

Radionova I.F.,
D.Sc. (Economics), Professor,
Kyiv National Economic
University named after Vadym Hetman,
Kyiv, Ukraine

THE STABILIZATION OF THE NATIONAL ECONOMY IN TERMS OF MACROECONOMIC MODELS WITH IMPLEMENTED RULES

Summary. *This article is devoted to the issue of macroeconomic models application. It makes an assumption regarding the practical utility of theoretical models with implemented rules for the national economy stabilization. Thus, the IS-PC-MR model with MR monetary rule has been interpreted and the IS-DC-FR model theoretical construction with FR financial rule has been offered. Therefore, the article defines the steps of stabilization programs improvement based on the models with implemented policy rules.*

Key words. *Stabilization policy, macroeconomic models, policy rules, targeting variables, endogenous and exogenous shocks.*

Formulation of the issue. The governments objectively regard the stabilization programs for national economies with critical imbalances as priority tasks. The Ukrainian economy of the second half of 2010s is critically unbalanced and unstable. This implies a dangerously high debt-to-GDP ratio, galloping inflation, permanent hryvnia exchange rate jumps, and low rates of economic recovery after a significant GDP fall in 2015. The stabilization measures of the Ukrainian government do not provoke public confidence. According to the authoritative Razumkov Center Ukrainian Sociological Service, at the end of 2017 73.1% of citizens did not trust the Ukrainian government, and 75.2% – the National Bank of Ukraine (NBU) [1]. Under such circumstances, the question ‘how to act?’ becomes of particular relevance. A well-known saying ‘If you do not know how to act, act by law’ in relation to government stabilization programs can be rephrased as follows: ‘If you do not know how to act, act by algorithms and rules which derive from theoretical macroeconomic models.’ We assume, that the permanent testing of macroeconomic models to learn whether they are suitable for application in order to substantiate macroeconomic stabilization, is an urgent issue.

The analysis of last researches and publications. Modern Macroeconomics takes advantage of dozens of theoretical macroeconomic models of various kinds, suitable for use in the process of stabilization programs substantiation. In particular, the cyclical fluctuation models utility is associated with the emphasis on the probable causes of deviations from the established trends. The theoretical arsenal of the investigated causes is extremely diverse and is represented by phenomena from different spheres: innovational, monetary, financial, international economy etc. At different times the innovations intensity (J.A.Schumpeter [2]) and the innovative accelerator (R. Frisch [3]), monetary base fluctuations (M.Fridman, A. Schwartz [4]) and

monetary and price disturbances (R. Lukas [5]), financial assets overstatement and debt financing (H.P.Minsky [6]), the growth of external debt and 'cross-country financial impacts' of interconnected economies («OECD's new global model» [7]) etc. were recognized as such phenomena-reasons.

The practical utility of shocks (impulses) influences models for the stabilization programs is connected with generalizations on economic transmission. The division of economic shocks into endogenous, which determine the internal nature of economic fluctuations, and exogenous, which display the government's intentions to change the economic situation, has become methodologically important. The endogenous shocks of aggregate demand and aggregate supply are revealed in many macroeconomics textbooks, for example, in the classical textbook of R. Dornbusch, St. Fisher [8]. Exogenous shocks, or macroeconomic policy shocks, are being explored by many analysts from international (IMF) and national governmental institutions, such as, for instance, Berg A., Karam Ph, Laxton D. [9], Murray J. [10], Niedermayer L. [11].

Identification of previously unsolved parts of the general issue which are disclosed in the article. The least solved part of the general issue is attributed to the macroeconomic models with macroeconomic policy implemented rules. Despite the fact that policy rules have been actively explored since the 1990s (see, for example, [12]), their formalization and 'fitting' into the logic of macroeconomic models require additional research efforts.

Purpose of the article. The purpose of this article is to summarize the achievements regarding policy rules implementation into the general equilibrium models, the creation of a new theoretical design and the testing of the ability of models with the implemented rules to explain the real situation, creating theoretical basis for the stabilization program.

Main results of the research. The study of macroeconomic models with implemented policy rules involves the clarification of the content of 'policy rules' notion. We consider, it is expedient to distinguish between the two sides of this content. On the one hand, the policy rules have an objective basis - the interconnections of macroeconomic variables, without which the economy loses integrity. On the other hand, the rules implementation implies their institutionalization – public recognition and determination of national regulators (the National Bank, the Ministry of Finance, etc.) responsibility.

