Features of public food availability regulation

ОСОБЛИВОСТІ ДЕРЖАВНОГО РЕГУЛЮВАННЯ ДОСТУПНОСТІ ПРОДОВОЛЬСТВА

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Abstracts

Food availability is a complex sustainable development issue, linked to health through malnutrition, but also to sustainable economic development, trade and based on two components: physical and economic food availability. Food availability priorities are related to improvement of the food supplies moving from production through marketing channels for domestic consumption and poverty eradication. The physical food availability is defined as the ability of the population within its financial resources to buy food products, or to produce them if there are personal subsidiary farms. The economic food availability is linked with the purchasing power of various social groups to buy food products. Taking into account the absence of perfect methods of comprehensive assessment of food availability it is proposed to calculate the integral indicator of sufficiency based on indicators of physical and economic sufficiency, using weights system and factor analysis. The economic interpretation of the values of the integral indicator of food availability is proposed to use as a basis for public regulatory decision-making. The main areas of public regulation of food availability are to improve trade infrastructure and marketing channels of sales, to overcome poverty and social inequality.

Доступність продовольства виступає комплексною проблемою сталого розвитку з охорони здоров'я, яка пов'язана не тільки з недоїданням, але й зі стійким економічним розвитком, торгівлею та базується на двох складових: фізичній і економічній доступності продуктів харчування. Фізичну доступність продовольства визначено як можливість населення у межах своїх фінансових ресурсів купувати продовольчі товари, а за наявності особистого підсобного господарства виробляти. Економічну доступність продовольства пов'язано з купівельною спроможністю придбання різними соціальними групами населення продовольчих товарів. Враховуючи відсут-

ність досконалої методики комплексної оцінки доступності продовольства, запропоновано розрахувати інтегральний індикатор достатності на основі показників фізичної і економічної достатності, використавши систему ваг та факторний аналіз. Економічну інтерпретацію значень інтегрального індикатора доступності продовольства запропоновано використовувати як основу для прийняття державних регуляторних рішень. Основними напрямками державного регулювання доступності продовольства визначено удосконалення торгівельної інфраструктури, маркетингових каналів збуту, подолання бідності та соціальної нерівності.

Key words:

food availability, economic food availability, physical food availability, factor analysis, weights system, integral indicator of food availability, the principles of public food availability regulation.

Доступність продовольства, економічна доступність продовольства, фізична доступність продовольства, факторний аналіз, система ваг, інтегральний індикатор доступності продовольства, принципи державного регулювання доступності продовольства.

Introduction

Today, not only in Ukraine, but also all over the world, there is no perfect method of a comprehensive assessment of food availability within the food security that prevents the timely identification of potential threats, developing mechanisms of counteraction, determining priorities in the regulation, evaluation of the effect of state and international investment.

The proposed method aims to provide a comprehensive assessment of objectivity, completeness and validity of measuring, the effectiveness of management decisions made on its basis and the possibility to form the timely and adequate public regulatory impact on threats.

The main hypothesis of the research is based on the assertion that the basis for decision making concerning the public regulation of food availability should be its comprehensive assessment.

The main objectives of our research are: improving the methodological principles of economic and physical food availability evaluation; calculating the integral indicator of food availability using factor analysis; elucidating the main food availability threats; offering directions of public availability regulation.

The strategic course of Ukraine to build a democratic and constitutional state with a developed economy provides priority in achieving social goals, focus on the

needs and values of its citizens. In the hierarchy of human needs, the need for food refers to the priority that requires increased attention of the state in ensuring the availability of food for all groups of the population and guarantee of food security.

Based on the constitutional definition Ukraine as a social state whose policy is aimed at creating conditions to ensure a decent standard of life the main purpose of public regulation is primarily the protection of citizens right to good nutrition. Ensuring the protection of this right, the state must find means to eliminate food dependence on foreign countries and to reduce food imports.

The state aims to establish social order, to create a fair policy of food security, to help with raising the level of calorie daily diet of the population, eliminating imbalance in food intake between social groups, increasing the purchasing power of the poor and socially disadvantaged groups, including those with fixed incomes (pensioners, students), who depend on the public social security.

With the rapid globalization and increasing world food crisis the strategically important and basic condition for maintaining economic stability, social stability and sovereignty of Ukraine is its food security. A special role in the implementation of this task belongs to a comprehensive assessment of components of food security: availability, sufficiency, sustainability, quality and safety.

Existing methods of currently evaluating food security and its components have, firstly, significant differences due to the different levels and purposes of the analysis, and secondly, none of them allow taking into account the full list of indices, and in some methods the indices are defined without proper scientific and practical substantiation of their link with the integral indicator.

