COMMENTS ON THE PROBLEMS OF METHODOLOGY OF CALCULATION BY REGULATORY COSTS IN THE ACCA MANAGEMENT ACCOUNTING

Merab JIKIA
Ivane Javakhishvili Tbilisi State University, Georgia
merab.jikia@tsu.ge

Abstract
In conditions of a market economy, the use of mathematical methods and modern computer technologies in analytical research has significantly increased their level and role. Management analysis has become deeper and more complex, can be carried out more quickly, include more objects and study much more information. Considering that the companies' budgets are based on regulatory costs, regulatory costs are important in calculating and analyzing deviations. The analysis of deviations plays the role of a certain "regulatory" mechanism for management, since it shows how well or poorly the company is performing. A systematic approach in management analysis makes it necessary to study factors taking into account their internal and external relationships, interactions and hierarchy of subordination, which is achieved by systematizing factors. A distinction is made between deterministic and stochastic factor systems. The creation of a deterministic factor system means the representation of the event under study in the form of an algebraic sum, a quotient or an increment of several factors that determine its size and are in functional dependence with it. One of the most important methodological tasks of management analysis is the accurate measurement of the magnitude of the influence of individual factors on the indicators under study. For this purpose, the following methods are used in deterministic analysis: chain insertion method, absolute difference method, relative difference method, integral method, logarithmic method, etc.

Keywords: *Factors; Normative cost; Multiplicative model; Chain insertion method; Absolute difference method; Relative difference method; Integral method; Logarithmic method.*

JEL Classification: *E16, H83, M48*

I. GENERAL ANALYSIS

All events and processes of economic activity of companies are interconnected, interdependent and mutually definable. One group of them directly, directly depends on each other, and the other group - indirectly.

Each event can be considered as a cause or effect. If in the process of analysis one or another indicator is considered as the result of one or more reasons and is presented as an object of research, then in the study of relationships it is called resultant indicators, and indicators that determine the behavior of the properties of the resultant indicator are called factor indicators.

The chain insertion method is used to calculate the influence of factors for all types of deterministic factor models (additional, multiplicative, multiple and combined). Therefore, the chain insertion method is used when there is a functional relationship between the resultant indicators and the factors affecting them. The main requirement for using this method (as well as methods of absolute and relative difference) is that at first the influence of quantitative factors on the resultant indicator is determined, and then – of qualitative factors. The essence of the chain insertion method is that in a chain of values of various factors, in which the value of all links, that is, all factors, is planned, sequentially, in accordance with each individual factor and in turn, the actual values of factors are taken and each calculation is subtracted from its previous calculation. The obtained magnitude will be the influence of the given factor on the resultant indicator. To illustrate all of the above, let's consider a particular example and take the numerical data from the ACCA management accounting examination exercises (Task N332)

Table N1

Indicator	Conditional designation	Planned	factual	Deviation (+ , -)
1. Total costs of materials, USD	Q	25 500	25 839	+339
2 Output volume (unit)	X	600	580	-20
3. Unit price of materials (1 kg), USD	Y	17,0	16.5	-0,5
4.Material consumption per unit of production (kg)	Z	2, 5	2.7	+0.2

In case of the chain insertion method we will have the following calculations:

1. $X_0*Y_o*Z_0=Q_0$ **Note:** 0s - show the planned indicators
2. $X_1*Y_o*Z_0=Q^1$ 1s - show the factual indicators
3. $X_1*Y_1*Z_0=Q^{11}$ Primes – show the intermediate indicators
4. $X_1*Y_1*Z_1=Q_1$

I. Factor - Impact of changes in the output volume of products:

$$X_0*Y_o*Z_0=Q_0$$

$$X_1*Y_o*Z_0=Q^1$$

$$\pm\Delta_1= Q^1 - Q_0 = 580 * 17.0 * 2,5 – 600 * 17,0 * 2,5 = - 850 \text{ USD}$$

II. Factor - Impact of price changes per unit of material (1kg):

$$X_1*Y_o*Z_0=Q^1$$

$$X_1*Y_1*Z_0=Q^{11}$$

$$\pm\Delta_2= Q^{11} – Q^1 = 580 * 16,5 * 2,5 – 580 * 17,0 * 2,5 = - 725 \text{ USD}$$

III. Factor - Impact of material consumption changes per unit of production:

$$X_1*Y_1*Z_0=Q^{11}$$

$$X_1*Y_1*Z_1=Q_1$$

$$\pm\Delta_3= Q_1 – Q^{11} = 580 * 16,5 * 2,7 – 580 * 16,5 * 2,5 = +1914 \text{ USD}$$

$$\pm\Delta = \pm\Delta_1 \pm\Delta_2 \pm\Delta_3 = - 850 - 725 + 1914 = + 339 \text{ USD}$$

Absolute difference method is used to calculate value of the influence of individual factors on the result indicator in deterministic factor analysis, only in case of multiplicative ($Y=X_1*X_2*X_3*…X_n$) and multiplicative-aditional $Y=(a-b)*c$ and $Y=a*(b-c)$ type models. Indeed, its use is limited, however, due to simplicity of the methodology, it is widely used when conducting managerial analysis.

