease or increase?

Not all commodities

Effect on developing countries depend on commodity.
E.g.:

- Aluminum exporters have seen a decrease in T-o-T
- Tobacco exporters have seen an increase in T-o-T

5 Understanding terms of trade

Final remark about gains from trade:

- Trade balance

5 Understanding terms of trade

Misconceptions from "Pop Internationalism" (Krugman)

Another misconception:

- "You need to generate a trade surplus to gain from trade"
- Examples:

China & Germany gain more from trade because they run a trade surplus

What we learn from Ricardo:

- All countries can gain from trade even if trade is balanced

Wait a minute…

Q: Is trade balanced in Ricardo?

Wait a minute…

Q: Is trade balanced in Ricardo?

Yes, of course!

- Consumers cannot spend more than the value of production: *expenditures = income = production*
- The trade balance condition is equivalent to the budget constraint:

BC for Home: $P_W \cdot Y_W = P_W \cdot Q_W + P_C \cdot Q_C$

Value of production

Wait a minute…

Q: Is trade balanced in Ricardo?

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BC for Home: $P_W \cdot Y_W = P_W \cdot Q_W + P_C \cdot Q_C$

Trade Balance: $P_W \cdot (Y_W - Q_W) = P_C \cdot Q_C$

Value of exports

Trade balance: other comments

In general, trade is balanced in our models:

- Because the trade balanced condition is equivalent to the budget constraint
- And because there is only one period
- Focus is on sectors, goods, production, wages, etc.

Key difference from “International FINANCE” (Econ 182):

- Generally only one sector
- But multiple periods:
    - Hence Trade doesn’t have to balance at each period
    - Borrowing and Lending

Conclusion

In the Ricardian model:

1. The pattern of trade is determined by:

   comparative advantage,

2. Both countries *gain* from trade, even if trade is *balanced.*

3. The *terms of trade* determine how much a country gains from trade (e.g. smaller countries gain more).

4. While trade depends on comparative advantage, *wages* depend primarily on *absolute advantage*

Conclusion

Limitations?

Conclusion

Limitations?

- Only one factor of production: Labor.
  - The PPF is a straight line when there is only one factor – the analysis is more complex with 2 factors
  - We need more factors to talk about **inequalities**: gains from trade are not positive for everyone in a more realistic setting.

➔ *See chapters 3 and 4*

- Ricardo assumes **perfect competition**

➔ *See chapter 6 for imperfect competition*

More advanced readings

If you are interested:

These papers (folder "/Other Readings/For grad studies") provide modern versions of the Ricardian model:

- Dornbush, Fisher and Samuelson (1977):
  - Generalizes Ricardo with many goods

- Eaton and Kortum (2002):
  - Generalizes DFS with many countries and trade costs.
  - This is the most popular trade model these days
  - Grad' students in Trade have to be very familiar with it!