Journal of Economic Integration | Vol: 11 - N°: 06 / (January 2024) | pp: 455 - 470

The impact of agricultural public spending on food security in Algeria An econometric study for the period 2001-2021

تحليل أثر الإنفاق الحكومي الزراعي على الأمن الغذائي في الجزائر

دراسة قياسية خلال الفترة 2001–2021

Mazouzi Driss[1], Benkheznadji Amina[2]

[1] University Mohamed El Bachir El Ibrahimi of Bordj Bou Arreridj, Faculty of Economics, Business, and Management Sciences, Studies and Research Laboratory in Rural Development (LERDR)- Bordj Bou Arreridj (Algeria), driss.mazouzi@univ-bba.dz

[2] University Mohamed El Bachir El Ibrahimi of Bordj Bou Arreridj, Faculty of Economics, Business, and Management Sciences Economic Studies Laboratory on Industrial Zones in Light of the New Role of the University (LEZINRU)- Bordj Bou Arreridj (Algeria) , amina.benkheznadji@univ-bba.dz

Received: 25/10/2023 **Accepted:** 05/01/2024 **Published:** 06/01/2024

Abstract:

Based on the assumption that government agricultural spending contributes significantly to agricultural products and enhancing food security. This paper analyses the linkages between government agricultural expenditure and per capita food supply as an indicator of food security in Algeria. The methodology is based on a multiple regression model. The results show that all variables, except for the consumer price, have a positive effect on the rate of food energy supply, and their increase, reduces food insecurity. The elasticity of the index of public spending on agriculture is the most important (0.06), followed by the gross national income GNI (0.04). However, despite the positive relationship, its effect remains weak, and there is a need to redirect agricultural support policies.

Keywords: Agriculture; Public spending; Food security; Food supply per capita; Consumption prices.
JEL Classification Codes: Q14; G28.

ملخص:

انطلاقاً من فرضية أن الإنفاق الحكومي الزراعي يساهم بشكل كبير في الإنتاج الزراعي وتعزيز الأمن الغذائي. تحلل هذه الورقة العلاقة بين الإنفاق الحكومي الزراعي ومعدل نصيب الفرد من الإمدادات الغذائية كمؤشر للأمن الغذائي في الجزائر. تعتمد المنهجية المتبعة على نموذج الانحدار الخطي المتعدد. خلصت الدراسة إلى أن كل المتغيرات، باستثناء مؤشر أسعار الاستهلاك، لها تأثير إيجابي على معدل إمدادات الطاقة الغذائية، وزيادتها تقلل من انعدام الأمن الغذائي. حيث تعتبر مرونة الانفاق العام على الزراعة الأكثر أهمية (0.06)، متبوعا بنصيب الفرد من الناتج القومي (0.04). لكن رغم ايجابية العلاقة إلا أنها تبقى ضعيفة الأثر، وتستدعي هذا ضرورة إعادة النظر في توجيه سياسات الدعم الزراعي.

كلمات مفتاحية: الفلاحة، الإنفاق الحكومي العام، الأمن الغذائي، نصيب الفرد من الإمدادات الغذائية، أسعار الاستهلاك.

تصنيفات JEL : Q14، G28.

Corresponding author: Mazouzi Driss, **e-mail:** driss.mazouzi@univ-bba.dz

1. Introduction:

Government support is any measure that keeps prices below the market level, keeps prices for producers above the market level, or reduces costs for consumers or producers by granting direct or indirect subsidies (Mehdaoui & Moussaoui, 2023), Government support on its various types is one of the most effective policies for governments around the world to achieve agricultural growth and development. Algeria has established a set of agricultural support and financing programs through which it seeks to revive the economy and achieve food security. Where was the beginning of agricultural support programs in Algeria in 1989 (Ferroukhi, Boumghar, & Chehat, 2021). However, the real breakthrough was through the National Program for Agricultural Development (PNDA) 2000-2009, followed by the implementation of the Rural Renewal Policy in 2010-2014. Then the 2015-2019 Agriculture Plan (BESSAOUD, 2019).

Finally, the agricultural sector roadmap (2020-2024), which aims to stimulate the increase in added value and agricultural growth, achieve food security, upgrade farms and support their productive activity, and create favorable conditions for the return of the population to their areas of origin and significant financial envelopes have been allocated in order to devote these plans.

1.1. Research Issue: based on the foregoing and given the controversy over the role of agricultural support in increasing agricultural growth and achieving food security, we can formulate the following issue:

What is the impact of agricultural government spending on the per capita rate of food energy supply and food security in Algeria?

Study Hypotheses: To answer the posed issue, we adopt the following hypotheses:

-Increasing government agricultural spending increases the per capita rate of food supply and enhances food security.

-Increasing the gross national income per capita leads to an increase in the per capita rate of food energy supply.

-Reducing the level of consumer prices leads to increase the per capita rate of food energy supply.

1.2. Research aims: through this research paper, we seek to achieve a set of objectives, which we summarize as follows:

- Defining food security, its dimensions, and indicators, and analyzing the reality of food security in Algeria through a presentation of its various indicators.
- Introducing the various agricultural support programs and policies in Algeria, and analyzing the development of government support directed at production and consumers.
- Highlighting the impact of government agricultural spending on the per capita rate of food supply.

1.3. Research Importance: The importance of the study lies in clarifying the effectiveness of government support programs in advancing agricultural growth and achieving food security.

1.4. Study methodology: In our study, we relied on both the descriptive approach and the analytical approach through a description of the various variables of the study, and analysis of the impact of government spending on the per capita rate of food energy supply. We also used the statistical approach to study the relationship between the dependent variable and the independent variables, relying on the multiple linear regression model, using the statistical software (Eviews, release 11).

1.5. Previous studies: During our study, we found numerous related studies:

- (Ferroukhi, Boumghar, & Chehat, 2021) "analysis of the effects of subsidies on agricultural growth: a test of measurement for the period(200-2018)" :

Through their study, the researchers analyzed the impact of subsidies on agricultural growth during the period (2000-2018), they used the multiple linear regression model to measure and analyze the impact of production and consumer subsidies on agricultural added value and growth. The study concluded that there is a positive effect of subsidizing production on agricultural added value, estimated at 1.3.