According to the principle of the absolute difference method, in order to measure the magnitude of the influence of a particular factor on the resultant indicator, it is necessary to find the difference between the actual and the planned indicators of the given factor, first multiply the obtained magnitude by the actual indicators of the factors preceding this factor and then by the planned indicators. When using this method, similar to the principle of using the chain insertion method, the influence of quantitative factors on the resultant indicator is determined first, and then of the qualitative ones. In addition, the calculation is simpler and more convenient, each calculation already gives an answer to the question, whereas when using the chain insertion method to measure the magnitude of the influence of each factor, two calculations were required.

To illustrate the above, use the data in Table N1, from which the influence of each factor is expressed as follows by the formulas:

I. **Factor -** Impact of changes in the output volume of products:

$$\pm\Delta_1 = (X_1 – X_0) *Y_0 * Z_0 =(580 – 600) * 17,0 * 2,5 = - 850 \text{ USD}$$

II. **Factor -** Impact of price changes per unit of material (1kg):

$$\pm\Delta_2 =(Y_1 – Y_0) *X_1 * Z_0 = (16,5 – 17,0) * 580 * 2,5 = - 725 \text{ USD}$$

III. **Factor -** Impact of material consumption changes per unit of production:

$$\pm\Delta_3 = (Z_1 – Z_0) *X_1 * Y_1 = (2,7 – 2,5) * 580 * 16,5 = + 1 914 \text{ USD}$$

$\pm\Delta_{=}\pm\Delta_1\pm\Delta_2\pm\Delta_3$**= - 850 - 725 + 1 914 = + 339 USD**

The integral method is used to measure the impact of factors in multiplicative, multiple and multiplicative-aditive models. Its use allows to obtain more accurate results of the impact of factors than we get when using chain insertion or absolute difference method, since as a result of the interaction of factors an additional change in the resultant indicator joins not the last factor, but is evenly distributed between them. Besides, when determining the influence of quantitative or qualitative factors on the average, their location does not matter. To illustrate this, let's look at a specific example (Table N2) for factor analysis of the cost of products sold.

Table N2

Indicators	Conditional designation	Planned	Factual	Deviation (+ , -)
Cost of products sold, USD	Q	107 500	180 000	+ 72 500
Output volume (unit)	X	250	400	+150
Selling price per unit of production, USD	Y	430	450	+20

In the above example, the cost of the proucts sold Q is the function of to variables. In particular, it is the product of the output volume (X) and the selling price per unit of production (Y). The above function is a type of multiplicative model, since it is represented as two co-multipliers

Changes in the value of products sold during the reporting period can be represented as follows:

$$\mathbf{Q_1 - Q_0 = X_1 * Y_1 - X_0 * Y_0}$$

Changes in the resultant indicator can be represented as follows:

$$\mathbf{\Delta Q = \Delta Q_x - \Delta Q_y}$$

In fact, the change in the resultant indicator during the reporting period is formed not by two, but by three elements:

$$\mathbf{\Delta Q = Q_1 - Q_0 = (X_0 + \Delta X) * (Y_0 + \Delta Y) - X_0 * Y_0}$$

$$\mathbf{\Delta Q = \Delta X * Y_0 + \Delta Y * X_0 + \Delta X_0 * \Delta Y_0}$$

Let's enter the data from Table 2 in the above formula:

Δ Q = 150 * 430 + 20 * 250 + 150 *20 = 64 500 + 5 000 + 3 000 = **72 500 USD**

As the calculation shows, the amount of sales increased by 64 500 USD, i.e. by change of the unit price of the the sales - 5 000 USD, while as for the last item - 3 000 USD, it is the result of simultaneous action of both factors, which is often called undistributed balance. The most common way to distribute is to evenly distribute it on the both acting factorst. Therefore, the impact of the firnst factor will be equal to 66 000 US dollars (64 500 + 1 500), while factor 2 is 6.500 USD (5000 + 1500).

