2. ՏՆՏԵՍՈՒԹՅԱՆ ԻՐԱԿԱՆ ՀԱՏՎԱԾԻ ՀԻՄՆԱԽՆԴԻՐՆԵՐ

ECONOMETRIC ASSESSMENT OF THE LEVEL OF WHEAT SELF-SUFFICIENCY IN RA AS A GUIDELINE FOR DETERMINING THE PRIORITIES OF STATE POLICY

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Հոդվածը ստացվել է՝ 02.10.23, ուղարկվել է գրախոսման՝ 23.11.23 երաշխավորվել է տպագրության՝ 07.12.23

Introduction. Agriculture is one of the key sectors of the Armenian economy, the development of which conditions the development of infrastructures in the value chain of food production, as well as ensures the country's food security. Agriculture in RA has the potential for development, but the problems and challenges in the sector, such as ensuring food security, hinder the use of the opportunities that contribute to the development of the sector.

Food security is of primary importance for modern states, forming an integral part of military security. Food security issues are more acute in countries with adverse climatic conditions or with scarce arable lands. Such conditions of those countries do not allow them to meet the demand for necessary food products at the expense of their resources, that is, to be a self-sufficient country from the point of view of food production. The Republic of Armenia is one of those countries, for which the successful solution of food security problems is highly relevant. The relevance of the article is due to the fact that wheat is a primary food product, and monitoring its self-sufficiency level and keeping it at the center of attention is of strategic importance for Armenia. The main goal of the article is to carry out an econometric assessment of the wheat self-sufficiency level and, based on the obtained results, give the priorities of the state policy in regards to increasing wheat self-sufficiency. The following main problems were addressed on the way to achieving the goal of the research:

- to analyze the dynamics of wheat self-sufficiency level and wheat production in RA,
- to assess the nature of the impact of the main indicators of wheat production on the level of wheat self-sufficiency, using econometric regression modeling,
- to present the state policy priorities based on the results of the econometric assessment.

Literature review. Issues related to food self-sufficiency in the world became more important and relevant in 2007-2008, after the crisis years, when the issues related to physical and economic availability aspects of food security raised their heads¹.

¹ Jennifer Clapp, Food self-sufficiency: Making sense of it, and when it makes sense, Food Policy <u>Volume</u> <u>66</u>, January 2017, Pages 88-96, p. 88

One of the main global challenges is ensuring food security for billions of people. Since the beginning of mankind, the population has been making efforts to ensure food security. In general, food security has been at the center of research for scientists for a long time, but the concept of food security emerged only in the 1970s. In the beginning, food security was focused on the physical security (availability) of food, then the problem of economic security (affordability) of food, especially among the poor population, also emerged¹.

One of the main components of food security is the sufficiency of grain crops. Grains and grain-based products are critically important for world food security as primary and widely consumed food products. Cereals are considered one of the main food products all over the world, especially among the poor population. From the food security point of view, one of the important characteristics of cereals is their high storage capacity and, compared to other food products, such as fruits, vegetables, and meat products, cereals are more affordable².

The grain sub-complex is a set of economic relations where the economic interests of all links of the commodity producer-consumer chain intersect. Consequently, undermining the interests of any link in the chain can hinder the development and efficiency of the entire system.

The role of state policy is very important in raising the level of food security in RA. The state support programs for agriculture introduced and implemented by the RA Government have a direct impact on the level of wheat self-sufficiency. In particular, according to the data of the RA Ministry of Economy, until 2022, the "STATE SUPPORT PROGRAM FOR PROMOTION OF WINTER WHEAT PRODUCTION IN THE REPUBLIC OF ARMENIA" was applied, the purpose of which was to mitigate the effects of the geopolitical situation, external restrictions, the increase in the price of labor, and to ensure food security, the cost of cultivating 1 ha of winter wheat, in particular, by partially compensating the costs of purchasing seed, fertilizer, and fuel, to contribute to the increase of the sown areas of winter wheat, also through the use of uncultivated arable lands, to the increase of the volume of locally produced wheat and the income of farms, to ensure the physical and economic availability of wheat. According to the program implementation report of 2022, it was implemented in all RA regions, except for Armavir and Ararat regions, and according to operational data received from regional administrations, around 68,000 ha of winter wheat were sown³.

