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METHODOLOGICAL APPROACHES TO EVALUATION OF MACROECONOMIC SYSTEM EFFICIENCY

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Abstract

The article describes methodological approaches to evaluation of macroeconomic system efficiency. The author of the article offers indicators of GDP and public expenses to be employed for calculating indicator of macroeconomic system efficiency. Distribution of GDP and public expenses to economic subsystems determines final economic efficiency of the whole economy and enables analysis of possible variants of such distribution. Formalization of indicators is carried out by means of tools compatible with so called matrix models. Experimental research of macroeconomic system efficiency under different models of public expenses distribution indicates that resources allocation must be adjusted for the GDP trend for macroeconomic system's being efficient. Also, public expenses allotted to social sector development must be equal to resources invested in the economy.

Introduction

Economists were always committed to taking up the challenges connected with the research of macroeconomics behavior and trends in interrelated social and economic processes. At the same time, the events that had place in the world and national economies over the last period require new concepts and methodological approaches to be found as well as new tools for exploring dynamic social and economic phenomena and processes and for evaluating perspective development of macroeconomic system.

Current macroeconomic challenges are mainly caused by not having a proper framework for macroeconomic policy. Most scientists recognize that there is a gap between virtual economic development and current economic theories despite new concepts were introduced and strong data were collected. Unfortunately, they are not able to be used for solving conflicts between sustainable economic development and factors blocking that path. Certainly it can be explained with increasing complexity of economic systems. Many economic challenges has been fostered with internal factors. Scientists agree that classical approach to research of dynamic processes can be effective only until balance can be described without applying to structural economic factors. Economic system is not sustained because of its structural changes that can provoke another system's path which is far different than initial one. Though, it is urgent to analyze and evaluate macroeconomic system efficiency through research of interconnection of structural elements of a system. Economic development influenced by structural factors that changes from time to time is a key point of research conducted by such economists as S. Yerokhina, Y. Zhalilo, B. Kvasnyuk and I. Kryuchkova. Ukrainian structural dynamics and conducting Ukraines' economy structural modernization are issues that applied by D. Pokryshko. Among foreign authors whose reaserch works are devoted to structural changes in different economic systems are V. Leontiev, G.Klark, S.Koval', E.Denison, K.Nutakhar, R.Minasyan, A.Karter, M.Sonis, G.Guo and others. These research works address issues of economic growth, resource allocation and its efficiency, but there are still no obvious results. Therefore, challenges of macroeconomic growth require further developed tools that include indicators for evaluation of trends and efficiency of macroeconomic systems. That was determined as the goal of the article.

Results

For conducting economic research that might have different objectives, various macroeconomics indicators are usually used. Among them are GDP per capita, labor productivity and other indicators of national accounts such as employment and unemployment rates, inflation, rates of government monetary policy and capitalization of share market related to GDP. These indicators enable evaluation of

macroeconomic system at a certain point of time, but it is impossible to assess macroeconomic system efficiency influenced by the pattern of resources allocation through employing above stated indicators.

For this reason, using GDP combined with the government spending indicators is more appropriate as ultimately, government expenses allocation between different public sectors affects the macroeconomic efficiency and allows to analyze different variants of such allocation (Tab.1).

Table 1

GDP and Central Government Spending Allocated to Subsystems of General Macroeconomic System, (in millions of grivnas)

Indicator	2006	2007	2008	2009	2010	2011	2012
GDP	544153	720731	948056	913345	1082569	1302079	1408889
Central Government Spending made for:	137108	174254	241490	242437	303589	333459,5	395661,8
Donation subsystem							
Economic activities	20426	29749	38693	33294	36030	44771,6	49396,0
Reception subsystem							
Housing Services	181	724	444	271	844	324,2	379,6
Health Care	4100	6321	7366	7535	8759	10223,9	11360,6
Culture and Sport	1389	1988	2918	3217	5166	3830,4	5488,5
Education	12122	15149	21554	23926	28808	27232,7	30242,9
Transfer Payments	30284	29220	50798	51518	69311	63540,3	75254,3
Total for Reception Subsystem	48076	53402	83080	86467	112888	105151,5	122725,9
Total	68502	83151	121773	119761	148918	149933,1	172121,9

