

# Modeling in markets with a dominant firm

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# Outline

1. Dominant firm and its reasons of its existence
2. Market models with dominant firm
3. Example

# Dominant firm and the reasons for its existence



# Dominant firm – 1

- ▶ A dominant firm is considered if its market share exceeds 35% (in some countries a stricter criterion of dominance is used – 25% of the market).
- ▶ Dominant firm is also considered if its share of the product market is 35 percent or less and it **does not experience significant competition** due to limited access to other entities for the purchase of raw materials, supplies and sale of goods, the presence of barriers to market access of other entities, the availability of benefits or other circumstances.

# Dominant firm – 2

- ▶ Dominant firm – company within a market that has **the largest market share**, such as McDonald's or Procter & Gamble. Dominant firms have a competitive advantage by virtue of their size, name recognition, and resources. They may hold onto their dominance through various strategies, including innovation, brand extension, and price wars. Dominant firms often have greater influence with distributors and can get their products into more retail outlets and in better display positions than trailing firms.

# Reasons of domination

- ▶ Dominant firm owns benefits in costs;
- ▶ dominant firm releases products with higher quality, than outsiders (advertising, reputation etc.);
- ▶ A group of competitive firms concluded an appropriate agreement between them.

# The process of domination

innovation



domination



monopoly profit



innovation stimulation



domination



monopoly profit



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# Maintaining the leadership

- ▶ Creating barriers to market entry (Erecting Barriers to Entry);
- ▶ Predatory pricing of the dominant firm's market (Predatory Pricing)



# Inefficiency of dominance

- ▶ the dominant position of the firm is considered inefficient due to inflated prices and reduced production compared to the competitive level.

# Market models with dominant firm



# Stackelberg model

- ▶ In Stackelberg's model «leader–follower» consider dominant firm (leader – L) and  $n$  competing firms (followers – F), and leader has advantages in costs over last.

# Stackelberg model: psqueaking

- ▶ marginal costs of competing firms  $c_F$  are constant and the same for each of the competitors;
- ▶ marginal cost for the firm  $L$  –  $c_L < c_F$ ;
- ▶ market demand varies linearly:  $P = a - bQ$ , where  $Q$  – industry volume of production;
- ▶ all firms recognize the superiority of the firm  $L$ : it could increase production until the price falls lower  $c_F$ , which causes losses to competitors, but maintains a positive profit for the firm  $L$ ;
- ▶ competitors behave like "followers", "leader" uses the functions of competitors' reactions to maximize its own profits.

# Stackelberg model: equilibrium

- ▶ In equilibrium, the output of the firm  $L$  equals:

$$q_L = \frac{(a - c_L) + (c_F - c_L)}{2b}$$

- ▶ production for a typical "follower" of the firm  $F$ , stock:

$$q_F = \frac{(a - c_F) - 2(c_F - c_L)}{4bn}$$

- ▶ market share of the "leader":

$$s_L = \frac{q_L}{(q_L + nq_F)} = 2 \frac{(a - c_L) + (c_F - c_L)}{2(a - c_L) + (a - c_F)}$$

