International Economics August 2019 - suggested answers

Problem 1 - 50 per cent

1.1. A country gains from trade even if it has higher productivity than its trading partner in all industries.

True

1.2. The Rybczynski theorem states that an increase in the supply of labor will, holding prices constant, lead to a fall in the price of the capital-intensive good.

False[1]

1.3. Imperfect competition gives governments incentives to subsidize exports, but these policies can be jointly suboptimal.

True. In the Brander Krugman model both countries have an incentive to subsidize exports, but the resulting equilibrium lowers prices and is suboptimal.

1.4. The classical trade models (the Heckscher–Ohlin model and the Ricardian model) are well-suited to explain all three of the following facts: The increase in income inequality in the developed world, the decrease in the labor share in the developed world, the rise in income inequality in the deveveloping world.

False. They can explain the first two, but not the latter.

1.5. Brexit is expected to disproportionately affect low-wage workers

False: It is expected to be proportional across income groups.

1.6. Imposing an import quota or imposing and import tariff are equivalent when markets are competitive and the home government sells the quota (and gets the revenue).

True.

1.7. In a competitive market, a foreign country strictly prefers a voluntary export constraint to an import tariff that reduces imports by the same amount.

True. Prices are then higher instead of lower

Problem 2

Consider a market in country C with an inverse demand function of:

$$p(D),$$

where p is the price that results from total consumption of D units. $p'(D) < 0$ and $p''(D) \leq 0$.

Country C does not itself have a firm that can service this market. Country A and B each have one firm that can. They each have constant marginal costs of c_A and c_B, with $c_A \geq c_B$ where for simplicity we suppose that c_A and c_B are close enough that both firms will be producing throughout. The two firms choose

[1] *This question is somewhat poorly written and a lot of flexibility has been given for the answers*

how much to produce, q_A and q_B, simultanously, i.e. they play a simultanous move game where actions are quantitites.

a) Show that (a) Nash equilibrium is given by:

$$p'(q_A + q_B)q_A + p(q_A + q_B) - c_A = 0,$$

$$p'(q_A + q_B)q_B + p(q_A + q_B) - c_B = 0,$$

and show what the necessary constraint is for firm A to have positive production.

Answer: The maximization problem for firm A is :

$$max_{q_A} p(q_A + q_B)q_A - c_A q_A,$$

where the first order condition is

$$p'(q_A + q_B)q_A + p(q_A + q_B) - c_A$$

and analogously for firm B. To ensure that both first order conditions are binding we must ensure that firm A would want to produce when firm B is a monopolist (i.e. there is no equilibrium with just firm B producing). That is:

$$p'(q_B)q_B + p(q_B) - c_B = 0,$$

$$p(q_B) > c_A,$$

which gives:

$$c_B - p'(q_B)q_B > c_A,$$

where q_A is the production of firm B if it were a monopolist.

b) Show that the response functions (A's best response to production by firm B and $B's$ best response to production by firm A) are downward sloping and argue that this means the equilibrium is unique. Interpret

Answer: Write the first order condition for firm A as:

$$\phi(q_A; q_B, c_A) = p'(q_A + q_B)q_A + p(q_A + q_B) = 0,$$

which defines the quantity $q_A(q_B, c_A)$ as a function of q_B and c_A. The second order condition requires $\partial\phi/\partial q_A < 0$. Then differentiate wrt q_B to get:

$$\frac{\partial\phi}{\partial q_A}\frac{\partial q_A(q_B, c_A)}{\partial q_B} + \frac{\partial\phi}{\partial q_B} = 0 \Leftrightarrow$$

$$\frac{\partial q_A(q_B, c_A)}{\partial q_B} = \frac{\frac{\partial\phi}{\partial q_B}}{-\frac{\partial\phi}{\partial q_A}},$$

which will have the same sign as $\partial\phi/\partial q_B$. This is:

$$\frac{\partial\phi}{\partial q_B} = p''q_A + p' < 0,$$

which is negative by assumption. There are two effects on the production of firm A from an increase in production by firm B: Higher B will reduce the price which will make production less profitable by itself. But it will also increase the negative effect on the price of higher production, i.e. ($p'' < 0$).