- (Ngobeni & Muchopa, 2022), examined the effect of government expenditure and other selected variables(average rainfall, consumer price index, food import value, and population) on the value of agriculture in South Africa, for the period 1983 to 2019. Using the Johansen cointegration test, the result suggests that government expenditure in agriculture does not Granger cause the value of agricultural production.

- (Thiam & Malik, 2020), analyzed the links between resources mobilized for the agriculture sector and food security in Senegal, where the adopted methodology is based on a multiple regression model. The results show that all the variables, with the exception of the credit of MFIs (Micro Finance Institutions), significantly affect the prevalence of undernourishment.

- (Rima, 2014)"agricultural credit flow of commercial banks and impact on agricultural production in Nepal":

Through the study, the researcher dealt with determining the effect of agricultural credit to commercial banks on agricultural production in Nepal using the multiple linear regression method, by estimating the Cobb-Douglas production function using time series data for the period (2002-2012).

The study concluded that there is a positive effect of the flow of agricultural credit as an independent variable on the gross domestic product, as an increase of 1% in agricultural credit leads to an increase in domestic production by 0.183%.

- (BESSAOUD, 2019) addressed many axes related to the agricultural sector in Algeria, focusing on the axis of agricultural support, through a descriptive and analytical study of the share of agriculture in the state budget and its development. They cited also privileges for investors in the private sector (subsidized loans, tax cuts, and exemptions, input subsidies, etc.). The report concluded that, due to the government's interventions in the sector, a good performance was recorded, whether in terms of productivity or improving the resources of the rural family.

- (Mestoui, 2020)"Modeling the relationship between agricultural output and economic growth outside the hydrocarbons sector using the VAR autoregressive ray model during the period (2000-2018)":

Through the study, the researcher analyzed the reality of the development of agricultural activity, and studied the impact of the development of agricultural output on economic growth outside the hydrocarbon sector, using the ray autoregressive model.

Based on the results of estimating the autoregressive beam model, the researcher concluded that there is no effect relationship between the two variables in the long term and in the short term.

The study also showed the weakness of the interpretation of the variable of the agricultural sector for the variable of economic growth outside the fuel sector during the study period.

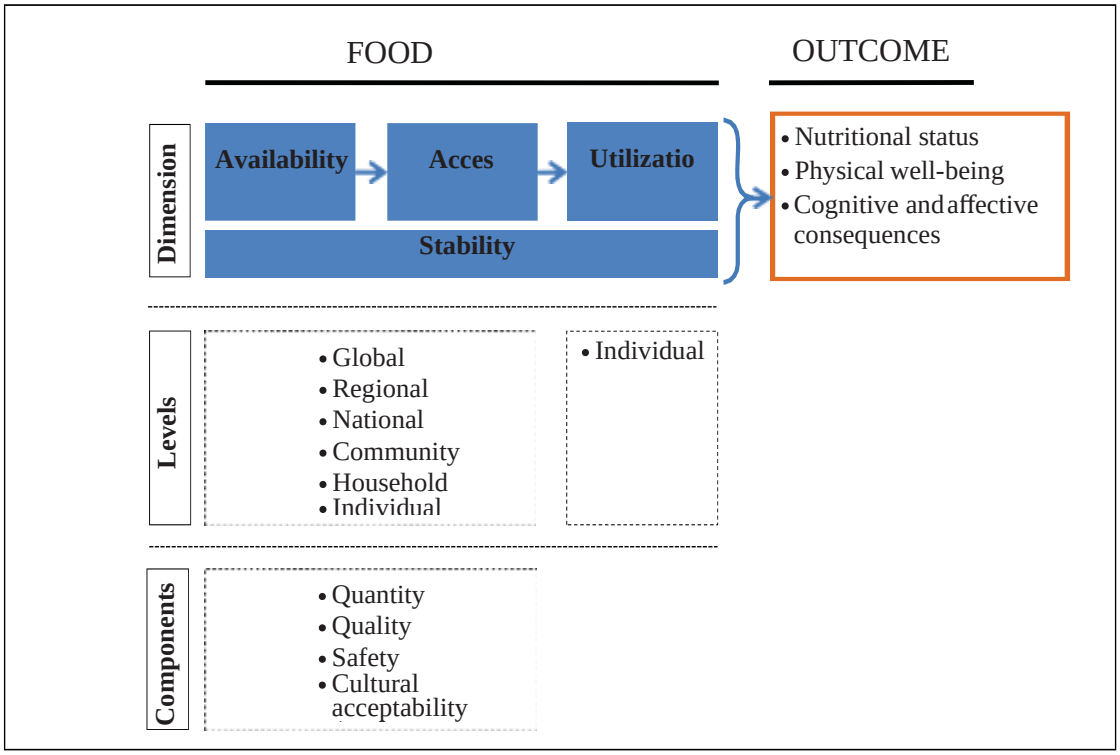
2- Literature review and theoretical framework:

In this section, we present the theoretical framework for the food security relationship with agricultural government spending.

2.1.Food Security definitions and Conceptual Framework: The agreed and most common definition of food security is that issued by the World Food Summit in 1996, in which it states "when all people, at all times, have physical, and economic access to sufficient safe and nutritious food to meets their dietary needs and food preferences for an active and health life" (Organization F. a., 1996).

This definition covers many dimensions and components of food security, including physical access (abundance), economic and social access to food (access), quantity and quality of food sufficient to meet dietary requirements, and food safety (use), with the need for food to be available at all times, including in crises and shocks (stability). Figure No. (01) shows the main dimensions of food security (abundance, access, use, and stability), and its various levels (from international to individual).

