

**VILNIUS UNIVERSITY**

Miroslav Švabovič

**MODELLING OF STATE ECONOMIC POLICY DECISIONS DURING  
CRISIS**

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

Vilnius, 2016

This doctoral dissertation was prepared at Vilnius University in 2012 – 2016

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The dissertation will be defended at the public meeting of the scientific council in the field of Economics on 16 September 2016 at 2 pm in auditorium 403 at the Faculty of Economics, Vilnius University.

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The summary of the dissertation was distributed on 15 August 2016.

The dissertation is available at the library of Vilnius University and in Vilnius University website: [www.vu.lt/lt/naujienos/ivykiu-kalendorius](http://www.vu.lt/lt/naujienos/ivykiu-kalendorius).

**VILNIAUS UNIVERSITETAS**

Miroslav Švabovič

**VALSTYBĖS EKONOMINĖS POLITIKOS SPRENDIMŲ KRIZĖS  
SĄLYGOMIS MODELIAVIMAS**

Daktaro disertacija  
Socialiniai mokslai, ekonomika (04 S)

Vilnius, 2016

Disertacija rengta 2012 – 2016 m. Vilniaus universitete, Ekonomikos fakultete, Ekonominės politikos katedroje.

**Mokslinis vadovas** - prof. dr. Algirdas Miškinis (Vilniaus universitetas, socialiniai mokslai, ekonomika - 04 S)

**Disertacija ginama Vilniaus universiteto Ekonomikos mokslo krypties taryboje:**

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Disertacija bus ginama 2016 m. rugsėjo 16 d. 14 val. viešame ekonomikos krypties posėdyje, kuris įvyks Vilniaus universitete, Ekonomikos fakultete (Saulėtekio al.9- 403 a., II rūmai, Vilnius).

Daktaro disertacijos santrauka išsiuntinėta 2016 m. rugpjūčio 15 d.

Su disertacija galima susipažinti Vilniaus universiteto bibliotekoje ir VU interneto svetainėje adresu: [www.vu.lt/lt/naujienos/ivykiu-kalendorius](http://www.vu.lt/lt/naujienos/ivykiu-kalendorius).

## **GENERAL CHARACTERISIC OF THE DISSERTATION**

### **Relevance of the topic**

A few years ago, the world faced 2008-2010 economic crisis, the negative consequences of which affected the economic conjuncture of the most countries. The origination of the crisis was conditioned by rapid economic growth, and sharp burst of the so-called bubble of consumption and expectations. The effect of economic crisis on the most countries was different – one states needed significant financial support, while the others managed to overcome the crisis with appropriate economic policy decisions.

Unfortunately, Lithuania, as many other countries, failed to avoid economic crisis, however, according to the government assessment and assessments of foreign economists (Fonteye, 2010; Frankel, Vegh, Vuletin, 2011; Jickling, 2010, etc.), our country was quite successful in coping with crisis consequences and managed the change of macroeconomic indicators. Other economists (Beležentis, Vijeikis, 2010; Gylys, 2009; Jakeliūnas, 2010; Keršiulytė, 2013; Kulvelytė, 2011; Kuodis, 2011; Kuokštis, 2011; Maksvytienė, Dapkus, 2012; Medaiskytė, 2009; Mishkin, 2011; Proškutė, 2012, etc.) argue that resistance to the influence of crisis was not so smooth, and it led to a series of wrong political decisions and application of the anti-crisis measures, conflicting with the economic theory.

Thus, since crisis discussions of different economic views have been taking place, and it is failed to agree on, therefore, the problem remains unsolved. Complex empirical research, carried out, following the example of the Baltic and other countries, show that economic crisis affects economic condition of the countries differently. It is influenced by a number of factors, including uneven development of the state and the rise of globalization, different economic policy decisions before crisis and during crisis, different government models, different macroeconomic and geographic position, number of residents and other significant factors. It once again confirms that nowadays it is needed to model the application of economic policy measures, seeking to apply the reasonable anti-crisis measures of economic policy in the future. The results of this paper could be useful for civil servants, economists, students of economic field, in order to objectively assess the economic situation during crisis in Lithuania

and other countries, and to propose viable scenarios for modelling the economic policy measures.

### **Problem of the research**

According to Ahrend, Cournède, Price, 2008; Alesina, Campante, Tabellini, 2008; Allen, Gale, 2007; Atesoglu, Emerson, 2008; Bachmann, Jinjui, 2013; Barrell, Holland, 2010; Beležentis, Vijeikis, 2010; Benetrix, Lane, 2011; Bratčikovienė, 2014; Castro, 2010; Cicek, Elgin, 2010; Forni, Monteforte, Sessa, 2009; Galinienė, Melnikas, Miškinis, 2011; Gylys, 2009; Harvey, 2010; Hennessey, Chairman, 2010; Isaac, 2008 etc., during crisis, it is appropriate to apply expansionary fiscal and expansionary monetary policy measures, in order to stimulate the economic system to move to the recovery phase as soon as possible. However, today, there is a lack of explanations and recommendations on what exactly to do differently, seeking to mitigate the negative consequences of economic crisis. These researchers usually follow the common opinion that economic crisis of 2008-2010 is the basis for not only qualitative, but also quantitative research, for identification of problems and solutions for the future.

While analysing the scientific literature, the author of this paper failed to find detailed and comprehensive economic analysis methods to be followed for research of the problem. The authors of foreign scientific literature rarely analyse the problems of economic crisis of 2008-2010 in Lithuania, while the scientific literature of Lithuanian authors focuses on qualitative analysis. It led to the fact that the author of this paper lacked unanimous conclusions in scientific literature, therefore, the concept of research, carried out in this paper included inductive and deductive laws, making certain assumptions and validating them by empirical modelling research, carried out in this paper.

Current scientific literature (Karazijienė, 2011; Keršiulytė, 2013; Kuodis, 2011; Maksvytienė, Dapkus, 2012; Mishkin, 2011; Rėklaitis, 2009; Sanz, 2011; Sinevičienė, Vasiliauskaitė, 2010; Tamašauskienė, Žadvidaitė, 2011; Šidlauskienė, Šeputienė, 2008; Šiurkutė, Jakaitienė, 2009; Woo, 2009, etc.) usually applies regression analysis and single statistical studies, e.g., determination of elasticity of fiscal policy measures for economic indicators, for research of effect of economic crisis on Lithuanian economy. However, according to the author of this paper, it is only certain excerpts of quantitative research, with

the help of which specific trends are fragmentary observed, however, they do not provide the possibility to assess economic situation and anti-crisis measures of economic policy in a complex manner. Thus, seeking to implement the crisis prevention purposefully, the economic policy decision must include more effective economic analysis modelling instrument.

### **Object of the research**

Object of the research – analysis and modelling of anti-crisis measures of the state economic policy.

### **Aim of the research**

Aim of the research – to carry out a complex research of the possibilities to improve the state economic policy decisions in response to the challenges of economic crisis and to develop the modelling measures for these decisions, which would be adequate to the modern needs.

### **Tasks of the research**

The following tasks are set to achieve the aim of the research:

1. To analyse the state economic policy measures during crisis, seeking to implement effective crisis prevention in the future.
2. To analyse the modelling of efficiency of the state fiscal and monetary policies in response to crisis threats.
3. To perform IS-LM modelling of application of economic policy during crisis, following the example of Lithuania, and propose preventive measures for the future crisis.
4. To perform a complex analysis of economic policy decisions, following the example of Lithuania, Latvia, Estonia, and other countries.
5. To carry out complex quantitative research of the government budget revenue, deficit and debt of Lithuania, and propose promising solutions for future crisis prevention.

6. To develop a viable modelling system for the main state tax rates, designed for the state economic policy decisions for future crisis prevention.

### **Defended statements**

- Anti-crisis decisions of economic policy of Lithuania during crisis were not sufficiently effective.
- During economic crisis, it is appropriate to apply the expansionary economic policy measures – the research revealed that more appropriate anti-crisis decisions are required in the future.
- The proposed complex quantitative research of dependencies between government budget revenue, deficit, and debt of Lithuania can be useful for the future crisis prevention.
- The proposed modelling system for the main state tax rates can be useful for fiscal policy decisions for the future crisis prevention.

### **Scientific novelty**

The author of this paper failed to find detailed and comprehensive economic analysis methods to be followed for research of the problem, therefore, he developed and hereby proposes the viable modelling system for the main state tax rates, designed for economic policy decisions for the future crisis prevention. By using this modelling, it is possible to analyse in a quantitative manner and find out the effective values of the main tax rates, seeking for certain government budget revenue and, thus, planning and developing the effective anti-crisis measure of the state economic policy.

### **Theoretical significance of the research results**

The dissertation thesis presents a systematic analysis of anti-crisis measures of economic policy, given in Lithuanian and foreign scientific literature, which highlights essential differences between application of contractionary and expansionary economic policy measures during crisis by taking into account conceptual application of economic theory



models in practice. Following the methods of economic theory and economic analysis modelling, the viable modelling system for the main state tax rates was developed, which may be further developed by scientists and economists, researching efficiency of application of anti-crisis measures of economic policy in practice.

### **Practical significance of the research results**

The dissertation presents a systematic analysis of application of anti-crisis measures of economic policy of Lithuania, Latvia, Estonia, and other countries, and IS-LM projections models of application of economic policy during crisis are developed, following the example of Lithuania, providing the possibility to reflect the influence of economic policy measures on economic processes better, and to practically assess the efficiency of fiscal and monetary policy application during crisis, and to improve the accuracy and sustainability of the prepared forecasts. The results of the research, described in the dissertation, can be used for complex assessment of Lithuanian economic policy measures during crisis and for making short-term and long-term forecasts, while modelling different economic situations.

The author of this paper, following the RMSM.X quantitative modelling method, developed by the World Bank, and modern models for response to crisis prevention, and seeking to complement the practical significance of anti-crisis decisions of economic policy, developed the modelling system for the main state tax rates, which could be used for economic scenario modelling, determining variation values of optimum tax rates. While applying this modelling system in practice, it is possible to calculate the value added tax, corporate tax and personal income tax rates of maximum likelihood, seeking to collect the fixed amount of revenue to the state budget. This methodology gives the possibility to assess the influence of application of fiscal policy measures on the government budget, to reflect the economic processes better, and to make exact long-term and short-term forecasts. Application of this modelling system in practice can be broader, including more indicators and quantitative research methods.

Theoretical and practical significance of the dissertation is relevant for economic policy makers, specialists of the government and central bank, responsible for anti-crisis measures of fiscal and monetary policy, and researchers and economists, analysing application of economic policy decisions during crisis. The results of this research can be applied for

modelling the current economic situations and provide some viable decisions for the future crisis prevention.

### **Organization and methodology of the research**

While analysing the economic policy measures of the period of 2008-2010, the following methods were used: analysis of relevant literature of Lithuanian and foreign researchers (Allen, Carletti, 2009; Bachmann, Jinjui, 2013; Barrell, Holland, 2010; Benetrix, Lane, 2011; Brazinskas, 2010; Castro, 2010; Di Mauro, Dees, McKibbin, 2009; Fatima, 2011; Girdzijauskas, Mackevičius, 2009; Harvey, 2010; Krugman, 2008; Kotz, 2009; Kuokštis, 2011; Liesionis, Račkauskas, 2012; Misses, 2009; Maksvytienė, Dapkus, 2012; Melnikas, 2011; Miškinis, Augustauskas, 2011; Nowak, 2013; Proškutė, 2012, etc.), information and data collection, comparison, grouping, descriptive research, selection of theoretical models, selection of statistical methods of mathematical analysis, according to Čekanavičius, 2011; Valkauskas, 2006; Kėdaitis, 2009; Kvedaras, 2005; Bagdonas, Skvernys, 2006; Frankel, Vegh, 2011; Harvey, 2010, etc., graphical, logical inductive and deductive analysis, and other methods.

