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FINANCIAL POLICY RULES IN THE EDUCATIONAL SPHERE: SUBSTANTIATION ALGORITHM

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The purpose of the article is to substantiate the educational sphere financial rules, what can answer the question of how education financing indices must change under the alteration of macroeconomic indices, which determine the national economy state. The authors are investigating the issue regarding the substantiation and specification of educational sphere financial rules and related public administration benefits. The research has applied the fiscal and monetary rules analysis methodology. The applied result of the education financing rules substantiation issue research consists in the application of the algorithm, which covers 5 stages: rules idea formulation, the assessment of variables relationships significance according to the rules idea, the selection of endogenous and exogenous variables with significant relationships, the definition of gaps between the actual and trend values of the selected variables, the derivation of the equation of dependencies between the gaps.

Key words: government policy rules, monetary, fiscal rules, educational sphere.
JEL Codes: E62, G28, I22.

1. Introduction

The public administration system covers a complex and manifold toolkit of influence upon the national economy. Monetary and financial rules are regarded as this system element. The governments obey them to achieve macroeconomic stability and sustainable economic growth. In order to become an effective regulatory tool, the rules have to be substantiated or, in other words, derived. And macroeconomics has a decisive role in this substantiation.

It is important to develop and implement financial rules for different spheres, and for the national education sphere in particular, for the economy public administration system of any country. The Ukrainian education has been experiencing reforms for two decades. The development of the education financing effective mechanism, which would meet the European standards, is regarded as this reforming priority direction.

The approach to macroeconomic analysis from the standpoint of policy rules was initiated by prominent macroeconomists back in 1950s. We mean the works of Friedman (1951), Phillips (1954), Baumol (1961). Despite the long research period the macroeconomic policy rules issue remains relevant at the beginning of the XXI century. We consider the need of these policy rules permanent specification, modification under the new conditions and specialization to be one of the reasons of the constant theoretical and applied interest in them. Such specialization may have respect to separate spheres, and educational sphere in particular. This article gives prominence to educational sphere financial rules substantiation.

The aim of the study

The aim of this study is to solve a scientific issue regarding the substantiation of the approach to educational sphere financing rules definition. The consideration of these rules content becomes an important element of any national economy public government with due regard to education particular role. After all, modern economies have acquired the features of "knowledge economies", "innovation economies", "information economies". The defined aim of the study is particularly relevant for the national economies with incomplete institutional reforms, which include the Ukrainian economy. This is explained by the fact, that expedient and predictable (in accordance with the rules) activity of the government in the most important society sphere, i.e. education, can become an engine and marker of real transformations of the whole national economy.

The methodological basic for the research

A series of indisputable ideas, which form the theoretical basis of macroeconomic policy rules analysis, has become the methodological basis of the study. Firstly, the rules have an objective basis in the form of dependencies (ratios, proportions) between macroeconomic variables. The rules can be derived deductively, and then can undergo econometric verification. Secondly, «rules rather than discretion», as it is indicated in the title of a well-known article written by Kydland and Prescott (1977). We mean that the rules are institutionalized, i.e. recognized, by the governments and therefore they are presented in official documents. They are presented as requirements, action algorithms, evaluation indicators etc., and in this role have certain advantages over the discrete (impulsive) actions of the government in response to certain challenges. The rules have advantages over discretionary actions, at least because they guarantee greater predictability of the government actions consequences and specify the responsibility subjects. Thirdly, policy rules are not only an instrument of national economy public management, but also a tool for its analysis. The macroeconomic policy rules, implemented in macroeconomic models, give an opportunity to better understand both the national economy functioning and the government policy effectiveness. The researches of Muscatelli and Trecroci (2000), in particular, disclose the peculiarities of modelling with due consideration of rules. The overwhelming majority of econometric models of the general equilibrium, economic growth cover the policy rules formalized in the form of equations as the component (see, for instance, the study of Mason and Jayadev (2016).

Despite the fact that our study discloses financial rules, we consider it expedient to use the positive experience of monetary rules substantiation and application in macroeconomic analysis.

