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### **Children's Welfare in Ukraine's Economy: Analysis and Modelling**

**Abstract. Introduction.** In the current global crisis, the problem of social policy is not only for children but also for all other categories of the population, especially over time. In Ukraine identifying these problems acts as a barometer of the maturity of the welfare state and of building a civil society. Particular attention is drawn to the analysis and evaluation of status indicators, the factors of formation and welfare of our citizens, taking into account their age qualification. It is the basis for creating the conditions for the proper development of the younger generation and for ensuring positive change. Without the formation of effective mechanisms for the implementation of social policy, it is unthinkable to argue for the effectiveness of socio-economic reforms and the implementation of a course of gradual entry into the international economic space. In this regard, the idea of presenting a model of children's welfare formation in the form of an integral index, the arguments and mechanisms of implementation of which are outlined in this scientific work, deserves attention.

**Purpose.** The aim of the research is to justify scientific and methodological foundations and to develop practical recommendations for the formation of children's welfare model in Ukraine. To achieve this aim, it has to be solved the following tasks: to highlight modern methods of assessing children's welfare; to determine indicators of the living standard of households with children as an environment for the formation of children's welfare, as well as to define indicators of social, cultural and spiritual children's development; to present a methodology for calculating children's welfare index; to carry out the methodology approbation and predict children's welfare index (by time lag of 5 years).

**Results.** The scientific results obtained are to develop an innovative approach to modelling the children's welfare in Ukraine based on the method of weighing indices of multidimensional averages over a specific period (2002-2017). The method of calculation of the integral index of the children's welfare is offered, which allows carrying out a quantitative and qualitative estimation of this trait, based on the dynamics of determinant indicators (stimulants and stimulators). They contribute to the definition of a system of indicators of living standards, socio-cultural and spiritual development of children (medical-demographic, infrastructural, socio-economic and socio-cultural).

**Conclusions.** Much of the work is devoted to modelling the welfare of children in Ukraine with three scenarios (realistic, optimistic and pessimistic). The effectiveness of social protection programs for children and households with children has been evaluated based on the methodology developed and the integral index, taking into account the objective laws and features of the search for reserves that contribute to their development.

**Keywords:** children's welfare, socio-economic situation, welfare modelling, population quality of life, social protection programs.

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### **Добробут дітей в економіці України: аналіз та моделювання**

**Анотація.** В умовах сучасної світової кризи проблеми соціальної політики не лише стосовно дітей, але й усіх інших категорій населення, є актуальними. В Україні виявлення цих проблем виступає у ролі барометра зрілості соціальної держави та розбудови громадянського суспільства. Особливо привертають увагу питання аналізу та оцінювання індикаторів стану, факторів формування та забезпечення добробуту наших співгромадян з врахуванням їхнього вікового цензу. Це основа створення умов для належного розвитку майбутніх поколінь та забезпечення позитивних змін. Без формування ефективних механізмів реалізації соціальної політики неможливо стверджувати стосовно ефективності соціально-економічних реформ та реалізації курсу поступового входження у міжнародний

*економічний простір. У цьому плані заслуговує на увагу ідея представлення моделі формування добробуту дітей у формі інтегрального індексу, аргументи та механізми втілення в життя якої викладені у даній науковій роботі.*

*Метою роботи є обґрунтування науково-методичних засад і розробка практичних рекомендацій щодо формування моделі добробуту дітей в Україні.*

*Отримані наукові результати полягають у розробці інноваційного підходу до моделювання добробуту дітей в Україні на основі використання методу зважування індексів багатомірних середніх величин за конкретний період (2002-2017 рр.). Запропоновано методу розрахунку інтегрального індексу добробуту дітей, що дозволяє проводити кількісну та якісну оцінку даної ознаки, виходячи з динаміки детермінуючих показників (стимуляторів і дестимуляторів). Вони сприяють визначенню системи індикаторів рівня життя, соціально-культурного та духовного розвитку дітей (медико-демографічні, інфраструктурні, соціально-економічні та соціально-культурологічні). На основі розробленої методики та побудови інтегрального індексу оцінено ефективність програм соціального захисту дітей та домогосподарств з дітьми з урахуванням об'єктивних закономірностей та особливостей пошуку резервів, що сприяють їхньому розвитку.*

