International Economics
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Pugel Chapter 2. Supply and Demand Analysis of International Trade

Remind yourself of the following basic concepts from introductory microeconomics:
- Distinguish between demand (the demand curve) and the quantity demanded (a point on the curve) and between supply and the quantity supplied.
- What shifts the demand curve? (changes in income, taste, price of other goods -- NOT own price change)
- What shifts the supply curve? (changes in technology, price of inputs -- NOT own price change)
- What does the slope coefficient of a demand or supply equation tell you?
- What is the relation between the slope of a demand curve and the price elasticity of demand?

- What is consumer surplus? How does it show up graphically and how can we compute it?
- What is producer surplus? What is its relation to profit? (= operating profit, but not total profit)

How do you find market equilibrium algebraically?

Warm-up exercise 1. Consider the following demand and supply equations:

\[ Q_d = 1200 - 4P \]
\[ Q_s = 2P \]

Draw a graph of the supply and demand equations.
- Get the intercepts of the demand equation exactly right.

Solve for equilibrium price and quantity.
- [Answer: \( P^* = 200, Q^* = 400 \)]

Compute consumer and producer surplus.
- [Answer:
  \[ CS = 0.5 \times (300 - 100) \times 400 = $40,000 \]
  \[ PS = 0.5 \times (200 - 0) \times 400 = $40,000 \]
]

Warm-up exercise 2. Suppose an increase in consumer incomes changes the demand equation to:

\[ Q_d = 1800 - 4P \]
\[ Q_s = 2P \]

Repeat the steps above.
Exercise 1. Suppose we have the supply and demand equations:

Supply: $P = 100 + 0.5Q_s$
Demand: $P = 1300 - 2.5Q_d$

Draw the curves in the space to the right, indicate the intercepts exactly.

Solve for equilibrium price and quantity:
Show your work clearly in the space to the right.

Equil. Price = ________________
Equil. Quantity = ________________

Calculate consumer surplus and producer surplus
Again, show your work clearly; indicate CS and PS on the graph.

Cons. surplus: ________________
Producer surplus: ________________

Exercise 2. Suppose the economy whose domestic supply and demand curves are given above is a "small economy" (cannot influence international prices) enters into international trade, and that the INTERNATIONAL price of the good is _______.

a. Is the country an importer or exporter of the good? Draw a supply-demand graph and show the quantity of imports or exports.

The country trades ________ units of the good.

b. What happens to consumer and producer surplus in the problem?

New value of CS: ________________
New value of PS: ________________

c. Explain in what sense international trade is "a good thing" on the basis of your answers.
Textbook problems for chapter 2, "The Basic Theory Using Demand and Supply"

You should review ALL problems for this (and every other) chapter. I will not often provide answers for questions already answered at the end of the text (for example, problems 1, 3, 7, 9 and 11) or which are fairly clearly explained in the text (for example, problem 4 of the text, which requires just a slight modification to problem 3, which is answered in the text).

You are responsible for doing ALL the text problems, whether an answer key has been provided or not. Please raise any questions you have about the problems in class.

Problems 1-2. Consumer surplus/producer surplus review. See the chapter 2 exercise.


Suppose the given supply and demand curves were

Supply:    \( P = 10 Q_s \) 
Equilibrium quantity = 500

Demand:  \( P = 6000 - 2 Q_d \) 
Equilibrium price = $5000

Get the equations with quantities on the left hand side:

Supply:  \( Q_s = 0.1 P \)
Demand:  \( Q_d = 3000 - 0.5 P \)

The supply of exports is: \( Q_x = Q_s - Q_d = 0.1 P - 3000 + 0.5 P = 0.6 P - 3000 \)

Note that when \( P = $5000 \), the quantity of exports is equal to zero.

If \( P \) is less than \$5000, exports will be negative -- and negative exports are the same as imports !

To avoid the awkwardness of saying "negative exports", you can derive the demand for imports equation:

The demand for imports is \( Q_m = Q_d - Q_s = 3000 - 0.5 P - 0.1 P = 3000 - 0.6 P \)

When \( P = $5000 \), the quantity of imports is equal to zero.