Targeting is becoming an important moment in policy rules institutionalization and covers fixing as a desired goal of a government as regards certain quantitative values of macroeconomic variables: inflation level, national currency rate, money supply growth, budget deficit-to-GDP and public debt-to-GDP ratio, etc. Targeting is not always implemented in its classical form. However, even the official recognition of algorithms for assessing certain phenomena (for example, inclusive growth [12]) or critical values of macroeconomic indicators (for example, those necessary to determine the level

of national security [13]) already means a certain level of rules institutionalization.

The implementation of policy rules into the general equilibrium model is known to be the New Keynesian Economics property. Following the well-known article by R. Clarida, J. Gali J., M. Gertler M. [14], the toolkit of macroeconomic analysis was renewed with a basic model consisting of three equations: (1) Taylor rule, (2) New Keynesian Philips curve, (3) dynamic IS curve:

$$i_t = \pi_t + r_t^* + \alpha_\pi (\pi_t - \pi_t^*) + \alpha_y (y_t - y_t^*) \quad (1)$$

$$\pi_t = \beta E_t(\pi_{t+1}) + k y_t \quad (2)$$

$$y_t = y_{t+1} + \frac{1}{\sigma} (i_t - E_t(\pi_{t+1})) + v_t \quad (3)$$

Every equation reflects an idea, important for stabilization mechanism implementation:

- (1) Taylor rule – implies that the short-term nominal interest rate i_t should depend not only on the inflation rate (π_t) and the equilibrium real interest rate (r_t^*), but also on the deviation of the actual inflation level from the expected one ($\pi_t - \pi_t^*$) and on actual GDP growth determined by the linear trend ($y_t - y_t^*$);

- (2) New Keynesian Philips curve: contains an idea of inflation determination in a short-term period (π_t) by the expectations as regards the prices in the next period $E(\pi_{t+1})$ and by current GDP (y_t);

- (3) dynamic IS curve: is based on the fact that the current GDP (y_t) is determined by the existing GDP changes trend (y_{t+1}) and depends on the interest rate (i_t) (with due account of the expectations regarding the future inflation $E(\pi_{t+1})$) and on unforeseen (stochastic) influences (v_t).

The simpler and more suitable for application New Keynesian model variant is represented by the *IS-PC-MR* model construction, which is considered, for instance, in the work by Carlin W., Soskice D. [14]. *IS-PC-MR* model has a potential to explain the situation and substantiate stabilization mechanisms for several reasons:

- it is based on the assumption that after disequilibrium due to certain disturbances (shocks) it is possible to return to an equilibrium,

- it consists of the functions which are presented as dependencies between the gaps of macroeconomic variables, the increase of which may be interpreted as destabilization, and the decrease, on the contrary, as stabilization,

- it contains a function that reveals the content of the monetary rule (*MR*) with a variable of the inflation (π^T) targeted by the national bank, which offers an opportunity to predict the direction of national regulator stabilization actions.

The *IS-PC-MR* model encompasses three equations, which like the equations in the basic New Keynesian model, reflect the relationships between the gaps of macroeconomic variables. Actual and equilibrium GDP gap ($Y - Y^e$), actual and stabilization interest rate gap ($r - r_s$), actual and previous inflation period gap ($\pi - \pi_{-1}$), actual and targeting inflation gap ($\pi - \pi^T$) are meant:

$$\text{IS: } Y - Y^e = -\alpha(r - r_s) \quad (4)$$

$$\text{PC: } \pi - \pi_{-1} = \beta(Y - Y^e) \quad (5)$$

$$\text{MR: } Y - Y^e = -\gamma(\pi - \pi^T) \quad (6)$$

(where α, β, γ – are the coefficients of dependence between the changes (gaps) of corresponding variables).

