STUDY ON THE METHODOLOGY FOR CALCULATING STATISTICAL INDICES THROUGH THE PROCESS OF SEPARATING THE ISOLATED ACTION OF EACH FACTOR AND THE PROPORTIONAL DISTRIBUTION OF THE INTERACTION OF INFLUENCING FACTORS

Associate Professor Nicolae Mihăilescu, PhD *(n.mihailescu@yahoo.com)*
"Hyperion" University of Bucharest
Associate Professor Claudia Căpăţînă, PhD *(claudiacapatana@yahoo.com)*
"Hyperion" University of Bucharest

Abstract

The methodological study presented in this article provides a solution of practical utility for substantiating the decisions aimed at increasing the economic and financial performance of the economic operators, based on the identification and quantification of the factors that determined the size and modification of an indicator of strong representation of the activity carried out.

The methodology presented in this study has a rigorous content from mathematical point of view, that respects a principle of calculation and proportional attribution of the influence of each factor that explains the change of a result indicator of the economic activity, synthetic or complex, obtained through sequential contributions, but, at the same time, unitary, of two or more factors, with different degrees of importance. The general purpose of this methodology is to provide information unaffected by limited, particular principles, with justifications to which more or less pertinent counter-arguments can be made.

It is mentioned that there is the inconvenience of the complexity of the calculations, which is more difficult to achieve if a manual procedure is used and an IT solution would be fully recommended.

Keywords: statistical index, influence factor, economic indicator.

JEL Classification: C02

Introduction

In order to substantiate the decisions aimed at the management of the economic activity, a special utility presents **the index method,** due to the information content provided by the statistical dimension called index, obtained as a result of the comparison made in dynamic or static terms.

The statistical index is a relative quantity, which expresses one of the following categories of states of economic phenomena:

- *dynamic,*
- *the degree of compliance with the programmed or planned indicators,*
- *the relative level of the proposed burden for increasing or decreasing an economic indicator in the time segment that follows,*
- *the size ratio between two economic indicators identical in terms of content and method of calculation, referring to two similar territorial entities (city, county, country) or two economic agents, but coexisting over time.*

Therefore, the index is the result of the ratio of two statistical indicators relating to the same economic phenomenon, which, in turn, can be presented in absolute, relative or average form. The index expresses the relative change in the size of the indicator at the numerator, compared to the size at the ratio denominator.

From the point of view of the scope of coverage, two categories of statistical indices are distinguished: *individual indices, elementary* or *simple* and *group indices*.

The individual index expresses the size ratio between two statistical indicators that characterize collectivities of homogeneous units (objects or types of products) or phenomena with the same economic content. For example, the individual index of the dynamics of physical volume, price dynamics or the dynamics of the value of goods sold by an economic operator for each type of goods can be calculated separately.

The general formulas for calculating the individual indices of dynamics are:

- for a quantitative economic indicator (*f*),

$$\boxed{i(f)=\frac{f_1}{f_0}},$$

- for a qualitative economic indicator (*x*),

$$\boxed{i(x)=\frac{x_1}{x_0}},$$

- for a complex economic indicator (*Y*),"

$$\boxed{i^{fx}=\frac{f_1 x_1}{f_0 x_0}}$$

The group index expresses the relative average change in the characteristic of a community of units, which differs from each other in content or usage value.

For example, the group index of the dynamics of the value of goods sold by a company (the group index of turnover dynamics), which is an index of a complex statistical indicator, is calculated as the ratio between the sum of receipts (value of sales) in the current or calculation period and the sum of receipts (value of sales) in the base period of comparison, according to the following relationship,

$$\boxed{I^{qp}=\frac{\Sigma q_1 p_1}{\Sigma q_0 p_0}} ,$$

in which,

"*q*" is the physical volume of sales by type of goods (economic indicator of quantitative type - *f*),

'*p*' means the unit selling price for each kind of goods (economic indicator of qualitative type $-$ *x*).

It is stated that both the physical volume of sales and the unit sales prices are not directly aggregated because they refer to different types of goods and, consequently, in order to highlight the influence or separate change of each of the two factors (*q* and *p*), factorial group indices are calculated, by applying a particular weighting system.