Fig.(01): Food security dimensions, levels, and components



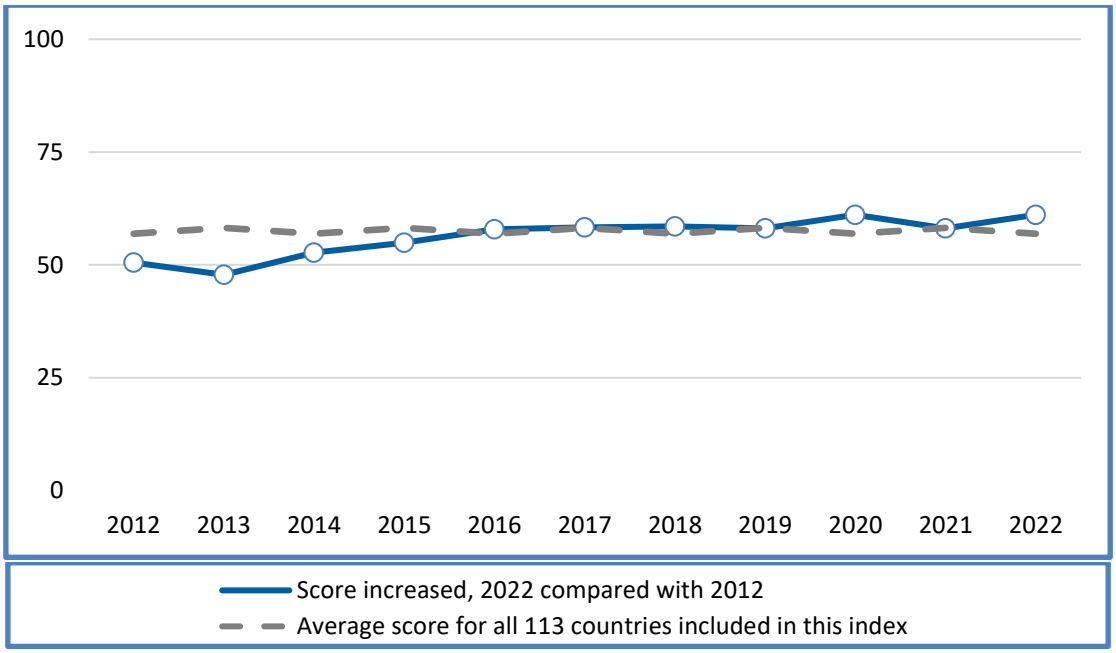
Source: Jef L. and All, Measuring the food access dimension of food security: A critical review and mapping of indicators, Food and nutrition bulletin, Vol. 36(2), 2015, p170.

2.1.1. Food Security Indicators: An indicator is used to reflect an aspect of a given characteristic (in this case some dimension or component of food security). Indicators are typically constructed by classifying values of a single measure, or an index or scale calculated from multiple measures, based on degree or specific meaning (Jef, 2015).

Food security is measured at various levels through many indicators that reflect the different dimensions of the problem. Some of the different types of indicators most used in assessing

food security conditions include those related to food production, total expenditure on food, expenditure share of food calorie consumption, and nutritional status (Frank & al, 1999).

Fig.(02): The development of the food security environment in Algeria during the period (2012-2022).

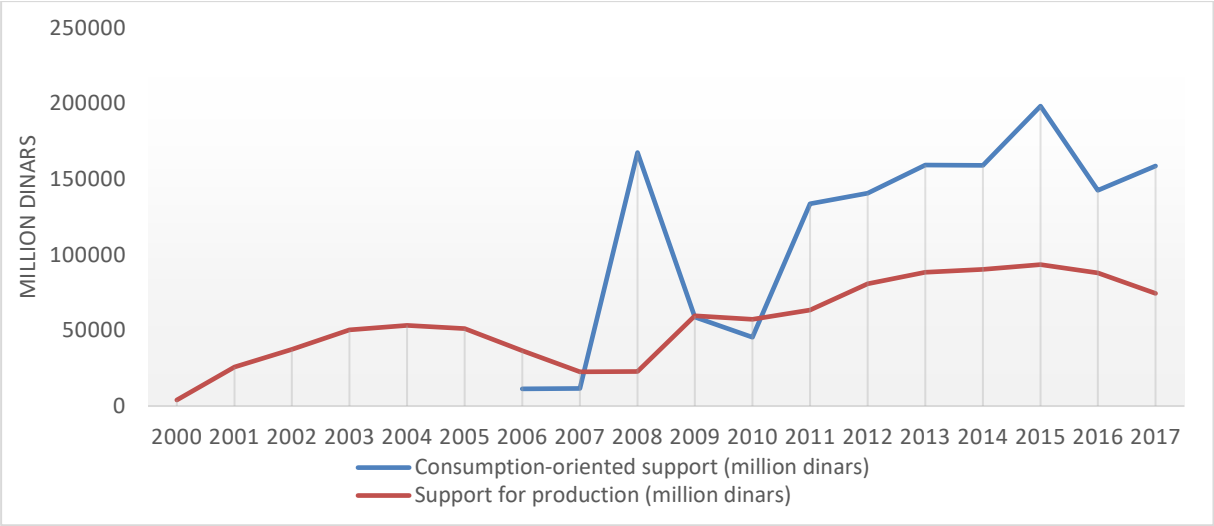


Source: Impact economist on web site :
https://www.impact.economist.com/sustainability/project/food-security-index

According to the Global Food Security Index (GFSI), Algeria ranked first at the continental level in the food security index, due to the positive development in indicators of availability, sustainability, and access to food, achieving respectively 57 degrees, 54.2 degrees, and 66.8 degrees during the year 2022. The safety and quality index witnessed a decrease in its value during the period (2018-2022), as it achieved during the year 2022 a value of 54.7 out of 100 (economist, 2022).

2.2. Support directed at consumers and agricultural producers: agricultural support takes various forms, and the most widely used are, price incentives and financial subsidies, whether based on production or on inputs (FAO U. U., 2021), in addition to supporting public services. Algeria, in its support of the agricultural sector, follows a policy of price incentives through border measures such as imposing tariffs and import quotas and fixing prices, especially subsidized ones. It also provides financial subsidies targeting agricultural producers, for the acquisition of inputs or for the purchase of equipment and machinery and for the development of infrastructure. The following figure (No 03) shows the evolution of government financial subsidies directed to agricultural producers and consumers during the period (2018-200).

