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An Economic Analysis of Supply Response of Barley Crop Area In Iraq (1990 - 2016)

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Abstract: *The research aims at estimating the farmers' response to the increase of barley cultivated area in the period (1990-2016) at the country level. The research was based on quantitative analysis method in estimating barley yield response functions using dynamic Nerlove Modelas well as estimation of short and long termflexible price offer. The estimated results showed the main variables in the response to the offer of barley cultivated area which is cultivated area of the previous year's which reached (0.74), the relative price of the barley crop modified by wheat prices for the previous year (0.553), as well as the production risk (- 0.03) and irrigation water which was (0.068). Where the drainage rate of the Tigris and Euphrates rivers was taken. The estimated flexibility showed that the flexible of the barley yield to its relative price was (0.553) in the short term and (9.74) in the long term. The flexibility of crop offer to irrigation water (0.068) in the short term and (0.262) in the long term, We find that all of flexibilities were less than one, which means that the offer of these crops is described as being inflexible. The research concluded that the government subsidy policy had achieved positive growth rates and that the positive response to the cultivated area of the barley crop for the change in its prices led to the possibility of increasing the production of this crop. The research recommends the need to pay attention to the development of a successful price policy to meet the requirements of society through attention to the results of economic derivatives, which contribute to increase of cultivation of this important crop.*

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I. Introduction

The study of the supply response is more comprehensive than the offer function as it represents the response of the area cultivated for price change with the stability of other factors. The change in offer usually results from climate change, technological development, availability of production resources and changes in its cost. The study of the offer response is of great importance in the agricultural field, but agriculture still suffers from the problem of offer adjusting to meet the increasing demand for agricultural commodities and the change in the supply of resources. technological development, third (3). Analysis response of the field crop offer has become more complicated as agricultural policies change to subsidize crop prices or support production resources. The barley crop is one of the main crops in Iraq and ranks second after wheat, which is grown for various purposes, including its use as green forage, as well as part of human food, as well as in various local industries.it was also used earlier as a coin beside the wheat.research was concerned with the economic and nutritional importance of barley production for farmers and consumers. It is the second largest cereal crop in Iraq after wheat in terms of cultivated area and the third most important economic importance after wheat and rice. it is characterized by its high tolerance to drought, salinity and alkalinity, while it is considered an acidity sensitive crop. The importance of barley is indicated by the fact that it is used as food for humans and is a forage in animal feeding (1). Therefore, attention to the barley crop is important to reach the integration of plant and animal production.

Research problem

There is a fluctuation in the cultivated areas with barley and a decrease in production and productivity of the crop despite the price policies, which should encourage the farmers to increase the cultivated areas of the this crop based on the importance of this crop and the growing population, which led to increased demand and accompanied by deficiencies in local production, Therefore, it is necessary to study the offer response of the cultivated areas of this crop to determine the reasons that led to this fluctuation in cultivated areas and the factors that limit the farmers from the expansion of cultivated areas with barley crop.

Research Hypothesis

The price policy did not increase the offer of cultivated area and increase the productivity of barley, and the impact of prices on this crop depends on the profitability, abundance and appropriateness of natural resources. However, for research purposes, we will assume that farmers respond to local prices and appear the competition among crops on resources. increasing the price of a crop leads to an increase in the area allocated to this crop compared toother competing crops. Thismeans, there is a positive relationship between crop price changes and farmers' response through increased production as well as the competition for using available resources.

objective of search

1- Identify the reality of barley production in Iraq and its growth rates in period (1990 - 2016).
2- Estimating the farmers' response to the increase of barley crop cultivated area in period (1990- 2016) at the country level by estimating and selecting the best economic model for the offer function based on the statistical, economic and standard criteria.
3- Determination of the flexibility of the offer price of barley.

II. Materials and Methods

The prices of barley and wheat yield were obtained from publications issued by the Planning Authority - Central Statistical Organization for the period (1990 - 2016). While the data on cultivated area, total production and yield of donum are obtained from the statistical booklet which issued by the Department of Agricultural Economics Research - Agricultural Research Department - Ministry of Agriculture.
The research was based on the method of quantitative analysis in the estimation of the barley yield response functions using the dynamic Nerlovemodels and using the statistical program (SPSS) and (EViews).