*Розглянуто підходи до комплексної оцінки якості життя та добробуту населення, які у попередні періоди були розроблені представниками різних наукових шкіл (Д. Моррісома, Е. М. Лібанової, А. Боулі, О. О. Левицької тощо). На основі опрацьованих джерел висвітлено основні алгоритми розрахунку, їх позитивні та негативні сторони. У другій частині роботи основне місце відведено обґрунтуванню вибору показників, їх поділу на стимулятори та де стимулятори, а також представленню комплексної методики побудови інтегрального індексу (з виділенням етапів алгоритму розрахунку). Представлено інтегральний індекс добробуту дитини в Україні за 2002-2017 рр., висвітлено тенденції та причини зміни ситуації у часовому вимірі. Авторами здійснено моделювання добробуту дітей в Україні з виділенням трьох сценаріїв розвитку (реалістичного, оптимістичного та песимістичного).*

**Ключові слова:** добробут дітей; соціально-економічна ситуація; моделювання добробуту; якість життя населення; програми соціального захисту.

**Introduction.** One of the key problems of Ukraine transition to sustainable development is the low level and poor quality of life of most citizens. Limited access to material, social, spiritual goods and services is rotated by the processes of marginalization of entire families. In this situation, the risks of increasing economic restraint and the social exclusion of children, which demonstrate hyper-economic activity in the fight for their welfare and education, are particularly alarming. All this actualizes the need for a comprehensive analysis of the factors shaping the children's welfare, the separation of those that are in dissonance with established socio-cultural norms, providing prerequisites for improving social policy in the affairs of children with a view to the exercise of their rights and freedoms.

To build a comprehensive children's welfare index in Ukraine and to implement this indicator in the implementation of the national social policy on children affairs, it is necessary to pay attention to those basic researches, which are devoted to the analysis and evaluation of such phenomena as human potential, human development, etc. In fact, we are talking about the long-term experience of the work of international expert groups of the United Nations (relevant commissions) who, having summarized the state of affairs of statistics development in many countries, came to the conclusion that it is possible to calculate the 'Human Development Index (HDI)' (1990), later the Sustainable Development Index, etc. The HDI is formed by the following components: life expectancy, level of education, gross domestic product (GDP) per capita. At the same time, for each component, limit (minimum and maximum) values are set by which the standard of living of the population in a particular country, is the level of civilization of the country, is estimated. In particular, life expectancy limits are 25 85 years; Level of education - from 0 to 100 % (regarding the number of years that a citizen spent after

15 years in the mode of study); GDP per capita is 200,000\$. The HDI is considered low when its value is below 0.5 and relatively high if the HDI is 0.9-1 [10].

In 2001, a national methodology for calculating IDRs was published in Ukraine, developed by a team of leading Ukrainian scientists under the leadership of E. Libanova, Director of the Institute of Demography and Social Research of NAS of Ukraine, and specialists of the State Statistics Service of Ukraine. The results of the HDI calculations are intended to be used to monitor the state of regional human development, to measure its progress and factors, to substantiate the socio-economic development policy of the regions of Ukraine [6]. The development of such indicators in the country took place with a certain time lag. However, there is no information about the children's welfare.

Of interest were the proposals for the calculation of the 'Social Development Index' formulated by the United Nations Research Institute for Social Development. This index consists of 9 social and 7 economic indicators. The authors of the study concluded that with an average income per person less than 500 \$ per year, social development outweighs economic [3].

The Human Suffering Index (HSI), developed by the International Committee on Population Crisis, identifies differences in living conditions in different countries, including living standards in market economies and third world countries. HSI is based on 10 indicators characterizing the welfare of people depending on their financial and demographic situation, health and social system, like income, inflation, and demand for new jobs, degree of city overpopulation, children mortality, nutrition, availability of clean drinking water, energy use, adult literacy and degree of individual freedom. According to the HSI, Mozambique, Angola and Afghanistan were the most disadvantaged countries. The most favourable living conditions for the population in Switzerland, Germany

and Luxembourg [8]. Ukraine ranks 39<sup>th</sup> among 43 countries is classified as ‘more developed’ when it comes to maternal conditions and 37<sup>th</sup> in terms of children’s welfare [11].