Source: [1, 2]

At the same time the challenge of calculating these indicators arises, though, for its taking up so-called matrix models can be used. Today the models of this class are regularly designed in other countries. They are used to analyze, plane and forecast economic systems' development as well as to regulate economic growth, develop strategic long-term plans, optimize external trade balance and interregional balances and make prices. All tasks that can be performed by means of matrix models are not restricted to above stated items. The most typical matrix model is considered to be the model for intersectional balance developed by V.Leontiev.

The core element of all matrix models is balance that is usually presented as a table to show cross relationship between different parts of social and economic system.

Using this approach as well as data in the table 1 enable indexes of GDP and government spending to be calculated (Tab.2).

Table 2

Indexes of GDP and Government Spending Increase Related to the Previous Year, (times)

Indicator	2007	2008	2009	2010	2011	2012
GDP	1,32	1,32	0,96	1,19	1,20	1,08
Government Spending for:	1,27	1,39	1,004	1,25	1,10	1,19
Donation subsystem	1,46	1,30	0,86	1,08	1,24	1,10
Reception subsystem	1,11	1,56	1,04	1,31	0,93	1,17

Let fraction of government spending in the GDP be calculated over the certain period of time (Tabl.3).

It is offered to calculate the indicator of efficiency of macroeconomic system according to the following equations developed by the author:

$$\begin{cases} ISPD = (\sum KB / \sum XN) * K_k \\ IEMS_{general}(\%) = 100 * \sum ISPD, \end{cases}$$

where ISPD – indicator of macroeconomic system proportional sustainable development,

$\Sigma_{кв}$ – sum of coefficients for government spending to social sector,

Σ_{xn} – sum of indicators' values for each year,

Σ_{yn} – sum of indicators' values for each year,

$К_к$ – coefficient of correlation for calculated indicators obtained through the formula:

$$K_k = (\sum yn + \sum xn) / N,$$

where N – total number of indicators in the matrix.

Table 3

Fraction of Government Spending in GDP and Its Indexes

Fraction of Government Spending for Social and Economic needs in the GDP							
Indicator	2006	2007	2008	2009	2010	2011	2012
GDP, %	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Government spending in GDP, % for:	25,20	24,18	25,5	26,59	28,08	25,61	28,08
Donation subsystem, %	3,75	4,13	4,08	3,64	3,32	3,43	3,50
Reception subsystem, %	8,84	7,41	8,76	9,46	10,43	8,07	8,71
Rate of spending (social services / economic activities), times	2,35	1,79	2,14	2,59	3,14	2,35	2,49
Index of Government Spending in GDP growth, times							
Government spending in GDP for:		0,96	1,05	1,04	1,05	0,91	1,10
Donation subsystem		1,10	0,99	0,89	0,91	1,03	1,02
Reception subsystem		0,83	1,18	1,07	1,10	0,77	1,06

Basing on the obtained data, make a matrix containing indicators of social and economic development of Ukraine over the period from 2007 to 2012. Among the indicators are those that track macroeconomic system's development. Such matrix provides opportunity to make experiments with structure and indicators themselves and analyze how will changes in them influence macroeconomic system.

For the first experiment virtual state of macroeconomic system was assessed taking into consideration actual indicators of its development (Tab.4).

