

Modeling the Economic Saturation

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Abstract. The analysis of cyclic processes in the financial markets has drawn attention to the possibility of market saturation. It should be noted that overproduction is carried out in open markets, and saturation – in closed markets. Due to saturation, **profitability** of investing in closed markets increases and thus price bubbles are formed. The increase in profitability and emergence of price bubbles are forms of expression of a new economic paradox. The analysis of saturated economic systems started only in the last decade. This article contains modeling of saturated economic systems, supported by the newly-created "Logistic analysis tool". The tool is based on the model of logistic interest, developed in the last decade (S. Girdzijauskas, 2002).

Keywords: Market capacity, market gap, real market, market saturation, saturation, paradox, logistical model, economic growth, bubbles.

1 Introduction

Modern world agrees on pursuing economic welfare. Most experts (but not all) agree that economic welfare is not possible without economic growth. But it is impossible to achieve constant, unstoppable in time (endless) economic growth. "Everything that rises must converge" was rightly pointed out by Flannery O'Connor [14]. It is not hard to realize, that nothing can grow endlessly. Thus, if economy is growing, and endless growth is impossible, then growth must stop at some point of the time and this automatically means a crisis [3,8,12]. From this a conclusion can be derived that the main cause of economic crises lies in its growth.

Relevance of the topic. In the economic growth, as in every part of nature or society, thought, the externally visible chaos and chains of coincidence, the economic patterns manifest. We must agree that individual economic processes as well as the whole economic growth are generally controlled by the inner laws. Everything has its own cause and everyone's responsibility is to try to find it, wrote Ralph Nelson Elliot (1871-1948) a researcher of economic waves. [9,12]

Limited growth is defined by a logistic function. Such growth is widely used in researching saturation of populations (biological and etc.) [14].

So far we have modelled the economic situations by using MS Excel or “Loglet Lab” programme that was created and presented by New York’s Rockefeller University’s students in 1999. Since the “Loglet Lab” tool uses a logistic function which is oriented for the analysis of several biological processes, it was decided to create and design the economic logistic analysis tool [2]. The core of the new tool is – a mathematical-economical logistic interest model (S.Girdzijauskas, 2002) [6]. It represented the economic saturation by using MS Excel and the new tool, of which the advantages, possibilities and functionality are described in the article.

The purpose of the topic is to introduce a logistic software tool for simulating the growth of the economic processes by using logistic interest function.

The main goals of the article are:

- Present the logistic capital growth model;
- Specify its importance for the market economy;
- Represent the advantages and opportunities of the “Logistic analysis tool”.

2 Capital Growth Model Market Saturation

In order to find out the main causes that drive the growth, we have to understand the logistic growth model before simulated the growth [3,6]:

$$K = \frac{K_p \cdot K_0 (1+i)^n}{(K_p - K_0) + K_0 (1+i)^n} \quad (1)$$

In these formulas: K – population (capital size) after n periods; K_p – maximal (potential) capital value (market capacity); K_0 – initial capital value (initial investment); i – interest rate.

Market saturation can be understood as an amount of capital that could be effectively absorbed in investments. The main characteristic of market saturation is the potential capital. Market saturation is the biggest theoretically possible sales amount of products or services that could be achieved by all companies at a certain time. Very often, producing and selling more and more goods or services of the same market, the market is gradually filled and market saturation is reached. The term ‘saturated’ in most cases means *fullness, filling up to a certain limit, absolute loading* [4,7].

All the market capacity could be understood as consisting of two parts: a) the part, which is already filled and b) the part which is not filled yet. Let us call the already filled market the real market, and the unfilled market – a market niche. Then, the market capacity will be equal to the real market plus market niche, i.e.

In such a way, semi-closed and especially closed markets can become saturated increasing investments. Meanwhile open markets cannot be saturated (it is only possible to have an overproduction). Hints of saturation are increasingly common in the world [5,10,14]. Unfortunately, they cover only the outside – a superficial half of the saturation.

During the last decade, deeper research in Lithuania has exceeded its expectations – it has become clear that saturation does not only exist in financial areas but it occurs in a paradoxical way and thus, it is one of the major factors that cause economic cataclysms.

3 “Logistic Analysis Tool” – The Price Bubble Simulation

There is a lot of different software tools used for economic analysis, such as: *Matlab*, *Loglet Lab*, *Excel*, *MS* and others, by their functionality and user interface but none of them meets the requirements for the smooth and logistic function-based modeling. For this reason, it was decided to propose the “logistic analysis tool” to solve this problem.

The purpose of designing the “Logistic analysis tool” is to create a software tool for the analysis of the selected logistic function. This tool is intended to provide the user with the possibility to import and export processed data. The user is also able to apply the “Logistic analysis tool” in a virtual area and the results are presented in a graphical form. With the help of this tool, the time distributed data is aimed at to be analyze: the first step is to divide the main growth process into subprocesses (with the help of a software code) in order to determine the limits of growth, then, according to the graphic form, allow the definition of the entire system’s behavior.

3.1 The Algorithm and Dynamics of the Software Tool

The algorithm of the created logistic tool is presented in figure 1. The main steps for simulation of economical situation are [13]:

1. The user enters the data;
2. The data are processed by the system;
3. The economic logistic model is being simulated;
4. The graph of simulation is presented for the user;
5. The user has the option to adjust the growth at any time of simulation.

