ECONOPHYSICAL ANALYSIS OF THE RELATIONSHIP BETWEEN MONOPOLY AND COMPETITION

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Received 10 January 2017; accepted 20 June 2017; published online 10 July 2017

Abstract

The article considers the econophysical analysis of the relationship between monopoly and competition and the philosophy of progress. It is shown that competition being a derived monopoly displaces the competition providing progress, and to achieve progress, a nonlinear increase in the production of output by the passage of time is necessary.

Key words: monopoly, competition, philosophy of progress, linear output, polycrystal.

JEL Classification: A12

Suppose that the volume of production (H) depends linearly on the time t:

$$\dot{I} = b\,t \qquad (1)$$

Here b is the proportionality coefficient, which shows the volume of production produced per unit time. At b = 0 there is no production, i.e. Commodity is not produced. We can assume that in the case of a pure monopoly, b remains constant (b = bm = const) and does not change with time. In this case, there is production, although there is no progress. For progress, it is necessary that the quantity of products produced per unit of time increases with time. In other words, for progress, the linear İ (t) dependence should become nonlinear or change nonlinearly. This means that the proportionality coefficient b in formula (1) should increase with time. We believe that this is a necessary condition for progress. In this paper, the necessary results are applied to the results obtained in the field of physical sciences.

In physics, there are a number of phenomena where linear output characteristics become non-linear under the influence of various factors. Such phenomena include, for example, low-energy cathode sputtering [Плешивцев Н. В.19681].

Cathodic sputtering is a physical phenomenon that occurs when a surface of a solid is bombarded with ions. This phenomenon is characterized, basically, by two parameters: the sputtering coefficient Y (atom / ion) and the threshold energy E0 of the sputtering. The first parameter shows the number of atoms knocked out from the surface by a single incident ion. The second parameter shows the minimum ion energy threshold below which the spraying process does not occur.

We have shown [Аскеров Ш.Г., Сена Л.А., 1969 p.1591-15962] that the character of the dependence of the cathode sputtering coefficient on the ion energy in the near-threshold energy region is very different for single-crystal and polycrystalline samples. In Fig. 1, it is shown that the dependence of Y (Ep) for different faces of a single crystal is linear (a, b, c line), and a face with a large angular coefficient has a large sputtering threshold (Eo). In the case where the bombarded surface consists of several single-crystal faces, the Y (Ep) dependence becomes a broken line (1-2-3). When there are many polyline lines, i.e. When the bombarded surface is a polycrystalline, such a dependence is described by a cubic law:

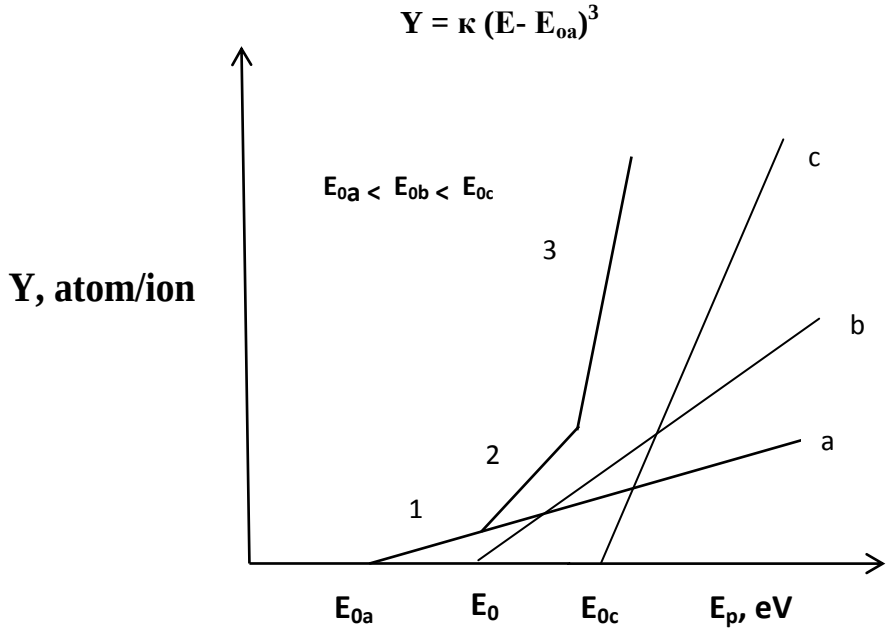


Fig. 1. Energy dependence of the sputtering coefficient for single crystals (aa, bb and cc lines) and inhomogeneous surfaces (1-2-3 broken line).