The algorithm of calculation in case of **two-factor model (Q = X * Y)** will be as follows:

$$\mathbf{\Delta Q_x = 1/2\, \Delta X(Y_0 + Y_1)\ ;} \qquad \mathbf{\Delta Q_y = 1/2\, \Delta Y(X_0 + X_1);}$$

According to our example:

Δ $\mathbf{Q_x}$ = 1/2 * 150(430 + 450) = **66 000 USD**

Δ $\mathbf{Q_y}$ = 1/2 * 20(250 + 400) = **6 500 USD**

The algorithm of calculation in case of **three -factor model (Q=X * Y * Z)** will be as follows:

$$\Delta Q_x = 1/2 \, \Delta X(Y_0 * Z_1 + Y_1 * Z_0) + 1/3 \, \Delta X * \Delta Y * \Delta Z;$$

$$\Delta Q_y = 1/2 \, \Delta Y(X_0 * Z_1 + X_1 * Z_0) + 1/3 \, \Delta X * \Delta Y * \Delta Z;$$

$$\Delta Q_z = 1/2 \, \Delta Z(X_0 * Y_1 + X_1 * Y_0) + 1/3 \, \Delta X * \Delta Y * \Delta Z.$$

If we include the data of Table N1 in the above formulas, then the impact of factors will have the following values:

I. Factor - Impact of changes in the output volume of products:

$\pm\Delta_1$ = 1/2 * (- 20) (17,0 * 2,7 + 16,5 * 2.5) + 1/3 * (-20) * (-0,5) * 0.3 **= - 870,8 USD**

II. Factor - Impact of price changes per unit of material (1kg):

$\pm\Delta_2$ = 1/2 * (-0.5) (600 * 2,7 + 580 * 2,5) + 1/3 * (-20) * (-0,5) * 0.3 **= - 766,8 USD**

III. Factor - Impact of material consumption changes per unit of production:

$\pm\Delta_3$ = 1/2 * (0,2)(600 * 16,5+ 580 * 17,0) + 1/3 * (-20) * (-0,5) * 0.3 **= + 1 976,6 USD**

$\pm\Delta = \pm\Delta_1 \pm\Delta_2 \pm\Delta_3$ **= - 870,8 -766,8 + 1 976,6 = 339 USD**

Compared to the integral integral method the logarithmic method provides higher accuracy of calculations. If, as a result of the interaction of factors when using the integral method, additional changes in the resultant indicator are distributed evenly among the acting factors, under the logarithmic method, the result of the joint action of factors at the level of the resultant indicator is distributed in proportion to the specific weight of the isolated impact of each individual factor.

As we have already mentioned above, the methodology of using traditional methods of economic analysis in deterministic factor analysis (chain insertion method, absolute difference method, relative difference method) requires to determine first quantitative and then qualitative factors.

If their places are shifted, then the value of the impact of specific factors will also change. Such changes (by shifting the places of factors) do not relate to the value of the impact of factors when using integral and logarithmic methods. To illustrate this, let's consider an example based on the change of location of quantitative and qualitative factors (the 2nd and the 3rd factors) provided by us in Table N1

According to the data of Table N1, **before changing the location**, , the impact of the change of factor 2 (Impact of price changes per unit of material (1kg)), by the absolute difference method and the integral method, respectively, is equal to:

$$\pm\Delta_2 = (Y_1 - Y_0) * X_1 * Z_0 = (16,5 - 17,0) * 580 * 2,5 = - 725 \text{ USD}$$

$$\pm\Delta_2 = ½ \, \Delta Y (X_0 Z_1 + X_1 Z_0) + 1/3 \Delta X \, \Delta Y \Delta Z = - 766,8 \text{ USD}$$

Data for factor analysis of the total cost of materials

Table N3

Indicators	**Conditional designation**	**Planned**	**Factual**	**Deviation (+ , -)**
1. Total cost of materials, USD	Q	25 500	25 839	+339
2. Output volume, unit	X	600	580	-20
3.Material consumption per unit of production (kg)	Y	2.5	2,7	+ 0,2
4. Material unit price (1kg.) USD	Z	17,0	16,5	-0,5

By the data of Table N3, after changing location, the impact of the 3rd Factor (Impact of material consumption changes per unit of production) by the **absolute difference method** and the **integral method,** respectively, is equal to:

$\pm\Delta_3 = (Z_1 - Z_0) * X_1 * Y_1 = - 0,5 * 580 * 2,7 = - 783$ **USD**

$\pm\Delta_3 = ½ \, \Delta Z (X_0 Y_1 + X_1 Z_0) + 1/3 \Delta X \, \Delta Y \Delta Z = - 766,8$ **USD**

Comment:

a) Under the **absolute difference method**, the impact of quantitative factor has changed (**-725 USD** changed to **-783 USD**);

b) Under the **integral method,** the impact of quantitative factor has remained unchanged (**766,8 USD**).