# Stackelberg model: conclusion

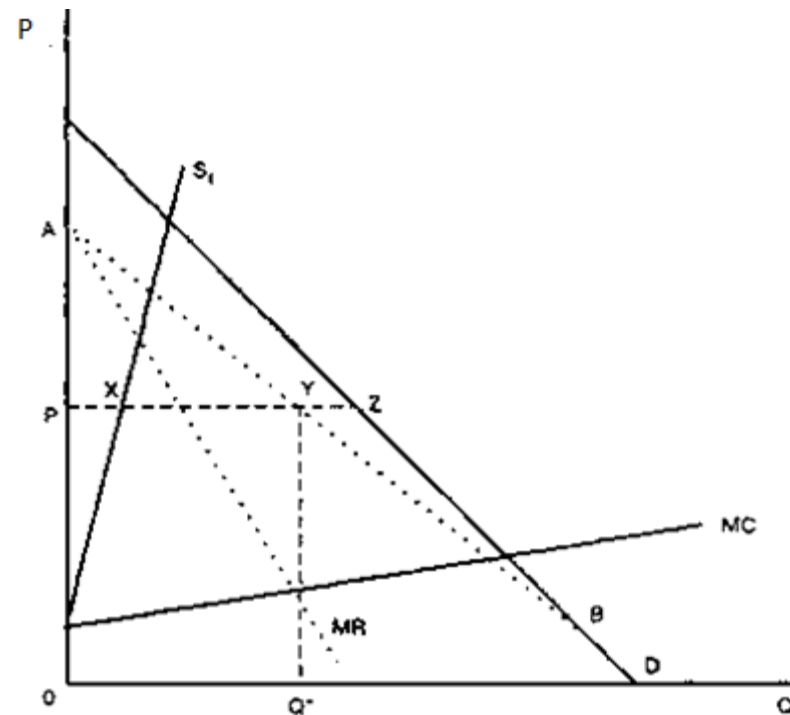
- ▶ If the industry consists of a "leader" for Stackelberg and  $n$  firms– "followers", the market price will be lower than for the industry where it operates  $n + 1$  identical firms, each of which follows the Cournot equilibrium.

# Forheimer model: assumptions

- ▶ all enterprises of industry produce a homogeneous product;
- ▶ the dominant firm determines the market price of the product in the market;
- ▶ outsider firms accept the market price as a given, setting its output at a level that ensures equality  $P = MC$ ;
- ▶ all outsider firms have the same production costs and increase output when the price rises, reduce production when price falls;
- ▶ the dominant firm knows market demand function;
- ▶ dominant firm maybe determine the total output of outsider firms at each price level and thus know the supply function of their competitive environment.

# Forheimer model

- ▶  $D$  – general demand;
- ▶  $ABD$  – residual demand function of dominant firms;
- ▶  $Q^*$  – output of the dominant firm provided  $MR = MC$ ;
- ▶  $P$  – the price of the products of the dominant firm;
- ▶  $YZ$  – output of outsider firms.





# Forheimer model: conclusion

- ▶ The dominant firm will not always improve the functioning of the market.
- ▶ It can be reduced if the advantages of the dominant firm arise from monopoly control over key resources or from other conditions that prevent the expansion of production by competitors or entry into the industry of other firms.

