

THE ESTIMATION INERTIAL AND STRUCTURAL COMPONENTS OF THE INDEX OF VALUE PRODUCTION AND SERVICES OF KINDS OF ECONOMIC ACTIVITIES

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Keywords: inertia component, active component, passive component.

The author of the article develops the method of decomposition of general index of cost of products on inertia and structural constituents, selecting the active (positive and negative) and passive (positive and negative) structural constituents of general index in structural changes.

The future of the development of the Russian economy in many cases is predetermined by transformation of its structural system.

Therefore in much scientific research it features structurally-dynamic analysis, design of dynamic indices and indicators estimating structural changes, the scopes of those or other methods of an estimation of structural shifts.

Works of many scientists are devoted to the research and to the application of methods of the index theory and the theory of structural shifts. These are works by K.Gatev, Kazinets, S.V.Kuryшева, N.P.Persteneva, V.M.Ryabtsev, A.Salai, M.M.Juzbashev, frequently deepening to the greatest degree one of these two theoretical aspects of the structurally-dynamic analysis.

The application of methods of these two directions of the statistical analysis have a rather modest place in spite of the fact that all scientists-statisticians recognize the influence on size of the general indices of quantity indicators of the structural factor.

It is remarkable that, in L.A. Dedov's scientific work and J.N. Ejssner, one of widely known formulas of indicators of structural shifts and distinctions mathematically is deduced by Ejssner from communication of the general (I_Q) and individual indexes (i_Q) of a physical volume of output.

Really, individual and general indexes of physical volume of production and a share of volumes of production in the prices of the basic period are connected among themselves as follows:

$$I_Q \cdot f_1 = i_Q \cdot f_0,$$

$$\text{where } I_Q = \frac{\sum Q_1 P_0}{\sum Q_0 P_0}, \quad i_Q = \frac{Q_1}{Q_0} = \frac{Q_1 P_0}{Q_0 P_0},$$

$$f_1 = \frac{Q_1 P_0}{\sum Q_1 P_0}, \quad f_0 = \frac{Q_0 P_0}{\sum Q_0 P_0}.$$

This implies, that

$$f_1 - f_0 = \frac{f_0}{I_Q} (i_Q - I_Q) = \frac{f_0 t}{I_Q},$$

where $t = i_Q - I_Q$.

Then

$$\sum (f_1 - f_0) \cdot I_Q = \sum f_0 t \quad (1)$$

the general gain of their increase can be interpreted as a part of an index of the growth I_Q , providing at all shares of the structural system, which have increased in the accounting period ($f_1 > f_0$), the general gain of increase in physical volume of production.

Thus the size $\sum (f_1 - f_0)$ in the left part of equality (1), in which the positive differences $\Delta f = f_1 - f_0$ are aggregated only is identical to known factor in the statistics of structural shifts by K. Gatev

$$L = \frac{1}{2} \sum |f_1 - f_0|. \quad (2)$$

It is possible to agree with L.A.Dedov and J.N.Ejssner in interpretation $L \cdot I_Q = \sum f_0 t = M2$ as a structural component index I_Q for effect of expansion of shares of structural system ($f_1 > f_0$). As treatment L as fixed measures of distinction of two structures ($0 < L < 1$), and $1 - L$ it is possible to characterize as an opposite measure (a similarity measure) is quite admissible and to treat size

$$M1 = I_Q - M2 = I_Q(1 - L) \quad (3)$$

as an inertia component in decomposition of the general index:

$$I_Q = M1 + M2 = (1 - L)I_Q + LI_Q. \quad (4)$$

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We should notice that aggregation only negative differences ($f_1 - f_0 < 0$) taken on the module or with an opposite sign also is identical to indicator L . At that time the effect of expansion of one shares will be always accompanied by effect of narrowing (replacement) of other shares of the same structural system as the total sum of shares of all parts of set is always equal in the current and basic period 1 ($\sum f_1 = \sum f_0 = 1$).

Therefore, the inertial and structural components in expression (4) should be interpreted logically not only in a case $I_Q > 1$ at the account only positive Δf , but also in all other situations, that is: $I_Q > 1$ at the account $\Delta f < 0$; $I_Q \leq 1$ at the account $\Delta f > 0$; $I_Q \leq 1$ at the account $\Delta f < 0$.