Table 4

Matrix of indicators of social and economic development of Ukraine over the period from 2007 to 2012 (experiment 1)

Indicator	x_1	x_2	x_3	x_4	x_5	x_6	Σ_{xn}
y_1	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_2	1,27	1,39	1,004	1,25	1,10	1,19	7,204
y_3	1,46	1,30	0,86	1,08	1,24	1,10	7,04
y_4	1,11	1,56	1,04	1,31	0,93	1,17	7,12
y_5	0,96	1,05	1,04	1,05	0,91	1,10	6,11
y_6	1,10	0,99	0,89	0,91	1,03	1,02	5,94
y_7	0,83	1,18	1,07	1,10	0,77	1,06	6,01
$\Sigma_{yn} = \Sigma_{xn}$	8,05	8,79	6,86	7,89	7,18	7,72	46,49
$K_в$	1,79	2,14	2,59	3,14	2,35	2,49	Σкв = 14,50

In this case the indicator K_k is (46,49 + 46,49) : 42 = 2,21.

Calculation of indicator for assessing efficiency of social and economic system at the actual variant is given in the Table 5.

Table 5

Indicator of Ukrainian Macroeconomic System's Efficiency

Years	Calculation	ISPD
2007	(14,50 : 46,49 x 8,05) x 2,21	5,55
2008	(14,50 : 46,49 x 8,79) x 2,21	6,06
2009	(14,50 : 46,49 x 6,86) x 2,21	4,73
2010	(14,50 : 46,49 x 7,89) x 2,21	5,44
2011	(14,50 : 46,49 x 7,18) x 2,21	4,95
2012	(14,50 : 46,49 x 7,72) x 2,21	5,32
Σ ISPD		32,05
IEMS $_{general}$ = 100 : 32,05 = 3,12%		

If taking experiments will be continued, then it is useful to explore the model which shows equality of increasing tempos of government spending for economic activities and social services ($y_3 = y_4$) (Tab.6).

Table 6

Matrix of Social and Economic Development of Ukraine Indicators if Government Spending for Economic Activities are Equal to Government Spending for Social Services ($y_3 = y_4$), (experiment 2)

Indicator	x_1	x_2	x_3	x_4	x_5	x_6	Σ_{xn}
y_1	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_2	1,27	1,39	1,004	1,25	1,10	1,19	7,204
y_3	1,11	1,56	1,04	1,31	0,93	1,17	7,12
y_4	1,11	1,56	1,04	1,31	0,93	1,17	7,12
y_5	0,96	1,05	1,04	1,05	0,91	1,10	6,11
y_6	1,10	0,99	0,89	0,91	1,03	1,02	5,94
y_7	0,83	1,18	1,07	1,10	0,77	1,06	6,01
$\Sigma_{yn} = \Sigma_{xn}$	7,70	9,05	7,04	8,12	6,87	7,79	46,574
Кв	1,79	2,14	2,59	3,14	2,35	2,49	Σкв = 14,50

The coefficient that shows the extent of correlation in this case is $K_к$ = (46,574 + 46,574) : 42= 2,22. Further calculations are given in the Table 7.

Table 7

Calculation of Macroeconomic System of Ukraine Efficiency if Government Spending for Social and Economic needs are equal

Years	Calculation	ISPD
2007	(14,50 : 46,574 x 7,70) x 2,22	5,32
2008	(14,50 : 46,574 x 9,05) x 2,22	6,25
2009	(14,50 : 46,574 x 7,04) x 2,22	4,87
2010	(14,50 : 46,574 x 8,12) x 2,22	5,61
2011	(14,50 : 46,574 x 6,87) x 2,22	4,75
2012	(14,50 : 46,574 x 7,79) x 2,22	5,38
Σ ISPD		32,18
IEMS $_{general}$ = 100 : 32,18 = 3,11%		

As data show, the strategy of artificial equalizing tempos of increasing government spending leads to no positive results. Also, macroeconomic system's efficiency can be dropped dramatically in a short-run. Absolutely different circumstances can be seen if these changing indicators are adjusted for GDP growth.

Coefficient to define the extent of correlation is $K_к$ = (49,49 + 49,49) : 42= 2,36. The following calculation is in the Table 9.