What combines financial and monetary policy rules? Above all, they are united by the fact, that practically they represent the conscious requirements to governments activity, which have to be accomplished in the process of macroeconomic policy implementation. In other words, both kinds of rules – financial and monetary – are formalized and, mostly, institutionalized governments responsibility.

What distinguishes financial and monetary policy rules?

In the period between the beginning of 1990 and the beginning of 2000 monetary rules became of a great research interest. At that time an active move to inflation indices targeting by the governments of different countries took place. Therefore, along with such variables as economic growth, interest rate and currency rate a targeted (expected) variable emerged in monetary rules. The article of Taylor (1993), which disclosed the monetary policy rules, became one of the most famous and cited works of that period. This article triggered a series of new studies and verifications of a variable, derived by Taylor. This discussion has greatly promoted macroeconomic policy rules theory.

Financial (fiscal) policy rules became of a great interest much later – at the end of 2000–2010. This period involves significant macrofinancial imbalances formation in the national economies of many countries, the financial crisis of 2008–2010, the need to overcome its effects and to prevent new macrofinancial imbalances. The main fiscal policy rules regarding the limitations of budget deficits and EU countries public debt are presented in the official documents of the European Union, in particular, in the so-called "Six Pack" (2011). Fiscal rules institutionalization in the EU has reached the level of a complex procedure all stages specification regarding the influence on the countries, which do not adhere to certain proportions (balances) in the financial sector. This has found a reflection in special EU documents, and namely in “Excessive Deficit Procedure”, “Excessive Imbalances Procedure”.

There is a clear difference between monetary and fiscal rules presentation. Monetary rules are mostly presented as equations with certain quantitative parameters (coefficients at variables). Instead, financial rules are usually presented as critical (which have not to be transposed in the process of financial policy implementation) values of important macrofinancial proportions (balances). Although modern studies of fiscal rules are more focused on variables formalized dependencies, in particular, as it is depicted in the works of Halac and Yared (2017), Elbadawi, Schmidt-Hebbel and Raimundo (2015), Portes and Wren-Lewis (2014).

We consider that fiscal rules theory development and these rules application practice are attributed to these rules presentation in the form of dependencies (equations) between variables similar to monetary rules. There are certain signs of movement in this direction. We mean that the so-called «correction rules», fixed in “Excessive Imbalances Procedure” and annual reports regarding these rules abidance in

"Alert Mechanism Report", are based on the analysis of the dynamics of not only two main financial balances, i.e. state budget deficit share and GDP debt share, but of ten other macroeconomic indices. They include net international investment position, real effective exchange rate, nominal unit labour cost, private sector credit flow, unemployment rate etc. Such approach to the financial sphere analysis within the limits of correction fiscal rules is the actual recognition of interdependence between fiscal and other macroeconomic balances (proportions).

The experience of monetary rules derivation, which has to be an example for financial rules derivation, has been described in the work of Taylor (2000). One of the parts of this work has the corresponding title: "Which is the best policy rule? A common way to pose normative policy questions". Which points of the mentioned work of J. Taylor are important for our study?

Firstly, a standpoint regarding "using policy rules as a way to evaluate policy" has a significant theoretical value. As mentioned before, we consider this standpoint as a methodological basis for our study.

Secondly, Taylor describes monetary rule step-by-step (stagewise) derivation from the very idea of a rule to its formalization in the form of an equation. According to the researcher, in the rule derivation process it is important to implement this rule into corresponding macroeconomic model.

Thirdly, the researcher illustrates various modifications of the same monetary rule from different authors. It turns out that these modifications depend both on the assumptions (ideas), which form the basis for a rule, and on the peculiarities regarding econometric toolkit application. The monetary rule of such a general kind is implied:

$$i_t = g_\pi \pi_t + g_y y_t + \rho i_{t-1}$$

where i_t, i_{t-1} – a nominal interest rate of the current and previous periods respectively, π_t – inflation rate, y_t – deviation of real GDP from potential, g_π, g_y, ρ – coefficients at the corresponding variables.

