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ECONOMIC ANALYSIS OF BARLEY CROP IN IRAQ BY ESTIMATING THE SUPPLY AND DEMAND FUNCTIONS FOR THE PERIOD (1990-2017)

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Abstract

The Barley is an important economic crop, which is grown for various purposes, including the use of green fodder and grain as well as use in various industries. The fluctuation of cultivated areas and the low yield per unit area negatively affected the cultivation of barley crop, in addition to the lower price per ton of barley compared to wheat. For the purpose of studying the barley crop market system, emphasis should be placed on various aspects of this market, perhaps the most important of which are supply and demand. The results showed that the demand function table indicates that the price variable px_1 is identical to the economic theory and reflects the inverse relationship between the price and quantity required. As the price decreases by 1%, the required quantity of barley crop increases by 1.66%. Also the variable of maize crop price also comes with a negative signal; this means when the price of maize crop is reduced by 1%, the required amount of barley crop will increase by 2.4%, which explains the competitive relationship between the two crops. The variable of cultivated area reached 0.107, which is also contrary to the economic logic. The increase in area led to decrease of supply quantities because of the weak administrative capacity when expanding the cultivation of the crop or cultivating with minimum areas. The parameter of agricultural mechanization reached 2.8, which means that by increasing the use of mechanization by 1%, the offered quantity of barley crop will decrease by 2.8%, indicating the inefficiency of the mechanization component. But the amount of fertilizer had a positive effect with a value of 0.15 that is; the increase in the use of fertilizer by 1%, the amount of barley will increase by 0.15%. Also the results showed that the factors affecting barley demand were barley price, maize and wheat price, production management, import and time. On the other hand the factors affecting barley supply were cultivated area, price, fertilizer price and state agricultural policy and support crop production.

Keywords : Barley crop, Estimation function, Supply function, Demand function.

Introduction

The barley (*Hordeum vulgare* L.) is the first crop was cultivated in the Paleolithic modern stone times. The ancient Egyptians believed that it was their goddess (Isis) who introduced it into Egypt, while the Greeks were the enemy of barley from the holy grains (Alomri and Armush.1999). This crop has important food, scientific and industrial uses as it has many medicinal uses. Many studies indicate that the barley crop has very important medical uses, such as encouraging the healing of stomach ulcers and its properties against some cancers. In 1993, Japanese researchers found that flavonoids in green barley had an antioxidant effect. Flavonoid was also found in green barley called (2-OGIV) which has anti-oxidant, anti-allergic and anti-inflammatory properties (Karkhi, 2014; Melhem, 2010; O'Hara, 2004). In Iraq the barley ranked after wheat in terms of cultivated area and production (Jabr, 1997) in terms of importance of this crop, its cultivation rates have increased in the world and the Arab countries, including Iraq, which is ranked fourth after Morocco, Algeria and Syria. The cultivated area with barley in Iraq represents about 36% of the total cultivated area with grain crops. The cultivated area of this crop amounted to 4632 thousand donums and productivity reached 1278 thousand tons (Directorate of Agricultural Statistics, 2014). The cultivation of this crop is widespread in the central and southern regions of Iraq because of its high tolerance to salt stress and drought.

The problem of research is summarized in the widening gap between the rates of local consumption of barley and locally produced. This has led many researchers to diagnose the causes of the emergence of this gap and study the effects of various aspects, especially that this crop occupies an important position in the Iraqi agricultural economy. Most of the studies on the barley market focused on a particular aspect of their research, which is either the subject of supply or the subject of the demand, which resulted in the failure to give an integrated picture of this crop. Therefore, it was not possible to determine the factors affecting the demand and supply of barley in one time, in giving a clear picture of the barley market in Iraq.

The research assumes that the required quantities of barley are affected by a number of price factors in addition to the average prices of this crop and the technical factors expressed in time, while the offered quantities are influenced by price factors as well as cultivated areas and water resources levels. The study also assumes that government policies have not played its real role in supporting the cultivation and production of this crop, which is reflected on performance of the barley market system in Iraq.