We model the welfare of children in Ukraine using the experience of the international organization Save the Children. To do this, we will build children’s welfare index by first defining the indicators that will characterize the

standard and quality of life of children in Ukraine. From the whole set of factors and indicators, we propose to use four groups: medical-demographic, infrastructure, socio-economic and socio-cultural indicators (Table 1). The indexes take into account those indicators that correlate with each other but lack multicollinear relationships and reflect the main aspects of the welfare of children and their development.

Table 1 Children’s welfare assessment indicators

	Medical and demographic situation	Infrastructure environment	Social and economic situation	Social and cultural environment
INDICATORS OF CHILDREN’S WELFARE INDEX	Children mortality	Children libraries	Consumer price index for children	Children theatres
	Average life expectancy at birth	Local broadcasts for children and young people	Total resources of households with children	Schools of aesthetic education (choreographic, artistic, musical and other ones)
	The number of HIV-positive and AIDS patients among children aged 0-14 diagnosed for the first time	Boarding schools for orphans and children deprived of parental care	Minimum subsistence level for children aged 6-18 years	Children taken from parents who were deprived of parental rights
	The number of children diagnosed with malignant neoplasms for the first time	Large families who have received housing in urban areas	Total household expenses where children live	The proportion of children suspected of committing a theft
		Setting up general educational institutions	The average parents’ salary	Children living in boarding schools for orphans
		Family-friendly children’s homes		Children-subscribers of mobile connection
		Internet subscribers		

Our goal is to justify scientific and methodological foundations and to develop practical recommendations for the formation of children’s welfare model in Ukraine. In doing so, we have developed one hypothesis:

Hypothesis: The deep economic system crisis in the country produces a decrease in the families’ and children’s welfare. The poor financial and other conditions of the family, where the children lives, is a cause of destructions in the motivational settings, the growth of children labour and the development of children.

**Data and Methods.** In recent years, scientists from different countries, including UN experts, have offered a large number of mathematical, statistical and demographic models for integrated assessment of the standard of living of the population. However, when it comes to children’s welfare index in a comprehensive assessment of the quality of life of the population, these techniques have disadvantages in practice due to the lack of indicators and other statistics or complex calculations. The proposed method of authorship tries to minimize or avoid these shortcomings. To this end, we use Index-Numbers A. Bowley methodological approach.

Normalization is carried out by the formula (1) for indicator-stimulators and by the formula (2) for indicator-disintegrators:

$$z_{ij}^s = \frac{x_{ij}}{x_{maxj}} \quad (1)$$

$$z_{ij}^d = \frac{x_{minj}}{x_{ij}} \quad (2)$$

It is formed the standardized series of values for each group of indicators ( $z_{ij}^d$ ) after having carried out the normalization of indicators-stimulators and indicators-disintegrators.

The results of the calculations are given in Annex A.

After summarizing the data for each of the four groups of indicators, it is necessary to calculate a multivariate mean ( $\bar{z}_{il}$ ) for each year of the study period by the formula (3) [4].

$$\bar{z}_{il} = \frac{1}{k_l} \sum_{j=1}^{k_l} z_{ij} \quad (3)$$

$k_l$  is the number of indicators in the group;  $l$  is the number of the group ( $l = 1, 2, 3, 4$ ).

When calculating a multidimensional mean, it is important to take into account the fact that some indicators affect the integral index differently. Variables such as life expectancy, infrastructure security and others that have a positive impact on overall welfare should be used as  $z_{ij}$ . And factors with a negative impact on the children’s welfare (mortality rates, morbidity, number of thefts committed by children, etc.) should be used in the form  $(1-z_{ij})$ , which will allow you to move to one-vector values. The results of calculations of the multivariate mean for each block of indicators are shown in Fig. 2.