Fig.(03): The evolution of government support in Algeria directed at agricultural producers and consumers during the period (2000-2018)



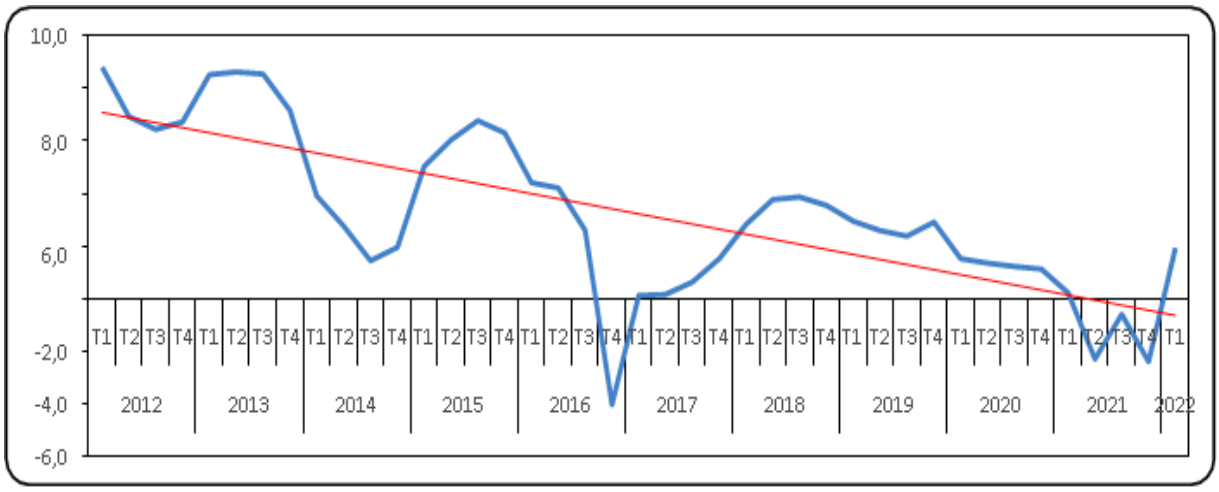
Source : Sid Ahmed FERROUKHI, Mohamed Yazid BOUMEGHAR, Foued CHEHIT, Analyse des effets des subventions sur la croissance agricole : Un essai de mesure pour la période (2000-2018), Les cahiers du CREAD, Vol.37, n°02, CREAD, 2021, p51.

During the period (2000-2018), the subsidy allocated to consumers was estimated at about 15,609 million dinars, constituting 60% of the total subsidy during the same period, and the subsidy recorded its highest levels during the year 2015, at about 198,355 million dinars. As for the support directed to agricultural producers, it was estimated at about 55,565 million dinars during the same period, constituting 40% of the total support, achieving its highest rate during the year 2015 by about 93,521 million, However, it did not maintain this level, as it then decreased to reach 74,512 million dinars in 2017, a decrease of about 20% compared to 2015.

2.2.1. Contribution of the agricultural sector to the gross domestic product:

The agricultural sector in Algeria contributes positively to the gross product, achieving in the first quarter of the year 2022 a growth rate of 1.9%, compared to a growth rate of 0.2% in the year 2021. Other sectors (including the oil sector) also achieved a growth in production estimated at 1.5% in 2022, compared to 2.3% in 2021 (ONS, 2022).

Fig.(04): The evolution of the agricultural added value growth rate (%) of GDP in Algeria during the period (2012-2022)



Source: National Statistics Office, Quarterly national accounts - 1st quarter 2022, No. 962, ONS, Algeria, 2022, p2.

Through Figure No (04), we note that the agricultural added value growth rate witnessed a continuous decrease during the period (2012-2021), to improve during the first quarter of the year 2022, achieving a growth rate of 1.9 compared to 0.2% during the same period of the year 2021.

3. Materials and methods:

3.1. Introducing the study model: In our study, we rely on the Multiple Linear Regression Model to measure the relationship between agricultural orientation of public expending and food security, with the help of (Eviews11) software in presenting and analyzing the results of the study.

Multiple linear regression is an advanced statistical method used to describe the relationship between the dependent variable (Y) and the independent variables (X_1, X_2, X_3, …, X_k), and is used to predict changes in the dependent variable that affect several independent variables.

The multiple linear regression equation is as follows (Mark Tranmer, 2020):

$Y = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots\ldots + \beta_p X_{pi} + \varepsilon_i$

Where: Y = the dependent variable

p =1, 2, 3,….., n

X_1, X_2, ….X_k = independent variables

β_0, β_1, β_2,…, β_k = regression coefficients

ε_i = random error

3.1.1. Model specifications:

This study aims to determine the linear relationship between the agricultural orientation of public spending and food security. Based on the previous studies, we determined the theoretical model, taking into account the test of the dependent variable and some control variables.

The theoretical model can be formulated as follows:

$\ln(FAK) = a_0 + a_1 \ln(IOA_t) + a_2 \ln(GNI\_H_t) + a_3 \ln(CPI_t) + C + \varepsilon_t$

where:
FAK: Per capita dietary energy supply (kilocalories/capita/day).
IOA: Agricultural Orientation Index of Public Expenditure.
GNI_H: Gross National Income per capita.
CPI: Standard Price Index for Consumer Goods.
Data were collected from FAO, the World Bank, the Ministry of Agriculture and Rural Development, and the National Bureau of Statistics, during the period 2001-2021.

3.1.2. Description of model variables:

A. Per capita dietary energy supply in kilocalories (FAK):

The per capita rate of dietary energy supply is one of the main indicators of food security, and it expresses the amount of food available for human consumption, expressed in calories per person per day (kcal/person/day). At the national level, the rate indicates the amount of food remaining for human consumption after deducting all non-food quantities consumed (exports, animal feed, industrial use, seeds, and waste) (FAO F. A., 2004). The Food and Agriculture Organization of the United Nations estimated the average food energy supply in Algeria in 2021 at 3451 (kilocalories/person/day), and it was 2938 (kilocalories/person/day) in 2000 ((FAO), 2022).

