Handout 6: International Trade

Mankiw Ch 9

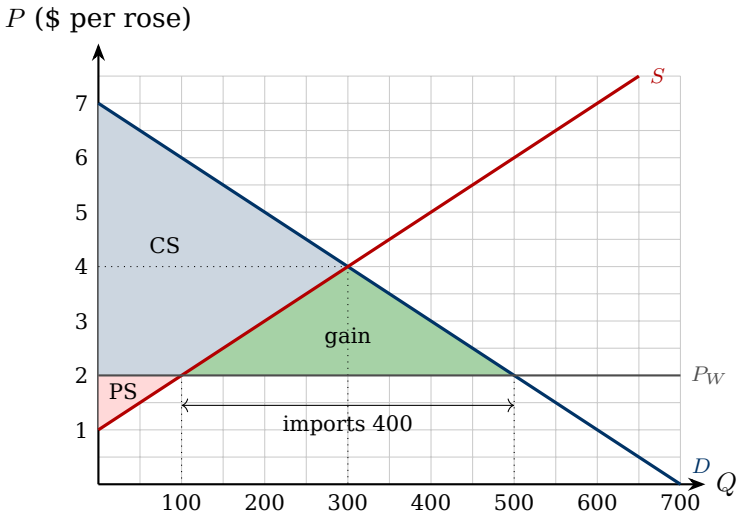
Answer key

Problem 1. Roses in Roseland

The daily market for roses in Roseland is

$$Q_d = 700 - 100P \qquad Q_s = 100P - 100$$

where P is the price of a rose in dollars and Q is roses a day. Roseland is a small economy, and the world price of a rose is $P_W = \$2$.



a) Without trade, find the equilibrium price and quantity. Compare this price with the world price. Does Roseland have a comparative advantage in roses?

> $700 - 100P = 100P - 100$, so $P_D = \$\mathbf{4}$ and $Q = \mathbf{300}$ roses.
> $P_W = \$2 < P_D = \$4$: the rest of the world grows roses at a lower opportunity cost. Roseland does **not** have the comparative advantage in roses; if it opens to trade, it will **import** them.

b) Who has more reason to lobby for free trade in roses, Roseland's consumers or its producers? Answer in two sentences, without calculations.

> **Consumers.** Free trade lowers the price of roses from \$4 to \$2, so buyers gain and Roseland's growers lose. (In practice the growers are few and organized, while each buyer gains only a little, so the growers' lobbying against free trade is often louder; see (e).)

c) Roseland allows free trade with no tariff. What is the price of roses in Roseland? How many roses do Roseland's buyers want, how many do its growers sell, and how many are imported? Mark them on the graph.

The price falls to $P_W = \$\mathbf{2}$. $Q_d = 700 - 200 = \mathbf{500}$, $Q_s = 200 - 100 = \mathbf{100}$, imports $= 500 - 100 = \mathbf{400}$.

d) Find consumer surplus, producer surplus and total surplus without trade and with free trade. How much does each change? What is the gain from trade? Shade the areas on the graph.