Obviously, the model equations are consistently interconnected by three variables and formed a system. Therefore, they can be used to explain stabilization steps logic. If, for instance, inflation exceeded the targeting level, the logic of the following relationships might look like this:

$$\text{if } \pi > \pi^T, \text{ then } r \uparrow \rightarrow \underbrace{Y^{AD} \downarrow \rightarrow Y \downarrow}_{\text{IS}} \rightarrow \underbrace{\pi \downarrow}_{\text{PC}} \rightarrow \underbrace{Y \uparrow \rightarrow \pi = \pi^T}_{\text{MR}} \quad (7)$$

We emphasize, that such logic is not a ‘pure abstraction’. In particular, the NBU took advantage of it, substantiating the expediency of returning inflation to the targeting level by increasing the discount interest rate. This increase occurred in the second half of 2017. The theoretical principles of this approach are described in the works of NBU analysts S. Nikolaichuk, V. Lepushynskyi, A. Hrui [15] and V. Lepushynskyi [16].

The considered models - basic New Keynesian model and its variation IS-PC-MR - concern monetary policy and monetary rule, related to inflation targeting. The substantiation of financial stabilization measures considering the financial rules as well became urgent at the beginning of the XXI century. According to IMF analysts researches, governments use four types of financial rules, which focus on different elements of public finances, namely: Debt Rule, Balance Rule, Expenditure Rule and Revenue Rule. At the same time, several financial rules can be used, but the vast majority of countries (up to 80%) use rules related to public debt and state budget balance [17; 9].

The works of Ph. Engler, J. Tervala [17] and Ph. Engler, M.Klein [18] have disclosed the issue of economy stabilization regarding financial rule implementation background. For our research they are interesting, because contain the analysis of contradictions, which have emerged in the EU Member States economies after 2008 financial crisis. The essence of the contradiction is that in the recession period fiscal policy should not be restrictive, because it should stimulate the exit from the recession. Instead, it should be restrictive in the view of financial consolidation general rules adopted in the EU. The purpose of the latter is to reduce debt-to-GDP ratio and deficit-to-GDP ratio to a targeting secure level. Researchers have proved, that in three EU countries - Italy, Spain and Portugal - the threat of a return to the recession appeared due to the use of rigid restrictive financial measures. The authors make an interesting conclusion regarding the expediency of stimulating financial measures combination during a recession period with the reforms in other spheres (tax, pension, administrative) precisely to prevent the deviation from the financial indices targeting values. Consequently, the introduction of financial rules in

macroeconomic equilibrium models has not only a theoretical, but also a significant practical value.

Using the IS-PC-MR model approach, we offer a theoretical design named IS-DC-FR model (function DC – from Debt Curve, function FR – from Fiscal Rule).

The offered IS-DC-FR theoretical design is based on the following assumptions:

- FR fiscal rule as well as DC debt function can be deduced from the so-called ‘budget restriction’ and relate to the provision of public debt non-growth. The logic of this deduction is the following:

$$\text{budget restriction } G + i \times B = T + \Delta B \rightarrow \frac{\Delta B}{P \times Y} = \frac{G - T}{P \times Y} + i \frac{B}{P \times Y} \rightarrow \Delta b = d + i \times b.$$

$$\text{Whereas } b = \frac{B}{P \times Y}, \text{ to } \Delta B = bY\Delta P + bP\Delta Y + PY\Delta b \rightarrow \frac{\Delta B}{PY} = \frac{bY\Delta P}{PY} + \frac{bP\Delta Y}{PY} + \frac{PY\Delta b}{PY} \rightarrow$$

$$\Delta b = d + b(i - \pi - g_Y) \quad \Delta b = d + b(r - g_Y)$$

Considering that the public debt non-growth is becoming an objective purpose of governments in destabilized economies, ($\Delta b = 0$), the connection of four macroeconomic variables is described by the equation: $b \leq \frac{d}{g_Y - r}$ (where b ,

d – respectively, the shares of public debt and budget deficit in GDP, g_Y – economic growth rate, r – the real percentage of public debt servicing),

- financial market interest rate (r) from IS function correlates with public debt servicing interest rate (r) and therefore can be identified with it for the purpose of theoretical construction development.

Two important conclusions for FR and DC functions formalization follow from the equation $b \leq \frac{d}{g_Y - r}$ (8): public debt share (b) is *inversely* related to the economic growth rate (g_Y) and is directly related to the debt servicing interest (r). Taking into account everything mentioned above, IS-DC-FR model can be represented by three equations:

$$\text{IS: } Y - Y^e = -\alpha(r - r_s) \quad (9)$$

$$\text{DC: } r - r_s = \delta(b - b_s) \quad (10)$$

$$\text{FR: } b - b_s^T = -\varepsilon(Y - Y^e) \quad (11)$$

(where δ , ε – the relationships coefficients between the changes (gaps) of corresponding quantities).

