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FACTORS AFFECTING THE MARKETING SURPLUS OF WHEAT IN BAGHDAD PROVINCE USING THE REGRESSIVE ECONOMETRIC MODEL*

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ABSTRACT

The research aims to study and identify the most important economic and social factors affecting the marketing surplus of wheat farms in Baghdad Province for the agricultural season 2023 using the regressive regression model. The data were obtained through a questionnaire prepared for this purpose and the study relied mainly on the raw data of a random sample of a total of 150 wheat farmers in the province distributed over the various agricultural units of Baghdad Province. Results showed that the marketing surplus of the wheat in Baghdad province is sold through three channels; the first is marketing to the state by 57%, the second is marketing to wholesalers by 40%, and the third is marketing to brokers by 3%. Results also displayed that the marketing surplus of wheat crop in Baghdad is positively affected by a set of variables, namely the amount of production of the getter, the average selling price per ton, and the efficiency of marketing services, while the marketing surplus is related to wheat is negatively affected by variables of in-kind deductions, family consumption, and loss of harvest and collection. The study recommended the need for nutritional awareness for individuals in rationing wheat consumption from the farm, as well as encouraging the establishment of an efficient marketing system by governmental and non-governmental organizations to market wheat production.

Keywords: deductions, distribution channels, loss of harvest, sequential equations.
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INTRODUCTION

The wheat crop is one of the most important strategic grain crops, it ranks first in the world and in Iraq in terms of importance and cultivated area compared to other cereal crops, and more than a third of the world's population depends on the consumption of it (Al-Mahasneh and Saleh, 2022 ; Hussain et al., 2023). Iraq suffers from a low rate of wheat productivity compared to global productivity rates, this necessitates those interested in this sector to focus their attention on methods leading to increasing production and productivity (Nasser et al., 2024). The agricultural sector in Iraq is one of the basic sectors in the Iraqi economy, as this sector occupies an important place in the formation of the gross national product, and constitutes a significant contribution among other sectors, in addition to that, agriculture is a major source of employment of the Iraqi workforce, as the number of workers in this sector is estimated at about 28% of the total labor force in the Iraqi economy, and agriculture is also an important source of income and purchasing power for many of the population of Iraq who work in the agricultural sector or live In rural areas, the number of this population is estimated at more than 30% of the total population and despite all these factors

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possessed by Iraqi agriculture, this sector still suffers from a lack of complementary and auxiliary products, especially in the areas of modern marketing of agricultural products and industries based on surplus agricultural production, which can be marketed, and agriculture is the main source of all foodstuffs that achieve food security for the country's population (Ghoneim et al., 2021). The population is one of the main factors that affect the consumption of the crop when the population increases, this ultimately leads to an increase in the number of consumers and thus an increase in nutritional needs (Naghmush, 2022). The marketable surplus is defined as the amount of production that can be made available to the non-agricultural population in the country, while the theoretical concept of marketing surplus is what is left for productive farmers after meeting its requirements from family consumption, farm requirements of seeds and fodder for livestock, payment for work, payment to the landowner such as rent, in-kind deductions, and others (Sharma et al., 2020). Marketable surplus is also generally defined as that part of production that actually enters the market regardless of farm requirements for family consumption, farm requirements, and social and religious payments. Therefore, the actual The marketed surplus may be more, less or equal to the marketable surplus, depending upon the condition of the farmers and type of the product (Sharma, 2016). The actual marketed surplus is more than the marketable surplus when the farmer keeps a small amount of the crop, and these farmers usually buy products from the market to meet their needs, and the actual marketed surplus is less than the marketable surplus when farmers with a better ability to preserve large quantities of production (Grover et al., 2012). Marketable surplus of production expresses the concept of an unsold product that still holds some value for the farm (Danielle, 2023), in other words that the products are saleable in the market – undamaged, unopened and likely to be sold. From this concept, it is clear that the marketing surplus is mostly focused on unsold goods produced beyond what the farmer plans to sell in the market (Kadhim et al., 2022), as this surplus can result from increased production, accumulation of unsold goods, or from a combination of other factors. In agriculture, the marketing surplus represents the surplus of the crop that can be sold for profit after the farmer sells his crop to cover the costs of maintaining and operating his farm, which includes the maintenance of machinery, labor costs, fertilizers, mortgage payment on the land and other expenses that the crop production must be able to cover in order for the farmer to continue his work (Al-Sheriff, 2001). The agricultural concept comes into effect in areas where agriculture is the main source of income for the population, where the family consumes the cultivated food and the surplus is sold in the market. In order to balance the amount of food a family needs, and the amount of food that must be sold to cover costs, this surplus marketing can have significant effects, especially on low-income farms (Suleiman et al., 2018). The amount of marketing surplus varies from region to region and within the same region, from crop to crop, and varies from farm to farm according to the determinants of those farms (Al-Shishiny 2017). The research problem explain that the change in the familiar features of wheat crop markets in Iraq in general, where there is a change in the means by which the total output of the crop and the marketed surplus of it are distributed in different markets. The surplus is discharged through various distribution channels such as the state, wholesalers, local markets, family, neighbors, relatives and friends, and it is also stored as seeds for use in the next year. Identifying the way in which