While carrying out quantitative research, the following methods were used: regression analysis, verification of eligibility of the obtained data, analysis of determination coefficient, Durbin-Watson statistical analysis, autocorrelation analysis, p value analysis, Fisher's statistical analysis, verification of null hypothesis, analysis of standard deviations, analysis of correlation strength, factor analysis, standard deviation and time series modelling, Spearman correlation matrix formation, compilation of various statistical models, analysis of models on the basis of information criteria, development of quantitative model of optimum tax rate variation, forecasting, etc. The following software was used: Statgraphics Centurion, Gretl, IBM SPSS, and EViews.

### **Scope and structure of the paper**

The paper consists of summary, introduction 4 chapters, conclusions and recommendations, 206 references. The volume is 193 pages. There are 46 figures, 14 tables, 20 appendices, 2 footnotes in the paper.

The logical structure of the dissertation is showed in Fig. 1.

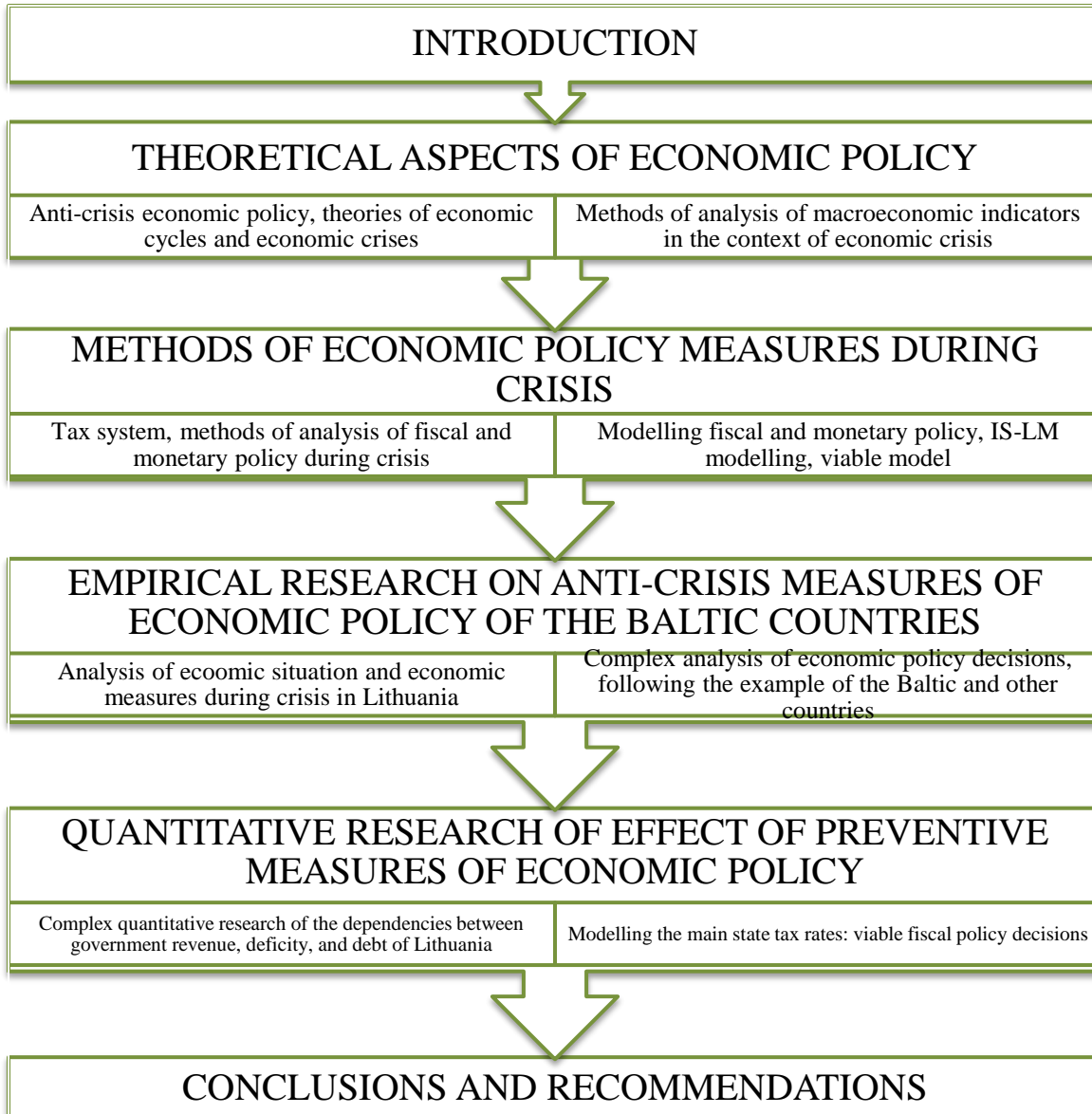


Fig. 1. Logical structure of the dissertation

## SUMMARY

**First chapter** of the dissertation analyses theoretical aspects of the state economic policy. The aim is to research the modern views towards economic crisis and response for crisis prevention.

**Section 1.1** of the dissertation analyses theoretical and practical significance of the state economic policy. It was found out that the state must have a long-term social and economic development strategy, which would reflect the state vision, mission, strategic goals, priorities, tasks, their implementation stages, action directions, and measures (Poviliūnas, 2003). The impact of each of these policies and its efficiency is exact, can be measured quantitatively, therefore, while applying any regulating measure, the government must predict how and when it will start to operate and what will the consequences be (Rėklaitis, 2009).

Assume that the aims are formed and measurable, and the target function consists of the following:  $k$  – elements,  $s$  – economic policy measures,  $n$  – market factors, uncontrolled by the government. The function can be expressed in terms of production volume, i.e., gross domestic product (GDP) or obtained revenue, and marked as  $Y$ . Then, any aim  $Y_i$  (when  $i=1, \dots, k$ ) is the function of many political measures  $x_1, \dots, x_s$  and market variables  $z_1, \dots, z_n$  (Lakštutienė, 2008):

$$Y_i = f(x_1, \dots, x_s; z_1, \dots, z_n) \quad (1)$$

Where:  $Y$  – gross domestic product.

Efficiency of impact of political measures  $x_j$  ( $j=1, \dots, s$ ) on the aim  $Y_i$  is shown by multiplier  $m_{ij}$ :

$$m_{ij} = \frac{\Delta Y_i}{\Delta x_j} \quad (2)$$

Where:  $\Delta Y_i$  – change in gross domestic product;

$\Delta x_j$  – change in variable of some operating economic policy.

$m_{ij}$  – multiplier, coefficient, showing dependency of one resulting variable on the impact of another variable.

**Section 1.2** of the dissertation analyses the modern views towards economic crisis and response for crisis prevention. The researchers (Rakauskienė, 2006; Jickling, 2010; Kydland, 1991) argue that logical models of crisis formation, causes must be analysed, similarities and differences must be found. For example, the mechanism of origination of crisis 2008-2010 was clearly researched and characterized by the following aspects (Ahrend, Cournède, Price, 2008; Allen, Carletti, 2009; Barrell, Holland, 2010, etc.): trust in unstoppable growth of assets price, reinvestment, asset price destabilization, decline and losses. If losses were incurred by individual investors, it would not be significantly felt by other economic entities, however, losses over reinvestment are usually incurred by the entire national economy and the economy of countries with close economic ties. All this leads to the necessity of response of the governments of individual countries, and coordinated international prevention.

Thus, there are certain methods for analysis and forecast of financial crises. For example, the economist Babecky (2012) suggests using IRCCOI to define the real costs of financial crisis. Using this index, it is possible to analyse the real costs within two years after crisis occurrence or to forecast the potential costs.

Another one preventive crisis assessment method is the exchange market EMP index (Bucevska, 2011), calculated as a weighted average of the percentage change in the nominal foreign exchange rate of the currency of country against the Euro, percentage change in the nominal gross foreign exchange reserves expressed in Euro and the interest rate differential between the nominal short-term interest rates of specific country (Bucevska selected Croatia, Macedonia, and Turkey).

One more preventive crisis assessment method is the model of forecasting financial stress, proposed by the economists Slingenberg and Haan (2011), based on Financial Stress Index, consisting of changes in stock prices, spread of corporate bonds, difference of interbank loan interest and short-term state debt interest, bank sector dividend yield trend index, and change in exchange rate.

Thus, following the modern view towards economic crisis and response for crisis prevention, the researchers (Babecky, 2012; Bucevska, 2011; Slingenberg ir Haan, 2011; Kotz, 2009; McCraw, 2006; Mishkin, 2010; Miškinis, Augustauskas, 2011; Russo, 2009, etc.) emphasize the following factors, required for financial stability: 1) stable macroeconomic

situation, 2) effective state economic policy, 3) effective tax system, 4) effective interest rate regulation.

**Section 1.3** of the dissertation researches the views towards prevention of economic crises, based on economic cycle theories. Gali (2003), Held, McGrew, Goldblat (2002), Kindsfaterienė, Lukoševičius (2008), Liudvig von Mises (2009) and others agree on that the key macroeconomic indicators, closely related with fluctuations of economic cycles, are the following: GDP, government debt, unemployment level, inflation pace, personal income, interest rate, corporate profit, investments. These indicators are followed by economists, governmental, and economic organizations.

Frequency of economic cycles can be assessed from the start and end point of certain cycle, for example: from the lowest to maximum point, middle point between extremes or inflection point.

If in point  $x_0$ , the first derivative of function  $f(x)$  is  $f'(x) = 0$ , and its second derivative  $f''(x_0)$  in the environment of this point is continuous and  $f''(x_0) \neq 0$ , it means that there is minimum in that point, when  $f''(x_0) < 0$ , and maximum, when  $f''(x_0) > 0$ . There is a middle point between two extremes.

If  $f''(x_0) = 0$  or  $f''(x_0)$  does not exist, and  $f''(x)$  changes its sign, passing through point  $x_0$ , then  $x_0$  is called the inflection point. The slope of the inflection point in the point  $x_0$  is equal to the function  $f'(x_0)$ . Measurement formula for curvature of extremes (Karazijienė, 2009):

$$K = \frac{1}{R} \quad (3)$$

Where:  $R$  – the radius of the circle, calculated, according to the following formula:

$$R = \frac{\left[ 1 + \left( \frac{dy}{dx} \right)^2 \right]^{\frac{3}{2}}}{\left| \frac{d^2y}{dx^2} \right|} \quad (4)$$

Time series and various autoregression methods are usually used for mathematical analysis of cause and effect model. For example, random walk process  $Y_t$ :

$$Y_t = Y_{t+1} + \varepsilon_t, \varepsilon_t \sim WN(0, \sigma_\varepsilon^2) \quad (5)$$

Where:  $\sigma_\varepsilon^2$  is constant.

$\varepsilon_t$  - white noise, marked  $\varepsilon_t \sim WN$ .

The required characteristics of white noise, according to which it is considered as stationary process:

- Average  $\mu_\varepsilon = E(\varepsilon_t) = 0$ ;
- Dispersion  $\gamma_0 = E(\varepsilon_t^2) = \sigma_\varepsilon^2$ ;
- Covariance coefficient  $\gamma_k = 0$ .

If time series has rising or descending direction, called trend, which is likely to continue in the future, this model must include the constant, not equal to zero (random walk with drift). This process is called random walk with drift. It is individual case of autoregressive integrated moving average ARIMA, i.e., ARIMA (0,1,0) with constant of 1 (Karazijienė, Sabonienė, 2008).

Multiple vector autoregression VAR model is evidenced by effective link between various variables. Here, more information with decreased number of assumptions is used. The process  $Y_t$  is equal to (Kindsfaterienė, Lukaševičius, 2008):

$$Y_t = c + \sum_{i=1}^p AY_{t-i} + \varepsilon_t, \varepsilon_t \sim WN(0, \sum \varepsilon), p > 0 \quad (6)$$

Where: VAR  $p$  row vector autoregression;

$Y_t$ ,  $c$  and  $\varepsilon_t$  are vectors of  $n$  dimension endogenous variables, constants and white noise errors, respectively;

$\sum \varepsilon$  and  $A_i$ ,  $i = 1, \dots, p$ , are quadratic matrix of  $n \times n$  dimension covariance and parameters.