Baer-Nawrocka A, Sadowski A (2019) Food security and food self-sufficiency around the world: A typology of countries. PLoS ONE 14(3): e0213448. https://doi.org/10.1371/journal.pone.0213448

https://www.amisoutlook.org/fileadmin/user_upload/amis/docs/resources/Grains_Storage_and_Global_Food_Security.pdf

³ RA Ministry of Economy, Agriculture Support Programs 2022, annual report. Source: https://mineconomy.am/media/22735/2022.pdf, last accessed: 10/09/2023.

Research shows that to increase the level of food security, particularly the level of self-sufficiency in different types of food, the selected and implemented state policy has a fundamental role. In the long term, the best policy for increasing self-sufficiency in wheat and ensuring the well-being of producers and consumers is investing in experimental development and research in the agricultural sector and improving the irrigation system, while the best approach in the short and medium term is the policy of subsidizing the costs of agro-inputs¹. Studies highlight the increase in the efficiency of wheat production, which is considered from the point of view of the improvement of agricultural technology. Moreover, in this context, the subsidy of agricultural products by the state is important to reduce the costs of the producers and ensure a high level of profitability². Dramatic changes in state support mechanisms in Egypt between 2000 and 2020, showed that the reduction of various state support programs led to a sharp decline in the attractiveness of wheat production, which caused both the average yield and the economic efficiency of wheat cultivation to fall and the sown areas to decrease3. However, as Iran's experience shows, state policy should be justified and take into account not only social and economic but also political nuances of food security in order to avoid further negative developments⁴.

Methodology. In our opinion, state support programs and state policy development must be based on scientifically substantiated approaches and provisions.

For example, it is particularly important to assess the nature of the influence of various factors on the self-sufficiency of wheat and put the obtained results on the base of the policymaking process. Within the framework of the research, we assessed the impact of wheat sown areas and the average yield on wheat self-sufficiency by using an econometric regression model. The chosen approach is based on the idea that it is necessary to find out whether the self-sufficiency of wheat is mainly determined by the change of wheat sown areas or by the average yield, which will allow making more targeted state support programs. The policy implications of the assessment will be the following: if, for example, the nature of the impact of the average yield is greater, then the support programs should be aimed at obtaining the highest yield of wheat per 1 ha, which can be ensured, for example, by high-yielding seeds, fertilization by precision agricultural machinery and other means. Or vice versa, if it turns out that the impact of

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¹ Ali, A., & Ali, M. (2001). Wheat Self-sufficiency in Different Policy Scenarios and Their Likely Impacts on Producers, Consumers, and the Public Exchequer. The Pakistan Development Review, 40(3), 203–223. http://www.jstor.org/stable/41260392

Ahmadzai, Mohammad & Eliw, Moataz & Eliw, & Zhou, Deyi. (2019). Descriptive and Econometric Analysis of Wheat Production in Afghanistan (A Case Study in Paktia Province). South Asian Journal of Social Studies and Economics. 10.9734/SAJSSE/2019/v5i330146.

³ Abdalla, A.; Stellmacher, T.; Becker, M. Trends and Prospects of Change in Wheat Self-Sufficiency in Egypt. Agriculture 2023, 13, 7. https://doi.org/10.3390/agriculture13010007

⁴ Amid, J. (2007). The dilemma of cheap food and self-sufficiency: The case of wheat in Iran. Food Policy, 32(4), 537–552. doi:10.1016/j.foodpol.2006.11.001

the wheat sown areas is greater, then such programs should be implemented that will give an impetus to put more arable land under wheat.

The necessary data was obtained from the publications of the RA Statistical Committee. The time series of the data includes the years 2003-2022. The following variables were selected within the framework of the research:

- Wheat self-sufficiency level in RA as dependent variable Y,
- Wheat sown areas in RA as independent variable X_1 ,
- Wheat average yield in RA as independent variable X₂: The mathematical formula of the econometric model will be as follows:

$$Y = c + b_1X_1 + b_2X_2$$

Before constructing the econometric regression model, correlation coefficients were calculated between the variables included in the study to determine whether there is a statistically significant relationship between these indicators and what the nature of that relationship is. Then, an econometric assessment was performed using the OLS method and a linear regression model was developed. The SPSS software package was used for the calculations.

