

Our apologies for the errors contained on pages 242-245 of the textbook, Agricultural Marketing and Price Analysis, by F. Bailey Norwood and Jayson L. Lusk.

Everything under the section "The Mathematics of International Market Equilibrium," is incorrect. Below are the corrections. Again, we regret any confusion this may have caused students, instructors, and other readers.

Sincerely,

F. Bailey Norwood and Jayson L. Lusk

The Mathematics of International Market Equilibrium

International markets were previously described using supply and demand diagrams. Yet, it is often desirable to depict markets in mathematical form. When organizations calculate the impacts of trade barriers or trade agreements, they need numbers, and the numbers come from and are used in mathematical models. Using an earlier example, suppose that the U.S. cannot trade rice with Japan because of Japan's excessively high import tariffs. Consequently, the price of rice is higher in Japan. Suppose also that these tariffs are expected to be eliminated soon. We know the Japanese rice price will fall and the U.S. rice price will rise, but by how much? Answering this question requires mathematical models of supply and demand, very similar to those in covered in Chapter 3. Suppose you know the supply and demand curves in both countries, as reported in Figure 8.10. The curves are reported in U.S. dollars for Japan, which means they assume a particular exchange rate. In the next section you will learn how the supply and demand in Japan change if exchange rates move.

Using these supply and demand curves, we want to solve for the equilibrium price of rice if countries are allowed to freely trade rice (no import tariffs). We also want to know how much rice will be exported from the U.S. into Japan. For simplicity, we will assume the cost of transporting rice from the U.S. to Japan is so small we can ignore it, meaning after free trade ensues the price will be bid up in the U.S. and down in Japan until the prices are equal.

There are three general steps to calculating the new international price of rice and trade volume.

Step 1: Calculate the equilibrium price of rice in both countries if trade does not occur.

Step 2: Using these prices, find the export supply curve and the import demand curve.

Step 3: Set the export supply curve equal to the import demand curve, and solve for the equilibrium price and quantity. The price will be the international price and the quantity will be the volume traded.

U.S. Rice Market	Japan Rice Market (at exchange rate 112 yen / dollar)
Supply: $P_{\text{Dollar}} = 400 + (Q)$	Supply: $P_{\text{Dollar}} = 500 + (Q)$
Demand: $P_{\text{Dollar}} = 700 - (Q)$	Demand: $P_{\text{Dollar}} = 800 - (Q)$
P_{Dollar} = price in U.S. dollars	P_{Dollar} = price in U.S. Dollars
Q = tons	Q = tons

Figure 8.10.

Step 1: Solving for domestic prices and quantities without trade

If the U.S. and Japan did not trade, market prices would be set by the supply and demand in each country. Using the supply and demand curves for each country, let us calculate this equilibrium as shown in Chapter 4.

Equilibrium for U.S. Market

Calculate equilibrium quantity by setting supply equal to demand

$$700 - (Q) = 400 + (Q)$$

$$\Rightarrow 700 - 400 = (Q) + (Q)$$

$$\Rightarrow 300 = 2(Q)$$

$$\Rightarrow Q = 300/2 = 150$$

Use equilibrium quantity and supply/ demand curves to calculate equilibrium price.

$$P = 700 - (Q = 150) = 550 \text{ or}$$

$$P = 400 + (Q = 150) = 550$$

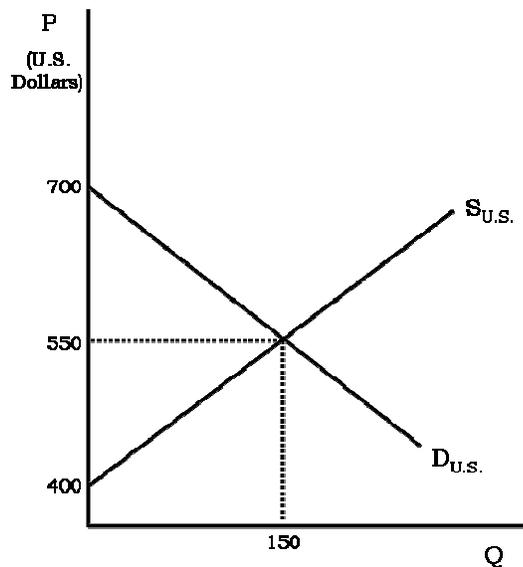


Figure 8.11. No Trade Equilibrium for U.S.