Given this, it is necessary to improve and substantiate scientific and methodological principles of the comprehensive assessment of food availability in the assessment of food security, economic interpretation of the results in order to consider them in the development of national programs and strategies of socio-economic development.

As availability is a system category, the status of which is formed by the interaction of a large number of indices, so while making an assessment, in our view, it is necessary to consider their complex mutual influence. Accordingly, we propose to evaluate the adequacy of food through an integral indicator, calculated on the basis of indicators of physical and economic availability.

Having analyzed the subsystems of the physical and economic availability, using the integral indicator will enable to move from plurality of indices and indicators to one of the most informative generalizing indicator that shows the appropriate level of safety or danger and is suitable for making analysis and public regulatory decisions.

Calculating the integral indicator of food availability provides the method-

ological unity of constructing indices and indicators of food security and their comparability in the dynamics, and this will make it possible to take into account the proportion of each one in an integral assessment.

As each of the marked indicators of food availability operates, to some extent, independently, and the status of availability depends on the status of each of them, then it is appropriate to calculate the integral value of the indicators of physical and economic availability.

Calculation of integral indicators, as an intermediate stage of food availability estimation, allows to avoid informative over-burdening of the integral indicator of availability, makes it possible to discover which of the indicators causes the deteriorated condition and enables to make operational regulatory decisions in the relevant subsystem.

Considering the hierarchical structure of food availability for its complex evaluation we suggest a phased scheme of calculating the integral indicator.

At the first level it is necessary to calculate the indices of physical and economic availability, to make their differentiation into stimulants and destimulants depending on the ongoing impact, to choose an adequate way to normalization and to carry out the normalization of indices.

The second level involves the calculation of integral indicators that characterize each of the subsystems of availability. For that purpose, we propose to determine the calculation method of weight coefficients of indices in blocks of indicators and to calculate them, to choose the calculation method of integral indicators, to calculate indicators.

At the third level we perform basic calculations - the integral food availability indicator based on the chosen calculation method using the values of integral indicators of physical and economic availability.

Physical availability of food provides its uninterrupted flow in the place of consumption in the required quantities and range, i.e. it gives the population the possibility to purchase certain food items within its financial capabilities, or in the case of having private subsidiary farms or gardens and summer cottage areas - to develop them in the household. It also gives possibility to supply food to special consumers in volume and structure according to standards. Sufficiency of food expressed by physical availability does not guarantee that everyone in the society has enough food. Food security of a person depends to a large extent on the level of money income received and its purchasing power expressed by economic availability of food. The economic availability of food characterizes the possibility of various social groups to purchase foodstuffs (Hoychuk, 2004, s.16). Growing differences in real income of the population predetermine the appropriate inequality in distribution and consumption of food. If that inequality deepens and the num-

ber of poor people grows, the society is reducing the consumption of food.

Accordingly, the physical availability of food is offered to be determined on the basis of indicators, each of which performs its specific characteristics: number of retailers with preferably food range per 10 thousand people. (units); number of food markets per 10 thousand population (units); agricultural products grown on subsidiary farms per 10 thousand people, mln.hrn.

The component indicators of economic availability are: cost Index; index of real wages; Gini index.

The calculated values of the physical and economic availability are presented in Table 1 and Table 2.

Table 1

Indicators of physical availability of food

(calculated by the author according to (State Statistics Service of Ukraine)

Years	Number of retailers with preferably food range per 10 thousand people (units)	Number of food markets per 10 thousand population (units)	Agricultural products grown on subsidiary farms per 10 thousand people, mln. hrn.
2007	1,64313	0,45536	11,44399
2008	1,60925	0,45815	12,35969
2009	1,49978	0,44946	12,21518
2010	1,46326	0,44761	12,04065
2011	1,41812	0,44345	13,61048

Analysis of indices of physical food availability indicates: negative dynamics in the number of retailers which is steadily decreasing from 1.64313 units in 2007 to 1.41812 units in 2011, thereby reducing the possibility of purchasing food in retail trade; tend to reduce the number of food markets, due to unreasonable state tax policy; increase of agricultural production, grown in subsidiary farms from 11.44399 million hrn. in 2007 to 13.61048 million hrn. in 2011, which is apparently enforced.

Dynamics of calculated indices of economic availability of food (Table 2) compared to the physical availability is more stable, but there is also a decrease in index of real wages in 2011 compared to 2007 from 112.50 to 108.70. Reducing the cost index and the Gini index, which is a positive trend, is insignificant and does not cause much impact on the overall level.