The logic of connections in case of exceeding the targeting (stabilizing) value of public debt share may look like this:

$$\text{if } b > b_s^T, \text{ then } Y^{AD} \uparrow \rightarrow \underbrace{Y \uparrow \rightarrow r \downarrow}_{\text{IS}} \rightarrow \underbrace{b \downarrow}_{\text{DC}} \rightarrow \underbrace{Y \uparrow}_{\text{FR}} \rightarrow b = b_s^T \quad (12)$$

Graphical visualization of the macroeconomic policy exogenous shock consequences in terms of IS-PC-MR and IS-DC-FR models is depicted in Fig. 1a) and 1b). It is assumed that the equilibrium disturbance occurred due to the additional expenses impulse.

The additional expenditure impulse on both figures is represented by the *IS* function right-side shift. It violates the stability since it causes *r* interest rate increase. In both cases the result is the targeting indices values actual excess: $\pi > \pi^T$, $b > b^T$. The difference in stabilization processes is related to the fact that:

- according to the logic of *IS-PC-MR* model, higher than stabilizing (taking into account the Phillips curve in the long period (*VPC*)), interest rate ($r_2 > r_{s1}$), ‘triggers’ the mechanism of returning inflation to the targeting level in the manner represented by the logical chain (7),

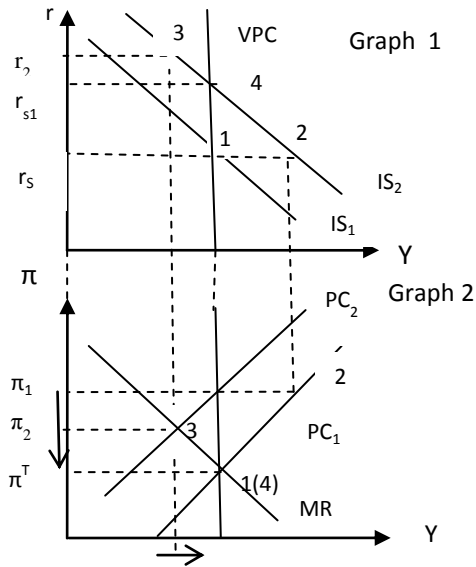


Fig 1a). The stabilization algorithm under additional expenditure impulse in terms of *IS-PC-MR* model

(developed by the author using the source [14])

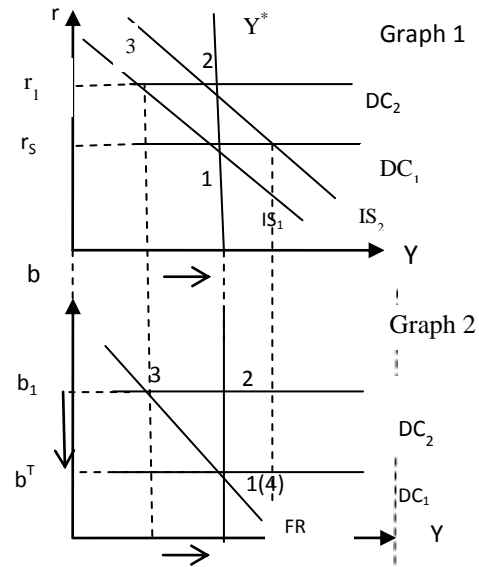


Fig 1b). The stabilization algorithm under additional expenditure impulse in terms of *IS-DC-FR* model (developed by the author individually)

- according to the logic of *IS-DC-FR* model, against the background of aggregate demand growth, under the condition of economy real sector reforming, the mechanism of returning the output, lost due to the growth of the interest rate (*r*), to the potential GDP level (Y^*) is launched. The return of the public debt-to-GDP ratio to the targeting level may occur in accordance with the logical chain (12).

An important point in applying macroeconomic models is their verification. We have made an attempt to verify the character of the connections of variables gaps, considered in the *IS-PC-MR* model, according to the Ukrainian data [20]). In particular, the connections of variables gaps with the *MR* monetary rule function looks like this (Fig. 2).

