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Economical Sustainability and Crises: The Application of Economic Logistic Analysis in the Research of Financial Crises

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Abstract: Each economic cycle consists of a rise, peak, fall and crises. Year after year this curve has been studied by the scientists. It is attempted to explain the reasons of these phenomena, to foresee their range, to reduce the negative impact or to use the positive benefit of the range. In other words, it is pursuing economic sustainability by providing the compatibility with environmental, social, technical and other factors. Constantly repeated downturns, crises require new market researches and these researches help to develop theories that explain the crises. In this article both classic and new theories of financial and economic crises were reviewed and compared. The representatives of these theories are K. Marx, J. Keynes, H. Minsky, P.F. Verhülst, S. Girdzijauskas. The professor of Vilnius University, Stasys Girdzijauskas established a well-developed theory of logistic management of capital which reveals the reasons of financial and economic crises, unnamed paradoxes in economy which cause the economic crises, closed and open markets and development of their capacity. The theory of logistic management of capital as the biggest problem emphasizes and indicates the filling of system capacity by capital, in which it is invested. It is shown that the economic downturns can be prevented by invoking the theory of logistic management of capital.

Keywords: The theory of logistic management of capital, financial crisis, economic crisis, the classic theories of crises, new theories of crises, economic paradoxes, market capacity, economic sustainability, capital.

1. Introduction

Economic sustainability is one of the essential and basic attribute (feature) of a successful public development. The concept of the sustainable development means that it must ensure not only the economic growth but also the compatibility of economic activity with environmental, social, technical and other factors. Recently, there is a belief that it is impossible to achieve sufficient economic, ecological, or social sustainability individually, at the same time not providing at least a minimal level of sustainability in each of these forms of sustainability. Only a concerted interplay of all three links of system allows at least partially achieve the desired goal.

Not so long ago it was thought that economic sustainability is easily achievable, that the economy can grow steadily. In the fifties of the twentieth century the leadership of the USA stated that America has got rid of the recurring recessions and extinguishes periodic fires before they have started by using a new strategy. Unfortunately, the reality was different. Today, nobody doubts in recurring threats of the market downturn in economy.

The economy of market is characterized by a fluctuation which regularly brings upturns and downturns to its members' activity. Each cycle of economy (from upturn to downturn) influences important macroeconomic factors – gross domestic product, inflation, deflation, level of unemployment, rate of interest, taxes etc. Thus, these economic fluctuations are relevant to everyone – natural and legal entities.

For many years it is attempting to acknowledge the reasons of these phenomena, to predict their possible consequences and to derive an economic benefit at the point of upturn or downturn. Increasingly recurring economic and financial crises in the world show that there are no answers to many important questions, that newer market researches are required to develop new theories explaining crises. The breakthrough was made at Vilnius University a few years ago when the theory of logistic management of capital was made and developed. The theory explains the fundamentals causes of the rise of financial and economic crises. [4-16]

The **aim** of this work is to show that the economic logistic analysis, which is based on the theory of logistic management of capital, is a theoretical background for the stable economic growth. Therefore, on the basis of the possibilities of this theory, it is possible to reveal the characteristics of financial crises and to manage crises as well.

Methods: A review of scientific articles, an analysis and a review of scientific books, computations.

2. Results and Discussion

2.1. Theories Explaining Financial Crisis

First of all, there is a need of distinction between the concepts "financial crisis" and "economic crisis". In the dictionary of economic terms and definitions crisis is described as a business cycle phase with a relatively long-lasting unemployment and with the freezing and non-usage of production capacity. Economic crisis is described as a situation in which the economy of a country experiences a sudden downturn brought on by a financial crisis. After downturn follow a falling GDP and money supply, falling/rising prices due to deflation/inflation. Financial crisis is a situation in which the supply of money is outpaced by the demand for money, therefore the liquidity preference is money

withdrawal from banks, bringing worse credit terms and forcing banks either to sell other investments to make up for the shortfall or to collapse. In short, the economic crisis is assumed to be a sudden downturn of the whole country's or region's standard of life and financial crisis is the main cause of the economic crisis. [8]

