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THE FINANCIAL RESOURCES OF STATE SOCIAL INSURANCE: TWO-FACTORS MODELS OF FORMATION

The purpose of the article is to consider the impact of a number of factors (the wage fund in the economy, its share in GDP, and state social insurance fees rates) on the result indicator – the amount of the financial resources of the state social insurance. Two-factor models of the formation of financial resources of the state social insurance in the article have investigated. The largest change in the result indicator has caused by the size of the wage fund in the economy and the size of the insurance fees rate is calculated. The current practice of reducing the number of insurance fees in 2016 negatively affected the number of financial resources of state social insurance have investigated. It is determined that the reserve for increasing the result indicator is an increase in the absolute size of the wage fund in the economy, which taxpayers due to certain circumstances do not seek to declare and tax. To a lesser extent, such a reserve is the share of the wage bill in the country's GDP.

Keywords: *financial resources, state social insurance, wage fund, share of wage fund in GDP, insurance premiums of the state social insurance system, two-factor model, correlation analysis.*

JEL classification: *C15, I13, H55*

ДВОФАКТОРНІ МОДЕЛІ ФОРМУВАННЯ ФІНАНСОВИХ РЕСУРСІВ ДЕРЖАВНОГО СОЦІАЛЬНОГО СТРАХУВАННЯ

Метою статті є розглянути вплив ряду факторів (величини фонду оплати плати в економіці, його питомої ваги у ВВП та страхових ставки зборів системи державного соціального страхування) на результативний показник – обсяг фінансових ресурсів державного соціального страхування. У статті досліджено три двофакторні моделі формування фінансових ресурсів державного соціального страхування. В процесі дослідження та аналізу використовувався синтез як метод теоретичного пізнання явищ. Порівняння та вимірювання використовувались як емпіричні методи для проведеного дослідження. Для проведення досліджень та обґрунтування відповідних висновків були проаналізовані теоретичні моделі державного соціального страхування та представлені їхні загальні ознаки та відмінності. Найбільша зміна результативного показника зумовлена зміною комбінації факторів – величини фонду оплати плати в економіці країни та розміром ставки страхових внесків у системі державного соціального страхування. Зокрема, при збільшенні величини цих факторів на 1%, фінансові ресурси системи державного соціального страхування збільшуються на 0,845%. Сучасна практика зменшення розміру страхового внеску у 2016 році негативно вплинула на обсяг фінансових ресурсів державного соціального страхування. У комбінації із зміною питомої ваги фонду оплати праці у ВВП даний фактор призвів до зменшення досліджуваного нами результативного фактору на 0,14%. Визначено, що резервом збільшення результативного показника є збільшення абсолютного розміру фонду оплати праці в економіці, який платники страхових внесків через певні обставини не прагнуть декларувати та оподатковувати. Меншою мірою таким резервом виступає зміна питомої ваги фонду оплати праці у ВВП країни. Практична цінність статті полягає у висновках, що відображають аналіз формування фінансових ресурсів державного соціального страхування у 2012–2018 роках. Вивчення окреслених нами факторів впливу на формування фінансових ресурсів системи соціального страхування відкриває перспективи для подальших досліджень у цій галузі фінансової науки.

Ключові слова: *фінансові ресурси, державне соціальне страхування, фонд оплати праці, питома вага фонду оплати праці у ВВП, страхові внески державної системи соціального страхування, двох факторна модель, кореляційний аналіз.*

The problem. Practice shows an increase in the financial resources of state social insurance in absolute terms. This may be due to the impact of changes in the size of the wage fund in the economy, the rate of insurance fees of the state social insurance system or a change in the share of the wage fund in GDP. Each of these factors could affect the change in the size of financial resources of state social insurance in both positive and negative directions. In order to determine the influence of individual factors on the volumes of such resources, we considered linear two-factor models of correlation and regression analysis.

Despite considerable interest from economists, the issue of financial resources of social insurance needs more complete and comprehensive coverage. This is confirmed by the practice of their formation at the expense of both insurance fees and the state budget, which indicates the

lack of proper theoretical justification of the financial base of state social insurance and makes it impossible to develop long-term financial policy in this area.