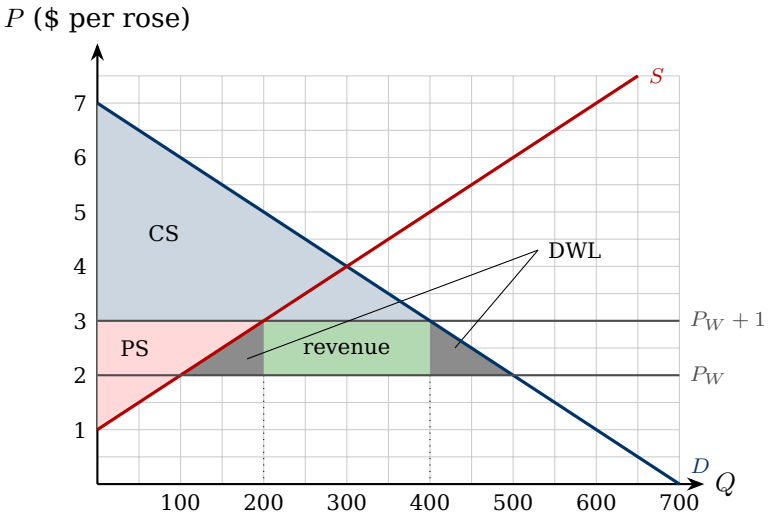
Demand reaches $Q = 0$ at $P = 7$; supply starts at $P = 1$.
No trade: CS $= \frac{1}{2} \times 300 \times (7-4) = \$450$, PS $= \frac{1}{2} \times 300 \times (4-1) = \$450$, TS $= \$900$.
Free trade: CS $= \frac{1}{2} \times 500 \times (7-2) = \$1{,}250$, PS $= \frac{1}{2} \times 100 \times (2-1) = \$50$, TS $= \$1{,}300$.
CS **rises by \$800** $= 2 \times \frac{300+500}{2}$; PS **falls by \$400** $= 2 \times \frac{100+300}{2}$.
Gain from trade = \$400 $= \frac{1}{2} \times 400 \times 2$, the green triangle: buyers gain more than growers lose.

e) Roseland now trades freely. Who has more reason to lobby for a tariff on imported roses, consumers or producers? Answer in two sentences, without calculations.

Producers. A tariff raises the price of roses in Roseland, so growers sell more at a higher price while buyers pay more. Each grower's gain is large and the loss is spread over many buyers, which is why tariffs get lobbied for.

f) The growers win: Roseland puts a **\$1 tariff** on each imported rose. Find the new price, the quantities bought and grown in Roseland, and imports. Then find consumer surplus, producer surplus, tariff revenue, total surplus and the deadweight loss.

Price $= 2 + 1 = \$\mathbf{3}$. $Q_d = 700 - 300 = \mathbf{400}$, $Q_s = 300 - 100 = \mathbf{200}$, imports $= \mathbf{200}$.
CS $= \frac{1}{2} \times 400 \times (7-3) = \$\mathbf{800}$. PS $= \frac{1}{2} \times 200 \times (3-1) = \$\mathbf{200}$. Revenue $= \$1 \times 200 = \$\mathbf{200}$.
TS $= 800 + 200 + 200 = \$\mathbf{1{,}200}$, \$100 below free trade.
Deadweight loss = \$100, two triangles: $\frac{1}{2} \times (200-100) \times 1 = 50$ for the extra 100 roses grown at home at a cost above \$2, and $\frac{1}{2} \times (500-400) \times 1 = 50$ for the 100 roses buyers valued above \$2 but no longer buy.



g) Rank total surplus under no trade, free trade and the \$1 tariff. Is the tariff better or worse for Roseland than no trade at all?

> Free trade \$1,300 > tariff \$1,200 > no trade \$900. The tariff throws away \$100 of the \$400 gain from trade, but Roseland still keeps \$300 of it: a tariff is **better than no trade** and **worse than free trade**.

h) A bill would cut the tariff to \$0.50. Who lobbies for the bill, and who against? Find the deadweight loss of the \$0.50 tariff. The tariff is cut in half; what happens to the deadweight loss?

> Consumers lobby **for** the cut (the price falls to \$2.50); growers lobby **against**.
> At \$2.50: $Q_d = 450$, $Q_s = 150$, imports 300, revenue $0.50 \times 300 = \$150$.
> DWL $= \frac{1}{2} \times 50 \times 0.50 + \frac{1}{2} \times 50 \times 0.50 = 12.50 + 12.50 = \$\mathbf{25}$.
> Halving the tariff cuts the deadweight loss to **a quarter** (\$100 to \$25): both the base and the height of each triangle are halved. The deadweight loss of a tariff, like that of a tax, grows with the square of its size.

i) The president of Roseland opposes the cut: "Everything can be made more cheaply abroad. The tariff protects Roseland's jobs. Roseland first!" Do you agree? Answer in three or four sentences.