By deeper examination of financial crises it is worth mentioning that references about that amount to the beginning of our era and even earlier. Alexander Macedonian (the 4th century BC) had concurred the East and brought tons of gold to coinage it and pay for the war debts. Such a money emission has caused a financial crisis – the prices have doubled. Similar crises took place later too. During the great geographical discoveries (1500-1650) a lot of gold and silver were brought to Europe. As a result the prices for goods have increased from 2 to 5 times. Although wages have grown too, the inflationary crisis has included a large part of Europe.

The oldest financial crisis of the New era is officially regarded as the Dutch Tulip mania (1637), although economic and financial crises were generally considered as a separate economic feature only in the 20th century. There is enough information about Shanghai crisis (1910), the Great Depression (1929-1933), the Japanese real estate bubble (1980), the Internet bubble „Dot - com" (2000) and others. [17]

The best known economists in the world are afflicted by the questions of the cause of the financial crises and how to make sustainable economic growth. The creator of „The theory of crisis", K. Marx claims that the main idea of this theory is that the biggest contradiction of capitalism is a contradiction between the appropriation of a state mode of production and general private work. It means that a free market concentrates all productive resources in a private market and then a profiteering involves the private market into the races of staple product making and when out of it comes the affluence – the supply exceeds the demand. A man and his created work are considered to be a resource of added value, although the worker does not receive the whole created capital value – the capitalist receives a great part of it. In the free market more and more achievement in added value leads to competition among the capitalists, who are willing to gain maximum profitability and therefore they reduces costs of the labor force. K. Marx believes that in this way the labor force is impoverished, it reduces the consumption, the bankruptcies take place until the economic crisis strikes. The logistic analysis showed that although Marx used unsuitable tools for considering the creation of added value and therefore did not identify major failures of the free market, but he made the right resulting deduction. He deduced that the free market will crash if it is influenced by a globalization due to constantly recurring and uncontrolled overproduction. Such a path of an unsustainable development is confirmed by economic logistic analysis too. [9-19]

According to the theory of the variability of investments, represented by J. Keynes and H. Minsky, it can be claimed that the cause of the financial crisis is the variability of investments. The variation of investments is determined by the investors assumed risk, by the factors which can affect investment, by the reliability of investor's estimations and decisions. J. Keynes considers that the main factors, influencing the variations, are investors' decisions and their level of changes, while H. Minsky orientates to the periodic financial instability caused by the investment decisions. [18]

2.2. Market Capacity and Its Saturation

Now it can be confirmed that unsustainable economic development and the existence of global economic crises are the result of imperfection or even shortcoming of economic system itself. The existence of crises and their causes are not any cosmetic defect in the system, but internal and essential feature of a market economy. In order to understand and to manage the evolving situation, a new approach to the economy is needed. [1]

Currently, most of the negative economic phenomena are associated with the irrational behavior of market participants. In the absence of the fundamental explanation for these phenomena crises overtake non prepared society. Recent achievements of the economic logistic analysis showed that the periodic development of economy must trim simple fundamental explanation, it is the market saturation and associated with it overproduction. The term saturation refers to the completeness, filling up to the limit, filled to repletion, satiety. There are known a lot of saturation meanings. For example: the dew point is a condition when the humidity of atmosphere reaches 100% and the air cannot absorb more moisture; or the oxygen saturation of blood in medicine; the magnetic saturation of materials in physics; the habitat saturation of population in biology, etc. [12]

Saturation is very important in chemistry, physics, biology, medicine and elsewhere and how about economy? Let us look at the investment as at a solution, where the market is a solvent and a capital is a soluble material. What is “the solubility” of the capital? Is “the solubility” of the capital really endless in the market, as it was considered before, or limited?

