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UDC 303.725.3:330.111.4:364.05

Socio-economic determinants' impact on financial support for social safety in Ukraine

Abstract. The authors estimate the nature and scale of interrelation between socio-economic factors and the level of financial support for the social safety net, which is characterized by general financial expenditures for social purposes both through the public finances system (Consolidated Budget of Ukraine and funds of mandatory state social insurance) and the private sector (insurance companies, private pension funds, charitable funds, etc.). The public finance crisis and complicated demographic situation require finding new sources of social expenditures funding, which, according to the authors, is possible only after the full analysis of the socio-economic factors impact on the level of financial support for the social safety net.
The contribution of the authors in this problem development lays in comprehensive and complex assessment of the nature and impact of factors not only on the social safety net, but also on other factors that determine the socio-economic development of society. This assessment is conducted under econometric modelling, namely, correlation pleiades applying, based on multiple regressions, in order to establish the influence of selected factors that determine financial support for the social safety net.
The obtained research results indicate the significant effect of selected factors (indicator features) on the resulting characteristic (social security budget). However, analysis of obtained parameters (regression coefficients, elasticity coefficient, pair correlation coefficients) made it possible to distinguish the main socio-economic determinants, which have the greatest impact on the financial support of the social safety net. It allows focusing attention in future studies on the most important socio-economic factors aiming to identify potential areas of the financial support for the social safety net improving.
Keywords: Financial Support; Social Safety; Public Expenditures; Financial Resources; Econometric Modelling
JEL Classification: E24; G22; G23; H53

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Вплив соціально-економічних детермінант на фінансове забезпечення соціального захисту в Україні

Анотація. У статті оцінюється характер та масштаби взаємозв'язку між соціально-економічними факторами та рівнем фінансового забезпечення системи соціального захисту населення, що характеризується загальними фінансовими витратами на соціальні цілі як за рахунок системи державних фінансів (Зведеного бюджету України та фондів загальнообов'язкового державного соціального страхування), так і приватного сектору (страхові компанії, недержавні пенсійні фонди, благодійні фонди тощо).
Криза державних фінансів і складна демографічна ситуація вимагають пошуку нових джерел фінансування соціальних видатків, що можливо, на думку авторів, лише після повного аналізу впливу соціально-економічних факторів на рівень фінансового забезпечення соціального захисту.
Внесок авторів у розвиток зазначеної проблеми полягає у всебічній і комплексній оцінці характеру та впливу факторів не лише на систему соціального захисту, а й на інші чинники, що визначають соціально-економічний розвиток суспільства. Оцінка здійснюється на основі економетричного моделювання, а саме за рахунок використання кореляційних плеяд, які базуються на множинних регресіях для встановлення впливу відібраних факторів, що визначають фінансове забезпечення соціального захисту.
Отримані результати дослідження засвідчують значний вплив відібраних факторів (індикаторних ознак) на результативну ознаку (бюджет соціального захисту). Водночас, аналіз розрахованих показників (коефіцієнти регресії, коефіцієнти еластичності, парні коефіцієнти кореляції) дав змогу виокремити основні соціально-економічні детермінанти, які справляють найбільший вплив на фінансове забезпечення соціального захисту. Це дозволяє в майбутніх дослідженнях, з метою виявлення потенційних напрямів поліпшення фінансового забезпечення соціального захисту, зосередити увагу на найбільш вагомих соціально-економічних факторах.
Ключові слова: фінансове забезпечення; соціальний захист; державні видатки; економетричне моделювання.

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Влияние социально-экономических детерминант на финансовое обеспечение социальной защиты в Украине

Аннотация. В статье оценивается характер и масштабы взаимосвязи между социально-экономическими факторами и уровнем финансового обеспечения системы социальной защиты населения, которая характеризуется общими финансовыми затратами на социальные цели как за счет системы государственных финансов, так и частного сектора.
Вклад авторов в развитие указанной проблемы заключается во всесторонней и комплексной оценке характера и влияния факторов не только на систему социальной защиты, но и на другие факторы, определяющие социально-экономическое развитие общества. Оценка осуществляется на основе эконометрического моделирования, а именно за счет использования корреляционных плеяд, которые основаны на множественных регрессиях для установления влияния отобранных факторов, которые определяют финансовое обеспечение социальной защиты.
Полученные результаты исследования свидетельствуют о значительном влиянии отобранных факторов на результативный признак. Вместе с тем, анализ полученных показателей (коэффициентов регрессии, коэффициентов эластичности, парных коэффициентов корреляции) дал возможность выделить основные социально-экономические детерминанты, которые оказывают наибольшее влияние на финансовое обеспечение социальной защиты.
Ключевые слова: финансовое обеспечение; социальная защита; государственные расходы; эконометрическое моделирование.