Table 2

Economic indicators of food availability

(calculated by the author according to (State Statistics Service of Ukraine)

Years	Cost Index	Index of real wages	Gini index
2007	0,88613	112,50	0,252
2008	0,84685	106,30	0,259
2009	0,86302	90,80	0,257
2010	0,88951	110,20	0,253
2011	0,88575	108,70	0,243

As a result of testing existing statistical techniques of integral assessments (multidimensional medium, taxonomic indices) the factor analysis was chosen to calculate the integral indicators of food security availability.

A mathematical foundation of the factor analysis of food availability is a correlation matrix R with units diagonally. Non-diagonal elements of the matrix – are paired correlation coefficients that assess the relationship between economic indicators of food availability due to the influence of their common causes of their variation.

Let us calculate the values of elements of the correlation matrix of physical availability (R1) and economic availability of food (R2).

Correlation matrix of indices of physical availability of food:

$$R_1 = \begin{pmatrix} 1 & -0.92 & -0.97 \\ -0.92 & 1 & 0.96 \\ -0.97 & 0.96 & 1 \end{pmatrix}$$

Correlation matrix of indices of economic availability of food:

$$R_2 = \begin{pmatrix} 1 & 0.31 & 0.37 \\ 0.31 & 1 & 0.5 \\ 0.37 & 0.5 & 1 \end{pmatrix}$$

According to the correlation matrix data we determine the factor loadings, having used integrated data processing system Statistica 6.0 by procedures of Prin-

cipal components method of the Factor Analysis module (Yerina, 2001, s.47).

For the purpose of effective public regulation of physical and economic availability to food and determination of its dynamics, while calculating the integral indicator the values of weight coefficients should be taken into account (Table 3, Table 4).

The elements of the resulting matrix of factor loadings are the correlation coefficients between indicators of economic food availability and economic factors. Then for each indicator we determine the maximum loading by the module multiplied by the share of total variance, which is explained by the corresponding factor.

Thus the results obtained by all indicators are summarized and the proportion of each of them in the amount is calculated. The result is weights of indicators, which are used for calculating the integral indicator of economic food availability.

Table 3

Factor loadings and weights of indicators of physical food availability

Indicators	Factor 1	Factor 2	Factor 3	Weights
Number of retailers	0,97228	-0,13157	0,19327	**0,34810**
Number of food markets	-0,93954	0,30488	0,15591	**0,33637**
Agricultural products grown in subsidiary farms	-0,88131	-0,47019	0,04701	**0,31553**
Eigen values	2,60477	0,33134	0,06387	

Estimated weights of indicators of the physical food availability point out that the greatest impact on the physical food availability is provided by the number of retailers indicator (0.34810), somewhat less – by the number of food markets indicator (0.33637), and the least - by the indicator of agricultural products grown in subsidiary farms (0.31553).

These weights of indicators of the physical food availability are later included in the calculation of the integral indicator of the physical availability.

Table 4

Factor loadings and weights of indicators of economic food availability

Indicators	Factor 1	Factor 2	Factor 3	Weights
Cost Index	-0,84466	0,46598	0,26346	**0,33904**

Index of real wages	-0,70977	-0,69295	0,12670	**0,28490**
Gini index	-0,93690	0,10485	-0,33351	**0,37606**
Eigen values	2,09499	0,70831	0,19670	

Based on the calculated values of the weights of indicators of the economic food availability, it can be argued that the greatest impact on the integral indicator of the economic food availability has Gini index (0.37606), somewhat less - cost index (0.33904), the least - index of real wages (0.28490).

Based on the impact of the physical and economic food availability indicators on the integral indicator we distribute them on stimulants and destimulats.

The basis of differentiation of indices is the nature of their impact:

- stimulant – the increase of an index causes the increase of availability;
- destimulant - the increase of an index causes the decrease of availability.

Accordingly stimulants are the indicators: the number of retailers with preferably food range, the number of food markets, agricultural products grown on subsidiary farms, the index of real wages. Destimulating impact is exercised by the indices: cost index and Gini index.

Considering different dimension of indicators in determining the integral indicator we use standardized values according to variation dimension (Makarova, 2012, s.12):

for indicators- stimulants , $$z_{ij} = \frac{x_j - x_{j\min}}{x_{j\max} - x_{j\min}} \quad (1)$$

for indicators-destimulants, $$z_{ij} = \frac{x_{j\max} - x_j}{x_{j\max} - x_{j\min}} \quad (2)$$

where x_{ij} - the value of the j indicator in the i time period (i = 1 .. n, j = 1 .. m);

x_{jmin} - minimum value of the j indicator;

x_{jmax} - the maximum value of the j indicator;

z_{ij} - standardized value of x_{ij} indicator.