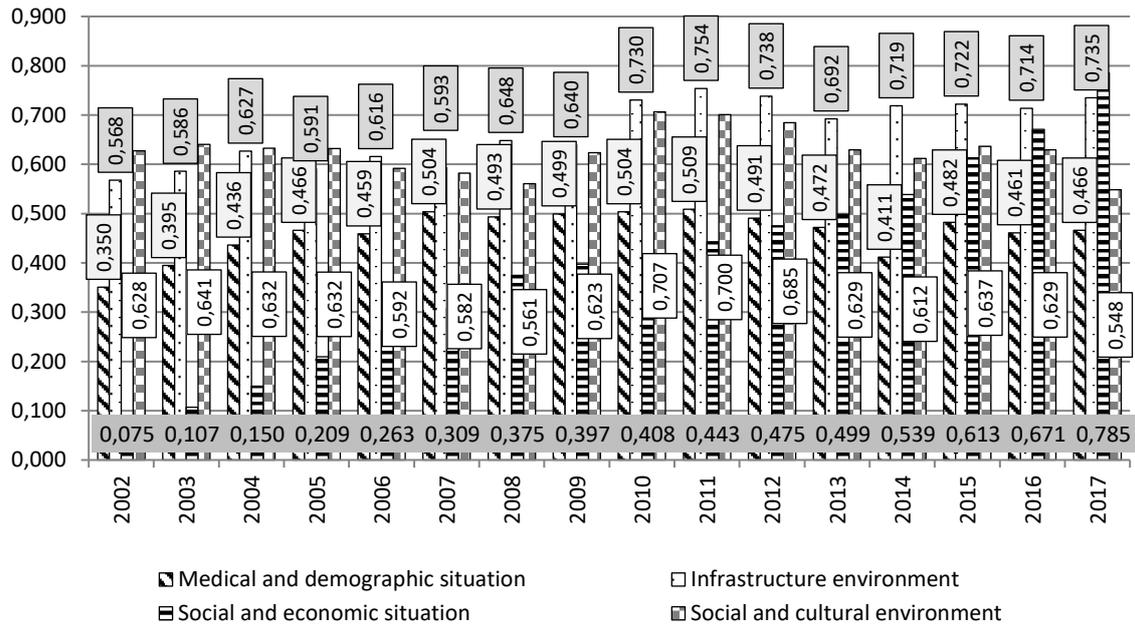


Figure 2 – Values of multidimensional averages, 2002-2017

Source: the author's computation results

To construct an integral children's welfare index, we propose, based on multivariate averages, to calculate time series of indices for each group of indicators and to evaluate the significance of each group of indicators. The calculation of the values of the weights of the groups of indicators in the aggregate index is made by the method of constructing a matrix of paired correlations [8]:

$$w_i = \sum_{u=1}^l r_{uv} / \sum_{u=1}^l \sum_{v=1}^l r_{uv}, v = \overline{1, l} \quad (4)$$

Table 1 The weights of the block of indicators of children's welfare index (by the method of constructing the matrix of pair correlations)

$r_{uv}$	$r_{1.1}$	$r_{1.2}$	$r_{1.3}$	$r_{1.4}$	$S_i$	$W_l$
$r_{1.1}$	1	0,474832	0,453154	0,135939	2,063925	0,250683
$r_{2.1}$	0,474832	1	0,833835	0,345058	2,653725	0,32232
$r_{3.1}$	0,453154	0,833835	1	-0,12621	2,160775	0,262446
$r_{4.1}$	0,135939	0,345058	-0,12621	1	1,354783	0,164551
S	-	-	-	-	8,233208	1

Source: the author's computation results

According to the results of the research in the structure of selected indicators, infrastructure factors 32.23% and socio-cultural indicators (16.46%) have the greatest weight. The weights of the medical-demographic and socio-economic blocks are 25.07% and 26.24%, respectively.

The conclusion on the reliability of the calculated coefficients of pair correlation as statistical variables and the fact that their error is within the allowable limits, is made on the basis of probability estimation using the T-test. The calculated values are compared with the table values for  $df = n-1$  degrees of freedom.

