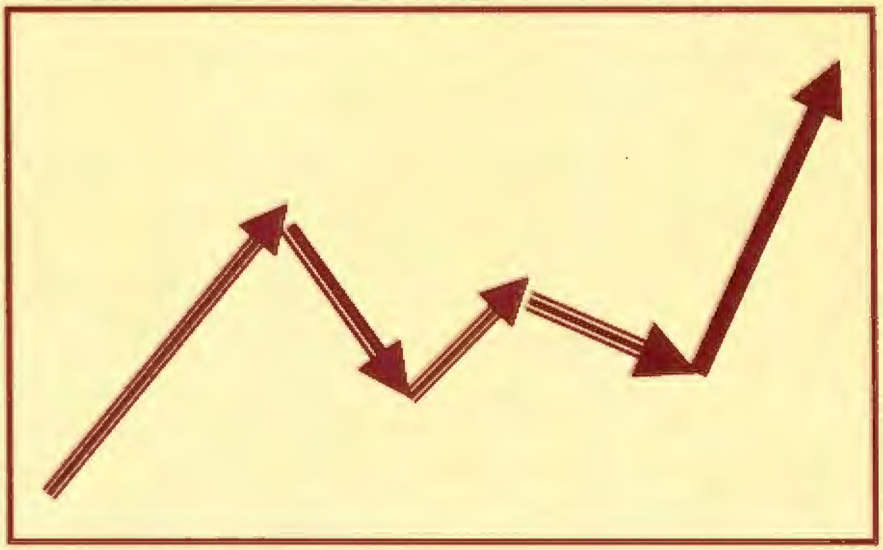
STANISŁAW PIASECKI

AN INTRODUCTION TO A THEORY OF MARKET COMPETITION

Volume II



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Volume II

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INTRODUCTION

The purpose of the present book is to show the possibility of developing a quantitative description of the action of "invisible hand" on the market. This is why the text is full of mathematical expressions, even though they are kept purposefully at the possibly simple level.

At the same time, the book is a subsequent publication of results from the work on establishment of foundations for the theory of economic competition, limited, however, essentially to what is called price competition. Let us note at this point that the "competitors" here considered are the companies selling their produce on the common and limited market, and that price competition analysed takes place among the products of different companies, serving to satisfy the very same kind of demand from the side of the customers.

Price competition ought to be regarded as a dynamic market game, which takes place within the space of retail prices, i.e. in the "open", before the eyes of the consumers, or in the space of wholesale prices – behind the scenes. The strategies of the players consist in selection of prices, at which their products (services) are sold.

Under a close examination of the problem it turned out that most important for defining the market price game is determination of the "payoff function". The present book is devoted, therefore, mainly to this problem.

This volume constitutes a continuation of the considerations from the first volume of "*Introduction to a Theory of Market Competition*", in which territorial expansion strategy of companies has been analysed, this strategy allowing for expansion of sales and lowering of prices. Yet, sooner or later, the instant has to come when a company must enter an "alien" market, and, after a successful entry, face the problem of expanding its market share.

Hence, it is the last two issues that this book takes up and analyses.

The considerations forwarded therein are based on three fundamental assumptions:

- Increase of price of purchase entails a decrease of the number of products sold.
- Increase of the number of products turned out makes it possible to lower the cost of producing these products.
- The market secures the preservation of equilibrium between demand and supply. Customers are directed by reason when making purchasing decisions.

The first assumption results from the fact that each customer has limited financial capacities (of purchasing products and services).

The second assumption is justified by the commonly observed "production scale effect", which results from the continuous technological progress, taking place especially in the domain of production technologies. This fact finds its confirmation in the history of economic development – from handicraft through workshop production to the present-day mass (even if customised) production.

The third, double assumption is associated with the adoption of principles of free market.

In order to represent the "scale effect", the hyperbolic relation was used, resulting from the analysis of the constant and variable production costs.

To describe the dependence of demand upon the product price, stemming from the income structure of potential customers, the linear dependence was used, which is characteristic for the constant income density of customers.

Other adopted assumptions and simplifications are of technical character.

Many of the Readers shall certainly be disappointed, as they will not find in the book the statistical inquiries, based on what is called "real-life data", that would confirm the assumptions adopted and the results obtained. In order, though, for a theory to be subject to verification, it must first be formulated. It should be indicated that the precepts of this theory have been successfully implemented in economic reality, in the practice of quite a significant company in Poland.

Thus, the contents of this book ought to be regarded as an attempt of formulating a definite theory, by no means pretending to having exhausted the entire problem area. It should be added that the results contained in both volumes published so far result from the research done by the respective authors within the Systems Research Institute of the Polish Academy of Sciences. Separate thanks go to the NTT System S.A. company that supported financially the publication of both volumes.

The authors of both volumes hope that this modest contribution shall serve its purpose of providing to the Readers the very first insight into the possibility of representing and analysing in quantitative terms the processes we observe daily on the globalising markets. The authors would also like to announce the preparation of the subsequent volume, presenting the extension to the theory here expounded.

Warsaw, June 2011

Chapter IV

MODELLING OF MARKET PROCESSES

1. The case of entry into a new market

On a certain market a product of Company B is being sold for the sales price of C_B. Some Company A intends to enter this market with its product that is competitive with respect to the product sold to date on this market.

For this purpose, Company A plans to sell its product for the price $C_A < C_B$. The fundamental issue is how to determine the value of C_A in such a manner as to succeed with the market entry – i.e. to gain a stable position of the product A on the market or even assure 100% share in the market (meaning complete pushing away of the product of Company B from the market). The degree of success, especially in the latter case, depends, of course, also upon the defensive strategy of Company B.

We shall base our assessment of the correctness of determining the value of C_A on the value of the difference of profits:

$$\Delta Z = Z_A - Z_B$$

at some time instant $\tau = 1/\alpha_1$, assuming that the game started at the time instant $\tau = 0$.

In general terms, the market game considered is a multi-step game, in which the two parties (Companies A and B), make successively their choices, concerning the values of C_A and C_B. The very first move belongs to Company B.

Assume, as before, that demand for a product depends upon its price:

$$\Lambda = \Lambda_{mx} \cdot \left(1 - \frac{C}{C_{mx}}\right).$$

At the time instant t_0, which corresponds to the instant $\tau = 0$, of starting the game, demand for (and sales of) the product of Company B was equal

$$\Lambda_0 \equiv \Lambda_B = \Lambda_{mx} \cdot \left(1 - \frac{C_B}{C_{mx}}\right).$$

Now, starting with the time instant t_0+, the sales of the product of Company B, constant hitherto, shall start to decrease, while the sales of the product of Company A shall be increasing (if $C_A < C_B$). Of course, after a sufficiently long time period, the sales of the product of Company B would have dropped to zero, if Company B had not changed the price of the product. Company A, though, cannot count on such a course of events. That is why we shall be assessing the advantage, resulting from the choice of the "entry" price C_A in terms of the sales effects after the time period of a standard length equal 1, i.e. at the time instant $\tau = 1$ of the game time, corresponding to the calendar time t_0+1/α_1. In view of dependence upon the value of α_1, the unit of game time may have various durations, when measured in the units of the real (calendar) time.