The Dynamic Nerlove Model

Static analysis assumes that the balance between offer and demand is automatically stabilized, but in dynamic analysis time enters as a factor of stability, so the adjustment in offer and demand passes through a given time, even if it is one hour.

For agricultural offer functions, the product responds to prices later,this means that the offer function of prices is expected based on previous prices. Nerloveshows that production cannot be adjusted 100% based on price expectations, and it takes a period in order for the producer to produce the desired quantity orbalance amounts, and Nerlove introduced these institutional factors such as the identification of cultivated area.Nerlove has distinguished between two models: the dynamic model and the static model (5) to measure the flexibility of the offer response. Short and long term flexibilities can be obtained from the dynamic model, while only the short term flexibility of the static model can be obtained (4). Nerlove assumed that there was no possibility of a complete response to prices in the short term, so he distinguished two types of area actually cultivated and the desirable area, the long term equilibrium area and formulated a hypothesis to distinguish farmers' behavior as follows:

$$At^{*} = b_o + b_1 p_{t-1} + u_t \ldots\ldots\ldots\ldots\ (1)$$

He explained that the farmer does not respond immediately to the change in price, but gradually, and explained the difference between the area actually cultivated and the desired area of cultivation according the formula below:

$$A_t - A_{t-1} = B(A_t^{*} - A_{t-1}) \ldots\ldots\ldots\ldots\ (2)$$

That is:

A_t^{*} = **desired cultivated area**.
A_t = **cultivated area in this season.**
A_{t-1} = **cultivated area in Previous season.**
B = **Coefficient of adjustment.**

Since it is not possible to obtain (A_t^{*}) because we do not observe it, so by compensating equation (1) with equation (2) we get the following equation (3).

$$A_t - A_{t-1} = B(b_o + b_1 p_{t-1} + u_t - A_{t-1})$$
$$A_t - A_{t-1} = Bb_o + Bb_1 p_{t-1} + Bu_t - BA_{t-1}$$
$$A_t = Bb_o + Bb_1 p_{t-1} + A_{t-1} - BA_{t-1} + Bu_t$$
$$A_t = C_o + C_1 p_{t-1} + C_2 A_{t-1} + V_t \ldots\ldots\ldots\ldots\ (3)$$

That is $C_o = Bb_o$, $C_1 = Bb_1$, $C_2 = (1-B)$, $V_t = Bu_t$

Equation (3) can be estimated because all variables are observable, and their estimated parameters are short term parameters.

$$A_t = Bb_o + Bb_1 P_{st-1} + (1-B)A_{t-1} + Bu_t \ldots\ldots\ldots\ldots (4)$$

The adjustment parameter can be calculated as follows:

$B = (1-C_2)$
The adjustment parameter is limited to the value between one and zero,
$1 \geq B \geq 0$ so that $\geq C_2 \geq 0$
Therefore, if a negative is a very rare condition called over adjustment, in this case the adjustment parameter is $B \geq 1$, and the duration of the adjustment can be calculated as follows (4):
$(1-B)^n <= 0.05$
That is
0.05= Required ratio for adjustment.
N= number of years which are required for adjustment.
B= adjustment parameter.
The higher the adjustment parameter means the ability of farmers to adapt productive decisions according to price incentives.
Some economic concepts such as short and long term flexibilities are derived from the previously mentioned relationships. The flexibility of the short term price offer is usually obtained according to the following linear model:

$$ESR = \frac{\partial A_t}{\partial P_{t-1}} . \frac{P_{t-1}}{A_t}$$

Where the P_{t-1} and A_t represent arithmetic average of the price and area, respectively.
Long term flexibility (ELR) is derived by dividing the short term flexibility (ESR) on the adjustment parameter (B) as follows:

$$ELR = \frac{ESR}{B}$$

III. Results and discussion

First:
the agricultural reality of the barley crop in Iraq.

