

VILNIUS UNIVERSITY

Vera Moskaliova

THE LOGISTIC ANALYSIS OF UNSUSTAINABLE ECONOMIC SITUATIONS

Summary of Doctoral Dissertation
Social Sciences, Economics (04S)

Vilnius, 2009

Doctoral dissertation was prepared in 2004–2009 at Vilnius University

Scientific supervisor:

prof. dr. Stasys Albinas Girdzijauskas (Vilnius University, Social Sciences, Economics — 04S)

Adviser:

prof. dr. habil. Rimvydas Simutis (Vilnius University, Physical Sciences, Informatics — 09 P)

The Dissertation will be defended in council of Vilnius University Economics Science trend:

Chairman

prof. dr. Linas Čekanavičius (Vilnius University, Social Sciences, Economics — 04S)

Members:

prof. dr. habil. Jonas Čičinskas (Vilnius University, Social Sciences, Economics — 04S);

prof. dr. habil. Valentinas Klevas (Lithuanian Energy Institute, Social Sciences, Economics — 04S);

prof. dr. Vytautas Snieška (Kaunas University of Technology, Social Sciences, Economics — 04S);

prof. dr. habil. Edmundas Kazimieras Zavadskas (Vilnius Gediminas Technical University, Physical Sciences, Informatics — 09P)

Official opponents:

prof. dr. Vytautas Boguslauskas (Kaunas University of Technology, Social Sciences, Economics — 04S).

prof. dr. Dainora Grundey (Vilnius University, Social Sciences, Management and Administration — 03S)

The official defence of the dissertation will be held at 11 a.m. on 18th December, 2009, in a public session of the Council of Economics Science trend in the J.Jablonskis auditorium at Kaunas Faculty of Humanities of Vilnius University.

Address: Muitinės str. 12, LT-44280, Kaunas, Lithuania

The summary of doctoral dissertation was sent-out on 18th November, 2009. The doctoral dissertation is available at the library of Vilnius University.

VILNIAUS UNIVERSITETAS

Vera Moskaliova

NETVARIŲ EKONOMINIŲ SITUACIJŲ LOGISTINĖ ANALIZĖ

Daktaro disertacijos santrauka
Socialiniai mokslai, Ekonomika (04S)

Vilnius, 2009

Disertacija rengta 2004–2009 metais Vilniaus universitete

Mokslinis vadovas:

prof. dr. Stasys Albinas Girdzijauskas (Vilniaus universitetas, socialiniai mokslai, ekonomika — 04S)

Konsultantas:

prof. habil. dr. Rimvydas Simutis (Vilniaus universitetas, fiziniai mokslai, informatika — 09P)

Disertacija ginama Vilniaus universiteto Ekonomikos mokslo krypties taryboje:

Pirmininkas

prof. dr. Linas Čekanavičius (Vilniaus universitetas, socialiniai mokslai, ekonomika — 04S)

Nariai:

prof. habil. dr. Jonas Čičinskas (Vilniaus universitetas, socialiniai mokslai, ekonomika — 04S);

prof. habil. dr. Valentinas Klevas (Lietuvos energetikos institutas, socialiniai mokslai, ekonomika — 04S);

prof. dr. Vytautas Snieška (Kauno technologijos universitetas, socialiniai mokslai, ekonomika — 04S);

prof. habil. dr. Edmundas Kazimieras Zavadskas (Vilniaus Gedimino technikos universitetas, fiziniai mokslai, informatika — 09P)

Oponentai:

prof. dr. Vytautas Boguslauskas (Kauno technologijos universitetas, socialiniai mokslai, ekonomika — 04S).

prof. dr. Dainora Grundey (Vilniaus universitetas, socialiniai mokslai, vadyba ir administravimas — 03S)

Disertacija bus ginama viešame Ekonomikos mokslo krypties tarybos posėdyje 2009 m. gruodžio mėn. 18 d. 11 val. VU Kauno humanitariniame fakultete J.Jablonskio auditorijoje.

Adresas: Muitinės 12, LT–44280, Kaunas, Lietuva

Disertacijos santrauka išsiuntinėta 2009 m. lapkričio mėn. 18 d.
Disertaciją galima peržiūrėti Vilniaus universiteto bibliotekoje.

Vilnius University

Vera Moskaliova

SUMMARY OF DOCTORAL DISSERTATION

Relevance of the topic. Unsustainable economic situations are known from ancient times. They stimulate the emergence of both the opportunity of social shock and the threat of uneven economic development. According to *G. Kancerevyčius (2004, 2008)*, various crises in the world occur periodically every nine years. Unsustainable economic situations cause anxiety not only for common people but also for various scientists. The latter have employed various scientific theories and information technologies and thus explore the reasons, patterns of unsustainable economic situations; try to determine their features and suggest prevention measures. The understanding of the causes of unsustainable economic situations allows for precise forecast of financial and economic phenomena as well as anticipation of economic development threats and investment failures. Therefore it is important to be aware of the fundamental causes of unsustainable economic situations.

The explosion of price bubbles has had a greatly negative impact on economics. An obvious and the newest example of this effect is the explosion of a real estate price bubble in the USA in 2008 that has led to the bankruptcy of many companies, large and small banks and even countries (e.g. Iceland). Most of the world has been overtaken by a long-term recession. Due to globalization the impact of exploded price bubbles may be indicated not only in separate economic sectors but in almost all countries' economics in the world. For this reason it has been crucial to continue and develop scientific researches of unsustainable economic situations, to know the reasons of price bubbles formation, to recognize their characteristics and be able to escape such situations in future.

Financial pyramids are quite an old fraud means that create many economic problems. Swindlers have always wanted to make benefits of others. Moreover, they become more inventive: computers, internet and information technologies serve as means for swindlers to invade electronic environment. The main impetus of fraud activity has always been the trust, naivety and ardour of common people. As the notorious *Madoff* fraud, revealed in 2008, proved neither famous and influential people nor the poor are protected from such swindlers. People have always wished to gain wealth easily without great physical effort. The majority of people involved in such projects and schemes experience failure. Hence, it is important to educate people and to know the mechanism of such schemes because it may help avoid unacceptable phenomena, e. g. the loss of assets and investments.

Forecasting of unsustainable economic situations is a complicated task that requires full understanding of origin, nature and fundamental reasons and development stages of the phenomena. It is necessary to know how to avoid such situations and not repeat mistakes. The logistic theory of capital management created and developed by *S. Girdzijauskas* (Vilnius University) allows for innovative perspective of the phenomenon of unsustainable economic situations. The theory reveals fundamental reasons of the formation of such situations and it may be widely applied in economics. This theory and its context lead to the discovery of new economic paradoxes. With

regard to the research of price bubbles and financial pyramids, the theory appears to be useful in identifying, knowing, revealing and modeling unsustainable situations.

The level of the exploration of the problem. Knowledge about the first unsustainable economic situations comes from the 17th c. when the notorious Dutch tulips mania was described. At that time some kinds of tulips cost as much as it was possible to buy a house for one bulb. Later France was shattered by J. Law monetary system (1716—1720), afterwards by Southern Seas Company (1720—1721). In the beginning of the 20th c. the Ponzi fraud (1920) and speculation boom in the USA (1927—1929) had an enormous reaction. The phenomenon of the long-term Japan real estate bubble has been widely discussed (1980). Due to globalization unsustainable situations have influenced the sphere of information technologies: in the end of 2000 the internet bubble exploded, while the explosion of the real estate bubble in the USA (2007) has had an impact on the economics of all countries of the world.

The problem has been discussed since the second half of the 20th c. Regarding the theory of rational expectations price bubbles have been investigated by *E. Fama* (1965); *O. J. Blanchard* (1979); *O. J. Balnchard, M. Watson* (1982); *R. S. Gürkaynak* (2005); *P. M. Garber* (2000); *K. A. Froot, M. Obstfeld* (1991), *V. Lei, C. N. Noussair, S. R. Plott* (2001), *R. Kuodis* (2006, 2008); *H. Lind* (2008); *A. Г. Шульгин* (2008); *V. Azbainis* (2009). *C. P. Kindleberger* (1978, 1996); *R. Thaler* (1994); *A. Shleifer* (2000); *R. Shiller* (2000, 2005) paid much attention to price bubbles concerning the theory of irrational expectations. Having rejected one of the rational expectations hypothesis, the approach of limited rationality has been formulated. Its main representatives are *D. Sornette; A. Johansen* (1999, 2001); *D. Sornette* (2003, 2008).

The problem of real estate bubbles has been discussed by *S. Shiratsuka* (2003); *A. V. Gusev* (2008); *J. H. Cochrane*, (2002); *J. Calverley* (2004); *F. Modigliani, R. Cohn* (1979); *A. O. Недосекин* (2004); *C. Mouceev* (2001); *Ch. Martenson* (2008); *H. Minsky* (1986); *K. Ertürk, G. Özgür* (2009); *F. S. Mishkin, E. White* (2003); *A. Г. Шульгин* (2008); *R. Lawrence* (2008). The issue of the real estate bubble in Lithuania has been considered by *R. Kuodis* (2004, 2005, 2006, 2008); *B. Galinienė, A. Marčinskas, S. Malevskienė* (2006); *L. Belinskaja, V. Rutkauskas* (2007); *V. Azbainis* (2009); *M. Leika, M. Valentinaitė* (2007); *R. Rudzkis, N. Titova, V. Titarenko* (2005); *I. Zakalskytė* (2006), *G. Staniškauskas* (2005); *G. Jankauskas* (2006). However, only a few of the scientists treated real estate bubbles as an unsustainable economic situation that might be forecasted and controlled (*S. Girdzijauskas, D. Štreimikienė* (2009).

Financial pyramids have been investigated by *D. A. Valentine* (1998); *D. W. VanArsdale* (1998, 2002, 2007); *R. Heakal* (1999); *J. M. Taylor* (1999), *R. L. FitzPatrick, J. K. Reynolds* (1997); *A. Ю. Зомова* (1994); *B. B. Радаев* (1998); *O. E. Кузина* (1999); *A. К. Бекряшев, И. П. Белозеров* (2000); *A. Belianin, O. Isupova* (2000); *S. V. Dubovskij* (2000, 2001); *G. G. Dimitriadi* (2002, 2004, 2005); *G. A. Agasandian* (2002; 2003); *A. Goriačeva, R. Michel* (2004); *O. Kovaliova, A. Goriačeva* (2008); *A. Buchvalov, V. Buchvalova, A. Idelson* (2001).

The progenitor of the logistic analysis who also applied the logistic growth law to forecast biological populations was *P. F. Verhulst* (1804—1849). The first attempts to apply the law in economics were carried out by *O. C. Ferreira* (1998, 2002); *C. F. Alvim* (1998). They proved that the logistic growth model was more appropriate than the exponential one to describe the economics of Brazil. The drawback of exponential

models is that the growth function was not expressed by compound percents. *S. Girdzijauskas*, professor of economics at Vilnius University was the first to notice and evaluate this drawback (2002). His works have evolved into a separate theory – *The Logistic Theory of Capital Management* (2006, 2008). The possibilities to apply the logistic growth model have been studied by *S. Girdzijauskas* (2002, 2005, 2006, 2008); *S. Girdzijauskas, R. Mackevičius* (2009); *P. Tanenbaum, R. Arnoldas* (1995); *Z. Bodie, R. C. Merton* (2000); *C. H. Edwards, D. E. Penney* (1985); *O. C. Ferreira* (1998); *C. F. Alvim* (1998); *C. P. Obi* (1998); *R. Shone* (2001); *F. Wattenberg* (1995); *S. Girdzijauskas, D. Štreimikienė, M. Dubnikovas* (2009); *S. Girdzijauskas, D. Štreimikienė* (2007, 2008, 2009).