Therefore, in the case of a factorial-deterministic relationship of the form $Y = fx$, or $\Sigma y = \Sigma fx$ the separate modification of each of the factors (quantitatively $- f$ and qualitatively $- x$) that determined the modification of the complex indicator (*Y*) or, in another form of interpretation, used only in the case of factorial group indices, to quantify the average change of the quantitative and qualitative indicator, the **method of successive substitutions (in chain)** is usually used, but in the analysis practice, other weighting methods are sometimes used: Laspeyres Index, Paasche Index, Logarithmic Weights Procedure (Fisher Index), Average Weights Procedure (Edgeworth Index), The Finite Increases Procedure (Lagrange Index).

In order to systematize, generalize and rigorously apply the method of successive substitutions, the economic indicators are grouped as follows:

- quantitative economic indicators (f), such as: the physical volume of production or service benefits (*q*); the average number of employees (*N*); the time worked by the employees, expressed in man-hours (*Nh*); the time worked by the employees, expressed in man-days (*Nz*); the average value of the fixed assets (*Mf*); the average value of the current assets (*Ac*); places existing tourist accommodation capacity or capacity built and intended for accommodation of tourists - (*L*); places-days existing tourist accommodation capacity (*Le*); places-days tourist accommodation capacity available, in operation or active (*Lz*); tourists staying in tourist accommodation units (*T*); number of days-tourists (*Tz*) etc.;

- qualitative economic indicators (x): the production price or the tariff per physical unit of services (*p*); the retail selling price (*pv*); the labor costs incurred on average with one employee; the complete unit cost ($\overline{cfm}\ c$); the specific consumption of material and energy resources expressed in natural units (*m*); expenditures per 1000 lei turnover (*Ch*); the rate of financial return (*Rrf*); labour productivity (*w*); the average number of rotations of current assets (*n*), the average duration in days of a rotation of current assets (*d*) and in general all indicators expressing economic efficiency;

- complex economic indicators (fx): turnover (*CA*); trade margin (*DBM*); year output (*Q*); value added (*VA*), total expenditure (*Ct*); total revenue (*Vt*); total labour expenditure (*MFF*);); total expenditure on raw materials, materials and energy related to the productive activity, trade or service provision activity (*CM*); total consumption of raw materials, materials and fuel expressed in natural units - by types of resources - (*M*); operating result (*Re*); net profit or loss on the financial year (*Rn*), gross profit or loss for the financial year (*Rb*).

The application of the method of successive substitutions implies compliance with the following two basic rules:

1) *the individualization and sizing of the influence of a quantitative factor that determined the modification of the complex indicator is achieved by weighting (constant maintenance) with the basic qualitative factor as a basis for comparison;*

2) *the individualization and sizing of the influence of a qualitative factor that determined the modification of the complex indicator shall be achieved by weighting with the comparative quantitative factor.*

We mention that, in the case of the analysis on factors of influence of the indicators that characterize the efficiency of the use of direct or primary production factors (labor force, fixed assets and material assets or material and energy resources), consumed to obtain an economic result, the indicators of economic effect are treated as indicators of qualitative type, and those of economic effort have the significance and behave as quantitative indicators.

The general calculation formulas used in the case of the successive substitution method, when we want to quantify the respective changes in relative and absolute quantities, are the following:

- total modification of the complex phenomenon (indicator):

Index

$$I^{fx} = \frac{f_1 x_1}{f_0 x_0} \quad \text{or} \quad I^{fx} = \frac{\Sigma f_1 x_1}{\Sigma f_0 x_0}$$

The related absolute change,

$$\Delta = f_1 x_1 - f_0 x_0 \quad \text{or} \quad \Delta = \Sigma f_1 x_1 - \Sigma f_0 x_0$$

of which:

- the influence of the change in the quantitative factor (*f*):

Index

$I(f)=\frac{f_1x_0}{f_0x_0}$, or $I(f)=\frac{\Sigma f_1x_0}{\Sigma f_0x_0}$

The related absolute change,

$\Delta(f)=f_1x_0-f_0x_0$, or $\Delta(f)=\Sigma f_1x_0-\Sigma f_0x_0$

- the influence of the change in the qualitative factor (*x*):

Index

$I(x)=\frac{f_1x_1}{f_1x_0}$ or $I(x)=\frac{\Sigma f_1x_1}{\Sigma f_1x_0}$

The related absolute change,

$\Delta(x)=f_1x_1-f_1x_0$ or $\Delta(x)=\Sigma f_1x_1-\Sigma f_1x_0$

following the verification of the ties:

$$I^{fx}=I(f)\cdot I(x)$$

$$\Delta=\Delta(f)+\Delta(x)$$

Reference literature

The methodological study on the calculation of statistical indices through the process of comparing the isolated action of each factor and the proportional distribution of the interaction of influence factors joins the numerous methodological substantiation works that have been presented in articles and specialized papers in the country and abroad.

