Economic and econometric analysis of the quantities produced and demanded of fish meat in Iraq for the period 1990-2022 (Salah al-Din Governorate as a model(

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A**btract**

The research dealt with studying the demand for fish meat and analyzing it in Iraq by taking time series data from (1990) to (2022). Data was also collected from various districts and sub-districts of Salah al-Din Governorate, with a population of (1,812,822) people for the year (2023-2024) using a questionnaire prepared for this purpose, where the sample size was (400) families with an average number of members (7). The study aimed to estimate the factors affecting individual consumption of fish meat using a time series represented by individual income, commodity price, and prices of alternative and competing goods (red meat and chicken) and estimating the elasticities of income demand for protein, calories and fats in addition to future predictions for all variables of the series from (2023) to (2035). The study relied on the use of the autoregressive distributed lag (ARDL) model in addition to applying the linear, logarithmic, semi-logarithmic and inverse semi-logarithmic regression models. The study reached the most important conclusions, the fluctuation in the average per capita share of fish consumption according to the quantities of local production and imports on the one hand and the increase in population size on the other hand. The research also indicated a direct relationship between the average prices of both red meat and poultry with the required quantities of fish meat, while the relationship was inverse between the average prices of fish meat and the required quantity of fish meat. While the cross-section data indicated the inverse relationship between the quantity of fish consumed on the one hand (the price of fish, the quantity of chicken consumed, the quantity of red meat consumed) on the other hand, while the relationship was direct with each of (the price of one kilogram of chicken, the price of one kilogram of red meat, the number of family members, the monthly income). As for the income elasticity of the quantities of fish consumed, it reached (0.43), which means that it is considered a necessary commodity and the level of satisfaction from this commodity is appropriate. The study concluded with some recommendations, the most important of which is paying attention to the fish production sector and working to provide all possible means to develop production and increase the quantities available for fish consumption in a manner that matches the increase in population numbers.

Keywords: analysis, economic, standard, demand, fish meat

Introduction

The importance of fish meat comes from it containing important nutrients, which are considered an essential source of protein, despite the fact that it is considered an essential food source in the Arab world (including Iraq). There is difficulty in filling the large and severe shortage in the provision of fish as food. The annual rate of per capita consumption in developed countries reached from 17.4 kg per capita in 1961 to 24.4 kg per capita in 2017, while in developing countries the value was Less, although it increased significantly from 5.2 kg in 1961 to reach 19.4 kg per capita in 2017, with an average annual

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rate of increase 2.4% (2020, FAO). Although Iraq produces 59.1 thousand tons of fish There is an increasing demand for fish meat, especially with the increase in population, as well as the high standard of living and high consumption rates, which indicates the extent of the decline in the per capita share of fish meat in Iraq (Arab Organization for Agricultural Development, Baghdad, 1999, p. 37). Despite the nutritional importance of fish, there are factors affecting fish production that prevent it from being available in sufficient quantities and at appropriate prices in local markets. Some studies also indicate an increase in demand for animal products (red meat, chicken, eggs, dairy...) in general, and fish in particular are topics of importance, especially in those countries that suffer from a protein deficiency, which requires estimating the demand function for fish, specifically. In Iraq, estimating the individual's actual need for fish production, in addition to consumption planning, which is of great importance in studies. The study of consumer behavior is also an important tool that helps the planner to draw up the state's price policy, as consumption is subject to a group of variables, including economic variables and social variables, and therefore it affects and is affected. The most prominent of these variables are the income factor and its distribution, the number of population, the price of the commodity, and the prices of alternative and complementary goods. These factors are called quantitative factors, in addition to the presence of another type of factors called descriptive (qualitative) factors that cannot be measured quantitatively Iraq also depends for its provision of fish on internal waters (the Tigris and Euphrates), lakes, reservoirs and marshes, in addition to the territorial waters represented by the Shatt al-Arab. Despite the large number of water sources, this decrease in the rate of annual consumption of fish meat in Iraq Compared to the global per capita rate, the result of a number of causes, most notably (wars, revolutions, internal uprisings, and external disturbances), the large number of dams built on rivers, low water levels, overfishing, pollution, and others.