First of all, let us consider market as “the potential solvent” of capital. The market is an exchange area in which operates buying and selling process. A capacity of the market can be understood as an amount of capital which could be effectively reclaimed in the investment environment. Markets can be closed and open or semi-closed (there are mostly such markets). Semi-closed, especially closed markets can be saturated by expanding investment. After made researches it is settled that all markets have their capacity (the capacity of infinite market is also infinite). [13-16]

3. Experimental Section

3.1. Logistic growth

In the 19th century, by investigating variation of closed biological systems, the Belgian mathematician, biologist and demographer P.F.Verhülst suggested the differentiated equation of population growth.

$$\frac{dK}{dt} = \left(1 - \frac{K}{K_p}\right) \cdot m \cdot K \tag{1}$$

Where K is an amount of population (in separate case of capital) at a moment of time t, Kp is a maximum (potential) value of the population (it will be named as a habitat amount of population), m is a factor that evaluates the growth rate. [3]

After solving the equation (1) and applying m coefficient to the modeling of economic tasks (taking $m = ln(1+i)$), and also assuming that $t = n$, we obtain formula of the model of logistic interest (compound percent of limited growth):

$$K = \frac{K_p \cdot K_0 (1+i)^n}{(K_p - K_0) + K_0 (1+i)^n} \tag{2}$$

The received model represents a limited (logistic) growth and therefore it is the most appropriate for modeling the long-term processes. By the help of this model discounting cash flows when the parameter *Kp* is limited in size (not infinite) paradoxical behavior of the system is observed: with the increase of saturation (and thereby of overproduction) the profitability of the system increases. It helps in explaining the emergence of economic bubbles. [20]

3.2. Investment Bubble Simulation

During the financial operations, examination of cash flows, especially estimating contribution values, the present values of those contributions have to be calculated. In the research of net present value by the classical method, formula of compound interest discount is applied. If the invested market is at least partially saturated, it is appropriate to use formula of logistic discounting. [5]

$$K_0 = \frac{K_p \cdot K}{K + (K_p - K) \cdot (1+i)^n} \tag{3}$$

Formula (3) can be used for investments by the methods of net present value and internal rate of profit (return). When internal rate of profit is calculated, the net present value of cash flow is equated to zero. According to the definition, the internal rate of profit project is such a value of discount coefficient by which the present values of the forecast cash outlay and the forecast cash inflow become equal. [6, 11, 14]

The general case in terms of mathematics is quite complicated, therefore easier case when cash flow consists of only two members is taken: the invested sum and the only member of income. Furthermore, investment is assumed as equal to one monetary unit (m.u.), and the income accruing over one period of time are equal 1,1 o.p.

Then in the equation (3) taking the initial investment as $K_0 = 1$, and $n = 1$ we obtain a rate expression of internal income for one period.

$$i = \frac{K - 1}{1 - \frac{K}{K_p}} \tag{4}$$

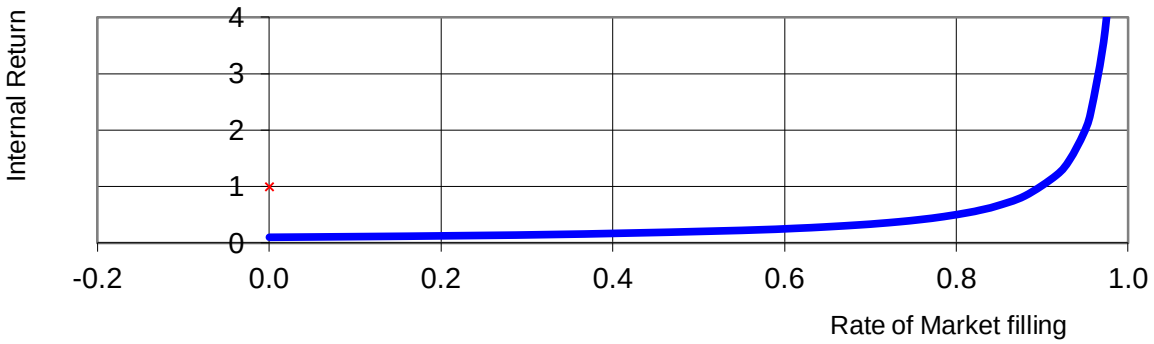
From dependence (4) a table is made, where $K = 1{,}1$ (which corresponds to an annual rate of interest, equal to 10%), and $K_p > 1{,}1$. The degree of filling market is expressed by the ratio K/K_p. In order to get even variation of degree of market fill, appropriate and potential meanings of capital K_p should be chosen.[7]

Table 1. The degree of filling market.