1. Introduction

In the post-industrial society, based on the developed market economy, the social safety net has always played an important role in stable and progressive economic development ensuring. At the same time, science and practice show that social spendings should be harmoniously related to the economic indices of the country, which directly influence the formation of the main sources of financing for the social safety net. The economic resources are required to build the fundamental basis and be a form of economic content of the social safety net. In recent decades, the rate of increase in expenditures for social purposes in Ukraine is far ahead of economic indicators. The complicated demographic situation and economic crisis caused significant problems in the sphere of financial support of the social safety net, which affects negatively not only the level of welfare, but also the economy as a whole. Therefore, in our opinion, the detailed determination of key socio-economic determinants and their impact on the financial support of the social safety net are extremely topical.

2. Brief Literature Review

Problems of financial support formation and development have always been in the focus of attention of both domestic and foreign researchers who take into consideration the social and economic processes in the global economy. Current issues of financial support of the social safety net system, its impact on economic indices and vice versa are reflected in many works of domestic scholars: Barannyk L. B. (2012) [1], Tropina V. B. (2008) [2], Malinovska O. Ya. and Rudzinska R. O. (2014) [3] and others. Foreign scholars and practitioners also widely reflected the issue, namely: M. Cichon, V. Scholz, van de Meerendonk, K. Hagemeyer, F. Bertranou, and P. Plamondon et al. (2004) [4], Commander S. J., Davoodi H. R., and Lee U. J. (1997) [5], Gwartney J. D., Lawson R., and Holcombe R. G. (1998) [6], Arjona R., Ladaique M., and Pearson M. (2003) [7], Furceri D. (2010) [8], Furceri D. and Zdzienicka A. (2012) [9] and others. However, despite the significant amount of researches, the issues of objective assessment of the social and economic determinants impact on financial support of the social safety net are insufficiently studied and require further research.

3. Purpose

To conduct an economic and statistical analysis of the social and economic determinants impact on financial support of the social safety net.

4. Results

To assess the impact of socio-economic factors on the financial support of the social safety net, the authors used economic and statistical method of correlation pleiades. To create a mathematical model, four main features-indicators were used: 1) payroll budget in Ukraine, million UAH; 2) the number of insurance premium payers in Ukraine, thousand people; 3) consolidated budget revenues in Ukraine, million UAH; 4) amount of assets of non-state social insurance system in Ukraine, million UAH (research period – 1996-2013). Within each feature-indicator the groups of features which made correlation pleiades were defined by calculating multiple correlations and building correlation matrices. Thus, within the indicator feature «payroll budget in Ukraine», a group of indicators was defined: 1) MW – the minimum wage, UAH; 2) PCGDP – per capita GDP, UAH; 3) SGPMI – the share of gross profit (mixed income) in GDP of the country, %; 4) SES – the shadow economy share by the World Bank methodology to GDP of the country, %; 5) GRW – the growth rates of nominal wages till the previous year, %.

Within the indicator feature «The number of insurance premium payers in Ukraine», a group of indicators was selected: 1) NWP – number of working population, thousand people; 2) EL – employment level, in % to working-age population; 3) UL – unemployment level, in % to working-age population; 4) NWIS – the number of workers in the informal sector, thousands people; 5) ALE – the average life expectancy in Ukraine, years.

Within the indicator feature «Consolidated budget revenues in Ukraine», a group of indicators was selected: 1) DFIA – amount of direct foreign investment, million USD; 2) GRRW – the growth rates of real wages compared to the previous year, %; 3) TPI – taxes on production and imports, million UAH; 4) IPA – investments in property assets, million UAH; 5) VIGDP – volume index of GDP (in prices of previous year), %.

