Pugel. Chapter 3. Why Everybody Trades: Comparative Advantage

Historical background:
Many of the basic texts are online, and linked to from my web page.
  Mercantilism: Thomas Mun, *England's Treasure by Foreign Trade* (1664)
  David Hume: "Of the Balance of Trade" (1752); price-specie flow mechanism
  Adam Smith: *The Wealth of Nations* (1776)
    Book IV, Chapter 1. "Of the Principle of the Commercial or Mercantile System"
    Book IV, Chapter 2. "Of Restraints on the Importation of Such Goods as can be Produced at Home"
  Thomas Malthus, "Observations on the Effects of the Corn Laws" (1814)

Limits of the analysis of chapter 2:
-- Uses partial rather than general equilibrium analysis. Focuses on one market in one country; trade necessarily involves more than one market and more than one country.
  What happens in one market affects what happens in others -- expanding production of one good takes resources away from the production of others, and so has an opportunity cost.
-- Does not try to explain the sources of comparative advantage in international trade.
  Demand and supply curves are given rather than derived from the available resources and technology.

-- Does not explain income distribution effects of trade among producers.
  Does international trade benefit capitalists, landlords, or workers? Does it harm some groups of producers while harming others?

To note in the chapter:
  **Mercantilism** case study (p. 33) Lecture will expand on the policies of mercantilism (tariffs, maximum wage legislation, prohibition of specie export) as seen in policies of Elizabeth I and Jean-Baptiste Colbert.

Adam Smith's notion of **absolute advantage** (and from lecture, "vent for surplus").

Malthus' worry about the loss of English absolute advantage and his defense of the **Corn Laws**.

Ricardo's concept of **comparative advantage** (Chapter 7 of his *Political Economy*).
  Principle of comparative advantage: Comparative advantage in a product goes to the low opportunity cost producer of a good.

In what sense does absolute advantage matter (p. 40-41)

Focus on the tools used and make sure you get the definitions of (they will be used through the first half of the course).

**Production function**: Example: \( Q_x = 5 L_x \) where 5 is the productivity coefficient.

**Activity requirement**: In the above example, if the productivity coefficient is 5, it requires 1/5 of a unit of labor to produce one unit of the good. The activity requirement is 1/5.
  Text p.34 and p.35 tables label the activity requirements as "Labor hours to make"

**Production possibility frontier** (or production possibility curve in text)
  Be able to derive a Ricardian PPF from given labor endowments and production functions.

**Trade line**: line starting from production point (not necessarily specialization as in Fig. 3.1. See prob. 3.4) and having as its slope the post-trade price ratio. Hence also called the **price line**.
  Defines a **trading possibility frontier** or a **consumption possibility frontier**
Pugel Chapter 3 Problems.

Note that I have materials online describing the Production Possibility Frontier and its connections with opportunity cost, efficiency and its connection with wages and prices. Go to the assignments link on the course web page and download the material on the PPF, comparative advantage, and the problems on comparative advantage.

**Problem 3.1.** Quotation states a simplified version of Adam Smith's absolute advantage, not Ricardo's comparative advantage. (Text answer p. 678)

**Problem 3.2.** From the perspective of Smith and Ricardo, imports are good; exports are the necessary payment for imports. Smith and Ricardo focus on consumption as the end of economic activity. See page 33 for the contrast of this attitude with mercantilism.

**Problem 3.3.** This quotation describes the attitude which preceded mercantilism: Eli Heckscher, in his treatment of mercantilism, labelled it a "policy of provision" because it had as its goal ensuring the adequate provision of the home market by (for example) stopping exports of food in a time of famine. Mercantilists insisted that exports were good, and that consumption was at best a secondary goal. Malthus was trying to return to the old policy of provision.

**Problem 3.4.** Incomplete specialization can bring gains. I reproduce below the graphs from Figure 3.1 (p.39) and assume that production remains the same after trade as in autarky. The trade line based on the original production point shows a wider range of consumption possibilities after trade, and hence gains from trade.

The red lines start from the autarky production points of 15 cloth and 20 wheat for the US and 76 cloth and 16 wheat for ROW (Rest of the World). The US line shows that with the autarky production bundle, the US could now consume up to 35 units of cloth (the 15 it produces and the 20 it could consume if it traded 20 units of wheat at the assumed international price ratio of $P_w / P_c = 1$).

The blue lines show that consumption possibilities would be even greater with complete specialization, but trade would bring gains even if specialization were incomplete.