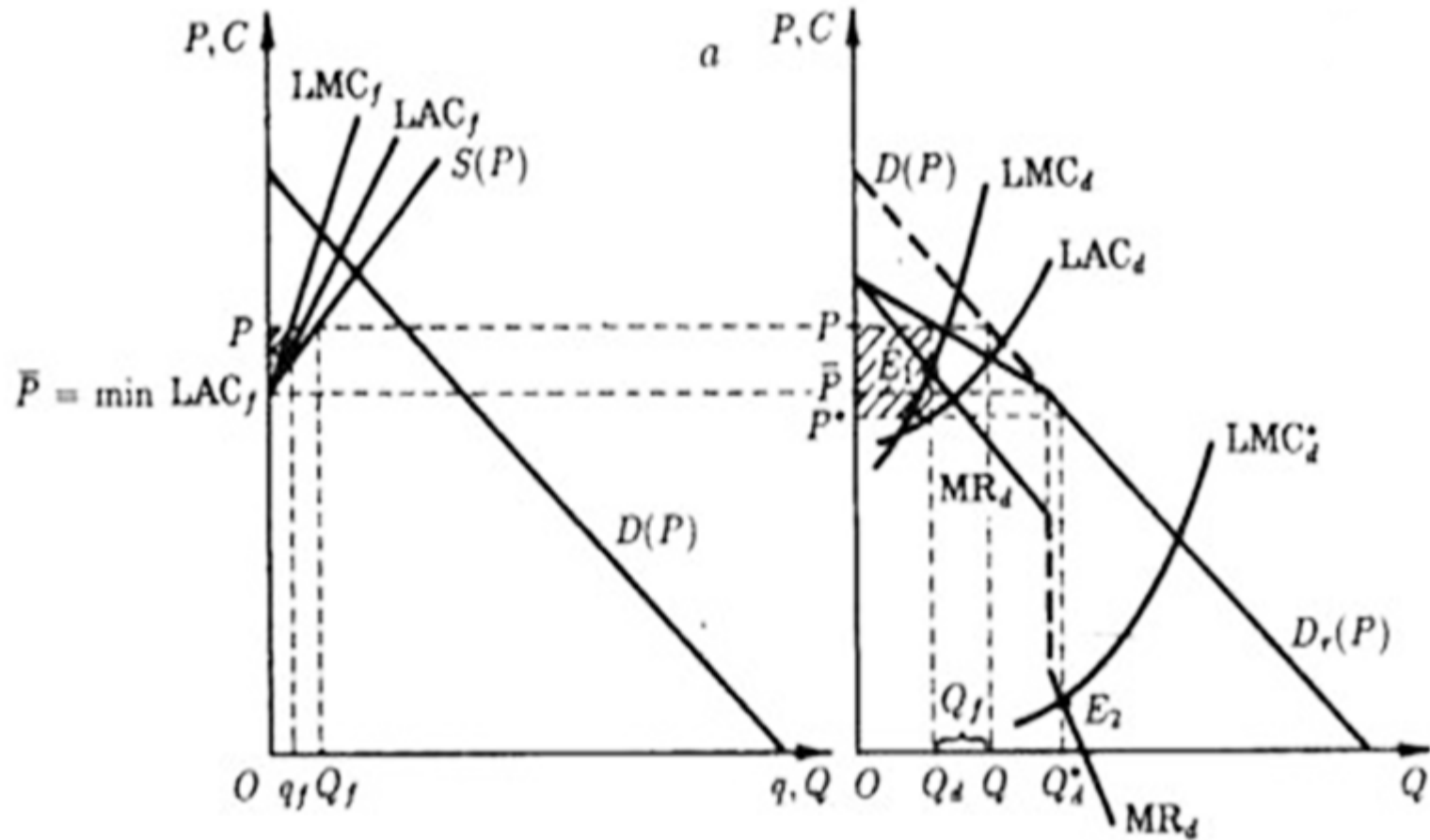
# DF model with closed entrance: assumptions

- ▶ all enterprises in the industry produce a homogeneous product;
- ▶ the dominant firm determines the market price of the product in the market;
- ▶ outsider firms accept the market price as a given, setting its output at a level that ensures equality  $P = MC$ ;
- ▶ all outsider firms have the same production costs and increase output when the price rises, reduce production when the price falls;
- ▶ the dominant firm knows the function of market demand;
- ▶ the dominant firm can determine the total output of outsider firms at each price level and thus knows the supply function of its competitive environment;
- ▶ **Exit new firms is blocked.**