$p$  – autoregression row

All variables are described as linear regression functions of lags of their own and other system variables (Kvedaras, 2005).

Often, besides the variables  $Y_t$ , which are considered endogenous, the modelling includes exogenous variables  $X_t$ , resulting in VARX( $p,q$ ) model (Karazijienė, 2011):

$$Y_t = c + \sum_{i=1}^p AY_{t-i} + \sum_{j=0}^q BX_{t-i} + \varepsilon_t \quad (7)$$

The developed model was adequate, if the errors are eliminated as white noise. These methods are applicable for simulation or experimental modelling, i.e., for research of response to the variable impulses, where it is examined, how the values of VAR and RMSE variables change after certain impulses are included in the system (Kvedaras, 2005).

**The second chapter** of the dissertation analyses the state economic policy measures and their application during crisis.

**Section 2.1 and 2.2.** of the dissertation examines analysis of the state economic policy decisions and modelling measures, applicable in response to economic crisis threats and the need to eliminate its consequences. Dependence of general tax revenue on tax rate is shown by Laffer curve. The government, setting high tax rates, may gain lower revenue than in case of low tax rates. High tax rate will lead to the higher tax revenue, if the national product remains the same. However, the national product is dynamic and may decrease, if high taxes have negative impact on economic activity. What is more, as taxes are high, it is attempted to avoid them illegally – to hide a part of income, thus, increasing black economy (Weale, 2009).

Considering the possible impact of fiscal policy on economic system during crisis, expansionary fiscal policy measure should be selected for implementation of the following functions: increase of the government expenditure, decrease of taxes or increase of transfer payments, or combination of both measures.

Another important state economic policy measure is monetary policy or money policy, which affects the country's economy and is applied as preventive measure for economic crisis. Bendorienė (2005) defines monetary policy as the entirety of the measures and actions, prepared and realized by the central bank, whereby it is sought to implement the economic aims in the way of regulating money amount and interest rate. The actions of monetary policy in economy are practically felt only after certain period, since monetary policy implementation takes long time (Svensson, 2004).

**Section 2.3** of the dissertation develops a viable theoretical model for the state economic policy decisions during crisis. As this paper established, economic crisis prevention models in the modern methodology are different, involving different quantitative analysis methods, such as: IRCCOI index is applied for defining the crisis costs, EMP method is applied to



currency market crisis, Slingenberg and Haan's method is applied to financial stress prediction, and VAR and RMSE methods are widely used in time series analysis in the context of economic cycles. At the same time, these empirical models employ different quantitative methods and instrumentation of different economic indicators and the objectives pursued. The purpose of these models is analysis of certain macroeconomic areas that can be treated in a fragmented manner. Therefore, the author of this paper was faced with the problem that the modern methodology does not present any modelling measures for the state economic decisions, which could be used for research of fiscal policy efficiency during economic crisis. Looking deeper, quantitative analysis methods for determination of efficiency of the main tax rates are missing, and they would be an important crisis prevention measure of the state economic policy.

However, the author of this paper found the RMSM.X (Revised minimum standard model extended), developed by the World Bank, which is in part close to this research. The aforementioned model is applied in the central banks (as well as in the central bank of Lithuania), Ministries of Economy and Finances, as well as in statistics agencies (Nowak, 2013; Ranaweera, 2012; Karazijienė, 2009, etc.). Although it is not the main measure of empirical analysis for statistical forecasting because of the small sample of statistical indicators, the usage of this model provides the possibility to research the mutual dependencies of macroeconomic indicators, to analyse the influence of economic policy measures on the state budget, and to examine the influence of changes in individual economic sectors on the values of indicators of all other sectors. RMSM.X model includes the following main parts: the government finance, national accounts, taxes paid, direct investments, price indices, other economic indicators. For example, the structure of long-term equilibrium of the model is generalized by the equations with regression and autoregression components:

$$\Delta \log(Y(t)) = \beta \cdot \Delta \log(f(X_1(t), X_2(t))) - \gamma(\log(Y(t-1)) - \log(f(X_1(t-1), X_2(t-1)))) + \varepsilon \quad (8)$$

Where: Y – dependent variable;

X<sub>1</sub>, X<sub>2</sub> – independent variables;

α and β – considered parameters.

RMSM.X model system can be formed as the system of regression, trend, seasonal fluctuations, or autoregression analysis, for example:

$$Y_t = a_0 + \sum_{k=1}^K \sum_{l=0,1,4} a_{kl} \cdot X_k(t-l) + b_1 \cdot t + b_2 \cdot \frac{1}{t} + \sum_{s=1}^3 c_s \cdot S_s(t) + \sum_{j=1,4} d_j \cdot Y(t-j) + \varepsilon(t) \quad (9)$$

Where:  $S_1(t)$ ,  $S_2(t)$ ,  $S_3(t)$  – season identification variables.

This results in the fact that the equations of the RMSM.X model are grouped into a number of blocks, thus, the block structure of models may differ, however, most of them, e.g., Estonian “HERMIN HE4”, New Zealand “NBNZ-DEMONZ”, Finland “BOF3” and “BOF5”, Korean central bank “BOK97” etc., identifies the block of government finances, which allows modelling the main revenue and expenditure flows of this sector (Forni, Monteforte, Sessa, 2009).

The author of this paper, seeking to determine the effective rates of the main taxes, in order to collect the corresponding government budget revenue, thus, developing the preventive measure of fiscal policy for crisis, recommends to apply another quantitative modelling system. Upon analysing different methods of economic analysis of tax modelling, given in scientific literature (Bachmann, Jinjui, 2013; Bagdonas, Skvernys, 2006; Benetrix, Lane, 2011; Charemza, Makarova, Parkhomenko, 2002; Čekanavičius, 2011; Kraev, Akolgo, 2005; Kvedaras, 2005; Kėdaitis, 2009; Martišius, 1992, etc.), the author selected standard deviation modelling as the basic method of empirical research. This selection was caused by the fact that the instrumentation of this methodology is widely applied, popular, specifies clear results, and is often applied for experimental research.

Thus, by using this method and following the example of Lithuania, it is planned to determine the optimal personal income tax (hereinafter – PIT), value added tax (hereinafter – VAT) and corporate tax (hereinafter – CT) rates, in order to collect the required tax revenue to the state budget, in order there is no deficit. According to the researchers (Allen, Carletti, 2009; Atesoglu, Emerson, 2008; Barrell, Holland, 2010; Benetrix, Lane, 2011; Cicek, Elgin, 2010, Galinienė, Melnikas, Miškinis, 2011, etc.), the state budget without deficit during crisis would provide the possibility to make more effective economic policy decisions and mitigate the negative consequences of crisis. The methodology of the modelling system is given below.

Standard deviation statistically describes the “dispersion” of the random variable around the mean. Standard deviation in statistics has the following mathematical expression:

$$\sigma = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - x_{vid})^2} \quad (10)$$

Where: n – number of values;

$x_{vid}$  – average of these values.

For example, PIT, VAT and CT rates are directly measured numbers of particles or other independent random variables x, y, z with standard deviation of  $\sigma_x$ ,  $\sigma_y$ ,  $\sigma_z$ , while function of these values is (x, y, z), then, if the standard deviations of partial derivatives of this function are lower than the derivative modules, standard deviation of the random value  $\sigma_u$  will follow this equation:

$$\sigma_u^2 = \left(\frac{\partial u}{\partial x}\right)^2 \sigma_x^2 + \left(\frac{\partial u}{\partial y}\right)^2 \sigma_y^2 + \left(\frac{\partial u}{\partial z}\right)^2 \sigma_z^2 \quad (11)$$

When preparing interval measurements of parameter estimates, by modelling the number of observations accordingly, it will be possible to check the hypotheses of significance of parameter estimates. Confidence interval of parameters  $\beta_0$  and  $\beta_j$  is the set of values, which fit into the interval between the bottom and top critical values of checking hypotheses, and any parameter value, going into this interval, will be compatible with the calculated estimate value. Thus, interval estimates are calculated, according to the following formula:

$$\begin{aligned} \hat{\beta}_0 - t_{\alpha/2, n-k-1} SE_{b_0} \leq \beta_0 \leq \hat{\beta}_0 + t_{\alpha/2, n-k-1} SE_{b_0} \\ \hat{\beta}_j - t_{\alpha/2, n-k-1} SE_{b_j} \leq \beta_j \leq \hat{\beta}_j + t_{\alpha/2, n-k-1} SE_{b_j} \end{aligned} \quad (12)$$

Where: n – sample size (number of observations);

k – number of independent variables;

$\alpha$  – significance level, in practice, usually 95% confidence interval is sought, i.e., when  $\alpha = 0,05$ ;

$SE_{b_j}$  – standard deviations of parameter estimates;

$\beta_0$  and  $\beta_j$  – parameters;

$\hat{\beta}_0$  and  $\hat{\beta}_j$  – parameter estimates.

Then, the model significance with the help of null hypothesis  $H_0$  must be checked, model estimates by using p-values, t statistics and Durbin Watson statistics.

If the model is significant, determination coefficient  $R^2$  is determined, seeking to verify the adequacy of the model. Fisher's statistical criterion will be used for determination of significance of  $R^2$  coefficient, while calculating the ratio of the sum of squared systematic deviations to the sum of squared residual error deviations, and dividing the numerator value from the number of variables, and denominator value – from degrees of freedom:

$$F = \frac{\sum_{i=1}^n (\hat{Y}_i - \bar{Y})^2 / k}{\sum_{i=1}^n (Y_i - \hat{Y}_i)^2 / (n - k - 1)} = \frac{ESS/k}{RSS/(n - k - 1)} \quad (13)$$

In practice,  $R^2$  must be higher than 0,25 value. Otherwise, model is inappropriate. If model's  $R^2 > 0,25$ , the next step is to check multicollinearity.

Multicollinearity may occur as the problem of ongoing observations. Most of variables can be significantly related with each other, and this is one of the main causes of multicollinearity. The conclusion on presence or absence of multicollinearity can be obtained by using VIF. For this, multiple regression models  $X_j = f(X_1, X_2, \dots, X_{j-1}, X_{j+1}, X_k)$ , i.e., auxiliary regressions, are necessary:

$$\begin{aligned} X_{1i} &= \hat{\gamma}_0 + \hat{\gamma}_2 X_{2i} + \hat{\gamma}_3 X_{3i} + \hat{\gamma}_4 X_{4i} + u_i \rightarrow R^2 \\ X_{2i} &= \hat{\gamma}_0 + \hat{\gamma}_1 X_{1i} + \hat{\gamma}_3 X_{3i} + \hat{\gamma}_4 X_{4i} + u_i \rightarrow R^2 \\ X_{3i} &= \hat{\gamma}_0 + \hat{\gamma}_1 X_{1i} + \hat{\gamma}_2 X_{2i} + \hat{\gamma}_4 X_{4i} + u_i \rightarrow R^2 \\ X_{4i} &= \hat{\gamma}_0 + \hat{\gamma}_1 X_{1i} + \hat{\gamma}_2 X_{2i} + \hat{\gamma}_3 X_{3i} + u_i \rightarrow R^2 \end{aligned} \quad (14)$$

Later,  $R_j^2$  is calculated from each additional model by determining the dispersion decreasing j multiplier, according to the following formula:  $VIF_j = \frac{1}{1 - R_j^2}$ , where  $R_j^2$  is determination coefficient between  $X_j$  and the remaining independent variables.

Next, time series analysis takes place. In order to find the components of time series, spectral analysis is used. In other words, when stationary time series is present, it may be divided into infinite weighted sum of periodic orthogonal components. The spectrum is defined in the following way:

$$\text{Spectrum}_y(\omega) = \frac{1}{2\pi} \sum_{j=-\infty}^{\infty} y_j e^{-\omega j}, \quad -\pi \leq \omega \leq \pi \quad (15)$$

Where:  $i^2 = -1$ ;

$\omega$  – frequency in radians;

$y_j$  – autocovariance function of  $j$  delay of series  $\{y(t)\}$

The, the process  $\{z(\omega), -\pi \leq \omega \leq \pi\}$  exists, when

$$E \left[ (z(\omega) - z(-\pi))(z(\omega) - z(-\pi)) \right] = F_Y[\omega] = \int_{-\pi}^{\omega} \text{Spectrum}_y(\omega) d\omega, \quad -\pi \leq \omega \leq \pi$$

$$y(t) = \int_{-\pi}^{\pi} e^{i\omega t} dz(\omega) \quad (16)$$

can be divided into infinite weighted number of orthogonal oscillations with frequency of  $\omega$ .