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this surplus is distributed under the influence of certain factors can contribute to a reconsideration of marketing channels related to the distribution of wheat production and marketed surpluses. In general, the study aims to identify the outlets selling surplus quantities produced and ways to distribute them from the wheat crop at the level of the study sample, as well as to identify the most important economic factors affecting the marketing surplus of the crop in Baghdad Province using the regressive econometric model technique.

MATERIALS AND METHODS

The study was based mainly on data and information from its primary sources through a questionnaire prepared for this purpose for a random sample totaling 150 wheat farmers (2% of study population) in Baghdad Province distributed over the various agricultural divisions for the season 2022/ 2023. The data was collected through personal interviews. Secondary data relevant to the study were also obtained from ministries and official departments in Iraq, as well as previous studies (Challa et al., 2016 ; Dibaba and Goshu, 2018; Habte et al., 2020).

Model specification

The system of sequential equations of four equations and four dependent variables takes the following mathematical formula (Sharma, 2016; Hamid and Abdul, 2025; Sharma et al., 2020):

Cropped Area Equation Y_1

$$Y_{1t} = a_0 + a_1 x_1$$

Production Equation Y_2

$$Y_{2t} = B_0 + B_1 Y_{1t} + B_2 X_2 + B_3 X_3 + B_4 X_4 + B_5 X_5$$

Family consumption Y_3

$$Y_{3t} = C_0 + C_1 Y_{1t} + C_2 Y_{2t} + C_3 X_6$$

Marketable surplus $Y_{4=======}$ $Y_{4t} = D_0 + D_1 Y_{2t} + D_2 Y_{3t} + D_3 X_7 + D_4 X_8 + D_5 X_9 + D_6 X_{10}$

Where:

Endogenous Variables:

Y_{1t} Planted area / dunum
Y_{2t} Quantity of crop production/ ton
Y_{3t} Household consumption of production/ ton
Y_{4t} Marketing surplus/ ton

Exogenous Variables:

X_1 Total Holding Size in Sample Farms/ Dunum
X_2 Seed water required for crop area in sample farms/kg
X_3 Amount of chemical fertilizer/ kg
X_4 Labour work/ hour
X_5 Mechanical work/ hour
X_6 The number of family members/ Person.
X_7 Total amount deductions/ ton
X_8 Loss in the harvest and collection phase (2%)/ ton
X_9 Average selling price/dinar per ton
X_{10} Efficiency of marketing services as a dummy variable (1 good services, 0 unsuitable services) (Jamil, 2020; Khalaf and Aziz, 2017).

The statistical estimates of the regressive econometric model equations of marketing surplus (for wheat crop) are extracted by estimating the first equation for the total area in the sample farms, and then estimated $\hat{y_1}$, then use it as an independent variable in the second equation in addition to the other independent variables (the amount of seeds needed, the amount of fertilizer, the amount of human labor) are all factors that affect production (Hamid and Abdul, 2025), as through these variables the production equation will be estimated and the estimated crop production will be estimate $\hat{y_2}$, while the family consumption equation will be obtained through the equation of estimated crop area and the equation of estimated crop production in addition to the other independent variable, which is the number of family members, and then the estimated consumption function of the equation is estimate $\hat{y_3}$, for the marketing surplus equation, it will be estimated through what has been estimated in the equation of production, household consumption, the amount of other deductions from crop output (gifts, etc.), the amount of losses during

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harvest, as well as the selling price of the crop and the variable of the efficiency of marketing services (Al-Mu'ayyin, 2023; Al-Takmak, 2025). One of the most important characteristics of regressive regression is ridding the estimated model of econometric problems, or what are known as second-order tests (Gujarati and Porter, 2018).Since economic theory does not indicate the appropriate mathematical form of the relationship between the variables of the study, four different functional formulas will be estimated for the marketing surplus regression model: linear formula, double logarithm, half-logarithmic, and exponential formula (Gujarati and Porter, 2018).