As a consequence of introduction of a competitive product on the market, the overall demand shall increase to the value

$$\Lambda = \Lambda_{mx} \cdot \left(1 - \frac{C_A}{C_{mx}}\right) = \Lambda_0 + \Delta\Lambda$$

where $\Delta\Lambda = \Lambda - \Lambda_0 = \frac{\Delta C}{C_{mx}} \Lambda_{mx}$; $\Delta C = C_B - C_A$.

The increase of demand by the value of $\Delta\Lambda$ takes place almost immediately through purchases of the cheaper product of the Company A. At the same time, the customers having until that time used the product of Company B, shall be purchasing the product of

Company A at the rate of using up the previously purchased products.

Consequently, the dynamics of increase of sales of the Company A product shall be described by the following expression:

$$\Lambda_A(\tau) = \Lambda_0\left(1 - a^{\alpha_1}\right) + \Lambda_{mx}\frac{C_B - C_A}{C_{mx}}\left(1 - a^{\alpha_2\tau}\right) \cdot$$

Similarly, for the product of Company B, the following expression of its sales dynamics will be valid:

$$\Lambda_B(\tau) = \Lambda_0 \cdot a^{\alpha_1\tau}$$

As we substitute $a = C_A/C_B$ and normalise the expression obtained, we get

$$\frac{\Lambda_A(\tau)}{\Lambda_{mx}} = \left(1 - \frac{C_B}{C_{mx}}\right)\cdot\left[1 - \left(\frac{C_A}{C_B}\right)^{\alpha_1\tau}\right] + \frac{C_B - C_A}{C_{mx}}\cdot\left[1 - \left(\frac{C_A}{C_B}\right)^{\alpha_2\tau}\right]$$

and

$$\frac{\Lambda_B(\tau)}{\Lambda_{mx}} = \left(1 - \frac{C_B}{C_{mx}}\right)\cdot\left(\frac{C_A}{C_B}\right)^{\alpha_1\tau} \cdot$$

Of particular interest is the difference of the demand value, $\Delta\Lambda = \Lambda_A - \Lambda_B$.

As we introduce the respective formulae, we obtain

$$\frac{\Delta\Lambda(\tau)}{\Lambda_{mx}} = \left(1 - \frac{C_B}{C_{mx}}\right)\cdot\left[1 - 2\left(\frac{C_A}{C_B}\right)^{\alpha_1\tau}\right] + \frac{C_B - C_A}{C_{mx}}\left[1 - \left(\frac{C_A}{C_B}\right)^{\alpha_2\tau}\right]$$

For calculation purposes, instead of the continuous variable τ a discrete one was adopted, τ_n, with $n = 0, 1, 2, \ldots$, and $\tau_n = n/\alpha_1$.

By taking, next, the notations

$$\frac{C_A}{C_B} \equiv x \quad ; \quad \frac{C_B}{C_{mx}} \equiv C \quad ; \quad \frac{C_B - C_A}{C_{mx}} \equiv \frac{C_B}{C_{mx}} - \frac{C_A}{C_{mx}} \cdot \frac{C_B}{C_B} = C(1-x)$$

we obtain the following calculation formulae, in which no explicit units appear:

$$\frac{\Lambda_A(n)}{\Lambda_{mx}} = (1-C)\cdot\left(1-x^n\right) + C\cdot(1-x)\cdot\left(1-x^{kn}\right)$$

$$\frac{\Delta\Lambda(n)}{\Lambda_{mx}} = (1-C)\cdot\left(1-2x^n\right) + C\cdot(1-x)\cdot\left(1-x^{kn}\right)$$

where $k = \alpha_2/\alpha_1$, and it is assumed that $k > 3$.

The courses of dependences for $\Delta\Lambda$ (shown as dL) as functions of x, C and n, for $k = 4$, are presented in Figs. 4.1 through 4.3, respectively.

Yet, it is, of course, much more important to look at the dependence of profits, and of their difference, as indicated at the outset, i.e. the value of $\Delta Z = Z_A - Z_B$, determined by the decisions of both parties.

Thus, conform to the previously introduced formula for the difference of profits, we get

$$\Delta Z = \left(C_B - b\right)\cdot\Delta\Lambda - \left(C_B - C_B\right)\cdot\Lambda_A$$

which, after division of both sides by Λ_{max}, becomes

$$\frac{\Delta Z}{\Lambda_{mx}} = \left(C_B - b\right)\cdot\frac{\Delta\Lambda}{\Lambda_{mx}} - \left(C_B - C_A\right)\cdot\frac{\Lambda_A}{\Lambda_{mx}}\cdot$$

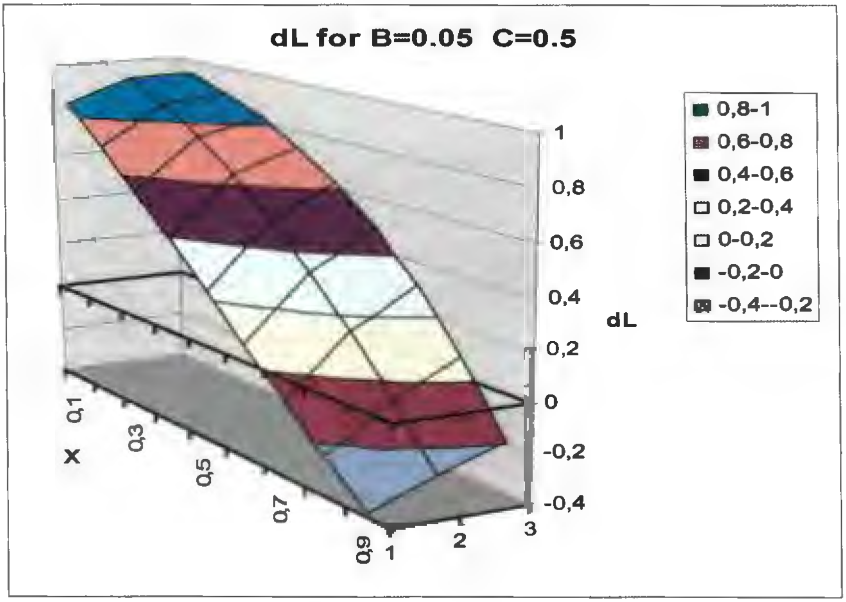


Figure 4.1.