At \( P \) more than $5000, imports will be negative -- and negative imports are the same as exports !

Extended problem. Consider my illustration for problems 3-4 to represent the HOME country.

Find the international equilibrium.

Note that since the home price is lower in foreign, they will be the exporters of the good.

First, find foreign supply of exports and demand for imports.

Supply of exports by Foreign = \( Q_x* = Q_s* - Q_d* = 0.25 P* - 5000 + 1.00 P* = 1.25 P* - 5000 \)

Then, combine this with Home's demand for imports:

Demand for imports by Home:  \( Q_m = 3000 - 0.6 P \)

Graph the two curves to get a picture of the international market for the good.

In international equilibrium, \( Q_x* = Q_m \) and \( P* = P \), so we have

\[ 1.25 P - 5000 = 3000 - .6 P \]
\[ 1.85 P = 8000 \]

so

\[ P = 4324.32 \]
\[ Q_x* = Q_m = 405.4 \]

You could extend the problem even more by calculating what happened to consumer and producer surplus in each of the two economies. Quick answer: consumer surplus increases by more than producer surplus falls in Home; producer surplus increases by more than consumer surplus falls in Foreign.
Problems 5-6. Gains and losses from trade.

Problem 5 (answered in text, p. 677). I don't know whether the island nation of Mauritius exports winter coats, but they are a very successful tropical clothing exporter. Even if they have no domestic demand for their product, they can use foreign sales as a way of obtaining goods they do want -- cell phones, automobiles, pharmaceuticals.

Problem 6. Think of what happens to the price of scrap iron and steel when they are exported (what happened to the Foreign price of the good in the extended example?) and what happens to consumer surplus in the exporting country.

Problem 7. Once trade equalizes the prices of goods between the two countries, there is no reason to expect further growth of trade. That does not mean that the equilibrium amount of trade will be zero. (see p. 677)

Problem 8. The U.S. oil market is said to have the domestic supply and demand curves

Demand: \( P = 104.4 - 12 Q_d \) \quad \text{or} \quad Q_d = 8.7 - .0833 P

Supply: \( P = 0.5 + 17.75 Q_s \) \quad \text{or} \quad Q_s = -0.0282 + .0563 P

Autarky equilibrium would be found by setting the domestic supply price equal to the domestic demand price

\[
104.4 - 12 Q_a = 0.5 + 17.75 Q_a
\]

\[
103.9 = 29.75 Q_a
\]

\[
Q_a = 3.4924 \quad \text{(rounded to 3.5 for computational convenience below)}
\]

Hence \( P_a = 0.5 + 17.75 (3.4924) = $62.4908 \) (rounded to $62.50 for convenience below).

Note that these values imply a sharp rise from the international price (at the time the text was written) of $36 per barrel, which would considerably reduce consumer surplus.

The international trade price is $36, so at that price US consumption would be \( Q_d = 8.7 - .0833 (36) = 5.7 \) and US production would be \( Q_s = -.00282 + .0563 (36) = 2.00 \) million barrels.

Given these values, the gain in producer surplus would be

\[
\text{Gain in PS} = (62.50 - 36) 2.0 + 0.5 (62.50 - 36) (3.5 - 2.0) = 26.50 * 2.0 + 13.25 * 1.5
\]

\[
= 72.875 \text{ or almost 73 billion dollars worth of producer surplus.}
\]

and the decline in consumer surplus would be:

\[
\text{Loss in CS} = (62.50 - 36) 3.5 + 0.5 (62.50 - 36) (5.7 - 3.5) = 26.50 * 3.5 + 13.25 * 2.2
\]

\[
= 121.9 \text{ or almost 122 billion dollars worth of consumer surplus would be lost.}
\]

Label the areas between 36 and 62.50 from left to right as A, B, C, D. The gain in PS is area A plus area B. The loss in CS is area A plus area B plus area C plus area D.
Problem 2.9 and 2.10. Shifts in supply and demand

**Problem 2.9** involves a shift in the domestic demand curve. The text explains the answer qualitatively (p.677)

Quantitatively, the text supply and demand curves for the US motorbike market are:

- **Demand:** \( P = 3600 - 40 Qd \) or \( Qd = 90 - 0.025 P \)
- **Supply:** \( P = 400 + 40 Qs \) or \( Qs = -10 + 0.025 P \)

So US import demand is

\[
Qm = Qd - Qs = 90 - 0.025 P + 10 - 0.025 P = 100 - 0.05 P
\]

or

\[
P = 2000 - 20 Qm \] (which form is easier to connect with the graph of the international market on page 23)

Suppose the increase in US domestic demand resulted in a new domestic demand curve:

\[ P = 4000 - 40 Qd \] (or \( Qd = 100 - 0.025 P \))

Draw the new demand curve on the supply demand graph; recalculate the American import demand curve as

\[
Qm = Qd - Qs = 100 - 0.025 P + 10 - 0.025 P = 110 - 0.05 P
\]

or American import demand is given by the equation \( P = 2200 - 20 Qm \)

Note that the foreign supply curve (Figure 2.3B) is \( P = 700 + 6 Qx^* \)

What will be the new price of motorbikes and the new quantity of motorbikes imported into the US?

Answer: \( Qx^* = Qm = 57.6923 \) and \( P = 700 + 6 (57.6923) = 1046.15 \)

**Problem 2.10** returns us to the original supply and demand curves, and asks us to consider the impact of an increase in US productivity.

We can give a precise new supply curve as \( P = 400 + 20 Qs \) or \( Qs = -20 + .05 P \)

[Graph the curve precisely to convince yourself that this is in fact an increase in supply].

What happens to the US demand-for-imports curve?

\[
Qm = Qd - Qs = 90 - 0.025 P + 20 - 0.05 P = 110 - .075 P
\]

or the American import demand curve is \( P = 1466.67 - 13.33 Qm \)

You can calculate that the shift in US import demand will lead to a new equilibrium with

\( Qm = Qx^* = 39.6552 \) and \( P = 700 + 6 (39.655.2) = 937.93 \).

The graph of the international motorbike market shows the new US import demand in blue.
Problem 2.11. Belgian writing paper.

Domestic demand and supply:

\[ Q_d = 350 - 0.5 \ P \quad \text{or} \quad P = 700 - 2 \ Q_d \]
\[ Q_s = -200 + 5 \ P \quad \text{or} \quad P = 40 + 0.2 \ Q_s \]

Find the equilibrium values: \( P = 100 \) and \( Q = 300 \)

At an international price of 120, Belgium would EXPORT paper.

Its export supply function is \( Q_x = Q_s - Q_d = -200 + 5 \ P - (350 + 0.5 \ P) \)

or \( Q_x = -550 + 5.5 \ P \)

To calculate consumer and producer surplus changes, first draw the graph:

Label the areas between price lines 100 and 120 from left to right, as A, B, C, D.

Area A extends over to a quantity of zero, so its area is \( 290 (120 - 100) = 5800 \)

Area B is a triangle with base (300 - 290) and height (120 - 100), so its area is \( 0.5 \times 10 \times 20 = 100 \)

The loss of consumer surplus due to exporting is area A plus area B or 5900.

Area C is a triangle with base (300 - 290) and height (120 - 100) so its area is \( 0.5 \times 10 \times 20 = 100 \)

Area D is a triangle with base (400 - 300) and height (120 - 100) so its area is \( 0.5 \times 100 \times 20 = 1000 \)

The gain in producer surplus is the sum of all four areas, A, B, C and D: or 7000.

Net gain is represented by the triangles C and D, or 1100.

Belgian producers of writing paper gain more than consumers lose.

[As another exercise, change the supply curve to \( P = 5 \ Q_s \). You will find that equilibrium \( Q = 100 \) and \( P = \€ 500 \).

Let the international price be 400 euros, so Belgium will be an importer of paper.

Since \( Q_d = 350 - 0.5 \ P \), at 400 euros Belgium will demand 150 units of paper and domestic supply will be \( Q_s = 0.2 \ P = 80 \) units, so Belgian imports are 70 units. Show the situation graphically and calculate changes in surplus CS increases by 12500 and PS decreases by 9000, for a net gain of 3500]