All the studies we refer to are based on the logic of basing the statistical approach on economic theory. There are described, separately, the methods and procedures of statistical processing of statistical information data, the particular cases regarding the size, structure and dynamics of economic variables, as well as the formation of interdependence relations between them.

In this respect, the works that describe the statistical methodology of calculation and interpretation statistical indices, the informational significance of the results, published by prof. univ. dr. Andrei T., *Statistics and econometrics*, Economic Publishing House, Bucharest, 2003[1]; Baron T., Biji E., Tövissi L., Wagner P., Isaic-Maniu Al., Korka M., Porojan D., *Theoretical and Economic Statistics*, Didactic and Pedagogical Publishing House, Bucharest, 1996[2]; Calot G., *Cours de statistique descriptive*, DUNOD Publishing House, Paris, 1965[3]; Desabie, J., *Theorie et pratique des sondages*, Statistique et programmes economiques, Volume 10, DUNOD Publishing House, Paris, 1966[4]; Isaic-Maniu Al., Mitruţ C. , Voineagu V. , *Statistics for Business Management*, Economic Publishing House, Bucharest, 1995[6]; Mihăilescu, N. , *Statistics and Statistical Bases of Econometrics*, Transversal Publishing House, Bucharest, 2021[8]; Mills F. C., *Statistical Method*, Columbia University Press, New York, 1956[9].

A customized applicative treatment refers to the factorial analysis of the dynamics of complex indicators, which is predicted by Mihăilescu N. in the paper *Analysis of economic and financial activity – Research methodologies, case studies solved for the substantiation of economic and financial decisions and knowledge tests*, Transversal Publishing House, Bucharest, 2021[7].

The above-mentioned works present, in the context of the scientifically substantiated methodology, from the economic point of view, statistical studies, in order to express the reality of the economic processes with dynamic development or in static profile.

Method of separating the isolated action of each factor with the distribution proportional interaction of influence factors
(The method of proportion increases)

Another methodological procedure used to calculate the influence of the factors that determined the modification of a complex indicator is known as *"Method of the separation of the isolated action of each factor"*.

The application of the principle of separation of the individual action of the factors that determine the modification of a complex indicator - presented according to two or more factors of influence, according to a factorial-deterministic relationship - is based on a weighting system that invariably uses the basic indicators of comparison, regardless of whether they are of a quantitative or qualitative nature. The result is, in this case, also an additional influence that is caused by the interaction of factors or the simultaneous action of factors.

The procedure of separating the isolated action of each factor leads to the amplification of the volume of calculations, especially when the number of factors that determined the modification of the complex indicator is more than two. To demonstrate this fact, we present the following scheme:

The number of statistical indices and the related absolute changes in *the case of the Procedure for the separating the isolated action of each factor*

Table 1

Number of factors	Index synthetic	Number of indices of isolated influences	Number of factor interaction indices						
2 factors	C_2^0	C_2^1	C_2^2						
No. Indices	1	2	1	1					
3 factors	C_3^0	C_3^1	C_3^2	C_3^3					
No. Indices	1	3	3	1	4				
4 factors	C_4^0	C_4^1	C_4^2	C_4^3	C_4^4				
No. Indices	1	4	6	4	1	11			
5 factors	C_5^0	C_5^1	C_5^2	C_5^3	C_5^4	C_5^5			
No. Indices	1	5	10	10	5	1	26		
6 factors	C_6^0	C_6^1	C_6^2	C_6^3	C_6^4	C_6^5	C_6^6		
No. Indices	1	6	15	20	15	6	1	57	
7 factors	C_7^0	C_7^1	C_7^2	C_7^3	C_7^4	C_7^5	C_7^6	C_7^7	
No. Indices	1	7	21	35	35	21	7	1	120

<u>**Note** on the exemplification of the calculation of the number of combinations,</u>

$$C_3^1 = \frac{3!}{1!(3-1)!} = \frac{1\cdot 2\cdot 3}{1\cdot 1\cdot 2} = 3 \quad ; \quad C_5^3 = \frac{5!}{3!(5-3)!} = \frac{1\cdot 2\cdot 3\cdot 4\cdot 5}{1\cdot 2\cdot 3\cdot 1\cdot 2} = 10$$

Thus, it is noted the important increase of the typology of the factor interaction indices, as the number of indicators considered as influencing factors is higher. It is also noted that the influences expressed by the indices of the interaction of the factors (the simultaneous action of the factors) present difficulties for interpretation and, consequently, their dimensions are to be distributed over the specified factors, using a proportionality criterion; thus, we have the image of the complexity of the calculations involved in the application of the procedure of separating the isolated action of each factor.