The overall minimum per capita energy requirement(R_L), which is used as a threshold for estimating the prevalence of undernourishment, is calculated as follows (Organization(FAO), 2002).

$r_L = \Sigma_{ij}(MER_{ij} \times P_{ij}) + PA$

MER: Minimum energy requirement per person.
i: Age group.
j: gender.
P_{ij}: The proportion of each age group and **gender** in the total population.
PA: Pregnancy allowance.

B. Agricultural Orientation Index for Public Expenditure: The agricultural orientation index for public expenditure is defined as the share of agriculture in public spending divided by the agricultural added value share of GDP. The agricultural sector includes agriculture, forestry, and fishing resources (World Bank, 2022).

Our hypothesis is that Agriculture government expenditure is positively correlated with the per capita rate of dietary energy supply.

C. Per Capita Gross National Income, according to purchasing power parity (at current US dollar prices): It is the total amount of money earned by individuals and businesses in the country. It is used to measure and track a nation's wealth from year to year. Gross national income (GNI) includes gross domestic product (GDP) plus the income from external sources.

The per capita gross national income index is available in several scales: at constant prices of the local currency, at current prices of the US dollar, (%) annually, at constant prices of the US dollar in 2010 US dollars, and at US dollars per capita...etc.) (Bank, 2023).

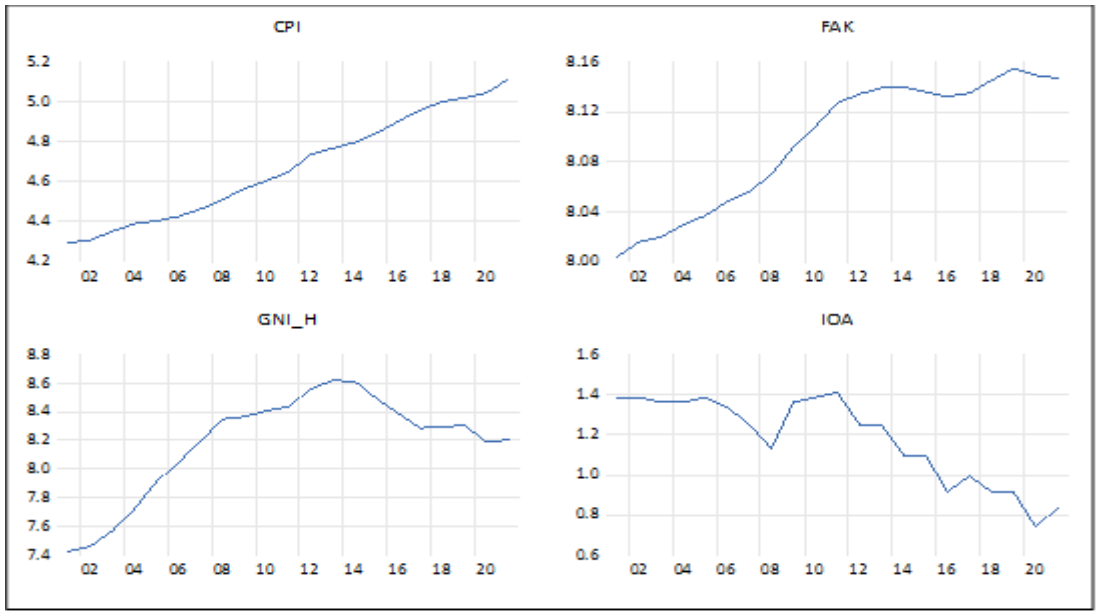
We formulate the following hypothesis: an increase in GNI_H makes it possible to increase the per capita rate of dietary energy supply.

D. Standard Price Index for Consumer Goods(2010=100%): It is an economic and social indicator designed to measure changes over time in the general level of consumer prices and services that households obtain, use, or pay for their consumption (Organization W. L., 2003). This indicator is tracked by the National Statistics Office, by monitoring the evolution of prices in the city of Algiers, the capital, as it is the largest urban center in Algeria.

We assume that a rise in food prices translates into a drop in the per capita rate of dietary energy supply).

3.1.3. Presentation of the model variables: The following figure shows a presentation of the study variables:

Fig.(05): The development of study variables in Algeria during the period(2001-2021)



Source: National Office of Statistics, World Bank, Food and Agriculture Organization, Ministry of Agriculture and Rural Development.

The agricultural government spending index during the period (2001-2012) witnessed a fluctuation, and there was a stage of decline, which reflects the weakness of agricultural government spending compared to the total public expenditures during that period. The per capita calorie intake also witnessed a remarkable increase, which confirms the state's endeavor to achieve food security by providing food, whether from the national product or by supplementing it with imports.

The per capita income of the national income witnessed a stage of development until the year 2014, recording its highest value, after which a stage of continuous decline was known, and the reason for this decline is due to the global crisis and the accompanying significant collapse in the value of the national currency.

4. Results and discussion

4.1. Results: Based on the different estimates of the impact of government agricultural spending on food security (see Appendix No. (01)), we obtained the main results shown in Table No. (01).

Table.(01): Regression Results: Average Per Capita Food Supply in Kilocalories (lnFAK)

Dependent Variable: lnFAK
Method: Least Squares
Date: 05/11/23 Time: 21:48
Sample: 2001 2021
Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.
lnIOA	0.065718	0.016913	3.885759	0.0012
lnGNI_H	0.046622	0.006097	7.646828	0.0000
lnCPI	0.190152	0.016544	11.49347	0.0000
C	6.748275	0.071154	94.84083	0.0000

R-squared = 98.73%, Adjusted R-squared = 98.50%, Prob(F-statistic) =0.0000

Source: Eviews11

From Table No. (01), we can notice that:

- All variables are significant (P<0.005), where the P-Value is respectively (0.0002), (0.0000), (0.0000), (0.0000), which are values less than 0.005.

