

Study Questions to Accompany International Energy Markets

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Chapter 10 Game Theory in W. European Natural Gas Market

10.1. Go to BP's Statistical Review of World Energy. For the latest year available, we will compute natural gas consumption (C) minus production (P) divided by consumption (C-P)/C.

10.1a What is the interpretation of (C-P)/C?

10.1b Compute (C-P)/C for the following countries or regions: European Union, Russia, Germany, Norway, U.K., Italy, Poland, Turkey, Algeria.

10.2 Using Table 10.1 and 10.2, write a brief summary of how energy production and consumption changed in W. Europe, E. Europe and the former Soviet Union from 1950 to 2012.

10.3 Suppose two Cournot duopolists face the following demand and cost functions.

$$P = 100 - 0.5(q_1 + q_2),$$

$$C_1 = 6 + 1.5q_1^2$$

$$C_2 = 4 + 2q_2^2$$

At the equilibrium level, compute q_1 , q_2 , P , MC_1 , MC_2 , π_1 and π_2 be?

10.4 Again let $P = 100 - 0.5(q_1 + q_2)$, $C_1 = 6 + 1.5q_1^2$, $C_2 = 4 + 2q_2^2$

Redo 10.3 assuming the two producers are competitive.

10.5 Again let $P = 100 - 0.5(q_1 + q_2)$, $C_1 = 6 + 1.5q_1^2$, $C_2 = 4 + 2q_2^2$ Redo 10.4 assuming the two producers agree to monopolize the gas market as a multiplant monopoly.

10.6 Each player in a monopoly expects to get a share of the profits. In 10.5 we allocated each firm the profits from producing and selling their production. However, one gets less profits in this case and might try to negotiate some side payments to raise its profits for it to stay in the agreement. If the agreement falls apart, assume the market will revert back to a Cournot market. Other possible redistribution proposals could be:

I. Split the profits in half

II. Give each the share of the monopoly profits they would have gotten in a Cournot market.

III. Give each the share of the monopoly profits they would have gotten in a competitive market.

10.6a If you were negotiating for firm one, would you prefer any of the above 3 redistributions to the multiplant monopoly distribution in 10.5. Rank any preferred

redistribution proposals in the order you would favor them? For each case would firm one ever consider agreeing to your proposal? Why or why not?

10.6c If any of the negotiations are feasible and firm 1 won its preferred feasible solution, what would be the profits for q_1 and q_2 ?

10.6d. Would your feasible set change if the breakdown of the agreement caused the market to become competitive? Briefly defend your answer.

10.7 Again take the model from **10.3**: $P = 100 - 0.5(q_1 + q_2)$, $C_1 = 6 + 1.5q_1^2$, $C_2 = 4 + 2q_2^2$. Solve for q_1 , q_2 , P , π_1 , and π_2 , if firm 2 is a Stackleberg leader.

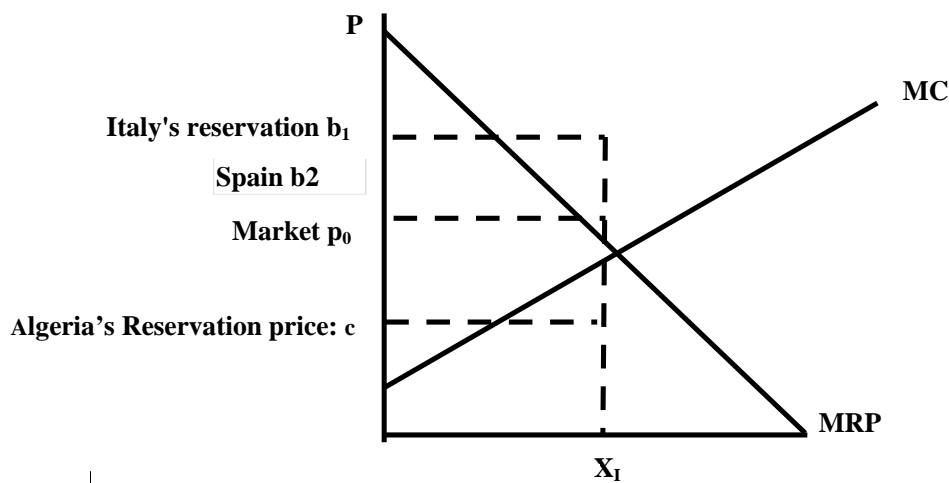
10.8 An interesting result, in this example is that firm 1 does better in the Cournot and Stackleberg case than in the monopoly case. Why do you think this happens?

10.9 How does the price leader model differ from the dominant firm model, we discussed in chapter 6. If firm 2 is the dominant firm and firm 1 is the competitive fringe, compute q_1 , q_2 , P , π_1 and π_2 ? Compare this these results to the Stackleberg results above.

10.10 Again take the model from question **10.3**: $P = 100 - 0.5(q_1 + q_2)$, $C_1 = 6 + 1.5q_1^2$, $C_2 = 4 + 2q_2^2$. Solve for q_1 , q_2 , P , π_1 and π_2 if the buyer is a monopsonist and the sellers are competitive.

10.11 Suppose that Algeria has been selling all its natural gas (X_1) to Italy at a negotiated price of p_0 . Italy's reservation price is b_1 and Algeria's reservation price is c .

10.11a Explain how the reservation prices are derived in this simply bilateral monopoly model represented in the figure below. Why must the negotiated price lie between c and p_1 ?



10.11b Now the contract price is up for renewal and there is the possibility of selling natural gas into Spain. Spain's reservation price p_2 is higher than the market price but lower p_1 . $b_1 > b_2 > p_0 > c$. Work out the likely new price range for this example with 2 buyers (duopsony) and 1 seller (monopoly) using the same logic in the text as for the duopoly selling to a monopoly. What does this example imply about Algerian rents if they can sell not only to Italy but also to Spain?

10.12 Pick a renewable energy resource that could be a potential backstop and describe the technology used to produce energy.

10.13 Suppose the average cost function for a backstop technology is $20/x$ for x less than 20 and is 1 for $x \geq 20$. Demand is $Q = 100 - 2P$. A monopolist has a marginal cost curve $MC = 0.1Q$. What would be P and Q for a monopoly following the limit pricing model?