However, the scientific researches mentioned above which discuss the application of the Logistic Theory of Capital Management to analyze the phenomena of economic bubbles and overheated economics lack a unifying research tool that would enable scientists to employ logistic analysis as well as explore and control various unsustainable economic situations.

The object of the work is unsustainable economic situations, i.e. price bubbles and financial pyramids.

The objective of the work is to create the Logistic valuation model of unsustainable situations on the basis of theoretical analysis of unsustainable economic situations. The model should aid in determining the dependence of unsustainable economic situations on market margin and as well as in managing of unsustainable situations.

To achieve the set aim, the following theoretical and **practical tasks** have been held:

1. To systematize and generalize the conception of unsustainable economic situations provided in scientific literature.
2. To construct theoretical logistic valuation model of unsustainable situations on the basis of the Logistic Theory of Capital Management.
3. On the basis of the Logistic Theory of Capital Management to systematize the factors and reasons of price bubble formation as well as to specify the definition of a price bubble.
4. To carry out the valuation of price bubbles in stock exchanges of the Baltic States by means of the logistic valuation model of unsustainable situations and adaptation of *LogLet 2.0* - the applied programme of logistic growth used in biology.
5. By means of the logistic valuation model of unsustainable situations to determine the dependence of an investment project elasticity of the logistic internal rate of return on marginal capital.
6. By means of the logistic valuation model of unsustainable situations to identify the dependence of the current value of accumulated capital of a financial pyramid on the resource rate.

The research has been carried out in 2004–2009.

The methods of the research are as it follows: theoretical analysis based on the results and conclusions of various scientific works; systematic analysis; modelling; evaluation; generalization; comparison; abstraction. The applied programme of logistic

growth *LogLet 2.0* used in biology was employed to study the phenomenon of price bubble formation in the stock exchanges in the Baltic States as well as to evaluate market saturation. The logistic model of financial pyramids was calculated by *Microsoft Excel*.

Statements defended in the thesis

1. The formation of unsustainable situations is revealed by the Logistic Theory of Capital Management which allows for the effective identification and control of such situations.
2. Market margin is the main condition (or cause) of the formation of unsustainable situations.
3. The elasticity of the logistic internal rate of return for marginal capital is the main tool which shows the intensity of the price bubble formation.

The scientific originality of the research

Logistic Valuation Model of Unsustainable Situations has been created. The model includes the logistic valuation model of price bubbles, models of the dependence of elasticity of the logistic internal rate of return on marginal capital and logistic models of financial pyramids research. The research has revealed the fundamental reasons of unsustainable economic situations formation which aid in recognizing, forecasting and controlling of such unsustainable economic situations.

Practical benefits of the work

The valuation model of unsustainable economic situations may be widely applied practically because it helps to detect unsustainable economic situations and enables to make to right decisions in both policies of economics and a separate investment company. Therefore the economy of the state, an individual investor or a businessman is able to manage such situations on time and thus avoid great economic loss.

The publication of the scientific work results

The results of the scientific work have been published in ten scientific articles eight of which have been published in issues approved by the Research Council of Lithuania as appropriate to defend doctoral thesis. Hereafter, the list of the articles is given:

1. DUBNIKOVAS M., MOSKALIOVA V., GIRDZIJAUSKAS S. (2009). Analysis of the Share Price Bubbles in the Baltic Countries. *Business Information Systems Workshops BIS 2009 International Workshops. Poznan, Poland, April 27—29, 2009. Lecture Notes in Business Information Processing*. Vol. 37, p. 119—129. ISBN 978-3-642-03423-7 (Print), 978-3-642-03424-4 (Online).
2. GIRDZIJAUSKAS S., ŠTREIMIKIENĖ D., ČEPINSKIS J., MOSKALIOVA V., JURKONYTĖ E., MACKEVIČIUS R. (2009). Formation of Economic Bubbles: Causes and Possible Preventions. *Technological and Economic Development of Economy*. Vol. 15 (2), p. 267—280. ISSN 1392-8619 (Print), ISSN 1822-3613 (Online).
3. 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*. P. 131—136. ISBN 978-9955-28-283-9.
4. MOSKALIOVA V., GIRDZIJAUSKAS S. (2006). The risk of investment: determinate models. *Databases and information systems: seventh international Baltic conference, Baltic DB&IS 2006, Vilnius, July 3—6*. P. 91—100. ISBN 9986-19-920-4.

5. GIRDZIJAUSKAS S., MOSKALIOVA V. (2005). Instability modeling of financial pyramids. *Environment. Technology. Resources: proceedings of the 5th international scientific and practical conference, June 16—18, 2005, Rzekne*. P. 26—32. ISBN 9984-779-06-8.

Articles in other reviewed periodicals or continuous international or foreign issues:

1. MOSKALIOVA V., GIRDZIJAUSKAS S. (2005). Finansinių piramidžių stabilumo modeliavimas. *Informacijos mokslai*. T. 35, p. 158—169. ISSN 1392-0561.
2. GIRDZIJAUSKAS S., MOSKALIOVA V. (2003). Finansinių piramidžių modeliai. *Ekonomika: mokslo darbai*. T. 64, p. 37—48. ISSN 1392-1258.
3. GIRDZIJAUSKAS S., MOSKALIOVA V. (2003). Virtualių finansinių piramidžių nestabilumo modeliavimas. *Informacijos mokslai: mokslo darbai*. T. 27, p. 105—114. ISSN 1392-0561.

The structure and scope of the research.

The dissertation consists of an introduction, 4 chapters, and conclusions. The main material of the dissertation is 141 pages, including 9 tables, and 25 figures. Additionally 3 appendices are presented. The list of references contains 8 pages.

SHORT OVERVIEW OF THE DISSERTATION CONTENT

The introduction presents the basic information, regarding the research object of the dissertation, the relevance of the topic, the tasks to be tackled, research methods, scientific novelty and practical relevance of the results, and publications.

Chapter 1. Theoretical Aspects of Unsustainable Economic Situations

This part of the thesis provides the conception of unsustainable situations and a review of theories explaining unsustainable situations. The Subchapter “Conception of Unsustainable Situations” introduces types of unsustainable situations, i.e. price bubbles and financial pyramids. An unsustainable situation occurs when extremely high excess profits are gained in a particular market segment. High excess profits may be earned either if a price bubble forms in a market or if a financial pyramid is organized by swindlers.

The Subchapter “Economic Bubble” discusses various scientific approaches to the phenomenon of a bubble. Having studied scientific literature concerning the notion of economic bubble it was determined that the authors of definitions accentuate the following essential elements: unfounded price rise, expectations, psychological factors, speculation, sudden and significant price rise with succeeding decrease, the gap between the price and the fundamental price value. Nevertheless, it is not clear why and when expectations appear and determine a considerable price growth, when the economic sector overheats.

The Subchapter “The Financial Pyramid” gives an overview on the phenomenon of financial pyramids. A financial pyramid is a means of fraud based on a hierarchical system and imitation of investment. The main idea of the scheme is that a subject pays a lump fee to become a member of a pyramid and thus acquires the right to gain profit from fees paid by newly accepted members of the financial pyramid. Such structures do not generate any product or service, make no investments and for that reason the fraud is subsequently revealed, the scheme collapse and the bigger part of the participants lose their money.

The Subchapter “Theories on Unsustainable Situations” describes the main theories regarding unsustainable situations. Scientific approach to price bubbles is usually based on two main theories: theory of rational expectations and theory of irrational expectations. The subchapter provides the main aspects of the theories in question, discern their strengths and weaknesses. From the perspective of the theory of rational expectations, a price bubble is the difference of the market price of some asset and its price based on fundamental value. The most prominent representatives of this approach are *O. Blanchard* and *M. Watson (1982)*, *R. S. Gurkaynak (2005)*. The weakness of this theory is the assumption that participants of a market have all possible information about the situation in the market which is a rather complicated condition.

The supporters of the theory of irrational expectations (*A. Shleiffer (2000)*, *R. Thaler (1994)*, *C. P. Kindleberger (1978)*, *R. Shiller (2000, 2005)*) claim that bubbles are created by human psychology and emotions, i.e. herd behaviour, fashion, short memory of investors and speculative enthusiasm, etc. These anomalies of the behaviour of investors encourage bubble formation and explosion in finance markets.

There is also an attitude of limited rationality towards the phenomenon of bubbles. *A. Johansen* and *D. Sornette* (1999) accentuate that all participants of a market share the same information, however, they interpret and use it in different ways.

The Logistic Theory of Capital Management is targeted at the investigation of the limited capital growth (*S. Girdzijauskas*, 2002; *S. Girdzijauskas*, *D. Štreimikienė* (2005, 2008), *S. Girdzijauskas*, *R. Mackevičius*, 2009). Thus it enables the study of unsustainable economic situations formation which occurs due to market margin.

The issue of trust in financial pyramids has been investigated by *A. Ю. Зотова* (1994); *В. В. Радаев* (1998), *О. Е. Кузина* (1999); *А. К. Бекряшев*, *И. П. Белозеров* (2000). The authors state that the intensive development of fraud companies was determined by high trust in private market institutes, the lack of experience in the finance market, trust in savings banks.

Mathematical description models of financial pyramids are based on the following approaches: game theoretic approach (*A. Belianin*, *O. Isupova* 2001); quantity theory of money (*G. A. Agasandian* (2002; 2003)); scenario approach (*S. V. Dubovskij* (2000, 2001); *G. G. Dimitriadi* (2002, 2004, 2005)). The latter author identifies financial pyramids with financial bubbles.

The analysis of the scientific literature has revealed that the above mentioned authors have explored the problem of unsustainable situations, however, they have not investigated the dependence of elasticity of the logistic internal rate of return on the investment development space.

Chapter 2. Empirical methods and models of identification of unsustainable situations

This part of the work provides the classification of unsustainable economic situations based on the analysis of scientific literature and introduces factors that determine the formation of unsustainable situations.

The analysis of scientific literature led to the discovery that price bubbles may be classified according to lifecycle, sphere or markets in which they are formed and theories explaining price bubbles (See Figure1).

Short-term bubbles last less than ten years. Nickel price bubble (2005-2007), gold price bubble (1979-1982) may serve as examples of this type of bubbles. Short-term bubbles are often treated as mistakes or artificial situations that determine the correction of unbalanced economy. Long-term bubbles are much more dangerous for economy.

The most prominent price bubble is the real estate bubble in Japan. Prices of real estate had been growing for 14 years and then fell in 1991. The recovery took another 14 years.

Following the theories targeted at the explanation of bubble nature it is possible to discern the following types of bubbles: those of rational expectations, irrational expectations, limited rationality and logistic ones.

Regarding the sphere in which the phenomena occur it is possible to indicate stock, real estate, goods, currencies and other price bubbles.

It has been stated in scientific literature so far that stock market price bubbles are formed when investors notice a sudden raise/increase of stock value. They predict the raise of the stock value and decide to acquire more stocks. Thus the stock becomes popular not because of its net value but because of speculative goals of investors.

Another reason of a sudden stock price rise (the logistic one) is a limited amount of stocks in the market. Investors who seek to acquire such stocks re-buy them at higher price from previous buyers.