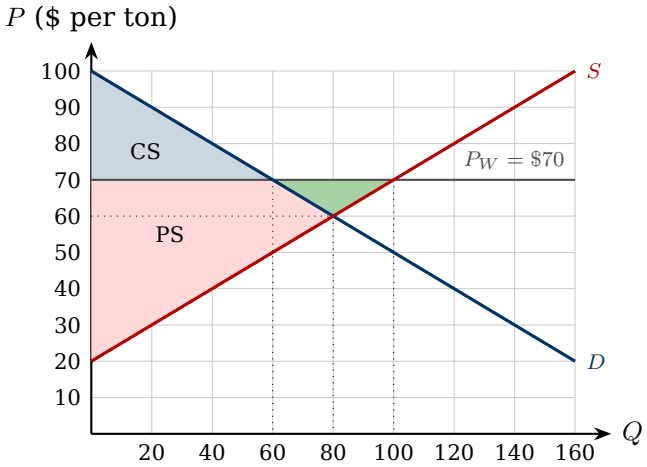
> **No.** Even if other countries can make everything more cheaply (an absolute advantage in everything), Roseland still has a **comparative** advantage in some goods, and it gains by exporting those and importing roses. The tariff does keep more rose growers at work (output rises from 100 to 200 roses), but buyers lose \$450 to give growers \$150 and the government \$200; the \$100 deadweight loss is a pure loss. Jobs are not lost on net either: fewer roses imported means fewer dollars abroad to buy Roseland's exports, so jobs in Roseland's export industries shrink.

Problem 2. Steel exports and an export subsidy

The market for steel in Hamsterdam is

$$Q_d = 200 - 2P \qquad Q_s = 2P - 40$$

where P is the price in dollars per ton and Q is tons a day. Hamsterdam is a small economy.



a) Without trade, find the equilibrium price and quantity, consumer surplus and producer surplus. Draw both curves on the grid.

$200 - 2P = 2P - 40$, so $P_D = \$\mathbf{60}$, $Q = \mathbf{80}$ tons. Demand reaches $Q = 0$ at $P = 100$; supply starts at $P = 20$.
CS $= \frac{1}{2} \times 80 \times (100 - 60) = \$\mathbf{1{,}600}$. PS $= \frac{1}{2} \times 80 \times (60 - 20) = \$\mathbf{1{,}600}$. TS $= \$3{,}200$.

b) Hamsterdam opens to trade and **exports** steel. Is the world price \$50 or \$70? Explain. At that price, how much steel do Hamsterdam's buyers want, how much do its producers make, and how much is exported?

\$70. A country exports when the world price is above its own no-trade price (\$60): its producers can sell abroad for more than at home. At \$50 Hamsterdam would import.
At \$70: $Q_d = 200 - 140 = \mathbf{60}$, $Q_s = 140 - 40 = \mathbf{100}$, exports $= \mathbf{40}$ tons.

c) Find consumer surplus, producer surplus and total surplus with trade. Who is better off and who is worse off than without trade? By how much does total surplus change?

CS $= \frac{1}{2} \times 60 \times (100 - 70) = \$\mathbf{900}$, down \$700 $= 10 \times \frac{80+60}{2}$.
PS $= \frac{1}{2} \times 100 \times (70 - 20) = \$\mathbf{2{,}500}$, up \$900 $= 10 \times \frac{80+100}{2}$.
TS $= \$3{,}400$, **up \$200** $= \frac{1}{2} \times 40 \times 10$ (the green triangle). In an exporting country, producers gain and domestic buyers lose, because buyers now pay the world price; the producers' gain is larger.

