Modern Model of Interconnection of Inflation and Unemployment in Latvia

Yuri Kochetkov

Baltic International Academy
Lomonosova str., 4, LV-1019, Riga, Latvia
e-mail: kochetkov@rtulf.lv

Globalisation contributes to stabilisation of monetary policy of countries, achievement of price stability and decrease rates of inflation. There is no clear generally accepted concept for "inflation". A number of experts consider inflation to be a complicated multisided process, which depends not only on economical but also on social and political reasons. One of the main aims of state governments and central banks of the majority of world countries is the decrease of inflation due to its negative effect on the economy. Researches have shown that in developed countries inflation higher than 3% leads to substantial slowdown of economy growth rate. A. Phillips determined the presence of negative correlation between the rate of inflation and the rate of unemployment. On the basis of so called Phillips curve a wrong conclusion was done that by increasing inflation it is possible to decrease unemployment. It wasn't confirmed in practice. There is a hypothesis stating that unemployment has a certain "natural" Not Accelerating Inflation Rate of Unemployment (NAIRU). Nowadays Phillips curve (1958) is considered in a wider sense as a complicated event, developing in the absence of neutrality of money in economic processes. The object of the research is interconnection of inflation and unemployment in Latvia. The goal of the research – analysis of interconnection between inflation and unemployment in Latvia, estimation of the "natural" rate of unemployment. All these researches have not been done before. By using the statistical data of Latvia and analysis thereof show the possibility of using modern mathematical regression models for researches of macroeconomic indicators. Methods of the research are mathematical modelling, correlation and regression analysis.
 In Latvia systematic accounting of unemployment is done from 1996. For analysis of the interconnection between time series of inflation rate and unemployment a non-linear regression equation - a quadratic parabola was computed and estimated. The considered period is from the year 1996 until 2008. The negative correlation between inflation and unemployment occurs within the whole considered time length. Classical Phillips curve is missing. However, within the period from the year 1999 until 2008 negative correlation occurs, as it is with Phillips curve. Such change of correlation between inflation and unemployment from positive to negative value at the turn of 1998-99 is obviously explained by macroeconomic changes and development peculiarities in Latvia. To identify peculiarities of inflation in Latvia the period from 1999 to 2008 has been analysed separately. To check the quality of the regression models the correlation and regression analysis was done. The calculated index and coefficient of determination in both cases point at quite good quality of regression models: with the help thereof it is possible to explain 70 % and 60 % of inflation respectively. It is possible to say that both models of regression adequately fit empirical data and are appropriate for use. As long as analysis of dynamics time series is fulfilled, a check has been done for the presence of autocorrelation in residuals, which is subjected to autoregressive process of the first order. For the check of the main hypothesis $H_o : \rho = 0$ Durbin-Watson test statistics has been used. Analysis showed that in these models there is no autocorrelation, econometric models can be used for analyses. A multiple linear equation of inflation autoregression model was obtained and analysed also. To determine the "natural" rate of unemployment in Latvia (NAIRU) the last equation is changed. As a result it is obtained that the estimate of the "natural" rate of unemployment for Latvia's economy is quite large 16%. In developed market economies NAIRU is much less. This denotes existence of disproportions and drawbacks of macroeconomic development. This is confirmed by very adverse consequences of the financial and economic crisis for Latvia. A number of macroeconomic experts believe that Latvia needs an "industrial revolution": accent on development of the priority branches of industry, export. Changes in the structure of government, education, as well as creation of attractive environment for investments are necessary also. The analysis of interconnection between inflation and unemployment in Latvia, which was done according to mathematical regression models quite sufficiently corresponding to empirical data, points to the possibility of successful application of such models for analysis and researches of macroeconomic indicators.

Keywords: *unemployment, inflation, econometric model, correlation, regression*.

Introduction

Development of financial market that is a component part of the global world-wide market continued in the beginning of the XXI century. Process of globalisation increases financial flows and leads to equalisation of interest rates in all parts of the world. National economies, including that of Latvia, are more and more involved into world-wide system of economic relations (Adamowicz, 2009; Melnikas, 2008a). This strengthens their interdependence and affects

the formation of prices. Due to the global competition goods producer companies are not able to manipulate product prices anymore as it was before. Indications of world external trade and currency market are increasing at a swift rate. Thus, within 15 years, starting from1989, the average annual rate of growth of the world trade of goods and services was 6.4%, but the increase of turnover of the world currency market was 8% a year (IMF, 2006; Reich, 1992).

Globalisation of financial field limits the independence of national financial policy of countries to some extent. They have to make decisions taking into account development of the world economy and financial markets and first of all to consider actions of world financial leaders (the USA, European Union, Japan and China) (Ritzer, 2007). On the other hand, globalisation contributes to stabilisation of monetary policy of countries, achievement of price stability. This created favourable conditions for development of national economy (Melnikas, 2008b). Globalisation helps carry out more rational economic policy of countries and decrease rates of inflation (Cicarelli, 2005).

Subject and relevance. Medical term "iflatio", which means "swell", was first used to describe peculiarities of money turnover in the USA economy during a civil war in the XIX century. This term is used to denote a "swell", "puff-up" of money turnover. There is no clear generally accepted concept for "inflation". More often inflation is considered as stable, continued price increase. However, such definition does not reveal the essence of inflation. Usually only external results of inflation processes are considered – the devaluation, which is increase of the general price level, depreciation of money. A number of experts consider inflation to be a complicated multisided process, which depends not only on economical but also on social and political reasons. Theory of inflation considers unanimity of three components thereof: excessiveness of currency circulation; depreciation of money; redistribution of income, property and downfall of net remuneration (Trahtenberg, 1962; Pilinkus, 2009).