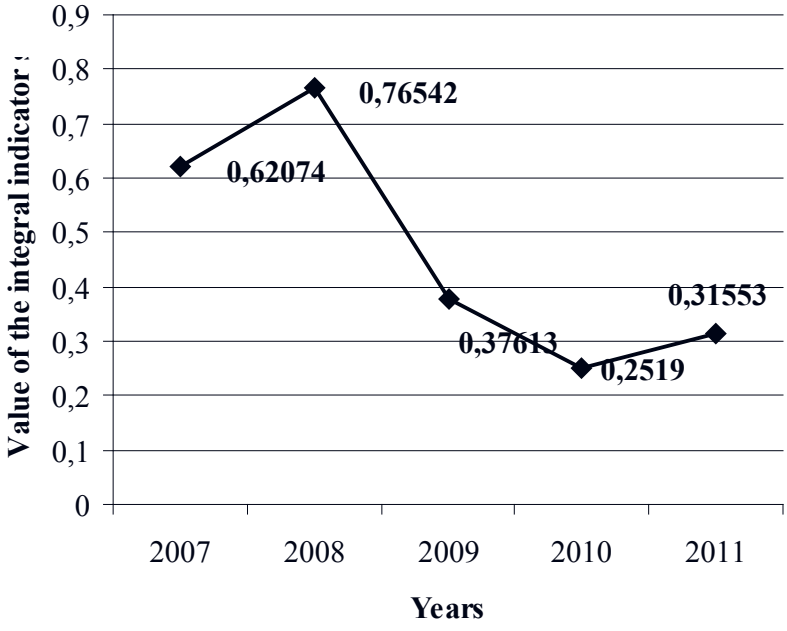
The values of integral indicators of the physical and economic food availability are found as a sum of results of the normalized values of indicators and corresponding weights (see Table 5 and Table 6).

Table 5

Calculation of the integral indicator of physical food availability

Years	Normalized values			**Integral indicators**
	Number of retailers with preferably food range	Number of food markets	Agricultural products grown on subsidiary farms	
2007	1	0,81055	0	**0,62074**
2008	0,84942	1	0,42267	**0,76542**
2009	0,36292	0,40870	0,35596	**0,37613**
2010	0,20061	0,28292	0,27540	**0,25190**
2011	0	0	1	**0,31553**

The analysis of the calculated integral indicator of the physical food availability indicates its significant decrease during the years 2007-2011. It acquires the smallest value in 2010, and the biggest one - in 2008 (fig. 1). Obviously, the reason for decreasing the values of the integral indicator of physical availability is the impact of the global financial crisis of 2008 that provoked the closure of retailers and food markets.



Given that the values of the integral indicator lie in the range from 0 to 1 (where 0 - indicates danger, and 1 - security), most of the values of the integral indicator of the physical food availability are closer to the lower range, thus indicating its critical level.

Table 6

Calculation of the integral indicator of economic food availability

Years	Normalized values			**Integral indicators**
	Cost index	Index of real wages	Gini index	
2007	0,07922	1	0,43750	**0,47628**
2008	1	0,71429	0	**0,54254**
2009	0,62086	0	0,12500	**0,25750**
2010	0	0,89401	0,37500	**0,39572**
2011	0,08816	0,82488	1	**0,64096**

The obtained the values of the integral indicator of the economic food availability show its significant variations during the years 2007-2011. It acquires the smallest value in 2009, and the biggest one - in 2011 (fig. 2).

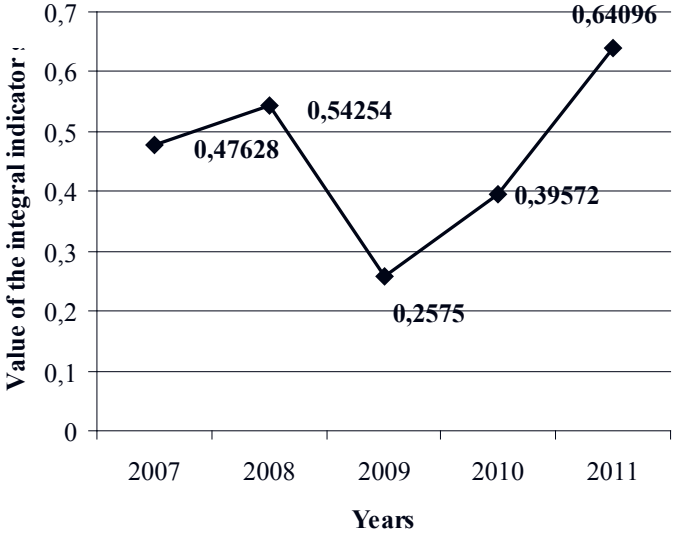


Fig.2 Dynamics of indicator of economic food availability

Taking into account the vital importance of both the indicator of the physical and economic food availability to achieve food availability, we calculate the value of the integral index of availability giving each indicator a weight of 0.5. Calculating the integral indicator of food availability by the method of factor analysis enables the methodological unity of indices that characterize it.