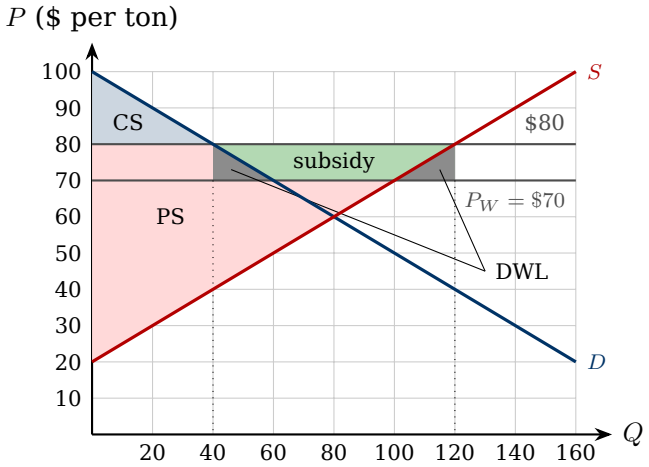
d) The government pays producers a **\$10 subsidy for each ton exported**. Foreign buyers still pay \$70, and steel sold abroad cannot be brought back. What price do Hamsterdam's buyers now pay? How much steel do they buy, how much do producers make, and how much is exported?

A producer gets $70 + 10 = \$80$ for a ton sold abroad, so it will not sell at home for less: the domestic price rises to **\$80**, and producers receive \$80 on every ton.
$Q_d = 200 - 160 = \mathbf{40}$, $Q_s = 160 - 40 = \mathbf{120}$, exports $= \mathbf{80}$ tons (doubled).

e) Find the change in consumer surplus, producer surplus and government spending

from the subsidy, and the change in total surplus. Would you advise Hamsterdam to subsidize steel exports?

CS $= \frac{1}{2} \times 40 \times (100 - 80) = \$400$: **down \$500**.
PS $= \frac{1}{2} \times 120 \times (80 - 20) = \$3{,}600$: **up \$1,100**.
Government spending $= \$10 \times 80 = \$$**800**.
Total surplus changes by $-500 + 1{,}100 - 800 = -\$$**200**: a deadweight loss of \$200, two triangles of $\frac{1}{2} \times 20 \times 10 = 100$. One is the 20 tons buyers no longer buy though they value them above \$70; the other is the 20 extra tons made at a cost above the \$70 they sell for abroad.
No. Producers gain, but buyers and taxpayers lose more. Here TS falls back to \$3,200, the no-trade level: the subsidy wipes out the whole gain from trade.



Problem 3. Televisions

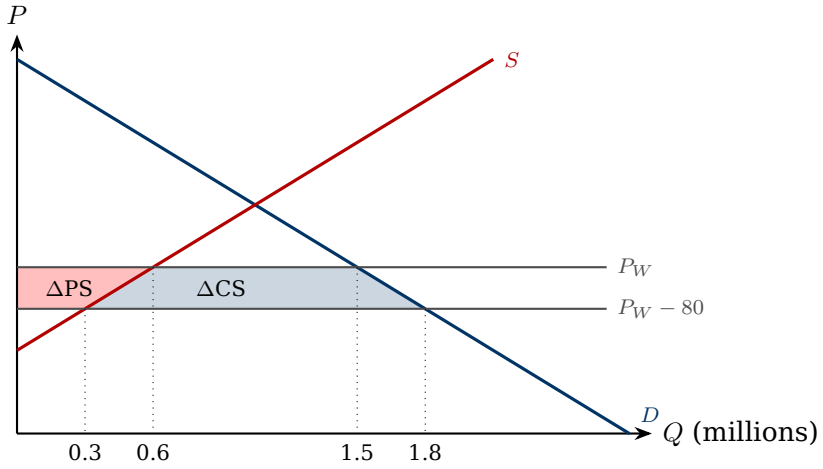
The United States imports televisions, with no trade restrictions. U.S. buyers purchase 1.5 million televisions a year: 600,000 made in the United States and 900,000 imported.

a) Sketch U.S. demand and supply for televisions, with the world price. Mark the quantities bought, made at home and imported.