An analysis of recent research and publications. The issue of public finance in general and the financial resources of public social insurance in particular attracts the attention of many scholars. Among Ukrainian researchers are O. Kyrylenko, B. Nadtochiy, M. Shavaryna, N. Shamanska, and others.

Setting aims. The purpose of the article is to consider the impact of a number of factors (wage fund in the economy, its share in GDP and rates on insurance fees) on the result indicator – the number of financial resources of state social insurance in combination.

Results of the research. The multifactor correlation-regression analysis evaluates the degree of influence on the studied result indicator of each of the factors introduced by us in the model at a fixed and average level of other factors.

The calculation of the parameters of the linear two-factor regression equation is given using the equation [1, p. 120]:

$$y_x = a_0 + a_1 x_1 + a_2 x_2 , \quad (1)$$

where y_x – calculated values of the result function;

x_1, x_2 – factor features;

a_0, a_1, a_2 – equation parameters that can be calculated by least squares by solving a system of normal equations [2, p. 78]:

$$\begin{cases} \sum y = na_0 + a_1 \sum x_1 + a_2 \sum x_2, \\ \sum yx_1 = a_0 \sum x_1 + a_1 \sum x_1^2 + a_2 \sum x_1 x_2, \\ \sum yx_2 = a_0 \sum x_2 + a_1 \sum x_1 x_2 + a_2 \sum x_2^2. \end{cases} \quad (2)$$

Each coefficient of the equation shows the degree of influence of the corresponding factor on the result indicator at a fixed position of the other factors, as the change of a single factor per unit changes the result indicator [3, p. 45; 4, p. 208–209].

First, we will analyze the relationship between the factors – between the size of the wage fund in the economy and its share in GDP and the resultant indicator – the number of financial resources of state social insurance. Then, we'll do these actions between the share of the wage fund in GDP and the rate of insurance fees in the economy to the result indicator, and then the wage fund and the rate of insurance fees in the economy to the result indicator.

The free term of the multiple regression equation has no economic meaning.

Model 1 shows the indicators of the wage fund in the economy, the share of the wage fund in GDP and the number of financial resources of state social insurance for 2012–2018.

The desired relationship equation, which determines the dependence of the resultant factor on two factorial features, will look like this:

$$y_x = -56,34 + 0,09x_1 + 3,81x_2$$

Thus, with the increase of the wage fund by UAH 1 billion the financial resources of the state social insurance increase by 0,09 units, and with an increase in the share of the wage fund in GDP by 1%, the volume of such resources increases by 3,81 units.

Substituting the values of x_1 and x_2 into the equation, we obtain the corresponding values of the variable average, which reproduce the values of the actual levels of financial resources of state social insurance. This indicates the correct choice of the form of mathematical expression of the correlation between the three studied features.

However, on the basis of regression coefficients, it is impossible to say which of the factor features has the greatest impact on the resultant feature, because they are not comparable, because these features are expressed in different units. To identify the comparative force of influence of individual factors and reserves inherent in them, statistics calculates the partial coefficients of elasticity ε_i by the following formula [4, p. 209]:

$$\varepsilon_i = a_i \frac{\overline{x_i}}{\overline{y}} , \quad (3)$$

Where a_i – regression coefficient at i's factor;

$\overline{x_i}$ – Average value i's factor;

$\overline{y}$ – Average value result factor.

Partial coefficients of elasticity show how many per cent on average the effective feature will change when each factor changes by 1% and the fixed position of other factors.

$$\varepsilon_1 = 0,09 \frac{923,857}{190,42} = 0,43$$

$$\varepsilon_2 = 3,81 \frac{43,229}{190,42} = 0,86$$

Analysis of partial elasticity coefficients shows that in terms of relative growth, the largest impact on the number of financial resources of state social insurance has

Model 1

Dynamics of indicators of the wage fund in the economy, the share of the wage fund in GDP for 2012-2018 and their impact on the number of financial resources of state social insurance[1]