Since the surface of the polycrystal consists of numerous chaotically oriented faces, it can be assumed that both the angular coefficients b of the Y (Ep) dependences and the threshold energies vary chaotically and continuously. As can be seen from the figure, the character of the output characteristics of the sputtering depends on the structure of the bombarded surface and, changing the structure, it is possible to change the angular coefficients of the Y (Ep) dependence.

To achieve progress in the field of market economy, one can borrow the scientific results obtained in the field of cathode sputtering at low ion energies. Figure 2 shows the dependence of the volume of output (or services) on time in

conditions of perfect (mm straight line) and imperfect monopoly (1-2 broken lines), more precisely in the case of duopoly [3]. As it is easy to see, the presence of a second independent producer of identical goods (dd direct) in the market causes competition and the dependence İ (t) is transformed from a straight line into a broken line. As new independent producers of goods (oo lines) appear on the market, competition will increase, and the number of broken lines will also increase (1-2-3). In economic theory, this case is called oligopoly [В.Д. Камаева, М.2010]. In the case of oligopoly, the angular coefficient b0, respectively, will increase as the number of firms increase.

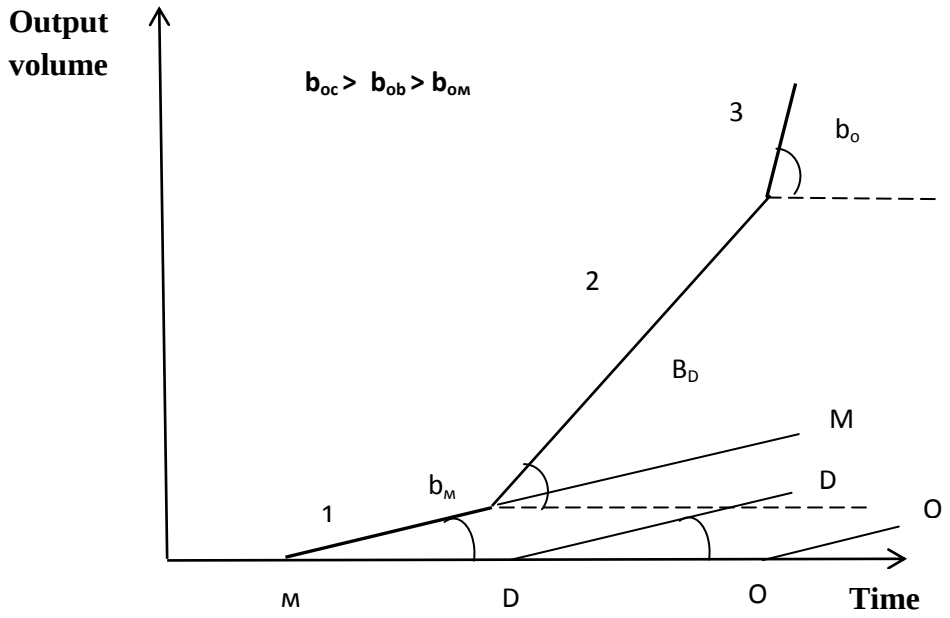


Fig. 2. Dependence of the volume of goods / services on time in duopolistic environment (aa and bb lines).

The parallelity of the lines mm, dd and oo in Fig. 2 means that the technologies used in the production of goods by competing firms are at the same level and, as can be seen from the graph, as the competitors grow, the volume of output produced per unit time $b_o > b_д > b_м$.