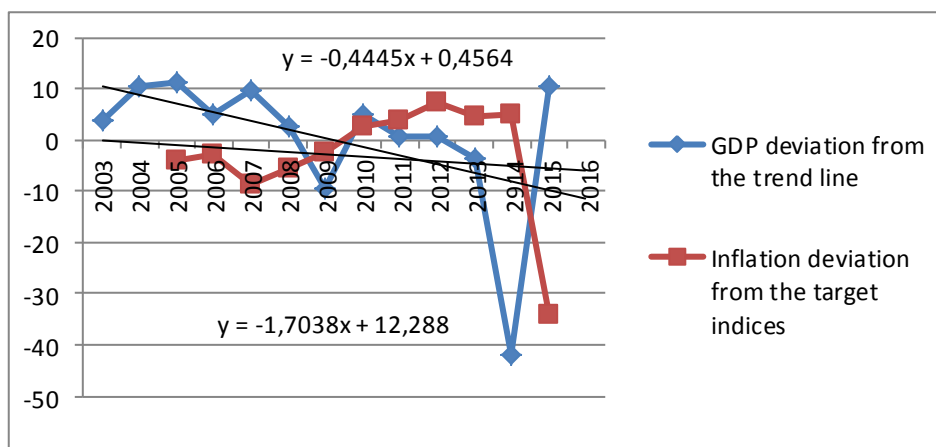


Fig. 2. **The dynamics of GDP and inflation gaps represented by MR function** (developed by the author individually and presented in the source [20] for the first time)

The graph illustrates the fact that both gaps – GDP and inflation – changed over the analyzed period in one direction: their linear trends in time were decreasing. This contradicts the content of the monetary rule, according to which the change in GDP and the change in inflation must be divergent. If our conclusions are correct, such character of the actual dependencies of the mentioned variables casts a doubt on the realistic expectations regarding the possibility to influence the inflation decrease to a targeting level by means of interest rate increase.

Conclusions. The application of the macroeconomic models with implemented policy rules for the national economy stabilization programs development involves, at least, the implementation of the following steps:

- expanding the range of theoretical model constructions by creating such which would reflect different versions of financial and monetary rules,
- verification of the data on the actual connections of the variables of those theoretical assumptions and logics, which make up the contents of model constructions, with a view to their objectification,
- definition of algorithms (procedures) regarding the government stabilization programs formation and changes in accordance with developed and econometrically verified macroeconomic models with implemented rules.

References

1. Ставлення громадян України до суспільних інститутів. – Центр Разумкова, 23 жовтня 2017 р. Режим доступу: razumkov.org.ua/.../stavlennia-hromadian-ukrainy-do-suspilnykh-institutiv-elektoral.
2. Schumpeter J.A. Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process. — First edition. — New York ; London: McGraw-Hill, 1939. — 393 p.
3. Frisch R. Propagation Problems and Impulse Problems in Dynamic Economics [Electronic resource]. — Oslo, 1933. — 35 p. — Mode of access: <http://www.sv.uio.no/econ/om/tall-og-fakta/nobelprisvinnere/ragnar-frisch/published-scientific-work/PPIP%5B1%5D.pdf>.