The modifications of the analyzed monetary rule are revealed in different values of variables coefficients, and namely:

Rule I (Taylor rule, 1992): $i_t = 1.5\pi_t + 0.5y_t$

Rule II (a later specified Taylor rule): $i_t = 1.5\pi_t + y_t$

Rule III (Ball rule, 1999): $i_t = 3\pi_t + 0.8y_t + i_{t-1}$

Rule IV (Rudebush and Svensson rule, 1999): $i_t = 1.2\pi_t + y_t + i_{t-1}$

Rule V (Rotemberg and Woodford rule, 1999): $i_t = 1.2\pi_t + 0.06y_t + 1.3i_{t-1}$

Fixing the differences in variable held coefficients, J. Taylor wittily notes, that they represent macroeconomic policy disagreements.

The works of Taylor and other theorists and practitioners of monetary regulation (for instance, Orphanides (2003)) emphasize the importance of the "idea of the rule". The idea is a peculiar theoretical foundation and an instrument of organizing our ideas about policy rules.

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The education financing mechanism improvement is an urgent issue of developed countries public administration (Strehl, 2007). Some researchers emphasize the determinative role of econometric researches in the process of education financing policy shaping (Agasisti, 2010; Dearden, 2008; de Oliver, 2011).

The research departments of International Organizations are constantly analyzing the financial rules. The recommendations for certain countries or their associations in educational sphere, including the education financing rules, are defined by the World Bank. In particular, in 1991, the Perspectives on Higher Education Financing document was issued (Perspectives on…, 1991), which described the main challenges faced by higher education in developing countries. The document identifies four main principles of the future development strategy, including its financial component. In the early 2000s, the World Bank continued studying the financing of education. The results were presented in Higher Education in Developed Countries document (Higher Education in…, 2000), which clearly formulated the rules of education financial mechanism development.

Following the mandate of the Economic Policy Committee, the Working Group on Quality of Public Finances and the European Commission have focused on the efficiency and effectiveness of expenditure on tertiary education (Efficiency and…, 2010).They formulated the following Funding rules:

- some stability in funding appears necessary: institutions need time to adjust, in particular, when they have limited autonomy e.g. as regards staff policy and they cannot fire or adapt the wages of staff;
- in designing financial schemes, relate funding to the institutions' performance in output terms, rather than relying only in inputs used or in historical trends;
- maintain a balance between input and output indicators to avoid tradeoffs and perverse incentives such as (i) grade inflation in the case of output-oriented funding (where the need for quality control by an external authority may be strong) (ii) incentives to keep students in the education system when funding is based on the number of students – of importance in systems where students persist beyond the usual time of studies.

Government organizations from different countries create documents, based on the results of benchmarking, which regulate the education financing mechanism. The experience in such documents development is important for other countries. In particular, these are Higher Education Financing in Latvia: the Analysis of Strengths and Weaknesses document (Higher Education Financing…, 2014), Assessment of Current Funding of the Model of Strategic Correspondence with the Purposes of Politics in Higher Education Sphere Document (Assessment of…, 2014).

2. Research results and discussion

The assumption regarding the fact, that educational sphere financing rules substantiation involves several iterative steps (stages), has formed the basis of our research. This substantiation should be completed by formalization in the form of equations, in which certain educational sphere financing indicators will appear as endogenous variables.

The fundamental education financing rules idea, as we consider, is related to the answer to the question: what do education financing indices depend on and what can they influence.

Relying upon the existing experience regarding policy rules derivation, we offer the following educational sphere financing rules derivation algorithm (Fig. 1).

The offered rules derivation algorithm encompasses, as it may be seen in Fig.1, five related stages. The sequential implementation of these stages, in our opinion, provides the possibility to get closer to educational sphere financing rules derivation, which will be useful for this sphere management. Further on the sequential implementation of the offered algorithm stages is illustrated.