1- Production: The table (1) shows that the average production of barley in Iraq reached 779,785 tons in the period 1990-2016. The maximum production for the country in 1990 was 1,854,300 tons, while in 2000 obtained the lowest production was 192,700 tons. , the statistical range of production volatility (1,661,600) tons. it is also noted that there is a clear fluctuation in production during the period as shown in Figure (1).
2- Cultivated Area: The table (1) shows that the average area cultivated with barley in Iraq reached (4,285,822) donums in the period (1990 - 2016), and the maximum area was planted in 1991 (9,618,100) donums, while in 2015 recorded the lowest cultivated area reached (1,003,000) donums, and the statistical range of fluctuation reached (8,615,100) donums. it is also noted that there is a clear fluctuation in the cultivated area of the crop as shown in Figure (1).
3- Productivity: The table (1) shows that the average yield of donums in Iraq reached about (202.3) kg.donum^{-1} in the duration of the study. The maximum level of yield in 2016 was about 470 kg.donum^{-1}, while the lowest level of yield was in 1999 which reached (68) kg.donum^{-1}. (402) kg.donum^{-1}. It is also noted that there is a clear fluctuation in productivity as shown in figure (1).

This is due to the fluctuation in production, area and productivity of price policies that are discouraging or because of the prevailing political conditions in the country.

Table (1): Area, Production and Productivity of Barley Crop in Iraq in the Period (1990 - 2016).

years	Production 100 tons	Cultivated area 100 donums*	Productivity Kg.donum^{-1}
1990	18543	79801	232
1991	7684	96181	80
1992	13538	70559	191
1993	8904	63333	141
1994	8540	55537	154
1995	7124	46707	152
1996	6473	41639	155
1997	4296	39991	107

1998	**6299**	**41796**	**151**
1999	**2830**	**41808**	**68**
2000	**1927**	**23000**	**84**
2001	**7128**	**22135**	**322**
2002	**8334**	**38621**	**216**
2003	**8604**	**42529**	**202**
2004	**8054**	**38286**	**210**
2005	**7544**	**42522**	**177**
2006	**9193**	**41028**	**224**
2007	**7483**	**43738**	**171**
2008	**4040**	**53941**	**75**
2009	**5015**	**28145**	**178**
2010	**11371**	**40267**	**282**
2011	**8202**	**36509**	**225**
2012	**8319**	**28495**	**292**
2013	**10032**	**33636**	**298**
2014	**12777**	**46322**	**276**
2015	**3297**	**10030**	**329**
2016	**4991**	**10616**	**470**
Total	**210542**	**1157172**	**5462**
Average	**7797.85**	**42858.22**	**202.3**
Highest value	**18543**	**96181**	**470**
Lowest value	**1927**	**10030**	**68**
Statistical range	**16616**	**86151**	**402**

source: Ministry of Agriculture, Agricultural Research Department, Agricultural Economics Research Department, Statistical Manual of Agricultural Crops Data.