One of the main objectives of central bank monetary policy of the majority of states is the decrease of inflation due to its negative effect on the economy. Researches have shown that in developed countries inflation higher than 3% leads to substantial slowdown of economy growth rate (Khan, 2001). Increasing the degree of uncertainty in the economy higher inflation may lead to that money loses its functions of exchange tools and means for conservation of value. According to data from the International Monetary Fund (IMF) from 1970 until the beginning of the 90-ies annual price growth rates in the world (inflation on the world economy) increased from 5-6% to 35-36%. However, later under influence of financial globalisation world inflation started decreasing and in 2007 it was 4-5%, but in industrially developed market economies it was 1-3% (IMF, 2007). On the other hand, national economies and financial systems became in high degree prone to external financial impacts (Melnikas, 2007). This, for instance, is the influence of Asian financial crisis in 1997 on a number of European countries and particularly on the global financial and economic crisis, which started in 2008 and embraced the majority of world countries. Problems concerned with inflation were always given careful attention by state governments and central banks.

In 1958 A. Phillips determined the presence of negative correlation between the rate of inflation and the rate of unemployment (Phillips, 1958). Originally on the basis of so called Phillips curve a wrong conclusion was done that by increasing inflation it is possible to decrease unemployment and achieve acceleration of the rate of economic growth. It wasn't confirmed in practice. Moreover, in the second half of the XX century most states faced the problem of stagflation: high rate of inflation occurred at the high rate of unemployment and at low rates of economic growth. This phenomenon could be explained with the help of Friedman-Phelps hypothesis (Friedman, 1968; Phelps, 1967). According to this hypothesis unemployment has a defined "natural" rate, which does not accelerate inflation rate (Not Accelerating Inflation Rate of Unemployment - NAIRU). This rate does not depend on macroeconomic and monetary policy. E. Phelps came to the conclusion that in real life there are two Phillips curves: a short-term curve and a long-term curve. The "New Keynesian" Phillips curve points at negative connection between inflation and unemployment only over the short term, not over the long term. Short-term nature of the unemployment decrease effect is explained by growth of inflation expectations in economy during monetary growth. As a result inflation increases at the same rate of unemployment. Nowadays Phillips curve is considered in a wider sense as a complicated event, developing in the absence of neutrality of money in economic processes. In many respects the existing dependence between the rate of inflation and the rate of unemployment is defined by structured characteristics of economy, but without a choice between inflation and unemployment.

Object of the research is interconnection of inflation and unemployment in Latvia.

Goal of the research – analysis of interconnection between inflation and unemployment in Latvia, estimation of the "natural" rate of unemployment. All these researches have not been done before. By using the statistical data of Latvia and analysis thereof show the possibility of using modern mathematical regression models for researches macroeconomic indicators.

Methods of the research are mathematical modelling, correlation and regression analysis.

Analysis of Interconnection between Inflation and Unemployment

In Latvia systematic accounting of unemployment is done from 1996 (Table 1). In Table 1 there are statistical data for unemployment and inflation up to 2008 (CSB, 2008). For macroeconomic analysis of interconnection between time series of inflation and unemployment rates a nonlinear regression equation y = f(x) was computed and estimated. As the resultant property **y** is taken the rate of inflation, factor property **x** – the rate of unemployment. As a result of polynomial approximation a square parabola equation is obtained, which provides the best quality of approximation:

$$y = 0.2051x^2 - 5.1022x + 35.257 \qquad (1)$$

Graphically the regression model is shown in Figure 1.

Table 1

Statistical data for unemployment and inflation in Latvia (% %)

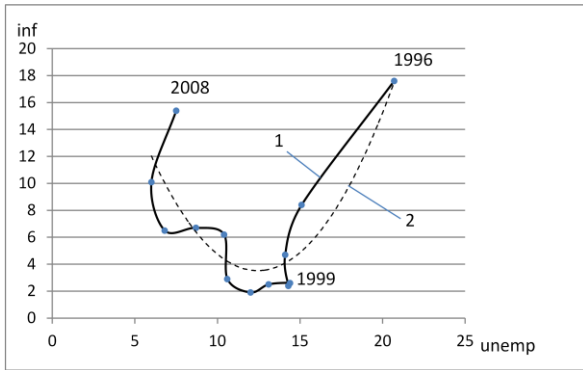| Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Unemp.	20.7	15.1	14.1	14.3	14.4	13.1	12.0	10.6	10.4	8.7	6.8	6.0	7.5
Inflat.	17.6	8.4	4.7	2.4	2.6	2.5	1.9	2.9	6.2	6.7	6.5	10.1	15.4

Figure 1. Dependence of inflation in Latvia on the rate of unemployment, % (1996 – 2008).
1 – actual data, 2 – according to the model.

It is obvious that negative correlation between inflation and unemployment occurs within the whole considered time length. There is no classical Phillips curve like in many other states. However, in the time line after 1998 it is possible to see the dependence y = f(x) significantly corresponding to Phillips curve. Such change of correlation between inflation and unemployment from positive to negative value at the turn of 1998-99 is obviously explained by macroeconomic changes and development peculiarities in Latvia, which are connected to the sequences of regional Asian financial crisis of 1997 and the Russian crisis of 1998 (Daugeliene, 2007; Dubra, 2008).

To identify peculiarities of inflation in Latvia the period from 1999 to 2008 has been analysed separately. For this period of time the best quality of approximation gives the equation of non-linear regression in the form of quadratic parabola:

$$y = 0.0709x^2 - 2.5582x + 24.031 \qquad (2)$$

determination index $R^2 = 0.6148$.