Frequency analysis of integrated time series uses the following pseudospectrum:

$$S_y(\omega) = \frac{\sigma_\varepsilon^2}{2\pi |1 - e^{-i\omega}|^2}, \quad \omega \neq 0 \quad (17)$$

Peaks of spectrum function show the current components of the time series. The peak, when  $\omega = 0$ , will be related with trend component. The peaks in the interval  $\varepsilon_1, \varepsilon_2 > 0$  and  $\varepsilon_1 < \frac{\pi}{2} - \varepsilon_2$  will show where the considered time series has cyclical fluctuations in the period longer than a year. In this case, the methods of modelling the time series components, the trend component will be described by certain optimal deterministic function, for example: linear, long-transformed, exponential, polynomial, or other, the parameters of which will be assessed by the least square and maximum likelihood methods.

Maximum likelihood estimates are one of the most accurate, therefore, this method can be applied, when distribution of the random variable is known. For example, suppose that the random density function will be described by  $f(x)$ , when  $f \in \{f_0, \beta \in \Theta\}$ , then likelihood function will be described as  $L(\beta) = \prod_{j=1}^n f_0(X_j)$ . Maximum likelihood estimate of the unknown parameters  $\hat{\beta}$  will be the maximum point of the function  $L(\beta)$ , i.e.,  $\hat{\beta} = \arg_{\beta \in \Theta} \max L(\beta)$ . Seeking to assess the unknown parameters, the function  $L(\beta)$  will be  $\log l(\beta) = \ln L(\beta)$ . Since  $\beta = (\beta_1, \dots, \beta_n)^T$  will make  $n$  unknown parameters, the modelling will calculate the partial  $l(\beta)$  derivatives under  $\beta_1, \dots, \beta_n$ , equating to 0. The obtained result will be considered as the estimate of maximum likelihood. At the same time, if Gaussian distribution is found,

maximum likelihood estimate will correspond with the least square method estimate  $\hat{\beta} = B^{-1}XY^T$ . This modelling system will be used in fourth chapter for quantitative tax rate modelling.

**The third chapter** of the dissertation presents empirical research on effectiveness of anti-crisis measures of economic policy of Lithuania, Estonia, and other countries.

**Section 3.1** of the dissertation presents empirical analysis of economic situation of Lithuania during crisis. It was found out that the crisis of 2008-2010 had negative effect on all macroeconomic indicators, analysed in this paper (see Table 1).

Table 1. **Summary of changes in economic indicators of Lithuania during 2008-2010**

Indicator	2008	2009	2010
<b>GDP</b>	increased (+3%)	deep crisis (-17%)	stabilized (+16%)
<b>Government budget deficit</b>	deep crisis (+287%)	deep crisis (+193%)	stabilized (-24%)
<b>Government debt</b>	increased (+2%)	deep crisis (+64%)	deep crisis (+30%)
<b>Inflation</b>	crisis (+4%)	stabilized (-7%)	increased (+2%)
<b>Export</b>	increased (+28%)	deep crisis (-27%)	stabilized (+32%)
<b>Import</b>	increased (+18%)	deep crisis (-38%)	stabilized (+34%)
<b>Labour productivity</b>	crisis (-4%)	deep crisis (-8%)	stabilized (+20%)
<b>Unemployment level</b>	increased (+2%)	deep crisis (+8%)	deep crisis (+5%)
<b>Emigration</b>	decreased (-15%)	deep crisis (+59%)	deep crisis (+116%)
<b>Number of residents</b>	decreased (-1%)	crisis (-2%)	crisis (-3%)
<b>Bankruptcies of business</b>	crisis (+58%)	deep crisis (+93%)	decreased (-11%)
<b>Economic sentiment indicator</b>	deep crisis (-42%)	deep crisis (-36%)	crisis (-14%)
<b>Consumer confidence indicator</b>	deep crisis (-51%)	deep crisis (-50%)	crisis (-26%)

Source: compiled by author, according to the data of Statistics Lithuania

The data show that almost all indicators became worse, and the majority of them experienced a deep crisis. Some indicators became worse in 2009, other indicators deteriorated in 2010. It should be noted that as the crisis passed, some of the economic indicators have still been in the crisis situation, i.e., government debt, unemployment, emigration, decrease of population, economic sentiment indicator and consumer confidence indicator. In 2009, inflation rate significantly decreased, conditioned by fall of consumption and demand. Thus, the statistics show that the economic policy measures were ineffective, with the exception of anti-inflationary policies, as it was failed to stabilize almost all of the analysed indicators.

**Section 3.2** of the dissertation presents the empirical analysis of Lithuanian economic policy decisions during crisis. The main tax rates were actively changed during crisis in Lithuania.

In 2008, *personal income tax rate* was 27%, consisting of 24% personal income tax rate and 3% state social insurance contribution. As crisis entrenched, at the end of 2008, the Government of Lithuania decided to change the rates of components of this tax (“night reform”). On 1<sup>st</sup> of January, 2009, the personal income tax rate was divided into personal tax rate, equal to 15%, and compulsory health insurance tax, equal to 6%, as well as state social insurance contribution of 3%. Considering the change of tax in a complex manner, it might be argued that although PIT rate decreased, redistribution of tax forced all residents, including those without any income, to pay the health insurance tax of 6%. What is more, as personal income tax rate decreased down to 15%, while submitting annual tax returns, less funds are recovered. Furthermore, upon refusing the equal value of untaxable income, the tax burden on those, who earn slightly more than the average wage, increased.

Changes in *corporate tax rate* are presented in Table 2.

**Table 2. Changes in corporate tax rate during the period of 2001-2010**

Period	Tax rate, percentage
2001.01.01 – 2008.12.31	15
2009.01.01 – 2009.12.31	20
2010.01.01 – present	15

Source: compiled by author, according to the Law on Corporate Tax of Lithuania

Changes in *value added tax rate* are presented in Table 3.

**Table 3. Changes in value added tax rate during the period of 2002-2010**

Period	Tax rate, percentage
2002.01.01 – 2008.12.31	18
2009.01.01 – 2009.08.31	19
2009.09.01 – present	21

Source: compiled by author, according to the Law on Value Added Tax of Lithuania

The changes of the analysed taxes show that during the period of 2008-2010 the Government of Lithuania, redistributing the personal income tax rate and, thus, increasing the value added tax and corporate tax rate, and the main excise duties, implemented contractionary fiscal policy, what is in conflict with economic theory. Negative influence of crisis and these decisions of fiscal policy led to significant decrease of the collected taxes. Corporate tax decreased by 41,3% in 2009, in comparison with 2008. Although in 2010, corporate tax rate was restored to the 15% rate, it was collected 44,1% less than in 2009. This

change could have been conditioned by decreased profit, increased number of bankruptcies, transfer of business activity to foreign countries, etc., as business faced activity contraction, decreased number of employees, and needed to undertake radical steps, in order to avoid bankruptcy. Revenue from value added tax also decreased by 26,4% in 2009, in comparison with 2008. It leads to the fact that as unemployment, emigration, number of business bankruptcies increased during the period of 2009-2010, consumption decreased. It is evidenced by significantly decreased GDP, economic sentiment and consumer confidence indicators. Following the statistics of household consumption, it might be assumed that the major part of consumers reviewed their shopping bag and started saving more.

Other economic policy measure, monetary policy, is analysed further. While comparing the dynamics of EURIBOR and VILIBOR changes, it is possible to compare the monetary policy of the European Central Bank and the Bank of Lithuania (see Figure 2).

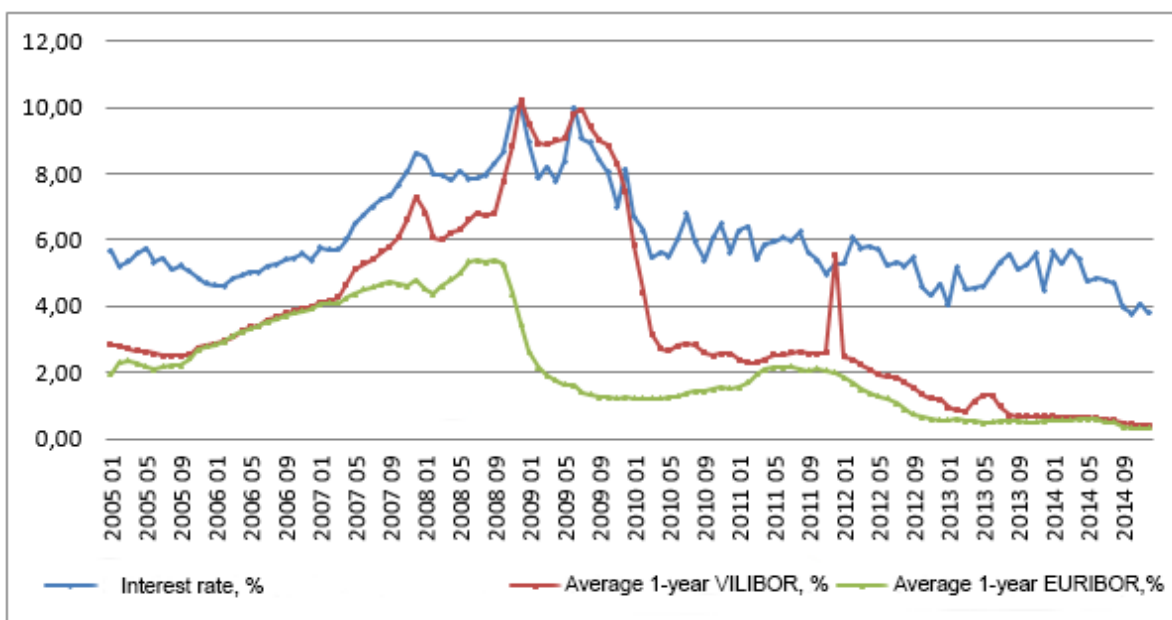


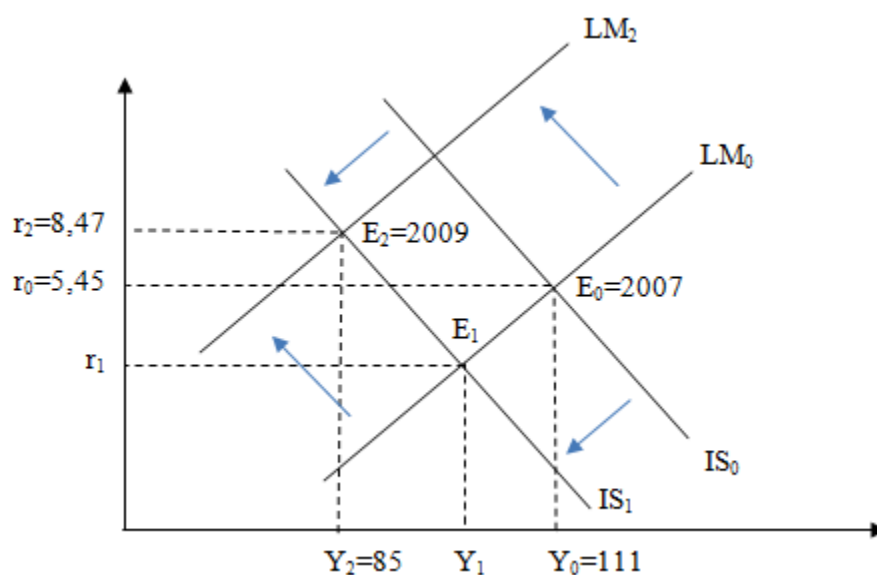
Fig. 2. Average 1-year EURIBOR and average 1-year VILIBOR interest rate, percent  
 Source: compiled by author, according to the data, published by the Bank of Lithuania

As it is demonstrated by the given data, VILIBOR and EURIBOR interest rates were almost identical in May of 2005-2007 and the gap between interbank interest rates started to increase during the next period. It was caused by constantly growing inflation in Lithuania in 2007. Then, contractionary monetary policy was started to be applied by insignificantly increasing VILIBOR interest rate. However, increase of VILIBOR by 0,4-0,5% did not stop inflation pace, and in 2007, inflation was equal to 8,1%, and in 2008, to 8,5%. As the state



decided to reduce inflation, according to the Maastricht criterion (inflation of no more than 1,5 percent above the average inflation rate of the three European Union (EU) member states with the most stable prices), VILIBOR interest rate was increased rapidly and significantly. In December, 2008, it reached even 10,08%. This VILIBOR growth practically eliminated all lending possibilities at the national currency litas. Thus, the Government of Lithuania implemented contractionary monetary policy, meanwhile the European Central Bank started applying expansionary monetary policy, and EURIBOR interest rate was decreased down to 2,14% in February, 2009.

