Labor productivity and Comparative advantage

The Ricardian model

Chapter 2

Intermediate International Trade

International Economics, 5th ed., by Krugman and Obstfeld
Building block concepts

**opportunity cost**
the opportunity cost of good X in terms of good Y is the amount of good Y that could have been produced with the resources used to produce a given amount of good X

**comparative advantage**
a country has a comparative advantage in producing good X if the opportunity cost of producing good X in terms of other goods is lower in that country than it is in other countries
One-factor economy model

• one factor: labor, with total supply $L$
• two goods: wine and cheese
• technology: $a_{LW}$ and $a_{LC}$ are respectively the unit labor requirements (number of hours of labor) to produce one gallon of wine and one pound of cheese
• total production: $Q_W$ and $Q_C$
• production possibility frontier (PPF): illustrates the different mixes of goods the economy can produce:
\[ a_{LC}Q_C + a_{LW}Q_W \leq L \]

- the absolute value of the slope of production possibility frontier is the opportunity cost of a pound of cheese in terms of wine: 
  \[ a_{LC} \]
  \[ a_{LW} \]
- when there is only one factor of production, the PPF is a straight line and the opportunity cost is constant
• *actual* production is determined by *prices*: $P_C$ and $P_W$ are prices of cheese and wine

• since there is only one factor, *hourly wages* are determined by $P_C / a_{LC}$ in the cheese sector, and $P_W / a_{LW}$ in the wine sector

• if $P_C / a_{LC} > P_W / a_{LW}$ then all workers would like to produce cheese!!
Patterns of Production

- if $\frac{P_C}{P_W} > \frac{a_{LC}}{a_{LW}}$ only cheese
- if $\frac{P_C}{P_W} < \frac{a_{LC}}{a_{LW}}$ only wine
- if $\frac{P_C}{P_W} = \frac{a_{LC}}{a_{LW}}$ cheese and wine

(1) The economy will specialize in the production of good X if the relative price of good X exceeds its opportunity cost

(2) In the absence of international trade, prices are determined by the labor theory of value: relative prices of goods are equal to their relative unit labor requirements
Trade in the one-factor model

• two countries: home and foreign
• foreign is characterized by labor supply $L^*$ and by unit labor requirements $a^*_{LC}$ for cheese and $a^*_{LW}$ for wine
• **absolute advantage**: if one country can produce one unit of good X with less labor than other country, then the first country has an absolute advantage in producing X:
  
  $a_{LC} < a^*_{LC}$ then home has absolute advantage producing cheese
• in the absence of trade there is no relative price equalization across countries:

  home: \[ \frac{P_C}{P_W} = \frac{a_{LC}}{a_{LW}} \]

  foreign: \[ \frac{P_C}{P_W} = \frac{a^*_{LC}}{a^*_{LW}} \]

• \( \frac{a_{LC}}{a_{LW}} \geq < \frac{a^*_{LC}}{a^*_{LW}} \) allows us to compare opportunity costs across countries, and to establish comparative advantage and patterns of trade: *absolute advantage is not enough to define patterns of trade.*
• assume that:
\[ \frac{a_{LC}}{a_{LW}} < \frac{a^*_{LC}}{a^*_{LW}} \]
which means:
home has a lower opportunity cost of cheese in terms of wine
home has a comparative advantage in cheese
home’s relative productivity in cheese is higher than it is in wine

• when there is trade there is relative price equalization:
\[ \frac{P_C}{P_W} = \frac{P^*_C}{P^*_W} \]
• why? because prices of internationally traded goods are determined by the **world relative supply** and **world relative demand** of goods

• *relative* refers to quantity of good X divided by quantity of good Y

• the world relative demand curve of cheese shows how the quantity demanded of cheese relative to wine is decreasing on the relative price of cheese
World relative supply curve of cheese:

\[ \frac{P_C}{P_W} < \frac{a_{LC}}{a_{LW}} \quad \text{zero cheese supply} \]
\[ \frac{P_C}{P_W} = \frac{a_{LC}}{a_{LW}} \quad \text{home supplies any amount of cheese} \]
\[ \frac{a_{LC}}{a_{LW}} < \frac{P_C}{P_W} < \frac{a^*_{LC}}{a^*_{LW}} \quad \text{home specializes in cheese and foreign in wine} \]
\[ \frac{P_C}{P_W} = \frac{a^*_{LC}}{a^*_{LW}} \quad \text{foreign supplies any amount of cheese} \]
\[ \frac{P_C}{P_W} > \frac{a^*_{LC}}{a^*_{LW}} \quad \text{infinite cheese supply} \]
in general, with trade the price of good X relative to good Y is somewhere in between the pretrade level in the two trading countries

Computing gains from trade for home:

$\frac{1}{a_{LW}}$ gallons of wine produced in 1 hour

$\frac{1}{a_{LC}}$ pounds of cheese produced in 1 hour

$(\frac{1}{a_{LC}})(\frac{P_C}{P_W})$ gallons of wine that home gets in exchange for cheese

if $(\frac{1}{a_{LC}})(\frac{P_C}{P_W}) > \frac{1}{a_{LW}}$

home can get more wine by trading, or home can indirectly “produce” more wine by producing cheese and trading
Gains from trade – Example

\( a_{LC} = 1 \) hour per pound \( a_{LW} = 2 \) hours per gallon
\( a^*_{LC} = 6 \) hours per pound \( a^*_{LW} = 3 \) hours per gallon

\( a_{LC} / a_{LW} = \frac{1}{2} \) opportunity cost of cheese home
\( a^*_{LC} / a^*_{LW} = 2 \) opportunity cost of cheese foreign

if \( P_C / P_W = 1 \) both countries specialize

Gains from trade for home:
- home produces \( \frac{1}{2} \) gallon of wine in 1 hour
- home produces 1 pound of cheese in 1 hour
- at prices \( P_C / P_W = 1 \) home can get 1 gallon of wine “in 1 hour”
Some common misconceptions

• **Wrong # 1:** “Free trade is beneficial only if your country is strong enough to stand up foreign competition”
  
  • Missing point #1: gains from trade depend on comparative advantage, not in absolute advantage

• **Wrong # 2:** “Foreign competition is unfair and hurts other countries when it is based on low wages”
  
  • Missing point #2: what matters for a country to gain from trade is that the good it produces is cheaper in terms of its own labor and not if the other country has lower wages or high productivity
• **Wrong # 3:** “*Trade exploits a country and makes it worse off if its workers receive much lower wages than workers in other nations*”

• Missing point #3: the desirability of free trade does not have to do with workers deserving a better paid, but with a country being better off by exporting
Many goods economy model

• two countries: home and foreign
• one factor: labor
• \( N \) different goods, indexed from 1 to N
• technology: \( a_{Li} \) is the home unit labor requirement for good indexed by \( i \); and \( a^*_{Li} \) that for the foreign country
• reorganize the indexes of the goods so that we get the following ranking:

\[
\frac{a^*_{L1}}{a_{L1}} > \frac{a^*_{L2}}{a_{L2}} > \ldots > \frac{a^*_{LN}}{a_{LN}}
\]

• let \( w \) be the wage rate per hour at home and \( w^* \) that for foreign
• rule for allocating world production: \textit{goods will be produced where it is cheaper}
• home produces good \( i \) if:

\[
w \cdot a_{Li} < w^* \cdot a^*_{Li}
\]
Key concepts.....

- **relative home productivity advantage** is the “number of times” home is more productive at good $i$ and is given by $\frac{a^*_L_i}{a_{Li}}$
- we say that home has a **cost advantage** in producing good $i$ if:
  $$\frac{a^*_L_i}{a_{Li}} > \frac{w}{w^*}$$
  because the relative productivity advantage is larger than the relative wage
Example

**home country:**
\[ a_{L1} = 1 \quad a_{L2} = 5 \quad a_{L3} = 3 \quad a_{L4} = 6 \quad a_{L5} = 12 \]

**foreign country:**
\[ a^*_{L1} = 10 \quad a^*_{L2} = 40 \quad a^*_{L3} = 12 \quad a^*_{L4} = 12 \quad a^*_{L5} = 9 \]

**relative home productivity advantage:**
\[ \frac{a^*_{L1}}{a_{L1}} = 10 \quad \frac{a^*_{L2}}{a_{L2}} = 8 \quad \frac{a^*_{L3}}{a_{L3}} = 4 \]
\[ \frac{a^*_{L4}}{a_{L4}} = 2 \quad \frac{a^*_{L5}}{a_{L5}} = 0.75 \]

**relative wage:**
\[ \frac{w}{w^*} = 3 \quad \text{home produces goods 1,2,3} \]

**gains from trade for home:**
- home imports goods 4 and 5
- foreign uses 12 hours to produce good 4
- these 12 hours cost 4 hours of home labor \((\frac{w}{w^*} = 3)\)
- at home it costs 6 hours to produce good 4
How do we determine the relative wage rate?

At the intersection of:

- **relative demand for labor**: at home is a negative function of the relative wage rate \( w/w^* \) because:
  1. higher relative wages imply more expensive goods produced home, and less world demand
  2. with higher relative wages, home produces less goods and requires less labor

- **relative supply of labor**: is determined by the relative size of home and foreign labor force
Limitations of the Ricardian model

- Ricardian model predicts an extreme degree of specialization that is not observed in reality; this is due to the one-factor assumption
- due to this same assumption, effects of trade on income distribution within a country cannot be studied
- differences in resources across countries are not considered
- there is no consideration of economies of scale as a cause of trade