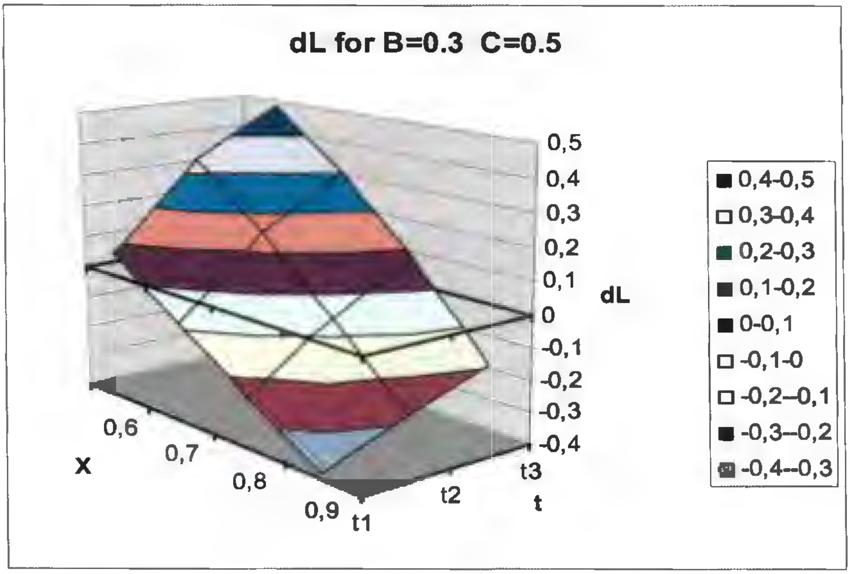


Figure 4.2.

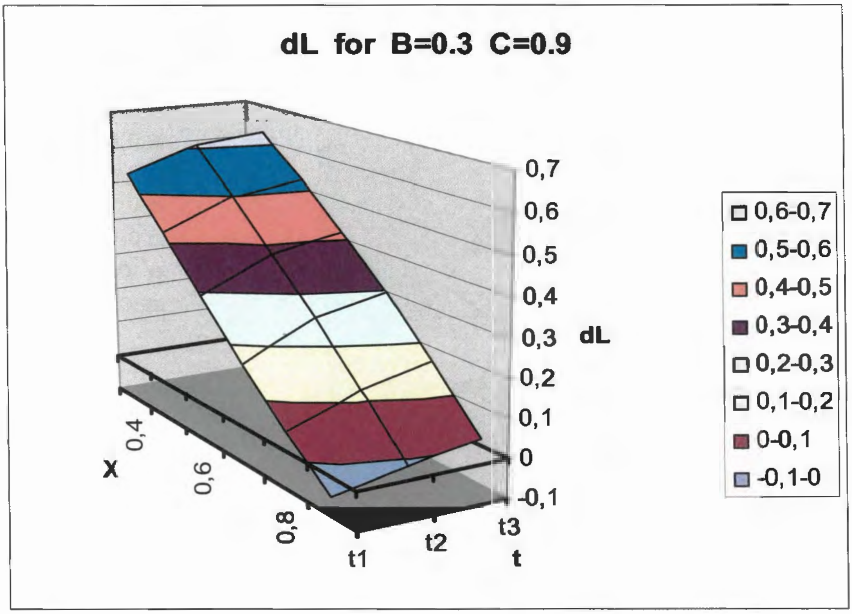


Figure 4.3.

Now, in order to get rid of the explicit units we divide this form of the differences of profits by b to get

$$\frac{\Delta Z}{b\cdot\Lambda_{mx}}=\left(\frac{C_B}{b}-1\right)\cdot\frac{\Delta\Lambda}{\Lambda_{mx}}-\left(\frac{C_B}{b}-\frac{C_A}{b}\right)\cdot\frac{\Lambda_A}{\Lambda_{mx}}.$$

If we introduce, next, the notations

$$x=\frac{C_A}{C_B}\;;\quad B=\frac{b}{C_{mx}}\;;\quad C=\frac{C_B}{C_{mx}}$$

then we obtain

$$\frac{\Delta Z}{b\cdot\Lambda_{mx}}=\left(\frac{C}{B}-1\right)\cdot\frac{\Delta\Lambda}{\Lambda_{mx}}-\frac{C}{B}\cdot(1-x)\cdot\frac{\Lambda_A}{\Lambda_{mx}}.$$

We have now to define the domain of variability of the values of x and the respective parameters. As we already know, they must fulfil the following inequalities

$$0 < b < C_B < C_A < C_{mx} < \infty .$$

The sequence of inequalities, given above, is equivalent to the following set of inequalities

$$B < C < 1, \qquad \frac{B}{C} < x < 1$$

Let us note, therefore, that the value of difference of profits depends upon four quantities: x, B, C and t (or n). For these dependences calculations were performed to show the shape of respective surfaces as defined over the plane x x n (with, here, n = 1, 2, 3, but denoted as $t1$, $t2$ etc.). The values of B and C were treated as parameters of the calculated surfaces. Figs. 4.4 through 4.9 show the respective calculation results (again, dZ standing for ΔZ).

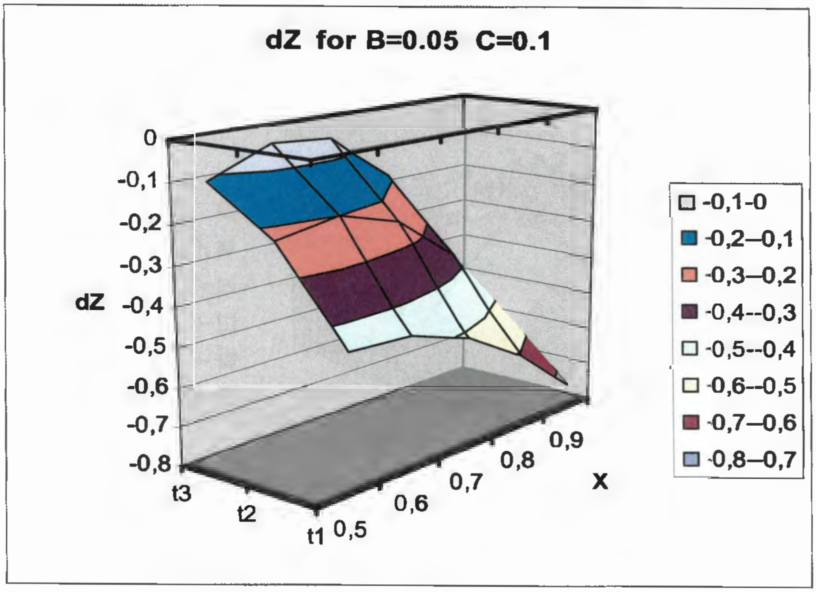
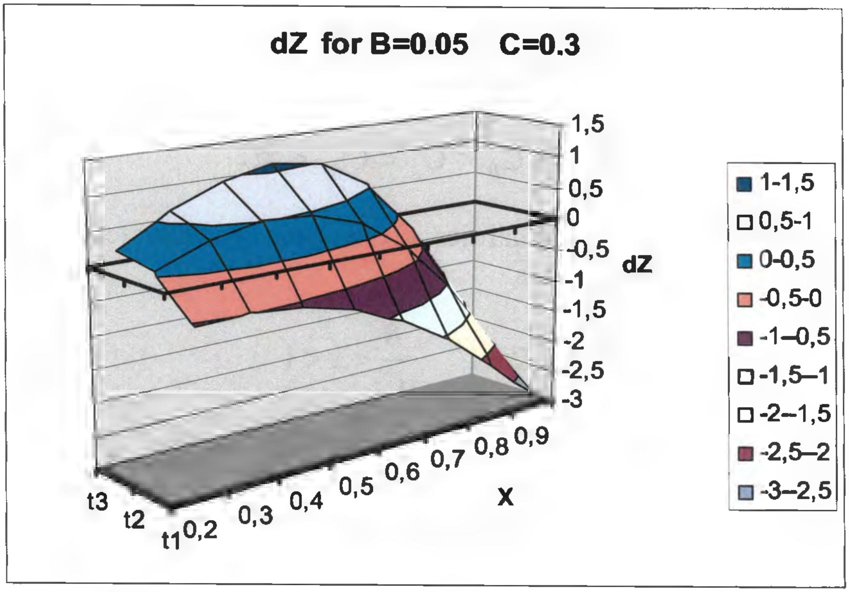