Within the indicator feature «Assets of non-state social insurance system in Ukraine», such indicators were identified: 1) GIPR – ratio of gross insurance premiums to GDP, %; 2) LEP – level of profitability (loss rate) of all activities of the enterprises, %; 3) SES – the shadow economy share by the World Bank methodology to GDP of the country, %; 4) EL – employment level in % of the working-age population.

Between correlation pleiades indicators the relations were established and correlation ring was built (general pleiad) that determine the formation of financial support of the social safety net (social safety budget) (Figure).

Results obtained showed that in the correlation pleiad, where the indicator feature is payroll budget, there is a close interrelation of the resultant feature with MW amount in Ukraine (x_1), the amount of GDP per worker in the economy (x_2), and the shadow economy share (x_4). Other analyzed factors (x_3, x_5) affect the resultant feature, but their influence is rather weak. Thus, two factors, namely, the share of gross income (mixed income) in GDP of the country (x_3) and the shadow economy share (x_4) inversely affect the resultant feature.

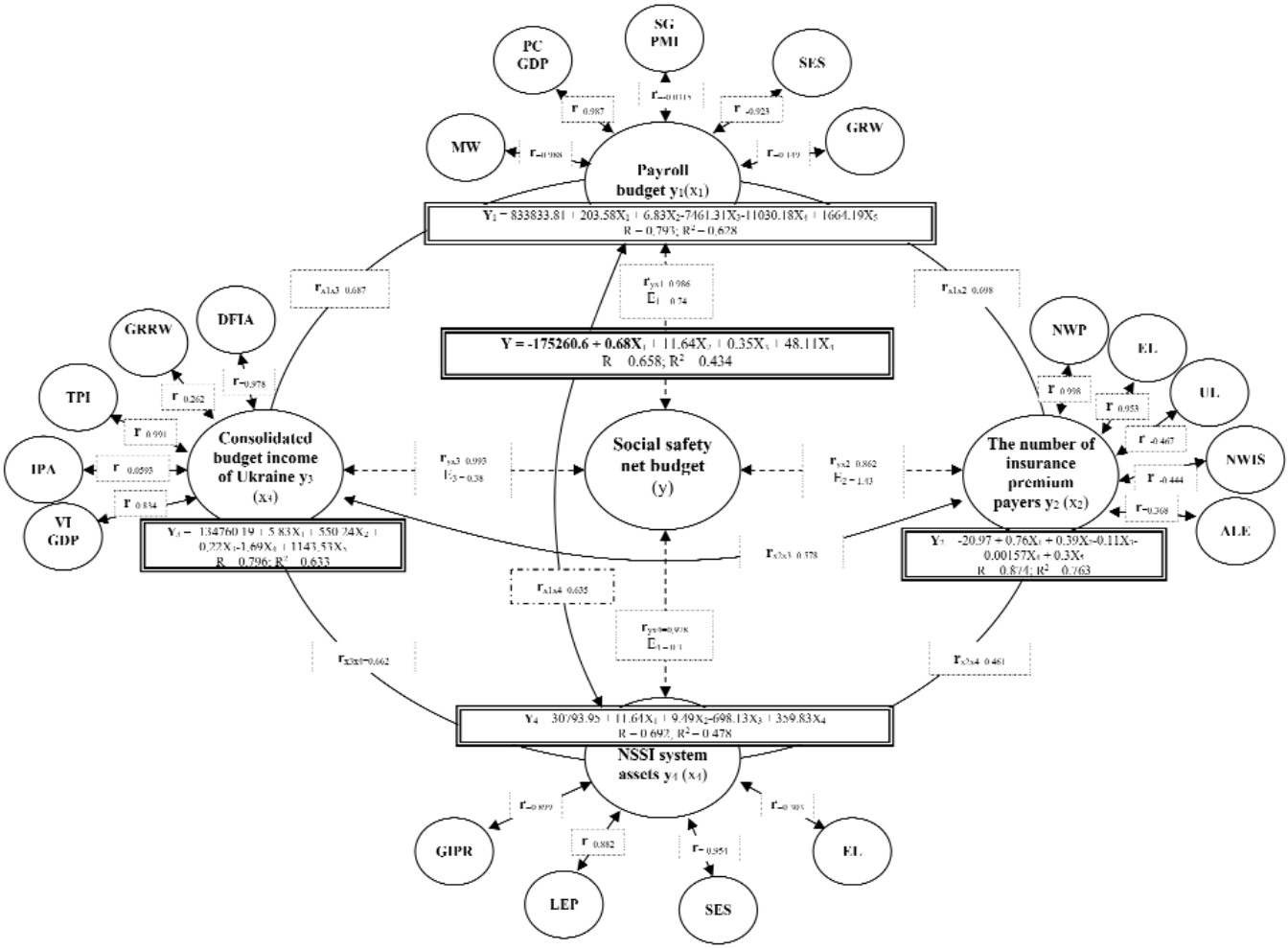

Figure: **Correlation circle for dependence of the social safety net financial support forming from social-economic indices (1996–2012)**
Source: Calculations of the authors

In correlation pleiad with the indicator feature «the number of payers of insurance premiums», close correlation between resultant feature and two factors – the number of working-age population (x_1) (r = 0.998) and employment level (x_2) (r = 0.998) were revealed. Connection of the other factors (x_3, x_4, x_5) with resultant feature, in accordance with the calculated paired correlation coefficients, is medium. The level of unemployment and the number of working-age population in the informal economic sector has inverse relation with resultant feature.

Analysis of the indicator feature «consolidated budget income» showed its close correlation with foreign direct investments (x_1) (r = 0.978), taxes on production and imports (x_3) (r = 0,991) and volume index of GDP (in prices of the previous year) (x_5) (r = 0.834). Paired correlation coefficient of the factor x_2 (the growth rate of real wages to the previous year, %) shows a weak connection with the resultant feature and the factor x_4 (fixed assets investment, million UAH) – in fact, its absence.