# DF model with closed entrance: equilibrium – 1

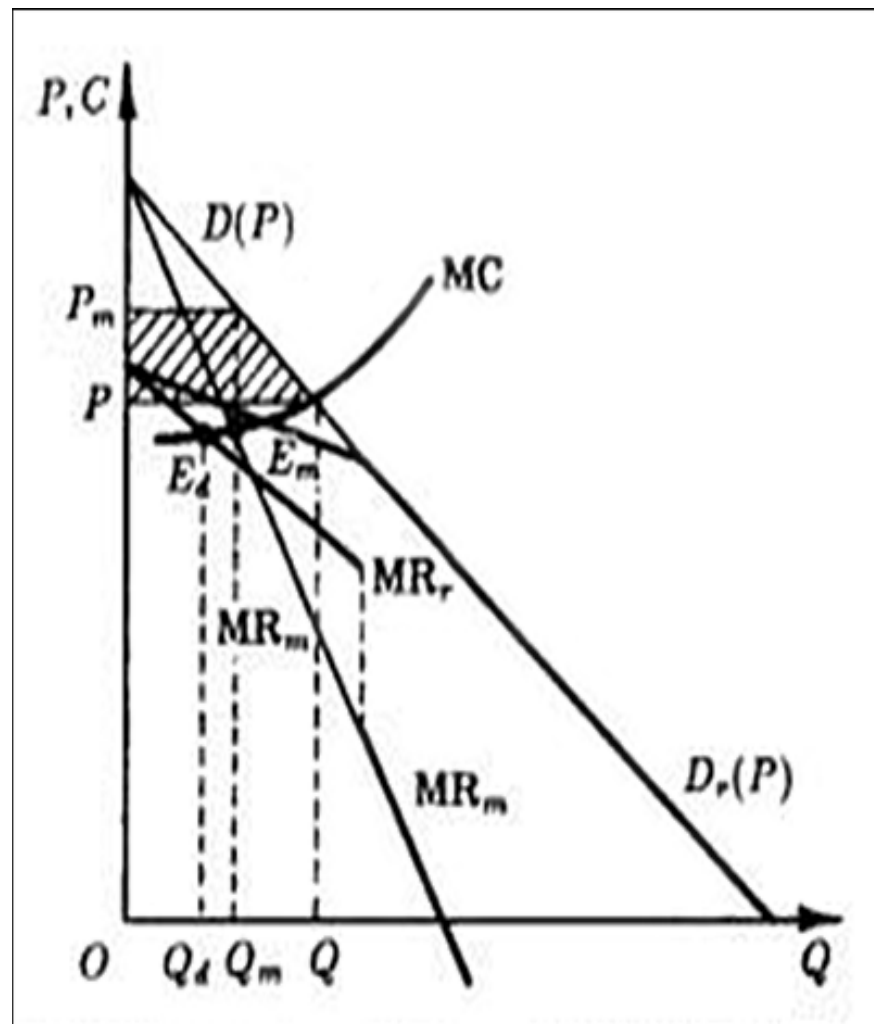
- ▶ either there is a balance between the dominant enterprise and its competitive environment (if costs of dominant enterprises are something lower than costs of enterprises of competitive environment),
- ▶ or the competitive environment disappears and the dominant enterprise becomes a monopolist (if costs dominant enterprises are significantly lower than costs of others enterprises).

# DF model with closed entrance: equilibrium - 2



# DF model with closed entrance: conclusion

- ▶ Output and prices, for DF and competitive environment is better for consumers, than in case of perfect monopoly.