The research aims at estimating the demand and supply functions of the barley crop, evaluating the performance of its price policy and finally giving the integrated picture of the barley market in Iraq. A number of researchers (Habeeb, 2006) (Shadeed, 1994) (Anderson, 1994; Munsef, 2009) dealt with this subject and many of them obtained in relation to the demand function to the role of price factors and some factors of production on the required amount of barley. And in terms of the supply function, the studies have pointed to the importance of price factors as well as the role of irrigation water and other factors of production in influencing the production of this crop.

Materials and Methods

The market can be defined economically as a demand compliant with the supply of goods, services and capital. It is also defined as the place where sellers and buyers can contact each other to sell or buy certain goods. It is also defined as

marketing as a set of tags discovered by the consumer which describing the product, or as a group of persons who have needs require saturation, have money and have a desire to agree. Kilter and Dubo have defined it as a group of customers who are capable and willing to carry out the exchange process. The American Marketing Association defined it as the total consumer demand for certain goods or services (Mosa, 1998).

The study of markets is of great importance because it is directly related to the life and development of societies. The study of the market is the main focus of the study of the project because through market research the amount of demand for the product is determined and the production capacity of the projects is determined. And through production capacity it is possible to test the technologies, the means of production, the size of the project and all its technical aspects. Therefore, it is possible to determine the production and sales plan on which the financial and economic analyzes of the project are based, and it concludes the profitability and returns of the financial, economic and social project (Munsef, 2009). Data were obtained from secondary sources represented by the Ministry of Agriculture - Planning Department, Ministry of Planning, Central directorate of Statistics. The method of analysis will be based on the quantitative method of using multiple regressions and the method of least squares method (OLS) to estimating the demand and supply characteristics of the barley crop in Iraq for the period 1990-2017. The data were analyzed using the statistical program e views.9

Results and Discussion

First: the demand function

The basic concepts adopted from the economic theories as well as the previous studies are the most important considerations for guiding the selection of the appropriate mathematical formula and determining dependent and independent variables and accordingly The demand function we are estimating is described as follows:

$$Qd= b_0+b_1 px_1+b_2px_2+ b_3px_3 + b_4t +ui$$

That is

Qd = the required quantity of barley crop (1000 tons)

Px_1 = Barley crop price (IQD.ton^{-1})

Px_2 = Wheat crop price (IQD.ton^{-1})

Px_3 = maize crop price (IQD.ton^{-1})

T = Time expressed by years

Ui = random variable that absorbs the effect of variables not included in the function, which is many and has been excluded part of them due to the lack of data, although important in the demand function.

The order function was estimated by the above variables using the least squares method (OLS) and viewer. 9 program using several mathematical formulas (semi-logarithmic, logarithmic, linear). The logarithmic formula was the best formula based on the statistical and standard tests.

Table 1 : Demand function on barley crop

Dependent Variable: LNQD
Method: Least Squares
Date: 01/18/19 Time: 11:12
Sample: 1 28
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNPX1	-1.666820...	3.544433	-0.4702...	0.6426
LNPX2	-1.017036	2.990308	-0.340111	0.7369
LNX3	-2.445064	1.545565	-1.581987	0.1273
T	5.661188	3.031128	1.867684	0.0746
C	15.93548	6.561087	2.428787	0.0234

R-squared	0.428279	Mean dependent var	8.358891
Adjusted R-squared	0.328849	S.D. dependent var	3.413251
S.E. of regression	2.796264	Akaike info criterion	5.054878
Sum squared resid	179.8392	Schwarz criterion	5.292772
Log likelihood	-65.76830	Hannan-Quinn criter.	5.127605
F-statistic	4.307355	Durbin-Watson stat	0.660216
Prob(F-statistic)	0.009557		

The results of the demand function table indicate that the price variable px_1 is identical to the economic theory and reflects the inverse relationship between the price and quantity required. As the price decreases by 1%, the required quantity of barley crop increases by 1.66%.