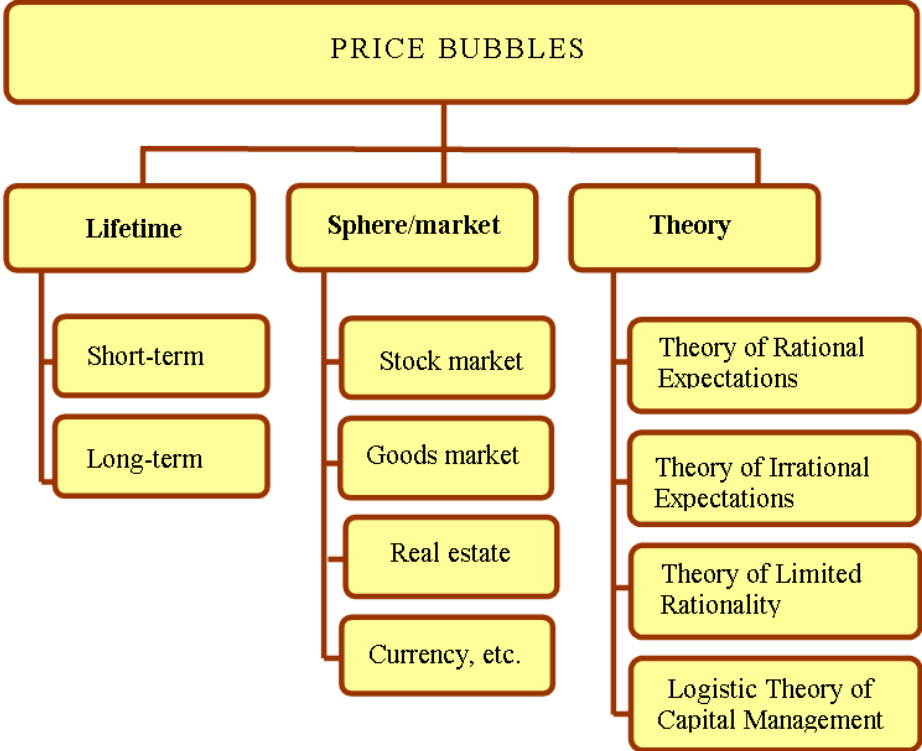


Fig. 1. Classification of price bubbles.

Tech bubbles should also be mentioned regarding the topic of stock market bubbles. Tech bubbles are formed when innovation and advanced technologies are applied in particular sectors of a market. *R. Shiller*, who has investigated such bubbles, states that the tendency of tech bubbles exists (e.g. General Motors stocks bubble (1912-1922); The Internet bubble (1992-2002)).

Bubbles in goods markets appear periodically and they are usually short-term (e.g. nickel price bubble (2005-2007), gold price bubble (1979-1982)). The most prominent goods market price bubble was a tulip bulb bubble in 1634-1637. Then a price of a single bulb reached that of a house.

Real estate bubbles appear periodically in different countries (Japan (1990-2005), Great Britain (2005), the USA (2000-2008), Sweden (1990), Lithuania (2003-2008)). It has been designated that the formation of real estate bubbles is determined by the following factors: the growth of people income, access to capital, interest rate decrease, decreasing unemployment rate, a long loan rollover, good credit conditions, unpopularity of other investment tools, belief that real estate is the most trustworthy investment, favourable prognoses of experts in mass media. The scheme of investment needs (Figure 2) was created on the basis of the drawn assumptions.

The subchapter also provides classical indicators of real estate price bubble which lead to the understanding of a price bubble development process in a market.

The analysis of scientific literature regarding the life-cycle of a bubble revealed that price bubble has development phases. However, the number of the phases varies

according to different scientists. *A. Nedosekin* (2001) enumerates 6 phases of bubble development (germination, expansion, overheat, explosions, fall, recession). *B. Galiniene and others* discern 4 phases (expansion; slowdown, peak, fall; decline, slowdown decline, stagnation; rise), whereas *F. Allen, D. Gale* (2000) state there are three development phases. Almost all authors claim that no restrictions or regulation function in the development of a real estate bubble. Yet, regulation policy may determine if the bubble is going to explode or just shrink.

Financial pyramids may be classified according to the scheme of performance and activity. The first ones may be divided into classical financial pyramids, matrix and Ponzi schemes. Regarding the activity, financial pyramids may be either open or disguised.

In case of a classical financial pyramid money is collected with the promise of high interest return for newly attracted members. The so called dividends for the members of a financial pyramid are paid from new fees. Such a pyramid works following a strict scheme when it is obligatory to attract a particular number of new members. In matrix scheme, an organizer sells goods at a large discount. The real value of the goods is covered by new members. In Ponzi scheme money is collected in disguise of investment and the promised profit to clients is paid from newly brought money (e.g. *Ponzi, MMM, Madoff*). According to activity, financial pyramids may be either open, when it is advised to invest a particular sum of money into a financial pyramid, or disguised ones when they work under the cover of investing, insurance, elite clubs or other activity.

All pyramids may function directly when individuals are carefully selected and invited for “a business interview” during which a psychological pressure is usually applied. With the appearance of information technologies and Internet, swindlers have also moved into the virtual environment.

Occasional financial pyramids may occur when an investment company which has operated normally lacks capital due to some reasons (mistakes or mis-performance) and tries to compensate the lack by issue of new liabilities. Then newly collected money covers earlier liabilities and finally the financial pyramid fails. There is an assumption that the notorious *Madoff* pyramid was an occasional one.

The scheme of investment needs (Figure 2) based on the analysis of scientific literature is provided in the end of the Second Chapter. Economic stability creates conditions for investment. The need to invest for short-term or long-term investors is influenced by expectations, human factors, access to capital and mass media. Investors invest both their own and loan capital.

Chapter 3. Logistic Valuation Model of Unsustainable Situations

The Third Chapter of the thesis is devoted to the logistic valuation model of unsustainable situations. After the overview of growth models, the logistic growth models are accentuated.

Classical investment/capital growth models applied in contemporary economy are based on exponential growth. However, these models have a drawback, i.e. they cannot provide exact results of forecasts in far future. An exponential (or, in other words, compound interest) model which values the re-investment of capital is an improved model of simple interest.

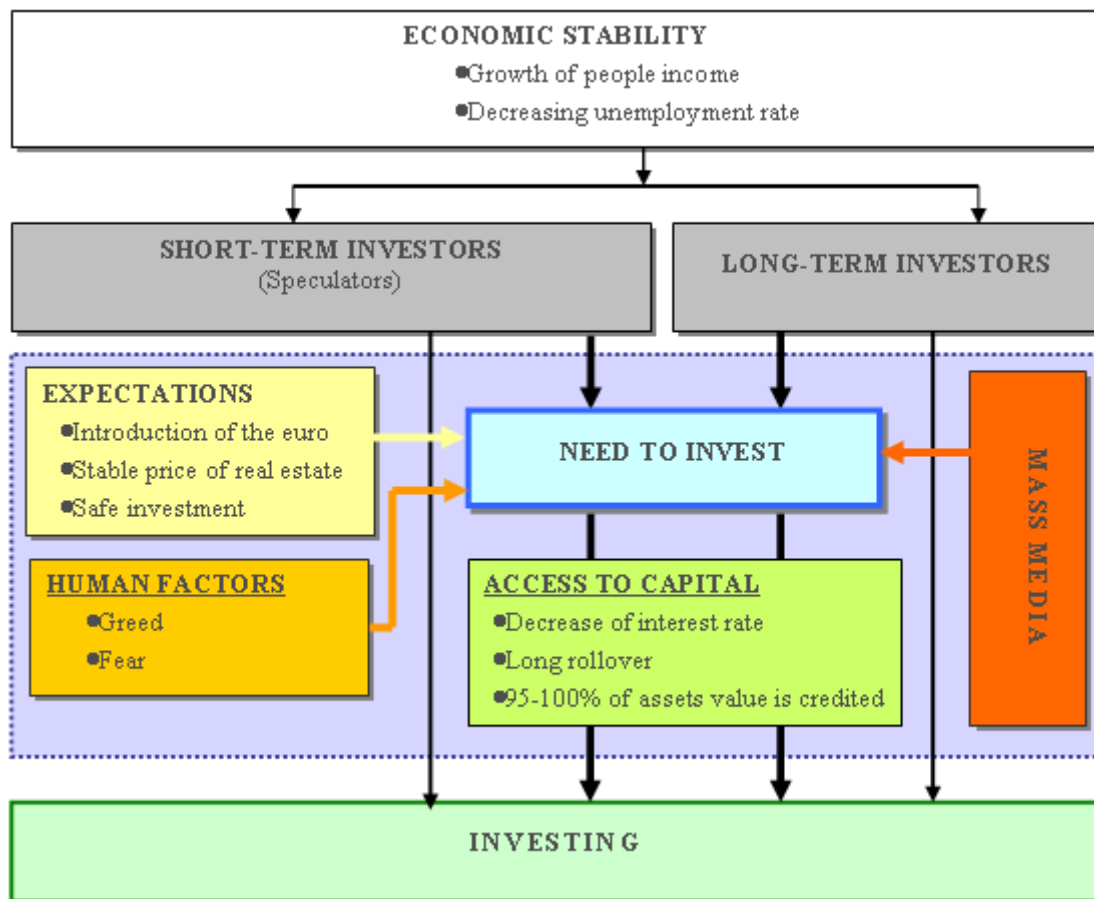


Fig. 2. Scheme of investment needs.

Yet, in reality a “naturally growing” population (capital, investment) cannot increase at an even speed all the time. Its growing is restricted by both external and internal factors. For that reason gradual growing reaches its maximum speed and then gradually slows down till it eventually stops. This type of growing is best expressed by means of the logistic model. The progenitor of the logistic model *P. F. Verhulst* improved the Maltus equation by introducing the factor indicating the decrease of population growth speed which appears due to the restriction of area or the amount of resources. The factor shows the system saturation rate. Later on this model was applied wider by *R. Pearl* and *L. Read* (1920). They encouraged a wider application of the model. The logistic growth model has been applied in the research of economic phenomena since 1998. In that year the attempt was made to apply the model for the growth of Brazil economy. The drawback of these models is that the function of growth was not expressed by compound percents. The Logistic theory of capital management formulated by prof. *S. Girdzijauskas* evaluates this drawback.

Logistic theory is based on restricted growth (logistic function). Logistic theory approaches naturally growing populations dependent on time. Such growing populations give increment which is growing according to the same principle. Capital, cash flow and investments are prescribed to such populations because their growth is based on time value. Logistic Theory of Capital Management relates capital and investments to a particular environment/ market segment in which they are invested. The assumption is drawn that there is maximum investment size that can be invested in that particular

market segment. The size is expressed as K_m . in the Logistic Theory of Capital Management.

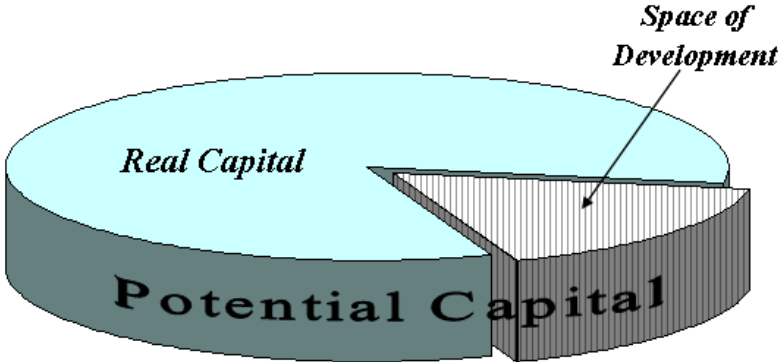


Fig. 3. Components of the logistic model.