As the oligopoly is created, the angular coefficient b0 also increases, as a result of which İ (t) dependence takes the form of a broken line (1-2-3). Thus, in the transition from an absolute monopoly to an imperfect monopoly (oligopoly), the system becomes more complex, and its output characteristics are nonlinearly time-dependent. The transition from a linear characteristic to a nonlinear one means that the system obeys the theory of complex systems [Лоскутов А.Ю., Михайлов А.С.,

p.17-543], and its output characteristics differ significantly from the output characteristics of individual independent producers on the market.

The increase in the quantity of production per unit time (bo) with duopoly can be represented by the following formula:

$$\mathbf{b_д = b_м + \alpha t} \qquad (2)$$

Here, $\mathbf{b_д}$, $b_м$, respectively, are the angular coefficients of a duopoly and pure monopolistic firm; **α** is a constant characterizing progress. According to the formula (2), progress can be defined as a quantity numerically equal to the change in **b** per unit time.

In the physics section of "Mechanics," we used this formula when we determined the speed of the alternating motion at any time:

$$\mathbf{v_t = v_0 + at} \qquad \mathbf{(2')}$$

Where v_t is the velocity at time t, and v_0 is the velocity at the time of the reference, and a is the acceleration.

If we take formula (2) into account in formula (1), we can get that İ is nonlinearly time-dependent. Even with perfect competition (many firms) and an identical technology, the amount of output per unit time proportionally increases the square of time, which leads to the emergence of progress. In such conditions there is no need for the development of science, it is sufficient to have a high level of university education and a legal field for competition. Some countries which belong to so-called emerging economies often choose this path of development.

Another factor that strongly influences progress is technology [Şahlar Əsgərov, 2016]. It is well known that technology depends on the level of science. The need for technological development leads to a greater need for science. For this reason, in developed countries, science spends a lot of money. The intellectual path is their characteristic development: science-technology-progress.

The relationship between the change in the level of technology (ΔT) and science (E) in a certain time interval Δt can be represented in the following form:

$$\mathbf{\Delta T = \kappa_1 E\, \Delta t} \qquad \mathbf{(4)}$$

Where k1 is the coefficient of proportionality. Figure 3 shows the time dependence of the growth of production of goods by competing firms using different technologies. The graph shows the case where each newly created company uses more advanced technology for economic growth.

