

65.053

**V.O. Kostiuk, M. V. Kovalyov***O.M. Beketov National University of Urban Economy in Kharkiv***ANALYTIC MODELING AND FACTOR ANALYSIS OF WATER SUPPLY ECONOMY PROFIT**

*Methodics of analytic modeling and calculation of influence of separate factors on the general changing of profit of water supply economy are considered. It is suggested the factor analysis of this index involves a series of multiplied determinated models including a list of important production-operational and economic factors. For the calculation of the influence of these factors on the change of the researched index of profit it is suggested to apply the method of chain substitutions, which in the factor model involves chain substitution of base value of each of the interacting factors – both reported and compared results that are successively received from each substitution. This approach allows determining the influence of each factor on quantity of the resulting index separately.*

**Key words:** modeling, factor analysis, profit, water supply economy, tariff, water pumping, volume of water output to the consumer, income, rate of return.

**Background of the problem**

Due to transformation in Ukrainian economy, providing effective functioning of enterprise requires new approaches to formation of management system. Techno-economic analysis has become important for realization of these processes. It (analysis) helps evaluate objectively manufacturing activities of economy subjects, base management solutions and control their fulfillment. Negative influence of our environment, growth of economical information role, integration and globalization of social phenomena also require corresponding changes in managing enterprise. So, it is essential to improve analytic subsystem aimed at searching better final financial results of its working.

Thus, essential means of many economic problems solution and analytic and synthetic research is application of enterprise economic activity modeling and usage of economic and statistical methods. It requires economic and mathematical modeling for entire reliable representation of functioning process as subject of economy on the whole, as well as separated structural subdivisions. At the same time, general model of economic analysis functional subsystem realization is transformation of economical information into analytical one, which may be used for corresponding scientifically based management solutions.

Written above can be referred to full extent to activity of any enterprise including water supply economy, which is taken as an example for explanation of analytical modeling method and factor analysis of final financial results.

**Analysis of the latest research**

Problems of usage of enterprises of analytic modeling and factor analysis of economic and statistical

indices were considered by lots of economists [1-6]. But they use general characteristic of indicated questions in their works and peculiarities of some enterprises manufacturing activities were not taken into account.

Therefore, the aim of the paper is generalization of theoretical approaches and practical recommendation development as to gradual modeling and factor analysis of water supply economy according to peculiarities of its work.

**Discussion**

The most important generalized index of enterprise activity which characterizes final result of work is profit. Formation of current assets, fulfillment of obligations, credit worthiness of enterprise greatly depend on absolute profit of it.

Therefore, factor analysis of the index as well as influence of particular factors on its change becomes essential. One of the ways of making such analysis is elimination, exclusion of all impact factors on the index except one. It gives the opportunity to study the influence of concrete factor on final index under condition of excluding other impact factors, in other words, to study the influence of each factor irrespective of others [1,4].

Thus, it is proposed to use the method of chain substitutions based on elimination mode while analyzing the profit of water supply economy. In addition to that, it is recommended to make step-by-step factor analysis of indicated index. Such approach gives the opportunity in each case to determine the influence of only those factors on profit which (factors) are the most meaningful [1, 4, 5].

The important way of resolving this economic and analytic task is modeling index as object of research which require corresponding factor modeling.

Taking written above into account, let's consider, at first, two-factor analysis of profit from water supply service realization. Factor model of this index, reflecting its correlation with factors which influence its change, is indicated in fig. 1

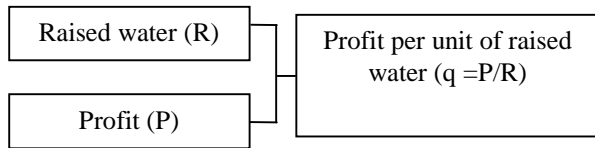


Fig 1. Structural and logical model of profit two-factor analysis

On the basis of this correlation scheme (fig.1), profit of water supply economy can be presented as following:

$$P = R \times q.$$

If the method of absolute inequality factors calculation for this model is applied it will be resulted in the following formulas for calculation of indicated factors influence on general change of studied index of profit («0» means absolute values of factor indices in base period, «1» - means their value in period under review):

- absolute impact factor «R»  
 $\Delta PR = (R1 - R0)q0,$
- absolute impact factor «q»  
 $\Delta Pq = R1 (q1 - q0),$

where  $\Delta PR$ ,  $\Delta Pq$  – absolute influence of factors «R» «q» on change of profit.