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
i	0,1	0,111	0,125	0,143	0,167	0,2	0,25	0,333	0,50	1	10

Only the standard points are shown in the table. Realistically more functions of points in the zone of intensive change can be used. The graph should be drawn.

Figure 1. The degree of filling market.



Pic. 1 The dependence of investments „buy-sell (after a year)“ of a rate of internal change on a rate of market filling when Ko=1 and K=1,1; Kp>1,1

By growing the degree of market filling (filling rate) the internal return also increases, although the increase is accelerating: in the beginning it is relatively insignificant, but when the market becomes semi-completed, the return doubles and reaches 20%, and when the market is filled 90%, the internal return increases in ten times. Finally, when the market is filled 99,9%, the internal change increases 100 times. The growth, raised by the growing market saturation, increases profitability notably, blows the bubble of prices and at the same time evokes concealed overproduction in the market. [4, 10, 15]

The reasons why the economic crises occur are seen after the research of model of investment bubble. The main cause of the crises is the economic paradoxes. One of them is a paradox of increasing profitability. It can be defined so: if the capital is invested in the closed market, then the saturation of that market increases by the capital (overproduction) and the profitability of that investment (capital) increases. [2]

4. Conclusions

A conclusion of this research would be that the satiety of the market destroys the sustainability of economic development: satiated market becomes very profitable; although at the same time it becomes unstable: a small decrease in saturation can cause a significant drop in profitability and thus initiate a panic in the market. In order to influence or manage situations of crises, the saturation of the market (overproduction) must be limited and thus prevent the formation of financial bubbles.

After evaluation of all this, it can be argued that the economic logistic analysis is the foundation of the sustainable economic growth and therefore, according to the opportunities of this theory, it is possible to reveal some characteristics of financial crises and to manage the crises. Economic logistic analysis gives an opportunity to reach the sustainable economic growth, rather than “exploding”.