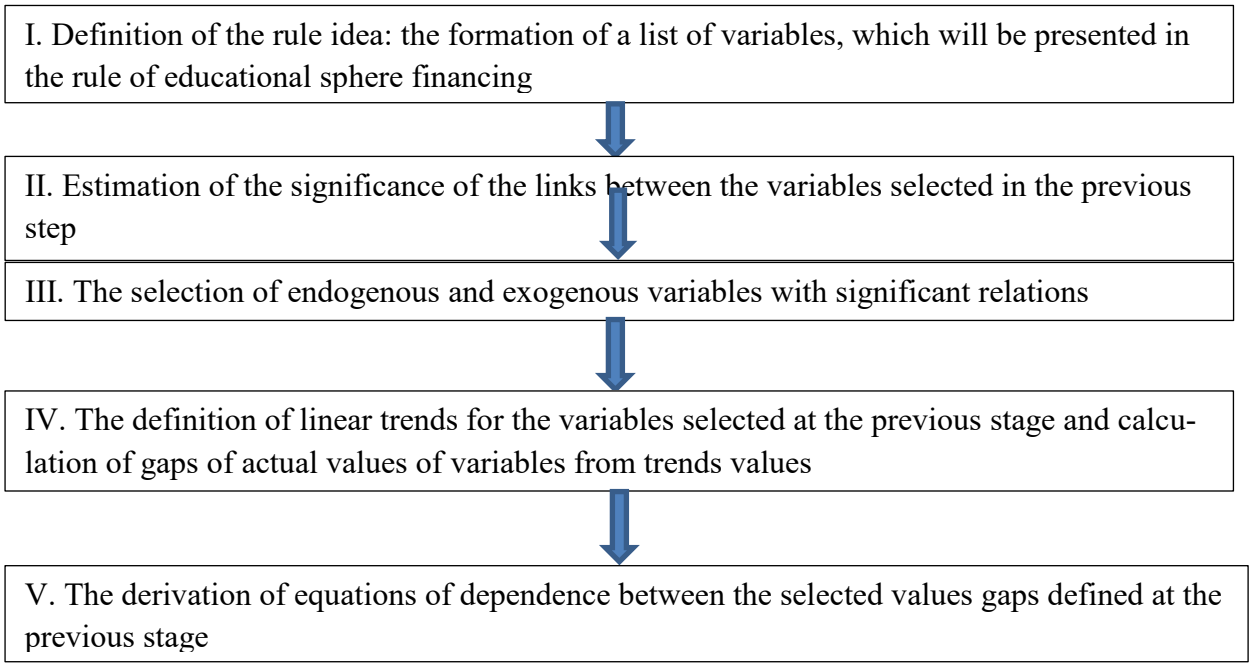

Fig. 1. The stages of educational sphere financing rules substantiation

The first stage. As a foundation of rules derivation process we have taken an idea, that education financing is related at least to national economy macroeconomic stability, to its innovativeness level and age pattern of the population.

Education financing is an indisputable precondition of human capital accumulation. Therefore, numerous works of hundreds of researches testify to the favour of the assumption regarding the connection of education financing with economic growth, labour productivity, economy innovativeness level etc. Human capital tradi-

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tional theory proceeds from the assumption on the decisive role of education in this capital creation (Psacharopoulos and Patrinos, 2004, for a review of the work by Becker, 1964, Schultz, 1971 and Mincer, 1974). Further researches in this field were made by the well-known macroeconomists Romer (1990) and Mankiw (1992). Considering the human capital traditional theory, Cunha and Heckman (2009) developed perspectives for the assessment of politics in educational sphere during a person's lifecycle. Being quite obvious, the assumption regarding the connection between certain aspects of education financing and population age pattern does not require any proof.

Our idea about variables groups, which should be represented in educational sphere financing rules, is formalized in Table 1.