The exemplification of the calculation methodologies will be carried out in the variants that present the complex indicator according to two factors of influence and respectively three factors of influence, between which there is a multiplying relationship.

Case 1 – Complex indicator with two influencing factors: *a* and *b*

- the synthetic index (index of the complex indicator),

$$I = \frac{a_1 b_1}{a_0 b_0}$$ and

absolute change of the complex indicator,

$$\Delta = a_1 b_1 - a_0 b_0$$

- indices of isolated influences of factors *a* and *b*

a) $I^{(a)} = \frac{a_1 b_0}{a_0 b_0}$ and

the related absolute change,

$$\Delta^{(a)} = (a_1 - a_0) \cdot b_0 = \Delta(a) \cdot b_0$$

b) $I^{(b)} = \frac{a_0 b_1}{a_0 b_0}$ and

the related absolute change,

$$\Delta^{(b)} = (b_1 - b_0) \cdot a_0 = \Delta(b) \cdot a_0$$

- factor interaction index *a* and *b*,

$$I^{(a)(b)} = \frac{a_1 b_1}{a_1 b_0} : \frac{a_0 b_1}{a_0 b_0} = \frac{(a_1 b_1) \cdot (a_0 b_0)}{(a_1 b_0) \cdot (a_0 b_1)}$$ and

the related absolute change,

$$\Delta^{(a)(b)} = a_1 b_1 - a_1 b_0 + a_0 b_0 - a_0 b_1 = \Delta(a) \cdot \Delta(b) = (a_1 - a_0) \cdot (b_1 - b_0)$$

Recurrence relationship between indices (multiplicative format),

$$I = \frac{a_1 b_1}{a_0 b_0} = I^{(a)} \, I^{(b)} \, I^{(a)(b)}$$

Recurrence relationship between absolute changes (additive format),

$$\boxed{\Delta = a_1 b_1 - a_0 b_0 = \Delta^{(a)} + \Delta^{(b)} + \Delta^{(a)(b)}}$$

After the proportional distribution of the change caused by the interaction of the factors, the factorial influences expressed in absolute numbers are:

- the influence of the "*a*" factor,

$$\boxed{\Delta^{(a)} = (a_1 - a_0) \cdot b_0 + \frac{(a_1 - a_0) \cdot b_0}{(a_1 - a_0) \cdot b_0 + (b_1 - b_0) \cdot a_0} \cdot \Delta(a) \cdot \Delta(b)}$$

- influence of factor "*b*",

$$\Delta^{(b)} = (b_1 - b_0)\cdot a_0 + \frac{(b_1 - b_0)\cdot a_0}{(a_1 - a_0)\cdot b_0 + (b_1 - b_0)\cdot a_0}\cdot \Delta(a)\cdot\Delta(b)$$

- the coefficient of proportionality of the isolated influence, determined by the change in the factor,

$$Ka = \frac{(a_1 - a_0)\cdot b_0}{(a_1 - a_0)\cdot b_0 + (b_1 - b_0)\cdot a_0}$$

- the coefficient of proportionality of the isolated influence, determined by the change in the factor,

$$Kb = \frac{(b_1 - b_0)\cdot a_0}{(a_1 - a_0)\cdot b_0 + (b_1 - b_0)\cdot a_0}$$