$w_i$  is a weight value of the  $i$ -th indicator in the  $j$ th group of indicators ( $i = \overline{1, n}; j = \overline{1, m}$ );

$r_{uv}$  – is a coefficient module of the correlation between the indicators ( $i = \overline{1, n}; j = \overline{1, m}$ ).

The values of the weights with which the multidimensional mean of each group is included in the aggregate index and the matrix of pairwise correlations are presented in Table. 1.

If the empirical value at a given level of error ( $p < 0,05$ ) and degrees of freedom exceeds the table value, the obtained results are significant.

Children's welfare index is calculated by means of a linear combination of group weights and indices of a multidimensional weight value according to the formula (5):

$$y_i = w_1 I_{i1} + w_2 I_{i2} + w_3 I_{i3} + w_4 I_{i4} \quad (5)$$

$I_{i1}, I_{i2}, I_{i3}, I_{i4}$  are the values of the indices of the multivariate averages for each group [5].

**Results.** The method of weighing indices of multidimensional averages for the years 2002-2017 has

obtained a model of children’s welfare in the form of index, reflecting their standard of living and development opportunities in Ukraine (Fig. 3). According to the proposed method, the integral index can take values from 0 to 1.

During the study period, children’s welfare levels in Ukraine fluctuated between 0.394 in 2002 and 0.650 in 2017, when the minimum and maximum values of children’s welfare index are observed. In particular, a sharp decline in the welfare of children in the country occurred in 2012-2014. This trend is due to the onset of the global economic crisis and due to the socio-economic instability of the country. The decline in the level of

domestic production, employment of working-age population and high unemployment has affected the living standards of the population and, at the same time, the children’s welfare. However, since 2015, there has been a significant increase in the value of children’s welfare index, which already reached 0.625 in 2016, which is due to the gradual stabilization of the national currency, receiving tranches of the currency fund, increasing social payments for households with children, which gave greater opportunities for development of the young generation.

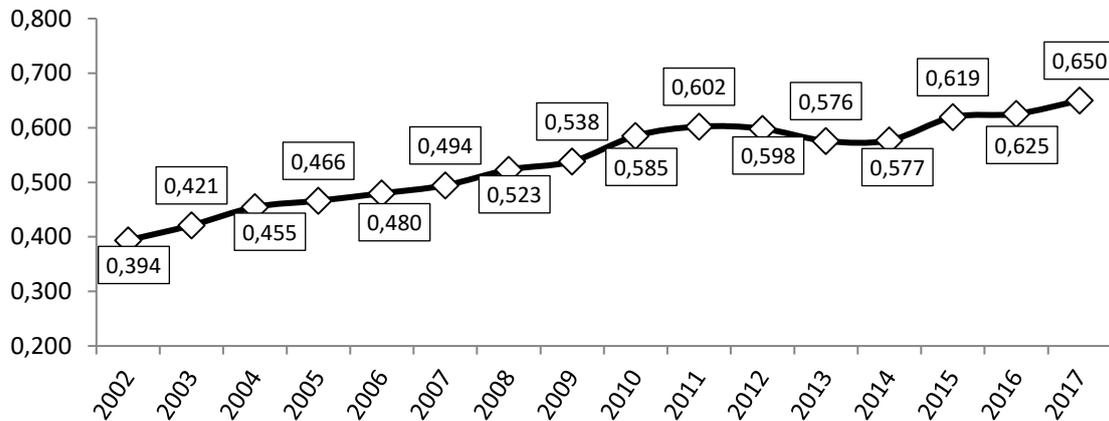


Figure 3 - Children’s welfare index in Ukraine, 2002-2017

Source: the author’s computation results

Over the period 2002-2017, the value of children’s welfare index increased by only 2.1%, indicating a slower pace of improvement in children’s quality of life and the able-bodied population, as well as opportunities for the development and learning of children.

To make correct conclusions about the growth rate of children’s welfare index in Ukraine, additional calculations are needed. To do this, we calculate the chain indices of multidimensional averages for each group of indicators. The results of the study are presented in Table. 2.

