Question 1: (75 points)

Note: To do this question, you will have to use the analysis of Cournot duopoly from the Microeconomics Review of Precepts Week 7, slide 3.

For the purpose of this question, you should regard Boeing as a company owned entirely by US citizens, and Airbus as a company owned entirely by EU citizens (or governments). Therefore US welfare includes Boeing's profits and EU welfare includes Airbus's profits. We will consider only the exports of Boeing and Airbus to third-country markets, assuming them to be segmented from the US and EU markets, so consumer surpluses in the US and EU are not an issue.

The duopoly between Airbus and Boeing in the third-country markets we will consider is about a specific pair of new aircraft, say the Airbus 333 and the Boeing 888. For potential buyers, these are perfect substitutes. The inverse demand curve from third-country buyers is given by

$$P = 360 - \tfrac{1}{2}\, Q$$

where Q is the total quantity of aircraft offered by the two manufacturers, and P is the common price they will receive, measured in millions of dollars. The two firms compete as Cournot duopolists.

(a) (5 points) Suppose Airbus has fixed cost F_a of the export operation, and constant marginal cost C_a for each 333, and Boeing has fixed cost F_b, and constant marginal cost C_b for each 888. The fixed costs are not sunk; they are incurred only if a positive quantity is exported. For the formulas in parts (a)-(c), (e) and (g), assume that the quantities are positive. For the numerical solutions in other parts you will have to check whether this is the case. Denote Airbus's quantity by Q_a and Boeing's quantity by Q_b. Write the expressions for the two companies' profits, Π_a and Π_b as functions of the quantities. (The cost parameters will also appear in the formulas, of course.)

(b) (5 points) Each firm chooses its quantity to maximize its profit, taking the quantity of the other as given. Find the equations for their best response functions.

(c) (10 points) Solve these for the two quantities to express the Cournot equilibrium quantities in terms of the cost parameters. Hence find expressions for the price, and for the profits of the two firms, also in terms of the cost parameters.

In parts (d)-(h), the cost parameters are as follows: the marginal costs are $C_a = C_b = 120$ Million dollars for each firm, and the fixed/sunk costs are $F_a = F_b = 5$ Billion dollars.

(d) (5 points) First consider the duopoly between Airbus and Boeing without any government involvement. Find the numerical values of the equilibrium price, quantities, and profits.

(e) (5 points) Now the EU offers Airbus a subsidy S_a per 333 exported to the third countries. Find the formulas for the equilibrium price, quantities, and profits, expressed as functions of S_a.

(f) (10 points) Find the EU's optimal subsidy (to maximize Airbus's profit minus the revenue cost of the subsidy), and the resulting equilibrium quantities,, price, profits of the two firms, and the welfare levels of the EU and US.

(g) (5 points) Now both governments offer subsidies, the EU offers Airbus S_a per 333 exported to the third countries, and the US offers Boeing S_b per 888 exported to the third countries. Find the formulas for the equilibrium price, quantities, and profits, expressed as functions of S_a and S_b.

(h) (10 points) Each government wants to maximize its welfare, equal to the profit of its firm minus the revenue cost of its subsidy. They act non-cooperatively, each choosing its subsidy rate to maximize its own welfare, taking the rate of the other as given. This is a game between the governments, and results in a (Nash) equilibrium of their subsidy rates. Use methods similar to those in parts (a)-(c) above, to find the equilibrium subsidy rates, and the resulting equilibrium quantities, price, profits of the two firms, and the welfare levels of the EU and US.

(i) (10 points) Go back to the case where only the EU offers a subsidy, but now suppose the fixed costs are $F_a = F_b = 8$ billion instead of 5. The events unfold as follows. The EU makes the first move and commits itself to its subsidy. Then the two firms decide their quantities. Find the equilibrium quantities, price, profits of the two firms, and the welfare levels of the EU and US.

(j) (10 points) Comments: on your findings in parts (d), (f), (h) and (i).

Question 2: (25 points)

Read the article "Why the U.S. Must reinstate Tariffs" by Craig Harrington at

> `http://www.economyincrisis.org/content/why-us-must-reinstate-tariffs`

Write a response to it, based on the analysis of the economics and political economy of international trade policy as we have studied in this course.