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**EXCESSIVE NUMBER OF FIRMS IN EQUILIBRIUM  
AT A FREE-ENTRY OLIGOPOLY MARKET:  
CASE OF HETEROGENEOUS COST FUNCTIONS**

Equilibrium states in economy are often socially ineffective. We can refer to different examples of the prisoner's dilemma, the tragedy of commons, insufficient financing of public good, negative selection, moral hazard, and other problems of the contract theory. In all of them we need a special market design and regulation that helps to decrease inefficiency.

In the paper we will concentrate on the problems of market power and number of firms. There is a common opinion that entry barriers are always bad for society, because they decrease the number of firms, weaken competition, raise prices and decrease quantities. However, we should understand that a lot of firms also mean duplicated fixed costs. Thus, free entry can lead to both situations: excessive and insufficient number of firms in equilibrium. The correct conclusion depends on the market structure, demand and cost functions, and features of strategic interaction between companies at a market.

[Von Weizacker, 1980] and [Perry, 1984] proposed reasons for the desired limitation of excessive competition in oligopoly. [Mankiw and Whinston, 1986] formulated some conditions (usually, though not always [Filatov, Makolskaya, 2015] satisfied) under which this reduction would lead to the social welfare maximization. Many empirical papers – [Berry, Waldfogel, 1999] for radio broadcasting, [Hsei, Morretti, 2003] for real-estate, [Hortacsu, Syverson, 2004] for investment foundations, [Davis, 2006] for cinema industry, etc. show the same result. There are also papers that investigate some by-effects: externalities and coo-petition [Hattori, Yoshikawa, 2016], possible changes of firms' behavior include collusion [Filatov, Makolskaya, 2017], etc.

But all these models deal with homogeneous firms. In reality producers are very different even within one country. Moreover, contrary to a popular opinion that in each country some industries live well and obtain high profits, and the other ones are on the edge of survival, inter-industry distinctions in the firms' productivity are less essential, than distinctions within industry. Particularly it was shown [Yakovlev et al, 2008] that the gap in productivity between the best 20% and the worst 20% of Russian enterprises within one industry is equal to 9–24 times. So we should take it into account.

Suppose we have a single product market with inverse demand function given by

$$p(Q) = a - bQ, \quad Q = \sum_{k=1}^n q_k$$

with  $a, b > 0$ . Let  $p$  be the product price, and  $Q$  – the total supply comprised of supplies of individual firms  $q_k$ . Assume that the cost function of  $k$ -firm is linear:

$$TC_k(q) = c_k q + f,$$

and each firm maximizes its profit under assumptions of the Cournot model. The equilibrium number of firms  $n_1$  can be obtained from the zero profit condition (ZPC)

$$\pi_n(q_n) = p(Q)q_n - TC_n(q_n) = 0.$$

Let's suppose without loss of generality that  $0 < c_1 < c_2 < \dots < c_n$ . Then the ZPC reduces to

$$\frac{a + C(n)}{b(n+1)} \left( \frac{a + C(n)}{n+1} - 2c_n \right) + \frac{c_n^2}{b} - f_n = 0, \quad C(n) = \sum_{k=1}^n c_k. \quad (1)$$

Assume that explicit dependence  $c_k = c(k)$  is linear (having real data we can just fit linear model to it):  $c(k) = c + dk$ . In this case equilibrium number of firms obtained from (1) is equal to

$$n_1 = \frac{1}{d} \sqrt{2d(a-c) + bf - d\sqrt{bf}} + \frac{d^2}{4} - \frac{\sqrt{bf}}{d} - \frac{1}{2}.$$

Social planner should maximize social welfare function equal to customer surplus (CS) and total profit (TP) changing the number of firms:

$$SW = CS + TP = \frac{1}{2}(a - p^*(n))Q^*(n) + \sum_{k=1}^n \pi_k(q_k^*(n)) \rightarrow \max_n. \quad (2)$$

**Theorem.** Assume that  $d/2 \leq \sqrt{bf} \leq a - c$ . Then the socially effective number of firms obtained from (2) is smaller than the equilibrium number  $n_1$  for all  $a, b, c, d, f$ .

The second assumption of the theorem is equal to the positive equilibrium number of firms so it's always satisfied. The first assumption means limited heterogeneity, but the possible level is very high, so we can say that in real situation of heterogeneous firms at a free-entry oligopoly market there's almost always excessive number of firms. Thus the entry barriers, constructed by incumbent companies, do not always decrease social welfare. In some cases, it's even better for regulator not to stimulate excessive competition but on the contrary to restrict the entry of new companies to the market.

### References

**Berry S., Waldfogel J.** (1999) Free Entry and Social Inefficiency in Radio Broadcasting // RAND Journal of Economics. – V.30. – P.397–420.

**Davis P.** (2006) Measuring the Business Stealing, Cannibalization and Market Expansion

Effects of Entry in the US Motion Picture Exhibition Market // *Journal of Industrial Economics*. – V 54. – P.293–321.

**Filatov A., Makolskaya Ya.** (2015) The equilibrium and socially effective number of firms at oligopoly markets: theory and empirics // *Czech Journal of Social Sciences, Business, and Economics*. – 2015. – V.4. – №4. - P.17–30.

**Filatov A., Makolskaya Ya.** (2017) The increasing concentration at industrial markets: the social welfare maximization and possible risks // *SHS Web of Conferences*. – 2017. – V.35, №01073. – P.1–6.

**Hortacsu A., and Syverson C.** (2004) Product Differentiation, Search Costs, and Competition in the Mutual Fund Industry: a Case Study of S&P 500 Mutual Funds // *Quarterly Journal of Economics*. – V.119. – P.403–456.

**Hsieh C., Moretti E.** (2003) Can Free Entry be Inefficient? Fixed Commissions and Social Waste in the Real Estate Industry // *Journal of Political Economy*. – V.111. – P.1076–1121.

**Mankiw G., Whinston M.** (1986) Free entry and Social Efficiency // *The RAND Journal of Economics*. – V.17. – P.48–58.

**Perry K.** (1984) Scale Economies, Imperfect Competition and Public Policy // *The Journal of Industrial Economics*. – 1984. – V.32. – P.313–330.

**Von Weizsacker, C.** (2000) Welfare Analysis of Barriers to Entry // *Bell Journal of Economics*. – V. 11. –P. 399 – 420.

**Yakovlev A., Golikova V., Gonchar K., Kuznetsov B.** (2008) Russian industry at the crossroads: what prevents our firms to become competitive. – Moscow: HSE (in Russian).