As the calculation shows, by changing the locations of factors a magnitude of their impact has changed when using the absolute difference method, and has remained unchanged in case of the integral method

One of the basic goals of the calculations by regulatory costs in the **ACCA Management Accounting is** to determine accurately and analyze the values of total deviations of materials, labor costs and variable overhead costs and the influence of factors affecting them.

So, for example, according to ACCA, there are two reasons for the deviation of material costs:

- Difference in purchase price;
- Difference in the amount of material used.

The total deviation of materials is the difference (difference):

between the normative cost of the material required for actual production and the actual cost of the direct material.

Material price deviation = (actual purchase quantity * actual price) – (actual purchase quantity * normative price);

Deviation from the use of materials = (number of materials actually used * normative price) - – normative quantity of materials used for actual production * normative price);

or,

(1) actual quantity * actual price

Deviation in price (difference between lines (1) and (2))

(2) actual quantity * regulatory price

Deviation in use (difference between lines (2) and (3))

(3) regulatory quantity * regulatory price (sum of the deviations in price and use)

Note:

In our opinion, in order to better analyze the total deviation, it would be advisable to subtract the second item from the first (i.e., we need to subtract the actual cost of direct material from the regulatory cost of material required for actual production). If the difference is a positive number, it ,rans that we have an overspending, i.e. an unfavorable deviation and vice versa, if the difference is a negative number, it means that we have economy, that is, a favorable deviation.

Let's consider the 3rd illustrative example given in the studying text of calculations by regulatory costs in the ACCA Management Accounting and, give proper **comment**

The following data relate to the production of X product:

Extract from the X product regulatory costs accounting card

Direct materials (40 sq.m. * $ 5,30 per sq.m.) $212

Actual results of consumption of direct materials:

1000 units were produced and 39 000 sq.m. material was used, valued as $210.600

Required:

To calculate the total deviation of materials for a given period, as well as deviations in the prices and use of materials for the X product.

Solution:

Actual quantity * $ 210 600
Actual price **Deviation in price** $ 3 900

Actual quantity *
Regulatory price
39 000 * $ 5.30 $ 206 700
Deviation in use $ 5 300

Regulatory quantity *
Regulatory quantity for actual production
1 000 * 40 * $ 5.30 $212 000
Total deviation $ 1 400

Let's solve the **3rd illustrative task** using the method of absolute difference and integral method. (**Note**:

planned and actual production data of X product coincide to each other).

Solution with absolute difference method:

Table N3

Indicators	Conditional designation	Planned	Factual	Deviation (+ , -)
1. Total cost of materials, USD	Q	212 000	210 0	-1 400
2. Output volume, unit	X	1 000	1 000	0
3. Material unit price (1kg.) USD	Y	5.3	5.4	+0.1
4. Material consumption per unit of production (kg)	Z	40	39	-1

Since both indicators participating in the calculation of the total deviation of materials are calculated based on the actual volume of production, when using the absolute difference method, in the three-factor model (**Q = X * Y * Z**), the magnitude of the impact of the first factor is actually ignored (i.e. the magnitude of the impact is zero), and the sum of the influences of the 2nd and the 3rd factors should give a total deviation of fhe matrllas

Total deviation = 1 000 * 5.4 * 39 – 1 000 * 5.3 * 40 = 210 600 – 212 000 = **1 400 USD (Favorable deviation).**

a) Factor - Impact of changes in the output volume of products:

$$\pm\Delta_1 = (X_1 - X_0) * Y_0 * Z_0 = (1\,000 - 1\,000) * 5{,}3 * 40 = 0 \text{ USD}$$

b) Factor - Impact of price changes per unit of material (1kg):

$$\pm\Delta_2 = (Y_1 - Y_0) * X_1 * Z_0 = (5{,}4 - 5{,}3) * 1\,000 * 40 = \textbf{4 000 USD (Unfavorable deviation);}$$

c) factor - Impact of material consumption changes per unit of production:

$$\pm\Delta_3 = (Z_1 - Z_0) * X_1 * Y_1 = (39 - 40) * 1\,000 * 5{,}4 = \textbf{- 5 400 USD (Favorable deviation).}$$