Expression of decomposition (4) is carried out not only for the general index of physical volume of production, but also for index of value production:

$$I_{PQ} = \frac{\sum Q_1 P_1}{\sum Q_0 P_0}.$$

$$\text{As, } \frac{\sum Q_1 P_1}{\sum Q_0 P_0} \cdot \frac{Q_1 P_1}{\sum Q_1 P_1} = \frac{Q_1 P_1}{Q_0 P_0} \cdot \frac{Q_0 P_0}{\sum Q_0 P_0},$$

that is $I_{PQ} \cdot f_1 = I_{PQ} \cdot f_0$,

where $f_1 = \frac{Q_1 P_1}{\sum Q_1 P_1}$, $f_0 = \frac{Q_0 P_0}{\sum Q_0 P_0}$ - shares of

cost of production of separate kinds in its general volume of the current and basic periods equality similar to the formula (4) is fair:

$$I_{PQ} = (1-L)I_{PQ} + LI_{PQ} = M1 + M2, \quad (5)$$

where $M1$, $M2$ are treated the same to index decomposition I_Q in the formula (4).

It is represented expedient in decomposition of the general indexes (4) and (5) structural component L or $M2$ to disaggregate on following four elements: positive and negative active and passive structural components.

Let's explain the given offer proceeding from following reasons. Active structural shift is considered as change of a share of a part of set f caused by change of actually given part m

all set $\sum m (f = m / \sum m)$, and passive shift as result of change of addition of this part $m = \sum m - m$ to all set:

$$\begin{aligned} \Delta f_{m_k} &= f(m_k, m_{k-1}) - f(m_{k-1}, m_{k-1}) = \\ &= \frac{m_k}{m_k + m_{k-1}} - \frac{m_{k-1}}{m_{k-1} + m_{k-1}}, \end{aligned} \quad (6)$$

$$\begin{aligned} \Delta f_{m_k} &= f(m_{k-1}, m_k) - f(m_{k-1}, m_{k-1}) = \\ &= \frac{m_{k-1}}{m_{k-1} + m_k} - \frac{m_{k-1}}{m_{k-1} + m_{k-1}}, \end{aligned} \quad (7)$$

where $f = f(m_k, m_k)$ - value of function f at values of arguments m, m for k -e time intervals into which the analyzed period is broken ($k = \overline{1, r}$); m_k, m_k - the sizes of parts the sets generated by the end of k the time interval for the astronomical period equal on duration analyzed:

$\Delta f_{m_k}, \Delta f_{m_k}$ - active and passive increments.

The error received at aggregation (α):

$$\Delta f = \sum_{k=1}^r \Delta f_{m_k} + \sum_{k=1}^r \Delta f_{m_k} + \alpha$$

it is distributed proportionally on an active and passive component.

Aggregating separately negative both positive active and passive increments of shares for k -e time intervals, we will receive following decomposition at effect of expansion:

the general structural change

$$L = \sum \Delta f_m^+ + \sum \Delta f_m^- + \sum \Delta f_m^+ + \sum \Delta f_m^-, \quad (8)$$

where $\sum \Delta f_m^+, \sum \Delta f_m^-$ - positive and negative active components of structural shifts;

$\sum \Delta f_m^+, \sum \Delta f_m^-$ - positive and negative passive components of structural shifts; the general index value of production (I)

$$\begin{aligned} I &= (1-L)I + \sum \Delta f_m^+ I + \sum \Delta f_m^- I + \\ &+ \sum \Delta f_m^+ I + \sum \Delta f_m^- I, \end{aligned} \quad (9)$$

Table 1

Inertial and structural making decomposition of value indexes of the goods, works and services of all kinds of economic activities for 2006 in comparison with 2000

Regions	№ sn	/	Components index value				
			inertial	structural			
				$(1-L)/$	$\sum \Delta f_m^+ /$	$\sum \Delta f_m^- /$	$\sum \Delta f_m^+ /$
A	B	1	2	3	4	5	6
Privolzhsky federal district	1	1,4833	1,4513	0,2275	-0,0022	0,0018	-0,1949
Mary El Republic	2	2,1472	1,9634	0,3002	-0,0172	0,0185	-0,1175
The Orenburg region	3	1,9434	1,6187	0,5335	0,0000	0,0097	-0,2184
the Samara region	4	1,4384	1,3901	0,2153	-0,0453	0,0341	-0,1559
the Saratov region	5	1,8703	1,6565	0,3215	-0,2138	0,2588	-0,1530
...
...
the Ulyanovsk region	15	1,3010	1,2361	0,1275	-0,0086	0,0267	-0,0805

where $\sum \Delta f_m^+ /$, $\sum \Delta f_m^- /$ - the structural components of an index l , caused by positive and negative active shifts; $\sum \Delta f_m^+ /$, $\sum \Delta f_m^- /$ - the structural components of an index l , caused by positive and negative passive shifts.

Similarly it is possible to describe decomposition (8), (9) and for effect of narrowing.

Each of decomposition (8), (9) and each of their components it is possible to allocate and analyze both in common, and separately from each other.

Let's calculate the general value indexes of the shipped goods, the executed works and services of all kinds of economic activities for regions of Privolzhsky federal district and their components in expression (9) according to Rosstata during 2001 - 2006 and we will in table 1 these sizes.