Equilibrium for Japan

Calculate equilibrium quantity by setting supply equal to demand

$$800 - (Q) = 500 + (Q)$$

$$\Rightarrow 800 - 500 = (Q) + (Q)$$

$$\Rightarrow 300 = 2(Q)$$

$$\Rightarrow Q = 300/2 = 150$$

Use equilibrium quantity and supply/demand curves to calculate equilibrium price.

$$P = 800 - (Q = 150) = 650 \text{ or}$$

$$P = 500 + (Q = 150) = 650$$

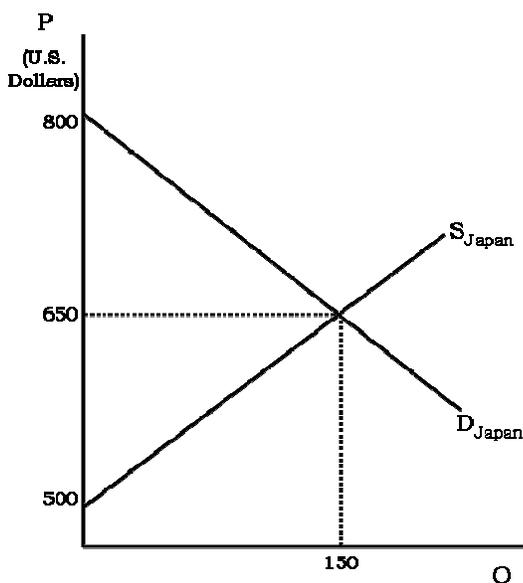


Figure 8.12. No Trade Equilibrium for Japan

Step 2: Find Export Supply and Import Demand Curves

As the above figures show, the equilibrium price in the U.S. is \$550 and \$650 in Japan. If the two countries trade, the price in the U.S. will rise and the price in Japan will fall. As the U.S. price rises, U.S. rice producers increase production and U.S. consumers purchase less. The difference between domestic production and consumption equals the exports to Japan. Notice that, starting at the price of \$550, a \$1 increase in the price of rice in the U.S. increases quantity supplied by 1 unit and decreases consumption by 1 unit in the U.S., leading to an excess supply of $1 + 1 = 2$, which will be exported to Japan. To graph an export supply curve, the new trade price will be on the y-axis and the volume traded on the x-axis. We know that with trade, price will start rising above \$550 in the U.S., and for every one dollar rise in price excess supply increases by two. Recall that the slope of a line is the rise divided by the run. In this case, the "rise" is 1 and the "run" is 2, so the slope of the export supply curve is 0.5. Thus, we know that the export supply curve has an intercept of 550 and a slope of 0.5. To obtain the export supply curve, simply take the equilibrium price as the intercept, and make the export supply curve slope equal to the inverse of the sum of the absolute value of the supply and demand curve slopes ($1 / (|1| + |1|) = 0.5$).

As the price in Japan falls, Japanese rice producers reduce their production and Japanese consumers increase their consumption, and the difference between domestic consumption and production equals Japanese rice imports from the U.S. For Japan, starting from the equilibrium price of 650, a \$1 decrease in price reduces Japanese production by 1, and increases Japanese consumption by 1, leading to imports of 2. The

“rise” (-1) divided by the “run” (2) is then -0.5. For this reason, we know that the import demand curve has an intercept of 650 and a slope of -0.5.

Step 3: Solve for price and quantity that sets export supply equal to import demand.

After trade, the price in the U.S. rises from 550 to 600, and the price in Japan falls from 650 to 600. This new common price of rice is often referred to as the international or world price of rice. The volume of trade is 100 units. The U.S. exports 100 units to Japan, which is the same way of saying Japan imports 100 units from the U.S. At this point we want to double-check our math to make sure the international market equilibrium makes sense. Notice at this world price the quantity demanded in the U.S. is 100 ($P = 700 - Q$; $600 = 700 - 100$) and quantity supplied is 200 ($P = 400 + Q$; $600 = 400 + 200$). In other words, the U.S. produces 200 units, consumes 100 of those units, and exports the remaining 100 units to Japan. Exports, or excess supply, is 100 units. In Japan, at the world price, quantity demanded is 200 ($P = 800 - Q$; $600 = 800 - 200$) and quantity supplied is 100 ($P = 500 + Q$; $600 = 500 + 100$). Japan consumes 200 units, produces 100 units, and therefore obtains the extra 100 units it needs from the U.S. Imports, or excess demand, is 100 units. Since the excess supply/exports from the U.S. equals the excess demand/imports from Japan, there is an equilibrium in world trade. The world price of 600 ensures that exports equal imports.