RESULTS AND DISCUSSION

First: Distribution channels of marketing surplus : It is clear from the data presented in Table (1) that the marketing surplus of the wheat in Baghdad province (1,992,963 kg) is sold through three distribution outlets; the first is marketing to the state, the second is marketing to wholesalers, and the third is marketing to intermediaries and brokers. The state's track account for the vast majority of this surplus at 57% (87 farmers), followed by wholesaler at 40% (52 farms), and brokers at about 3% (11 farms). The reason for the government's receipt of the largest quantity of surplus marketed wheat crop is due to the condition of marketing through the country's ports in exchange for supporting agricultural production requirements, to ensure the continued flow of wheat flour to the people through the ration card paragraphs that have been used since 1990 to keep pace with the economic sanctions imposed on Iraq in that era.

Table 1. distribution channels share for the marketing surplus in sample

Total marketing / Kg	Distribution channels for the marketing surplus of wheat for the agricultural season 2023								
	Government share			Wholesalers share			Share of mediators and brokers		
	Quantity/ Kg	%	Number of farmers	Quantity/ Kg	%	Number of farmers	Quantity/ Kg	%	Number of farmers
1,992,963	1,143,270	57%	87	788,243	40%	52	61,450	3%	11

Source: By authors using Questionnaire (2023).

Second: Economic and social characteristics of the sample

Table (2) shows the results of the analysis of some economic and social characteristics of the study sample, these characteristics are expected to have a noticeable impact on the quantities produced of wheat and then the quantities marketed of it. The marketing surplus varies from one farm to another, and within the farm itself, and it also varies from one crop to another, and in general there are some variables that will affect the marketable surplus at the farm level of various field crops, namely: farm area, the amount of crop production, withdrawn for family consumption, withdrawn as deductions and other uses, harvest and collection loss, the sale price of the yield and other factors. As noted in Table (2), the average age of the selected sample is about 45 years, about 61.3% of farmers are under or equal to 50 years of age, and about 38.7% of them are older than 50 years. With regard to the level of education, it is noted that most farmers receive education of different levels, with 69.3% of farmers being educated, and about 30.7% of them not able to obtain any form of education. It is noteworthy that the educational level of the individual has a major role in influencing the management of

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the quantities consumed and marketed of various local goods in the province of Baghdad (9, 10). With regard to the variable of the number of family members, it is noted that about half of the sample 56.7% have an average of 6-10 members, followed by households with an average of 30.7%, and then households with a large number of members with 12.6%. As for the variable of the area planted with wheat, it is noted that the largest category in the cultivation of the crop 1-10 dunums constituted 59.3%, while the category of large areas constituted 26.7% and the percentage of medium areas 14%, with regard to the variable of the quantity of wheat production, this variable was divided into three categories, the high-production category constituted about 25.3%, followed by the medium-production category about 14.7%, then the low-production category about 60%, as for describing the status of marketing the quotient as a dummy variable, as it reached the percentage of farmers who spend the farm's production completely as a surplus marketed through its various marketing outlets is about 26.7%, while the category of farmers who market their product partially constituted the largest percentage by about 73.3%, which confirms the presence of factors affecting the marketed quantities of wheat yield. Finally with regard to the quality of marketing services as a dummy variable, it indicates that good services are the largest percentage, reaching 59.3%, and bad services are the lowest percentage, amounting to about 40.7%.

Table 2. Economic and social characteristics of the study sample

n	Characteristics	Unit	Ave.	Description	No. of farmers	%
1	lifetime	year	45	Less or equal to 50	92	61,3
				More than 50	58	38,7
2	Education level	Dummy V.		Uneducated	46	30,7
				primary	41	27.3
				secondary	39	26
				academic	24	16
3	Family members	Person	6	1 - 5	46	30,7
				6 - 10	85	56,7
				More than 10	19	12,6
4	Area	Dunum	21	1 - 10	89	59,3
				11 - 20	21	14
				More than 20	40	26,7
5	Output	Ton	16	1 - 10	90	60
				11 - 20	22	14,7
				More than 20	38	25,3
6	Marketing status	Dummy V.		Fully drives	40	26.7
				Drive part of it	110	73.3
7	Marketing services	Dummy V.	-	Good services	89	59,3
				Not good services	61	40,7

Source: By authors using Questionnaire (2023).