Here denotations are the same as in the equation (1). If we consider a pair linear regression, it is expressed by equation:

$$y = -1.0933x + 17.068 \qquad (3)$$

coefficient of determination $r^2 = 0.6014$.

According to the equation (3) with increase of the rate of unemployment by 1% point, the rate of inflation (y) increases by 1.1%. The correlation, as with classical Phillips curve, is negative, coefficient of correlation r = -0.7755. It is known that the larger is the curvature of regression line, the less is the coefficient of determination

r^2 than the determination index R^2. The vicinity of these indexes states that it is not necessary to complicate the form of the regression line (equation 2) and it is possible to consider the linear regression function (equation 3). In this case the difference $(R^2 - r^2)$ does not exceed 0.02. For NAIRU estimate, the first and the foremost is the general tendency of inflation change when unemployment is changing, but not the oscillations thereof. Therefore a simpler linear regression is used for the analysis (Figure 2). Here the presence of negative correlation between the rate of inflation and the rate of unemployment is clearly seen.
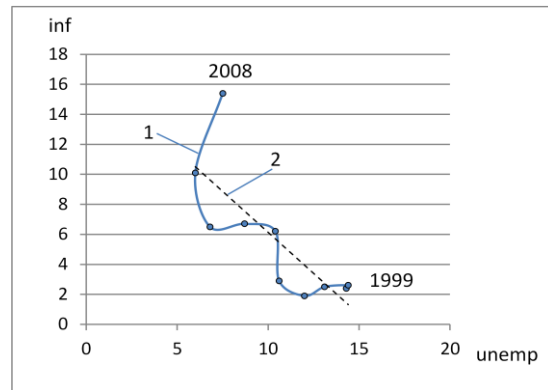

Figure 2. Dependence of inflation on the rate of unemployment, % (1999 – 2008). 1 – actual data, 2 – according to the model.

As a check on the quality of regression model, its correlation and regression analysis is done and the results are given in the Table 2.

Table 2

Results of statistical analysis of econometric models for dependence of inflation on the rate of unemployment in Latvia

Indexes	Analysed period	
	1996-2008	1999-2008
Econometric model	Quadratic parabola y=0.2051x2-5.1022x+35.257	Linear regression y=-1.0933x+17.068
Index (coefficient) of determination R2	0.7	0.6014
Index (coefficient) of correlation r	0.8367	-0.7755
Adjusted index (coefficient) of determination R2adj	0.64	0.5516
Standard error of regression equation Se	2.8776	2.8962
Mean-square deviation σy	4.8327	4.3251
Fisher's test F (calculated)	11.666	12.071
Critical criterion values Fcrit	4.844(α=0.05) 9.65(α=0.01)	5.318(α=0.05) 11.26(α=0.01)
Importance pof F-test	0.00243	0.00839
Confidence intervals for regression coefficients (α=0.05)	-7.5572≤β1≤-2.6472 0.1101≤ β2≤0.3001	-1.8189≤ β1≤-0.3676
Durbin-Watson test DW (calculated)	1.4596	1.1632
Critical boundaries for DW-statistics (α=0.05)	dL=1.01 dU=1.34	dL=0.879 dU=1.320

The calculated index and coefficient of determination in both cases point at quite good quality of regression models: with the help thereof it is possible to explain 70 % and 60 % of inflation respectively. According to the index and the coefficient of correlation r in models the rate of inflation dependence on the rate of unemployment in Latvia is strong and moderate. The adjusted index (coefficient) of determination was calculated taking into account the number of independent variables in the models:

$$R^2_{adj} = 1-(1- R^2)(n-1)/(n-h), \qquad (4)$$

where:

n – the number of observations,

h – the number of parameters in the regression equation.

Values of the adjusted index and coefficient of determination also point at quite good quality of the accepted models. To check the goodness of the models by empirical data, analysis of residuals e_i has been performed (Table 2). Residual is deviation of the actual dependent variable **y** value from the value of the same variable, obtained by calculation according to a regression equation: $e_i = y_i - y_i'$ (i=1; n). Standard errors Se of regression equations have been calculated:

$$Se = \sqrt{\frac{\sum_{n-1}^{n} e^2_i}{n-h}} \qquad (5)$$

The found values of regression equation errors Se appeared to be less than the corresponding calculated mean-square deviations $σ_y$ of the resultant properties. It is possible to say that both models of regression adequately fit empirical data and are appropriate for use.

To check the importance of regression equations in whole have been verified such hypotheses $H_o : ρ^2 = 0$, H_1: $ρ^2 > 0$, where ρ – the verifiable correlation coefficient of the general universe. By calculation (ANOVA analysis) it is established that the importance (p) of F-test in both cases is significantly less than the assumed level α=0.05.

Therefore, zero hypothesis H_o is rejected: regression equation statistically significantly explain changes of the resultant property (inflation). This is also verified with the use of Fisher-Snedecor distribution. The calculated values of Fisher's tests in both models are larger than their critical values F_{crit} with the levels of importance α=0.05, and also with α=0.01. Hence for both models it is assumed an alternative hypothesis about statistical importance in whole of the found regression equations with α=0.01.

To check the importance of coefficients with independent variable (x) in regression equations the check of hypotheses H_o is done: $β_1 = 0$, $H_1 : β_1 ≠ 0$ and $H_o : β_2 = 0$, H_1: $β_2 ≠ 0$ with level of importance α=0.05. Confidence intervals for regression coefficients are calculated with probability of 95 %. As it is obtained that hypothetic values $β_1 = 0$, $β_2 = 0$ do not appertain to the confidence intervals with probability of 95 %, and the importance (p) of F-tests is less than 0.05, then it is possible to make a conclusion that coefficients of regression are significant. Both equations of regression models can be used.