Figure 4.4.



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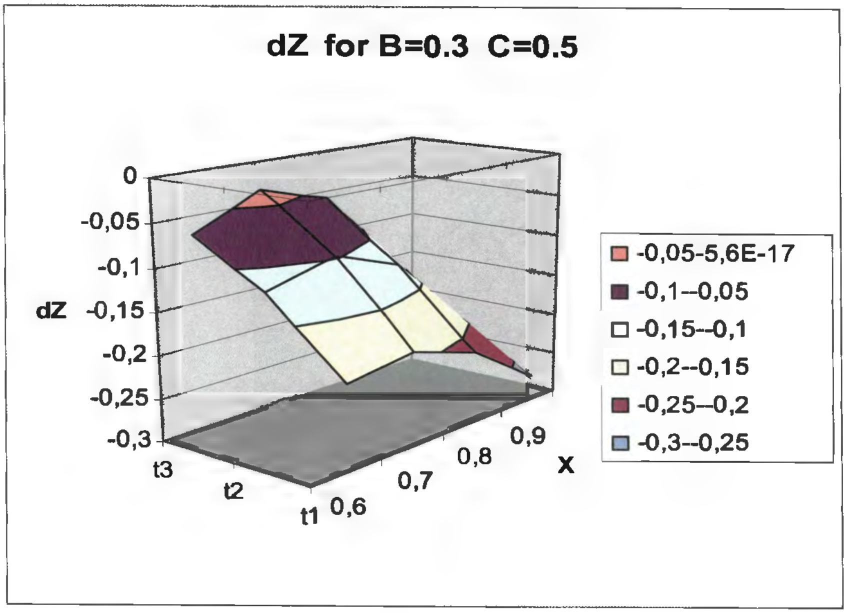

Figure 4.6.

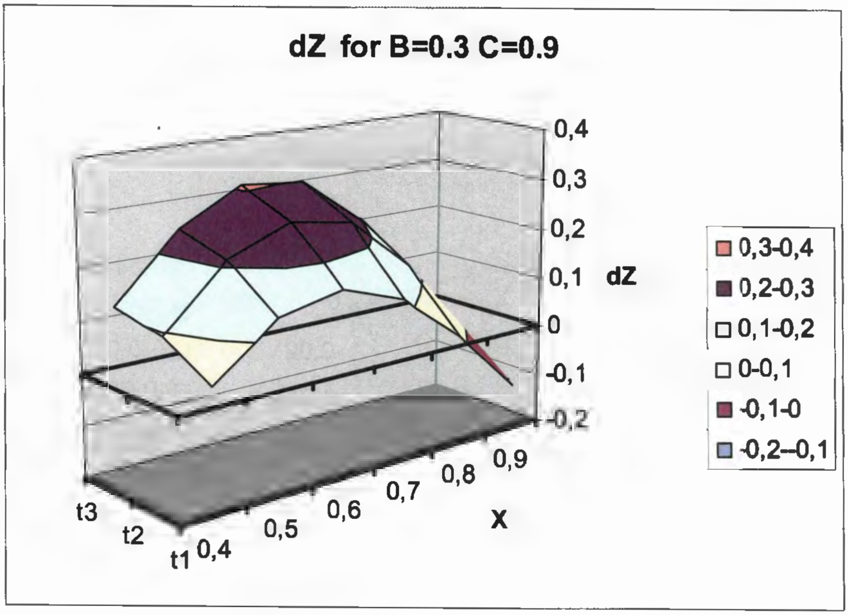

Figure 4.7.

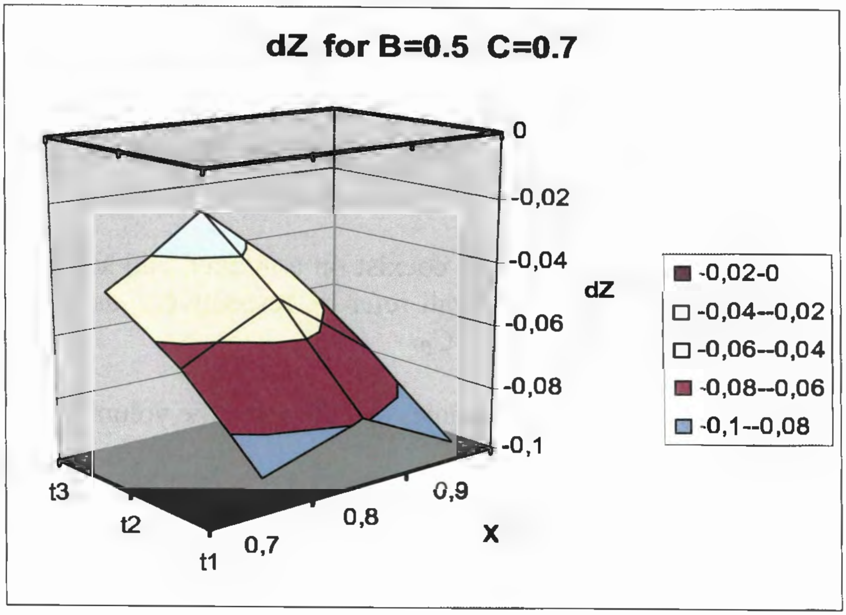

Figure 4.8.