What is the intercept of the red line on the graph for the rest of the world?
Problem 3.5. Arbitrage and profits from trade.

Thinking in monetary terms may help understand the problem.

Use the table on P. 34. Make the additional assumption that wages in the United States are $10 an hour and wages in the rest of the world are £20 an hour. We can now calculate the prices of the goods in the US and the ROW: We make a zero profit assumption for convenience; if you work the problem through with a 10 percent profit markup for each good in the US and a 20 percent profit markup for each good in ROW, you will find the basic lesson is unchanged.

US: Cloth has an activity requirement of 4 hours, so that labor costs for each unit of cloth will be $40. The lowest possible price for a unit of cloth in the US is therefore $40.
Wheat has an activity requirement of 2 hours, so the lowest possible price of wheat in the US is $20.

ROW: Cloth has an activity requirement of 1 hour, so the lowest possible price of cloth is £20.
Wheat has an activity requirement of 2.5 hours, so the lowest possible price of wheat is £50.

Start in the United States with $10,000. Buy 250 units of wheat and ship it to ROW (Again for simplicity, we assume zero transportation costs). Sell the wheat for 250 * 50 = £12,500.

Use the £12,500 to buy 12,500 / 20 = 625 units of cloth. Ship the cloth back to the US and sell it for $40 * 625 or $25,000. You have more than doubled your initial $10,000.

Note that this procedure will do four things:
   a. increase the price of wheat in the US. You are buying wheat on behalf of ROW consumers, increasing the demand for wheat in the US, and raising the price of wheat on the US market.
   b. lower the price of wheat in ROW. You are selling wheat to the ROW, increasing the supply of wheat to the ROW, and lowering the price of wheat there.
   c. lower the price of cloth in the US. You are selling cloth in the US (etc).
   d. increase the price of cloth in ROW. You are buying cloth in the ROW (etc).

Eventually, a common price ratio will be established and remove the opportunity for further arbitrage profits. [This does not mean that trade will cease -- see problem 2.7 -- but simply that it will not grow any further]

Note that although we use different monetary units, we do not have to raise questions about the exchange rate of the two currencies. All trades take place inside a country, and we do not have to have a foreign exchange market. We will worry about the foreign exchange market in the second part of the course.

To firm up your understanding of the situation, suppose you are a ROW merchant with £36,000. What do you do to make a profit, and how much of a profit do you make? Will your purchases and sales reinforce or counter the price changes described (in a-d above)?
Problem 3.7. Lindertania and ROW.

Text answer on p. 678.

Text gives a table of activity requirements (assume the input units are hours of labor):

<table>
<thead>
<tr>
<th></th>
<th>RICE</th>
<th>CLOTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINDERTANA</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>REST OF THE WORLD</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

Activity requirements in ROW are lower than in Lindertania; ROW has an absolute advantage in both goods.

To establish relative prices, assume that wages in Lindertania are 10 kopecks and wages in ROW are 10 credits.

In Lindertania, the price of rice will be 750 kopecks and the price of cloth 1000 kopecks.
In ROW, the price of rice will be 500 credits and the price of cloth 500 credits.

We can't conclude anything from the absolute level of prices in each currency (we have no idea whether a credit is worth 1 kopeck or 5 kopecks, although a little thought might convince you it will be worth between 1.5 and 2 kopecks).

Comparative advantage will show up in the relative prices of the two goods in the two countries:

In Lindertania, \( \frac{P_r}{P_c} = \frac{750}{1000} = 0.75 \)
In ROW, \( \frac{P_r}{P_c} = 1.00 \).

Lindertania is the low RELATIVE COST producer of rice, and therefore has a comparative advantage in rice.

If we look at the relative cost of cloth, we will find that \( \frac{P_c}{P_r} = \frac{1000}{750} = 1.33 \) in Lindertania and \( \frac{P_c}{P_r} = 1.00 \) in ROW; ROW is the low relative cost producer of cloth and therefore has a comparative advantage in cloth.

After international trade opens, the international price ratio will settle with \( 0.75 < \frac{P_r}{P_c} < 1.00 \)

Added exploration of the problem:

Suppose Lindertania and ROW each have a population of 150 million. Draw their PPFS, indicating maximum production points. (for L, 2 rice and 1.5 cloth; for ROW, 3 rice and 3 cloth).

Calculate the production functions of each country (L: Rice = 1/75 Labor; Cloth = 1/100 Labor)

In autarky, what is the average monthly real wage of a worker who works 150 hours a month:

Answers:
in Lindertania, 2 units of rice or 1.5 units of cloth.
in ROW, 3 units of rice or 3 units of cloth.