The world price is below the no-trade price. At P_W: domestic supply 0.6 million, domestic demand 1.5 million, imports the 0.9 million gap. See the figure.

b) A technological advance in Japan lowers the world price of televisions by \$80. U.S. buyers now purchase 1.8 million: 300,000 made at home and 1.5 million imported. Show the change on your graph.

Draw a second world-price line \$80 lower. Buyers move down the demand curve to 1.8 million; U.S. producers move down the supply curve to 0.3 million; imports widen to 1.5 million. Neither curve shifts.



c) Rank consumer surplus and producer surplus under no trade, trade before the price fall and trade after it. Then find how much consumer surplus and producer surplus change when the world price falls by \$80 (take the curves to be straight lines).

CS: no trade $<$ trade before $<$ trade after. PS: the reverse, no trade $>$ trade before $>$ trade after. Each fall in the price raises CS and lowers PS.
$\Delta\text{CS} = 80 \times \frac{1.5+1.8}{2}$ million $= +\$\mathbf{132\ million}$ (the blue area).
$\Delta\text{PS} = -80 \times \frac{0.6+0.3}{2}$ million $= -\$\mathbf{36\ million}$ (the red area, part of the buyers' gain).
Total surplus rises by **\$96 million**.

d) U.S. television makers ask for a tariff. Who would gain from it, and who would lose? Would the United States as a whole gain?

U.S. **television makers** (and their workers) gain: the price rises by the tariff and they sell more. The **government** collects the revenue. **Buyers** lose more than both gain together, since they pay more and buy fewer: the difference is the deadweight loss. The country as a whole **loses**.

Problem 4. Short questions

Answer each in two or three sentences.

a) Denmark imports computer chips at a world price of \$12 and charges a \$5 tariff on each one. If Denmark removes the tariff, what happens to the price of chips in Denmark, the number of chips Danish firms sell, imports, Danish buyers and total surplus?

The price falls from \$17 to **\$12**. Danish producers move down their supply curve and sell **fewer** chips; buyers buy more, so **imports rise** on both counts. Buyers are **better off**, and **total surplus rises**: the deadweight loss of the tariff disappears. (Danish producers and the tariff revenue lose.)

b) A small country imports tricycles. The price of tricycle helmets falls. What happens to the price of tricycles in the country, the quantity its producers make, and its

imports?

Helmets and tricycles are complements, so the **demand** for tricycles shifts right. A small country takes the world price as given, so the **price does not change** and domestic producers make the **same quantity**. The whole increase in demand is met by **more imports**.

c) Instead of the $1 tariff in Problem 1, Roseland limits rose imports to 200 a day. What is the price of roses, and how does the outcome compare with the tariff? Who gets the $200 that the tariff raised?

With only 200 imported, the price must rise until $Q_d - Q_s = 200$: $(700 - 100P) - (100P - 100) = 200$ gives $P = \$3$, **the same as the tariff**. Quantities, CS, PS and the $100 deadweight loss are the same.
The $200 goes to whoever holds the **import licenses** (they buy at $2 and sell at $3), often foreign firms, unless the government **auctions** the licenses, in which case it collects the $200 as with the tariff.

d) "The cost of the 2018–2020 U.S. tariffs on Chinese goods fell mainly on American households." Agree, disagree or uncertain? Use the tariff diagram.

Agree, for a small importer. The world price does not move, so the U.S. price rises by the **full tariff**: U.S. buyers pay it, through higher prices for the goods and for the parts U.S. firms use. Studies of these tariffs (Amiti, Redding and Weinstein 2019; Fajgelbaum et al. 2020) found U.S. import prices rose by about the full amount of the tariff. Chinese exporters bear part of it only if the U.S. is large enough that the tariff pushes the world price down.