Year	The wage fund in the economy, billion UAH, x_1	The share of the wage fund in GDP, %, x_2	The number of financial resources of state social insurance, billion UAH, y_x	Control $y_x = -56,34 + 0,09x_1 + 3,81x_2$
2012	705,8	50,2	188,6	197,634
2013	730,7	49,9	194,6	198,711
2014	734,9	46,3	193,9	185,350
2015	777,6	39,1	193,4	161,736
2016	873,8	36,6	134,2	160,736
2017	1170,7	39,2	188,8	197,020
2018	1472,3	41,3	239,4	231,754
Total	6465,8	302,6	1332,9	1332,9
The average value for 2012-2018				
-	923,857	43,229	190,42	-

[1] Calculated by the author based on data sources [5, p. 8]

an increase in the share of wages in GDP (factor x_2) by 1% – respectively, these resources increase by 0,86%. The effect of the factor x_1 (the value of the wage fund in the economy) on the increase in the financial resources of state social insurance is less – with an increase of 1%, these resources will increase by only 0,43%.

Model 2 shows the indicators of the wage fund in the economy, the rates of insurance fees for state social insurance and the number of financial resources of state social insurance for 2012–2018.

The desired relationship equation, which determines the dependence of the resultant factor on two factorial features, will look like this:

$$y_x = -131{,}373 + 0{,}174x_1 + 5{,}217x_2$$

Thus, with the increase of the wage fund by UAH 1 billion financial resources of the state social insurance increase by 0,174 units, and with an increase in the average rate of insurance fees for state social insurance by 1%, the volume of such resources increases by 5,217 units.

Substituting the values of x_1 and x_2 into the equation, we obtain the corresponding values of the variable average, which reproduce the values of the actual levels of financial resources of state social insurance. This indicates the correct choice of the form of mathematical expression of the correlation between the three studied features.

Partial coefficients of elasticity of wage fund factor (x_1) and the average rate of insurance fees (x_2) calculated by the formula (3) are equal to:

$$\varepsilon_1 = 0{,}174\frac{923{,}857}{190{,}42} = 0{,}845$$

$$\varepsilon_2 = 5{,}217\frac{30{,}857}{190{,}42} = 0{,}845$$

The analysis of partial elasticity coefficients shows that in terms of relative growth, the impact on the number of financial resources of state social insurance factors x_1 (wage fund in the economy) and x_2 (rate of insurance fees) are identical. In particular, when the value of these factors increases by 1%, the financial resources of the state social insurance system increase by 0,845%.

Model 3 shows the indicators of the share of the wage fund in GDP and the rates of insurance fees for state social insurance and the number of financial resources of state social insurance for 2012–2018.

The desired relationship equation, which determines the dependence of the resultant factor on two factorial features, will look like this:

$$y_x = 106{,}66 + 2{,}57x_1 - 0{,}88x_2$$

Thus, with an increase in the share of the wage fund in GDP by 1%, the financial resources of state social insur-

Model 2

Dynamics of indicators of the wage fund in the economy, the rates of insurance fees for state social insurance for 2012-2018 and their impact on the number of financial resources of state social insurance[1]

Year	The wage fund in the economy, billion UAH, x_1	The rates of insurance fees for state social insurance, %, x_2	The number of financial resources of state social insurance, billion UAH, y_x	Control $y_x = -131{,}373 + 0{,}174x_1 + 5{,}217x_2$
2012	705,8	37,5	188,6	187,152
2013	730,7	37,5	194,6	191,504
2014	734,9	37,5	193,9	192,200
2015	777,6	37,5	193,4	199,685
2016	873,8	22,0	134,2	135,535
2017	1170,7	22,0	188,8	187,235
2018	1472,3	22,0	239,4	239,630
Total	6465,8	216,0	1332,9	1332,9
The average value for 2012-2018				
	923,857	30,857	190,42	

[1] Calculated by the author based on data sources [5, p. 8]

Model 3

Dynamics of indicators of the share of the wage fund in GDP, the rates of insurance fees for state social insurance for 2012–2018 and their impact on the number of financial resources of state social insurance[1]