References and Notes

1. Burns, A., Mitchell, W., 1946. Measuring Business Cycles. – N.Y. National Bureau of Economic Research, - pp. 560.
2. Dubnikovas, M., Moskaliova, V., Girdzijauskas, S., 2009. Analysis of the Share Price Bubbles in the Baltic Countries. Lecture Notes in Business Information Processing: Series Editors: Aalst, W. van der, Mylopoulos, J., Sadeh, N.M., Shaw, M.J., Szyperski, C. ISSN: 1865-1348; Springer-Verlag Berlin / Heidelberg; pp.119-129.
3. Edwards, C. H. Penney, D. E., 2000. Differential Equations and Boundary Value Problems: Computing and Modelling. Prentice Hall, ISBN 0-130-79770-7; pp. 787.
4. Girdzijauskas S.. Sovereign Debt Crisis; Logistic Analysis. Vilnius: Vilniaus universiteto leidykla, 2011. ISBN 978-9955-634-52-2. pp. 40.
5. Girdzijauskas, S. A., Štreimikienė, D., Dubnikovas, M., 2009. Analyzing Banking Capital with LOGLET Lab Software Package // Transformations in Business and Economics. ISSN 1648-4460. vol. 8, No. 2 (17), pp. 45-56.
6. Girdzijauskas, S., 2004. Logistinis kritinių situacijų valdymas; burbulų fenomenas arba antrasis kvėpavimas. (Logistic Management of the Critical Situations: The Bubble Phenomenon, or the Second Breathing). Ekonomika ir vadyba; Vilnius: Vilniaus universiteto leidykla. ISSN 1392-8732; Nr.1(7), pp. 53-59.
7. Girdzijauskas, S., 2006. Logistinė kapitalo valdymo teorija; determinuotieji metodai (The Logistic Theory of Capital Management: Deterministic Methods) / monografija. Vilnius: Vilniaus universiteto leidykla, pp. 232.
8. Girdzijauskas, S., 2008. The Logistic Theory of Capital Management: Deterministic Methods; Monograph No 1, Published a peer-reviewed Supplement A to Transformations in Business & Economics, Vol. 7, No 2(14), pp. 163.
9. Girdzijauskas, S., 2002. Draudimas; kiekybinė finansinė analizė (Insurance; Quantitative Financial Analysis). Kaunas: Naujasis lankas, ISBN 9955-03-114-X., pp. 102.
10. Girdzijauskas, S., Boguslauskas, V., 2005. The Possibilities for the Application of the Logistic Model of Accumulation ; Inžinerinė ekonomika/Kauno technologijos universitetas; ISSN 1392-2785; Nr.1(41), pp.7-15.
11. Girdzijauskas, S., Dubnikovas, M. 2010. Logistic Analysis of Price Bubble and Current Situation in the USA Real Estate. Business Information Systems. Workshops: BIS 2010 International Workshops, Berlin, Germany, May 3-5, Revised Papers. Book Series: Lecture Notes in Business Information Processing, Vol. 57. pp. 13-18.
12. Girdzijauskas, S., Pikturna, A., Ivanauskas, F., Merkevičius, E., Moskaliova, V., 2008. Investigation of the Elasticity of the Price Bubble Functions; Continuous Optimization and Knowledge-based Technologies: 20th EURO Mini conference (EurOPT-2008), May 20-23, 2008, Neringa, Lithuania. ISBN 978-9955-28-283-9. Vilnius: Technika, pp. 131-136.
13. Girdzijauskas, S., Štreimikienė, D. 2010 . The Role of Logistic Analysis in Economic Theory. Коллективная монография: Экономические системы и их трансформация в XXI веке: теория, методология, практика. Экономические исследования/ под ред. д.э.н., проф. А.А. Абишева, д.э.н. Т.И.Мухамбетова, - Алматы: Экономика,– 900 стр., pp. 706-722.

14. Girdzijauskas, S., Štreimikienė, D., 2008. Logistic Growth Models for Analysis of Stock Markets Bubbles. The 2008 International Conference of Financial Engineering, Lecture Notes in Engineering and Computer Science pp.1166 - 1170,
15. Girdzijauskas, S., Štreimikienė, D., 2009. Application of Logistic Models for Stock Market Bubbles Analysis // Journal of Business Economics and Management. ISSN 1611-1699. Vilnius: Technika, Vol. 10, No. 1, pp. 45-51.
16. Girdzijauskas, S., Štreimikienė, D., 2010. Logistic Analysis of Business Cycles, Economic Bubbles and Crises. Chapter 3. Business Intelligence in Economic Forecasting: Technologies and Techniques. Publisher in the USA by Information Science Reference (an imprint of IGI Global). pp. 45-64.
17. Moskaliova V. 2009. The Logistic Analysis of Unsustainable Economic Situations. Doctoral Dissertation, Vilnius University.
18. Sornette, D., 2003 Why Stock Markets Crash: Critical Events in Complex Financial Systems. Princeton University Press,
19. Sterman, J. D., 2000. Business Dynamics: Systems Thinking and Modelling for a Complex World / John D. Sterman, ISBN 0-07-231135-5, pp. 950.
20. Štreimikienė, D., Girdzijauskas, S., 2008. Sustainable Development and Logistic Growth of Resource Consumption. International Business Development: Globalization, Opportunities, Challenges: International Scientific Conference, 15-16 of May 2008, Vilnius, Lithuania: Collection of Articles. ISBN 978-9955-879-06-0, pp. 266-275.