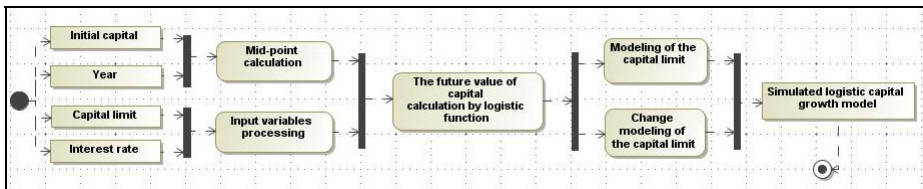


Fig. 1. The algorithm of “Logistic analysis tool”

In order to design the logistic economical model, we need to define four variables of the logistic function. These variables are: initial capital, period, capital limit and interest rate. After the introduction of these data, the mid-point is calculated and, with the help of the economic-logistic function, the output variables are processed. The

type of analysis of variables can be chosen by the user of a logistic tool. The user can decide whether he wants to simulate only the future capital value (threshold) or the scope of change of this threshold [13].

Final result of the tool – a simulated logistic capital growth model, which is reproduced graphically (figure 2).

3.2 The Realization of the “Logistic Analysis Tool”

It is decided to use software realization tools for “Logistic analysis tool” [13]:

- PHP 5.2.17. programming language;
- Control Panel "DirectAdmin", based on Linux (tool can be reached at: <http://lai.tefno.net/>);
- Notepad ++, for PHP programming language;
- Internet Explorer 8.0, Opera, Mozilla Firefox browsers for review of “Logistic analysis tool” outcome.

Consider the simplified case where all the cash flow consists of only two members: the amount of investment and the only income member. In addition, the investment should be equal to one cash unit (c.u.), and the income received after one period - equal to 1.1 c.u.

Then let us make a table when $K = 1.1$ (which corresponds to an annual interest rate equal to 10%), and $K_p > 1.1$. Express the degree of market filling by ratio of K / K_p .

Table 1.

K_p	10^8	11	5.5	3.67	2.75	2.20	1.83	1.57	1.38	1.22	1.10
K/K_p	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.99

The table shows only the standard points. Actually, it can be taken more in the function's intensive change area.

The graph in the 2nd “Logistic analysis tool” picture shows the tool's operation, capabilities and functionality. There are modeling a clear dependence on the profitability of market saturation rates: **with increasing saturation – increased profitability**. This is the paradoxical behavior of the market. Taking deeper consideration, we notice that the overproduction is accompanied by a decline in profitability only to open markets, where there is no saturation. Meanwhile, in partially or fully closed (and saturated) markets, overproduction is accompanied by growth in profitability, which in turn triggers the stock market. The latter further enhances overproduction. In this way price bubbles occur. When the bubble bursts, recession or crisis is expected. [1,2,3,11].

The user can easily understand the dynamics of the “Logistic analysis tool” from the input of data to graph drawing. With the help of this tool, each user can analyze and simulate the economic paradoxes at any time.

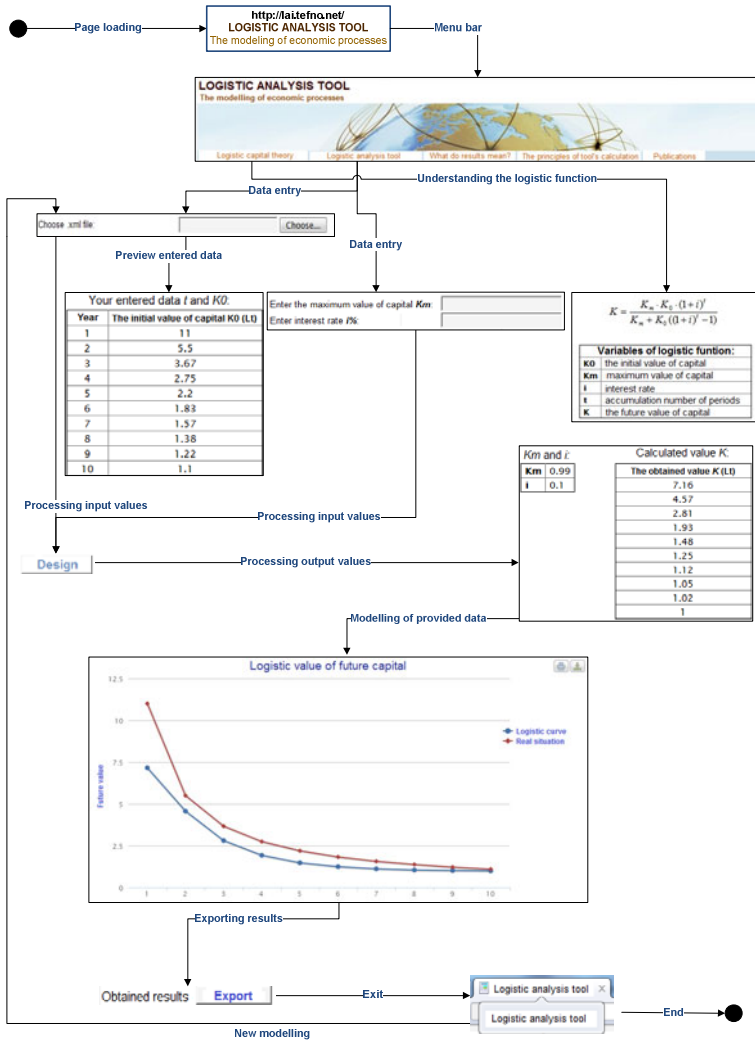


Fig. 2. “Logistic analysis tool”

4 Conclusions

- Market capacity, saturation effects which influence modern economic development are presented. The analyzed example allows the reader to understand the advantages and opportunities of logistic growth. Since that time, it is particularly important to examine the details of these paradoxes and their linkages with market capacity, excess liquidity, economic bubbles’ formation, cyclical evolution of economic development, overproduction, inflation, stagnation, unemployment and other economic phenomena.

- Price modeling has been presented with the help of the "Logistic analysis tool". The algorithm of the tool shows the modeling of economic processes in a clear way and is an opportunity for data analysis.

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