As long as analysis of dynamics time series is fulfilled, a check has been done for the presence of autocorrelation in residuals, which is subjected to autoregressive process of the first order. For the check of the main hypothesis H_o: ρ = 0 Durbin-Watson test statistics has been used:

$$DW = \frac{\sum_{i=2}^{n} (e_i - e_{i-1})^2}{\sum_{i=1}^{n} e^2_i} \qquad (6)$$

For the first model (quadratic parabola) by calculations $DW_{obs} = 1.4596$ was obtained. Taking into account the critical boundaries of DW with the level of importance α=0.05: $d_U < DW_{obs} < 2$, hypothesis H_o is assumed, there is no autocorrelation of the first order. For the second model (linear regression) the calculated value of the DW test is $DW_{obs} = 1.1632$. This value of DW test falls within the area of uncertainty: $d_L < DW_{obs} < d_U$. Therefore for additional check a graph was plotted showing the dependence of residuals on the observation number. Analysis of the graph showed also that there is no autocorrelation in this model.

Coefficients of regression are effective and consistent, econometric models can be used for analyses.

Estimation and Analysis of NAIRU in Latvia

It is known from the theory that the rate of inflation is negatively associated with the rate of unemployment and that inflation has certain inertia. There is also the theory of "natural" rate of unemployment, which does not accelerate the rate of inflation – NAIRU (Phelps, 1967). For analysis of inflation in Latvia the equation (3) is changed to the equation with a lagged variable:

$$y_n = - a \cdot x_n + b + c \cdot y_{n-1}. \qquad (7)$$

Here coefficients a, b, c are found by solving the system of simultaneous equations:

$$\begin{cases} y_2 = -a \cdot x_2 + b + c \cdot y_1 \\ y_3 = -a \cdot x_3 + b + c \cdot y_2 \\ y_4 = -a \cdot x_4 + b + c \cdot y_3 \end{cases} \qquad (8)$$

As a result a multiple linear equation of inflation autoregression model is obtained:

$$y_n = -2.187 \cdot x_n + 35.156 - y_{n-1} \qquad (9)$$

According to the equation (9) the coefficient of regression at x_n determines the constraint force between inflation and unemployment. The rate of previous year inflation in equation y_{n-1} is an inertial component. As y_{n-1} appears in the equation with coefficient (-1) it is a process of deceleration and it is positive.

To determine the "natural" rate of unemployment in Latvia the equation (9) is changed to the form:

$$y_n = 2.187(16.075 - x_n) - y_{n-1}. \qquad (10)$$

As a result it is obtained that the estimate of the NAIRU for Latvia's economy is quite large 16.075 %. This is verified by statistical data. During the period of relatively stable development of the economy of Latvia (1999 - 2003) the most favourable inflation for the national economy - less than 3 % was attended with 10.6 – 14.4 % of unemployment (Table 1). Under the conditions of economic crisis in 2009 - 2010, the inflation was 3.5 - (-1.1) % and unemployment was 16.9 – 18.7 % (CSB data of Latvia). In developed market economies NAIRU is much less. For instance, in the USA in the 80's of the XX century the estimate of the "natural" rate of unemployment was about 6 %.

High NAIRU rate in Latvia in comparison to the developed countries points at the presence of disproportion and shortages in its macroeconomic development (Belinskaja, 2010). For Latvia this is confirmed by very adverse consequences of the world financial and economic crisis, started in 2008. Latvia's liabilities are much larger than liquid assets. According to the statement of Latvia's prime minister the state suffered from the world crisis most of all other European Union states. Besides that, after 2004 REER according to data of EU Statistical Office *Eurostat*

index of Latvia's competitiveness has been rapidly increasing in comparison, for instance, to indexes of Finland, Sweden or Germany, that points at the loss of the competitive edge of the state. As a result in 2008 Latvia's competitiveness decreased almost by 40% in comparison to 2004 (Barzdenyte, 2009). A number of macroeconomic experts believe that Latvia needs an "industrial revolution": accent on development of the priority branches of industry, where certain success, capacity, experts and export development on this basis are already available (Melnikas, 2008c,d; World Bank, 2009). Necessary are also changes in the structure of government, bureaucracy, education, as well as creation of attractive environment for investments (Amdam, 2007; Brock, 2008; UNIDO, 2002).

Nowadays in Latvia's GDP services take more than 70 %, the part of industry in GDP, contrary to the developed countries, decreased almost by 3 times after 1990 (CSB, 2008). According to *Eurostat* data regarding the number of people involved into high-technology manufacturing Latvia takes one of the last places in EU, falling behind Lithuania and Estonia. Therefore, for instance, in the Report about world competitiveness according to data of the World Economic Forum (WEF) in 2005 Latvia took 44th position of more than 100 countries (Estonia took 20th position, Lithuania - 36th). Latvia has a problem of trade balance deficit: value of imports is almost 2 times larger than export of goods. In the course of independence years in Latvia has considerably increased GDP part of merchandise (almost by 4 times), in developed countries it has been decreasing. According to UN expert estimate (UNDP Human Development Report) Latvia is assigned to less developed countries with medium level of development, for which Latvia falls behind Estonia and Lithuania.

