

PROBLEM 1

- 1.1** True. According to the specific factors model opening to trade will increase the relative price of the good in the export sector, and the specific factor in the sector whose relative price increases will gain.
- 1.2** False. A country will tend to produce relatively more of goods that use its abundant resources intensively. The Hecksher-Ohlin theorem states that a country then exports this good.
- 1.3** False. There are aggregate gains, but there are both winners and losers. The owners of a country's scarce factor lose from trade.
- 1.4** True. A small country cannot affect foreign export prices, so a tariff raises the domestic price of the imported good by the full amount of the tariff.
- 1.5** True. A large country may have incentives to protect its industries to obtain terms of trade gains given the other countries' trade policy. However the other large countries have the same incentives, so they may end up in a suboptimal (Prisoner's dilemma type) equilibrium. They would all be better off under free trade, which may be achieved through international negotiations.

PROBLEM 2

Consider a world consisting of two identical countries, Denmark and Sweden. There is one firm in each country producing a homogenous product, z , with constant marginal costs $c = 1$. Demand in each country is given by $p = 9 - z$, where p is the price of z . Consider first the situation without international trade.

Question 2.1: State the Danish firm's profit maximization problem and find the profit maximizing price, p^M , quantity, z^M , and profit level π^M . Show that welfare, measured as the sum of profits and consumer's surplus, equals 24.

The Home firm's profit maximization problem is

$$\begin{aligned}\max \pi &= pz - z \\ &= (9 - z)z - z\end{aligned}$$

The first order condition is

$$\frac{\partial \pi}{\partial z} = 9 - 2z - 1 = 0,$$

so $z^M = 4$ and $p^M = 5$. The profit therefore is $\pi^M = 5 * 4 - 4 = 16$.

Consumer surplus is

$$\begin{aligned}CS &= \frac{1}{2}(9 - p^M)z^M \\ &= \frac{1}{2}(9 - 5)4 \\ &= 8,\end{aligned}$$

so welfare is $W^M = 24$.

International trade is now possible, and the Danish and Swedish markets for good z are characterized by Cournot competition. The quantities sold by the Danish firm for the Danish and Swedish markets are denoted x and x^* respectively. Likewise, the quantities sold by the Swedish firm are denoted y and y^* , such that the total quantity sold in Denmark is given by $z = x + y$, and the total quantity sold in Sweden is $z^* = x^* + y^*$. Markets are segmented by iceberg transport costs $g < 1$, so that $\frac{1}{g} > 1$ units must be shipped for 1 unit to arrive.

Question 2.2: State the Danish and Swedish firm's profit maximization problems and derive their reaction functions for the Danish market. Illustrate the reaction functions in a diagram with x and y on the axes.

The Danish firm's profit is

$$\pi = (9 - (x + y))x + (9 - (x^* + y^*))x^* - x - \frac{1}{g}x^*.$$

Maximization with respect to x yields

$$\frac{\partial \pi}{\partial x} = 9 - (x + y) - x - 1 = 8 - 2x - y = 0$$

which can be solved to give the Danish firm's reaction function $x = \frac{8-y}{2}$. The Swedish firm's profit is

$$\pi^* = (9 - (x + y))y + (9 - (x^* + y^*))y^* - y^* - \frac{1}{g}y.$$

Maximization wrt. y gives

$$\frac{\partial \pi^*}{\partial y} = 9 - (x + y) - y - \frac{1}{g} = 9 - 2y - x - \frac{1}{g},$$

which can be solved to give the Swedish firm's reaction function $y = \frac{9-x-\frac{1}{g}}{2}$.

Question 2.3: *Find the Cournot Nash equilibrium price and quantities. What is the condition for trade to take place? Interpret this condition.*

The Cournot Nash equilibrium is determined by the intersection of the two reaction functions. Solving the two equations for x and y we get

$$\begin{aligned} x &= \frac{8-y}{2} \\ &= \frac{8 - \frac{9-x-\frac{1}{g}}{2}}{2} \\ &= \frac{7+x+\frac{1}{g}}{4} \\ x^{CN} &= \frac{7+\frac{1}{g}}{3} \end{aligned}$$

and

$$\begin{aligned}y^{CN} &= \frac{9 - x^{CN} - \frac{1}{g}}{2} \\&= \frac{9 - \frac{7 + \frac{1}{g}}{3} - \frac{1}{g}}{2} \\&= \frac{10 - \frac{2}{g}}{3}.\end{aligned}$$

Thus the total quantity in the market is

$$\begin{aligned}z^{CN} &= x^{CN} + y^{CN} \\&= \frac{7 + \frac{1}{g}}{3} + \frac{10 - \frac{2}{g}}{3} \\&= \frac{17 - \frac{1}{g}}{3},\end{aligned}$$

and so the price is $p^{CN} = 9 - \frac{17 - \frac{1}{g}}{3} = \frac{10 + \frac{1}{g}}{3}$.

Trade takes place if

$$y = \frac{10 - \frac{2}{g}}{3} > 0$$

or

$$\frac{1}{g} < 5 = p^M$$

That is, trade occurs if the monopoly price covers the marginal cost of exporting.

Assume now that $\frac{1}{g} = 2$.

Question 2.4: Find the welfare level for Denmark (hint: use that the solutions are symmetric in the two countries). Are there gains from trade?

Prices and quantities now are

$$\begin{aligned}x^{CN} &= \frac{7 + \frac{1}{g}}{3} = 3 \\y^{CN} &= \frac{10 - \frac{2}{g}}{3} = 2 \\z^{CN} &= \frac{17 - \frac{1}{g}}{3} = 5 \\p^{CN} &= \frac{10 + \frac{1}{g}}{3} = 4\end{aligned}$$

Consumer's surplus is given by

$$\begin{aligned}
 CS^{CN} &= \frac{1}{2} (9 - p^{CN}) z^{CN} \\
 &= \frac{1}{2} (9 - 4) 5 \\
 &= 12.5.
 \end{aligned}$$

The total profit of the Home firm is

$$\begin{aligned}
 \pi^{CN} &= p^{CN} x^{CN} + p^{*CN} x^{*CN} - cx^{CN} - \frac{c}{g} x^{*CN} \\
 &= p^{CN} x^{CN} + p^{CN} y^{CN} - cx^{CN} - \frac{c}{g} y^{CN} \\
 &= p^{CN} z^{CN} - cx^{CN} - \frac{c}{g} y^{CN} \\
 &= 4 * 5 - 3 - 2 * 2 \\
 &= 13.
 \end{aligned}$$

Welfare is then

$$\begin{aligned}
 W^{CN} &= CS^{CN} + \pi^{CN} \\
 &= 12.5 + 13 = 25.5.
 \end{aligned}$$

That is, there are gains from trade since the welfare level in the closed economy is 24.

Question 2.5: *Use a diagram to illustrate and explain conflicting trade effects on welfare (the pro-competitive effect and waste due to transport costs). What effect dominates according to empirical evidence?*

The pro-competitive effect arises because competition is intensified by the entry of the Foreign firm on the market as reflected in a lower price. Cross hauling the product across the border is wasteful in the sense that transport costs are incurred, and this represents a loss. These effects can be illustrated in a diagram as Figure 2 in Brander and Krugman (1983). According to the empirical investigation by Friberg and Ganslandt (2006) (and the lecture slides), even in cases where the assumptions in the reciprocal dumping model likely are satisfied and the probability of a negative welfare effect is maximized, a positive welfare effect from trade is found. So the pro-competitive effect dominates.