The close relations are observed between the generalized indicator feature «the value of the NSSI assets» and the ratio of gross insurance premiums to GDP, % (x_1) (r = 0.899), the level of profitability (loss rate) of all activity of the enterprises, % (x_2) (r = 0.882) and the shadow economy share by the World Bank methodology to GDP of the country, % (x_3) (r = -0.954). However, between the level of employment in % to the working-age population (x_4) and the amount of assets of the NSSI system the connection is weak (r = 0.303).

The results of correlation and regression analysis of the selected indicator features' impact in general on the financial support of the social safety net are given in the Table. Thus, the results of correlation and regression analysis showed that connection between financial support of the social safety net and considered factors is medium (correlation coefficient is 0.658). Therefore, the resultant feature is influenced by the other factors not included in the model. Variability of the resultant feature by 43.4% is determined by variability of the selected factors.

At the same time, review of the significance of obtained paired correlation coefficients, using the Student's t-test, showed a strong influence of selected factors on the resultant feature:

$$r_{yx1} = \frac{30557783890.95 - 147587.73 \cdot 135839.61}{89854.79 \cdot 118671.02} = 0.986$$

$$r_{yx2} = \frac{2347884049.64 - 16636.8 \cdot 135839.61}{859.58 \cdot 118671.02} = 0.862$$

$$r_{yx3} = \frac{34442583680.26 - 149843.76 \cdot 135839.61}{119606.09 \cdot 118671.02} = 0.993$$

$$r_{yx4} = \frac{251243613.44 - 857.73 \cdot 135839.61}{1160.98 \cdot 118671.02} = 0.978.$$

However, obtained paired correlation coefficients allow you to assert about the validity of variables included in the regression model (if the coefficient is insignificant, it means that the connection between this factor and resultant variable is very weak or absent, so the factor can be excluded from the model). They showed a high connection level with the resultant feature, and therefore, we can affirm that during the construction of regression equation, the factors x_1, x_2, x_3, x_4 were correctly selected, what increases the objectivity and correctness of the gained results.