Modernisation of economy "from above" has failed almost in every undeveloped country. However, in many world's developed countries (South Korea, Japan, Spain, France etc.) in the XX century indicative planning was used with success. To decrease risks, connected with future uncertainty, governments of developed countries make planning in such a way that they leave a possibility to make certain decisions to managers and private sector at the local level (Bassem, 2009; Kazlauskaite, 2008; Kumpikaite, 2009). Inflation is a category of macroeconomics. Therefore, in reply to financial globalisation at the end of the XX century, in order to create favourable conditions for development of economy most countries started to reject targeting of money supply and currency rate, but introduced a mechanism of inflation targeting.

Monetary policy of inflation targeting became popular in the 90's of the XX century and it is the most effective mean fighting high inflation. There is no clear definition for inflation targeting policy. However, there are some compulsory demands, forming the base of targeting regime. Here the main thing is that the problem of achieving and preserving price stability becomes a priority in comparison to other aims and problems of the state central bank. For realisation of inflation targeting regime it is necessary to fulfil several conditions. There has to be high degree of central bank independence and accountability of

monetary policy, absence of money supply and currency rate targeting. Implementation of inflation targeting regime in less developed countries, including Latvia, is more difficult because of population low trust level to economic policy of governments that enhances inflation expectations. The majority of less developed countries, including Latvia, use "anchor" in monetary policy in the form of currency rate. Nowadays most developed countries have passed to inflation targeting regime.

Conclusions

Analysis on the basis of regression model of inflation dependence on the rate of unemployment in Latvia showed that within the considered time line (1996 – 2008) there is no classical Phillips curve, like in other countries. However, within the period from 1999 to 2008 the indicated dependence closely corresponds to the Phillips curve. As for NAIRU estimate, the general tendency of inflation change is important while unemployment level is changing, and therefore in this work the linear regression model of inflation was assumed, because it was statistically proved that it corresponds to empirical data on quite high

level in comparison to the non-linear model. The calculations performed according to mathematical model of inflation showed that the estimate of the NAIRU in Latvia is quite large – about 16%, which significantly exceeds values for world developed economies. Such deviation is most probably explained by the presence of disproportions and shortages in Latvia's macroeconomic development that is confirmed by statistical data. The analysis of interconnection between inflation and unemployment in Latvia, which was done according to mathematical regression models quite sufficiently corresponding to empirical data, points to the possibility of successful application of such models for analysis and researches of macroeconomic indicators.

Latvia's monetary policy is based on the use of currency rate "anchor". Only after macroeconomic stability, well-balanced budget and quite high level of financial market development are achieved it will be possible in Latvia to perform gradual transition to inflation targeting regime. The necessary condition for such changes is making "industrial revolution" in the economy (Adamoniene, 2007; Alas, 2008).

References

Adamoniene, R., & Trifonova, J. (2007). The State Support for small and Medium Sized Companies: General and Practical Aspects of Lithuania. *Inzinerine Ekonomika-Engineering Economics*(1), 16-21.

Adamowicz, E., & Walczyk, K. (2009). Comparative Analysis of Structures of the Polish and the Euro Area Economies. *Transformations in Business & Economics, 8*(3), 23-32.

Alas, R. (2008). Implementation of Organizational Changes in Estonian Companies. *Journal of Business Economics and Management, 9*(4), 289-297. doi: Doi 10.3846/1611-1699.2008.9.289-297.

Amdam, R. P., Lunnan, R., & Ramanauskas, G. (2007). FDI and the Transformation from Industry to Service Society in Emerging Economies: A Lithuanian-Nordic Perspective. *Inzinerine Ekonomika-Engineering Economics*(1), 22-28.

Barzdenyte, B. (2009). Competition Policy: Theory and Practice. *Transformations in Business & Economics, 8*(3), 179-183.

Bassem, B. S. (2009). Governance and Performance of Microfinance Institutions in Mediterranean Countries. *Journal of Business Economics and Management, 10*(1), 31-43. doi: Doi 10.3846/1611-1699.2009.10.31-43.

Belinskaja, L., & Galiniene, B. (2010). Baltic States: From Giddy Success Towards the Financial Meltdown? *Transformations in Business & Economics, 9*(1), 19-41.

Bernatonyte, D., & Normantiene, A. (2007). Estimation of Importance of Intra-industry Trade. *Inzinerine Ekonomika-Engineering Economics*(3), 25-34.

Brock, G., & Urbonavicius, S. (2008). Regional FDI growth in Lithuania, 1996-2003. *Transformations in Business & Economics, 7*(1), 80-88.

Central Statistical Bureau (CSB) of Latvia. (2008). Statistical Yearbook of Latvia. Riga. P.640.

Cicarelli, M., & Mojon, B. (2005). Global Inflation. *Central Bank of Chile Working Papers.* No 357, 18-20.

Competing Through Innovation and Learning: Industrial Development Report 2002/2003/UNIDO (United Nations Industrial Development Organization). Vienna, 2002. P.53.

Daugeliene, R. (2007). The Peculiarities of Knowledge Workers Migration in Europe and the World. *Inzinerine Ekonomika-Engineering Economics*(3), 57-64.

Dubra, E., Kasalis, E., & Purmalis, K. (2008). Research Study of Labour Force Supply and Labour Market Demand of National Economy in Latvia. *Transformations in Business & Economics, 7*(3), 236-253.

Friedman, M. (1968). The Role of Monetary Policy. *American Economic Review*, 58(1), 1-17.

Kazlauskaite, R., & Buciuniene, I. (2008). The Role of Human Resources and Their Management in the Establishment of Sustainable Competitive Advantage. *Inzinerine Ekonomika-Engineering Economics*(5), 78-84.