Analyses and discussion. The further development of grain production is one of the priorities of the development issues of the RA economy, both in terms of economic and food security. The main indicator defining the country's food security is the level of food self-sufficiency.

The analysis of the national food balance of the RA proves that, calculated by energy values, the self-sufficiency level of primary food products was about 52.5% (according to the data of 2019)¹.

 ${\it Table~1}$ The self-sufficiency levels, sown areas, and average yield of wheat in RA, 2003-2022 $^{\circ}$

	Self-sufficiency level,	Sown area,	Average yield,
	%	ha	centner/ha
2003	40,7	127,9	17,2
2004	41,6	128,7	23,4
2005	43,5	132,0	20,3
2006	31,4	107,7	14,6
2007	36,5	99,3	25,8
2008	39,5	93,1	24,3

¹ RA Ministry of Economy website, Food security. Source: https://www.mineconomy.am/page/1333, last accessed 25/09/2023.

² RA Statistical Committee, Food Security and Poverty, January-September 2006 (pages 65-68), January-September 2008 (pages 40, 69-72), January-September 2011 (pages 38, 67-70), January-September 2014 (pages 39, 68, 71, 74), January-June 2023 (pages 34, 63, 66, 69).

33,3	91,9	22,4
33,5	87,6	21,2
36,5	77,8	28,8
32,9	93,7	26,0
46,8	99,7	31,3
48,7	106,4	32,3
49,5	108,9	33,4
53,2	108,7	32,4
33,2	82,4	21,8
31,5	66,7	28,2
25,9	59,9	19,6
24,4	59,4	22,5
23,2	59,1	16,8
24,4	56,8	24,5
	33,5 36,5 32,9 46,8 48,7 49,5 53,2 33,2 31,5 25,9 24,4 23,2	33,5 87,6 36,5 77,8 32,9 93,7 46,8 99,7 48,7 106,4 49,5 108,9 53,2 108,7 33,2 82,4 31,5 66,7 25,9 59,9 24,4 59,4 23,2 59,1

A high level of self-sufficiency is ensured in terms of potatoes, vegetables, fruits, grapes, mutton and goat meat, eggs, and fish, an above-average level of self-sufficiency is provided for beef and pork, milk and dairy products, and for wheat and leguminous crops, vegetable oil, pork and poultry self-sufficiency level remains low¹. The analysis of the dynamics of wheat self-sufficiency is concerning as there is a serious problem in RA regarding this most important type of food. If wheat self-sufficiency reached 50% in the 2000s, last decade it has halved to 24%. Wheat sown areas have also been reduced, the trend is negative and there is no tendency for an increase in sown areas. It is noteworthy that certain positive dynamics is observed regarding the average yield of wheat (Table 1).

Now let's discuss the results of empiric assessment. The values of the correlation coefficients between the variables included in the study are presented in Table 2.

¹ Manucharyan M., Asatryan H., The assessment of the import substitution potential of food products with low self-sufficiency in RA, The Contemporary Issues of Socio-Economic Development in the Republic of Armenia, Scientific journal of articles, 2023(1), p. 142-153, DOI: 10.54503/1829-4324.2023.1-167

The results of the correlation analysis¹

ı	-	Y	X1	X2
Y	Correlation coefficients	1	,767**	,631**
	Significance		,000	,003
	N	20	20	20
X1	Correlation coefficients	,767**	1	,080
	Significance	,000		,739
	N	20	20	20
X2	Correlation coefficients	,631**	,080,	1
	Significance	,003	,739	
	N	20	20	20

^{**.} The correlation is significant at 0.01 level.