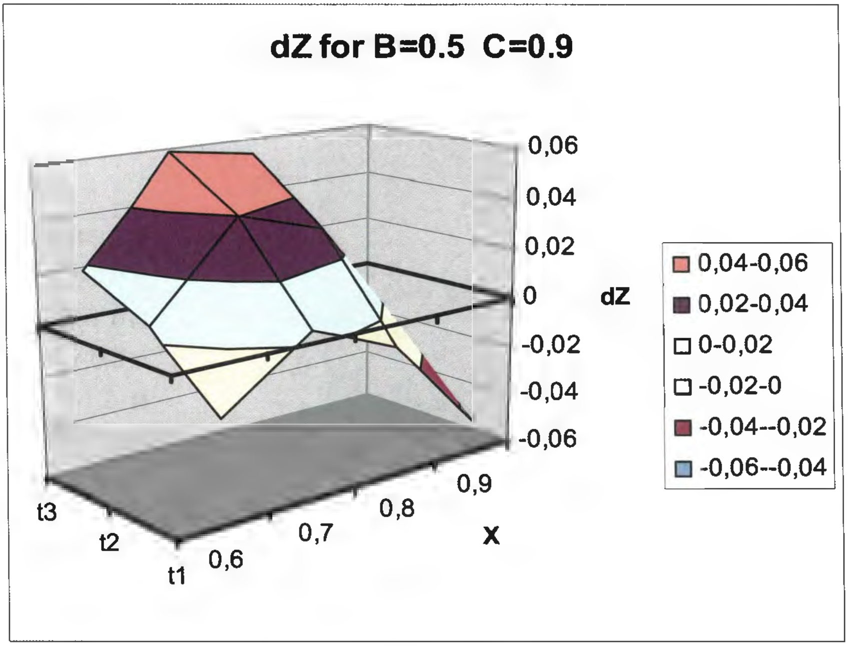

Figure 4.9.

2. The case of companies competing on a common market

Two companies, A and B, coexist on a market, and sell their competitive products that we shall refer to, respectively, as A and B, for the same price, $C_0 = C_A = C_B$.

The sales of the two companies shall assume the volume

$$\Lambda_0 = \Lambda_{mx}\left(1 - \frac{C_0}{C_{mx}}\right).$$

Under these conditions the market shares of the two companies shall be as follows:

$$\Lambda_A = \Lambda_0 \cdot \beta_A(\tau) = \Lambda_0 \frac{1}{1+a^{\alpha_1 \tau}} = \frac{1}{2}$$

$$\Lambda_B = \Lambda_0 \cdot \beta_B(\tau) = \Lambda_0 \frac{a^{\alpha_1 \tau}}{1+a^{\alpha_1 \tau}} = \frac{1}{2}$$

where $a = C_A/C_B = 1$.

We deal here, therefore, with a stable state of sales of the two companies, for $u = 1$, on a common market.

Consider now the situation, when one of the companies, say A, does lower at the time instant t_0 the price of its product by the quantity $\Delta C = C_0 - C_A$, with the aim of pushing Company B out of the market. Let us remind that the products A and B are genuinely competitive, i.e. they are similar in terms of their utility properties.

If Company B ignored the move of Company A, then, after a sufficiently long period of time, the sales of product B would drop down to zero, and Company A would gain the entire market, achieving the sales volume

$$\Lambda_\infty = \Lambda_{mx}(1 - C_A/C_{mx}) > \Lambda_0,$$

with $C_A = C_0 - \Delta C$.

The difference of the sales volume $\Lambda_\infty - \Lambda_0$ on the market results from the increase of the number of effective customers – the appearance of customers, for whom the price to date, C_0, has been too high, making it impossible to purchase the product, until the time instant t_0.

Hence, the difference in the sales volume shall be defined by the expression

$$\Delta\Lambda = \Lambda_\infty - \Lambda_0 = \Lambda_{mx} \frac{C_B - C_A}{C_{mx}}.$$

Similarly as before, we shall take an obvious assumption that the intensity of increase of sales, α_2, is much bigger than α_1. Consequently, we obtain

$$\Lambda_A(\tau) = \Lambda_0 \beta(\tau) + \Delta\Lambda_A(\tau).$$

After we substitute the expressions for the values of Λ_0, β and $\Delta\Lambda_A$ we get

$$\Lambda_A(\tau) = \Lambda_{mx}\left(1 - \frac{C_B}{C_{mx}}\right)\frac{1}{1 - a^{\alpha_1 \tau}} + \Lambda_{mx}\frac{C_B - C_A}{C_{mx}}\left(1 - a^{\alpha_2 \tau}\right)$$

Or, after having gotten rid of measurement units:

$$\frac{\Lambda_A(\tau)}{\Lambda_{mx}} = \frac{1 - \dfrac{C_B}{C_{mx}}}{1 + \left(\dfrac{C_A}{C_B}\right)^{\alpha_1 \tau}} + \frac{C_B - C_A}{C_{mx}}\left[1 - \left(\frac{C_A}{C_B}\right)^{\alpha_2 \tau}\right].$$

In a similar manner we shall obtain

$$\frac{\Lambda_B(\tau)}{\Lambda_{mx}} = \left(1 - \frac{C_B}{C_{mx}}\right)\frac{\left(\dfrac{C_A}{C_B}\right)^{\alpha_1 \tau}}{1 + \left(\dfrac{C_A}{C_B}\right)^{\alpha_1 \tau}}$$

If, now, we transform the continuous variable τ into a discrete one, taking the values $\tau = n/\alpha_1$, where $n = 0, 1, 2, \ldots$, then we obtain

$$\frac{\Lambda_A(n)}{\Lambda_{mx}} = \frac{1-\dfrac{C_B}{C_{mx}}}{1+\left(\dfrac{C_A}{C_B}\right)^n} + \frac{C_B - C_A}{C_{mx}}\left[1-\left(\frac{C_A}{C_B}\right)^{kn}\right]$$

$$\frac{\Lambda_B(n)}{\Lambda_{mx}} = \left(1-\frac{C_B}{C_{mx}}\right)\frac{\left(\dfrac{C_A}{C_B}\right)^n}{1+\left(\dfrac{C_A}{C_B}\right)^n}$$

Further, in a similar way we shall determine the dimensionless difference

$$\frac{\Delta\Lambda(n)}{\Lambda_{mx}} = \frac{\Lambda_A(n)}{\Lambda_{mx}} - \frac{\Lambda_B(n)}{\Lambda_{mx}}.$$

After the substitution of respective formulae, we get

$$\frac{\Delta\Lambda(n)}{\Lambda_{mx}} = \left(1-\frac{C_B}{C_{mx}}\right)\frac{1-\left(\dfrac{C_A}{C_B}\right)^n}{1+\left(\dfrac{C_A}{C_B}\right)^n} + \frac{C_B - C_A}{C_{mx}}\left[1-\left(\frac{C_A}{C_B}\right)^{kn}\right]$$

Then, as we introduce the notations

$$\frac{C_A}{C_B} \equiv x \quad ; \quad \frac{C_B}{C_{mx}} \equiv C \quad ; \quad \frac{C_B - C_A}{C_{mx}} \equiv \frac{C_B}{C_{mx}} - \frac{C_A}{C_{mx}} \cdot \frac{C_B}{C_B} = C(1-x)$$

we obtain the following dimensionless calculation formulae:

$$\frac{\Lambda_A(n)}{\Lambda_{mx}} = \frac{1-C}{1+x^n} + C\cdot(1-x)\cdot\left(1-x^{kn}\right)$$

$$\frac{\Delta\Lambda(n)}{\Lambda_{mx}} = (1-C)\cdot\frac{1-x^n}{1+x^n} + C\cdot(1-x)\cdot\left(1-x^{kn}\right)$$

where $k = \alpha_2/\alpha_1$, and we assume that k 4.