Case 2 – Complex indicator with three influencing factors: *a*, *b* and *c*

- synthetic index

$I = \frac{a_1 b_1 c_1}{a_0 b_0 c_0}$ and

absolute change of the complex indicator,

$\Delta = a_1 b_1 c_1 - a_0 b_0 c_0$

- indications of isolated influences of factors *a*, *b* and *c*

a) $I^{(a)} = \frac{a_1 b_0 c_0}{a_0 b_0 c_0}$ and

the related absolute change,

$\Delta^{(a)} = (a_1 - a_0)\cdot b_0 \cdot c_0 = \Delta(a)\cdot b_0 \cdot c_0$

b) $I^{(b)} = \frac{a_0 b_1 c_0}{a_0 b_0 c_0}$ and

the related absolute change,

$\Delta^{(b)} = (b_1 - b_0)\cdot a_0 \cdot c_0 = \Delta(b)\cdot a_0 \cdot c_0$

c) $I^{(c)} = \frac{a_0 b_0 c_1}{a_0 b_0 c_0}$ and

the related absolute change,

$\Delta^{(c)} = (c_1 - c_0)\cdot a_0 \cdot b_0 = \Delta(c)\cdot a_0 \cdot b_0$

- indications of the interaction of factors

1. interaction of factors *a* and *b*

$I^{(a)(b)} = \frac{a_1 b_1 c_0}{a_1 b_0 c_0} : \frac{a_0 b_1 c_0}{a_0 b_0 c_0} = \frac{(a_1 b_1 c_0)\cdot(a_0 b_0 c_0)}{(a_1 b_0 c_0)\cdot(a_0 b_1 c_0)}$ și

- modificarea absolută

$\Delta^{(a)(b)} = a_1 b_1 c_0 - a_1 b_0 c_0 + a_0 b_0 c_0 - a_0 b_1 c_0 = (a_1 - a_0)\cdot(b_1 - b_0)\cdot c_0 = \Delta(a)\cdot\Delta(b)\cdot c_0$

2. interaction of factors *a* and *c*

$$I^{(a)(c)}=\frac{a_1b_0c_1}{a_0b_0c_1}:\frac{a_1b_0c_0}{a_0b_0c_0}=\frac{(a_1b_0c_1)\cdot(a_0b_0c_0)}{(a_0b_0c_1)\cdot(a_1b_0c_0)}\text{ şi}$$

- modificarea absolută

$$\Delta^{(a)(c)}=a_1b_0c_1-a_0b_0c_1+a_0b_0c_0-a_1b_0c_0=(a_1-a_0)\cdot(c_1-c_0)\cdot b_0=\Delta(a)\cdot\Delta(c)\cdot b_0$$

3. interaction of factors *b* and *c*

$$I^{(b)(c)}=\frac{a_0b_1c_1}{a_0b_1c_0}:\frac{a_0b_0c_1}{a_0b_0c_0}=\frac{(a_0b_1c_1)\cdot(a_0b_0c_0)}{(a_0b_1c_0)\cdot(a_0b_0c_1)}\text{ şi}$$

- modificarea absolută

$$\Delta^{(b)(c)}=a_0b_1c_1-a_0b_1c_0+a_0b_0c_0-a_0b_0c_1=(b_1-b_0)\cdot(c_1-c_0)\cdot a_0=\Delta(b)\cdot\Delta(c)\cdot a_0$$

4. interaction of factors *a*, *b* and *c*

$$I^{(a)(b)(c)}=\left[\frac{a_1b_1c_1}{a_0b_1c_1}:\frac{a_1b_1c_0}{a_0b_1c_0}\right]:\left[\frac{a_1b_0c_1}{a_0b_0c_1}:\frac{a_1b_0c_0}{a_0b_0c_0}\right]=$$

$$=\frac{(a_1b_1c_1)\cdot(a_0b_1c_0)\cdot(a_0b_0c_1)\cdot(a_1b_0c_0)}{(a_0b_1c_1)\cdot(a_1b_1c_0)\cdot(a_1b_0c_1)\cdot(a_0b_0c_0)}\text{ şi}$$

- modificarea absolută

$$\Delta^{(a)(b)(c)}=(a_1b_1c_1)+(a_0b_1c_0)+(a_0b_0c_1)+(a_1b_0c_0)-(a_0b_1c_1)-(a_1b_1c_0)-$$
$$-(a_1b_0c_1)-(a_0b_0c_0)=(a_1-a_0)\cdot(b_1-b_0)\cdot(c_1-c_0)=\Delta(a)\cdot\Delta(b)\cdot\Delta(c)$$

Recurrence relationship between indices (multiplicative format),

$$I=\frac{a_1b_1c_1}{a_0b_0c_0}=I^{(a)}\,I(b)\,I(c)\,I^{(a)(b)}\,I(a)(c)\;I(b)(c)\cdot I(a)(b)\cdot^{(c)}$$

<u>Recurrence relationship between absolute changes (additive format),</u>

$$\boxed{\Delta=a_1b_1c_1-a_0b_0c_0=\Delta^{(a)}+\Delta^{(b)}+\Delta^{(c)}+\Delta^{(a)(b)}+\Delta^{(a)(c)}+\Delta^{(b)(c)}+\Delta^{(a)(b)(c)}}$$