Table 1. Educational sphere financing rules variables

Groups of variables	List of variables	Denomination of variables in a model
Educational sphere financing indices (endogenous)	Government expenditure on education as a percentage of GDP (%)	x1
	Expenditure on education as a percentage of total government expenditure (%)	x2
	Government expenditure on tertiary education as a percentage of total government expenditure on education (%)	x3
	Government expenditure per student, primary (% of GDP per capita)	x4
	Government expenditure per student, secondary (% of GDP per capita)	x5
	Government expenditure per tertiary student as % of GDP per capita (%)	x6
Macroeconomic stability and growth indices (exogenous)	GDP per capita growth (annual %)	x7
	Population ages 15–64, % of total	x8
	Unemployment, total (% of total labor force) (modeled ILO estimate)	x9
	General government debt total, % of GDP	x10
	Labour productivity forecast	x11
Innovativeness indices (exogenous)	Charges for the use of intellectual property, payments (% of GDP)	x12
	High-technology exports (% of manufactured exports)	x13
	Research and development expenditure (% of GDP)	x14
Age pattern indices (exogenous)	Adult education level, Below upper secondary, % of 25–64 year-olds	x15
	Adult education level, Upper secondary, % of 25–64 year-olds	x16
	Adult education level, Tertiary, % of 25–64 year-olds	x17

While forming the list of variables for educational sphere financing rules derivation, it is necessary to overcome statistical information certain limitations. Therefore, we have used the available statistical information of the EU and separate countries, which eminently answers the purpose of our research.

The second stage. In order to assess the relationships between the indices represented in Table 1, the information on 28[1] countries over the 11-years' period (2004–2014) has been used. That is, the total sample of data for analysis contains 17 indicators in 28 countries over 11 years. It means that more than 5000 indicators were analyzed. Due to the complexity of illustrating the calculation results in seventeen indices simultaneously (x1–x17), we have to display only one restricted calculation fragment. That is why Table 2 illustrates the density (significance) of relationships only between six (x1–x6) education financing indices and five (x7–x11) macroeconomic stability indices. The «+» sign means that the connection was significant, i. e. R^2>0.6. The Table summarizes the results of pair correlations matrices calculation in 28 countries.

Table 2. The characteristics of correlations between education financing indices and macroeconomic stability indices

Countries	Correlations between variables																													
	x1x7	x1x8	x1x9	1x10	X1x11	X2x7	X2x8	X2x9	X2x10	X2x11	X3x7	X3x8	X3x9	X3x10	X3x11	X4x7	X4x8	X4x9	X4x10	X4x11	X5x7	X5x8	X5x9	X5x10	X5x11	X6x7	X6x8	X6x9	X6x10	X6x11
1	+			+			+		+			+		+			+		+											
2	+			+													+					+								
3																		+												
4			+	+			+					+		+	+		+		+									+	+	
5																				+		+								
6	+											+		+	+											+				
7	+		+	+								+	+	+		+					+	+	+	+		+		+	+	
8	+					+	+	+	+												+									
9							+	+	+	+		+	+	+	+		+	+	+	+		+	+		+				+	
10	+							+	+					+			+		+		+	+	+			+	+	+		
11		+										+			+		+			+				+						
12	+		+				+			+			+	+					+		+					+	+	+		
13	+	+	+	+								+	+	+	+		+				+					+			+	

[1] The sequence of countries in the tables is as follows: 1. Austria, 2. Belgium, 3. Bulgaria, 4. Great Britain, 5. Denmark, 6. Estonia, 7. Ireland, 8. Spain, 9. Italy, 10. Cyprus, 11. Latvia, 12. Lithuania, 13. Malta, 14. Netherlands, 15. Germany, 16. Poland, 17. Portugal, 18. Rumania, 19. Slovakia, 20. Slovenia, 21. Hungary, 22. Finland, 23. France, 24. Czech Republic, 25. Sweden, 26. The USA, 27. Japan, 28. Australia