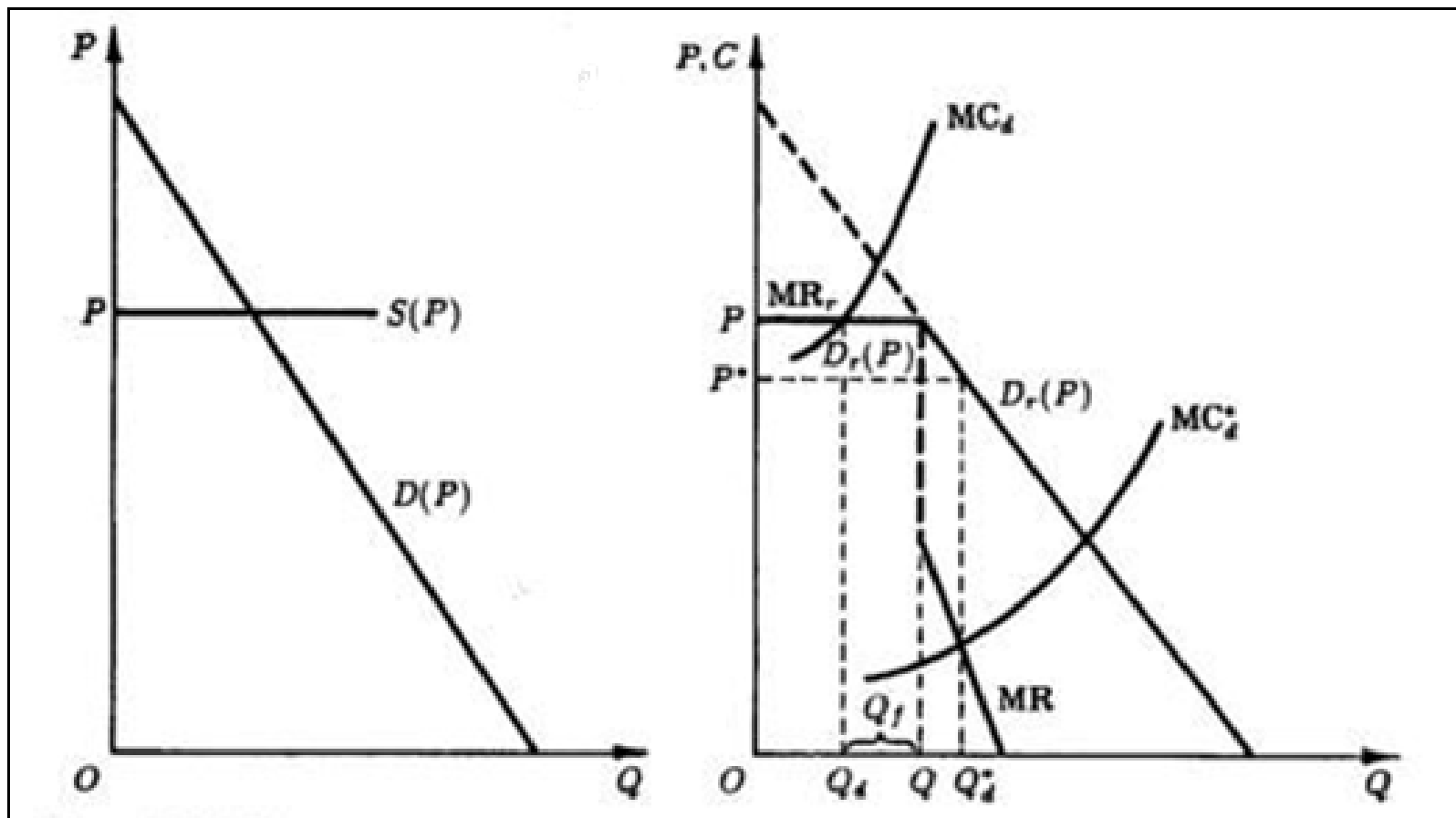
# DF model with open entrance: assumptions

- ▶ all enterprises in the industry produce a homogeneous product;
- ▶ the dominant firm determines the market price of the product in the market;
- ▶ outsider firms accept the market price as a given, ie there is price collectors, setting its output at a level that ensures equality  $P = MC$ ;
- ▶ all outsider firms have the same production costs and increase output when the price rises, reduce production when the price falls;
- ▶ the dominant firm knows the function of market demand;
- ▶ the dominant firm can determine the total output of outsider firms at each price level and thus knows the supply function of its competitive environment;
- ▶ **Exit and entrance of firms from the market is free.**

# DF model with open entrance: equilibrium – 1

- ▶ either the dominant firm will be pushed out of the market,
- ▶ or the competitive environment disappears and the dominant firm becomes a monopolist.