The variable of the wheat crop price was a negative sign to confirm the competitive relationship between wheat and barley. This may be contrary to the technical logic, but the reality proves this for two reasons. First, the barley crop needs a slightly different soil than the soils required by the wheat crop, especially with respect to the level of salinity. Secondly, the farms and because the areas in Iraq are a few areas, usually the farmer has identified the area cultivated for each crop, regardless of price. While the variable of maize crop price also comes with a negative signal, this means when the price of maize crop is reduced by 1%, the required amount of barley crop will increase by 2.4%, which explains the competitive relationship between the two crops.

The variable of time was a positive sign in line with the economic theory that assumes the increase in quantity required over time in accordance with population increases and increased demand for livestock (chicken, cattle, sheep), which increases the intensive demand for barley crops, as well as other uses in some food products for diabetics and beer industry.

Statistically, the function was significant as a whole at the level of 1%. The value of f was about 4.307, which confirms the realism of the variables, while the significance of the variables was the time and the constant coefficient with significant values at 1% and 15% respectively.

The explanatory variables were able to interpret only 42% of the requirements in the dependent variable by R^2. The other 58% belong to variables not included in the model, which absorbed by the random variable, although some of them were excluded due to lack of sufficient data.

In order for the analysis to be logical and dependable, standard second-level problems should be detected by:

1. Use the LM test to detect the problem of autocorrelation and the results of the test showed a lack of a model of this problem.
2. Use of the Glejser test to detect the problem of heteroscedasticity of variance, which also confirmed that the model does not suffer from the problem of

heteroscedasticity, which is often, accompanied to the cross section data.

3. Use of the VIF test to detect the problem of multicollinearity. The model was free of the problem of multicollinearity due to the decrease of R^2 value.

Table 2 : Breusch-godfrey serial correlation (LM) test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.823965	Prob. F(7,16)	0.1512
Obs*R-squared	12.42701	Prob. Chi-Square(7)	0.0874

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 01/18/19 Time: 11:19
Sample: 1 28
Included observations: 28
Presample missing value lagged residuals set to zero.

Table 3 : Heteroscedasticity test Glejser

Heteroskedasticity Test: Glejser			
F-statistic	1.048063	Prob. F(4,23)	0.4043
Obs*R-squared	4.316782	Prob. Chi-Square(4)	0.3648
Scaled explained SS	2.224118	Prob. Chi-Square(4)	0.6946

Test Equation:
Dependent Variable: ARESID
Method: Least Squares
Date: 01/18/19 Time: 11:24
Sample: 1 28
Included observations: 28

It should be noted here that as long as the estimated formula is logarithmic formula, the parameters here represent elasticity. Therefore, the elasticity of price demand indicates that demand for barley is flexible and the elasticity of competitive demand indicates the competitiveness of other crops.

Second: the supply function:

Before estimation, the barley function should be characterized as follows:

$$Qs = b_0 + b_1\, px + b_2E + b_3M + b_4Pe + ui$$

That is

Qs = the amount of barley produced which calculated from total production and import

Px = barley crop price

E = cultivated area with barley crop

M = Agricultural mechanization

PE = Quantity of Fertilizers

Ui = random variable

The order function was estimated by the above variables using the least squares method (OLS) and viewer.9 program using several mathematical formulas (semi-logarithmic, logarithmic, and linear). The logarithmic formula was the best formula based on the statistical and standard tests Table (4).

Table 4 : Supply function

Dependent Variable: LNQS
Method: Least Squares
Date: 01/18/19 Time: 12:01
Sample: 1 28
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNPX1	-0.146398	0.457636	-0.319901	0.7519
LNE	-0.107420	0.313045	-0.343147	0.7346
LNM	-2.869230	0.244669	-11.72701	0.0000
LNPF	0.152113	0.353079	0.430818	0.6706
C	39.22399	7.120418	5.508664	0.0000

R-squared	0.884998	Mean dependent var	8.358891
Adjusted R-squared	0.864997	S.D. dependent var	3.413251
S.E. of regression	1.254120	Akaike info criterion	3.451178
Sum squared resid	36.17481	Schwarz criterion	3.689072
Log likelihood	-43.31650	Hannan-Quinn criter.	3.523905
F-statistic	44.24906	Durbin-Watson stat	1.605457
Prob(F-statistic)	0.000000		

It is clear from the estimated of supply function that the price parameter was negative and contrary to the economic logic which assumes that the relationship between the price and output is positive, but this may be due to the nature of the farmers who grow the crop regardless of the price and the limited area and may need to grow this crop for use as feed for their cattle.