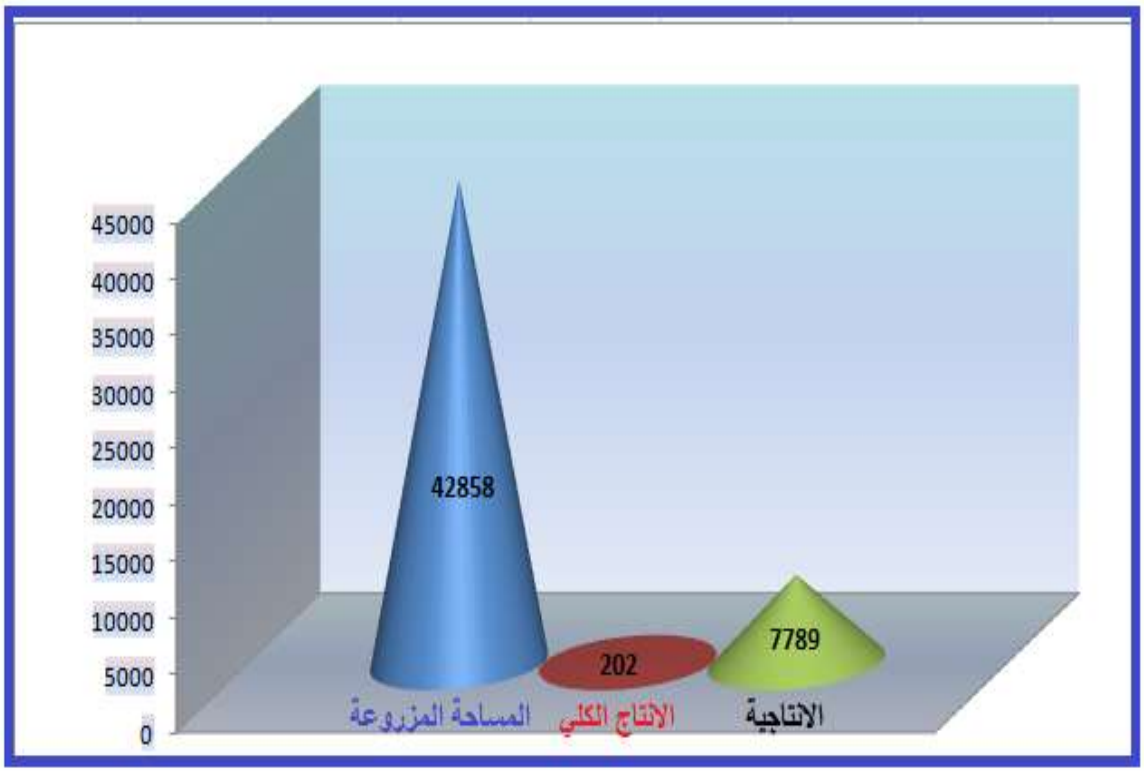

Figure (1) Average cultivated area, production and productivity of barley crop in the period (1990-2016) .

Table (2) field price of barley and wheat Crops in iraq in the Period (1990 - 2016).

years	Barley price 1000 IQD.ton^{-1}	Wheat price 1000 IQD.ton^{-1}
1990	0.25	0.26
1991	0.5	0.75
1992	2	3.9
1993	2.5	4.8
1994	20	35
1995	0.75	105
1996	0.75	100
1997	70	100
1998	100	114
1999	115	121
2000	152	144
2001	116	133
2002	133	145
2003	150	160
2004	160	175
2005	200	224
2006	203	342
2007	221	400
2008	350	458
2009	416	488
2010	450	600
2011	468	685
2012	479	686
2013	483	695
2014	434	582
2015	422	537
2016	369	550

source : Ministry of Planning, Central Department of Statistics, Directorate of Agricultural Statistics, Annual Report of Field Prices of Agricultural Products.

Annual growth rates and the index of variation of area, production and productivity in Iraqin the period (1990- 2016).

When studying the annual growth rates of area, production, productivity and the index of variation of barley in Iraq in period (1990- 2016) table 3. The annual growth rate of cultivated area and production was negative at -4.3% and -0.9%, respectively, while the productivity growth rate was positive at 3.4%.

Table (3) Annual growth rates and the index of variance in the area, production and productivity of barley in Iraq in the period (1990 - 2016).

Variable type	Annual growth mean	Variation index
Cultivated area	-0.043	0.38
Production	-0.009	0.50
Productivity	0.034	0.41

Reference: by the researcher based on the growth rate equation.

$Y = e^{a + bT}$

$Ln\ Y = a + bT$

That is:

Y = represents the dependent variable to measure its growth rate.

T = represents the time (number of years).

b = slope of the regression equation and represents the growth rate according to the above model.

While the variance indexm is the standard error of the estimated regression equation.

In order to obtain a clear picture, the time trend of the area, production and productivity was shown in Figure (2). The decreasing time trend of area and production is observed in the following three figures. This

reflects the neglect of the country's production policy towards barley cultivation, which resulted in a decrease in cultivated area and then in total production. The productivity growth rate was positive, reflecting the specialization in the cultivation of this crop, which led to an increase in productivity of one donum.