4. Friedman M., Schwartz A. Money and Business Cycles // Review of Economics and Statistics ; University of Chicago and National Bureau of Economic Research. Feb. 1963. — Vol. 45. — No. 1. — Part 2. — p. 24-77.
5. Lucas R.E. Understanding business cycles. Carnegie-Rochester Conference Series on Public Policy, 1977, vol. 5, issue 1, p.7-29. Mode of access: www.clsbe.lisboa.ucp.pt/docentes/.../LucasUnderstanding.pdf.
6. Minsky H.P. Can “It” happen again. Essay on instability and Finance. — Armonk, New York 1982. — 301 p.
7. Herve K., Pain N., Richardson P., Sedillot F., Pierre-Olivier Beffy P.- O. The OECD’s new global model // Economic Modelling, 2011, vol. 28, issue 1, 589-601.
8. Дорнбуш Р. Фишер С. Макроэкономика [пер. с англ.]. — М.: Изд-во МГУ : ИНФРА-М, 1997. — 784 с.
9. Berg A., Karam Ph, Laxton D. Practical Model-Based Approach to Monetary Policy Analysis // IMF Working Papers : Overview. — Washington, March 2006. —No. 06/80. — Pp. 1-45.
10. Murray J. Monetary policy decision making at the Bank of Canada. Bank of Canada Review, Autumn 2013. Mode of access: <http://www.bankofcanada.ca/wp-content/uploads/2013/11/boc-review-autumn13-murray.pdf>
11. Niedermayer L. Notes on the monetary transmission mechanism in Czech economy. BIS Papers No 35. Mode of access: <http://www.bis.org/publ/bppdf/bispap35j.pdf>
12. Taylor J. Discretion versus policy rules in practice // Carnegie – Rochester Conference Series in Public policy, 1993. Mode of access:: web.stanford.edu/~johntayl/Papers/Discretion.PDF
13. The Inclusive Growth and Development Report 2017. Published by the World Economic Forum. Mode of access: [http://www3.weforum.org/docs / WEF_Forum_IncGrwth_2017.pdf](http://www3.weforum.org/docs/WEF_Forum_IncGrwth_2017.pdf)
14. Clarida R., Gali J., Gertler M. Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory The Quarterly Journal of Economics, Vol. 115, No. 1 (Feb., 2000), pp. 147-180
15. Nikolaichuk S., Lepushynskiy V., Hruy A. Equilibrium Real Interest Rate in the Case of a Small Open Economy: Application for Ukraine. October 6th, 2017. Access mode: https://bank.gov.ua/control/uk/publish/article?art_id=56876292
16. Lepushynskiy V. Decision-making on Monetary Policy in the NBU. May 17th, 2017. Access mode: <https://bank.gov.ua/doccatalog/document?id=49122260>
17. Cottarelli C. Fiscal Rules—Anchoring Expectations for Sustainable Public Finances. Prepared by the Fiscal Affairs Department IMF. December 16, 2009. Mode of access: <https://www.imf.org/external/np/pp/eng/2009/121609.pdf>
18. Engler Ph., Tervala J. Hysteresis and Fiscal Policy. DIW Berlin. German Institute for Economic Research. 2016. Mode of access: <https://www.diw.de/>

documents/.../73/diw_01.../dp1631.pdf

19. Engler Ph. and Klein M. Austerity measures amplified crisis in Spain, Portugal, and Italy. DIW Berlin. German Institute for Economic Research. 2017. Mode of access: https://www.diw.de/.../73/.../diw_econ_bull_2017-08-1.pdf

20. Макроекономічна політика у макроекономічній стабілізації національної економіки : монографія / за наук ред. проф. І.Ф.Радіонової. – К.: Університет економіки та права «КРОК», 2017. – 240 с.

Shvidanenko O.A.,
doctor of economic sciences, professor,
Kyiv National Economic University
named after Vadym Hetman,
Kyiv, Ukraine

Busarieva T.G.,
PhD, associate professor
Kyiv National Economic University
named after Vadym Hetman,
Kyiv, Ukraine

IMPERATIVES OF THE FORMATION OF THE INFORMATION ECONOMY

Summary. The article is devoted to the complex analysis of the stages of formation and development of the information economy. The work presents a comparative characteristic of the industrial, postindustrial and informational society. The system characteristics that are inherent to the information economy in modern conditions are investigated.

Key words: information economy, formation, paradigm, technology, information.

Formulation of the problem. Despite the extensive conceptual base of the analyses concerning the development of the information economy, many theoretical and methodological issues remain controversial and require further clarification and justification, in particular, the imperatives of the formation of the information economy.

Analysis of recent research and publications. Among authors, whose works largely represent the development of modern stage of informative economy as the separate component part of economic science, it is necessary first of all to distinguish the following, such as D. Bell, T. Gryhiles, U. Dyzard, J. Martine, E. Masudu, F. Makhlop, E. Mansfield, R. Nelson, I. Nikolov, T. Stouniere, E. Toffler, J. Schumpeter, J. Ellul, A.B. And. Anchishkina, LL Veger, LM Gatovsky, LS Glyazer.

Formulation of the aim. The aim of this article is the exposure of the features and structural transformations of the formation of informative economy and factors of its development.