To illustrate, the maximum investment size is shown in Figure 3 as a restricted investment capacity and it is called **potential capital**. Really invested and growing capital takes only a part of the capacity. It is called **real capital**. The rest of the capacity is left for the development (growth) of capital and this space is called a **niche** or space of development. Thus the investment capacity or potential capital may be expressed by the following dependence:

$ \text{Potential capital} = \text{Real capital} + \text{Capital niche} $

In the beginning, when the amount of the invested capital is small and capital development space is big, the invested capital develops (grows) at high speed. Gradually the real capital increases and takes bigger part of the investment capacity saturated by capital. As the capital takes larger part of the investment capacity, the part of the niche becomes smaller. The capital has less and less space to develop, therefore, the growth slows down till it stops. Here the paradox arises: the less free space is left for the growth of the investment the more its efficiency increases. That is, return on capital (profit) grows substantially. It leads to the conclusion that sudden increase in profit attracts new short-term (not only) investors. Significant return on investment encourages participants of a market to invest actively. Increased interest in such profitable investment arises as well as expectations of further price growth, i.e. profitability rise. An increased number of investors and investments in the sector reduce the niche even more. The demand exceeds the supply thus the features of a mania or boom appear and create conditions a bubble formation. The Logistic Theory of Capital Management proves that the expectations of investors rise due to fundamental reasons, namely, suddenly increased profitability influenced by the margin of the market segment. The sequence of causes and factors determining the formation of a bubble is illustrated in Figure 4.

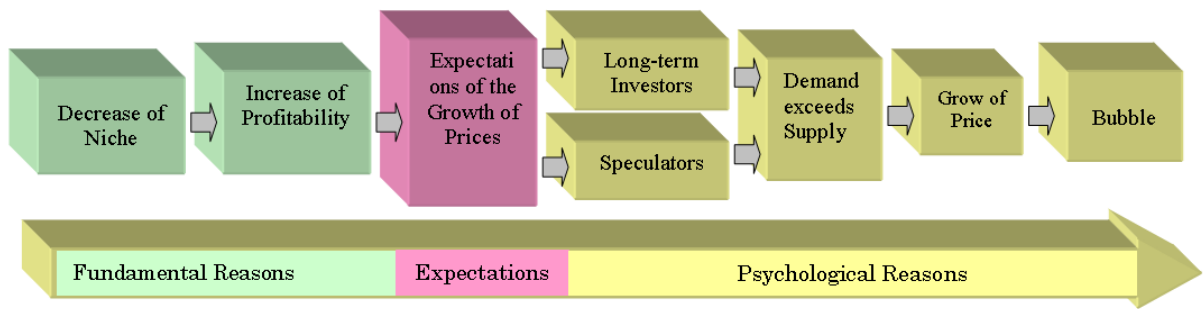


Fig. 4. Sequence of causes and factors of a bubble formation.

After the main reason of bubble formation, i.e. market margin, has been identified it is purposeful to complement the definition of a bubble. According to the Logistic Theory of Capital Management, a bubble is a constant growth of asset price which appears because of diminishing investment niche (space of development) and increased internal return on investment (profit increase) that determines the increase in the number of short-term investors (speculators) and that of the speculative capital.

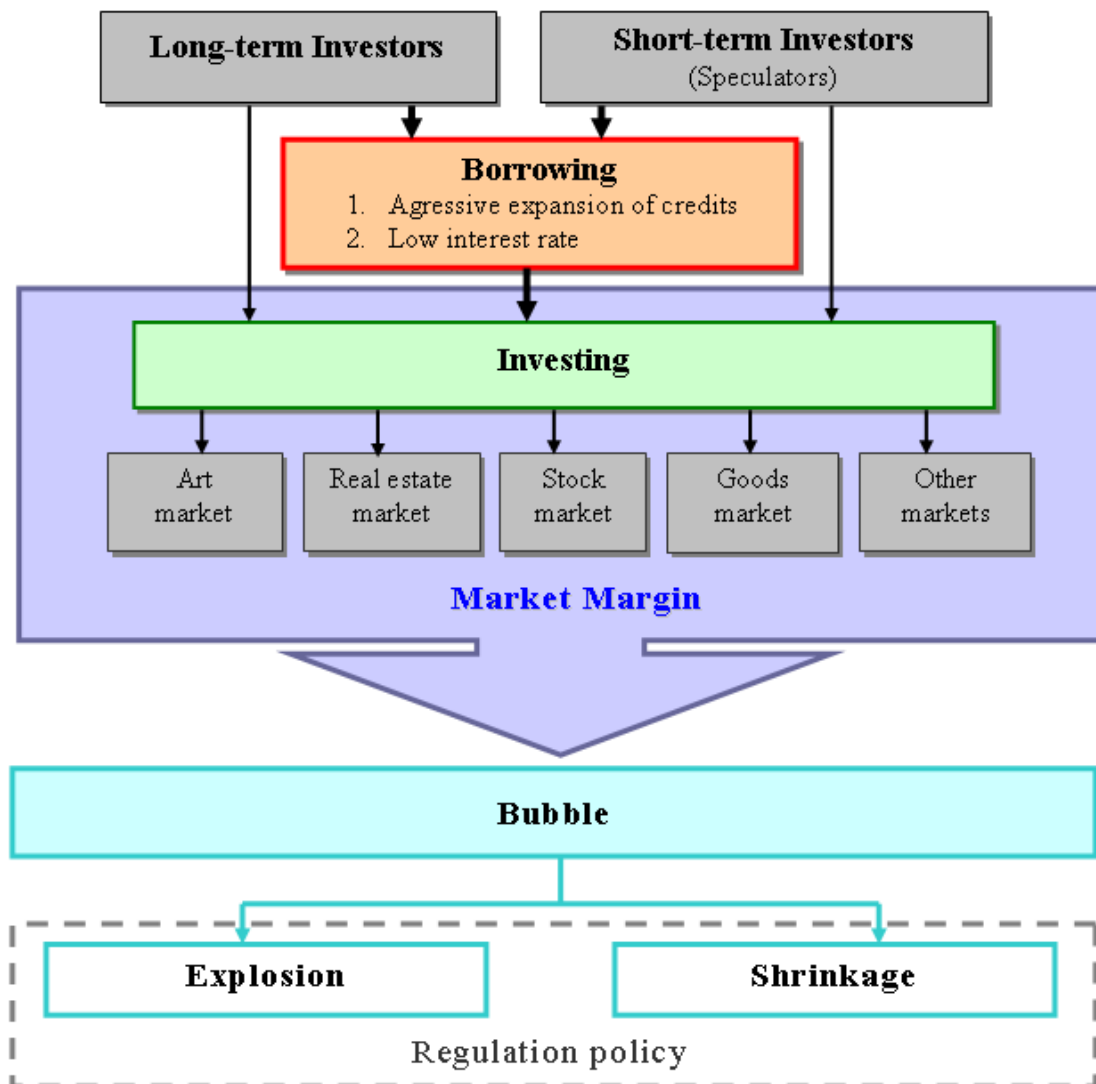


Fig. 5. Mechanism of price bubble formation.

Recent researches in the stock exchanges of the Baltic States support the above mentioned statements. It has been designated that the number of quoted companies has not changed since 2005 while prices were inflated by investment that became popular.

Aggressive crediting policy of Lithuanian banks and low interest rates created favourable conditions for a short-term borrowing targeted at investing. The increased need of market participants to invest in such a highly profitable sector creates possibilities of the formation of unsustainable situations, especially price bubbles, in a particular market sector or economy. The schematic view of bubble formation mechanism is given in Figure 5. The most common consequence of a bubble formation is its explosion accompanied by bankruptcies of companies and loss of the invested money which occur due to suddenly decreased prices of investment objects. Another possible outcome of a bubble is its slow shrinkage when the price decreases gradually during a longer period of time. This particular situation has been recently noticed in Lithuanian real estate market.

The following subchapter introduces the Logistic valuation model of unsustainable situations which includes logistic valuation models of price bubbles and financial pyramids (Figure 6).

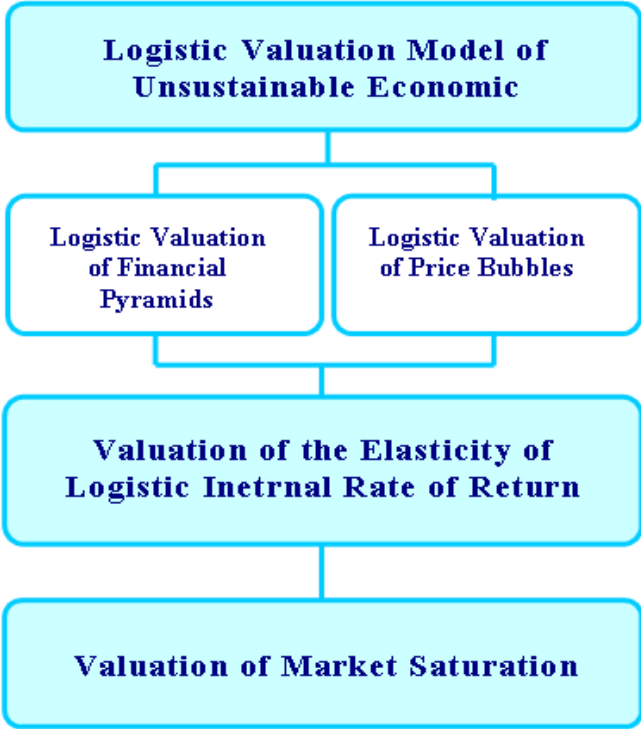


Fig. 6. The Logistic Model of Unsustainable Economic Situations

The valuation of investments or investment projects is usually based on the discount formula of compound percents. The following logistic formula of capital current value has been chosen for the valuation of unsustainable situations in the research:

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

The analysis of the formula shows that when the niche (investment development

space) diminishes, that is when the real capital approaches the maximum investment size K_m that may be invested in a particular market segment, the current value of capital rises significantly. When K_m is reached the dynamicity of the investment becomes unstable and thus an unsustainable situations occurs (S. Girdzijauskas 2002; V. Moskaliova, S. Girdzijauskas 2007).

The Logistic Model of Financial Pyramid

The following mathematical model is employed for the logistic valuation of a financial pyramid:

$$S_n = \sum_{m=1}^n \frac{K_{\max}}{1 + \left(\frac{K_{\max}}{a \cdot q^{m-1} \cdot (1 - (m-1) \cdot \beta)} - 1 \right) \cdot r^{m-1}} \quad (2)$$

Here S_n is the current value of the accumulated sum of money; n is a number of predicted accumulation periods; m is the number of a cash flow member; a is sums of money brought in the beginning of every period; q is the coefficient of the number of client fees; β is the interest rate on the initial sum of money; K_{\max} is the maximum (marginal) capital significance that evaluates the most highest possibilities of capital growth.

The logistic valuation of a financial pyramid proves that the stability of a financial pyramid depends on the coefficient of the number of client fees q , market capital price coefficient r , interest rate paid to clients β and the significance of marginal capital K_m . The less is the significance of marginal capita K_m , the higher current value of the accumulated capital is achieved. The decrease of the coefficients β and q and increase of r make the financial pyramid more stable.

The Logistic Model of Price Bubbles

Logistic Net Present (Current) Value (*LNPV*) and Logistic Internal Rate of Return (*LIRR*) models are applied to evaluate the profitability of investments. In this work the priority was given to the Logistic Internal Rate of Return (*LIRR*) model. Consider:

$$LIRR = \sum_{j=1}^n \frac{K_m \cdot K_j}{K_j + (K_m - K_j) \cdot r^j} - 1 \quad (3)$$

Here *LIRR* is the logistic internal rate of return, K_j is the j^{th} member of the cash flow (j is also the duration of accumulation expressed by the units of time fixed in the interest rate i ; $j = \overline{1, n}$), r is the coefficient of accumulation speed together with interest rate i ($r = 1 + i$); K_m is the maximum size of investment/potential capital.