On Privolzhsky federal district as a whole the value index has made 148,3 %. For regions the size of an interval of its distinctions [the bottom border - 109,7 % in the Kirov region, the top border - 214,7 % in Mary El's republic] has appeared considerable – more than 100 % (see table 1, column 1).

Given columns 2 testify to essential size of an inertial component of a value index, in the majority of regions of exceeding 140 %. Distinctions in size and directions of influence on an index different a component of a structural component are characterised by the maintenance of columns 3-6.

Directions of influence of structural components on size of a value index and priorities in parities of their estimations have appeared basically similar on regions: 1) positive active making (column 3) to some extent exceeds on absolute size negative active (column 4) except for two regions (the Penza and Nizhny Novgorod areas) – the certificate of that the effect of expansion of one kinds of economic activities advances effect of narrowing of other kinds for different intervals of time (years) analyzed 6-year-old period; 2) negative passive making (column 6) on absolute size, in the majority of regions PFO except for the Nizhny Novgorod, Penza and Saratov areas, exceeds a positive passive component of a value index (column 5) as mirror reflexion of parities of positive and negative active making structural shifts.

We will notice that distinctions in values of a value index on regions do not allow under the analytical data in table 1 to spend inter-regional comparisons of the contribution of each of four structural components to index size.

As the share of an inertial component in value index size makes $(1-L)/l = 1-L$, each structural component in the right part of expression (8) interprets its contribution to size of a value index which is expedient for differentiating by economic activities kinds (see table 2 where contribution estimations are calculated as for positive, and negative Δf and are for descriptive reasons expressed in percentage).

According to table 2 it is visible, as in each region the effect of expansion of individual share of one kinds of activity in creation of new cost of the goods and services was ac-

accompanied by effect of narrowing of others as result of their replacement from structural space.

For observance of equalities (8) and (9) it is necessary to take into consideration only positive sizes $\sum \Delta f$. So for PGD in whole (a line 1) they are equal 0,3 % and 1,9 % for the first and second kinds of economic activities in columns 2 and 7 and in the sum make 2,2 % - value of an indicator of the structural shifts L , expressed in percentage. However, analyzing effects of expansion of one kinds of activity it is necessary to pay attention and to effects of narrowing of other kinds as both those, and others can be differentiated on positive both negative active and passive structural components.

In PGD the size of a positive active component (17,9 % in column 17) is formed first of all at the expense of the second kind of economic activities (9,0 % in column 8), in the second – at the expense of the first kind (6,3 % in column 3) and in the third – at the expense of the third kind (2,6 % in column 13). Effect of expansion: by the first kind of economic activities has made 6,4 (6,3+0,1) for the account of a positive part of active and passive structural shifts (column 3 and 5); by the second and third kind of activity (9,0) only for the account active making (columns 8 and 13). The effect of narrowing has made: by the first and third kinds of activity (-6,1) and (-4,8) (in columns 6 and 16) only for the account of a passive component; by the second kind of activity (-7,2) for the account of active and passive components (-0,2) and (-7,0) (in columns 9 and 11).

In the Orenburg region the weakest role of an inertial component in formation of new cost in comparison with basic (83,3 %) was observed and the most essential influences of a positive active component for the first kind of activity (27,5 %) (table 2, column 3 see) therefore the effect of expansion of this kind of activity (16,7 %) has caused effect of replacement of the second kind of activity (-7,6 %)

and the third (-9,1 %) (table 2, columns 7 see, 12) in spite of the fact that to these *вилам* to activity also there corresponds a positive active component (11,8 %) for the second kind and (4,2 %) – for the third (columns 8, 13) which much more concedes on size to the first kind of activity (27,5 %) and consequently only partially compensates effect of replacement of these kinds of activity to the first.

In Mary El's Republic and Mordovia, the highest value of a value index (table 1, column 1) and consequently in the most considerable size of an inertial component (196,3 % and 197,7 % accordingly) (column 2) which influences on index size it has appeared not the strongest (91,4 %, 95,7 % accordingly) (see table 2, column 1). Thus the effect of expansion of the second kind of activity (column 7) caused by a positive active part basically by the second kind of activity (column 8) and smaller degree by two other kinds of activity has caused effect of narrowing of the first and third kinds of activity (column 2, 12).

Results of the spent structurally-dynamic analysis of decomposition of rates of increase of cost of the goods and services or their physical volume on inertial and structural components of active and passive shifts by kinds of economic activities and their inter-regional analysis for enough objects can be an information-analytical source of the differentiated estimation of development of administratively territorial formations, its monitoring and forecasting by working out of operative, operative, tactical and strategic aspects of change of the structural components defining qualitative level of economic systems.

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Recived for edition 18.03.2009