Research Problem

The problem is represented by the low level of Iraqi per capita consumption of fish meat compared to the level of per capita consumption of this commodity in countries of the developed world and even in Arab countries. Per capita food consumption is an indicator of the extent of the country's development and progress and the extent of the possibility of providing the nutritional needs of the people of the country. The decline is also due to Iraqi per capita share of these goods To the increasing demand for them as a result of the increase in population numbers as well as the increase in per capita income, in addition to the rise in the prices of these commodities as a result of the decrease in quantities (produced and supplied), which prompts the consumer to move towards consuming cheaper commodities that are available in abundance, represented by the consumption of chicken meat as an alternative to meet the need. Therefore, it is necessary to study this problem and find solutions to it with practical recommendations that serve the supply of the commodity For the purpose of reaching the point of self-sufficiency and satisfaction from its consumption.

Research objective

The research aims to use time series data

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-1 Estimating the factors affecting individual consumption of fish meat using a time series, which is represented by individual income, commodity price, prices of alternative commodities, and competition (red meat and chicken.(

-2 Estimating income flexibility.

-3 Estimating income elasticities of demand for calories, protein, and fat.

-4 Predicting the quantities consumed in the future.

Materials and Methods

Characterizing the Relationship Between the Variables Used to Estimate the Factors Affecting the Required Quantities of Fish Meat for the Period (1990-2022(

The description of the economic model in studies and research concerned with demand functions is considered the first step in building any standard model. In it, the most important factors influencing demand are identified, which can explain the changes occurring in it, and put them in a mathematical formula to later be estimated and results obtained through my agencies.

Y= f (X1،X2،X3،X4 (

Whereas:

Y = Quantity required (tons(

X1 = average fish meat prices (dinar/kg(

X2 = Average prices of poultry meat (dinar/kg(

X3 = average price of red meat (dinar/kg(

X4 = Average per capita income (dinar/year(

The economic model can be converted to the model following the studied function and converted to the logarithmic form, which is as follows:

Whereas

Y: is the dependent variable

Bo: is the intersection term

Bi: Elasticities with respect to the variables under study

Xi: descriptive variables

Ui: is the random variable

While the variables used in the analysis of the questionnaire form were according to the following formula.

Y=f (X1،X2،X3،X4, X5،X6،X7(

Whereas

Y = Quantity of fish consumed monthly (kg(

X1 = Quantity of chicken consumed monthly (kg(

X2 = Quantity of red meat consumed monthly (kg(

X3 = Price of one kilogram of fish

X4 = = Price of one kilogram of chicken

X5 = = Price of one kilogram of red meat

X6 = Number of family members

X7 = Monthly inco

Results and Discussion

Initial Estimation of the Autoregressive Distributed Lag (ARDL) Model

After ensuring the stability of the time series of variables by using stationarity of variables, we conduct the initial estimation of the autoregressive distributed lag (ARDL) model using the statistical program Eviews12. We note from Table (3) that the value of the Adjusted R2 coefficient of determination is equal to (0.99). The independent variables included in the estimated model explain about (99%) of the changes in the variable dependent, and this is an indication that the explained factors have the greatest influence on the function, while approximately (1%) are unexplained, that is, they are responsible for the variables not included in the model and represented by the random variable. The value

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of the calculated (F) test is equal to (151.317), which reflects the strength of The model and the observed effect of the exploited variables on the dependent variable with a probability level equal to (0.000), which is less than (0.05) and even less than (0.01). This means that The estimated model is significant as a whole and can be relied upon in the future planning and forecasting process.

-1 Dependent Variable: LNY (Required Quantity of Fish Meat(

LNY is the variable that we are trying to explain or predict using the independent variables LNX1, LNX2, LNX3) and LNX4 and their effect over time. Because the ARDL model takes into account temporal effects, it includes lags to see how the past affects the present and the lags of the dependent variable LNY are:

LNY(-1) coefficient = 0.276670-

It indicates that the value of LNY in the period one period earlier (the first lag) has a negative impact on the current value of LNY, which means that if LNY had increased in the last period, it is expected to decrease slightly in the current period, and this decrease is 27.7%, and since This effect is statistically significant, so we can rely on it in the analysis (p-value = 0.0090.(

LNY(-2) coefficient = 0.626983-

It indicates that the value of LNY two periods ago (the second lag) also has a larger negative impact on the current value of LNY. When the negative lag is this large (62.7%), it indicates that there is a strong inverse relationship between the old values of LNY and its current values. This effect is very significant (p-value = 0.0001), meaning that previous changes continue to significantly affect LNY.