Logistic Internal Rate of Return (*LIRR*) is such a significance of the discount coefficient under the presence of which the Logistic Net Present (Current) Value (*LNPV*) is equal to zero. The analysis of the cash flow of the investment project was carried out according to the model (2) given in Figure 7.

In the logistic analysis of the investment project cash flow the arguments of the function are grouped into permanent and alternating ones in advance. In the beginning of the investment project research the initial data – time (n) and invested capital (K) are treated as permanent arguments. When the Logistic Net Present (Current) Value method

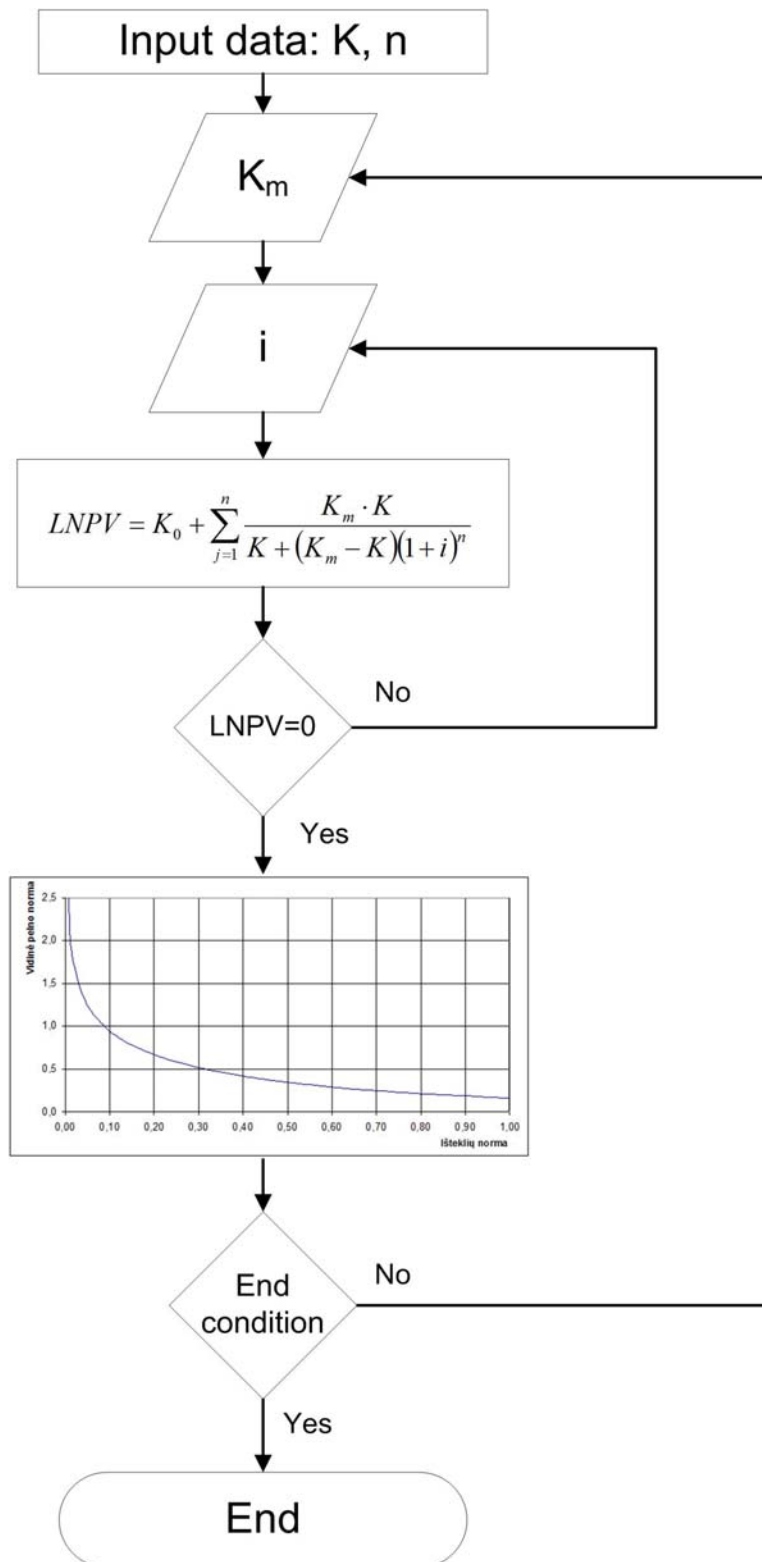


Fig. 7. Flowchart of the logistic model of unsustainable situations.

is applied it is important to be aware of the maximum investment capacity (K_m). In this research the value K_m is alternating one. According to the Logistic Theory of Capital Management the maximum investment capacity has a tendency to decrease because invested capital grows and thus takes larger and larger part of the capacity in the course of time. The decrease in capacity is a relative one, therefore the values of K_m chosen in the beginning are high. The main obscure value is interest rate (i).

When the small cycle is in progress, the interest rate is determined so that the logistic current value of the investment cash flow is equal to zero. The result is fixed in the diagram. When the value K_m is changed the cycle is repeated. The end condition is $K_m = K$.

The Valuation of the Elasticity of Logistic Internal Rate of Return

According to investors, it is important to designate the phases of price bubbles formation. To achieve the set goal, elasticity has been chosen as one of the change in speed characteristics applied in economics. The function is treated as elastic if its elasticity module is above 1. Yet, if the module is below 1, the function is taken as non-elastic. If the elasticity module is equal to 1, the function is of unit elasticity (*H. R. Varian 2003*).

The elasticity of the examined logistic current value from the perspective of time may be expressed in the following way:

$$E_t(K_0) = -\frac{(K_m - K) \cdot r^t \cdot \ln r}{K + (K_m - K) \cdot r^t} \quad (4)$$

Here $E_t(K_0)$ is the logistic elasticity of current value; K_m is the maximum investment size/potential capital; K is real (invested) capital, t is time, r is the coefficient of accumulation speed with the interest rate i .

The economic significance of elasticity is the percentage change of the function (*LIRR*) when the significance of an argument is changed by one per cent. It means that the value $E_t(K_0)$ indicates the percentage rise of *LIRR* when the growth space has changed by one per cent.

The research exposed that when the investment space of development diminishes, elasticity significantly increases and a price bubble forms. Valuation of the elasticity of logistic internal rate of return leads to the distinction of two essential price bubble formation phases: heating and boiling. The heating phase lasts till *LIRR* elasticity is below 1, whereas the boiling phase starts when the *LIRR* elasticity is above 1.

Valuation of market saturation

As the investment space of development decreases, its internal rate of return rises. The increase in the internal rate of return determines the growth of the investment effectiveness. The value of the elasticity of logistic internal rate of return is a sufficient indicator informing about market saturation.

The obtained results (described in Chapter 4) leads to the conclusion that the value K_m is of crucial importance in the analysis of an investment project. This supports the theoretical statement being defended that market margin is an essential condition/cause of unsustainable economic situations formation.

Chapter 4. Application of the Logistic Valuation Model of Unsustainable Economic Situations

The Chapter discusses and grounds the application possibilities of the created model in the logistic analysis of unsustainable situations. The logistic valuation model of unsustainable situations is elaborately described in Third Chapter. Hereafter the results of researches are provided.

The First enquiry was aimed at the logistic analysis of an investment project. The valuation model of unsustainable situations serves as a means to determine the dependence of investment project internal rate of return on the decrease in investment development space (niche).

The duration of the explored investment project is 6 years. Expenditure, income and general investment flow of the project are given in Table 1.

Table 1

Years	Cash flow in the end of the year (by relative monetary units)		General flow
	Expenditure	Income	
0	-1	0	-1
1	-1	0,5	-0,5
2	-0,5	0,5	0
3	-0,3	0,5	0,2
4	-0,2	1	0,8
5	0	1	1
6	0	1	1
Total:	-3	4,5	1,5

Table 2

K_m	LIRR	K_m	LIRR
10000	0,1648	1,3	0,6136
10	0,1860	1,2	0,7370
5	0,2130	1,15	0,8332
3	0,2597	1,12	0,9129
2,5	0,2893	1,11	0,9451
2	0,3446	1,1	0,9810
1,8	0,3820	1,05	1,2666
1,7	0,4078	1,02	1,7165
1,6	0,4395	1,01	2,1218
1,5	0,4802	1,001	4,0109
1,4	0,5352	1,0001	7,1470

The values of the logistic internal profit rate calculated according to the logistic price bubbles model are given in Table 2.

The diagram in Figure 8 illustrates the dependence of the logistic internal profit rate on the investment space of development.

It has been ascertained that as the investment space of development diminishes, the investment internal rate of return rises and influences the efficiency increase of the investment. In the initial stage of the investment project when the investment space is very big and invested capital may grow without restrictions it does not give high rate of return. When there is 30% of free space in the investment capacity, the profitability of the investment project grows to 50%. As the invested capital takes 95% of the investment capacity, profitability reaches even 130%. Such high rate of return of invested money is an indicator of overheat. It shows that an unsustainable situation has occurred.

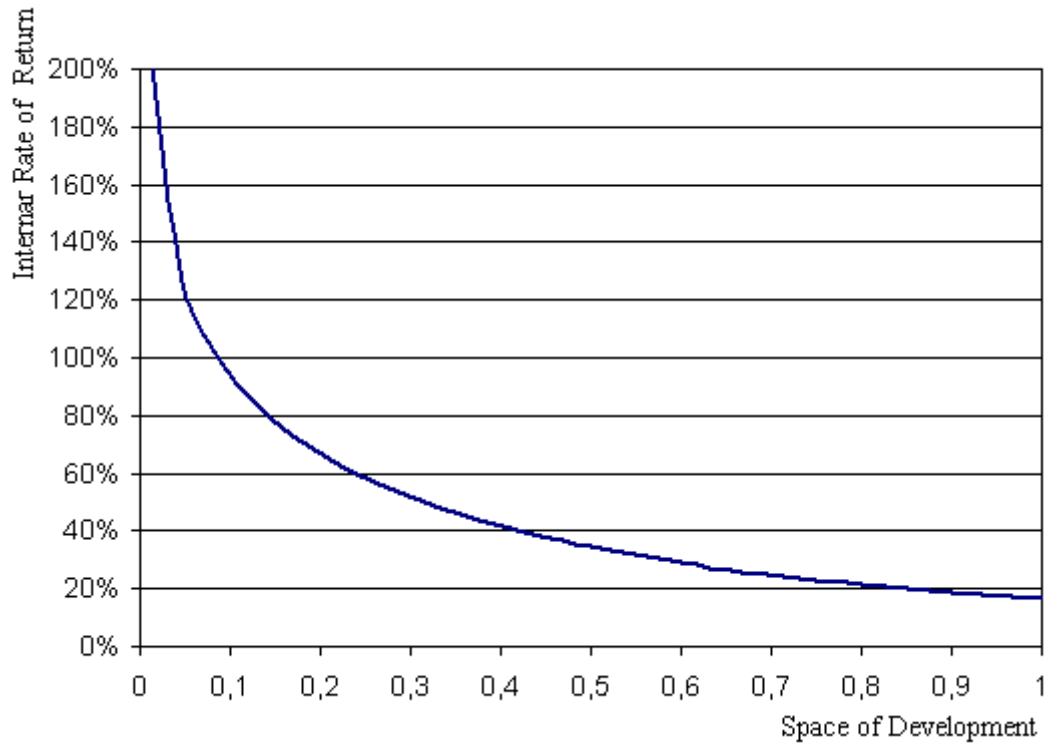


Fig. 8. Dependence of the logistic internal profit rate on investment space of development

The **second** enquiry was targeted at the valuation of the dependence of the elasticity of logistic internal rate of return on potential capital. The logistic valuation model of unsustainable situations was applied to designate how decrease in space of development influences the elasticity of internal rate of return.

