

Oligopoly Theory / Strategic Trade (third market case)

I - Homogeneous Products, 2 Firms.

Typical Demand function: $p = A - b(q_1 + q_2)$,

Costs (identical or not): $MC_1 = c_1, MC_2 = c_2$

(1) Firms choose quantities simultaneously. We look for the NE in quantities or Cournot equilibrium.

Step 1: Calculate reaction functions by choosing q_i to max. $\Pi_i(q_i, q_j)$ assuming q_j is fixed.

Let $R_i(q_j)$ be firm i 's reaction function.

Step 2: Calculate the NE by finding the intersection of the two reaction functions (i.e. find the values of q_1 and q_2 that solve : $q_1 = R_1(q_2)$ and $q_2 = R_2(q_1)$).

(2) Firms choose quantities sequentially (assume Firm 1 moves first). We look for the SPNE in quantities or Stackelberg equilibrium.

Step 1: Calculate Firm 2's reaction function by choosing q_2 to max. $\Pi_2(q_1, q_2)$ assuming q_1 is fixed.

Let $R_2(q_1)$ be firm 2's reaction function.

Step 2: Calculate the optimal q_1 by max. $\Pi_1(q_1, q_2)$ assuming $q_2 = R_2(q_1)$.

Replacing the optimal q_1 into $R_2(q_1)$ we get the value of q_2 at the SPNE.

Remark: $\Pi_1 > \Pi_2$ so the firm that goes first has an advantage.

(3) Firms choose prices simultaneously. We look for the NE in prices or Bertrand equilibrium with homogeneous products.

(i) If both firms have the same marginal costs ($c_1 = c_2$) no mathematical calculation needed. Just a clear argument to justify the NE prices.

(ii) If $c_1 < c_2$, there will be two cases depending on whether c_2 is bigger or smaller than the monopoly price for firm 1.

II - Differentiated Products, 2 Firms.

Typical Demand functions:

$$p_1 = a - b q_1 + c q_2,$$

$$p_2 = d - e q_2 + g q_1 \quad \text{for firms choosing quantity}$$

or

$$q_1 = h - m p_1 + n p_2,$$

$$q_2 = r - s p_2 + u p_1 \quad \text{for firms choosing prices}$$

Costs (identical or not): $MC_1 = c_1, MC_2 = c_2$; no fixed costs.

(5) Firms choose prices simultaneously. We look for the NE in prices or Bertrand with differentiated products.

Step 1: Calculate reaction functions by choosing p_i to max. $\Pi_i(p_i, p_j)$ assuming p_j is fixed.

Let $R_i(p_j)$ be firm i 's reaction function.

Step 2: Calculate the NE by finding the intersection of the two reaction functions (i.e. find the values of p_1 and p_2 that solve : $p_1 = R_1(p_2)$ and $p_2 = R_2(p_1)$).

(6) Firms choose prices sequentially (assume Firm 1 moves first). We look for the SPNE in prices.

Step 1: Calculate Firm 2's reaction function by choosing p_2 to max. $\Pi_2(p_1, p_2)$ assuming p_1 is fixed.

Let $R_2(p_1)$ be firm 2's reaction function.

Step 2: Calculate the optimal p_1 by max. $\Pi_1(p_1, p_2)$ assuming $p_2 = R_2(p_1)$.

Replacing the optimal p_1 into $R_2(p_1)$ we get the value of p_2 at the SPNE.

Remark: $\Pi_1 < \Pi_2$ so the firm that goes first is at a disadvantage.

Strategic Trade Policy :Third Market Sales

(III) Cournot Competition in Output market (homogeneous products)

(7) *Brander-Spencer argument for an optimal export subsidy.*

Set up: Two firms (Firm 1 and Firm 2) from countries 1 and 2 respectively choose quantities simultaneously. All their output is exported to a third country.

This is a sequential game where country 1 moves first choosing an export subsidy/tax and then the two firms compete as indicated. The government's objective is to maximize the country's welfare. By choosing a subsidy/tax level the government is choosing firm 1's marginal cost.

Theoretical Result: The optimal policy is an **export subsidy**. With the optimal subsidy, firm 1's output coincides with the output level of a Stackelberg leader. Therefore, the subsidy shifts profits from firm 2 to firm 1. Country **1 is better off** and country **2 worse off** than without intervention.

Steps:

- Calculate NE quantities for an arbitrary level of subsidy.
- Choose the subsidy/tax that maximizes country 1's welfare.

(8) *Both Governments can choose a Subsidy/Tax*

Set up: Two firms (Firm 1 and Firm 2) from countries 1 and 2 respectively choose quantities simultaneously. All their output is exported to a third country.

This is a sequential game where in :

Stage 1: both countries choose a subsidy/tax simultaneously .

Stage 2 : after the subsidy/taxes are known, the two firms compete choosing their outputs simultaneously.

Each government maximizes its social welfare. By choosing a subsidy/tax level governments are choosing their firm's marginal cost.

Steps:

- Calculate NE quantities for arbitrary levels of subsidies/taxes.
- Calculate the NE in subsidies/taxes assuming that the firms will use their NE quantities in Stage 2

Theoretical Result: At the NE both countries **subsidize** their firms. In that equilibrium both countries are **worse off** than without intervention.

(IV) Bertrand Competition in Output market (differentiated products)

(9) Eaton-Grossman result that an export **tax** is optimal

Set up: Two firms (Firm 1 and Firm 2) from countries 1 and 2 respectively choose prices simultaneously. All their output is exported to a third country.

This is a sequential game where country 1 moves first choosing an export subsidy/tax and then the two firms compete as indicated.

The government's objective is to maximize the country's welfare. By choosing a subsidy/tax level the government is choosing firm 1's marginal cost.

Theoretical Result: The optimal policy is an **export tax**. With the optimal tax profits for Firm 1 are obviously higher than without intervention. In this case Firm 2's profit also increase. Therefore both countries are better off than without intervention.

Steps:

- Calculate NE prices for an arbitrary level of subsidy.
- Choose the subsidy/tax that maximizes country 1's welfare.

(10) Both Governments choose a Subsidy/Tax

Set up: Two firms (Firm 1 and Firm 2) from countries 1 and 2 respectively choose prices simultaneously. All their output is exported to a third country.

This is a sequential game where in :

Stage 1: both countries choose a subsidy/tax simultaneously .

Stage 2 : after the subsidy/taxes are known, the two firms compete choosing their prices simultaneously.

Each government maximizes its social welfare. By choosing a subsidy/tax level governments are choosing their firm's marginal cost.

Steps:

- Calculate NE prices s for arbitrary levels of subsidies/taxes.
- Calculate the NE in subsidies/taxes assuming that the firms will use their NE prices in Stage 2

Theoretical Result: At the NE both countries **tax** their firms. In that equilibrium both countries are **better off** than without intervention.