Countries	Correlations between variables																												
	x1x7	x1x8	x1x9	1x10	X1x11	X2x7	X2x8	X2x9	X2x10	X2x11	X3x7	X3x8	X3x9	X3x10	X3x11	X4x7	X4x8	X4x9	X4x10	X4x11	X5x7	X5x8	X5x9	X5x10	X5x11	X6x7	X6x8	X6x9	X6x10	X6x11
14		+	+				+	+	+			+	+								+	+					+	+	+	
15			+		+		+	+			+		+		+	+			+	+		+						+	+	+
16							+	+	+	+																			+	
17		+		+			+		+		+																	+	+	
18				+			+	+									+	+		+	+			+	+				+	+
19							+	+	+												+	+	+	+			+	+	+	
20			+					+	+	+		+	+										+	+					+	
21				+								+		+					+	+		+		+			+		+	
22							+		+	+				+	+	+									+		+		+	
23	+																													
24																			+		+	+		+		+	+		+	+
25		+					+					+					+	+				+							+	
26								+	+	+		+			+		+				+						+			
27		+		+			+		+	+		+		+	+		+		+	+		+		+	+		+		+	
28	+		+					+										+								+				

Source: 1. DATA base OECD. – https://data.oecd.org/ [31 05 2018]. 2. DATA base Eurostat. – http://ec.europa.eu/eurostat/data/database [31 05 2018]. 3. DATA base Unesco Institute for statistics – http://data.uis.unesco.org/Index.aspx [31 05 2018]. 4. DATA base World bank. – ec.europa.eu/eurostat/data/database [31 05 2018].

The third stage. The selection of the dependencies between the variables for our further research has been carried out according to the frequency criterion, in accordance with the data in Table 2. At the same time, we were guided by variables meaningfulness criterion. This made it necessary to refuse from further analysis of those high-frequency connections, which are difficult to explain, proceeding from the

nature of the phenomena. Taking into consideration the frequency, i.e. the number of countries with statistically significant correlations between the variables, and regarding the correlation meaningfulness, we have made a conclusion concerning the expediency of such dependencies further research:

- between x2 (Expenditure on education as a percentage of total government expenditure (%)) and x8 (Population ages 15–64, % of total), x9 (Unemployment, total (% of total labor force), x10 (General government debt total, % of GDP);
- between x5 (Government expenditure per student, secondary (% of GDP per capita)), and x7 (GDP per capita growth (annual %)), x8 (Population ages 15–64, % of total).

The fourth stage. Having applied the approach, which had been used by monetary rules researchers (the assessment of correlations not between the very variables, but between their gaps), we assessed gaps in the same way. In our case, we mean the gaps between the actual meaning and the values of variables trends, selected at the third stage. Fig. 2 and fig. 3 illustrate the linear trends of variables x2, x8, x9, x10 and x5, x7, x8 according to one of the surveyed countries – Lithuania.

In the graphs is presented linear trend equation, using which you can identify gaps between actual and trend values of the variables analyzed.