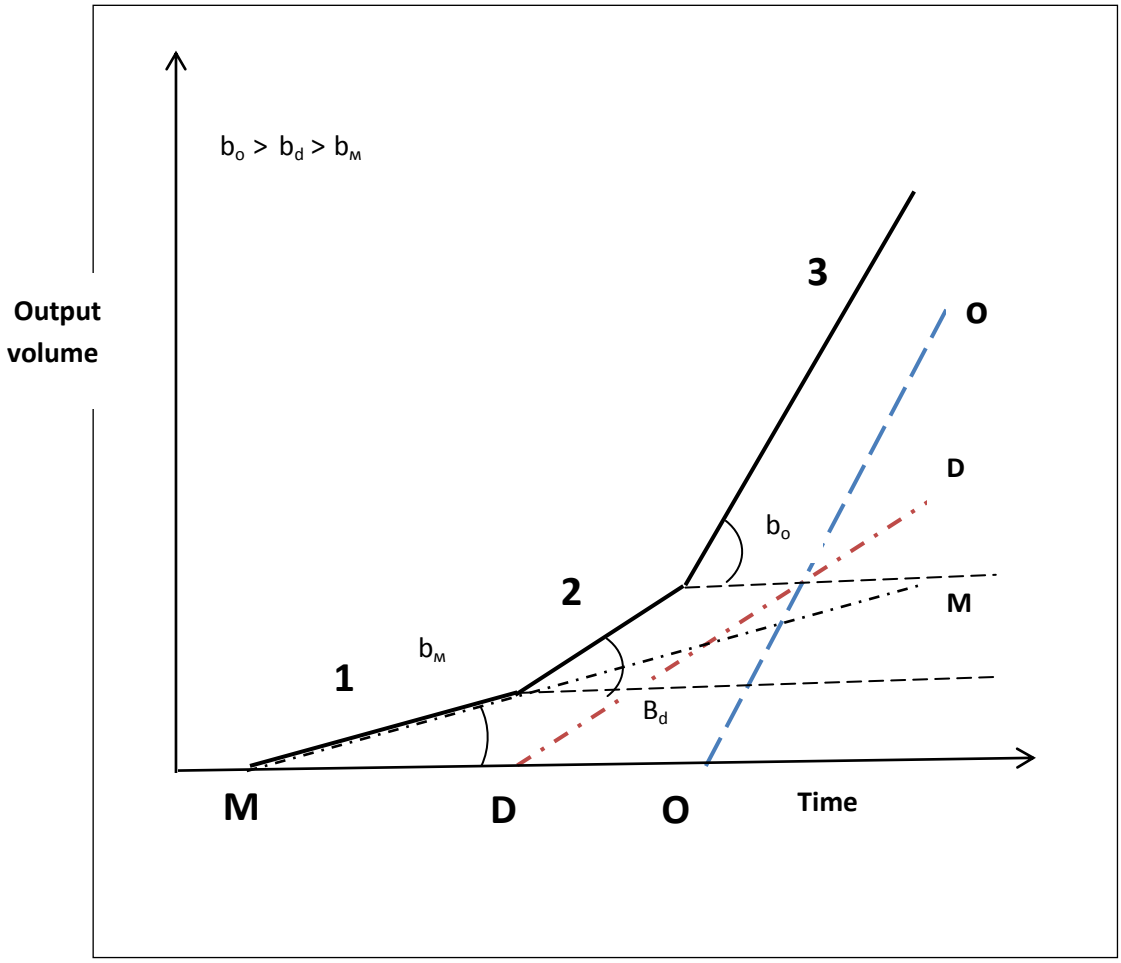
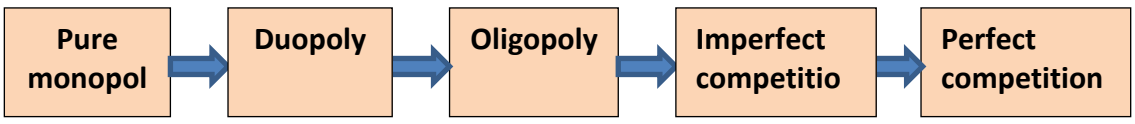


Fig. 3. Dependence of output characteristics of production on time in the environment of various technologies.

As can be seen, the relationship between monopoly and competition is very simple and there is no contradiction between them. Initially, the market is born as a monopoly, and then, through development, transfers into competition.

Thus, we can conclude that with the growth of the number of competing firms, the types of market structures change, and their sequence from pure monopoly to perfect competition can be represented by the following chain:



Proceeding from the foregoing, we can conclude that to achieve progress, a nonlinear increase in the production of output over time is necessary. To do this, it is sufficient to have a multitude of firms interacting with each other under the influence of competition. It is noted that as the number of firms grows, the market is subject to the law of complex systems. Acquiring technology and creating conditions for competition in the market, one can achieve progress even without having a strong science. In other words, free competition and unbreakable antitrust laws are very important for the economic growth of states. Technology is a factor that strongly influences the progress. There is a great need for science in order to develop the technology. Science is a very strong factor that influences the nonlinearly changing growth of the economy. Scientists are subjects that develop the science. Scientists are generators of ideas, they stand at the center of world development. This is the main reason for the so-called phenomenon, the "brain drain".

It is shown that with the growth of the number of competing firms, the types of market structures change, and their sequence from pure monopoly to perfect competition can be represented by the following chain: pure monopoly-duopoly-oligopoly-pure competition and again a monopoly arising from technological progress.

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