The author of this paper modelled the effect of contractionary fiscal and contractionary monetary policy of Lithuania on GDP on the basis of IS-LM model projection (Figure 3).



**Fig. 3. Effect of contractionary fiscal and contractionary monetary policy of the Government of Lithuania during crisis on economy, IS-LM projection**

Source: compiled by author

Where:  $r$  – interest rate, percentage;

$Y$  – GDP;

IS – fiscal policy effect curve;

LM – monetary policy effect curve.

The real modelling of the state economic policy decisions shows once again that application of wrong economic policy measures may significantly deteriorate the economic conjuncture of the country, when from point  $E_0$  it is moved to point  $E_1$  and  $E_2$ .

**Section 3.3** of the dissertation presents a complex analysis of economic policy decisions, following the example of the Baltic and other countries. The changes in the main tax rates of Lithuania, Latvia, and Estonia are summarized in Table 4.

**Table 4. Comparison of fiscal policy of the Baltic countries during 2008-2009**

<b>Lithuania</b>		
<b>2008</b>	<b>2009</b>	<b>2009</b>
Tax base is changed	Tax base is changed	Tax base is changed
Increased up to 20%	Increased up to 20%	Increased up to 20%
Increased up to 19%	Increased up to 19%	Increased up to 19%
Increased up to 21%	Increased up to 21%	Increased up to 21%
<b>Latvia</b>		
Decreased down to 23%	Decreased down to 23%	Decreased down to 23%
-	-	-
Increased up to 21%	Increased up to 21%	Increased up to 21%
<b>Estonia</b>		
-	-	-
-	-	-
Increased up to 20%	Increased up to 20%	Increased up to 20%

Source: compiled by author, according to the data, published by European Commission, 2010

As data demonstrate, not only Lithuania implemented contractionary fiscal policy, Latvia and Estonia also selected this economic policy measure. There is a question of how Estonia succeeded to manage the crisis with contractionary fiscal policy, although economic theory states that it is necessary to implement expansionary fiscal policy. It was caused by the following reasons:

- Budget surplus before crisis;
- Proper management of government budget;
- Strict saving policy;
- Election of political institutions before crisis;
- High trust in political institutions;
- Benevolent payment of taxes by economic entities for the benefit of economy;
- Small black economy;
- Stable assessment of state risk;

- Cheap borrowing from the International Monetary Fund;
- Proper strategic aims.

Meanwhile, fiscal policy, applied by Lithuania and Latvia during economic crisis, was contractionary in all senses. Economic indicators of Latvia decreased during crisis almost at the same pace as economic indicators of Lithuania, thus, the situation of Lithuania and Latvia was very similar during crisis.

Other EU countries selected expansionary fiscal policy measures (see Table 5).

**Table 5. Comparison of fiscal policy of EU countries during crisis**

	<b>Change in tax rates</b>	<b>Change in tax bases</b>
<b>Value added tax</b>		
Increased	Czech Republic, Hungary, Slovakia, Estonia, Latvia, Lithuania	Estonia, Latvia
Decreased	Finland, United Kingdom	Belgium, Germany, Cyprus, France, Hungary, the Netherlands, Romania, Finland
<b>Personal income tax</b>		
Increased	France, Latvia	Denmark, Estonia, Hungary, Latvia, Lithuania
Decreased	Austria, Germany, Denmark, France, Finland, Latvia, Romania	Austria, Belgium, Bulgaria, Germany, Denmark, Finland, Hungary, Latvia, the Netherlands, Poland, Romania, Slovakia, Sweden
<b>Corporate tax</b>		
Increased	Lithuania	Belgium, Bulgaria, Hungary
Decreased	Czech Republic, Hungary, Sweden, Lithuania	Austria, Belgium, Germany, Cyprus, Lithuania, Netherlands, Poland, Romania, Sweden, Slovakia, United Kingdom
<b>Excite duties</b>		
Increased	Belgium, Denmark, Estonia, Hungary, Latvia, Lithuania, Romania, Finland	Denmark, Finland, Latvia
Decreased	Poland, Slovakia	Bulgaria

Source: compiled by author, according to the data, published by European Commission, 2010

As other EU countries implemented expansionary fiscal policy as anti-crisis measure, the following economic effects occurred:

- In 2009, negative change in GDP was lower than in the states with contractionary fiscal policy: Lithuania, Latvia, Estonia, Czech Republic, Slovenia, etc.;
- In 2010, positive change in GDP;
- In 2009 and in 2010, increase of ratio of budget revenue and GDP from negative 0,5% to positive 2% - impact of collected tax revenue;

- In 2009 and 2010, increase of ratio between government budget expenditures and GDP from 2% to 4,5% - government expenditure for economic promotion;
- decreased inflation, black economy, unemployment in many countries.

Thus, the practice of Germany, Great Britain, Poland, Finland, Sweden, the Netherlands, Belgium, Austria and other countries reaffirmed the hypothesis, assumptions and conclusions, stated in the previous chapters, that, as said by economic theory, during economic crisis, it necessary to strive for tax rate reduction, or at least to leave them without changing until the economy will move into the recovery phase of the cycle. Expansionary fiscal policy reduces the negative change in GDP, increases the ratio of budget revenues to GDP, reduces inflation, unemployment and black economy.

**Section 3.4** of the dissertation generalizes the effectiveness of Lithuanian economic policy decisions in response to crisis threat, concluding that the anti-crisis measures, implemented by the Government of Lithuania, were ineffective, and the most aims of “The Convergence Programme of Lithuania of 2008” and Maastricht criteria have not been achieved. This showed that Lithuania and other countries that are more vulnerable to crisis, seeking to implement the crisis prevention in a purposeful manner in the future, must apply more effective instrument of economic analysis modelling for economic policy decisions.

**The fourth chapter** of the dissertation presents quantitative research and modelling of anti-crisis measures of economic policy. While carrying out complex quantitative research on dependence of government revenue, deficit and debt of Lithuania, regression model was developed, where GDP of Lithuania was chosen as the resulting  $y$ , and the influencing indicators  $x$  - the following macroeconomic indicators: GDP, government debt, government budget deficit, government tax revenue, inflation, foreign direct investment, unemployment level, and emigration. It was found out that only some indicators significantly correlate with each other (see Table 6).

Table 6. **Matrix of correlation analysis**

	BVP	Skola	Deficitas	Pajamos	Infliacija	TUI	Nedarbas	Emigracija
BVP		-0.8667	-0.2242	0.9879	-0.4061	0.9879	0.1152	-0.2000
rank		(10)	(10)	(10)	(10)	(10)	(10)	(10)
p value		<b>0.0023</b>	<b>0.0015</b>	<b>0.0010</b>	0.2232	0.1830	0.7297	0.5485
Skola	-0.8667		0.4667	-0.8182	0.6727	-0.9030	-0.5273	-0.1758
rank	(10)		(10)	(10)	(10)	(10)	(10)	(10)
p value	<b>0.0023</b>		0.1615	<b>0.0141</b>	<b>0.0436</b>	<b>0.0067</b>	0.1137	0.5980
Deficitas	-0.2242	0.4667		-0.2121	0.1515	-0.2727	-0.8424	-0.3455
rank	(10)	(10)		(10)	(10)	(10)	(10)	(10)
p value	<b>0.0015</b>	0.1615		0.5245	0.6494	0.4133	<b>0.0115</b>	0.3000
Pajamos	0.9879	-0.8182	-0.2121		-0.3333	0.9636	0.0667	-0.2606
rank	(10)	(10)	(10)		(10)	(10)	(10)	(10)
p value	<b>0.0010</b>	<b>0.0141</b>	0.5245		0.3173	<b>0.0038</b>	0.8415	0.4343
Infliacija	-0.4061	0.6727	0.1515	-0.3333		-0.4545	-0.4182	-0.3697
rank	(10)	(10)	(10)	(10)		(10)	(10)	(10)
p value	0.2232	<b>0.0436</b>	0.6494	0.3173		0.1727	0.2096	0.2674
TUI	0.9879	-0.9030	-0.2727	0.9636	-0.4545		0.1879	-0.1152
rank	(10)	(10)	(10)	(10)	(10)		(10)	(10)
p value	0.1830	<b>0.0067</b>	0.4133	<b>0.0038</b>	0.1727		0.5730	0.7297
Nedarbas	0.1152	-0.5273	-0.8424	0.0667	-0.4182	0.1879		0.7333
rank	(10)	(10)	(10)	(10)	(10)	(10)		(10)
p value	0.7297	0.1137	<b>0.0115</b>	0.8415	0.2096	0.5730		<b>0.0278</b>
Emigracija	-0.2000	-0.1758	-0.3455	-0.2606	-0.3697	-0.1152	0.7333	
rank	(10)	(10)	(10)	(10)	(10)	(10)	(10)	
p value	0.5485	0.5980	0.3000	0.4343	0.2674	0.7297	<b>0.0278</b>	

Source: compiled by author

The research results revealed that the highest correlation with GDP is typical for government budget revenue, 0.0010, government budget deficit, 0.0015, and government debt, 0.023. The government revenue is more significant for economic promotion during crisis than the government deficit and debt. The next research presents the modelling of the main tax rates on the basis of modelling methodology, developed in the previous chapter.

In specific case, the author of this paper calculates the optimum PIT, VAT, CT rates of Lithuania, in order to collect the tax revenue of 12500 million Euros to the state budget within a year. This selection was caused by the fact that the government budget revenue used to grow each year it reached 11446,3 million Euros in 2008, however, there was a deep crisis in 2009, and the government revenue decreased down to 9638,0 million Euros, meanwhile the government expenditure was 12090,6 million Euros, resulting in the budget deficit of 2452,6 million Euros. Thus, if the budget revenue exceeded expenditure, there would not have been any budget deficit in 2009, and the government, balancing the government finances during crisis, could undertake expansionary fiscal policy measures and promote economic recovery within a short time, as it was done by Poland, Estonian, and other governments.

**Step 1: Define the response variables to be measured**

<i>Name</i>	<i>Units</i>	<i>Analyze</i>	<i>Goal</i>	<i>Target</i>	<i>Impact</i>	<i>Sensitivity</i>	<i>Low</i>	<i>High</i>
Government revenue	Mln. EUR	Mean	Hit target	12500.0	1.0	High	9600.0	13000.0
Government revenue (SD)	Mln. EUR	Std. deviation	Minimize		1.0	High	0.0	10.0

**Step 2: Define the experimental factors to be varied**

<i>Name</i>	<i>Units</i>	<i>Type</i>	<i>Role</i>	<i>Low</i>	<i>High</i>	<i>Levels</i>
A:VAT	percentage	Continuous	Controllable	15.0	24.0	
B:CT	percentage	Continuous	Controllable	10.0	25.0	
C:PIT	percentage	Continuous	Controllable	6.0	33.0	

Various tax rates within the interval from the lowest to the highest were used for calculations, for example: PIT=22,3(...), PIT=22,4(...), VAT=18,5(...), VAT=18,6(...), CT=16,3(...), CT=16,4(...), etc. Taking into account the set of factors, 27 runs per 1 block were set. In this case, it would be 27\*3 factors. Observations are made with random walk, i.e., as significant VAT=23,6(...) is found, optimal matches of CT and PIT will be looked for by variational method.