Table 8

Matrix of Indicators of Social and Economic Development of Ukraine if Government Spending for Social and Economic Needs are Equal and Increase According to Increasing GDP (y_2; y_3; y_4; y_5; y_6; $y_7 = y_1$), (experiment 3)

Indicator	x_1	x_2	x_3	x_4	x_5	x_6	Σ_{xn}
y_1	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_2	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_3	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_4	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_5	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_6	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_7	1,32	1,32	0,96	1,19	1,20	1,08	7,07
$\Sigma_{yn} = \Sigma_{xn}$	9,24	9,24	6,72	8,33	8,40	7,56	49,49
$K_в$	1,0	1,0	1,0	1,0	1,0	1,0	$\Sigma_{кв}$ = 6,0

This experiment justifies that under balanced government spending for social and economic needs growing along with the GDP growth macroeconomic systems' efficiency is rising twice. Thus, given such variant of resources allocation, macroeconomic system is performing much more efficiently even in the short-run. The next experiment (Tab. 10 -11) frames the following concept: if government spending for economic activities is higher than those for social services, final efficiency of the whole macroeconomic system will be even higher (the trend will continue even if spending for donation economic subsystem is a little bit higher that is $K_в = 0,99$).

Table 9

Calculation of Indicator of Macroeconomic System Efficiency Under Balanced Government Spending for Social and Economic Needs while They are Growing Along with GDP Growth

Years	Calculation	ISPD
2007	(6,0 : 49,49 x 9,24) x 2,36	2,64
2008	(6,0 : 49,49 x 9,24) x 2,36	2,64
2009	(6,0 : 49,49 x 6,72) x 2,36	1,92
2010	(6,0 : 49,49 x 8,33) x 2,36	2,38
2011	(6,0 : 49,49 x 8,40) x 2,36	2,40
2012	(6,0 : 49,49 x 7,56) x 2,36	2,16
Σ ISPD		14,14
$IEMS_{general}$ = 100 : 14,14 = 7,07%		

Table 10

Matrix of Indicators of Social and Economic Development under Increasing Spending in Compliance with GDP Trends and under $K_в < 1$, (experiment 4)

Indicator	x_1	x_2	x_3	x_4	x_5	x_6	Σ_{xn}
y_1	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_2	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_3	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_4	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_5	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_6	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_7	1,32	1,32	0,96	1,19	1,20	1,08	7,07
$\Sigma_{yn} = \Sigma_{xn}$	9,24	9,24	6,72	8,33	8,40	7,56	49,49
$K_в$	0,99	0,99	0,99	0,99	0,99	0,99	$\Sigma_{кв}$ = 5,94

Also, the following may be stated for sure. If government spending for social services exceed those for economic activities, given $K_в > 1$, macroeconomic system's efficiency will go down comparing to the experiment 4 (Tab. 12-13).

Table 11

Calculation of Indicator of Macroeconomic System's Efficiency under Increasing Spending in Compliance with the GDP Growth and $K_в < 1$

Years	Calculation	ISPD
2007	(5,94 : 49,49 x 9,24) x 2,36	2,61
2008	(5,94 : 49,49 x 9,24) x 2,36	2,61
2009	(5,94 : 49,49 x 6,72) x 2,36	1,90
2010	(5,94 : 49,49x 8,33) x 2,36	2,36
2011	(5,94 : 49,49 x 8,40) x 2,36	2,38
2012	(5,94 : 49,49 x 7,56) x 2,36	2,14
Σ ISPD		14,00
$IEMS_{general}$ = 100 : 14,00 = 7,14%		

If macroeconomic dynamics is absent, the indicator Σ_{xn} will be «N». If spending for reception subsystem related to spending for donation subsystem are current $K_в = 2,5$, then the indicator $K_к$ to define the level of correlation is «2,0», that is: $K_к = (42+ 42) : 42 = 2,0$. Such experiment adjusted for anticipated tendencies of macroeconomic development justifies the system's low efficiency. This case is described in the Tables 14 and 15.