The indicators of the table prove that wheat self-sufficiency is in a statistically significant strong positive relationship with the average yield of wheat, and in the case of wheat sown areas, there is a statistically significant close positive relationship. The obtained results allow us to continue the research and carry out econometric modeling. The results of the calculations are presented in the Table 3 and Table 4. The dynamics of these three indicators from 2003 to 2022 are presented in Figure 1, and noticeably the curve characterizing the dynamics of the self-sufficiency level is more similar to the curve of sown areas.

 $^{^{\}scriptscriptstyle 1}\,$ The table was constructed by the author.

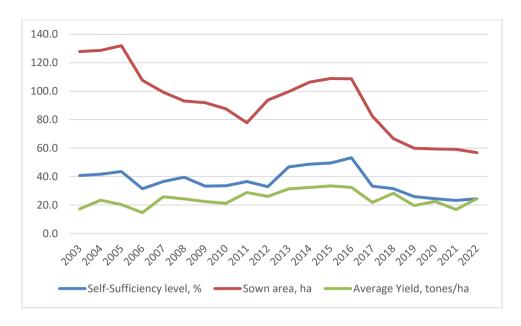


Figure 1. Dynamics of wheat self-sufficiency, sown areas, and average yield in RA, from 2003 to 2022¹.

The adjusted R² of the model has a value of 0.906, which means that the influence of the independent variables involved in the model explains the change of the dependent variable by 90.6%, which is quite a high indicator. The Durbin-Watson test was also performed, which is a test statistic used to detect **autocorrelation in the residuals from a regression analysis.** The Durbin-Watson statistic assumes a value between 0 and 4. A value of 2 indicates that there is no autocorrelation.

Model specifications²

Table 3

	R	\mathbb{R}^2	Adjusted R ²	St. dev.	Durbin-Watson
1	,957ª	,916	,906	2,706	2,364

a. Independent variable: X2, X1

b. Dependent variable: Y

RA Statistical Committee, Food Security and Poverty, January-September 2006 (pages 65-68), January-September 2008 (pages 40, 69-72), January-September 2011 (pages 38, 67-70), January-September 2014 (pages 39, 68, 71, 74), January-June 2023 (pages 34, 63, 66, 69)

² The table was constructed by the author.

It is accepted that if the value of the latter is in the range of 1.5-2.5, then the model does not have an autocorrelation problem¹. It can be assumed that there is no autocorrelation of residuals in our model because the coefficient has a value of 2.36

The results of the regression model²

Table 4

	The coeffici	ients of the model			
	В	St. dev.	t	Sig.	
C (Constant)	-10,872	3,590	-3,028	,008	
X1	,268	,026	10,225	,000	
X2	,930	,114	8,136	,000	

Dependent variable: Y

Taking into account the regression results, our econometric model will have the following functional form:

$$Y = -10,827 + 0.268*X_1+0,930*X_2,^3$$

The interpretation of the regression model is as follows: the increase of wheat sown areas in RA by one thousand hectares led to the increase of wheat self-sufficiency by 0.268%. In other words, if we put the assumption that the target level of wheat self-sufficiency needs an increase from the current level by 10 percentage points, then the wheat sown areas should be expanded by 37,313 hectares.

In the case of the average yield of wheat, the following result was obtained: an increase in the average yield by 0,1 centner/ha leads to an increase in the level of self-sufficiency by 0.93%, that is, to increase the degree of self-sufficiency by 10 percentage points, the average yield should be increased by 10.75 centner/ha.

Scientific Novelty. The scientific novelty of the article lies in the fact that it was proposed to base the development of the state policies aimed at increasing food security in the RA on the results of the econometric assessment of food self-sufficiency. In particular, the impact of the sown area and average yield on wheat self-sufficiency was assessed, and as a result, the priorities of state support for increasing wheat self-sufficiency were presented.

Source: https://help.sap.com/saphelp_SCM700_ehp02/helpdata/en/e8/3cc95360267614e10000000a174cb4/c ontent.htm?no_cache=true#:~:text=The%20Durbin%2DWatson%20statisticlies%20in,the%20presence%2 0of%20positive%20autocorrelation, last accessed: 10/10/2023.

² The table was constructed by the author.

³ The formula was constructed by the author.