Table 2 The chain indices of multidimensional average values for calculating the rate of change in children’s welfare index, 2002-2017

$I_{ij}$	2002	2003	2004	2005	2006	2007	2008	2009
$I_{i1}$	1,0000	0,3945	1,1054	0,4215	1,0882	0,4631	1,0647	0,4691
$I_{i2}$	1,0000	1,0319	1,0701	0,9428	1,0417	0,9639	1,0930	0,9865
$I_{i3}$	1,0000	2,5042	1,1450	1,4774	1,0732	1,2490	1,2326	1,0670
$I_{i4}$	1,0000	1,0209	0,9870	0,9991	0,9367	0,9840	0,9630	1,1118
	2010	2011	2012	2013	2014	2015	2016	2017
$I_{i1}$	1,0738	0,4736	1,0363	0,4552	0,9038	0,5336	0,8641	0,5391
$I_{i2}$	1,1416	1,0325	0,9792	0,9372	1,0387	1,0050	0,9882	1,0292
$I_{i3}$	1,0024	1,1025	1,1508	1,0327	1,1107	1,1857	1,0719	1,1731
$I_{i4}$	1,1336	0,9909	0,9774	0,9193	0,9727	1,0402	0,9885	0,8710

Source: the author’s computation results

We construct a matrix of pairwise correlations to determine the weights with which the indices of the multidimensional mean are included in the aggregate index. The results are presented in table. 3.

Table 3 Weights of the indices of the multivariate averages in children’s welfare index

$r_{uv}$	$r_{1.1}$	$r_{1.2}$	$r_{1.3}$	$r_{1.4}$	$S_i$	$W_l$
$r_{1.1}$	1	0.053085	0.543793	0.266852	1.757559	0.301785
$r_{2.1}$	0.053085	1	0.048703	0.273154	1.268772	0.217857
$r_{3.1}$	0.543793	0.048703	1	0.167477	1.425019	0.244685
$r_{4.1}$	0.266852	0.273154	0.167477	1	1.372529	0.235673
S	-	-	-	-	5.823879	1

Source: the author’s computation results

Our method of calculation of children’s welfare index allows to evaluate and obtain a reasonable quantitative and qualitative assessment of children’s welfare index (taking into account the indicators-stimulators and indicators-graduates). Such an algorithm also allows to estimate the children’s quality of life in Ukraine in the dynamics and to carry out a comparative analysis of their welfare on a spatial basis (regions of Ukraine and areas of settlement). The resulting index values may be the primary source of identifying priority problems and reserves for the development of a country and its regions.

**Discussion.** The strategic issue of the ILO and its subdivisions is to assess the changes in decent work in every country around the world, and in Ukraine as well. The Declaration ‘Social Justice for Equitable Globalization’ (ILO, 2008) states country-numbers can consider ‘the establishment of appropriate indicators or statistics to monitor and assess changes of children’s welfare’ [6].

To develop the concept of children development in Ukraine and to create the right environment to ensure a sufficient level of welfare, we predict children’s welfare

index using the least-squares method. This method makes it possible to construct medium-term pessimistic, realistic and optimistic forecasts with a high probability (coefficient of determination is 0.996; coefficient of approximation is 7.27%; T-test is 2.201).

According to the results of the realistic forecast, over the period 2018-2022 children’s welfare index will increase by approximately 13.23% from 0.673 in 2018 to 0.736 in 2022 (Fig. 3).

In the conditions of aggravation of the economic crisis, instability of the financial position of the family, children’s welfare index decreases with the previous growth, it is given a pessimistic scenario of development. Thus, the value of the integral index in 2019 will be 0.610 and reach the mark of 2015. The current strategy of social measures to improve the welfare of the population will not produce significant results and therefore is not an effective tool for ensuring the children’s welfare in Ukraine. This hypothesis is confirmed by the forecast for the pessimistic scenario: 0.594 in 2018, 0.610 in 2019, 0.626 in 2020, 0.642 in 2021 and 0.658 in 2022.