Table 12

Matrix of Indicators of Social and Economic Development of Ukraine under Increasing Spending in Compliance with the GDP Growth and Кв > 1, (experiment 5)

Indicator	x_1	x_2	x_3	x_4	x_5	x_6	Σ_{xn}
y_1	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_2	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_3	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_4	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_5	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_6	1,32	1,32	0,96	1,19	1,20	1,08	7,07
y_7	1,32	1,32	0,96	1,19	1,20	1,08	7,07
$\Sigma_{yn} = \Sigma_{xn}$	9,24	9,24	6,72	8,33	8,40	7,56	49,49
$K_в$	1,01	1,01	1,01	1,01	1,01	1,01	$\Sigma_{кв} = 6,06$

Table 13

Calculation of Ukrainian Macroeconomic System's Efficiency under Increasing Spending in Compliance with GDP Growth and $K_в > 1$

Years	Calculation	ISPD
2007	(6,06 : 49,49 x 9,24) x 2,36	2,67
2008	(6,06: 49,49 x 9,24) x 2,36	2,67
2009	(6,06 : 49,49 x 6,72) x 2,36	1,94
2010	(6,06 : 49,49 x 8,33) x 2,36	2,41
2011	(6,06 : 49,49 x 8,40) x 2,36	2,43
2012	(6,06 : 49,49 x 7,56) x 2,36	2,18
Σ ISPD		14,30
IEMS $_{general}$= 100 : 14,30 = 6,99%		

Therefore, given different variants of state resources allocation, the highest macroeconomic system's efficiency is obtained under experiments 3, 4, 5. At the same time, taking into consideration economic critical thinking path, the most appropriate way for macroeconomics being developed is based on the results under experiment 3.

Table 14

Matrix of Indicators of Social and Economic Development of Ukraine under Macroeconomic Dynamics's Being Absent and Social Spending's Exceeding Economic Spending, (Кв > 1), (experiment 6)

Indicator	x_1	x_2	x_3	x_4	x_5	x_6	Σ_{xn}
y_1	1,0	1,0	1,0	1,0	1,0	1,0	6,0
y_2	1,0	1,0	1,0	1,0	1,0	1,0	6,0
y_3	1,0	1,0	1,0	1,0	1,0	1,0	6,0
y_4	1,0	1,0	1,0	1,0	1,0	1,0	6,0
y_5	1,0	1,0	1,0	1,0	1,0	1,0	6,0
y_6	1,0	1,0	1,0	1,0	1,0	1,0	6,0
y_7	1,0	1,0	1,0	1,0	1,0	1,0	6,0
$\Sigma_{yn} = \Sigma_{xn}$	7,0	7,0	7,0	7,0	7,0	7,0	42,0
$K_в$	2,5	2,5	2,5	2,5	2,5	2,5	$\Sigma_{кв} = 15,0$

Table 15

Calculation of Ukrainian Macroeconomic System's Efficiency under Macroeconomic Dynamics's Being Absent and Social Spending's Exceeding Economic Spending

Years	Calculation	ISPD
2007	(15 : 42,0 x 7,0) x 2,0	5,0
2008	(15 : 42,0 x 7,0) x 2,0	5,0
2009	(15 : 42,0 x 7,0) x 2,0	5,0
2010	(15 : 42,0 x 7,0) x 2,0	5,0
2011	(15 : 42,0 x 7,0) x 2,0	5,0
2012	(15 : 42,0 x 7,0) x 2,0	5,0
Σ ISPD		30,0
$IEMS_{general}$ = 100 : 30,0 = 3,33%		

Discussion

According to the current trends in the state social and economic system's development, approaches to formulating macroeconomic policy must be changed to provide macroeconomic sustainability. Indicators show that resources must be allocated in the full compliance with the GDP trend, and spending for social services must be equal to spending for economic activities that is investments. It is a pragmatic approach without a doubt to reduce social spending for certain period of time, but under current economic conditions this is the only one way to invest appropriate amount of money into economics to provide sustainable development.

Generally speaking, as the author argues, such current approach opens wide possibilities for macroeconomic planning. By varying indicators' values to be included into a matrix, an opportunity to investigate macroeconomic system according to different options in macroeconomic and resource allocation policies occurs.

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