Third: Analysis of the regressive econometric model

The data of the sequential equation model of the marketing surplus of wheat (referred to earlier) were analyzed in the ready-made statistical program SPSS. The best functional formulas for the results were selected according to economic, statistical and standard tests, as presented in Table (3):

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Table 3. Results of Analysis for the Sequential Standard Model

F test	R^2	Equation	Best formula	Mean of dependent variable	Dependent variable
2485.67*	0.94	$LY_1 = -0.523 + 1.030\ LX_1$ (49.857)*	Logarithm	21	Area
445.92*	0.93	$LY_2 = 8.090 + 0.894LY_1 - 0.311LX_2 + 0.014LX_3 + 0.191LX_4 + 0.010LX_5$ (5.767)* (0.240) (0.358) (-3.861)* (44.747)*	Double logarithm	16	Production
149.480*	0.75	$Y_3 = -29.372 + 40.837LY_1 + 6.417LY_2 + 12.443LX_6$ (5.441)* (0.831)** (1.635)	Half logarithm	1.07	Family consumption
87.199*	0.78	$Y_4 = 21.673 + 20.804LY_2 - 0.002LY_3 - 0.583LX_7 - 6.648LX_8 + 0.017LX_9 + 0.647LX_{10}$ (0.466) (1.437) (-7.639)* (-1.571) (-2.590)** (10.161)*	Half logarithm	13.28	Marketing surplus

Source: SPSS output

t test results, *Significant at 1%, **Significant at 10%.

Table (3) shows the results of the estimates of the equations of the regressive model of the marketing surplus of the wheat crop, for the first equation (Area Y_1) the significance of the estimated parameters as a whole was confirmed and the reference agreed with the economic logic, the results indicate that the model is statistically acceptable with high explanatory power as the determination coefficient R^2 0.94 in the double logarithmic formula, and this means that 94% of the fluctuations in the dependent factor were caused by the illustrative variables included in the model, and that 6% of the fluctuations are due to other factors not included in the model Its effect was absorbed by the random variable. After conducting the necessary standard tests related to (second-degree problems), it became clear that the model was free of all these problems. With regard to the second equation (production Y_2), the results show that the estimated crop area and the amount of seeds needed are significant at statistical levels of 1%, the estimated area was positively affected on the production of wheat, as for the amount of seeds, its signal was negative contrary to economic logic, which means the possibility of not using good varieties of seeds by farmers or using more quantities than the need for the area allocated for growing the crop, which reflected negatively on the quantities produced from it, while the results show that the amount of chemical fertilizer and the number of hours of automated work came non-significant, but its positive signals are consistent with economic logic, which means that when these variables increase, production of wheat will increase, and the value of the number of human working hours X_4 was significant at the level of 1% and with a positive signal, as it indicates that increasing manual working hours leads to an increase in production, and the results indicate that the model has a high explanatory power and is statistically acceptable, as the value of the multiple determination coefficient R^2 0.93, which means that 93% of the fluctuations in the dependent factor was caused by the illustrative variables included in the model, and that 7% of the fluctuations are due to other factors not included in the model and the random variable was absorbed by its effect, and after conducting the necessary standard tests related to (second-degree problems), it became clear that the model is free of these problems. As for the third equation (household consumption Y_3), the half-logarithmic formula was chosen as the best formula, where the results showed that the crop area was significant at the level of 1% with a positive

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signal conforming to the economic logic, while the estimated crop production was significant at the level of 10% and positively affects consumption, and the other independent variable (the number of family members X_6) was non-significant and its sign is positive, which means when increasing the number of farm family members, it leads to an increase in the volume of consumption, and the results indicate. The model is statistically acceptable and has a high explanatory power, as the multiple determination coefficient R^2 0.75, which means that 75% of the fluctuations in the dependent factor were caused by the illustrative variables included in the model, and that 25% of the fluctuations are due to other factors not included in the model and the random variable has absorbed its effect, and after conducting the necessary standard tests related to (second-degree problems), it became clear that the model is free of all problems. Finally, with regard to the fourth equation (marketing surplus Y_4), the statistical significance was confirmed at the level of 1%, for the production variable, this variable came with a positive effect on the marketing surplus of wheat, that the positive relationship between the amount of production and the surplus marketed by farmers in the region shows the fact that farmers with the largest production have more "surplus for marketing" after meeting the subsistence needs of their families compared to their counterparts with low production, while the consumption variable came significant at the level of 10%. Its effect is negative, which means that when consumption increases, it will lead to a decrease in the quantities of surplus marketing of wheat. While the results show that the deductions were insignificant and the amount of loss was significant at the level of 1%, but negatively affected the marketing surplus of wheat, which means that the increase in these variables leads to a decrease in the marketing surplus of wheat in the study area. This is an inevitable consequence, that any losses in the yield will be at the expense of the quantities sold outside the farm as approved (6). The results also showed that the selling price and the quality of marketing services were insignificant, but their positive signal conformed to economic logic. The statistical significance of the model as a whole was also confirmed, as the multiple determination coefficient R^2 0.78, which means that 78% of the fluctuations in the dependent factor were caused by the illustrative variables included in the model, and that 22% of the fluctuations are due to other factors not included in the model and the random variable was absorbed by its effect, and after conducting the necessary standard tests related to second-degree problems, it became clear that the model was free of all econometrics problems.