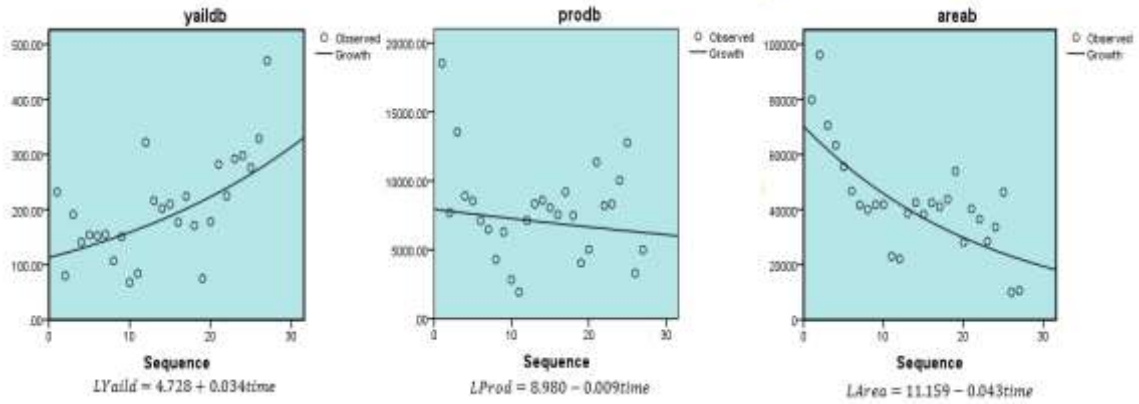

Figure (2): Growth rates of area, production and productivity of barley crop in Iraq in the period (1990 - 2016).

The index of variation in cultivated area, total production and productivity was 38%, 50% and 41%, respectively, and if we compare these values, we find that the area was more stable than production and productivity.

Second: The response function of the width of cultivated areas:

1 - Characterization and formulation of the model:

The following equation is the basis used to identify and describe the variables involved in the model. The response of the area cultivated with barley in Iraq takes the following double logarithmic form:

LArea = F(LArea$_{-1}$,LPBW,LRISK ,LWAT)

That is

LArea = (the dependent variable), the area cultivated with barley in Iraq in period (1990 - 2016) (one hundred donums).

Independent variables:

LArea$_{-1}$= barley cultivated area in a previous year (100 donums).

LPBW = Relative Price of Barley Crop Modified at Wheat Prices in Previous Year (IQD / donum).

LRISK = Productive risk that represents the deviation from production according to the following equation:

$$Risk = (Q_{(-1)} - MAT)^2/MAT$$

$$Mat = 0.333(Q_{(-2)} + Q_{(-3)} + Q_{(-4)})$$

MAT= adjustment parameter of function.

$Q_{(-1)}, Q_{(-2)}, Q_{(-3)}, Q_{(-4)}$ =Barley production for the previous year, two years, three years, four years, respectively.

WAT= = Irrigation water, where the rate of water drainage of the Tigris and Euphrates rivers ($m^3.s^{-1}$).

2- Model estimation:

The response equation of the barley yield in Iraq in the period 1990-2016 was estimated using theOrdinary least Square method, and in different functional formulas including linear formula, double logarithmic formula, half logarithmic formula and inverse formula, the double logarithmic formula at relative prices Response of barley crop was the best in terms of compatibility with economic and statistical criteria.

The variables analyzed in the estimated model accounted for most of the changes in the area under barley cultivation which reached 0.75, which means that explanatory variables (crop price, competitive crop price, irrigation water and production risk) are responsible for the interpretation of 75% of changes in the dependent variable. The model as a whole was significant accordingto F test at a significance level (1%).

The parameter of the cultivated area for the previous year which reached (0.74) indicates a positive and significant sign at 0.01significance level , less than 1 and greater than zero. in light of this parameter, the adjustment parameter reached 0.260091. This means the ability to modify the cultivated area of the barley crop according the price, which takes about two and a half years for thisadjustment .

The relative price parameter of the barley crop modified by the price of wheat for the previous year was positive and significant at 0.05, with a value of 0.253, which reflects the possibility of increasing this crop by raising its prices. This is consistent with economic theory as it indicates the rationality of farmers by

responding to the increase. The results also showed that there was a positive relationship between irrigation water and cultivated area reached (0.068) at significance level 0.05.The negative and non-significant negative risk parameter indicates that this variable is not important in the production of barley crop. This reflects the ability of the crop to resist severe climatic conditionsand low water quantities compared to other crops.