**Step 3: Select the experimental design**

<i>Type of</i>	<i>Design</i>	<i>Centerpoints</i>	<i>Centerpoint</i>	<i>Design is</i>	<i>Number of</i>	<i>Total</i>	<i>Total</i>	<i>Error</i>
<i>Factors</i>	<i>Type</i>	<i>Per Block</i>	<i>Placement</i>	<i>Randomized</i>	<i>Replicates</i>	<i>Runs</i>	<i>Blocks</i>	<i>D.F.</i>
Process	Multilevel factorial	0	Random	Yes	0	27	1	17

Number of samples per run: 30

Each observation generates 30 samples, thus, the set of factors will be 27\*3\*30=2070 units of VAT-CT-PIT combinations, i.e., VAT=18,3(...) with CT=12,4(...) and with PIT=16,9(...), etc. Seeking to obtain the most accurate research results, quadratic model was selected.

**Step 4: Specify the initial model to be fit to the experimental results**

<i>Factors</i>	<i>Model</i>	<i>Coefficients</i>	<i>Excluded effects</i>
Process	quadratic	10	

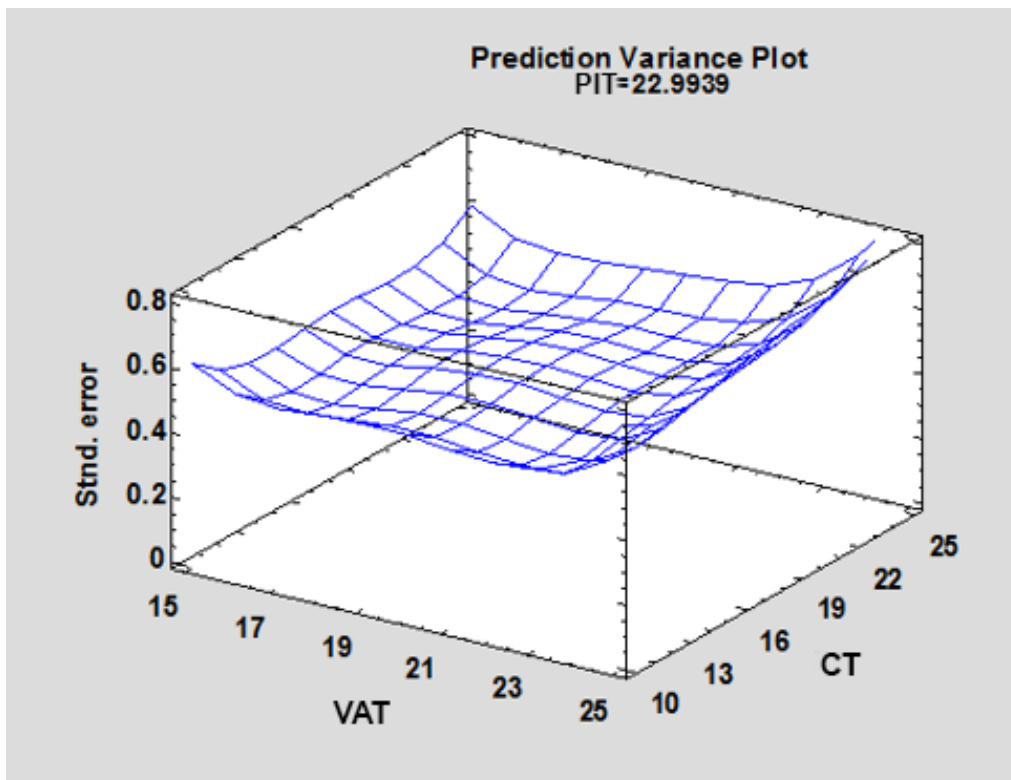
The fifth step of the research was experiments. Upon obtaining results, it was moved to the sixth step, i.e., model optimisation. Actually, it is the same as carrying out experimental research once more by eliminating the insignificant combinations of factors under the process  $\{z(\omega), -\pi \leq \omega \leq \pi\}$ .

**Step 7: Analyze the experimental results**

Model	Valstybes pajamos
Transformation	none
Model d.f.	6
P-value	0.0476
Error d.f.	3
Std. error	0.779
R-squared	94.15
Adj. R-squared	92.46

As the data of the specified research results show, no transformations took place. It means that the model was selected correctly. Model  $p$ -value is less than the acceptable limit of 0.05, it means that model data are correct. Three error coefficients and standard deviation coefficient are low. R squared  $R^2$  is equal to 94.15, and the adjusted  $R^2$  is 92.46. It means that the accuracy of the model results is near 100%. All  $VIF=0,827$ , thus this model is significant and quality.

The Figure 4 below shows the variance plot of VAT and CT factor data distribution, when  $PIT = 22.9939$ .



**Fig.4. Variance plot of VAT and CT factor data distribution, when  $PIT=22.9939$**

Source: compiled by author

The PIT rate, obtained during experimental research, is equal to 22,9939. It is assumed that it is the PIT rate, required for collecting the tax revenue of 12500 million Euros for the state budget. Other combinations of rates can be seen by interpreting the figure: the lower the standard deviation, the more accurate data. It can be visually seen that the most significant is the variation between VAT [15;17] and CT [10;16] or VAT [21;25] and CT [10;16], or VAT [15;17] and CT [22;25]. Thus, the lower the grid, the more significant is the variation between taxes.

The eight step is optimization of results, according to the maximum likelihood estimates by applying the maximum points of the maximum likelihood estimates function  $L(\beta)$  of the unknown parameters  $\hat{\beta}$ , when  $\hat{\beta} = \arg_{\beta \in \Theta} \max L(\beta)$ .

The ninth step is familiarization with the final results.

**Optimize Response**

<i>Factor</i>	<i>Low</i>	<i>High</i>	<i>Optimum</i>
VAT	15.0	24.0	17.2342
CT	10.0	25.0	15.2815
PIT	6.0	33.0	22.9939

Optimum value = 12500.0

The research revealed that in order to collect the government budget revenue of 12500 million Euros, the following combination of tax rates must be used: VAT=17%, CT=15%, PIT=23%. The obtained result does not conflict with the results of this research and confirm them, therefore, it is concluded that the result is objective and the research is successful.

Seeking to check the perspective of the obtained rates, the author made a long-term forecast by constantly applying the same VAT=17%, CT=15%, PIT=23% tax rates (see Figure 5).



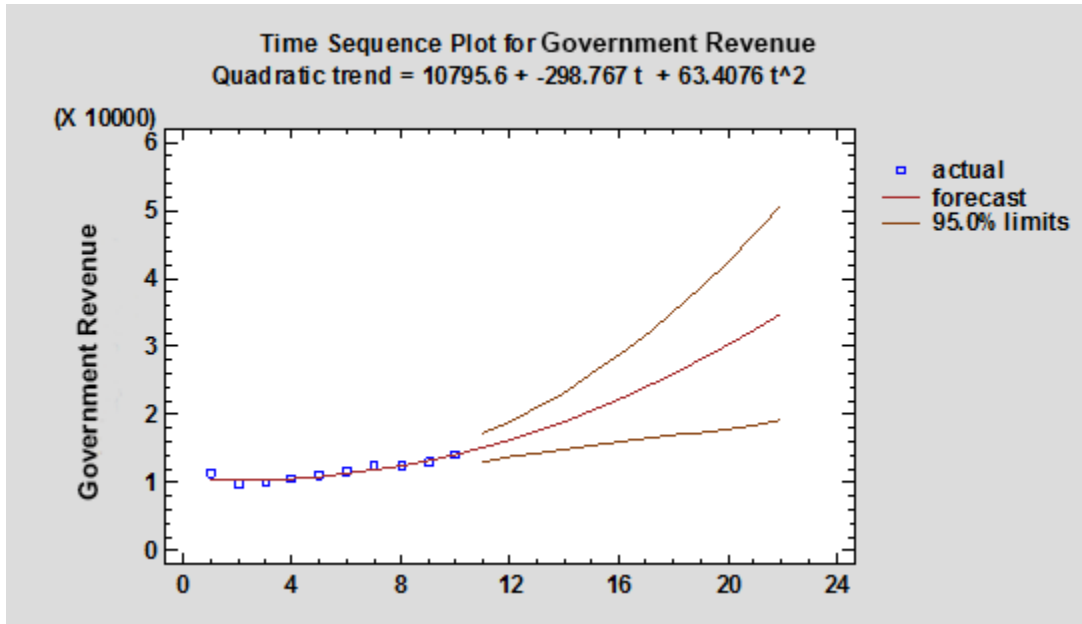


Fig. 5. Long-term forecast of the government revenue when VAT=17%, CT=15%, PIT=23%  
Source: compiled by author

This forecast is more for general information in order to determine whether it is worth to change the tax rates and whether they do not tend to generate less revenue in the long run. As shown in the figure, the blue points are relevant recalculated data of the state revenue, and from the 12<sup>th</sup> lag the forecast shows that the government revenue tends to grow in the long term without changing the tax rates.

According to the author, the developed modelling system can be applied in practice as anti-crisis measure of economic policy, in order to evaluate the planned tax rates and analyse the potential influence on the government revenue. This economic analysis measure may also help to decide on fiscal policy measure (expansionary or contractionary) should be applied, in order to achieve the goal.

The developed modelling system for the state tax rates partly corresponds with the RMSM.X methodology for the government budget revenue, developed by the World Bank. The main similarities include the fact that state budget revenue is the resulting  $Y$  or  $T$ , while PIT, VAT and CT are the influencing indicators  $x$  or  $t$ , the tax base of which is based on the statistics of GDP or other indicators. However, economic analysis measures and fields of these economic models are different. The basis of the model, developed by author, is standard

deviation factor experimental modelling, while the basis of RMSM.X is extrapolated elasticity modelling methods. In other words, RMSM.X model is more appropriate for analysis of the changes of government revenue and making forecasts, while the modelling method, developed by author of this paper, is designed for identifying the most accurate tax rates, in order to achieve certain government budget revenue. According to the author, the modelling system for the main state tax rates and RSMS.X modelling complement each other, and may be applied for analysis of economic policy measures and economic crisis prevention.

## **CONCLUSIONS**

Theoretical study of the state economic policy and its decisions during economic crisis states that in order to increase general demand and balance the state budget during crisis, it is necessary to apply the expansionary fiscal policy measures, i.e., to decrease the main tax rates and increase transfer payments. Expansionary monetary policy by decreasing interest rate must also be applied during crisis. These economic policy measures increase GDP growth, decrease unemployment, and improves many other economic indicators.

Analysis of the main economic indicators of Lithuania revealed that the lowest level of economic crisis was reached in 2009, when the most indicators, in comparison with 2008, had negative change: GDP decreased -14,7%, government budget deficit increased 193%, government budget total debt increased 64%, labour productivity decreased 8%, unemployment level increased 8%, number of emigrants increased 59%, number of residents decreased 2%, number of business bankruptcies increased 93%, economic sentiment indicator was negative and equal to -36%, and consumer confident indicator was negative and equal to -50%.

A part of the analysed indicators was characterized by negative change in the next 2010 in comparison with 2009: total government debt increased 30%, unemployment level increased up to 17% and reach its peak in 2010, the number of emigrants increased 116% and reached its peak in 2010, while the number of residents decreased 3%.

Since one of the main sources of budget revenue is tax revenue, all main tax rates were changed during crisis in Lithuania (“night reform”). Although the corporate tax rate was increased from 15% to 20% in 2009, it was collected to the state budget 41,3% less than the

previous year. Although in 2010, corporate tax rate was restored to the 15% rate, it still was collected less than before initial change of the tax rate. As the value added tax was increased from 18% to 19% , and repeatedly from 19% to 21% in 2009, it was collected to the state budget 26% less than in 2008. Decrease in collection of these taxes was caused not only by changes of tax rates, but also by economic downturn during crisis.