New Trade Equilibrium

Export Supply: $P = 550 + 0.5(Q)$

Import Demand: $P = 650 - 0.5(Q)$

Solve for Quantity Setting Export Supply Equal to Import Demand

$$550 + 0.5(Q) = 650 - 0.5(Q)$$

$$\Rightarrow 0.5(Q) + 0.5(Q) = 650 - 550$$

$$\rightarrow Q = 100$$

Solve for Equilibrium Price

$$P = 550 + 0.5(Q = 100) = 600$$

$$P = 650 - 0.5(Q = 100) = 600$$

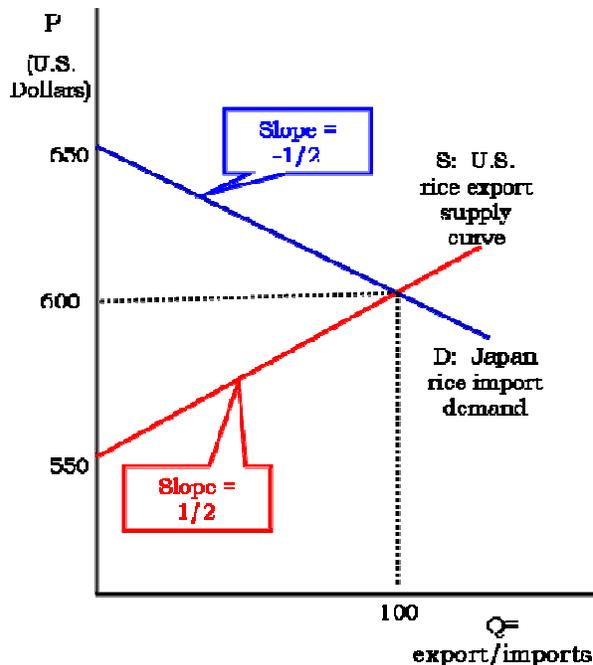


Figure 8.13. International Market Equilibrium

Figure 8.N reiterates the international market equilibrium, but shows the big picture in a three-panel diagram. This is one of the most familiar trade diagrams in

economics. Before trade, the price in Japan was higher than in the U.S. If allowed, U.S. rice producers would gladly export to Japan at a higher price, and Japan consumers would gladly import at a lower price. When trade is allowed, assuming no transportation costs, the price in both countries will equal. This new “international” or “world” price of 600 is where the export supply curve and import demand curves cross. At this price, U.S. exports of rice equal Japan imports of rice. The price of rice in each country now depends market conditions on both countries.

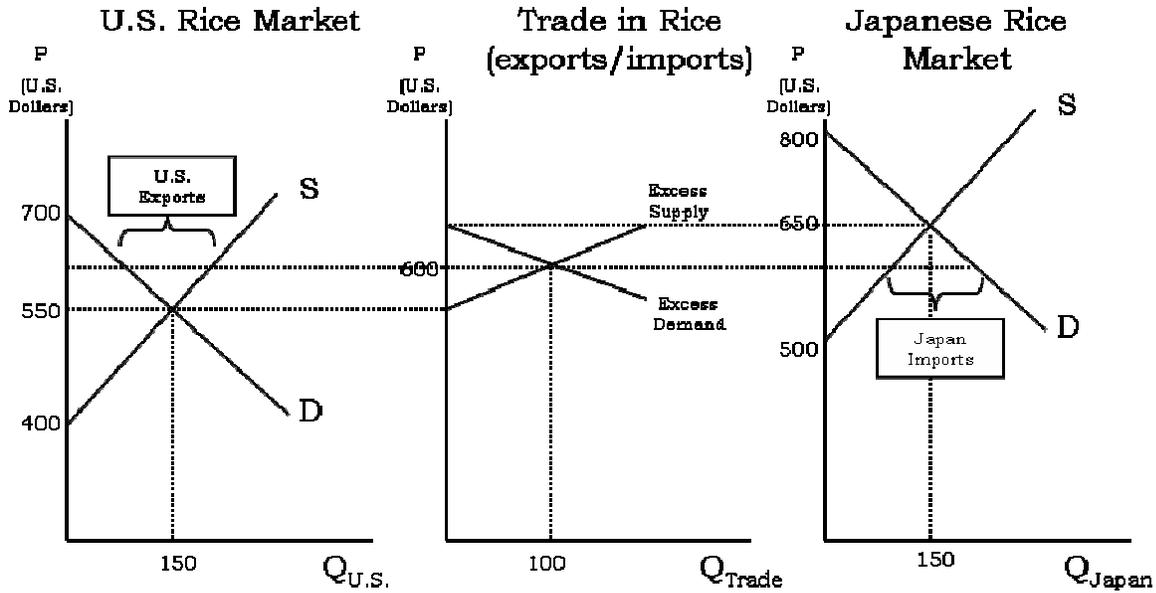


Figure 8.14. Three Panel Diagram of International Trade