Year	The share of the wage fund in GDP, %, x_1	The rates of insurance fees for state social insurance, %, x_2	The number of financial resources of state social insurance, billion UAH, y_x	Control $y_x = 106{,}66 + 2{,}57x_1 - 0{,}88x_2$
2012	50,2	37,5	188,6	202,457
2013	49,9	37,5	194,6	201,686
2014	46,3	37,5	193,9	192,442
2015	39,1	37,5	193,4	173,954
2016	36,6	22,0	134,2	181,218
2017	39,2	22,0	188,8	187,895
2018	41,3	22,0	239,4	193,287
Total	302,6	216,0	1332,9	1332,9
The average value for 2012-2018				
-	43,229	30,857	190,42	-

[1] Calculated by the author based on data sources [5, p. 8]

Table 1

Influence of wage fund factors, its share in GDP and insurance fees rates on the volumes of financial resources of state social insurance

Model	Factor	Influence on the volumes of financial resources of state social insurance		
1	The wage fund in the economy, billion UAH	absolute	1 billion UAH	0,09 units
		relative	1%	0,43%
	The share of the wage fund in GDP, %	absolute	1%	3,81 units
		relative	1%	0,86%
The combined influence of factors is 1,29%				
2	The wage fund in the economy billion UAH	absolute	1 billion UAH	0,174 units
		relative	1%	0,845%
	The rates of insurance fees for state social insurance, %	absolute	1%	5,217 units
		relative	1%	0,845%
The combined influence of factors is 1,69%				
3	The share of the wage fund in GDP, %	absolute	1%	2,57 units
		relative	1%	1,14%
	The rates of insurance fees for state social insurance, %	absolute	1%	- 0,88 units
		relative	1%	- 0,14%
The combined influence of factors is 1,00%				

ance increase by 2,57 units, and with a decrease in the average rate of fees for state social insurance by 1%, the volume of such resources decreases by 0,88 units.

Partial coefficients of elasticity of the share of the wage fund in the economy in GDP factor (x_1) and the average rate of insurance fees (x_2) calculated by the formula (3) are equal to:

$$\varepsilon_1 = 2,57\frac{43,229}{190,42} = 0,58$$

$$\varepsilon_2 = -0,88\frac{30,857}{190,42} = -0,14$$

Analysis of partial elasticity coefficients shows that in terms of relative growth, a positive impact on the number of financial resources of state social insurance has an increase in the share of wages in GDP (factor x_1) by 1% – respectively, these resources increase by 0,58%. The effect of the factor x_2) (the rate of insurance fees for state social insurance) on the increase in the number of financial resources of state social insurance has a negative effect – when reduced by 1%, these resources are reduced by 0,14%.

Based on the above models of correlation, we present a generalization of the results of the impact of factor characteristics – the size of the wage fund in the economy, its share in GDP, the number of insurance fees for state social insurance on the basis of financial resources of state social insurance (Table 1).

The concludes. Thus, the considered models of the influence of factors of the wage fund in the state economy, its share in GDP and tax rates on insurance premiums on the performance indicator – the number of financial resources of state social insurance in the next combination of factors (models 1-3) allows us to conclude that subject to the combined influence of factors:

a) The largest change in the financial resources of state social insurance was due to the size of the wage fund in the economy and the size of the insurance fees rate: with an increase in these factors by 1%, they increased by 1,69%. And such growth two provided singing in equal, equal shares of 0,845%;

b) The least change in the financial resources of state social insurance was due to the size of the specific wage fund in the economy and the size of the insurance premium rate: with an increase in these factors by 1%, the system resources also increased by 1,69%;

c) The negative impact on the change in the financial resources of the state social insurance in 2012–2018 was exerted only by the factor of reducing the insurance fee rate in 2016. In combination with the change in the share of the wage fund in the economy, it caused a decrease of 0,14%.

The above gives grounds to claim that the improvement of financial support of state social insurance in Ukraine can be achieved by:

– Increase in the number of financial resources of the system. The only reserve is the absolute size of the wage fund in the economy, which payers due to certain circumstances do not seek to declare. To a lesser extent, such a reserve is the share of the wage fund in GDP;

– Changes in tax rates for insurance fees. The current practice of reducing their size in 2016 negatively affected the number of financial resources of state social insurance.

The study of the ways outlined by us to improve the financial balance of the social insurance system opens up **prospects for future research** in this area of financial science.

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