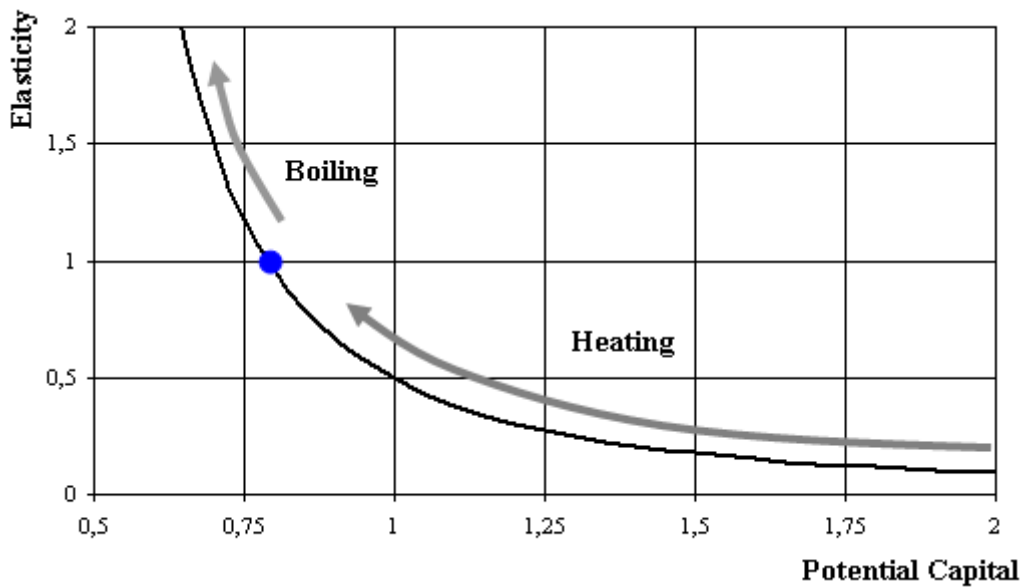


Fig. 9. Investment project elasticity of the logistic internal rate of return on potential capital and phases of bubble formation

When the project elasticity of logistic internal rate of return grows above 1, the internal rate of return becomes elastic (sensitive). As potential capacity diminishes and

approaches marginal value, elasticity rises significantly. That is, a price bubbles is under formation process.

The enquiry has revealed that the decrease of investment space of development in closed environment may essentially change the behaviour of investment environment: as investment growth space diminishes, the investment internal rate of return rises. As it has been already mentioned in the first research, the increase of internal rate of return determines a substantial rise in efficiency of a closed system. This allows for the designation of price bubble formation phases.

The third enquiry focused on the logistic analysis of price indices in the stock exchanges of the Baltic States. The applied programme of logistic growth *LogLet 2.0* aids in detection of a price bubble in the market. The main reason of the bubble formation is the margin of market capacity.

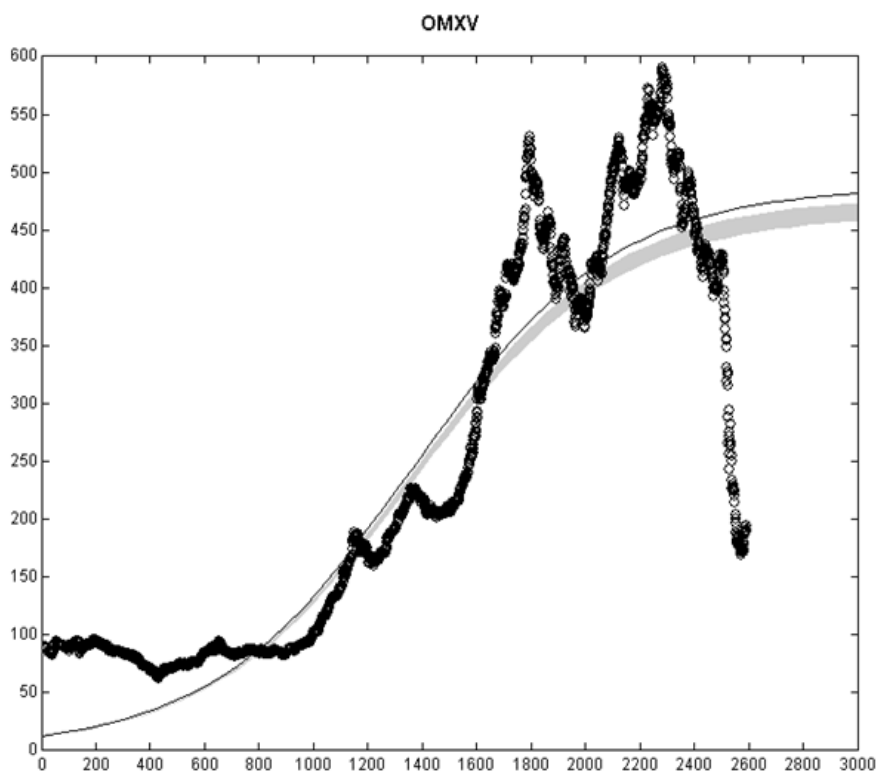


Fig. 10. Dynamics of the Vilnius Stock Exchange index and the curve of capital saturation

Among the reasons causing bubble formation one of the most important was the margin of market capacity. When the trade list is not complemented by new quoted companies, the potential (i.e. marginal) capital rate is reached. The very fact that no new companies appear on the market determines the limited choice open for investors as well as the limited amount of potential investments. It means that new investors are also forced to 'buy' the former investors and thus they do increase the gap between the share market prices of the quoted companies and their real rate. The second reason is the loan capital increase within the market. It shows that, on the one hand, with growing popularity of investment the market did not increase its share amount, on the other hand, the market was gradually filled with a rising amount of capital, a considerable part of which was made of loan capital. As the data of the Lithuanian Securities Commission embracing the three quarters of the year show, every fourth deal in Vilnius Stock Exchange was financed by loan capital.

The Fourth enquiry aims at the logistic analysis of a financial pyramid. The application of the Logistic valuation model of unsustainable situations in the investigation of financial pyramids showed that a financial pyramid may function as a common investment company if the money brought by clients is reinvested and vice versa.

Figure 11 illustrated the dependence of the current value of capital accumulated by an organizer of a financial pyramid on the investment space of development. The Figure provides different values of interest rates paid to clients (β). Under particular conditions when the investment space of development diminishes the current values of the capital increases significantly. On the contrary, as the investment space of development increases the current value of capital accumulated by an organizer of a financial pyramid drastically decreases and the financial pyramid collapse. This is best illustrated by the curve showing the lowest ($\beta = 0,03$) interest rate paid to clients.

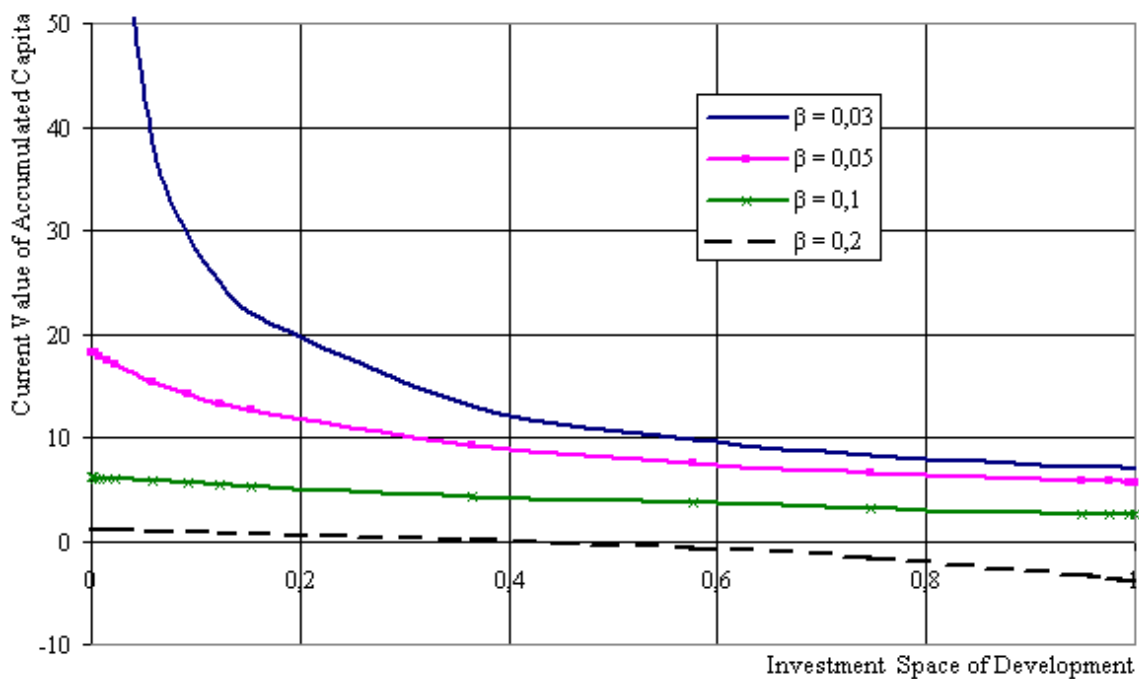


Fig. 11. Dependence of the current value of accumulated capital on investment space of development when β values differ, $n = 30$; $q = 0.9$; $r = 1.1$

The research has proved that a financial pyramid may operate as a common investment company if the investment of money brought by clients is performed. Under certain conditions when investment growth space approaches the margin, the current value of accumulated capital rises substantially. And vice versa, when investment growth space increases, the current value falls considerably and the financial pyramid collapse.

CONCLUSIONS

The overview of scientific literature, analysis of research methods, application of the logistic valuation model of unsustainable economic situations and empirical studies have confirmed the statements defended in the thesis.

1. after the analysis and systematization of different authors' approaches towards unsustainable economic situations it has been determined that the efforts to define the

market heating and price bubbles in the context of classical theories lack evaluation of the main cause of unsustainable situations, i.e. market capacity.

2. The created logistic valuation model that includes price bubbles and financial pyramids reveals the main reasons of unsustainable economic situations formation and aids in recognition and prediction of such unsustainable situations as well as their control.
3. The valuation of elasticity of logistic internal rate of return lead to the designation of bubble formation phases, or in other words, the stability degree of the bubble under formation process. When elasticity coefficient is above zero but below 1, the bubble is in “the heat” phase; when elasticity coefficient is above 1, the bubble formation, or “the boiling” phase starts.
4. The application of the logistic valuation model of unsustainable situations in the research of stock exchanges of the Baltic States ascertained the applicability of the logistic model. It has been determined that the main reason of price bubble formation is margin of market capacity.
5. The application of the logistic valuation model of unsustainable situations in the investigation of financial pyramids proved that a financial pyramid may operate as a common investment company if the investment of money brought by clients is performed. Under certain conditions when investment growth space diminishes, the current value of accumulated capital rises substantially. And vice versa, when investment growth space increases, the current value falls considerably and the financial pyramid collapses
6. The researches have demonstrated that the main cause of unsustainable situation formation is market margin. Thus the current definition of an unsustainable situation – a bubble – may be complemented: *a bubble is an exponentially growing price rise process when the initial price increase occur due to significantly diminished capital niche and thus considerably increased investment internal rate of return. This creates expectations of further continuous income growth and attracts new short-term investors (speculators)*

Vera Moskaliova
Vilniaus universitetas
DAKTARO DISERTACIJOS SANTRAUKA

Temos aktualumas. Netvarios situacijos ekonomikoje žinomos nuo neatmenamų laikų. Jos skatina ekonomikos vystymosi netolygumus, socialinių sukrėtimų atsiradimą. *G. Kancerevyčiaus (2004, 2008)* teigimu, įvairios krizės pasaulyje įvyksta periodiškai, maždaug kas devynerius metus. Daugelis autorių nurodo ir kitokias trukmes. Netvarios ekonomikos situacijos kelia rūpestį ne tik paprastiesiems žmonėms, bet ir įvairių mokslo sričių atstovams. Mokslininkai, pasitelkę įvairias mokslo teorijas bei informacines technologijas, ieško netvarių ekonominių situacijų atsiradimo priežasčių, dėsningumų, siekia nustatyti jų požymius ir pasiūlyti prevencijos būdus. Netvarių ekonomikos situacijų priežasčių suvokimas leistų tiksliau prognozuoti finansinius bei ekonominius reiškinius, aiškiau numatyti ekonomikos vystymosi grėsmes ir investavimo nesėkmes. Todėl svarbu suprasti fundamentalias priežastis, nulemiančias netvarių ekonomikos situacijų susidarymą.