The total absolute influence of these factors is equal to general absolute gain of profit during period under review according to base one ( $\Delta P = P1-P0$ ):

$$\Delta P = \Delta PR + \Delta Pq.$$

For more detailed analysis of profit it is possible to figure out the influence and other factor chain on general change of this index. Therefore it is proposed to expand two-factor model of profit factorizing complex factor «Profit per unit of raised water» in the following subfactors: coefficient of water supply into network ( ) and profit per unit of water supply into network (f).

It means that on this stage of factor analysis the factors such as raised water (R), coefficient of water supply into network ( ) and profit per unit of water supply into network (f) cause change of profit. Schematic model of profit index for factor analysis is indicated in fig.2

According to block-scheme (fig.2.), multiplicative model of profit is following

$P = R \times K \times f$  Using this model mentioned modification of chain substitutions «Method of factor indices absolute inequality calculation» the following formulas for calculation of indicated factors influence on general change of water supply economy profit:

- absolute impact factor «R»  
 $\Delta PR = (R1-R0)K0f0;$
- absolute impact factor « »  
 $\Delta P = R1(K1-K0)f0;$
- absolute impact factor «f»  
 $\Delta Pf = R1K1 (f1-f0),$

where  $\Delta P$  ,  $\Delta Pf$  – absolute influence of factors « » «f» on general change of profit.

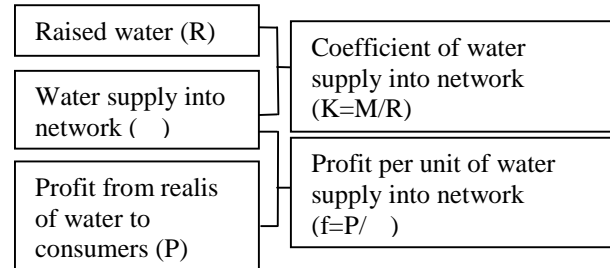


Fig.2 Structural and logical model of profit three-factor analysis

To check the accuracy of estimates on this stage of factor analysis it is necessary to determine absolute sums of influence of indicated factors on profit change. They must meet the requirements of equality of following equations of studied indices balancing coordination:

$$\Delta P = \Delta PR + \Delta P + \Delta Pf;$$

$$\Delta Pq = \Delta P + \Delta Pf$$

For the next stage of the analysis factor suggested profit factor “income per unit of water supplied to the network” decompose into simpler factors: the rate of implementation of water consumers ( ) and profit per unit of water sold to consumers (n).

In this case, the change in income will affect the following factors: water raised (R), coefficient of water supply to the network submission (K), implementation ratio of water to consumers ( ) profits per unit of water sold to consumers (n). Schematic model of the indicator at this stage of factor analysis would look like this (fig.3).

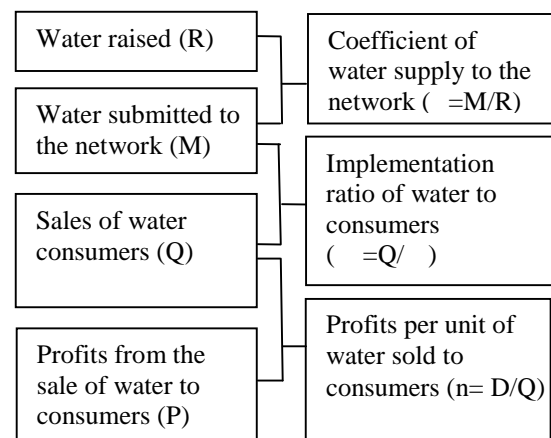


Fig.3. Structural and logical model four factor analysis profits

From the above flowchart (fig.3) follows a mathematical model of profit

$$P = R \times K \times \dots \times n$$

If this model is applied to the method of chain substitutions, we get the following formulas to calculate the absolute impact of these factors on overall profit change of water supply:

- impact factor «R»  
 $\Delta PR = (R1 - R0) K0 \dots 0 n0;$
- impact factor «K»  
 $\Delta P = R1 (K1 - K0) \dots 0 n0;$
- impact factor «Q»  
 $\Delta Pf = R1 K1 (1 - 0) n0;$
- impact factor «n»;  
 $\Delta PB = R1 K1 \dots 1(n1 - n0);$

where  $\Delta P$ ,  $\Delta Pn$  – the absolute value of impact factors «K» «n» to the income change.