Let us next determine the difference of profits, using the previously introduced general formula:

$$\Delta Z = Z_A - Z_B = (C_B - b)\Delta\Lambda - (C_B - C_A)\Lambda_A .$$

By dividing the value of ΔZ by the product $b\Lambda_{\max}$ we obtain the following dimensionless expression:

$$\frac{\Delta Z}{b\Lambda_{mx}} = \left(\frac{C_B}{b} - 1\right)\frac{\Delta\Lambda}{\Lambda_{mx}} - \left(\frac{C_B}{b} - \frac{C_A}{b}\right)\frac{\Lambda_A}{\Lambda_{mx}} .$$

We shall now refer to the notations introduced before, namely

$$x = \frac{C_A}{C_B} \;;\quad B = \frac{b}{C_{mx}} \;;\quad C = \frac{C_B}{C_{mx}}$$

whereby we get

$$\frac{C_A}{b} = \frac{C_A}{C_B}\frac{C_B}{b} = x\frac{C_B}{b} = x\frac{C_B}{C_{mx}}\frac{C_{mx}}{b} = x\frac{C}{B} .$$

Now, using the relations thus determined, we obtain

$$\frac{\Delta Z}{b\Lambda_{mx}} = \left(\frac{C}{B} - 1\right)\frac{\Delta\Lambda}{\Lambda_{mx}} - \left(\frac{C}{B} - x\frac{C}{B}\right)\frac{\Lambda_A}{\Lambda_{mx}} ,$$

or, after simplifications:

$$\frac{\Delta Z}{b\Lambda_{mx}} = \left(\frac{C}{B} - 1\right)\frac{\Delta\Lambda}{\Lambda_{mx}} - \frac{C}{B}(1 - x)\frac{\Lambda_A}{\Lambda_{mx}} .$$

Before we can pass over to the effective calculation formulae, we must define the ranges of sensible value of the variables involved. As we know, the following conditions must hold:

1) $C_A > b$; 2) $C_B > b$; 3) $C_A < C_B$; and 4) $C_A, C_B < C_{\text{mx}}$.

Consequently, therefore, the values of the new variables are subject to the following constraints

$$\text{a) } B < C; \quad \text{b) } B/C < x; \quad \text{c) } A, C < 1.$$

Let us note, especially, that the value of the ratio C_A/C_B, i.e. the value of x, is subject to the conditions

$$b/C_B < x < 1, \text{ since } b/C_B = (b/C_{\text{mx}})(C_{\text{mx}}/C_B) = B/C.$$

Using the same notations we can write down in a similar manner the formula for the value of ΔZ:

$$\frac{\Delta Z}{b \cdot \Lambda_{mx}} = \left(\frac{C}{B} - 1\right) \cdot \frac{\Delta\Lambda}{\Lambda_{mx}} - \frac{C}{B} \cdot (1 - x) \cdot \frac{\Lambda_A}{\Lambda_{mx}}.$$

It can be easily noticed that this formula is the same as for the case of entry onto an alien market. Yet, this formula contains the values of $\Delta\Lambda$ and Λ_A that are defined by different expressions.

In connection with the above, now, Figs. 4.10 through 4.12 show the examples of the surfaces, representing the function considered, depending upon x, C and n for particular values of B (dZ standing, as before, for ΔZ in these figures).

It is now quite appropriate to make the Reader aware that the value of $B = 0.1$ in the figure does not at all mean that the producer has set the price as equal ten times the production cost!

As we already know, from Volume I, in particular, cost of manufacturing the product is equal

$$k = b + \frac{W}{\mu}.$$

So, if, for instance, $B = b/C_B = 0.1$, then

$$\frac{k}{C_B} = \frac{b + \frac{W}{\mu}}{C_B} = \frac{0{,}1 \cdot C_B + \frac{W}{\mu}}{C_B} = 0{,}1 + \frac{W}{\mu \cdot C_B}.$$

The ratio of the production cost, k, to the sales price may in this case reach the value of 0.9, when the constant part of production costs, W, are equal 80% of the sales value. In the pharmaceutical industry this proportion may attain several hundred percent.

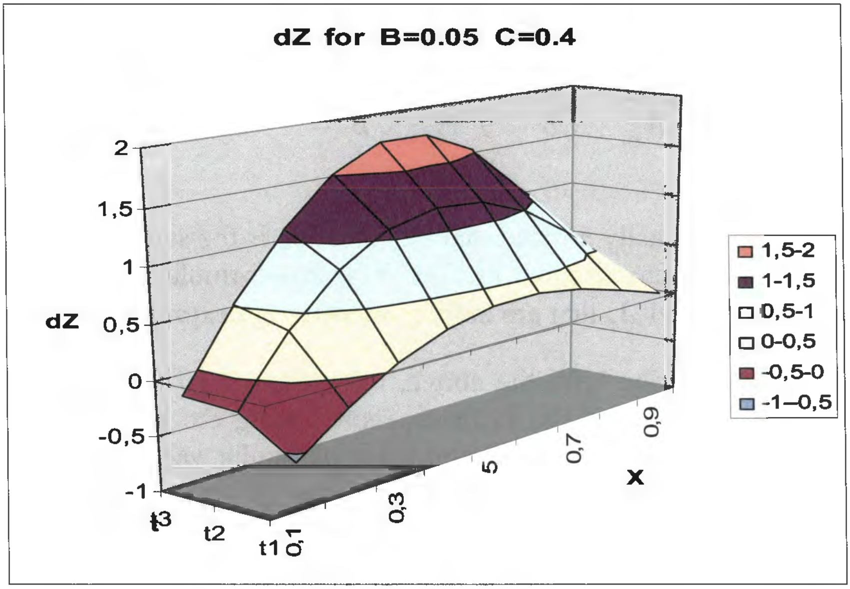

Figure 4.10.

Let us consider the influence, exerted by the trade intermediary on the development of the value of $B = b/C_B$.