-The value of the R-squared coefficient (R^2) = 98.73% and the corrected coefficient of determination (R-squared) = 98.50%, which explains the high explanatory power of the model. That is, 98.50% of the changes that occur in the per capita rate of food supply were challenged by the change in government spending, per capita GDP, and consumption prices.

4.1. Estimating the study model: Depending on the data of the study variables during the period (2001-2021), with the help of the Eviews11 statistical program, the model was estimated as follows:

Ln(FAK) = 6.74 + 0.06*Ln(IOA) + 0.04* Ln(GNI_H) + 0.19* Ln(CPI)

The linear regression model is based on several hypotheses, and the model is not valid unless it is verified. To prove this, we carried out the following tests:

4.1.1. Regression equation specification error test: We test the regression equation specification error based on the (Ramsey test), as the test was developed by James B. Ramsey through his doctoral dissertation at the University of Wisconsin Madison for Medicine in 1968, and it was published in the Journal of the Royal Statistical Society in 1969. The (RESET) is a general test for the specification of the linear regression model, and more specifically it tests whether the non-linear set of compatible values helps explain the study variable, and also helps to determine whether the model is specified correctly. Ramsey Test is the most common and easy to use in detecting nonlinearity (Hendri Prabowo, 2020).

Table (02): Regression equation specification error test" Ramsey Test"

Ramsey RESET Test
Equation: EQ01
Omitted Variables: Squares of fitted values
Specification: lnFAK lnIOA lnGNI_H lnCPI C

	Value	df	Probability
t-statistic	1.130819	16	0.2748
F-statistic	1.278751	(1, 16)	0.2748
Likelihood ratio	1.614664	1	0.2038

Source: Eviews11

We note that the probability value is greater than 5% (see Appendix No. (02)), so we accept the null hypothesis, which states that the model is determined correctly.

4.1.2. Heteroscedasticity test: Among the hypotheses of linear regression models is the heteroskedasticity of the random error variance of the residuals.

When the residual variances are not constant in relation to the value of the covariates, it is said that heteroskedasticity appears.

To verify the hypothesis, we test the homogeneity of the random error variance of the residuals using the Breusch-Pagan-Godfrey TEST. Which allows an autocorrelation test for errors that are ordered by the superiority of one (>1), as this test searches for a significant relationship between the remainder (e_i) and its lagging remainder (Mokhaledi & Elis Shawish, 2019).

Table (03): Breusch-Pagan-Godfrey TEST results

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.700953	Prob. F(3,17)	0.2046
Obs*R-squared	4.848244	Prob. Chi-Square(3)	0.1833
Scaled explained SS	2.206250	Prob. Chi-Square(3)	0.5307

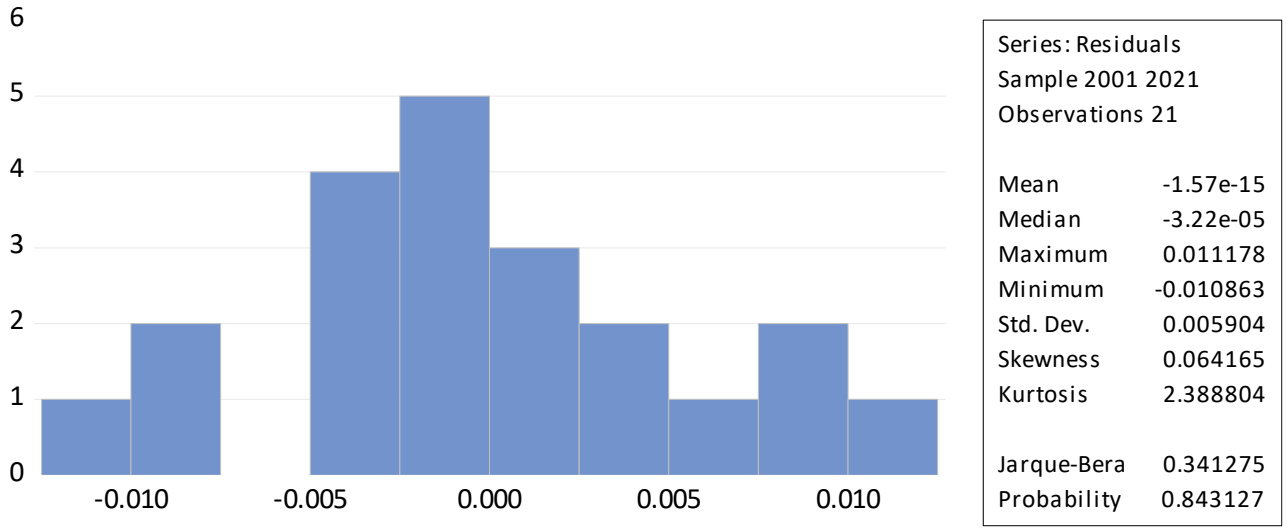
Source: Eviews11

Through the results of the Breusch-Pagan-Godfrey test shown in Table No. (03), we note that the probability associated with the Fisher test was estimated at 0.18 Prob. Chi-Square(3)=0.18, which is greater than 5% (Appendix No. (03)), and thus we accept the null hypothesis which states that the remainder of the model is homogeneous.

4.1.3. Residue distribution test: The regression analysis is based on several hypotheses, including that the residuals are normally distributed at all points of the independent variable. For testing the normality we investigate the power of several tests, first of all, the well-known test of Jaque and Berra (Thorsten Thadewald, 2004).

Figure No. (06) shows the Jarque-Berra test for the distribution of the residuals.