Khan, M., & Senhadji, A. (2001). Thereshild Effects in the Relationship between Inflation and Growth. *IMF Staff Papers*, 48, 1-21.

Kumpikaite, V. (2009). Human Resource Training and Development Importance in Post Communist Countries in Cross-Cultural Context. *Transformations in Business & Economics, 8*(3), 131-144.

Melnikas, B. (2007). New challenges for the Cultural and Economic Development in the European Union: the Long Term

Transformations. *Inzinerine Ekonomika-Engineering Economics*(2), 34-43.

Melnikas, B. (2008a). Integral Space Creation Processes in the Baltic Region: The New Case of Transformations in the European Union. *Transformations in Business & Economics, 7*(3), 99-119.

Melnikas, B. (2008b). Integral Spaces in the European Union: Possible Trends of the Social, Economic and Technological Integration in the Baltic Region. *Journal of Business Economics and Management, 9*(1), 65-77. http://dx.doi.org/10.3846/1611-1699.2008.9.65-77

Melnikas, B. (2008c). Integration Processes in the Baltic Region: the New Form of Regional Transformations in the European Union. *Inzinerine Ekonomika-Engineering Economics*(5), 54-64.

Melnikas, B. (2008d). The Knowledge-Based Economy in the European Union: Innovations, Networking and Transformation Strategies. *Transformations in Business & Economics, 7*(3), 170-192.

Phelps, E. (1967). Phillips Curve, Expectations of Inflation and Optimal Unemployment over Time 1967. *Economica*, 34, (3), 254-281. http://dx.doi.org/10.2307/2552025

Phillips, A. (1958). The Relationship between Unemployment and the Rate of Change of Money Wages in the United Kingdom, 1861 – 1957. *Economica*, 25, 283-299. http://dx.doi.org/10.2307/2550759

Pilinkus, D., & Boguslauskas, V. (2009). The Short-Run Relationship between Stock Market Prices and Macroeconomic Variables in Lithuania: An Application of the Impulse Response Function. *Inzinerine Ekonomika-Engineering Economics*(5), 26-33.

Reich R. (1992). The Work of Nations. Preparing Ourselves for 21-st Centure Capitalism. New York. P.331.

Ritzer G. (2007). The Globalization of Nothing-2. Pine Forge Press, California, US. P.241.

The World Bank. (2009). Knowledge in Development Notes. Washington. P.11.

Trahtenberg, I. (1962). Money Circulation and Credit under Capitalism. Moscow. P.779.

World Economic Outlook. (2006). *IMF*. Washington, DC. P.218.

World Economic Outlook database. (2007). *IMF* (www.imf.org).

Jurij Kochetkov

Šiuolaikinis infliacijos ir nedarbo tarpusavio ryšio Latvijoje modelis

Santrauka

Finansinės rinkos, kuri yra sudėtinė pasaulinės rinkos dalis plėtra XXI amžiaus pradžioje tęsėsi. Globalizacijos procesas didina ne tik finansinius srautus bet ir sudaro sąlygas suvienodinti palūkanų normas visose pasaulio šalyse. Šalių ekonomikos, įskaitant Latvijos, vis labiau yra įtraukiamos į pasaulinę ekonominių santykių sistemą. Tai didina jų tarpusavio priklausomybę vienai nuo kitos ir daro įtaką kainoms. Pasaulinė užsienio prekyba ir valiutų rinka sparčiai didėja. Tokiu būdu, per 15 metų, pradedant nuo 1989, vidutinis metinis pasaulinės prekybos prekėmis ir paslaugomis greitis buvo 6.4 %, o pasaulinės valiutų rinkos apyvartos didėjimas buvo 8 % per metus. Finansų srities globalizacija iki tam tikro lygio riboja šalių finansinės politikos nepriklausomybę. Šalys turi priimti sprendimus atsižvelgdamos į pasaulinės ekonomikos ir finansų rinkų plėtrą. Pirmiausia turi išnagrinėti pasaulio finansų lyderių – JAV, Europos Sąjungos, Japonijos ir Kinijos veiksmus. Globalizacija padeda stabilizuoti šalių monetarinę politiką, siekti kainų stabilumo ir mažinti infliacijos tempus. Nėra bendrai priimtos sąvokos infliacijai apibūdinti. Dažniausiai infliacija laikoma stabilus, besitęsiantis kainų didėjimas. Tačiau, toks apibūdinimas neatskleidžia infliacijos esmės. Daugybė ekspertų infliaciją laiko sudėtingu įvairiapusiu procesu, kuris priklauso ne tik nuo ekonominių, bet taip pat ir nuo socialinių ir politinių priežasčių. Infliacijos teorijoje nagrinėjamas trijų jos komponentų vieningumas: valiutos cirkuliacijos perviršis; pinigų nuvertėjimas; pajamų, nuosavybės perskirstymas bei grynojo uždarbio smukimas. Vienas iš svarbiausių šalių vyriausybių ir daugumos pasaulio šalių centrinių bankų tikslų yra sumažinti infliaciją dėl jos neigiamos įtakos ekonomikai. Tyrimai parodė, kad išsivysčiusiose šalyse didesnė nei 3% infliacija labai sulėtina ekonomikos augimo tempą. Didėjant ekonomikos nepatikimumo laipsniui, didesnė infliacija gali privesti prie to, kad pinigai praras savo mainų ir vertės išsaugojimo priemonės funkcijas. Vykstant finansinei globalizacijai, pasaulinė infliacija pradėjo mažėti ir 2007 metais sudarė 4-5 %, o išvystytose pramoninės rinkos ekonomikose ji sudarė 1-3 %. Kita vertus, nacionalinės ekonomikos ir finansinės sistemos tapo labai nuolaidžios išorinei finansinei įtakai. Problemos, susijusios su infliacija, visada sulaukdavo atidaus šalių vyriausybių ir centrinių bankų dėmesio. A. Phillips nustatė neigiamą koreliaciją tarp infliacijos tempo ir nedarbo tempo. Remiantis *Phillips* kreive, buvo padaryta klaidinga išvada, kad didėjant infliacijai yra įmanoma sumažinti nedarbą. Praktikoje tai nepasitvirtino. Egzistuoja hipotezė, kad nedarbas turi tam tiktą „natūralų" *Infliacijos negreitinantį bedarbystės tempą* (*plg. angl. - Not Accelerating Inflation Rate of Unemployment*) (NAIRU). Šiais laikais *Phillips* kreivė (1958) yra nagrinėjama platesne prasme kaip sudėtingas įvykis, atsirandantis esant pinigų neutralumo trūkumui ekonomikos procese. Daugeliu atžvilgiu egzistuojančią priklausomybę tarp infliacijos tempo ir nedarbo tempo apibūdina struktūrinės ekonomikos savybės. Šio tyrimo objektas yra tarpusavio ryšys tarp infliacijos ir nedarbo Latvijoje. Šio *tyrimo tikslas* – tarpusavio ryšio tarp infliacijos ir nedarbo Latvijoje analizė, „natūralaus" nedarbo tempo įvertinimas. Anksčiau šie tyrimai nebuvo atlikti. Panaudojant statistinius Latvijos duomenis ir analizę, parodoma galimybė naudoti šiuolaikinius matematinės regresijos modelius tiriant makroekonominius rodiklius. Tyrimo metodai – matematinis modeliavimas, koreliacijos ir regresijos analizė.