Conclusions. Thus, summarizing the obtained results, it can be concluded that the negative changes in wheat self-sufficiency in the RA during the past 20 years are mostly a consequence of the reduction of wheat sown areas. Unfortunately, in the case of our country, it was not possible to cover the gap caused by the reduction of sown areas at the expense of increasing the average yield. Despite the accepted approach that it is necessary to increase soil fertility and use high-yielding wheat varieties, the increase of wheat sown areas remains the priority. Wheat itself is a low-value crop, and the farmer receives less income per hectare than in the case of other crops. Therefore, the increase of the wheat sown areas should be based on increasing the profitability of wheat production, which will directly increase the attractiveness of wheat production among farmers. Moreover, the increase of wheat sown areas should be combined with the solution of the problem of uncultivated and inefficiently used arable lands. Thus, in terms of wheat self-sufficiency, the priorities of state policy in RA are:

- to develop and implement state support programs specifically for wheat cultivation,
- in order to expand wheat sown areas, apply zero land tax rates for wheat cultivation, especially in the Shirak, Gegharkunik, and Syunk regions,
- to implement public procurement measures with the option of purchasing wheat from local producers at guaranteed prices.

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ՀՀ-ՈՒՄ ՑՈՐԵՆԻ ԻՆՔՆԱԲԱՎՈՒԹՅԱՆ ՄԱԿԱՐԴԱԿԻ ԷԿՈՆՈՄԵՏՐԻԿ ԳՆԱՀԱՏՈՒՄԸ ՈՐՊԵՍ ՊԵՏԱԿԱՆ ՔԱՂԱՔԱԿԱՆՈՒԹՅԱՆ ԱՌԱՋՆԱՀԵՐԹՈՒԹՅՈՒՆՆԵՐԻ ՆԱԽԱՆՇՄԱՆ ՈՒՂԵՆԻՇ

Մերի Գագիկի Մանուչարյան

Համառոտագիր։ Պարենային անվտանգությունը ժամանակակից պետությունների համար ունի առաջնային նշանակություն, կազմելով ռազմական անվտանգության անբաժանելի մաս։ Պարենային անվտանգության հետ կապված հարցերը առավել սրությամբ դրված են անբարենպաստ կլիմայական պայմաններ ունեցող կամ սակավահող այնպիսի երկրների առջև ինչպիսին ՀՀ-ն է։ Հոդվածի հիմնական նպատակն է իրականացնել ցորենի ինքնաբավության մակարդակի էկոնոմետրիկ գնահատում և ստացված արդյունքների հիման վրա տալ պետական քաղաքականության առաջնահերթությունները՝ ցորենի ինքնաբավության բարձրացման հարցում։ Հետազոտական նպատակի իրականացման ձանապարհին դրվել են հետևյալ հիմնական խնդիրները.

- Վերլուծել ցորենի ինքնաբավության մակարդակի և ցորենի արտադրության արդյունքային ցուցանիշների դինամիկան ՀՀ-ում,
- Գնահատել ցորենի ինքնաբավության մակարդակի վրա ցորենի արտադրության արդյունքային ցուցանիշների ազդեցության բնույթը՝ էկոնոմետրիկ ռեգրեսիոն մոդելավորման կիրառմամբ,
- Կատարված քանակական գնահատման արդյունքների հիման վրա ներկալացնել պետական քաղաքականության առաջնահերթությունները։

Գիտական նորույթ։ Ներկայացվել են ցորենի ինքնաբավության բարձրացման պետական աջակցության մասով առկա առաջնահերթությունները՝ հիմնված ցո-

րենի ինքնաբավության վրա վերջինիս ցանքատարածությունների ու միջին բերքատվության ազդեցության էկոնոմետրիկ գնահատման վրա։ Կատարված հետազոտությունների արդյունքում եկել ենք այն եզրահանգման, որ ՀՀ-ում նախորդ 20 տարիներին ցորենի ինքնաբավության փոփոխությունների վրա ցորենի ցանքատարածությունների փոփոխությունները ավելի մեծ ազդեցություն են ունեցել, քան միջին բերքատվությունը։ Հետևաբար ՀՀ-ում պետական քաղաքականության առաջնահերթությունը ցորենի ինքնաբավության մասով՝ վերջինիս ցանքատարածությունների ավելացումն է՝ վերջինիս հիմքում դնելով ցորենի արտադրության եկամտաբերության բարձրացումը։