As the government of Lithuania did not follow the example of expansionary fiscal policy of other countries (Germany, Great Britain, Austria, Denmark, France, Finland, Estonia, etc.), the strategy of increasing the main tax rates was applied, and this is in conflict with economic theory. During crisis, it is appropriate to apply expansionary fiscal policy, decreasing some tax rates, and the Government of Lithuania applied contractionary fiscal policy, as a result collecting tax revenue less than before changes of tax rates. It evidences that this economic policy measure during crisis was pro-cyclical, ineffective, and caused negative consequences to the state budget, worsened the macroeconomic situation of the country.

Analysis of Lithuanian interbank interest rates revealed: VILIBOR started growing significantly in 2008, and reached 10,22% in December, meanwhile EURIBOR started decreasing in 2008 and reached 1,26% in September of 2009. It shows that the Government of Lithuania together with the Bank of Lithuania applied contractionary monetary policy, opposite to the European central bank. As a consequence, interbank distrust in VILIBOR increased, increased the risk of litas currency, increased the interest rate burden of the loans granted in litas and the repayment risk of loans granted in litas. The number of arrests increased by 60,6% in 2009, in comparison with 2008, while the loans in litas decreased from 42,8% to 27,4% in 2010, in comparison with 2008.

IS-LM model projections showed that contractionary fiscal and contractionary monetary policy, implemented by the Government of Lithuania during crisis of 2008-2010 worsened the economic situation in the country what is reflected by the main macroeconomic indicators.

The economy of Estonia moved to the phase of recovery quite fast. This was caused by the following reasons: budget surplus before crisis; proper management of government budget; strict saving policy; election of political institutions before crisis; high trust in political institutions; benevolent payment of taxes by economic entities for the benefit of economy; small black economy; stable assessment of state risk; cheap borrowing from the International Monetary Fund; reform of more flexible labour relationships; proper strategic aims.

Analysis of fiscal policy of the EU and other countries during the period of 2008-2010 revealed that most of the states decreased tax rates or tax base. Expansionary fiscal policy was applied by the following countries: Sweden, Finland, Netherlands, Great Britain, Germany, Austria, Poland, China, Japan, etc.

The countries, which applied expansionary fiscal policy, improved economic indicators: negative change in GDP in 2009 was lower than in countries with contractionary fiscal policy, and GDP growth was reached in 2010. Growth in ratio of budget revenue and GDP in 2009 and 2010 was equal from -0,5% to 2%. Inflation decreased, and unemployment decreased in many countries.

The Baltic countries applied different economic policy decisions during crisis. In 2009, Lithuania increased VAT and CT rates, while Latvia and Estonia focused on increase of VAT and excise duties. In this case, although all three countries applied contractionary fiscal policy, it was different. Therefore, in each case it is necessary to make a complex modelling of the main tax rates, seeking to make reasonable economic policy decisions in the future.

Complex quantitative research on dependencies of the government revenue, deficit, and debt of Lithuania revealed GDP, government revenue, budget deficit and government debt are characterized by strong correlation in Lithuania. The highest correlation with GDP is had by government budget revenue,  $p = 0.0010$ , while correlation of the government budget deficit with GDP is  $p = 0.0015$ , and correlation of government debt with GDP is  $p = 0.0023$ .

The results of modelling of the state main tax rates revealed that the value added tax rate must be decreased, when expansionary fiscal policy is implemented during crisis, in order to collect more tax revenue. If tax rates are increased during crisis, the opposite effect takes place, and less tax revenue is collected. It is evidenced by statistics. The VAT rate of 18% was valid till the end of 2008, and 18,13% more VAT tax revenue was collected in 2008, in comparison with 2007, despite the negative influence of crisis. Upon increasing the VAT rate up to 19% and later up to 21% in 2009, VAT tax revenue was collected -26,44% less in 2009, in comparison with 2008, while tax revenue was collected -21,08% less in 2010, in comparison with 2008, -8,01% less in 2011, in comparison with 2008, -5,67% less in 2012, in comparison with 2008, 3,83% less in 2013, in comparison with 2008.

Corporate tax rate must be decreased, when expansionary fiscal policy is implemented during crisis, in order to collect more tax revenue. If tax rates are increased during crisis, the

opposite effect takes place, and less tax revenue is collected. It is evidenced by statistics. The CT rate of 15% was valid till the end of 2008, and 41,71% more CT tax revenue was collected in 2008, in comparison with 2007, despite the negative influence of crisis. Upon increasing the CT rate up to 20% in 2009, CT tax revenue was collected -41,32% less in 2009, in comparison with 2008. As the Government of Lithuania returned the previous CT rate of 15%, -67,22% less tax revenue was collected in 2010, in comparison with 2008, and the revenue did not reach the pre-crisis level until the end of 2014.

The results, obtained during modelling of the state main tax rates, revealed that during crisis of 2008-2010, seeking to collect the budget revenue of 12500 million Euros without budget deficit and the need to borrow, the follow tax rates should have been applied: VAT=17%, CT=15%, PIT=23%, i.e., CT should not have been changed in 2009, and instead of VAT increase from 18% to 21%, VAT should have been decreased down to 17%.

Considering the state revenue perspectives, if VAT=17%, CT=15%, PIT=23% rates are applied, the applied quadratic trend forecast function =  $10795.6 + -298.767 t + 63.4076 t^2$  shows that during the forecasted period of 12 years the government revenue would be characterized by significant growth trend.

According to the author, the modelling system for the main state tax rates and the RSMS.X modelling complement each other, therefore, it is proposed to apply both of them for analysis of economic policy measures and economic crisis prevention.

## **APPROBATION AND DISSEMINATION OF THE RESEARCH RESULTS**

### **Publications in reviewed scientific journals and reviewed conference proceedings of international conferences:**

1. Švabovič M., Miškinis A. (2016). Quantitative analysis of main Lithuanian taxes and optimization during crisis. // *Ekonomika*. Vilniaus Universiteto leidykla.
2. Švabovič M. (2016). Lietuvos pagrindinių mokesčių tarifų analizė ir optimizavimas krizės sąlygomis // VDU doktorantų-magistrantų 2016 m. konferencijos leidinys. ISSN 1822-6736.
3. Švabovič M. (2015) Ekonominiai svyravimai ir jų stabilizavimas: teorinių koncepcijų analizė // Kolektyvinė monografija „Ekonomikos modernizavimas: globalizacijos iššūkiai ir ekonominė politika“. Vilniaus Universiteto leidykla.
4. Švabovič M. (2015) Lietuvos ekonominė aplinka krizės sąlygomis: iššūkiai ekonominei politikai // Kolektyvinė monografija „Ekonomikos modernizavimas: globalizacijos iššūkiai ir ekonominė politika“. Vilniaus Universiteto leidykla.

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### ***Education and competences:***

BA in Economics Sciences, 2003 – 2007. Vilnius University.

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2007-2008 AB Swedbank, specialist.

2009-2010 UAB Ecoil, director.

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2015-up now Danske bank A/S Lithuanian Branch, senior project manager.

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## REZIUMĖ

Prieš kelis metus pasaulį sukrėtė 2008-2010 ekonominė krizė, kurios neigiami padariniai paveikė daugumos valstybių ekonominę konjunktūrą. Krizės atsiradimo pradžią sąlygojo spartus ekonomikos augimas ir staigus taip vadinamo vartojimo ir lūkesčių burbulo sprogymas. Ekonominės krizės poveikis daugumai šalių buvo skirtingas – vienoms valstybėms prireikė ženklios finansinės pagalbos, kitos valstybės sugebėjo krizę įveikti atitinkamais ekonominės politikos sprendimais.

Lietuvai kaip ir daugumai kitų valstybių deja nepavyko išvengti ekonominės krizės, tačiau remiantis vyriausybės ir užsienio ekonomistų vertinimais (Fonteye, 2010; Frankel, Vegh, Vuletin, 2011; Jickling, 2010 ir kt.) mūsų valstybė pakankamai sėkmingai susidorojo su krizės padariniais ir suvaldė šalies makroekonominių rodiklių pokytį. Kiti ekonomistai (Beležentis, Vijeikis, 2010; Gylis, 2009; Jakeliūnas, 2010; Keršiulytė, 2013; Kulvelytė, 2011; Kuodis, 2011; Kuokštis, 2011; Maksvytienė, Dapkus, 2012; Medaiskytė, 2009; Mishkin, 2011; Proškutė, 2012 ir kt.) teigia, kad visgi ne taip sklandžiai buvo priešinamasi krizės įtakai, ką sąlygojo eilė neteisingų politinių sprendimų ir priešingų ekonomikos teorijai taikomų antikrizinių ekonominės politikos priemonių.

Taigi, krizės metu ir šiandieną vyrauja skirtingų ekonominių pažiūrų diskusijos ir neprieinama vieningos nuomonės, todėl problema lieka neišspręsta. Baltijos ir kitų šalių pavyzdžiu atlikti kompleksiniai empiriniai tyrimai rodo, kad ekonominė krizė skirtingai paveikia šalių ekonominę būklę. Tam įtakos turi be galo daug veiksnių, tame tarpe netolygi valstybių plėtra ir augimas globalizacijos sąlygomis, skirtingi ekonominės politikos sprendimai iki krizės ir krizės metu, skirtingi valstybių valdymo modeliai, skirtinga valstybių makroekonominė ir geografinė padėtis, gyventojų skaičius ir kiti ženkliūs faktoriai. Tai dar kartą patvirtina, kad ir šiais laikais reikia modeliuoti ekonominės politikos priemonių taikymą, siekiant ateityje priimti pagrįstas ekonominės politikos antikrizines priemones. Šio darbo tyrimų rezultatai galėtų būti naudingi valstybės tarnautojams, ekonomistams bei ekonomikos studijų krypties studentams, siekiant objektyviai įvertinti krizės metu buvusią Lietuvos ir kitų šalių ekonominę situaciją bei pasiūlyti perspektyvius ekonominės politikos priemonių modeliavimo scenarijus.

## **Mokslinė problema**

Kaip teigia Ahrend, Cournède, Price, 2008; Alesina, Campante, Tabellini, 2008; Allen, Gale, 2007; Atesoglu, Emerson, 2008; Bachmann, Jinjui, 2013; Barrell, Holland, 2010; Beležentis, Vijeikis, 2010; Benetrix, Lane, 2011; Bratčikovienė, 2014; Castro, 2010; Cicek, Elgin, 2010; Forni, Monteforte, Sessa, 2009; Galinienė, Melnikas, Miškinis, 2011; Gylys, 2009; Harvey, 2010; Hennessey, Chairman, 2010; Isaac, 2008 ir kt., ekonominės krizės ciklo fazėje tikslinga taikyti skatinačiosios fiskalinės bei skatinančiosios monetarinės politikos priemonės, siekiant paskatinti ekonominę sistemą kuo įmanoma greičiau pereiti į atsigavimo fazę. Tačiau ir šiandieną trūksta paaiškinimų bei rekomendacijų, ką tiksliai reikėtų daryti kitaip, siekiant sušvelninti ekonominės krizės neigiamus padarinius. Šie mokslininkai dažniausiai vieningos nuomonės, kad 2008-2010 m. ekonominė krizė – tai pagrindas mokslinė prasme atlikti ne tik kokybinius, bet ir kiekybinius mokslinius tyrimus, nustatyti problemas bei rasti sprendimo metodikas ateičiai.

Šio darbo autoriui analizuojant mokslinės literatūros šaltinius, nepavyko rasti išsamių bei vientisų ekonominės analizės metodų, kuriais galima būtų remtis problemai tirti. Užsienio mokslinės literatūros autoriai retai nagrinėja 2008-2010 m. ekonominės krizės problematiką Lietuvoje, o Lietuvos autorių mokslinėje literatūroje bene daugiausiai dėmesio skiriama kokybinei analizei. Tai sąlygojo, kad šio darbo autorius mokslinėje literatūroje pasigedo vieningų išvadų, todėl šiame darbe vykdomų tyrimų koncepciją, grindžiant ekonomikos teorija, sudarė indukcinį bei dedukcinį dėsnių pagalba, keliant atitinkamai tam tikras prielaidas bei grindžiant jas šiame darbe vykdomais empiriniais modeliavimo tyrimais.