-2 The Variable LNX1 and Its Effects Across Periods: (Average Fish Meat Prices(

LNX1 coefficient = 2.458608-

It indicates that the current values of LNX1 have a significant negative impact on LNY. When LNX1 increases, LNY decreases by 245.86% of its level (compared to a coefficient of -2.458608), which indicates an inverse relationship as it was shown that the variable LNX1 has strong and sustainable negative effects on LNY, Especially at the present values and the first and third lags where the effect declines over time but remains significant in some periods.

LNX1(-1) coefficient = 1.905248 -

The first lag of LNX1 also shows a significant negative effect, which is very statistically significant (p-value = 0.0003), which means that the continuing effect of LNX1 in the previous period strongly affects LNY in the present, highlighting the continuity of the negative effect.

LNX1(-2) coefficient = 0.294667 -

The second delay has a negative effect, but it is much weaker compared to the first effect, as it continues to weaken over time, but it is still present and is statistically significant (p-value = 0.0426.(

LNX1(-3) coefficient = 1.420096-

The third delay returns the large negative effect, which is strongly statistically significant (p-value = 0.0011). This means that these delayed values have intermittent effects, meaning that there are some factors that make the effect continue strongly in this period.

-3 The Variable LNX2 and Its Effects Across Periods: (Average Prices of Poultry Meat(

LNX2 coefficient = 3.867607

It indicates a very significant positive impact of the current value of LNX2 on LNY. When LNX2 increases, LNY rises significantly (by 386.76%), which indicates that the LNX2

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variable has strong positive effects on LNY, especially at the current values and the first and fourth lags, There are some changes in the effect (negative and positive) across time, which is statistically significant (p-value = 0.0000.(

LNX2(-1) coefficient = 1.131589

The first delay shows a strong positive effect, which is statistically significant (p-value = 0.0007). This means that the effect of LNX2 continues to support LNY in the following period, indicating a continuing positive effect.

LNX2(-2) coefficient = 0.341322 -

The second delay shows a negative effect, but it is not statistically significant (p-value = 0.1323). This indicates that the effect of LNX2 in this period becomes unreliable or insignificant, which indicates the presence of other factors affecting the model.

LNX2(-3) coefficient = 0.333452-

The third delay has a negative and statistically significant effect (p-value = 0.0386). Despite the positive effect in the first periods, there may be factors that cause the effect to turn negative in this period.

-4 The Variable LNX3 and Its Effects Across Periods: (Average Prices of Red Meat(

LNX3 coefficient = 1.579893

A strong positive effect of the current value of LNX3 on LNY, this indicates that LNX3 significantly enhances LNY and is very statistically significant (p-value = 0.0009.(

LNX3(-1) coefficient = 0.334866-

The first lag shows a negative effect and is statistically significant (p-value = 0.0491), which means that the effect of LNX3 in the previous periods is inverse.

LNX3(-2) coefficient = 1.054476

The second lag shows a very large and statistically significant positive effect (p-value = 0.0000). This means that the positive effect returns strongly, which may be the result of cumulative effects on LNY.

LNX3 (-3) coefficient = 0.781693

The third delay shows a positive effect and is statistically significant (p-value = 0.0047). Where he continues to support LNY.

LNX3 (-3) coefficient = 0.781693

The third delay shows a positive effect and is statistically significant (p-value = 0.0047) Where he continues to support LNY.

-5 The Variable LNX4 and Its Effects Across Periods: (Average Per Capita Income(

The variable LNX4 deals with the effect of its current and lagged values on the dependent variable LNY, as the nature of the relationship changes from large negative effects to small positive ones over time.

LNX4 coefficient =0.933730-

This coefficient indicates that the current value of LNX4 has a negative impact on LNY. When the current values of LNX4 rise, LNY decreases by 93.37% of its value. Since this effect is statistically significant (p-value = 0.0040), it indicates a strong and reliable inverse relationship between LNX4 and LNY in the current period.

LNX4(-1) coefficient = 0.480739-

The first delay of LNX4 also shows a negative effect on LNY. Increasing LNX4 in the previous period leads to a decrease in LNY in the current period by 48.07%. This effect is statistically significant (p-value = 0.0078), which confirms the continuation of the negative effect of LNX4 over time, albeit less severe. Compared to the current value, the negative effect of LNX4 extends over the short term, but weakens over time.