Dynamics of the integral indicator of food availability (fig. 3) shows significant instability and threats for the whole system of food security of Ukraine. Inconsequence and incompleteness of state reforms, made wrong decisions and actions related to social and economic changes, inability to resist the effects of the global financial crisis led to a decrease in food availability. It is obvious that to provide food availability is possible only within the framework of ensuring economic production and supply of the required amount of the appropriate food products. In addition, the priorities of public regulation of food availability must be to overcome poverty, to improve living standards and to narrow differentiation in incomes.

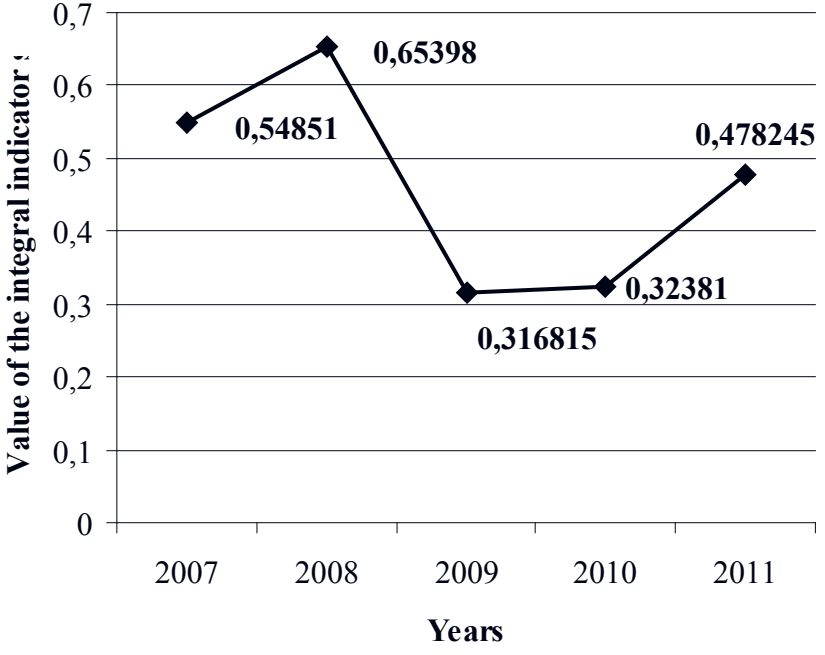


Fig.3 Dynamics of integral indicator of food availability

The main tasks of public regulation of food availability include: determination of objects and subjects of regulation, functions and tasks, management techniques, complex criteria for monitoring, precise mechanisms of regulation.

Food availability is an integral part of food security of the state and the condition of its stability. Ensuring availability of food is an urgent problem as for countries with low levels of economic development and for the developed countries. Government regulation of food availability has national characteristics; complexity and permanency are its inherent. Depending on the characteristics of the national food system, the period of its development, the achieved level and on what kind of availability component at some stage is a priority; its ensuring is modified by the change of internal and external threats. To meet the physiological human needs in quality and safe food products is the material basis of biological, political, social and spiritual existence of individual, family, social groups, the state, society and humanity in general. Ukraine's integration into the world and European community dwells upon the public regulation of food availability, as only guaranteeing supply of food under any conditions the state may pursue an independent policy.

Conclusions

The national level of food consumption is derived from the overall economic level of development that is why the problem of food availability requires thorough scientific research and improvement of public regulation of its ensuring.

Identifying threats to food availability and predicting the consequences of their actions should be based on a comprehensive assessment and values of the integral indicator of availability. The current system of public regulation in Ukraine mostly restrains the solution of the problems of effective interaction of the entities of the agricultural market, the formation of the mechanisms of their adequate support, the creation and development of the market and social infrastructure. As a result, there is a great need to further improve the system of public regulation of food availability, focused on creating the conditions for the effective functioning of the agricultural sector, the development of appropriate mechanisms of the state impact and the support of food markets.

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