Բանալի բառեր. պարենային անվտանգություն, ցորեն, ինքնաբավության մակարդակ, էկոնոմետրիկ վերլուծություն, գնահատում, ցանքատարածություներ, միջին բերքատվություն։

ЭКОНОМЕТРИЧЕСКАЯ ОЦЕНКА УРОВНЯ САМООБЕСПЕЧЕННОСТИ ПШЕНИЦЫ В РА КАК ОРИЕНТИР ДЛЯ ОПРЕДЕЛЕНИЯ ПРИОРИТЕТОВ ГОСУДАРСТВЕННОЙ ПОЛИТИКИ

Мери Гагиковна Манучарян

Аннотация. Продовольственная безопасность имеет первостепенное значение для современных государств, являясь неотъемлемой частью военной безопасности. Проблемы, связанные с продовольственной безопасностью, более остро стоят у стран с неблагоприятными климатическими условиями или скудной почвой, такими как РА. Основная цель статьи — провести эконометрическую оценку уровня самообеспеченности пшеницы и на основе полученных результатов обозначить приоритеты государственной политики в вопросе повышения самообеспеченности пшеницей. На пути к реализации цели исследования были поставлены следующие основные задачи:

- Проанализировать динамику уровня самообеспеченности пшеницей и результаты производства пшеницы в РА,
- Оценить характер влияния результатов производства пшеницы на уровень самообеспеченности пшеницы, используя эконометрическое регрессионное моделирование,
- Представление приоритетов государственной политики на основе результатов количественной оценки.

Научная новизна. Представлены существующие приоритеты государственной поддержки повышения самообеспеченности пшеницей на основе эконометрической оценки влияния самообеспеченности пшеницы на посевные площади и ее среднюю урожайность.

В результате проведенных исследований мы пришли к выводу, что в предыдущие 20 лет в Республике Армения изменения посевных площадей пшеницы оказали большее влияние на изменение самообеспеченности пшеницы, чем средняя урожайность. Поэтому приоритетом государственной политики РА по самообеспечению пшеницы является увеличение посевных площадей последней, беря в основу повышения рентабельности производства пшеницы.

Ключевые слова: продовольственная безопасность, пшеница, уровень самообеспеченности, эконометрический анализ, оценка, посевные площади, средняя урожайность.

ECONOMETRIC ASSESSMENT OF THE LEVEL OF WHEAT SELF-SUFFICIENCY IN RA AS A GUIDELINE FOR DETERMINING THE PRIORITIES OF STATE POLICY

Meri Gagik Manucharyan

Abstract. Food security is of primary importance for modern states, forming an integral part of military security. Food security issues are more acute in countries with adverse climatic conditions or with scarce arable lands such as the Republic of Armenia. **The main goal** of the article is to carry out an econometric assessment of the wheat self-sufficiency level and, based on the obtained results, give the priorities of the state policy in regards to increasing wheat self-sufficiency. The following **main problems** were addressed on the way to achieving the goal of the research:

- to analyze the dynamics of wheat self-sufficiency level and wheat production in RA.
- to assess the nature of the impact of the main indicators of wheat production on the level of wheat self-sufficiency, using econometric regression modeling,
- to present the state policy priorities based on the results of the econometric assessment.

The scientific novelty of the article lies in the fact that the priorities of state support for increasing wheat self-sufficiency were presented, based on the econometric assessment of the impact of the sown areas and average yield of wheat on its self-sufficiency. It was concluded that in the past 20 years in the RA, the changes in wheat sown areas had a greater impact on the changes in wheat self-sufficiency than the average yield. Therefore, the priority of the state policy regarding wheat self-sufficiency must be the increase of wheat's sown areas, by putting the increase of profitability of wheat production as the driving force behind the increase of sown areas.

Keywords: food security, wheat, self-sufficiency level, econometric analysis, assessment, sown areas, average yield.