If, for instance, the margin of the intermediary is equal p100%, where p is some fraction, between 0 and 1, then producer gets for the product sold the amount $(1-p)C_B$. This amount must at least cover the costs of turning out the product. If we wished, in addition, to achieve the profit of q100% off the sales price C_B of the product, then the cost of turning out the product must not be higher than the value of the remaining part of proceeds from sale:

$$(1\text{-}p\text{-}q)C_B = b + W/\mu, \text{ hence } b/C_B = (1\text{-}p\text{-}q) - W/(\mu C_B).$$

So, for instance, if $p = q = 0.2$ and the market price of the product sold, μC_B covers twice the constant costs of production, the value of b shall be equal 0.1.

We know that the set of admissible values of the variable x is constituted by the interval $(b/C, 1)$.

If, therefore, for instance, $B = 0.5$, then for $C > B = 0.8$ we get the interval (0.75, 1). If we distinguish only one digit after the decimal point, we deal with just two values: 0.8 and 0.9.

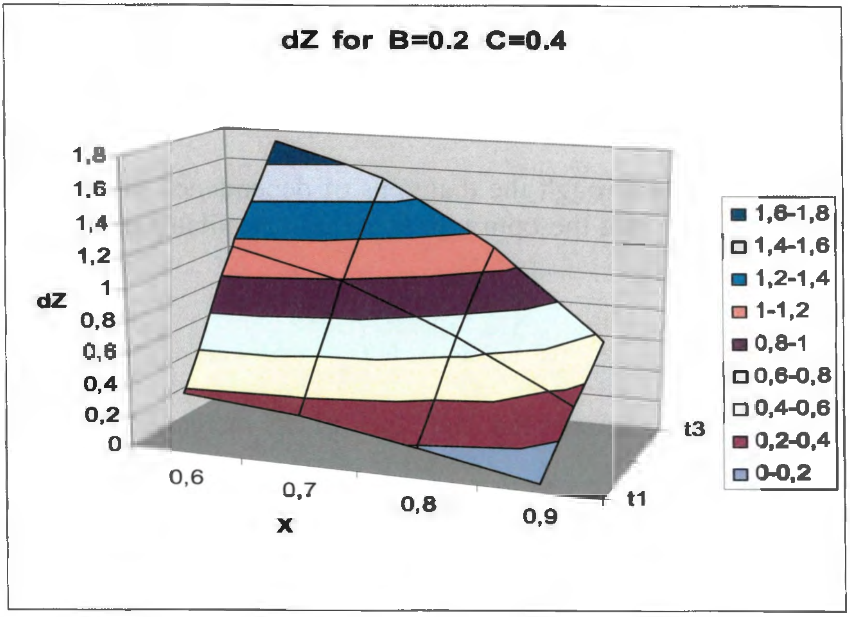

Figure 4.11.

On the other hand, for small values of B, for instance $B = 0.05$ and $C = 0.5$, the range of the admissible values spans the entire interval: $\{0.1, 0.2, 0.3, \ldots, 0.8, 0.9\}$.

Thus, we can see that only in the second case the issue of the choice of value of x or C_A is significant in terms of an appropriately wide range of admissible values of x.

Note, next, that in the first case, when $B = 0.6$ and $C = 0.8$, we have:

$$B = 0.6\ C_{\mathrm{mx}} \text{ and } C_B = 0.8\ C_{\mathrm{mx}},$$

meaning that we deal with the case of very expensive goods, not charged with high constant costs, such as, say, artistic jewellery.

In the second case, when $B = 0.05$ and $C = 0.5$, we have:

$$B = C_{\mathrm{mx}}/20 \text{ and } C_B = 0.5\ C_{\mathrm{mx}},$$

which now means that we deal with expensive goods, charged with high constant costs (e.g. high actual production costs, high costs of research and development). The respective examples are passenger jets, high-power turbines, some medicines or medical interventions.

As we look through the diagrams of dependence of ΔZ upon x, we can notice that the optimum value of x oscillates most often around the value

$$x \approx \frac{1}{2}\left(1 + \frac{B}{C}\right).$$

It can also be noted that the value of ΔZ increases with time under constant C_B.

Then, as we analyse the structure of the formula for the value of ΔZ, we can state that it becomes negative (for n or $t = 1$) when the first element of the difference is also negative, that is – when the following inequality is fulfilled:

$$\max\left\{\frac{1}{2}\ ;\ \frac{b}{C_B}\right\} < \frac{C_A}{C_B}$$

since $\Delta\Lambda$ is always positive.

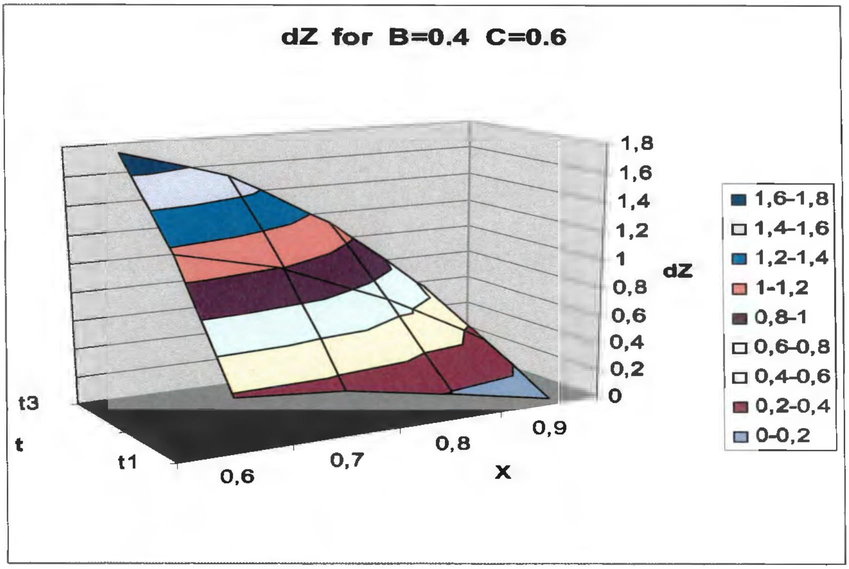

Figure 4.12.

This proposition is only a sufficient condition for ΔZ to be negative. It is not a necessary condition. Generally, for n or $t > 1$ this condition takes the form

$$\max\left\{\frac{1}{\sqrt[n]{2}}\ ;\ \frac{b}{C_B}\right\} < \frac{C_A}{C_B}.$$

At this point we shall terminate the consideration of the conclusions that could be drawn from the selected examples of modelling of market processes.

CONCLUDING REMARKS

This book, like the previous one, constituting Volume I of the introduction to a theory of market competition, contains considerations that involve a number of approximations and simplifications. We, that is – the authors of both these volumes – would like to draw the attention of the Reader to them.