CONCLUSIONS

Through the results of the study, it can be said that the marketing surplus of wheat in Baghdad province is positively affected by a set of variables, the quantity of the yield, average price per ton, quality of marketing services. While marketing surplus of wheat is negatively related to the variables of deductions, losses in harvest and collection, family consumption. Based on this, it can be concluded that it is possible to increase the marketing surplus of wheat by setting appropriate standards and measurements to improve the activities of farms and overcome some production and marketing obstacles facing farmers, including delaying the delivery of financial dues to marketed farmers, which makes them more vulnerable to exploitation by intermediate traders and brokers. In addition to this, the cost of high transportation fees for the crop from producing areas to other areas, the lack of marketing procedures by the government by providing the necessary services and improving efficiency. For

marketing services, the study also proved, farmers use poor types of seeds, which negatively affects production, and the prices of wheat crop in Baghdad province were more stable helped to increase the cultivated areas and motivate farmers to increase their production and then increase their marketing surplus.The study recommends encouraging and supporting farmers, and the need for food awareness for individuals in rationing wheat consumption from the farm, as well as encouraging the establishment of an efficient marketing system by governmental and non-governmental organizations to market wheat output at the province level, in a way that attracts farmers to increase their production of the crop and the formation of price incentives that enable them to achieve rewarding profits, and provide technical and logistical assistance by institutions and research centers located in the province . And also directing farmers to use improved varieties and selection of seeds free of impurities and high purity and propagation of improved seeds of high productivity, and guide farmers to use modern machines and machines to reduce the quantities of loss, and the research recommends conducting more studies and economic research on wheat production in the province of Baghdad to raise the optimal level of this crop.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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العوامل المؤثرة في الفائض التسويقي لمحصول القمح في محافظة بغداد باستعمال تقنية الانموذج القياسي التراجعي*

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المستخلص

يهدف البحث الى دراسة وتحديد اهم العوامل الاقتصادية والاجتماعية المؤثرة في الفائض التسويقي لمزارع محصول القمح في محافظة بغداد للموسم الزراعي 2023 باستخدام انموذج الانحدار القياسي التراجعي. تم تحصيل البيانات من خلال استمارة استبيان اعدت لهذا الغرض واعتمدت الدراسة بصورة اساسية على البيانات الاولية لعينة عشوائية بلغ مجموعها 150 مزارعا من مزارعي القمح في المحافظة موزعين على مختلف الوحدات الزراعية التابعة لمحافظة بغداد. أظهرت النتائج أن الفائض التسويقي لمحصول الحنطة في محافظة بغداد يباع عبر ثلاث قنوات رئيسة؛ الأول تسويق للدولة بنسبة 57%، والثاني تسويق لتجار الجملة بنسبة 40%، والثالث تسويق للوسطاء بنسبة 3%. كما اظهرت نتائج التحليل بأن الفائض التسويقي من محصول القمح في محافظة بغداد يكون متأثرا بصورة ايجابية بواسطة مجموعة من المتغيرات وهي كمية انتاج الحاصل، معدل سعر بيع الطن الواحد، وكفاءة الخدمات التسويقية، بينما يرتبط الفائض التسويقي للقمح سلبيا بمتغيرات الاستقطاعات العينية، الاستهلاك العائلي، فاقد الحصاد والجمع. واوصت الدراسة بضرورة التوعية الغذائية للأفراد في تقنين استهلاك القمح من المزرعة، فضلا عن التشجيع على تأسيس نظام تسويقي كفوء من قبل المنظمات الحكومية وغير الحكومية لتسويق ناتج القمح.

كلمات مفتاحية: الاستقطاعات، القنوات التوزيعية، فاقد الحصاد، المعادلات المتتابعة.

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