Total deviation = 4 000 – 5 400 = **-1 400 USD (Unfavorable deviation)**

Solution with integral method:

a) Factor - Impact of changes in the output volume of products:

$\Delta Q_x = 1/2\, \Delta X(Y_0 * Z_1 + Y_1 * Z_0) + 1/3\, \Delta X * \Delta Y * \Delta Z$=0 (planned and actual volumes of production coincide)

b) Factor - Impact of price changes per unit of material (1kg):

$$\Delta Q_y = 1/2\, \Delta Y(X_0 * Z_1 + X_1 * Z_0) + 1/3\, \Delta X * \Delta Y * \Delta Z =$$

= 1/2 * (0,1) (1 000 * 39 + 1 000 * 40) + 1/3 * (0) * (0.1) *(-1) =
+ 3 950 USD (Unfavorable deviation);

c) Factor - Impact of material consumption changes per unit of production:

$$\Delta Q_z = 1/2\, \Delta Z (X_0 * Y_1 + X_1 * Y_0) + 1/3\, \Delta X * \Delta Y * \Delta Z =$$

1/2 * (-1)(1 000 * 5,4 + 1 000 * 5,3) + 1/3 * (0) * (0,1) * (-1) **= -5 350 USD (Favorable deviation);**

Total deviation 3 950 – 5 350 = **-1 400 USD (Favorable deviation);**

Comment: The magnitude of the impact of factors by using the chain insertion and relative difference methods is received the same as in case of use of the absolute difference method). In other words, the magnitude of the influence of factors determined by the main working methods of economic analysis does not coincide with the data obtained according to the study text of the calculation of regulatory costs in the **ACCA management accounting** and the methodology used in the examination exercises, both by the factor analysis of deviations in material and labor costs, as well as by analysis of deviations in variable overhead costs. Moreover, the magnitude of the influence of factors determined by Integral and logarithmic methods is also different.

A certain question arises - which method of determining the factors of influence should we rely on? Or, why there is a difference in the magnitude of the influence of factors!? In our opinion, it will be more accurate if we rely on the values of the influence of factors calculated by Integral and logarithmic methods. However, to determine the magnitude of the influence of factors, the main thing, depending on the condition of the task, is to correctly compile an analytical table, and then, by which way we solve the task, it depends on us or on the condition of the task. We think that this approach is simpler to explain and understand than what is offered by the study text on calculation of regulatory costs in ACCA management accounting.

II. CONCLUSION

A need to solve complex economic tasks at the modern stage of development of a market economy has become a powerful incentive for the use of mathematical modeling in economic analysis.

The article discusses the advantages and disadvantages of different methods (chain insertion method, absolute difference method, relative difference method, integral and logarithmic method) used for determining the magnitude of the influence of individual factors on the study indicator.

When using separate methods (chain method, absolute difference method, relative difference method), the influence of quantitative factors on the resultant factors indicators is determined initially (in sequence), and later - qualitative. When using integral and logarithmic methods, the magnitude of the influence of quantitative and qualitative factors on the relative indicator does not change depending on their location.

The integral method is used to measure the impact of factors in multiplicative, multiple and multiplicative-aditive models. Its use allows obtaining more accurate results of the impact of factors than we get when using chain insertion or absolute difference method, since as a result of the interaction of factors an additional change in the resultant indicator joins not the last factor, but is evenly distributed between them.

Compared to the integral integral method the logarithmic method provides higher accuracy of calculations. If, as a result of the interaction of factors when using the integral method, additional changes in the resultant indicator are distributed evenly among the acting factors, under the logarithmic method, the result of the joint action of factors at the level of the resultant indicator is distributed in proportion to the specific weight of the isolated impact of each individual factor.

The magnitude of the influence of factors determined by the main working methods of economic analysis does not coincide with the data obtained according to the study text of the calculation of regulatory costs in the ACCA **management accounting** and the methodology used in the examination exercises (magnitude of the influence of factors determined by Integral and logarithmic methods is also different).

In our opinion, it will be more accurate if we rely on the values of the influence of factors calculated by Integral and logarithmic methods. However, to determine the magnitude of the influence of factors, the main thing, depending on the condition of the task, is to correctly compile an analytical table, and then, by which way we solve the task, it depends on us or on the condition of the task. We think that this approach is simpler to explain and understand than what is offered by the study text on calculation of regulatory costs in the **ACCA management accounting.**

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