In general, we do not explicitly consider the vague, uncertain or "fuzzy" character of some of the quantities we refer to. This concerns, in particular, such quantities as the limit value of d in the determination of the demand function, $\lambda(C)$.

Likewise, the uncertain, or specific character of some relations has not been treated in an explicit manner. Thus, for instance, we state in the book that the situation when the market shares of two competitors are equal, 50% each, constitutes indeed a kind of equilibrium, but this is an unstable equilibrium point, for any disturbance to this situation shall drive it far away from the equilibrium (assuming, of course, that this disturbance, due to behaviour of one of the competitors, does not find any "appropriate" reaction from the side of the other competitor).

In reality, though, this equilibrium point is not that unstable, i.e. it is not that sensitive to the very small disturbances. Actually, an interval of insensitivity always exists, due to various reasons, such as delays, information shortage, lack of reaction of customers to very small price changes etc. It is even possible that the "hysteresis" effect may appear. In terms of the notions introduced in this book, the magnitude of the zone of insensitivity depends upon the slope of the production characteristics (the value of the derivative $dk/d\mu$).

Independently of the above remarks the considerations here presented neglect the effect of the change in the number of potential customers due to the change in product price. Namely, along with the change in product price, there is also change in the value of the difference C-b, exerting the decisive influence on the magnitude of the optimum radius R^* of the area, over which the company effectively caters to its potential customers. This radius R^* defines, in turn, the number of such potential customers, i.e. the ones, to whom the products are effectively supplied. This number, in turn, together with the income structure of the customers, defines the value of Λ_{mx} (see also Volume I). Yet, in the book, for both companies selling their products for different prices, the very same value of Λ_{mx} was adopted.

Neglecting this particular aspect is justified by the following circumstances:

- a company that just enters the market (as well as the one, which tries to expand its market share) can hardly afford the advertising saying that its product is not worse than the one of the competitor, even though it is cheaper – and this not for all the potential customers, exception being constituted by the farthest ones;
- on the other hand, the company defending its market share and for this purpose decreasing the sales price of its products, ought not get rid of its more distant customers, since this would make a very disadvantageous effect on the remaining customers and would actually accelerate elimination of such a company from the market.

Of course, the fact that we neglected the influence, exerted by the changes in the reach, R, was also largely due to the wish of simplifying the complicated interrelations, constituting the description of the market process, the mechanism of functioning of the "invisible hand of the market".

Considerations, contained in the book, do not account, either, for the influence of advertising, although certain remarks on this subject are forwarded in Chapter I.

Likewise, we did not forward the estimates for the cost of entry onto an alien market, which could be formulated with the use of the formulae for the sales magnitudes (Λ_A and Λ_B).

When considering the (initial) shares of two competing companies, we analysed the case, when they start from equal market shares. For modelling and analysing other possible situations, we could use the coefficient u.

In the case when more than two companies have (non-negligible) shares in a market, the struggle for the market share ought to be started with the weakest company, avoiding the appearance of a hostile coalition of the remaining companies on the market. Otherwise, it would become necessary to establish an own coalition that would be able to withstand the competition of the other coalition. In such a case the struggle for the market shares would reduce to the case of two competitors, that is – to the situation described in the book.

In view of these and, indeed, many other aspects that remain to be accounted for, it is obvious that the description of the mechanism behind the functioning of the "invisible hand" is far from complete.

Concluding remarks

BIBLIOGRAPHY

In view, on the one hand, of the vast body of literature on the mechanisms of the market, mainly related to the micro-economic models and analyses, and, on the other, of the quite self-contained character of the considerations here forwarded, the list of references provided is quite short. It contains the publications of the authors, containing a similar or related content to the one here presented, and the essential positions, known internationally, which deal with similar problems.

Jehle G.A., Renyi P.J. (1998) *Advanced Microeconomic Theory.* Longman, Inc., London.

Łyszkiewicz W. (1999) *Industrial Organization.* WSHiFM, Warszawa.

Malawski M., Wieczorek A., Sosnowska H. (2004) *Konkurencja i kooperacja* (*Competition and cooperation*; in Polish). PWN, Warszawa.

Piasecki S. (1972) *Optymalizacja systemów obsługi technicznej* (*Optimisation of the technical service systems*; in Polish). WNT, Warszawa.

Piasecki S. (2000) *Sieciowe modele symulacyjne do wyznaczania strategii rozwoju przedsiębiorstw* (*Network simulation models for determining enterprise development strategies*; in Polish). The Interfaces Institute / Systems Research Institute, Warszawa.

Piasecki S. (1986) Wielokryterialne projektowanie linii technologicznych na przykładzie procesów obróbki (Multicriteria design of technological assembly lines on the example of the processing procedures; in Polish). In: *Materiały V Konferen-*

cji - Polioptymalizacja w projektowaniu. Politechnika Koszalińska, Mielno.

Piasecki S. (1999) *Teoria kooperacji gospodarczej i międzynarodowej wymiany handlowej* (*Theory of economic cooperation and international trade*; in Polish). WSZiP im. B. Jańskiego. Warszawa.

Piasecki S. (2002-2004) *Teoria rynkowej konkurencji przemysłowej* (*Theory of industrial market competition*; in Polish). Research Reports: RB/74/2002, RB/19/2003, RB/9/2004. Systems Research Institute, Warszawa.

Piasecki S. (2003) *Opłacalność uruchomienia produkcji nowych wyrobów* (*Profitability of starting manufacturing of new products*; in Polish). Wyd. PN-TTE, Warszawa-Lublin.

Piasecki S. (2005) Optymalizacja logistycznego systemu dostaw (Optimisation of the logistic system of supply; in Polish). In: *Materiały VII Międzynarodowej Konferencji 24-25 XI 2005.* AGH, Kraków.

Ruth M., Hannon B. (1997) *Modeling Dynamic Economic System.* Springer-Verlag, New York-Berlin-Heidelberg.

Salvatore D. (1995) *International Economics.* Prentice Hall International, Inc., New York.

Tinbergen J. (1965) *International Economic Integration.* New York.

This book is the second part of an exposition of a coherent and far-reaching theory of market competition. The theory is based on simple precepts, does not require deep knowledge of either economics or mathematics, and is therefore aimed primarily at undergraduate students and all those trying to put in order their vision of how the essential market mechanisms might work. The present Volume II constitutes a complement to the considerations, contained in Volume I.

The logic of the presentation is straightforward; it associates the easily grasped microeconomic elements of quantitative character in order to arrive at both more general conclusions and at concrete formulae defining the way the market mechanisms work under definite assumed conditions.

Some may consider this exposition too simplistic. In fact, it is deliberately kept very simple, for heuristic purposes, as well as in order to make the conclusions more clear. Adding a lot of details that make theory more realistic – these details, indeed, changing from country to country, and from sector to sector – is mainly left to the Reader, who is supposed to be able to design the more accurate image on the basis of the foundations, provided in the book.

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