After the proportional distribution of the changes caused by the interaction of the factors with the changes calculated by the isolated substitution of each factor, <u>the factorial influences expressed in absolute numbers</u> (process derived in additive format) are:

- the influence of the "*a*" factor,

$$\Delta^{(a)}=\Delta(a)\cdot b_0\cdot c_0+\frac{\Delta(a)\cdot b_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(b)\cdot a_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(a)\cdot\Delta(b)\cdot\Delta(c)+$$
$$+\frac{\Delta(a)\cdot b_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(b)\cdot a_0\cdot c_0}\cdot\Delta(a)\cdot\Delta(b)\cdot c_0+$$
$$+\frac{\Delta(a)\cdot b_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(\mathrm{a})\cdot\Delta(c)\cdot b_0$$

- influence of factor "*b*",

$$\Delta^{(b)}=\Delta(b)\cdot a_0\cdot c_0+\frac{\Delta(b)\cdot a_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(b)\cdot a_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(a)\cdot\Delta(b)\cdot\Delta(c)+$$
$$+\frac{\Delta(b)\cdot a_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(b)\cdot a_0\cdot c_0}\cdot\Delta(a)\cdot\Delta(b)\cdot c_0+$$
$$+\frac{\Delta(b)\cdot a_0\cdot c_0}{\Delta(b)\cdot a_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(b)\cdot\Delta(c)\cdot a_0$$

- the influence of the "c" factor,

$$\Delta^{(c)}=\Delta(c)\cdot a_0\cdot b_0+\frac{\Delta(c)\cdot a_0\cdot b_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(b)\cdot a_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(a)\cdot\Delta(b)\cdot\Delta(c)+$$
$$+\frac{\Delta(c)\cdot a_0\cdot b_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(a)\cdot\Delta(c)\cdot b_0+$$
$$+\frac{\Delta(c)\cdot a_0\cdot b_0}{\Delta(b)\cdot a_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(b)\cdot\Delta(c)\cdot a_0$$

The exposed methodology has a rigorous content, which respects a principle of calculation and proportional attribution of influence factors that explain the modification of an indicator of the result of economic activity, synthetic or complex, obtained through sequential contribution, but, at the same time, unitary contribution of two or more factors with different degrees of importance. The general purpose of this methodology is to provide information not affected by limited, particular principles, with justifications to which more or less sufficiently relevant counter-arguments can be made.

It is mentioned that there is an inconsistency in the complexity of the calculations, more difficult to achieve if a manual procedure is used, and a computer solution would be fully recommended.

Case study, demonstrative

It is mentioned that, in order to achieve a convenient demonstration, the derivative procedure in additive format will be applied and the statistical data to be used are conventional. The complex indicator ("Y") under analysis is presented as the product of a number of three indicators of influence factors, "a", "b" and "c"..

Statistical data system on the dynamics of the indicator "Y" and influence factors "a", "b" and "c".

Table 2

Name of the indicators	Base period u.m.	Calculation period u.m.	Dynamics indices
Complex indicator	$Y_0 = a_0 \cdot b_0 \cdot c_0 = 90$	$Y_1 = a_1 \cdot b_1 \cdot c_1 = 192$	2,13333
Factorial indicators a	3	4	1,33333
Factorial indicators b	5	6	1,20000
Factorial indicators c	6	8	1,33333

The total absolute change of the complex indicator, in the calculation period compared to the basic period de, is given by the following relationship:

$\Delta = a_1b_1c_1 - a_0b_0c_0 = 192 - 90 = +102$, of which:

- isolated influence of the indicator (factor) "a"

$$\Delta^{(a)}=(a_1-a_0)\cdot b_0\cdot c_0=(4-3)\cdot 5\cdot 6=+30$$

- isolated influence of the indicator (factor) *"b"*

$$\Delta^{(b)}=(b_1-b_0)\cdot a_0\cdot c_0=(6-5)\cdot 3\cdot 6=+18$$

- isolated influence of the indicator (factor) *"c"*

$$\Delta^{(c)}=(c_1-c_0)\cdot a_0\cdot b_0=(8-6)\cdot 3\cdot 5=+30$$

- simultaneous influence of indicators (interaction of factors) *"a"* and *"b"*

$$\Delta^{(a)(b)}=(a_1-a_0)\cdot(b_1-b_0)\cdot c_0=(4-3)\cdot(6-5)\cdot 6=+6$$

- simultaneous influence of indicators (interaction of factors) *"a"* and *"c"*

$$\Delta^{(a)(c)}=(a_1-a_0)\cdot(c_1-c_0)\cdot b_0=(4-3)\cdot(8-6)\cdot 5=+10$$

- simultaneous influence of indicators (interaction of factors) *"b"* and *"c"*

$$\Delta^{(b)(c)}=(b_1-b_0)\cdot(c_1-c_0)\cdot a_0=(6-5)\cdot(8-6)\cdot 3=+6$$

- simultaneous influence of indicators (interaction of factors) *"a"*, *"b"* and *"c"*