Suppose the actual international price ratio after trade is \( \frac{P_r}{P_c} = 0.90 \)
What impact will this have on the real wage of workers after trade and specialization?
Answers:
in Lindertania, still 2 units of rice, but now 1.8 units of cloth.
in ROW, still 3 units of cloth, but now 3.33 units of rice.

Note that real wages increase in both countries, but ROW has the higher standard of living both before and after trade.
Problem 3.8. Vintland and Moonited Republic

Table of Activity Requirements:

<table>
<thead>
<tr>
<th></th>
<th>Wine</th>
<th>Cheese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vintland</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>M.Rep.</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>

a. Moonited Republic has an absolute advantage in both goods -- it can produce both wine and cheese with lower labor inputs.

b. Opportunity cost calculations:

In Vintland: To produce an extra bottle of wine, you need 15 hours of labor. This means taking 15 hours of labor away from cheese, and since 10 hours is needed for each kilogram of cheese, this means giving up 1.5 kilos of cheese. Hence in Vintland the OC of a bottle of wine is 1.5 kilograms of cheese.

In Moonited Republic, to produce 1 bottle of wine you need 10 hours of labor, and to get the 10 hours of labor by transferring workers from the cheese industry, you must give up 2.5 kilos of cheese.

In Moonited Republic, the OC of a bottle of wine is 2.5 kilograms of cheese.

Hence, Vintland is the low opportunity cost producer of wine and has the comparative advantage in cheese.

Calculate the OC of producing another kilo of cheese: you will find it as 2/3 of a bottle of wine in Vintland, and as four-tenths of a bottle of wine in MR. Since 0.67 > 0.4, Vintland is the high opportunity cost producer of cheese, and MR has the comparative advantage in cheese.

c. PPFs: Write the production functions for Vintland:

Wine = 1/15 Labor. If all 30 million workers in Vintland were in Wine, Wine production would be 2 million.

Cheese = 1/10 Labor. If all 30 million workers in Vintland were in Cheese, Cheese production would be 3 million.

In MR, the production functions are Wine = 1/10 Labor, for a maximum of 2 million (the same as Vintland) and Cheese = 1/4 Labor, so that maximum production = 1/4 (20 million) or 5 million.

d. Autarky price ratios:

Suppose Vintland wages are $2, so that Pw = $30 and Pc = $20. Pw / Pc = 1.5

Suppose MR wages are €5, so that Pw = €50 and Pc = €20. Pw / Pc = 2.5

The text assumes that Pw / Pc = 2.0 [wine is twice as expensive as cheese]

Since this is higher than the Vintland Pw / Pc, Vintland will move toward specialization in wine.

Since this is lower than the MR Pw / Pc, MR will move toward specialization in cheese.

Trade price ratio is given as Pw / Pc = 2.0.

Note that the text refers, somewhat confusingly, to the "price ratio" in terms of bottles of wine per kilogram of cheese. If one-half bottle of wine trades for one kilogram of cheese (text problem part d), then wine is worth twice as much as cheese. I prefer to talk of the price ratio as the ratio of prices, not of quantities. It might help to remember that if we have an even trade for two goods, X and Y, the money you get from selling one of them will be equal to the money you have to pay for the other:

\[ P_x Q_x = P_y Q_y \]  so that \[ P_x / P_y = Q_y / Q_x \]

In our example, let wine be good X:  P wine / P cheese = Q cheese / Q wine.

The text problem states that Q wine / Q cheese = 1/2. Therefore P wine / P cheese = 2.

Review this relationship carefully. It is always the source of much confusion the first time through.
Problem 8, Parts e and f.

Graphical representation of problem 8.
A = Autarky production and consumption
TP = trade production point after specialization
TC = trade consumption point, with Vintland exporting 1 million bottles of wine
    and Moonited Republic exporting 2 million kilos of Cheese.

Production possiblity frontiers are the solid red lines;
trade line (= price line) the dashed black lines.

f. Note that with the numbers given in the problem,
Vintland's consumption of wine does not change after trade, but consumption of cheese is up from
1.5 to 2.0 million kilos.
Moonited Republic's consumption does not change after trade, but consumption of wine increases from
0.8 to 1.0 million bottles.