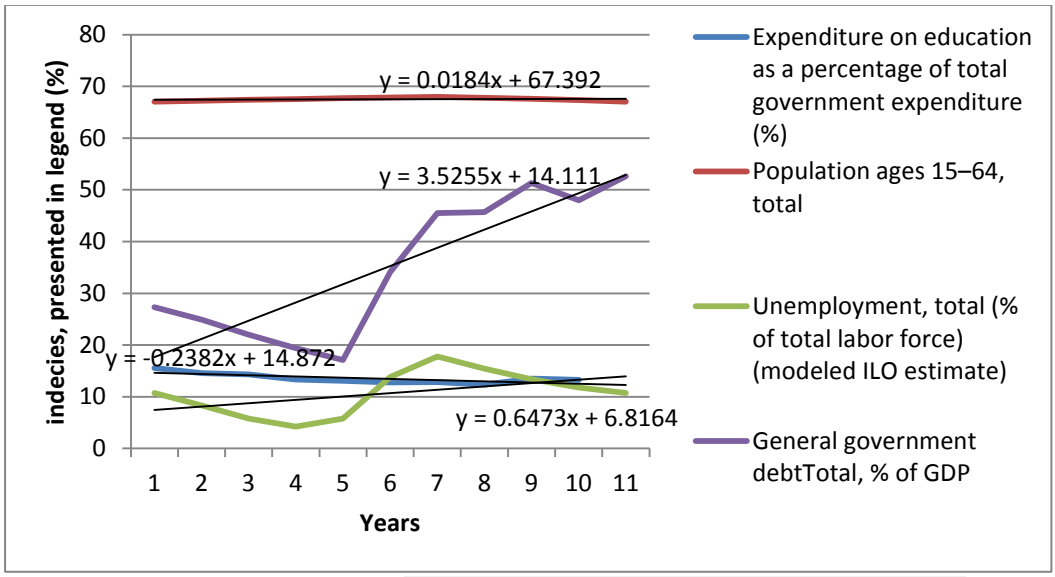

Fig. 2. The graphs of linear trends (specified in the legend of the graph) of four variables of a model according to the data of Lithuania (2004–2014)[2]

[2] The data used is limited to 2014 due to the lack of new comparative data for all analyzed countries in the OECD, Eurostat, the Unesco Institute for Statistics, World Bank statistics. The horizontal axis of the graph is postponed for years, and on the vertical - the value of the selected data, which are specified in the legend

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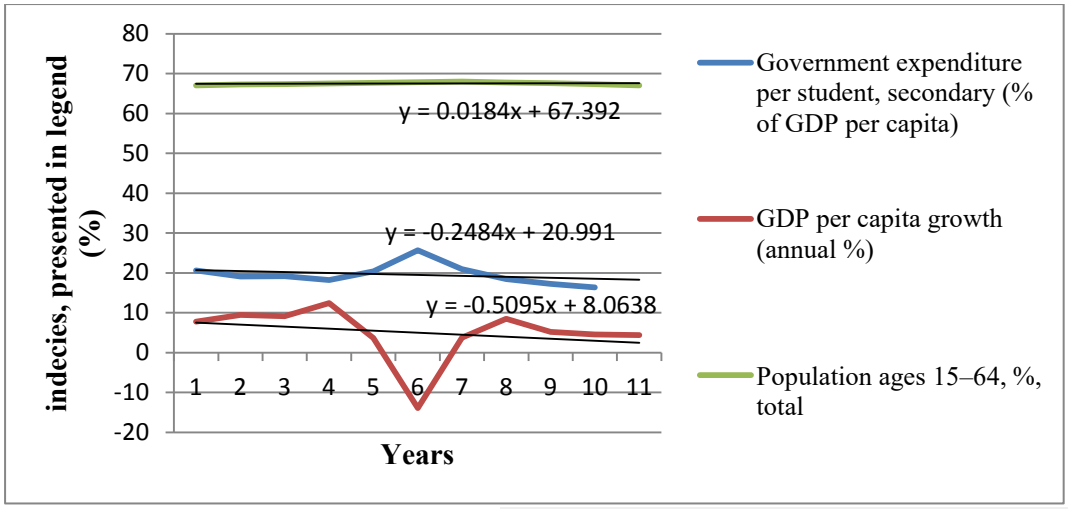

Fig. 3. The graphs of linear trends (specified in the legend of the graph) of three variables of a model according to the data of Lithuania (2004–2014)

The values of gaps between the variables actual indices and trends indices according to the data of one of the 28 countries – Lithuania – are offered in Table 3.

Table 3. The values of gaps of selected variables according to the data of Lithuania

Years	Gaps between the variables						
	x2	x8	x9	x10	x5	x7	x8
2004	0.938	–0.391	3.236	9.664	–0.083	0.199	–0.391
2005	0.184	–0.187	0.189	3.738	–1.431	2.451	–0.187
2006	0.132	–0.064	–2.958	–2.688	–1.098	2.600	–0.064
2007	–0.593	0.078	–5.206	–8.813	–1.762	6.389	0.078
2008	–0.628	0.229	–4.253	–14.639	0.630	–1.827	0.229
2009	–0.665	0.358	3.100	–1.164	6.175	–18.870	0.358
2010	–0.346	0.443	6.452	6.711	1.717	–0.704	0.443
2011	–0.630	0.254	3.405	3.385	–0.511	4.484	0.254
2012	0.808	0.033	0.758	5.460	–1.542	1.759	0.033
2013	0.798	–0.226	–1.489	–1.366	–2.099	1.591	–0.226
2014		–0.532	–3.237	–0.292		1.929	–0.532