Kainų burbulų sproginimas daro didelę žalą ekonomikai. Griaunanti žalos poveikį valstybių ekonomikos patyrė daugybę kartų. Vienas naujausių pavyzdžių — JAV nekilnojamojo turto burbulo sproginimas 2008 metais, lėmęs ne tik daugelio kompanijų, stambių ir smulkių bankų, bet ir atskirų šalių (pavyzdžiui, Islandijos) bankrotus. Didžiąją pasaulio dalį sukaustė ilgalaikė recesija. Dėl globalizacijos sprogusių burbulų padarinius jaučia ne tik atskiri ekonomikos sektoriai, bet ir beveik visų pasaulio šalių ekonomikos. Todėl tirti ir plėtoti mokslinius netvarių ekonominių situacijų tyrimus, žinoti kainų burbulų susiformavimo priežastis, atpažinti požymius ir mokėti išvengti tokių situacijų ateityje pastaruoju metu itin aktualu.

Nemažai problemų ekonomikoms sukelia ir finansinės piramidės. Finansų piramidės yra senas sukčiavimo būdas. Sukčiautojų noras pasipelnyti kitų sąskaita egzistavo nuo seno, yra dabar ir bus ateityje. Sukčiautojai tampa vis išradingesni. Atsiradus kompiuteriams, internetui bei informacinėms technologijoms, sukčiautojai savo tikslais panaudoja ir elektroninę erdvę. Kaip ir visais laikais, žaidžiama paprastų žmonių pasitikėjimu, naivumu bei azartu. Kaip parodė 2008 metais atskleista garsioji Madoffo afera, nuo tokių sukčiautojų nėra apsaugoti nei įžymūs ir įtakingi asmenys, nei vargšai. Visuomet egzistavo noras praturtėti lengvai, neįdėjus ypatingų pastangų. Didžiąjai daliai žmonių veikla tokio tipo projektuose arba schemose visuomet baigiasi nesėkme. Todėl svarbu šviesti žmones, žinoti tokių schemų veikimo mechanizmą. Tai galėtų padėti apsisaugoti nuo nepageidautinų reiškinių, pavyzdžiui, turto ar investicijų praradimo.

Nėra paprasta prognozuoti netvarias ekonomines situacijas. Reikia aiškiai suvokti tokių reiškinių kilmę, prigimtį, fundamentalias priežastis bei vystymosi etapus, mokėti išvengti tokių situacijų ir nekartoti klaidų. Vilniaus universitete sukurta ir išvystyta prof. Stasio Girdzijauskio Logistinė kapitalo valdymo teorija leidžia naujai pažvelgti į netvarių situacijų ekonomikoje fenomeną. Teorija atskleidžia fundamentalias tokių situacijų susiformavimo priežastis ir gali būti plačiai pritaikyta ekonomikoje. Ši teorija bei jos kontekstas leido atrasti naujų ekonominių paradoksų. Pritaikius šią teoriją kainų burbulų bei finansinių piramidžių tyrimui, galima aptikti tokias netvarias situacijas, jas pažinti, atskleisti ir modeliuoti.

Problemos ištyrimo lygmuo. Žinios apie pirmąsias netvarias situacijas ekonomikoje siekia XVII amžių, kai buvo aprašyta garsioji olandų tulpių manija. Tuomet kai kurių rūšių tulpių svogūnėlių kainos buvo tokios aukštos, kad už vieneta buvo galima nusipirkti namą. Vėliau Prancūziją sukrėtė garsioji J. Law pinigų sistema (1716—1720), po to — Pietų jūrų kompanija (1720—1721). XX amžiaus pradžioje didžiulį atgarsį turėjo Ponzi afera (1920) bei spekuliacinis bumai JAV (1927—1929). Plačiai aprašytas ilgai trukusio Japonijos nekilnojamojo turto burbulo fenomenas (1980). Globalizacijos kontekste netvarios situacijos palietė ir informacijos technologijų sritį — 2000 metų pabaigoje sprogo interneto burbulas, o JAV nekilnojamojo turto burbulas (2007) sprogo banga palietė visų pasaulio šalių ekonomikas.

Plačiau ši problema pradėta nagrinėti XX amžiaus antroje pusėje. Racionaliųjų lūkesčių teorijos požiūriu kainų burbulus tyrė *E. Fama* (1965); *O. J. Blanchard* (1979); *O. J. Blanchard, M. Watson* (1982); *R. S. Gürkaynak* (2005); *P. M. Garber* (2000); *K. A. Froot, M. Obstfeld* (1991), *V. Lei, C. N. Noussair, S. R. Plott* (2001), *R. Kuodis* (2006, 2008); *H. Lind* (2008); *A. G. Шульгин* (2008); *V. Azbainis* (2009). Iracionaliųjų lūkesčių teorijos požiūriu kainų burbulams daug dėmesio skyrė: *C. P. Kindleberger* (1978, 1996); *R. Thaler* (1994); *A. Shleifer* (2000); *R. Shiller* (2000, 2005). Atsisakius vienos iš racionaliųjų lūkesčių hipotezių, susiformavo riboto racionalumo požiūris, kurios reikšmingiausi atstovai yra *D. Sornette; A. Johansen* (1999, 2001); *D. Sornette* (2003, 2008).

Nekilnojamojo turto burbulų problematiką aprašė *S. Shiratsuka* (2003); *A. V. Gusev* (2008); *J. H. Cochrane*, (2002); *J. Calverley* (2004); *F. Modigliani, R. Cohn* (1979); *A. O. Недосекин* (2004); *C. Mouceev* (2001); *Ch. Martenson* (2008); *H. Minsky* (1986); *K. Ertürk, G. Özgür* (2009); *F. S. Mishkin, E. White* (2003); *A. G. Шульгин* (2008); *R. Lawrence* (2008). Lietuvoje nekilnojamojo turto burbulo problemas gvildeno *R. Kuodis* (2004, 2005, 2006, 2008); *B. Galinienė, A. Marčinskas, S. Malevskienė* (2006); *L. Belinskaja, V. Rutkauskas* (2007); *V. Azbainis* (2009); *M. Leika, M. Valentinaitė* (2007); *R. Rudzkiš, N. Titova, V. Titarenko* (2005); *I. Zakalskytė* (2006), *G. Stanišauskas* (2005); *G. Jankauskas* (2006). Tačiau tik keletas autorių nekilnojamojo turto burbulus traktavo kaip vieną iš netvarių situacijų ekonomikoje, kurią galima nuspėti iš anksto ir valdyti (*S. Girdzijauskas, D. Štreimikienė* (2009)).

Finansines piramides tyrė *D. A. Valentine* (1998); *D. W. VanArsdale* (1998, 2002, 2007); *R. Heakal* (1999); *J. M. Taylor* (1999), *R. L. FitzPatrick, J. K. Reynolds* (1997); *A. Ю. Зотова* (1994); *B. B. Радаев* (1998); *O. E. Кузина* (1999); *A. K. Бекряшев, И. П. Белозеров* (2000); *A. Belianin, O. Isupova* (2000); *S. V. Dubovskij* (2000, 2001); *G. G. Dimitriadi* (2002, 2004, 2005); *G. A. Agasandian* (2002; 2003); *A. Goriačeva, R. Michel* (2004); *O. Kovaliova, A. Goriačeva* (2008); *A. Buchvalov, V. Buchvalova, A. Idelson* (2001).

Logistinės analizės pradininkas, taikęs logistinį augimo dėsnį biologinių populiacijų prognozėms, yra *P. F. Verhulst* (1804—1849). Pirmuosius bandymus pritaikyti tokį dėsnį ekonomikoje atliko *O. C. Ferreira* (1998, 2002); *C. F. Alvim* (1998). Jie parodė, kad Brazilijos ekonomiką sėkmingiau leido aprašyti logistinis augimo, o ne eksponentinis modelis. Šių modelių trūkumas tas, kad augimo funkcija nebuvo išreikšta sudėtiniais procentais. Pirmasis tą pastebėjo ir įvertino Vilniaus universiteto ekonomikos profesorius *S. Girdzijauskas* (2002), kurio darbai išsivystė į atskirą savarankišką teoriją — Logistinę kapitalo valdymo teoriją (2006, 2008). Logistinio augimo modelio taikymo galimybės nagrinėjo *S. Girdzijauskas* (2002, 2005, 2006, 2008);

S. Girdzijauskas, R. Mackevičius (2009); P. Tanenbaumas, R. Arnoldas (1995); Z. Bodie, R. C. Merton (2000); C. H. Edwards, D. E. Penney (1985); O. C. Ferreira (1998); C. F. Alvim (1998); C. P. Obi (1998); R. Shone (2001); F. Wattenberg (1995); S. Girdzijauskas, D. Štreimikienė, M. Dubnikovas (2009); S. Girdzijauskas, D. Štreimikienė (2007, 2008, 2009).

Tačiau paminėti mokslininkų darbai, kuriuose pateiktas logistinės kapitalo valdymo teorijos taikymas ekonominių burbulų ir kitų ekonomikos perkaitimo reiškinių analizei tirti, stokoja vieningo tyrimo įrankio. Jis leistų pasitelkti logistinę analizę ir nagrinėti bei valdyti įvairias netvarias ekonomines situacijas.

Darbo objektas — netvarios situacijos ekonomikoje, t. y. kainų burbulai ir finansinės piramidės.

Darbo tikslas — remiantis teorine netvarių situacijų ekonomikoje analize bei logistine kapitalo valdymo teorija, sukurti logistinių netvarių situacijų vertinimo modelį, leidžiantį nustatyti netvarių ekonominių situacijų priklausomybę nuo rinkos ribotumo ir jas valdyti.

Siekiant šio tikslo, atliekami tokie teoriniai bei praktiniai uždaviniai:

1. Susisteminti ir apibendrinti mokslinėje literatūroje analizuojamą netvarių ekonominių situacijų sampratą.
2. Remiantis logistine kapitalo valdymo teorija, parengti teorinį logistinių netvarių situacijų vertinimo modelį.
3. Remiantis logistine kapitalo valdymo teorija, susisteminti kainų burbulo susiformavimo veiksnius ir priežastis bei patikslinti kainų burbulo apibrėžimą.
4. Pritaikius logistinių netvarių situacijų vertinimo modelį bei adaptavus biologijoje naudojamą logistinio augimo taikomąją programą *LogLet 2.0*, atlikti kainų burbulų Baltijos šalių biržose vertinimą.
5. Pritaikius logistinių netvarių situacijų vertinimo modelį, nustatyti investicinio projekto logistinės vidinės gražos elastingumo priklausomybę nuo rinkos ribotumo.
6. Pritaikius logistinių netvarių situacijų vertinimo modelį, nustatyti finansinės piramidės sukauptojo kapitalo dabartinės vertės priklausomybę nuo investicijų augimo erdvės.