Šių laikų mokslinėje literatūroje (Karazijienė, 2011; Keršiulytė, 2013; Kuodis, 2011; Maksvytienė, Dapkus, 2012; Mishkin, 2011; Rėklaitis, 2009; Sanz, 2011; Sinevičienė, Vasiliauskaitė, 2010; Tamašauskienė, Žadvidaitė, 2011; Šidlauskienė, Šeputienė, 2008; Šiurkutė, Jakaitienė, 2009; Woo, 2009 ir kt.) ekonominės krizės poveikiui Lietuvos ekonomikai tirti bene dažniausiai taikomi regresinės analizės metodai bei pavieniai statistiniai tyrimai, kaip pavyzdžiui fiskalinės politikos priemonių ekonominiams rodikliams elastingumo nustatymas. Tačiau, šio darbo autoriaus nuomone, tai yra tik tam tikros kiekybinių tyrimų ištraukos, kurių pagalba fragmentiškai stebimos specifinės tendencijos, tačiau tai nesuteikia galimybės vertinti ekonominės situacijos ir anktikrizinių ekonominės politikos priemonių kompleksiskai, todėl siekiant kryptingai vykdyti krizės prevenciją,



ekonominės politikos sprendime turi būti taikomas efektyvesnis ekonominės analizės modeliavimo aparatas.

### **Mokslinio tyrimo objektas**

Šio darbo mokslinio tyrimo objektas – valstybės ekonominės politikos antikrizinių priemonių analizė ir modeliavimas.

### **Darbo tikslas**

Šio darbo tikslas – kompleksiskai ištirti valstybės ekonominės politikos sprendimų tobulinimo galimybes reaguojant į ekonominės krizės iššūkius ir sukurti tokių sprendimų modeliavimo priemones, kurios būtų adekvačios šiuolaikiniams poreikiams.

### **Darbo uždaviniai**

Šio darbo tikslui pasiekti formuluojami tokie uždaviniai:

7. Išanalizuoti valstybės ekonominės politikos priemones krizės sąlygomis siekiant efektyviai vykdyti krizių prevenciją ateityje.
8. Išanalizuoti valstybės fiskalinės ir monetarinės politikų sistemos efektyvumo modeliavimą reaguojant į krizių grėsmes.
9. Atlikti Lietuvos pavyzdžiu ekonominės politikos taikymo krizės sąlygomis IS-LM projekcijų modeliavimą ir pasiūlyti krizių prevencines priemones ateityje.
10. Atlikti ekonominės politikos sprendimų kompleksinę analizę Lietuvos, Latvijos, Estijos ir kitų šalių pavyzdžiu.
11. Atlikti Lietuvos pavyzdžiu valdžios sektoriaus biudžeto pajamų, deficito ir skolos priklausomybių kompleksinius kiekybinius tyrimus bei pasiūlyti perspektyvius sprendimus ateities krizių prevencijai.
12. Sukurti perspektyvią valstybės pagrindinių mokesčių tarifų modeliavimo sistemą skirtą valstybės ekonominės politikos sprendimams ateities krizių prevencijai.

## **Ginami teiginiai**

- Lietuvos antikriziniai ekonominės politikos sprendimai pastarosios ekonominės krizės metu buvo nepakankamai efektyvūs.
- Ekonominės krizės sąlygomis tikslinga taikyti skatinančias ekonominės politikos priemones - tyrimas rodo, kad ateityje reikia tinkamesnių antikrizinių sprendimų.
- Siūlomi Lietuvos valdžios pajamų, deficito ir skolos priklausomybių kompleksiniai kiekybiniai tyrimai gali būti naudingi ateities krizių prevencijai.
- Siūloma valstybės pagrindinių mokesčių tarifų modeliavimo sistema gali būti naudinga fiskalinės politikos sprendimams ateities krizių prevencijai.

## **Mokslinis naujumas**

Šio darbo autoriui nepavyko rasti išsamių bei vientisų ekonominės analizės metodų, kuriais galima būtų remtis mokslinei problemai tirti, todėl šio darbo autorius sudarė ir siūlo perspektyvią valstybės pagrindinių mokesčių tarifų modeliavimo sistemą, skirtą ekonominės politikos sprendimams ateities krizių prevencijai. Šio modeliavimo pagalba galima kiekybiškai analizuoti ir nustatyti pagrindinių mokesčių tarifų efektyvius dydžius, siekiant atitinkamą valstybės biudžeto pajamų ir tokiu būdu planuojant bei sukuriant kryptingai efektyvią valstybės ekonominės politikos antikrizinę priemonę.

## **Darbo rezultatų teorinė reikšmė**

Disertaciniame darbe atlikta sisteminė Lietuvos ir užsienio šalių mokslinės literatūros ekonominės politikos antikrizinių priemonių analizė, kuri išryškina esminius skirtumus tarp stabdančiosios ir skatinančiosios ekonominės politikos priemonių taikymo krizės sąlygomis, įvertinant ekonomikos teorijos modelių konceptualų taikymą praktikoje. Remiantis ekonomikos teorija ir ekonominės analizės modeliavimo metodais, sukurta perspektyvi valstybės pagrindinių mokesčių tarifų modeliavimo sistema, kuri gali būti toliau vystoma mokslininkų ir ekonomistų, tiriančių ekonominės politikos priemonių krizių prevencijai taikymo efektyvumą praktikoje.

## **Darbo rezultatų praktinė reikšmė**

Disertacijoje atlikta Lietuvos, Latvijos, Estijos ir kitų šalių ekonominės politikos antikrizinių priemonių taikymo sisteminė analizė bei Lietuvos pavyzdžiu sudarytos ekonominės politikos taikymo krizės sąlygomis IS-LM projekcijų modeliai, kurie suteikia galimybę pilniau atspindėti ekonominės politikos priemonių įtaką ekonominiams procesams, o kartu praktiškai įvertinti fiskalinės bei monetarinės politikų priemonių taikymo efektyvumą krizės sąlygomis bei pagerinti rengiamų prognozių tikslumą ir tvarumą. Disertacijoje aprašytų tyrimų rezultatai gali būti naudojami kompleksiniam Lietuvos ekonominės politikos priemonių krizės sąlygomis efektyvumo įvertinimui bei trumpalaikių ir ilgalaikių prognozių sudarymui, modeliuojant skirtingas ekonomines situacijas.

Šio darbo autorius, remdamasis pasaulio banko sukurta RMSM.X kiekybinio modeliavimo metodika bei šiuolaikiniais reagavimo į krizių prevenciją skirtais modeliais, siekdamas papildyti ekonominės politikos antikrizinės politikos sprendimų praktinę reikšmę, sukūrė pagrindinių mokesčių tarifų ekonominės analizės modeliavimo sistemą, kurios pagalba gali būti vykdomi ekonominių scenarijų modeliavimo tyrimai, nustatant optimalių mokesčių tarifų variacinius dydžius. Praktikoje taikant šią modeliavimo sistemą, galima apskaičiuoti maksimalaus tikėtino pridėtinės vertės, pelno mokesčio ir gyventojų pajamų mokesčio tarifus, siekiant atitinkamai surinkti nustatytą pajamų sumą į valstybės biudžetą. Ši metodika suteikia galimybę tiksliai įvertinti fiskalinės politikos priemonių taikymo įtaką valdžios sektoriaus biudžetui, pilniau atspindėti ekonominius procesus bei sudaryti tikslias ilgalaikes ir trumpalaikes prognozes. Šios modeliavimo sistemos taikymas praktikoje gali būti platesnio pobūdžio, apimant daugiau rodiklių ir kiekybinių tyrimo metodų.

Disertacinio darbo teorinė ir praktinė reikšmė yra naudinga ekonominės politikos formuotojams, vyriausybės bei centrinio banko specialistams, atsakingiems už fiskalinės ir monetarinės antikrizinės politikos formavimą, bei mokslininkams ir ekonomistams, analizuojantiems ekonominės politikos sprendimų taikymą krizės sąlygomis. Darbo rezultatai gali būti taikomi taip pat šios dienos ekonominei situacijai modeliuoti bei suteikia perspektyvius sprendimus ateities krizių prevencijai.

## **Tyrimo organizavimas ir metodika**

Analizuojant Lietuvos ekonominės politikos 2008-2010 m. priemones, buvo vykdoma: Lietuvos ir užsienio mokslininkų aktualių literatūros šaltinių analizė (Allen, Carletti, 2009; Bachmann, Jinjui, 2013; Barrell, Holland, 2010; Benetrix, Lane, 2011; Brazinskas, 2010; Castro, 2010; Di Mauro, Dees, McKibbin, 2009; Fatima, 2011; Girdzijauskas, Mackevičius, 2009; Harvey, 2010; Krugman, 2008; Kotz, 2009; Kuokštis, 2011; Liesionis, Račkauskas, 2012; Misses, 2009; Maksvytienė, Dapkus, 2012; Melnikas, 2011; Miškinis, Augustauskas, 2011; Nowak, 2013; Proškutė, 2012 ir kt.) informacijos bei duomenų rinkimas, palyginimas, grupavimas, aprašomasis tyrimas, teorinių modelių parinkimas, matematinės analizės statistinių metodų parinkimas remiantis Čekanavičiumi, 2011; Valkausku, 2006; Kėdaičiu, 2009; Kvedaru, 2005; Bagdonu, Skverniu, 2006; Frankel, Vegh, 2011; Harvey, 2010 ir kt., grafinė, loginė indukcinė ir dedukcinė analizė bei kt. metodai.

Atliekant kiekybinius tyrimus, buvo vykdoma: regresinė analizė, gautų duomenų tinkamumo patikra, determinacijos koeficiento analizė, Durbin-Vatsono statistikos analizė, autokoreliacijos analizė, p reikšmės analizė, Fišerio statistikos analizė, nulinės hipotezės patikra, standartinių paklaidų analizė, koreliacijos stiprumo analizė, faktorinė analizė, standartinio nuokrypio ir laiko eilučių modeliavimas, Spirmeno koreliacinės matricos sudarymas, įvairių statistinių modelių sudarymas, modelių analizė informacinių kriterijų pagalba, optimalių mokesčių tarifų variacijos kiekybinio modelio sudarymas, prognozavimas ir panašiai. Naudojamos tokios kompiuterinės programos: Statgraphics Centurion, Gretl, IBM SPSS bei EViews.

## **Mokslinių publikacijų disertacijos tema sąrašas**

Paskelbtuose straipsniuose aptarta dauguma daktaro disertacijos dalių ir tyrimų rezultatų. Detalesnis disertacijos tyrimų apibavimas pateikiamas:

1. Švabovič M., Miškinis A. (2016). Quantitative analysis of main Lithuanian taxes and optimization during crisis. // *Ekonomika*. Vilniaus Universiteto leidykla.
2. Švabovič M. (2016). Lietuvos pagrindinių mokesčių tarifų analizė ir optimizavimas krizės sąlygomis // VDU doktorantų-magistrantų 2016 m. konferencijos leidinys. ISSN 1822-6736.

3. Švabovič M. (2015) Ekonominiai svyravimai ir jų stabilizavimas: teorinių koncepcijų analizė // Kolektyvinė monografija „Ekonomikos modernizavimas: globalizacijos iššūkiai ir ekonominė politika“. Vilniaus Universiteto leidykla.
4. Švabovič M. (2015) Lietuvos ekonominė aplinka krizės sąlygomis: iššūkiai ekonominei politikai // Kolektyvinė monografija „Ekonomikos modernizavimas: globalizacijos iššūkiai ir ekonominė politika“. Vilniaus Universiteto leidykla.

### **Darbo apimtis ir struktūra**

Darbą sudaro santrauka, įvadas, 4 skyriai, išvados ir pasiūlymai, 206 literatūros šaltiniai. Darbo apimtis 193 puslapiai, darbe yra 46 paveikslai, 14 lentelių, 20 priedų, 2 išnašai.