$$\Delta^{(a)(b)(c)}=(a_1-a_0)\cdot(b_1-b_0)\cdot(c_1-c_0)=(4-3)\cdot(6-5)\cdot(8-6)=+2$$

After the application of the procedure for allocating the inter-selection of the factors, it follows:

- the influence of the *factor "a"*

$$\Delta^{(a)}=\Delta(a)\cdot b_0\cdot c_0+\frac{\Delta(a)\cdot b_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(b)\cdot a_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(a)\cdot\Delta(b)\cdot\Delta(c)+$$
$$+\frac{\Delta(a)\cdot b_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(b)\cdot a_0\cdot c_0}\cdot\Delta(a)\cdot\Delta(b)\cdot c_0+$$
$$+\frac{\Delta(a)\cdot b_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(a)\cdot\Delta(c)\cdot b_0=$$
$$=30+\frac{30}{30+18+30}\cdot 2+\frac{30}{30+18}\cdot 6+\frac{30}{30+30}\cdot 10=$$
$$=30{,}00000+0{,}76923+3{,}75000+5{,}00000=+39{,}51923$$

- the influence of factor *"b"*

$$\Delta^{(b)}=\Delta(b)\cdot a_0\cdot c_0+\frac{\Delta(b)\cdot a_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(b)\cdot a_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(a)\cdot\Delta(b)\cdot\Delta(c)+$$
$$+\frac{\Delta(b)\cdot a_0\cdot c_0}{\Delta(a)\cdot b_0\cdot c_0+\Delta(b)\cdot a_0\cdot c_0}\cdot\Delta(a)\cdot\Delta(b)\cdot c_0+$$
$$+\frac{\Delta(b)\cdot a_0\cdot c_0}{\Delta(b)\cdot a_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0}\cdot\Delta(b)\cdot\Delta(c)\cdot a_0=$$
$$=18+\frac{18}{30+18+30}\cdot 2+\frac{18}{30+18}\cdot 6+\frac{18}{18+30}\cdot 6=$$
$$=18{,}00000+0{,}46154+2{,}25000+2{,}25000=22{,}96154$$

- the influence of the *factor "c"*

$$\Delta^{(c)} = \Delta(c)\cdot a_0 \cdot b_0 + \frac{\Delta(c)\cdot a_0 \cdot b_0}{\Delta(a)\cdot b_0 \cdot c_0 + \Delta(b)\cdot a_0 \cdot c_0 + \Delta(c)\cdot a_0 \cdot b_0}\cdot \Delta(a)\cdot \Delta(b)\cdot \Delta(c) +$$

$$+ \frac{\Delta(c)\cdot a_0 \cdot b_0}{\Delta(a)\cdot b_0 \cdot c_0 + \Delta(c)\cdot a_0 \cdot b_0}\cdot \Delta(a)\cdot \Delta(c)\cdot b_0 +$$

$$+ \frac{\Delta(c)\cdot a_0 \cdot b_0}{\Delta(b)\cdot a_0 \cdot c_0 + \Delta(c)\cdot a_0 \cdot b_0}\cdot \Delta(b)\cdot \Delta(c)\cdot a_0 =$$

$$= 30 + \frac{30}{30+18+30}\cdot 2 + \frac{30}{30+30}\cdot 10 + \frac{30}{18+30}\cdot 6 =$$

$$= 30{,}00000 + 0{,}76923 + 5{,}00000 + 3{,}75000 = 39{,}51923$$

In order to calculate the factorial influences that determined the modification of the complex indicator, the following coefficients of proportionality were used:

1) for the distribution of the interaction of factors *a*, *b* and *c*

- the coefficient of proportionality of the isolated influence, determined by the change in the *factor "a"*

$$K(a)bc = \frac{\Delta(a)\cdot b_0 \cdot c_0}{\Delta(a)\cdot b_0 \cdot c_0 + \Delta(b)\cdot a_0 \cdot c_0 + \Delta(c)\cdot a_0 \cdot b_0} = \frac{30}{30+18+30} = 0{,}384615$$