# DF model with open entrance: equilibrium - 2





# Gaskins model – 1

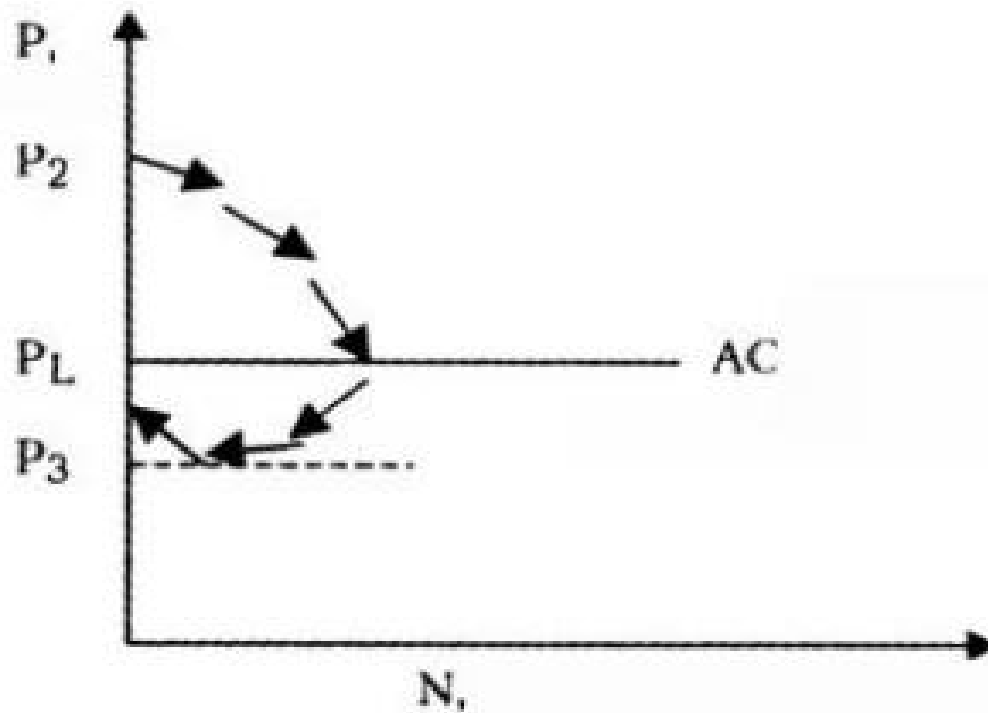
- ▶ The model assumes that firms are constantly entering the market, and the rate of entry is known to the dominant firm and depends on the expected profit.

# Gaskins model – 2

$$\frac{dQ}{dt} = k [P(t) - C_0]$$

- ▶  $dQ/dt$  – the rate of market expansion (growth rate of output in the industry);
- ▶  $P(t)$  – the price set by the dominant firm at the time  $t$ ,
- ▶  $C_0$  – costs of entering the industry;
- ▶  $k$  – the reaction rate of the issue (entry of new firms) to the difference between  $P(t)$  and  $C_0$ .

# Number of firms in industry



# Gaskins model: conclusion

- ▶ while competitors' average costs are so high that they exceed the price that the DF can set to maximize short-term profits, the DF always increases its long-term profits by limiting and keeping its price below the level of short-term profit maximization.

# Predatory pricing

- ▶ Predatory pricing involves setting prices below the average production costs of firms in a competitive environment;
- ▶ the leading firm must have a very significant cost advantage;
- ▶ for outsider firms the policy of predatory pricing leads to destruction and exiting from the market;
- ▶ this policy can be used by the dominant firm to "clear" the market, take over competing firms and turn the dominant firm into a monopoly;
- ▶ the effectiveness of predatory pricing depends on the ratio of average costs of the dominant firm and competing firms.
- ▶ predatory pricing in this case can turn into a price war that does not provide the dominant firm with a normal profit even in the long run.

# Areeda-Turner rule

- ▶ Ejection is the price that is less than the average avoidable cost – costs that the firm could have avoided if it had not practiced the strategy of ejection pricing.