Both countries gain from trade. If products are valued at the new international prices, Vintland gains more --
their gain of 0.5 million kilos of cheese could be translated into 0.25 million bottles of wine,
but MR's gain is only 0.2 million bottles of wine.
Problem 3.9. Real Wages and gains from trade.

"Real wages" = the goods that the money or nominal wages can buy = Nominal wages / Price of good

Rather than repeating the text problem (the answer is in the back of the book), we look at the last problem.
In Vintland, we assumed that nominal wages were $2.
Since it takes 15 hours to make a bottle of wine in Vintland, the minimum possible price for wine is $30;
since it takes 10 hours to make a kilo of cheese in Vintland, the minimum possible price for cheese is $20.
The price ratio Pwine / Pcheese = $30 / $20 = 1.5.

Assume that the typical worker in Vintland works for 3000 hours a year. Annual wages are $6000.
Since the price of wine is $30, his real wage in terms of wine is $6000 / $30 = 200 bottles of wine;
since the price of cheese is $20, his real wage in terms of cheese is $6000 / $20 = 300 kilos of cheese.

When trade opens, the price of cheese falls to half the price of wine or Pcheese = 0.5 Pwine
 [one half-bottle of wine trades for one kilo of cheese]
If the price of wine in Vintland stays at $30, this means that the price of cheese will be $15 --
a fall in the price of cheese from $20, and hence an increase in the real wage in terms of cheese:
Annual nominal wage / Pcheese = $6000 / $15 = 400 kilos of cheese.

What happens if the price of wine in Vintland rises to $45?
Answer: we have assumed that the prices = Activity requirement times wages.
Here, we have set the price of wine at $45 = 15 w, so nominal wages would rise to $3.
Workers would now make $9000 a year. They could still buy no more wine than before --
their real wage in terms of wine = $9000 / $45 = 200 bottles of wine.
They will try to buy more cheese, and hence drive up the price of cheese.
Since we assumed Pcheese = 0.5 Pwine, we have Pcheese = 0.5 (45) = $22.50
workers real wages in terms of cheese is $9000 / $22.50 = 400 kilos of cheese.

[We are making a lot of assumptions about the determination of wages; we will see in chapter 5 more about how trade will in fact impact on wages. The point of this example is that nominal prices and wages can vary without affecting real wages or the price ratio.]

For Moonited Republic, you should find that before trade, with nominal wages at €5 per hour so that the price of wine is €50 a bottle and the price of cheese is €20 a kilo. The price ratio is Pwine / Pcheese = 2.5

If MR workers work for 3000 hours a year, nominal wages are €15,000 and real wages are:
€15,000 / €50 = 300 bottles of wine and €15,000 / €20 = 750 kilos of cheese.
After trade, assume that the price of cheese remains fixed. Since after trade Pwine = 2 Pcheese, we have
Pwine = 2 * €20 = €40.
Real wages in MR in terms of cheese are now €15,000 / €40 = 375 bottles of wine.
**Problem 3.10.** Changes in US activity requirements. In the text example on page 35, the activity requirements are:

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Rest of World (ROW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloth</td>
<td>4.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Wheat</td>
<td>2.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

The US has an absolute disadvantage in both goods.

Wheat in the US takes only half as long to make as cloth in the US, so the opportunity cost of wheat is only half a unit of cloth. In the rest of the world, wheat takes 1.5 times as long to make as cloth in the rest of the world -- the opportunity cost of wheat in ROW is 1.5 units of cloth.

The US is the low opportunity cost producer of wheat, and by the same token, ROW is the low opportunity cost producer of cloth. (OC of cloth in ROW = 1/1.5 = 0.67 and OC of cloth in US = 4 / 2 = 2.0 units of wheat)

What happens if the numbers change?

a. If US activity requirement in wheat is cut in half, to 1.0 hours.
   - The US now has an absolute advantage in wheat.
   - It still has the comparative advantage in wheat, since the OC of wheat in the US has now fallen to one-quarter of a unit of cloth, much less than in the rest of the world (where the OC of cloth = 1.5 units of wheat).

b. If we return to the initial numbers and cut the activity requirement of cloth in the US in half:

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Rest of World (ROW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloth</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Wheat</td>
<td>2.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

The US has an absolute disadvantage in both goods.

The OC of cloth in the US is 1 unit of wheat and the OC of wheat in the US is 1 unit of cloth.

Therefore the US still has a comparative advantage in wheat, where the OC of wheat is 1.5 units of cloth; and the ROW has a comparative advantage in cloth, where the OC of cloth is only 0.67 units of wheat.