Table: **Result of the correlation and regression analysis of the indicator features influence on the social safety net expenses**

Parameter value:	Model characteristic:
correlation coefficient is 0.658	correlation ratio is medium
determination coefficient is 0.434	function variability on 43.4% is determined by the selected factors' variability
F-ratio test (forward test): F_f= 1.91; F_c= 3.33	$F_f < F_c$, null hypothesis about the absence of interrelation between the indices is rejected – the model is adequate to reality
Student's *t*-test: t_f= 21.01; t_c= 2.145	$T_f > t_c$, null hypothesis about the regression coefficient insignificance is rejected – it is statistically significant
Durbin Watson model: DW = 1.9744	Autocorrelation is absent if 1.5 < DW < 2.5. In our case: 1.5 < 1.98 < 2.5
Regression equation: $Y = -175260.6 + 0.68X_1 + 11.64X_2 + 0.35X_3 + 48.11X_4$	

Source: Calculated by the Authors

Obtained regression coefficients help us to draw the following conclusions:

1) increase of payroll budget in Ukraine on 1 million UAH with the fixed position of other model factors will stimulate the growth of the social safety net budget on 0.68 million UAH;

2) increase of the number of payers of insurance premiums per 1 thousand people with the fixed position of other model factors will provide increase of the social safety net budget on 11.46 million UAH;

3) increase of the consolidated budget income of Ukraine by 1 million UAH with the fixed position of the other model factors will cause increase of the social safety net budget by 0.35 million UAH;

4) increase of assets of non-state social insurance on 1 million UAH with the fixed position of other model factors will cause increase of the social safety net budget by 48.11 million UAH.

Paired correlation coefficients also indicate close connection between the selected factors:

$$r_{x1\,x2} = \frac{2524744396.67 - 16636.8 \cdot 147587.73}{859.58 \cdot 89854.79} = 0.898$$

$$r_{x1\,x3} = \frac{327206261 14.16 - 149843.76 \cdot 147587.73}{119606.09 \cdot 89854.79} = 0.987$$

$$r_{x1\,x4} = \frac{224162908.14 - 857.73 \cdot 147587.73}{1160.98 \cdot 89854.79} = 0.935$$

$$r_{x2\,x3} = \frac{2583183894.41 - 149843.76 \cdot 16636.8}{119606.09 \cdot 859.58} = 0.878$$

$$r_{x2\,x4} = \frac{15029101.82 - 857.73 \cdot 16636.8}{1160.98 \cdot 859.58} = 0.761$$

$$r_{x3\,x4} = \frac{262154069.03 - 857.73 \cdot 149843.76}{1160.98 \cdot 119606.09} = 0.962$$

Positive dynamics of one of the factors will give a multiplicative effect – it will influence not only the financial support of the social safety net directly, but also indirectly, through the growth of the other factors.

In order to expand opportunities of comprehensive analysis of regression model, the elasticity coefficients were calculated by the formula:

$$E_i = b_i \frac{\overline{x}_i}{\overline{y}}$$

The elasticity coefficient shows how changes the resultant feature on average in percentage with increase of x_j feature-factor on 1% of its average level with the fixed position of the other model factors:

$$E_1 = 0.68 \frac{147587.73}{135839.61} = 0.74$$

$$E_2 = 11.64 \frac{16636.8}{135839.61} = 1.43$$

$$E_3 = 0.35 \frac{149843.76}{135839.61} = 0.38$$

$$E_4 = 48.11 \frac{857.73}{135839.61} = 0.3.$$

Obtained indices show that all indicator features quite strongly influence the resultant feature, but the greatest impact have two factors: x_1 (after the increase of this index on 1%, the resultant feature reduces on 0.74%) and x_2 (after the increase of this index on 1%, the resultant feature increases on 1.43%).

5. Conclusions

Conducted economic and statistical analysis showed a strong correlation (correlation coefficient amounted R = 0,793) between the group of selected factors and resultant feature. Correlation pleiad application enabled assessing the impact of a wide range of socio-economic determinants on both the resultant and factor features. Conducted researches and obtained results give reason to conclude that the main ways to improve financial support of the social safety net, in our opinion, should be concentrated in spheres characterizing indicator features: labor market, public finances, development of non-state social insurance system. At the same time, we should not forget about other socio-economic indices improvement which directly or indirectly affects both the indicator feature and ineffective feature (coefficient of determination R^2= 0,628 shows that variability of resultant feature on 37.2% is determined by variability of factors which are not included in the current economic and mathematical model).

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Received 25.03.2015

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Стаття надійшла до редакції 25.03.2015