The fifth stage. The final stage of the proposed financial rules derivation algorithm involves the development of regressive equations in accordance with the panel data in regards to all 28 countries. In case equations correspond to quality statistical criteria. the rules derivation procedure can be regarded as completed. And the rules will have the form as follows:

$$x2 - \overline{x2} = \alpha(x8 - \overline{x8}) + \beta(x9 - \overline{x9}) + \chi(x10 - \overline{x10})$$

$$x5 - \overline{x5} = \delta(x7 - \overline{x7}) + \varepsilon(x8 - \overline{x8})$$

(where $\alpha, \beta, \chi, \delta, \varepsilon$ – coefficients at gaps. $(x2-\overline{x2}), (x8-\overline{x8})$, $(x9-\overline{x9}), (x10-\overline{x10})$ $(x5-\overline{x5}), (x7-\overline{x7}), (x8-\overline{x8})$ – selected variables gaps),

Further research should concern the obtaining of equations, which meet the necessary statistical quality criteria and provide a possibility to draw conclusions about how education financing indices should change in case of other macroeconomic indices alteration.

3. Conclusions

1. The theoretical analysis of the issue regarded in this article has resulted in a conclusion, that modern macroeconomics can offer a sufficient amount of instruments for macroeconomic policy analysis from the position of rules. In particular, monetary rules researchers contribution to the rules theory is related to the accumulated experience regarding the formalization of connections between macroeconomic (including monetary) variables. The contribution of financial (fiscal) rules researchers is embodied in the experience of macrofinancial imbalances analysis and these imbalances prevention procedure analysis.

2. The applied result of the research of education financing rules substantiation issue consists in the application of the algorithm, which involves 5 stages: rules idea formulation, the assessment of variables connections meaningfulness according to the rules idea, the selection of endogenous and exogenous variables with substantial connections, the definition of gaps between actual and trend meanings of the selected variables, the derivation of dependencies equations between gaps.

3. The derivation of educational sphere financing rules, based on the data from 28 countries over 11 years with the application of 11 indices, enabled us to confirm, that education financing is related to the national economy macroeconomic stability. Going through all the five stages of the education financing rules substantiation algorithm testified to the complexity, but feasibility of calculations according to its logic.

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VALSTYBĖS FINANSINĖS TAISYKLĖS ŠVIETIMO SFEROJE: PAGRINDIMO ALGORITMAS

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Santrauka

Švietimo srityje nėra finansinių taisyklių, pagal kurias Vyriausybė turėtų derinti finansavimo rodiklius, atitinkančius besikeičiančius šalies ekonomikos makroekonominius rodiklius. Straipsnio tikslas – parengti švietimo srities finansines taisykles, kurios prisidėtų prie viešojo administravimo privalumų, susijusių su politikos taisyklėmis, įgyvendinimo. Tyrime taikoma finansinių ir pinigų taisyklių analizės metodika, nustatant švietimo sferos finansavimo ir kitų makroekonominių rodiklių proporcijas (priklausomybes). Praktinis problemos tyrimo rezultatas – parengtas algoritmas, apimantis 5 etapus: 1) finansinių taisyklių idėjos formulavimas, 2) kintamųjų reikšmių vertinimas, 3) endogeninių ir egzogeninių kintamųjų parinkimas su reikšmingais ryšiais, 4) skirtumų tarp faktiškai pasirinktų ir plėtros tendencijoms būdingų kintamųjų reikšmių nustatymas, 5) finansinio kapitalo formalizavimo lygties nustatymas.

Raktiniai žodžiai: efektyvumas, rinkodaros kainų politika, bendrasis indeksas, matrica, vertinimas.

JEL kodai: C13, D21, E64.