For the next stage of factor analysis suggested profit factor “income per unit of water sold to consumers” decompose into simpler factors: the average tariff cubic meter of water sold to consumers (t) and the level of water services profitability (P). In this case, we get the following five-factor model figure income (fig. 4)

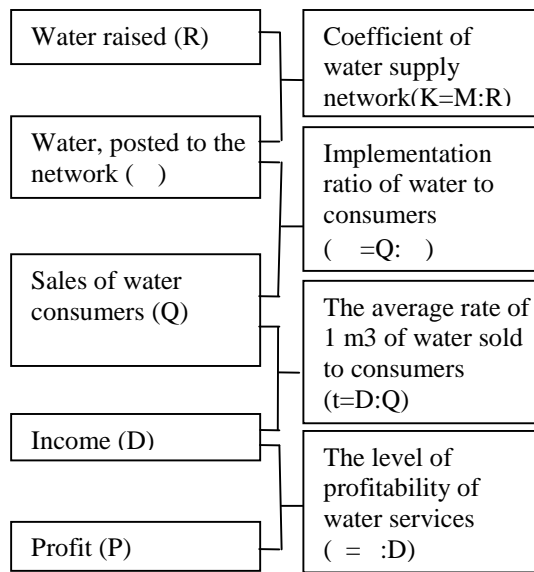


Fig.4 - Structural and logical model of the five factor analysis profits

Based on the scheme (pic 4), the original model for the multiplicative factor analysis profits will be:

$$P = R \times K \times \dots \times t \times P$$

Based on this profit model determined by applying to it the method of chain substitutions we obtain the following formulas for calculating the impact of individual factors on the change of this index:

- impact factor «R»

$$\Delta PR = (R1 - R0) K0 \dots 0 t0 \dots 0;$$

- impact factor «K»

$$\Delta P = R1 (K1 - K0) \dots 0 t0 \dots 0;$$

- impact factor «Q»

$$\Delta Pf = R1 K1 (1 - 0) t0 \dots 0 P0;$$

- impact factor «t»

$$\Delta Pt = R1 K1 \dots 1 (t1 - t0) P0;$$

- impact factor «P»

$$\Delta P = R1 K1 \dots 1 t1 (1 - 0),$$

where  $\Delta Pt$  and  $\Delta P$  – the absolute value of impact factors «t» and «P» to a total change in profit.

The value of the total impact of all factors on the overall change of the index must be equal to total absolute growth ( $\Delta P$ ):

$$\Delta P = \Delta PR + \Delta P + \Delta Pt + \Delta P + \Delta P$$

To determine the relative impact of these factors should be the absolute magnitude of the impact of each factor on a basic share value gains and multiply the result by 100. Similarly, to calculate the structure factors should influence the absolute partial effect of each factor divided by the amount of the total increase profits and results multiplied by 100 [5].

Thus, the method shown gradual profit factor analysis of water supply allows the figure expanded its range of components present in separate multiplicative models to calculate the impact of the major factors in its overall change at any period of the enterprise.

### Literature

1. Dolya, V.T. (2003). *Economic Analysis: Theory and Practical Methodology*. Kyiv. Kondor.
2. Golovach, A.V., Zahogay, V.B. and Golovach, N.A. (2005). *Statistical Provision of Economics Management*. Kyiv: Kyiv National Economic University.
3. Yureva, T.P (2002). *Economics of Municipal Services*. Kharkiv: KharDAMG.
4. Kosova, T.D. Sukharev P.M and Vashchenko L.O. (2012). *Organization and Methods of Economic Analysis*, TsUL. Kyiv.
5. ... 2012. – 528 .
6. ... 2010. – 245 .
7. ... 2004. -654 .

### References

1. Dolya, V.T. (2003). *Economic Analysis: Theory and Practical Methodology*. Kyiv. Kondor.
2. Golovach, A.V., Zahogay, V.B. and Golovach, N.A. (2005). *Statistical Provision of Economics Management*. Kyiv: Kyiv National Economic University.
3. Yureva, T.P (2002). *Economics of Municipal Services*. Kharkiv: KharDAMG.
4. Kosova, T.D. Sukharev P.M and Vashchenko L.O. (2012). *Organization and Methods of Economic Analysis*, TsUL. Kyiv.

5. Kostiuk, V.O. (2010). *Technical and Economic Analysis of the Performance of the Urban Economy Enterprises*. Kharkiv: KSAME.

6. Savitska, G.V. (2004). *Economic Analysis of the Company*. Kyiv: Znaniya.

**Reviewer:** Ph.D., prof., V.I. Torkatyuk, O.M Beketov  
National University of Urban economy in Kharkiv

**Author:** Kostiuk Vasyl Ostapovych  
O.M. Beketov National University of Urban economy in  
Kharkiv, Kharkiv  
PhD, Associate Professor in economy

**Author:** Kovalyov Maxim Vitaliyovych  
O.M. Beketov National University of Urban economy in  
Kharkiv, Kharkiv Student