Fig.(06): Test results (Test de Jarque-Berra)

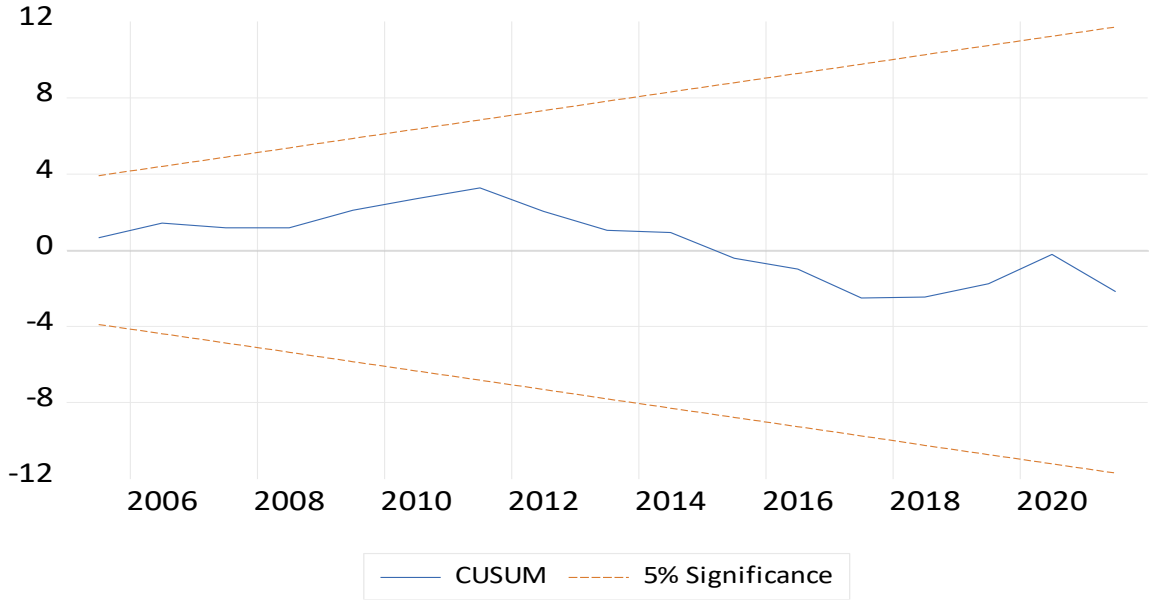


Source: Eviews11

Based on the data introduced in Figure No. (06), it turns out that the statistical probability value P-Value was estimated at 0.84, which is greater than 0.05, so we accept the null hypothesis, which states that the residuals are distributed normally.

4.1.4. Testing the structural stability of the model: The Cusum test, was introduced by Browen et all in 1975 as a test for structural breaks in the coefficients of a linear regression model (Brown, 1975). Which is based on expected error dynamics, and allows the detection of structural instability of the regression equations over time.

Fig.(07): CusumQ structural stability test results



Source: Eviews11

It is clear from Figure (07) that the estimated coefficients of the model are stable, as we note that the cumulative sum of the residuals is located within the borders of the critical region, which indicates that there is structural stability in the study model at a significant level of 5%.

4.2. Discussion: Based on the results of estimating the multiple linear regression model, it is clear that the three independent variables (agricultural orientation of public expenditure, gross national income per capita, standard prices of consumer goods) have weak rates of influence on the per capita dietary energy supply (in kilocalories/person/day).

1. Discussion

Numerous researchers have jointly examined the relationship between agricultural government spending and various variables, such as agricultural productivity, gross domestic product (GDP), agricultural growth and agriculture value add,…etc.

Through this study, we compare the results reached with those of previous studies, assuming that an increase in agricultural productivity, or in agricultural add value, leads to an increase in per capita dietary energy supply.

Based on the results of estimating the multiple linear regression model, it is clear that all variables, except for the consumer price index, have a weak positive rate of influence on the per capita dietary energy supply.

The agricultural orientation of public spending is significant at the 5% level of significance. Where the elasticity coefficient is estimated at (0.06), which means that, with all other factors being equal, an increase in government spending on agriculture by 10% leads to an increase in the per capita rate of food supply by 0.6%. There are very weak percentages, and this is due to the weakness of government support provided to the agricultural sector compared to other sectors, and the way in which this support is directed to the various agricultural divisions. These results agree with the findings of (Ferroukhi, Boumghar, & Chehat, 2021). Which confirms the relevance of government expenditure in ensuring agriculture growth.

For the per capita national income, its probability was (Prob = 0.0000), with an estimated elasticity of (0.04). Thus, an increase in per capita national income by 10% leads to an increase in the per capita rate of food supply by 0.4%, this result can be explained by inequalities in the distribution of income in the country. These findings contradict with the results obtained by (Mark Tranmer, 2020).

As for the consumer price index, it had a positive impact on the per capita rate of food supplies, with an elasticity estimated at (0.19), therefore, an increase in the consumer price index by 10% leads to an increase in the per capita rate of food supply by 1.19%. This is explained by the Algerian government's policy of subsidizing consumer prices, especially widely consumed foodstuffs such as milk, flour, oil, sugar...etc. This limits the impact of the increase in consumption prices on the purchasing power and, consequently, on the per capita rate of food supply. These results contradict with the results obtained by (Ngobeni & Muchopa, 2022), that the consumer price index has a negative effect on the value of agricultural production.

5. Conclusion:

The agricultural sector is one of the most important sectors for providing employment, and an effective means of reducing poverty and food insecurity. One of the main pillars for the development of any sector is the provision of financing support and accompaniment.

This paper aimed to analyze the empirical relationship between agricultural government spending and food security in Algeria, through a general linear model. Econometric estimates, using the least squares method have taken into account control variables that affect food

security. The result shows that all variables, with the exception of the consumer prices index, influence significantly the per capita rate of food supply.

The coefficients of independent variables such as the agricultural orientation of public spending and per capita national income are positive coefficients, and their increase allows an increase in per capita rate of food supply, and this confirms the hypotheses of the study which states that the increase of agricultural government spending and per capita national income leads to an increase of the per capita rate of food supply and enhances food security.

The consumer price index has a significant effect with a positive coefficient, and this invalidates the hypothesis that an increase in the consumer price index harms a decrease in the per capita rate of food supply. This phenomenon can be explained by the policy pursued by Algeria to support the prices of consumer foodstuffs, which limits the impact of the price increase, despite the increase in the general index of consumer prices in Algeria during the period (2001-2021), the per capita rate of the food supply was not affected and witnessed a steady increase.

