International Economics
June 2010
Answer key

PROBLEM 1

1.1 False. Distance between trade partners (and other factors) are also found to strongly explain trade between any two countries.

1.2 True. U.S. is relatively capital abundant and relatively labor scarce, so according to the Hecksher-Ohlin model U.S. should export capital intensive goods and import labor intensive goods. Leontief found that this was not the case.

1.3 False. International trade allows creation of a larger integrated market that offers consumers a greater variety of products, but each firm produces at larger scale and thus at lower average costs and prices.

1.4 False. It is found that rich countries produce less manufacturing and more services (that pollute less), and they also impose stricter environmental regulations. So at some point further growth may reduce environmental damage.

1.5 True. Producer surplus increases, and there are quota rents that possibly are earned by domestic license holders. However, import quotas have no terms of trade effects for small countries, and so the fall in consumer surplus will dominate the gains from higher producer surplus and quota rents.

1.6 False. Vertical foreign direct investments (outsourcing) may increase if trade costs fall, but horizontal foreign direct investments will fall because it becomes cheaper to serve a foreign market by exporting, while scale economies may be exploited by keeping production at home.

1.7 True. Skill biased technological change, such as the introduction of computers, will lead to a higher share of skilled relative to unskilled workers within industies (corresponding to employment changes within industries). This is in contrast to increased import penetration, that will lead to employment change between industries. Feenstra and Hanson show that skill biased technological change (together with outsourcing) explains the change in the relative demand for skilled labor that has taken place the U.S., where employment has changed within (and not between) industries.

PROBLEM 2

Question 2.1: *State the Home 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 $\frac{3}{4}$.*

The Home firm's profit maximization problem is

$$\begin{aligned} \max \pi &= pz - 2z \\ &= (4 - 2z)z - 2z \end{aligned}$$

The first order condition is

$$\frac{\partial \pi}{\partial z} = 4 - 4z - 2 = 0,$$

so $z^M = \frac{1}{2}$ and $p^M = 3$. The profit therefore is $\pi^M = (3-2)\frac{1}{2} = \frac{1}{2}$.

Consumer surplus is

$$CS = \frac{1}{2}(4 - p^M)z^M = \frac{1}{4},$$

so welfare is $W^M = \frac{3}{4}$.

Question 2.2: *State the Home and Foreign firm's profit maximization problems and derive their reaction functions for the Home market. Illustrate the Cournot Nash equilibrium solution graphically. Is it a stable equilibrium?*

The Home firm's profit is

$$\pi = (4 - 2(x + y))x + (4 - 2(x^* + y^*))x^* - 2x - (2 + t)x^*.$$

Maximization with respect to x yields

$$\frac{\partial \pi}{\partial x} = 4 - 2(x + y) - 2x - 2 = 2 - 4x - 2y = 0$$

which can be solved to give the Home firm's reaction function $x = \frac{1-y}{2}$. The Foreign firm's profit is

$$\pi^* = (4 - 2(x + y))y + (4 - 2(x^* + y^*))y^* - 2y^* - (2 + t)y.$$

Maximization wrt. y gives

$$\frac{\partial \pi^*}{\partial y} = 4 - 2(x + y) - 2y - 2 - t = 2 - 4y - 2x - t,$$

which can be solved to give the Foreign firm's reaction function $y = \frac{2-2x-t}{4}$.

A figure with the two reaction functions will show that the Home firm's reaction function has a steeper slope than the Foreign firm's reaction function. Therefore if one of the firms deviates from the Nash solution the two firms will gradually end up in the Nash solution. So it is a stable solution. This is also evident from the fact that the two firms' quantities are strategic substitutes:

$$\begin{aligned}\frac{\partial^2\pi}{\partial x\partial y} &= -2 < 0\\ \frac{\partial^2\pi^*}{\partial x\partial y} &= -2 < 0.\end{aligned}$$

Question 2.3: *Show that the Cournot Nash equilibrium quantity and price for the Home market are given by* $z^{CN} = \frac{4-t}{6}$ *and* $p^{CN} = \frac{8+t}{3}$*. Compared to the closed economy solution in question 2.1, what has happened to the price? Explain.*

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

$$\begin{aligned}x &= \frac{1-y}{2}\\ &= \frac{1-\frac{2-2x-t}{4}}{2}\\ &= \frac{1}{4}+\frac{1}{4}x+\frac{1}{8}t\\ &= \frac{1}{3}+\frac{1}{6}t,\end{aligned}$$

and

$$\begin{aligned}y &= \frac{2-2\frac{1-y}{2}-t}{4}\\ &= \frac{1+y-t}{4}\\ &= \frac{1}{3}-\frac{1}{3}t\end{aligned}$$

Thus the total quantity in the market is

$$\begin{aligned} z^{CN} &= x + y \\ &= \frac{1}{3} + \frac{1}{6}t + \frac{1}{3} - \frac{1}{3}t \\ &= \frac{2}{3} - \frac{1}{6}t \\ &= \frac{4-t}{6}, \end{aligned}$$

and so the price is $p^{CN} = 4 - 2\frac{4-t}{6} = \frac{8+t}{3}$.

Trade occurs whenever $y > 0 \Rightarrow \frac{1}{3} - \frac{1}{3}t > 0 \Rightarrow t < 1$. This means that $p^{CN} = \frac{8+t}{3} < 3 = p^M$. So trade leads to a lower price through the procompetitive effect.

Question 2.4: *Find the welfare level for the Home country (hint: use that the solutions are symmetric in the two countries). Determine how trade affects welfare when i) there are no transport costs, and ii) when transport costs are just below the trade prohibitive level.*

Consumer's surplus is given by

$$\begin{aligned} CS^{CN} &= \frac{1}{2}\left(4 - p^{CN}\right) z^{CN} \\ &= \frac{1}{2}\left(4 - \frac{8+t}{3}\right)\frac{4-t}{6} \\ &= \left(\frac{4-t}{6}\right)^2. \end{aligned}$$

The total profit of the Home firm is

$$\begin{aligned} \pi^{CN} &= p^{CN}x^{CN} + p^{*CN}x^{*CN} - 2x^{CN} - (2+t)x^{*CN} \\ &= (p^{CN} - c)z^{CN} - ty^{CN} \\ &= \left(\frac{8+t}{3} - 2\right)\frac{4-t}{6} - t\frac{1-t}{3} \\ &= \frac{8 - 4t + 5t^2}{18}. \end{aligned}$$

Welfare is

$$\begin{aligned} W^{CN}(t) &= CS^{CN} + \pi^{CN} \\ &= \left(\frac{4-t}{6}\right)^2 + \frac{8-4t+5t^2}{18} \\ &= \frac{32-16t+11t^2}{36}. \end{aligned}$$

Whithout transport costs the welfare level is $W^{CN}(0) = \frac{8}{9} > W^M = \frac{3}{4}$. Without transport costs only the procompetitive effect influences welfare, and the procompetitive effect always improves welfare.

The trade prohibitive level of transport costs is given by $y = 0 \Leftrightarrow t = 1$. A marginal change in transport costs has the following effect on welfare

$$\frac{\partial W^{CN}(t)}{\partial t} = \frac{-16+22t}{36},$$

so reducing transport costs slightly below the trade prohibitive level we get

$$\left.\frac{\partial W^{CN}(t)}{\partial t}\right|_{t=1} = \frac{-16+22}{36} = \frac{1}{6} > 0.$$

In other words, there will be a drop in welfare when transport costs are reduced from the trade prohibitive transport cost level. The reason is that at this level the welfare loss from wasteful transport is relatively large and it dominates the procompetitive effect.