Latvijoje sisteminė nedarbo apskaita atliekama nuo 1996. Tarpusavio ryšio tarp infliacijos tempo ir nedarbo laiko serijų analizei buvo apskaičiuota ir įvertinta nelinijinės regresijos lygtis – kvadratinė parabolė. Infliacijos tempas paimtas kaip atstojamasis rezultantas **y**, daugiklis rezultantas **x** – nedarbo tempas. Nagrinėjamas laikotarpis nuo 1996 iki 2008 metų. Neigiama koreliacija tarp infliacijos ir nedarbo atsiranda visu nagrinėjamu laikotarpiu. Klasikinės *Phillips* kreivės nėra, kaip ir daugelyje kitų šalių. Tačiau, laikotarpiu nuo 1999 iki 2008 metų, neigiama koreliacija pasireiškia tokia, kaip *Phillips* kreivėje. Tokį koreliacijos tarp infliacijos ir nedarbo pokytį iš teigiamos į neigiamą 1998-99 laikotarpiu aiškiai paaiškina makroekonomikos pokyčiai ir plėtros ypatumai Latvijoje. Norint nustatyti infliacijos ypatumus Latvijoje, reikėjo laikotarpį nuo 1999 iki 2008 metų analizuoti atskirai. Šiam laikotarpiui geriausią apytikslio skaičiaus kokybę duoda nelinijinės regresijos lygtis kvadratinės parabolės forma. Jei nagrinėsime porinę linijinę regresiją, ji bus išreikiama kita lygtimi. Tokiu atveju skirtumas (R^2 - r^2) neviršija 0.1. Todėl analizei naudojama paprastesnė linijinė regresija. Čia aiškiai matoma neigiama koreliacija tarp infliacijos tempo ir nedarbo tempo. Norint patikrinti regresijos modelių kokybę, buvo atlikta koreliacijos ir regresijos analizė. Apskaičiuotas indeksas ir apibrėžimo koeficientas abiem atvejais rodo gana gerą regresijos modelių kokybę: remiantis jais galima paaiškinti atitinkamai 70% ir 60% infliaciją. Remiantis modelių indeksu ir koreliacijos koeficientu r, infliacijos tempo priklausomybė nuo nedarbo tempo Latvijoje yra didelė ir nuosaiki. Priderintas nustatymo indeksas (koeficientas) buvo apskaičiuotas atsižvelgiant į nepriklausomų kintamųjų skaičių modeliuose. Priderinto indekso ir nustatymo koeficiento vertės taip pat parodo gana gerą pasirinktų modelių kokybę. Norint patikrinti modelių tinkamumą empiriniams duomenims, buvo atlikta liekanų e_i analizė. Liekana yra tikrojo priklausomojo kintamojo **y** vertės vedinys iš to paties kintamojo vertės, gautos skaičiuojant pagal regresijos lygtį. Pasirodo, kad stiprios regresijos lygties vertės klaidos Se yra mažesnės negu atitinkamai apskaičiuotos vidurinio kvadrato atstojamojo rezultanto σ_y išvestinė. Galima sakyti, kad abu regresijos modeliai tinka empiriniams duomenims ir tinka naudoti. Norint patikrinti regresijos lygčių bendrą tinkamumą, buvo patikrinta tokia hipotezė $H_o : \rho^2 = 0$, $H_1 : \rho^2 > 0$, kur ρ – bendrosios visatos patikrinamas koreliacijos koeficientas. Skaičiuojant (ANOVA analizė) yra nustatyta, kad F-testo (p) reikšmė abiem atvejais yra gerokai mažesnė, negu numatytas lygis α=0.05. Todėl nulinė hipotezė H_o