# Barometric price leadership

- ▶ Barometric price leadership is the situation when the leading company has not only a tendency to take risk of price decisions, but also, according to popular belief, most absolutely predicts changes in market conditions. The role of barometric price leader may fall to different companies.

# Example





# Example

- ▶ Let market demand is set by function:

$$Q = 500 - p,$$

where  $p$  – price of units products, costs of each firm from competitive environment are equal to

$$TC_f = 320q_f + 15(q_f)^2,$$

where  $q_f$  – output of firms in competitive environment.

- ▶ Let there are 30 firms in competitive environment.

# Situation 1

- ▶ Let total costs of dominant firm are equal to

$$TC_L = 320q_L + (1/6)q_L^2,$$

where  $q_L$  - output of dominant firm.

# Solution

- ▶ equilibrium price is 392;
- ▶ equilibrium output of a dominant firm is 72;
- ▶ Output of all firms in a competitive environment will be 36;
- ▶ dominant firm will control 66.67% of the market;
- ▶ profit of the dominant firm is 4320, almost 100 times more than profit of separate firm from competitive environment;
- ▶ the price of the dominant firm is quite high, so the firms of the competitive environment receive a positive profit, which stimulates the entry of new firms into the market;
- ▶ the dominant firm does not have a sufficient cost advantage to push the firms of the competitive environment out of the market.

# Situation 2

- ▶ Let total costs of a dominant firm are equal to

$$TC_L = 440q_L + (1/6)q_L^2,$$

where  $q_L$  - output of a dominant firm.

# Solution

- ▶ equilibrium price stock is 440;
- ▶ equilibrium output of a dominant firm is equal to 0;
- ▶ Output of all firms in a competitive environment will reach 60;
- ▶ dominant firm will control 0.0% of the market;
- ▶ dominant firm exits the market.

# Situation 3

- ▶ Let total costs dominant firms are equal to

$$TC_L = 31q_L + (1/6)q_L^2,$$

where  $q_L$  - output of a dominant firm.

# Solution

- ▶ equilibrium price is 276.4;
- ▶ equilibrium output of a dominant firm is equal to 245.4;
- ▶ output of all firms in a competitive environment will reach 0;
- ▶ dominant firm will control 100% of the market;
- ▶ competitive firms exit the market, dominant firm becomes a monopolist;
- ▶ monopolist price is 299 (higher than 276.4, but lower than AVC for competing firms, profit is 47134.5;
- ▶ Entrance to the market becomes blocked.

# Situation 4

- ▶ Let total costs of dominant firms are equal to

$$TC_L = 380q_L + (1/6)q_L^2,$$

where  $q_L$  - output of a dominant firm.



# Solution

- ▶ equilibrium price is 416;
- ▶ equilibrium output of a dominant firm is equal to 36;
- ▶ dominant firm will control only 42.86% of the market;
- ▶ profit of dominant firm is equal to 864, at 10 times exceeds profit of a separate firm from competitive environment;
- ▶ the price of the dominant firm is quite high, so firms in a competitive environment receive more positive profits than in situation 1, which further stimulates the entry of new firms into the market;
- ▶ the dominant firm does not have a sufficient cost advantage to push the firms of the competitive environment out of the market.

# Situation 5

- ▶ Let total costs of a dominant firm are equal to

$$TC_L = 380q_L + (1/6)q_L^2,$$

where  $q_L$  - output of a dominant firm.

- ▶ Let number of firms in a competitive environment is growing up to 60, and then to 102.

# Solution

At  $n = 60$ :

- ▶ A dominant firm will control only 22.2% of the market;
- ▶ profit of the dominant firm is equal to 337.5, it at 6.5 times exceeds profit of a separate firm from competitive environment.

At  $n = 102$ :

- ▶ a dominant firm will control only 5,37% of the market;
- ▶ profit of the dominant firm is equal to 20.71, which is less than a profit of a separate firm from competitive environment (34.53).

# Thank you!