The variable of cultivated area reached 0.107, which is also contrary to the economic logic. The increase in area led to decrease of supply quantities because of the weak administrative capacity when expanding the cultivation of the crop or cultivating with minimum areas.

The parameter of agricultural mechanization reached 2.8, which means that by increasing the use of mechanization by 1%, the offered quantity of barley crop will decrease by 2.8%, indicating the inefficiency of the mechanization component.

But the amount of fertilizer had a positive effect with a value of 0.15 that is, the increase in the use of fertilizer by 1%, the amount of barley will increase by 0.15%.

The elasticity of the price supply was 0.14, which means that the barley yield is inflexible and weak and corresponds to the low supply elasticity of agricultural commodities.

Statistically the function is significant as a whole, with F value reached 44.24, which is significant at the level of 1%, which indicates the realism of the function on the one hand and the importance of the variables studied on the other. As for the significance of the variables, the mechanization variable was significant at 1%. The explanatory variables under study were able to explain 88% of the fluctuations in the amount of barley. The remaining 12% were due to other variables not included in the model such as soil and weather.

In order for the analysis to be logical and dependable, standard second-level problems should be detected by:

1. Use the LM test to detect the problem of autocorrelation and the results of the test showed a lack of a model of this problem.
2. Use of the ARCH test to detect the problem of heteroscedasticity of variance, which also confirmed that the model does not suffer from the problem of heteroscedasticity, which is often accompanied to the cross section data.

3. Use of the VIF test to detect the problem of multicollinearity. The model was free of this problem and show that the model does not suffer according to the VIF test of 8.3.

Table 5 : LM test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.341559	Prob. F(2,21)	0.2829
Obs*R-squared	3.172188	Prob. Chi-Square(2)	0.2047

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 01/18/19 Time: 12:04
Sample: 1 28
Included observations: 28
Presample missing value lagged residuals set to zero.

Table 6 : ARCH

Heteroskedasticity Test: ARCH			
F-statistic	0.257187	Prob. F(1,25)	0.6165
Obs*R-squared	0.274934	Prob. Chi-Square(1)	0.6000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/18/19 Time: 12:05
Sample (adjusted): 2 28
Included observations: 27 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.207886	0.520163	2.322131	0.0287
RESID^2(-1)	0.101500	0.200143	0.507136	0.6165

Conclusions

From the demand function, it is possible to conclude that there is an inverse relationship between the price and the amount of barley required, as well as the prices of wheat and corn crops, the results of the analysis showed a competitive relationship between them and the barley crop, when the price of corn decreases by 1%, the demand for the quantity of barley increases by 2.4%. The elasticity of price demand indicates that demand for barley is flexible and the elasticity of competitive demand indicates the competitiveness of other crops. With regard to the estimated of supply function as for price, area and mechanization, they did not match the economic logic, while using fertilizer had appositive result. But the function is significant statistically as a whole, with F value reached 44.24, which is significant at the level of 1%. As for the significance of the variables, the mechanization variable was significant at 1%. The explanatory variables under study were able to explain 88% of the fluctuations in the amount of barley. The remaining 12% were due to other variables not included in the model such as soil and weather.

Recommendations

- From the results, we can see that management has a major role in the production process and the quantity produced of barley, so we need to give farmers courses in resource management.
- Study the local prices of the crop before starting planting.
- Increasing the area planted with barley, due to its economic importance with regard to its use as animal feed, as well as in many industries.

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