

## Topic 7: Product Differentiation

Firms choose prices or quantities but also the level of differentiation of their products.

- **Horizontal differentiation.** The simplest model is as follows. There is a continuum of consumers located uniformly between 0 and 1 and each consumer wants to buy only one unit of a good. If  $d$  is the distance between the place the consumer is located and the place he buys the good, he incurs a transportation cost  $t(d) = td^2$ . Consumers are otherwise identical. There are two firms with cost  $C(q) = c * q$ . At stage 1, firms locate simultaneously: firm 1 chooses  $a$  and firm 2 chooses  $1 - b$  and, at stage 2, firms choose prices  $p_1$  and  $p_2$  simultaneously. In the second stage,  $a$  and  $b$  are given. Given locations, there exists a cutoff point  $x^*$  such that any consumer located at  $x < x^*$  buys from 1, and any consumer located at  $x > x^*$  buys from 2. The residual demand of firm 1 is  $x^*$  and the residual demand of firm 2 is  $1 - x^*$ . Firms set prices that reflect the distance. In the first stage they choose their locations anticipating the pricing of the second stage. The main implications are as follows: (i) If firms locate at the same place, the goods are not differentiated and the competition in the second stage yields the Bertrand outcome. (ii) If  $t = 0$ , goods are equivalent for consumers and again the Bertrand outcome emerges. (iii) If firms differentiate and choose  $a = 0$  and  $b = 0$ , they enjoy prices greater than  $c$ . If one firm moves towards the center and if prices remain the same, this firm increases its profit (attracts more consumers). However, the other firm will then lower its price making the move towards the center non profitable. In the simple model, the overall effect of moving towards the center results in making smaller profits. Given consumers do not like distance and do not like to pay, maximal differentiation is desirable.

- **Vertical differentiation.** There is a continuum of consumers with tastes parameters on  $[0, 1]$  and each consumer wants to buy only one unit of a good. If  $s$  represents the quality of the good, the utility of a consumer with taste  $\theta$  buying a good of quality  $s$  at price  $p$  is  $\theta s - p$ . There are two firms with cost  $C(q) = c * q$  and the cost of production is independent of the quality of the good (to simplify only). In stage 1, firms choose qualities  $s_1$  and  $s_2$  simultaneously. At stage 2, firms choose prices  $p_1$  and  $p_2$  simultaneously. In the second stage,  $s_1$  and  $s_2$  are given and there exists  $\theta^*$  such that any consumer with  $\theta < \theta^*$  buys from 1 and any consumer with  $\theta > \theta^*$  buys from 2. The residual demand of firm 1 is  $\theta^*$  and the residual demand of firm 2 is  $1 - \theta^*$ . Prices reflect the difference in qualities. At stage 2, firms choose the qualities anticipating how they will price in the second stage. In this model, if firms choose the same quality, the goods are not differentiated and the competition in the second stage yields the Bertrand outcome. As in the horizontal differentiation model, differentiation is profitable: one firm sells a high quality good at a high price. The other sells a good at a lower price and the quality is lower.