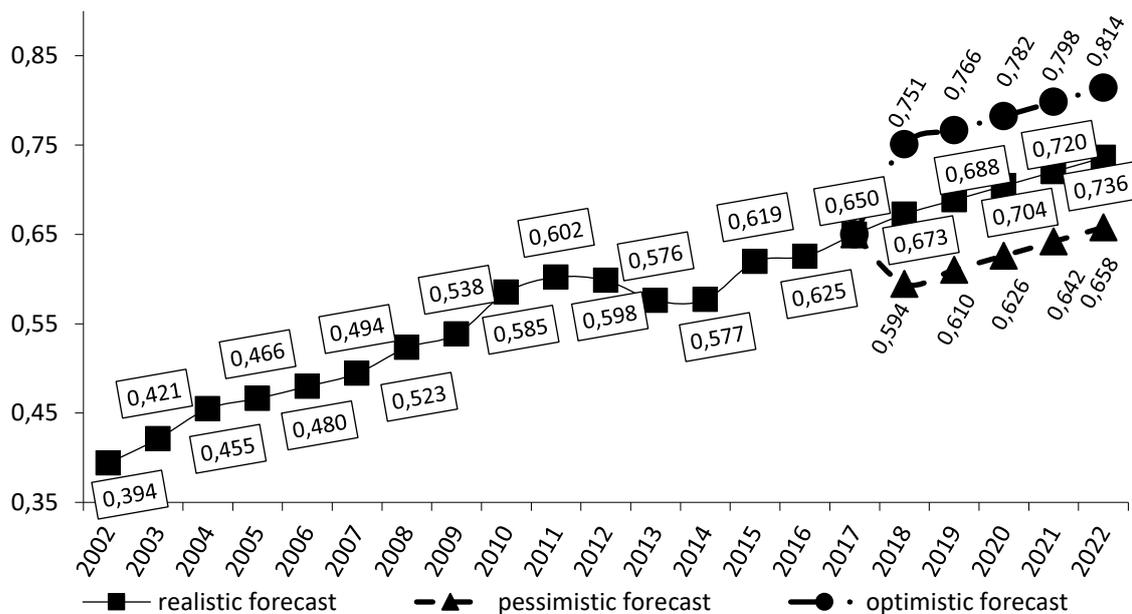


Figure 3 - Forecast of the children’s welfare index in Ukraine: scenario approach, 2018-2022

Source: the author’s computation results

Building a forecast on an optimistic scenario makes it possible to see the effectiveness of social and economic reforms that simultaneously affect the pay system, quality

of life, welfare of the population and children in particular. It is worth emphasizing that the optimistic forecast of children’s welfare index testifies to the importance of

active socio-economic instruments and measures in the formation of the appropriate concept of decent working conditions in the country. Priority in the decent work program is to ensure that parents can combine their work with family responsibilities. For example, children's welfare index understudy would increase by 25.23% in the following order: 0.751; 0.766; 0.782; 0.798; 0.814.

We believe that the children's welfare is mainly expressed in the decent wages of parents, which makes it possible to meet their own needs of the able-bodied population and the needs of their children, as well as in-state targeted social assistance in the form of cash payments from social protection programs. By completing this task, the state can improve the financial situation of households with children, since children with the lowest needs (the A. Maslow pyramid) will be able to fully study, attend extracurricular circles, and thus develop their skills.

Guaranteed minimum for the able-bodied population, and therefore high levels of welfare and children's development opportunities in the country should be at least 5 \$ per hour. In Ukraine, about 18 % of employees have wages at this level.

**Conclusion.** Today, the main task of economic policy in the labour market in Ukraine is to reduce the impact of the economic crisis. Therefore, there is a need to continue to monitor employment and labour markets, especially in reforming the area of income taxation and mandatory state social and pension insurance.

Unlike other methods of calculating the welfare index of population or children at the country level, this method also offers a regional cut. At the present stage of development of the economy of Ukraine, significant changes are taking place in the socio-economic situation, in information and statistical provision of research, and therefore new analytical needs arise every year. It should be noted that this is the reason and necessity to review the billing information at least every five years.

The results of calculations of children's welfare index in Ukraine can be used to monitor the conditions of children's development, to assess the rate of growth of the children's welfare in society and those factors that affect it, and to substantiate the children's welfare policy in Ukraine.

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