Table (4): Estimation of the Response of Barley offer in Iraq in the Period (1990 - 2016).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.604559	2.349978	1.108333	0.2803
LAREA1	0.739909	0.183625	4.029461	0.0006
LPBw	0.253452	0.080985	3.129607	0.0023
LRISK	-0.030884	0.032245	-0.957784	0.3491
LWAT	0.068275	0.030404	2.245555	0.0062

R-squared	0.747463	Mean dependent var	10.53187
Adjusted R-squared	0.702217	S.D. dependent var	0.492664
S.E. of regression	0.399570	Akaike info criterion	1.174184
Sum squared resid	3.352773	Schwarz criterion	1.416125
Log likelihood	10.26439	Hannan-Quinn criter.	1.243854
F-statistic	14.51621	Durbin-Watson stat	2.041830
Prob(F-statistic)	0.00000		

source: by the researcher based on Eviews.

Estimated flexibilities:

In order to measure the response of barley area to the change in its price and the price of the competing crop and the irrigation water in Iraq, these flexibilities were computed at the arithmetic averages of the variables concerned during the study period (Table 5). The self-flexibility of the barley crop compared to its relative price reached (0.253) The increase of barley price by 10% leads to increaseof cultivated area by (2.53%) in the short term and (9.74) in the long term. In order to determine the response of the barley crop to the change in the quantities of irrigation water, the flexibility of the crop offer was estimated for irrigation water. The increase of irrigation water in the Tigris and Euphrates rivers by 10% increases barley cultivated area by 0.6% in the short term and 2.6% In the long term.

From the review of the flexibilities we find that all of them were less than one, which means that the offer of these crops is described as being inflexible and are the same as the results reached by the researchers (Farhan, 2012, Alamiri 2011) when estimating the offer flexibilities of the barley crop.

Table (5) Short and long term flexibilities of barley crop in the period (1990 - 2016).

Cultivated area with barley	Self-flexibility	Irrigation water
Short term	0.253	0.068
Long term	0.974	0.262

Reference: by the researcher based on Eviews and flexibility laws.

Conclusions and recommendations:

IV. Conclusions:

1- According to the results of this research, it is noted that the policy of government support to stimulate farmers to expand the cultivated areas has achieved positive growth rates in productivity.

2 - The positive response to the cultivated area of the barley crop for change in prices reflects the possibility of increasing the production of this crop by raising its prices, but farmers do not make important adjustments in response to the expected prices, which indicated the low offer flexibilities short and long term, but most farmers make their decisions Productivity on the basis of non - scientific.

3 - Significant response to the cultivated area with barley crop with the availability of irrigation water makes this resource important in determining the areas cultivated with this crop, which are non-price variables affecting in the response ofcultivated area with this crop.

V. Recommendations:

1- Since price policy did not play its role effectively, this requires attention to other factors, especially irrigation, fertilization and control for the purpose of increasing productivity to meet the requirements of society.

2- Attention to the results of economic derivatives such as offer flexibilities in the short and long term as an important indicator of the adoption of a good agricultural policy contributes to reduce the low level of cultivation of this important crop.

References

[1]. Al-Hardan, M. A. I. 2007. Economic analysis of barley production response to different levels of nitrogen and phosphatase fertilizers. Journal of Iraqi Agricultural Sciences. Vol (38):5.
[2]. Annual report of field prices for agricultural products, Directorate of Agricultural Statistics, Central department of Statistics, Ministry of Planning.
[3]. Mushtaq,K. and P. J. Dawson .2002. Acreage response in Pakistan : A cointegration . Agric. Econ. 27:111-121.
[4]. Nerlove, M. and William Addison. "Statistical Estimation of Long-run Elasticities of Supply and Demand" . J. Farm Econ. 40(1958) pp(861-881) .
[5]. Nerlove, Marc. "Estimates of the Elasticities of Supply of Selected Agricultural Commodities." J. Farm Econ. 38 (1956) , PP(456-509) .
[6]. Statistical manual of Agricultural Crops Data, Agricultural Economics Department, Agricultural Research Department, Ministryof Agriculture.

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