It should be noted that, despite the significant amounts allocated to support the agricultural sector in Algeria through various schemes and programs, they did not reach the desired results, especially in the production of widely consumed agricultural food crops, such as grains, milk, oil, meat, ...etc. This is an obstacle to achieving food security.

In the light of the applied and theoretical study and the results reached, we decided to propose the following recommendations:

- The need to reconsider directing the agricultural support policy in Algeria, taking into account the category of small farmers, and the characteristics of each region.
- The priority of directing support in the development of infrastructure, support for investment, and public utilities, including roads and tracks, transportation, storage, cooling...etc.
- The priority of directing support to strategic crops (cereals, oil, meat, milk, etc.).
- Facilitate and simplify the procedures for benefiting from support.
- Developing financial incentive measures for farmers to establish investors and integrated model farms.
- Supporting farmers to establish water catchments, to avoid drought crises, and to facilitate access to irrigation equipment.

6. Bibliography list:

(FAO), F. a. (2022, 11 07). *suite of food security indicators*. Retrieved from FAOSTAT: https://www.fao.org/faostat/en/#data/FS

Bank, W. (2023). *GNI per capita, PP(current international)*. Retrieved 01 23, 2023, from world bank: https://www.data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD

BESSAOUD, O. (2019). Rapport de synthèse sur l'agriculture en Algérie. *ENPARD Méditeranée*, 7.

Brown, R. L. (1975). Techniques for Testing the Constancy of f Regression Relationships over Time. *Journal of the Royal Statistical Society*, 149-192.

economist, I. (2022). *Global Food security index 2022*. Retrieved 02 15, 2023, from economist impact: https://www.impact.economist.com/suistainability/project/food-security-index

FAO. (2002). Illustration of the FAO methodology as applied to a hypothetical country. *FAO*, https://www.fao.org/3/Y4249E/y4249e07.htm.

FAO, F. A. (2004, 09 20-23). *Follow-up reports to the World Food Summit 30th Session Plan of Action.* Retrieved 02 15, 2023, from https://www.fao.org/3/J2660a.htm#P739_23616

FAO, U. U. (2021). *A multi-billion-dollar opportunity-Repurposing agricultural support to transform food system.* Rom, Italy. doi:10.4060/cb6562en

Ferroukhi, S., Boumghar, M., & Chehat, F. (2021). ANALYSE DES EFFETS DES SUBVENTIONS SUR LA CROISSANCE AGRICOLE : UN ESSAI DE MESURE POUR LA PERIODE (2000-2018). *Les cahiers du CREAD*, 35-65.

Frank, R., & al. (1999). Food security indicators and framework for use in the monitoring and evaluation of food aid programs. *USAID*, 36.

Hendri Prabowo, S. D. (2020, 03). The Performance of Ramsey Test, White Test and Terasvirta Test in Detecting Nonlinearity. *INFERENSI,, 31(1)*, 1. doi:10.12962/j27213862.v3i1.6876

Jef, L. (2015). Measuring the food access dimension of food security : A critical review and mapping of indicators. *Food and nutrition bulletin, 36*(2), 170. ISSN:1564-8265. DOI: 10.1177/0379572115587274 .

Mark Tranmer, J. M. (2020). Multiple Linear Regression(2nd Edition). *Cathie Marsh Institute*, 11. Retrieved 06 26, 2023, from http://hummedia.manchester.ac.uk/institutes/cmist/archive-publications/working-papers/2020/multiple-linear-regression.pdf

Mehdaoui, H., & Moussaoui, F. (2023). Efficient government support programs in promoting agricultural product in. *Journal of Economic Integration, 11*(03), 451-470.

Mestoui, A. (2020). Modeling of the relationship between agricultural output and economic growth outside. *Revue des Réformes Economiques et Intégration En Economie Mondiale*, 1-15.

Mokhaledi, M., & Elis Shawish, F. A.-Z. (2019). Towards building an economic model to achieve sustainable growth in Algeria - an applied study. *Budex notebooks magazine, 08*(01), 144. ISSN: 2335-1136.

Ngobeni, E., & Muchopa, C. (2022). The Impact of Government Expenditure in Agriculture and Other Selected Variables on the Value of Agricultural Production in South Africa (1983–2019): Vector Autoregressive Approach. *Economies*, 205.

ONS. (2022). *Quarterly national accounts: 1st quarter 2022.* Alger: National Statistics Office. Retrieved 05 17, 2023, from https://www.ons.dz/IMG/pdf/cnt_1t_2022.pdf

Organization(FAO), F. a. (2002). *llustration of the FAO methodology as applied to a hypothetical country*. Retrieved from fao: https://www.fao.org/3/Y4249E/y4249e07.htm

Organization, F. a. (1996). *Report of the world food summit.* Rom: FAO. Retrieved 06 23, 2023, from https://www.fao.org/3/w3548e/w3548e00.htm

Organization, W. L. (2003). Seventeenth International Conference of Labor Statistics Experts. In W. L. Organization (Ed.), *Second and third reports (excerpts)* (p. 37). Geneva, Switzerland: World Labor Organization. Retrieved from https://www.ilo.org/public/english/standards/relm/gb/docs/gb289/pdf/icls-17.pdf

Rima, N. S. (2014). Agricultural Credit flow of Commercial Banks and Impact on Agricultural. *Scholars Journal of Arts, Humanities and Social Sciences*, 372-376.

Thiam, I., & Malik, T. (2020). Liens empiriques entre financement agricole et sécurité alimentaire au Sénégal. *African Journal of Agricultural and Resource Economics*, 311.

Thorsten Thadewald, H. B. (2004). Jarque-Bera Test and its Competitors for Testing Normality: A Power Comparison. *Diskussionsbeiträge*, 1. ISBN 3-935058-78-0.

World Bank, G. (2022). *Indicator: 2.a.1, SDG Metadata translation project*. Retrieved 03 02, 2023, from world bank: https://www.worldbank.github.io/sdg-metadata/fr/2-a-1/.

- ONS. (2022). *Les comptes nationaux trimesteriels.* Alger: Office National des Statistiques.