buvo atmesta: regresijos lygtis statistikai prasmingai paaiškina atstojamojo rezultato (infliacijos) pokyčius. Tai taip pat buvo patikrinta naudojant *Fisher-Snedecor* paskirstymą. Taigi abu modeliai numato alternatyvią hipotezę statistinei reikšmei visose stipriose regresijos lygtyse, kuriose α=0.01. Kol buvo baigiama laiko serijų dinamikos analizė, buvo atliktas patikrinimas ar egzistuoja autokoreliacija liekanose, kuri pirmiausia yra susieta su autoregresyviu procesu. Siekiant patikrinti pagrindinę hipotezę $H_o : ρ = 0$, buvo panaudota *Durbin-Watson* testo statistika. Analizė parodė, kad šiuose modeliuose nėra autokoreliacijos, analizei galima naudoti ekonometrinius modelius. Taip pat buvo gauta ir išanalizuota daugkartinė linijinė infliacijos autoregresijos lygtis. Norint nustatyti NAIRU Latvijoje, paskutinė lygtis buvo pakeista. Baigiant buvo gauta, kad „natūralaus" nedarbo tempo įvertinimas Latvijos ekonomikai yra gana didelis 16%. Išvystytų rinkų ekonomikose NAIRU yra daug mažesnis. Vadinasi egzistuoja makroekonominės plėtros disproporcijos ir trūkumai. Tai patvirtina labai nepalankios finansinės ir ekonominės krizės Latvijoje pasekmės. Be to, po 2004 REER remiantis ES Statistikos departamento duomenimis, Latvijos konkurencingumo *Eurostat* indeksas labai greitai didėjo, lyginant su Suomijos, Švedijos ar Vokietijos indeksais. Tai parodo valstybės konkurencingumo kritinės padėties praradimą. Todėl 2008 metais Latvijos konkurencingumas sumažėjo beveik 40 % palyginti su 2004 metais. Daugybė makroekonomikos ekspertų tiki, kad Latvijai reikia „pramoninės revoliucijos" norint pabrėžti pramonės šakų, eksporto plėtros pirmenybę. Taip pat būtini pokyčiai valdyme, švietime, turi būti patrauklios investicijos kuriant aplinką. Tarpusavio ryšio tarp infliacijos ir nedarbo Latvijoje analizė (kuri buvo atlikta remiantis matematinės regresijos modeliais pakankamai efektyviai atitinkančiais empirinius duomenis), rodo galimybę sėkmingai taikyti tokius modelius makroekonomikos rodiklių analizei ir tyrimams.

Dabar paslaugos Latvijos BVP sudaro daugiau nei 70%. Pramonės dalies BVP, priešingai negu išsivysčiusiose šalyse, sumažėjo beveik 3 kartus po 1990 metų (CSB, 2008). Remiantis *Eurostat* duomenimis apie žmonių, užimtų aukštųjų technologijų gamyba, skaičių, Latvija užima vieną iš paskutinių vietų ES, nusileisdama Lietuvai ir Estijai. Todėl, pavyzdžiui, ataskaitoje apie pasaulio konkurencingumą pagal *Pasaulinio ekonomikos forumo* (*plg. angl.* - World Economic Forum) (WEF) duomenis, 2005 metais Latvija užėmė 44 poziciją tarp daugiau kaip 100 šalių (Estija buvo 20-a, Lietuva – 36-a). Nepriklausomybės metais Latvijoje labai padidėjo prekių dalies BVP (beveik 4 kartus), išsivysčiusiose šalyse ji sumažėjo. Remiantis JT ekspertiniu įvertinimu (UNDP Human Development Report) Latvija yra priskirta prie mažiau išsivysčiusių šalių, turinčių vidutinį išsivystymo lygį, todėl Latvija atsilieka nuo Estijos ir Lietuvos. Siekdamos sumažinti riziką, susijusią su neužtikrintumu dėl ateities, išsivysčiusių šalių vyriausybės planuoja taip, kad vietinio lygio vadovai ir privatus sektorius turėtų galimybę priimti tam tikrus sprendimus. Infliacija yra makroekonomikos kategorija. Todėl, kaip atsakas į finansinę globalizaciją XX amžiaus pabaigoje, norėdamos sukurti palankias sąlygas ekonomikos plėtotei, daugelis šalių pradėjo atsisakyti piniginių atsargų ir valiutos kurso planavimo, bet įvedė infliacijos planavimo mechanizmą. Monetarinė infliacijos planavimo politika tapo populiari paskutiniame XX amžiaus dešimtmetyje ir yra efektyviausia priemonė kovoje su didėjančia infliacija. Nėra aiškaus infliacijos planavimo politikos apibrėžimo, tačiau egzistuoja keletas privalomų reikalavimų, sudarančių planavimo režimo pagrindą. Pagrindinis dalykas yra tai, kad kainos stabilumo pasiekimo ir išsaugojimo problema tampa prioritetine, lyginant su kitais valstybės centrinio banko tikslais ir problemomis. Norint realizuoti infliacijos planavimo režimą, būtina įvykdyti keletą sąlygų. Centrinio banko nepriklausomybė ir monetarinės politikos atskaitomybė turi būti aukšto laipsnio, turi nebūti piniginių atsargų ir valiutos kurso planavimo. Dauguma mažiau išsivysčiusių šalių, įskaitant Latviją, monetarinėje politikoje naudoja „inkarą" valiutų kurso forma. Infliacijos planavimo režimo įdiegimas Latvijoje yra daug sunkesnis, nes gyventojų pasitikėjimo lygis vyriausybės ekonomine politika yra mažas, dėl ko sustiprėja infliacijos tikimybė.