Tyrimas buvo atliekamas 2004—2009 metais.

Tyrimo metodai: teorinė analizė, pagrįsta įvairių mokslininkų darbų rezultatais ir išvadamis; sisteminė analizė; modeliavimas; įvertinimas; apibendrinimas; palyginimas; abstrahavimas. Tiriant kainų burbulų susiformavimo fenomeną Baltijos šalių biržose, siekiant įvertinti rinkos prisotinimą, pasirinkta biologijoje naudojama logistinio augimo taikomoji programa *LogLet 2.0*. Finansinių piramidžių logistinis modelis tirtas skaičiuokle *Microsoft Excel*.

Darbo struktūra

Įvade išdėstomas disertacijos tyrimo objektas, tikslas, temos aktualumas, uždaviniai, tyrimo metodai, rezultatų mokslinis naujumas, praktinė reikšmė, publikacijos.

Pirmoje darbo dalyje aptartos ir apibendrintos įvairių mokslininkų, analizavusių kainų burbulų fenomeno bei finansinių piramidžių problemas, nuomonės, susistemintos netvarias situacijas aiškinančios teorijos.

Antroje dalyje pateikiami empiriniai netvarių situacijų identifikavimo metodai ir modeliai. Atliekamas kainų burbulų bei finansinių piramidžių klasifikavimas, aprašomas kainų burbulo gyvavimo ciklas, sudaroma apibendrinta Lietuvos NT kainų burbulo susiformavimo priežasčių schema.

Trečioje dalyje, remiantis logistine kapitalo valdymo teorija, sudaryta kainų burbulo susiformavimo veiksnių ir priežasčių seka, aprašytas kainų burbulo susiformavimo mechanizmas bei patikslintas kainų burbulo apibrėžimas. Šioje dalyje parengtas logistinis netvarių ekonominių situacijų vertinimo modelis, apimantis kainų burbulų bei finansinių piramidžių vertinimo logistinius modelius. Modelis leidžia įvertinti netvarių ekonominių situacijų priklausomybę nuo rinkos ribotumo, tai yra nuo rinkos investavimo erdvės išsekimo (sumažėjimo).

Ketvirtoje darbo dalyje praktiškai pritaikytas sukurtasis netvarių situacijų ekonomikoje vertinimo modelis. Įvertinta netvarių ekonominių situacijų priklausomybė nuo rinkos ribotumo, tai yra nuo rinkos investavimo erdvės išsekimo (sumažėjimo). Rezultatai parodė, kad:

- Investicinio projekto logistinės vidinės gražos normos elastingumo vertinimas leidžia nustatyti burbulo susidarymo fazes;
- Modelio taikymas Baltijos šalių biržoms parodė, kad pagrindinė kainų burbulo susidarymo priežastis buvo rinkos apimties ribotumas.
- Modelio taikymas finansinių piramidžių tyrimui nustatė finansinės piramidės sukauptojo kapitalo dabartinės vertės priklausomybę nuo investicijos augimo erdvės.

Darbe ginami teiginiai

- Netvarių ekonominių situacijų susidarymą atskleidžia logistinė kapitalo valdymo teorija. Ji tokias situacijas leidžia efektyviai identifikuoti ir suvaldyti.
- Rinkos ribotumas yra pagrindinė sąlyga (arba priežastis) netvarioms situacijoms susidaryti.
- Logistinės vidinės gražos normos elastingumas ribiniam kapitalui yra pagrindinis instrumentas, parodantis burbulo formavimosi intensyvumą.

Darbo mokslinis naujumas

Sukurtas logistinis netvarių ekonominių situacijų vertinimo modelis, apimantis logistinių kainų burbulų vertinimo modelį, projekto logistinės vidinės gražos elastingumo priklausomybės nuo ribinio kapitalo ir finansinių piramidžių tyrimo logistinius modelius. Atskleistos fundamentalios netvarių situacijų ekonomikoje susiformavimo priežastys, leidžiančios atpažinti bei numatyti tokias netvarias situacijas ekonomikoje ir jas valdyti.

Praktinė darbo nauda

Sukurtasis netvarių situacijų ekonomikoje vertinimo modelis gali būti plačiai pritaikytas praktiškai, kadangi leidžia aptikti netvarias ekonomines situacijas ir įgalina priimti teisingus sprendimus tiek ekonominėje politikoje, tiek atskiroje investicinėje bendrovėje. Taip ir šalies ūkis, ir atskiras investuotojas ar verslininkas tokias situacijas gali laiku suvaldyti ir išvengti didelių ekonominių nuostolių.

IŠVADOS

Mokslinės literatūros apžvalga, tyrimo metodų analizė ir logistinio netvarių situacijų ekonomikoje vertinimo modelio pritaikymas ir atlikti empiriniai tyrimai patvirtino disertacijoje ginamus teiginius.

1. Išanalizavus ir susisteminius skirtingų autorių požiūrius į netvarias ekonomines situacijas, nustatyta, kad, apibrėžiant rinkos kaitimą ir kainų burbulus klasikinių teorijų kontekste, neįvertinama esminė netvarių situacijų susidarymo priežastis — rinkos talpa.
2. Sukurtas logistinis vertinimo modelis, apimantis kainų burbulus ir finansines piramides, atskleidžia svarbiausias netvarių situacijų ekonomikoje susiformavimo priežastis ir leidžia atpažinti bei numatyti tokias netvarias situacijas, o taip pat jas valdyti.
3. Logistinės vidinės gražos normos elastingumo vertinimas leido nustatyti burbulo susidarymo fazes arba apibrėžti besiformuojančio ekonominio burbulo stabilumo laipsnį: kai elastingumo koeficientas yra didesnis už nulį, bet mažesnis už vienetą, tai besiformuojantis burbulas yra „kaitimo“ fazėje; kai elastingumo koeficiento reikšmė didesnė už vienetą – prasideda burbulo formavimasis arba „virimo“ fazė.
4. Logistinio netvarių situacijų vertinimo modelio taikymas Baltijos šalių biržoms parodė logistinio modelio pritaikomumą. Nustatyta, kad pagrindinė kainų burbulo susidarymo priežastis buvo rinkos apimties ribotumas.
5. Logistinio netvarių situacijų vertinimo modelio taikymas finansinių piramidžių tyrimui parodė, kad finansinė piramidė gali veikti kaip įprasta investicinė bendrovė, jei vykdomas klientų įnešamų pinigų reinvestavimas. Esant tam tikroms sąlygoms, kai investicijos augimo erdvė senka, sukaupto kapitalo dabartinė vertė ženkliai išauga. Ir atvirkščiai, padidėjus investicijos augimo erdvei, dabartinė vertė stipriai krenta ir tokia finansinė piramidė sugriūva.
6. Tyrimai parvirtino, kad esminė netvarių situacijų susiformavimo priežastis yra — rinkos ribotumas. Tai leido patikslinti netvarios situacijos – burbulo, apibrėžimą: *burbulas yra eksponentiškai augantis kainos didėjimo procesas, kai pradinis kainos padidėjimas įvyksta dėl reikšmingai sumažėjusios kapitalo nišos ir dėl to smarkiai išaugusios investicijos vidinės gražos normos. Tai sukuria tolesnio nenutrūkstančio pajamų augimo lūkesčius ir papildomai pritraukia naujus trumpalaikius investuotojus (spekulantus).*

Mokslinio darbo rezultatų skelbimas. Mokslinio darbo rezultatai paskelbti dešimtyje mokslinių publikacijų, iš kurių aštuonios yra Lietuvos Mokslo Tarybos daktaro disertacijai ginti pripažįstamuose leidiniuose:

1. DUBNIKOVAS M., MOSKALIOVA V., GIRDZIJAUSKAS S. (2009). Analysis of the Share Price Bubbles in the Baltic Countries. *Business Information Systems Workshops BIS 2009 International Workshops. Poznan, Poland, April 27—29, 2009. Lecture Notes in Business Information Processing. Vol. 37, p. 119—129. ISBN 978-3-642-03423-7 (Print), 978-3-642-03424-4 (Online).*
2. GIRDZIJAUSKAS S., ŠTREIMIKIENĖ D., ČEPINSKIS J., MOSKALIOVA V., JURKONYTĖ E., MACKEVIČIUS R. (2009). Formation of Economic Bubbles: Causes and Possible Preventions. *Technological and Economic Development of Economy. Vol. 15 (2), p. 267—280. ISSN 1392-8619 (Print), ISSN 1822-3613 (Online).*
3. 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 technologines: 20th EURO Mini conference (EurOPT—2008), May 20—23, 2008, Neringa, Lithuania. P. 131—136. ISBN 978-9955-28-283-9.*

4. MOSKALIOVA V., GIRDZIJAUSKAS S. (2006). The risk of investment: determinate models. *Databases and information systems: seventh international Baltic conference, Baltic DB&IS 2006, Vilnius, July 3—6*. P. 91—100. ISBN 9986-19-920-4.
5. GIRDZIJAUSKAS S., MOSKALIOVA V. (2005). Instability modeling of financial pyramids. *Environment. Technology. Resources: proceedings of the 5th international scientific and practical conference, June 16—18, 2005, Rezekne*. P. 26—32. ISBN 9984-779-06-8.

Straipsniai kituose recenzuojamuose periodiniuose ar tęstiniuose tarptautiniuose ar užsienio leidiniuose:

1. MOSKALIOVA V., GIRDZIJAUSKAS S. (2005). Finansinių piramidžių stabilumo modeliavimas. *Informacijos mokslai*. T. 35, p. 158—169. ISSN 1392-0561.
2. GIRDZIJAUSKAS S., MOSKALIOVA V. (2003). Finansinių piramidžių modeliai. *Ekonomika: mokslo darbai*. T. 64, p. 37—48. ISSN 1392-1258.
3. GIRDZIJAUSKAS S., MOSKALIOVA V. (2003). Virtualių finansinių piramidžių nestabilumo modeliavimas. *Informacijos mokslai: mokslo darbai*. T. 27, p. 105—114. ISSN 1392-0561.

CURRICULUM VITAE

PERSONAL DATA

Name: Vera Moskaliova

Date and place of birth: September 17, 1973, Kaunas, Lithuania

E-mail: vera.moskaliova@vukhf.lt

INSTITUTION

Vilnius University Kaunas Faculty of Humanities

Department of Informatics

Muitines str. 8, LT-44280, Kaunas, Lithuania

Tel.: (+370 37) 422 566

Education background

- 2004—2008 Doctoral studies at the Department of Informatics, Kaunas Faculty of Humanities, Vilnius University, Kaunas, Lithuania.
- 1995—1997 Master of Business Administration and Management, Vilnius University, Kaunas Faculty of Humanities, Kaunas, Lithuania.
- 1991—1995 Bachelor degree in Computerised Document Systems, Vilnius University, Kaunas Faculty of Humanities, Kaunas, Lithuania.

Professional experience

- 1995— now Lecturer , assistant at Department of Informatics, Kaunas Faculty of Humanities, Vilnius University, Kaunas, Lithuania.
- 1997—1998, Lecturer at Kolping College, Kaunas, Lithuania.
2000

International courses

- 2007 PhD course at Brandenburg University of Technology, Cottbus, Germany. ERASMUS academic exchange program.
(May—
August)