- the coefficient of proportionality of the isolated influence, determined by the change in the factor *"b"*

$$Ka(b)c = \frac{\Delta(b)\cdot a_0 \cdot c_0}{\Delta(a)\cdot b_0 \cdot c_0 + \Delta(b)\cdot a_0 \cdot c_0 + \Delta(c)\cdot a_0 \cdot b_0} = \frac{18}{30+18+30} = 0{,}230769$$

- the coefficient of proportionality of the isolated influence, as determined by the change in the *factor "c"*

$$Kab(c) = \frac{\Delta(c)\cdot a_0 \cdot b_0}{\Delta(a)\cdot b_0 \cdot c_0 + \Delta(b)\cdot a_0 \cdot c_0 + \Delta(c)\cdot a_0 \cdot b_0} = \frac{30}{30+18+30} = 0{,}384615$$

2. for the distribution of the interaction of factors *"a"* and *"b"*

- the coefficient of proportionality of the isolated influence, determined by the change in the *factor "a"*

$$K(a)b = \frac{\Delta(a)\cdot b_0 \cdot c_0}{\Delta(a)\cdot b_0 \cdot c_0 + \Delta(b)\cdot a_0 \cdot c_0} = \frac{30}{30+18} = 0{,}625$$

- the coefficient of proportionality of the isolated influence, determined by the change in the factor *"b"*

$$Ka(b) = \frac{\Delta(b)\cdot a_0 \cdot c_0}{\Delta(a)\cdot b_0 \cdot c_0 + \Delta(b)\cdot a_0 \cdot c_0} = \frac{18}{30+18} = 0{,}375$$

3. for the distribution of the interaction of factors *"a"* and *"c"*

- the coefficient of proportionality of the isolated influence, determined by the change in the *factor "a"*

$$K(a)c = \frac{\Delta(a)\cdot b_0 \cdot c_0}{\Delta(a)\cdot b_0 \cdot c_0 + \Delta(c)\cdot a_0 \cdot b_0} = \frac{30}{30+30} = 0{,}500$$

- the coefficient of proportionality of the isolated influence, as determined by the change in the *factor "c"*

$$Ka(c) = \frac{\Delta(c)\cdot a_0 \cdot b_0}{\Delta(a)\cdot b_0 \cdot c_0 + \Delta(c)\cdot a_0 \cdot b_0} = \frac{30}{30+30} = 0{,}500$$

4. for the distribution of the interaction of factors *"b"* and *"c"*

- the coefficient of proportionality of the isolated influence, determined by the change in the factor *"b"*

$$K(b)c = \frac{\Delta(b)\cdot a_0 \cdot c_0}{\Delta(b)\cdot a_0 \cdot c_0 + \Delta(c)\cdot a_0 \cdot b_0} = \frac{18}{18+30} = 0{,}375$$

- the coefficient of proportionality of the isolated influence, as determined by the change in the *factor "c"*

$$Kb(c) = \frac{\Delta(c)\cdot a_0\cdot b_0}{\Delta(b)\cdot a_0\cdot c_0+\Delta(c)\cdot a_0\cdot b_0} = \frac{30}{18+30} = 0{,}625$$

Total absolute change of the complex indicator: CU +102.00000.
of which:
- influence of the factor *"a"*: CU +39.51923.
- influence of the factor *"b"*: CU +22.96154.
- influence of the *factor "c"*: CU +39.51923.

Based on these results, the following findings are outlined:
- the complex indicator recorded an increase in the calculation period, compared to the level of the base period of 2.1333 times, respectively by CU 102,000;
- the factor *"a"* caused the increase of the complex indicator *"Y"* by CU 39.51923 by 38.744%, respectively;
- factor *"b"* justifies the increase of the complex indicator *"Y"* by CU 22.96154 by 22.511%, respectively;
- factor *"c"* caused the increase of the complex indicator *"Y"* by CU 39.51923 by 38.744%, respectively.

Note: A custom situation for a complex indicator, such as "Turnover", can be written in the following functional relationship, $Y = f(a,b,c)$:

Turnover (Y) = Stock turnover rate expressed in number of turnovers (a) x Proportion of stocks in the value of current assets (b) x Value of current assets (c)

It is specified that the value of stocks and the value of current assets, respectively, are calculated as average values for a period of time for which turnover has been recorded.

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