To show that the equilibrium is unique we in addition require that one best response function is always steeper at the intersection. For this write:

$$\frac{\partial q_A(q_B, c_A)}{\partial q_B} = \frac{\frac{\partial \phi}{\partial q_B}}{-\frac{\partial \phi}{\partial q_A}} = -\frac{p'' q_A + p'}{p'' q_A + 2p'} > -1.$$

By analogous argument we also have for the best response function of firm B:$\partial q_B(q_A, c_B)/\partial q_A > -1$. This means that in a figure with q_B out the x-axis and q_A out the y-axis the slope of $q_A(q_B, c_A)$ will always be flatter than $q_B(q_A, c_B)$ and therefore the equilibrium is unique. (This wasn't particularly clearly articulated in the question so full points will be given even if the argument for uniqueness is not complete).

c) Show that firm B will be producing (weakly) more than firm A. Interpret

Answer: Subtract the two first order conditions:

$$p'(q_A + q_B)(q_A - q_B) = (c_A - c_B),$$

from which it follows that $c_A - c_B$ implies $q_A < q_B$ because $p' < 0$. Higher production will reduce price which will reduce profits on existing production. If firm B has bigger production this will hurt it disproportionately. It can only bear this if it has lower production costs.

d) Suppose that country A imposes an export subsidy of s per unit exported to country C. Show that this will increase firm A's production and reduce firm B's production. Interpret

Answer: The first order condition is now:

$$p'(q_A + q_B)q_A + p(q_A + q_B) - c_A + s = 0,$$

where a higher s will increase production for given q_B due to the first order condition. Specifically, we can define the optimal q_A by writing the first order condition as

$$\phi(q_A, s) = 0,$$

such that:

$$\frac{dq_A}{ds} = -\frac{\partial \phi}{\partial s} / \frac{\partial \phi}{\partial q_A}.$$

$\partial \phi / \partial q_A < 0$ by the second order condition and $\partial \phi / \partial s$ is positive by inspection. Hence, q_A will rise. We have already argued that this will reduce production by firm B.

In the following suppose the inverse demand function is given by:[2]

$$p(D) = A - BQ,$$

[2] *This additional assumption (linear demand curve) was accidentally cut out of the exam version. Students who assumed linear demand functions earlier on have therefore been given points for those answers as well.*

e) From now on, assume that both country A and country B impose subsidies of s_A and s_B, respectively. Show that the equilibrium is now given by:

$$q_B = \frac{A + (c_A - s_A) - 2(c_B - s_B)}{3B},$$

$$q_A = \frac{A + (c_B - s_B) - 2(c_A - s_A)}{3B}.$$

Answer:
With this demand function we have:

$$p' = -B,$$

$$p'' = 0,$$

which gives first order conditions of:

$$-B(q_A + q_B)q_A + A - B(q_A + q_B) - c_A + s_A = 0,$$

$$-B(q_A + q_B)q_B + A - B(q_A + q_B) - c_B + s_B = 0,$$

which can then be written as the two expressions.

f) Consider equal costs $c_A = c_B = c$. The home governments A and B seek to maximize home welfare (export profits minus government subsidies). Formally, we set up the following game: first stage, the two governments simultanously set subsidies (s_A, s_B), second stage: the two firms simultanously set quantities (q_A, q_B). Consumption takes place and profits are earned. Show that this equilibrium is worse for both countries A and B than an equilibrium with no subsidies $(s_A = s_B = 0)$. Interpret.

Answer:

Each government seeks to maximize the sum of profits of its firm minus the subsidies paid. For country A this equals:

$$p(q_A + q_B)q_A - (c_A - s_A)q_A - s_A q_A = p(q_A + q_B)q_A - c_A q_A,$$

which government A then seeks to maximize by choosing subsidy s_A:

$$max_{s_A} p(q_A(s_A, s_B) + q_B(s_A, s_B))q_A(s_A, s_B) - c_A q_A(s_A, s_B),$$

where $q_A(s_A, s_B)$ and $q_B(s_A, s_B)$ are functions of the subsidies and are given in question e). This gives:

$$[p'(q_A + q_B)q_A + p(q_A + q_B) - c_A]\frac{\partial q_A}{\partial s_A} + p'(q_A + q_B)q_A\frac{\partial q_B}{\partial s_A} = 0.$$

And then use the first order condition to get:

$$-s_A\frac{\partial q_A}{\partial s_A} + p'(q_A + q_B)q_A\frac{\partial q_B}{\partial s_A} = 0.$$

This gives that the subsidy will be positive.

Next, due to symmetry the two countries will have the same subsidy and correspondingly the two firms will produce the same, $q_A = q_B = q$ *and have the same profit. It suffices to show that at any equilibrium with* $s_A = s_B = s > 0$ *a coordinated reduction in* s *would raise profits. Clearly* $\partial q/\partial s > 0$

Home welfare is:

$$p(2q)q - cq$$

where the first derivative is:

$$\{2p'(2q)q + p(2q) - c\} \frac{\partial q}{\partial s}.$$

Use the first order condition from each firm when $c_A = c_B$*:*

$$p'(2q)q + p(2q) - c + s = 0$$

which then implies:

$$\{2p'(2q)q + p(2q) - c\} \frac{\partial q}{\partial s} = \{p'(2q)q - s\} \frac{\partial q}{\partial s} < 0 \ for \, s > 0$$

Such that welfare is always declining in subsidies when they are positive.