LNX4(-2) coefficient = -0.564022

The second lag shows a significant negative impact on LNY as the effect of two lag values for LNX4 was still significant, leading to a decrease of LNY by 56.40%. This effect is

statistically significant (p-value = 0.0048), strengthening the idea that LNX4 has a persistent inverse effect on LNY.
LNX4 (-3) coefficient = 0.180632

The third delay of LNX4 shows a small positive effect on LNY, but it is not statistically significant (p-value = 0.0589) Although the effect is positive,

Table (1) Preliminary estimation

Dependent Variable: LNY				
Method: ARDL				
Sample (adjusted): 1994 2022				
Included observations: 29 after adjustments				
Maximum dependent lags: 2 (Automatic selection)				
Model selection method: Akaike info criterion (AIC)				
Dynamic regressors (4 lags, automatic): LNX1 LNX2 LNX3 LNX4				
Fixed regressors: C @TREND				
Number of models evalulated: 1250				
Selected Model: ARDL(2, 4, 4, 4, 4)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNY(-1)	-0.27667	0.066844	-4.13906	0.0090
LNY(-2)	-0.62698	0.057542	-10.8962	0.0001
LNX1	-2.45861	0.273606	-8.98594	0.0003
LNX1(-1)	-1.90525	0.212512	-8.96538	0.0003
LNX1(-2)	-0.29467	0.109012	-2.70307	0.0426
LNX1(-3)	-1.42091	0.211691	-6.71216	0.0011
LNX2	3.867607	0.516988	7.481042	0.0007
LNX2(-1)	1.131589	0.225109	5.026857	0.0040
LNX2(-2)	-0.34132	0.189956	-1.79685	0.1323
LNX2(-3)	-0.33435	0.157303	-2.12554	0.0869
LNX3	1.579893	0.226711	6.968744	0.0009
LNX3(-1)	-0.33487	0.123265	-2.71664	0.0419
LNX3(-2)	1.054746	0.195224	5.402741	0.0029
LNX3(-3)	0.781693	0.161524	4.839496	0.0047
LNX4	-0.93373	0.195025	-4.78774	0.0049
LNX4(-1)	-0.48074	0.112127	-4.28745	0.0078
LNX4(-2)	-0.56402	0.147755	-3.81729	0.0124
LNX4(-3)	0.180632	0.092735	1.94783	0.1090
C	29.73636	1.815392	16.38013	0.0000
R-squared	0.998565	Mean dependent var		10.83076
Adjusted R-squared	0.991966	S.D. dependent var		0.528108
S.E. of regression	0.047335	Akaike info criterion		-3.36583
Sum squared resid	0.011203	Schwarz criterion		-2.23427
Log likelihood	72.80448	Hannan-Quinn criter.		-3.01144
F-statistic	151.3179	Durbin-Watson stat		2.544434
Prob(F-statistic)	0.000012			

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results of the (ARDL) model.

Source: Prepared by the researcher based on the outputs of the (Eviews12) program.

Estimation of factors affecting individual consumption of fish meat in Salah al-Din Governorate

In this paragraph, a regression model is built for the dependent variable (the quantity of fish consumed monthly) on the independent variables (the quantity of chicken consumed monthly, the quantity of red meat consumed monthly, the price of one kilogram of fish, the price of one kilogram of chicken, one kilogram of red meat, the number of family members, and the monthly income), where the analysis will be done using the multiple linear regression model, Because of the presence of these outliers, the Robust Least Squares (RLS) method was used instead of the regular least squares method.

Where we notice from the table that the linear regression model is significant, and this is clear from the P-Value value, as its value is less than the significance level of 0.05, and it is clear from the value of the coefficient of determination that it is significantly high compared to other models estimated using the ordinary least squares (OLS) method, as it equals 71.95% according to the corrected coefficient of determination and 86.98% according to the coefficient of determination proposed by (Renaud and Victoria-Feser, 2010), which the researchers confirmed in their research is a better measure than the corrected coefficient of determination, and this means that the independent variables explain 87% of the changes that occur in the dependent variable, as shown in Table (3) the value of the coefficients and the extent of their impact on the independent variable through the following interpretation.

C represents the constant, and it expresses the expected value Y, which represents (the amount of fish consumed per month) when all independent variables (x1) to (x7) are equal to zero, where the negative sign -3.027 indicates Y has a relatively negative value when there is no effect from other variables, and the negative signs of the coefficients mean that there is an inverse relationship between the independent variable and the dependent variable. In other words, an increase in the independent variable leads to a decrease in Y while positive coefficients indicate a positive relationship whereby an increase in the independent variable leads to an increase in the quantity consumed.

X1 represents the quantity of chicken consumed monthly with a coefficient of (-0.0387) indicating that every one-unit increase in X1 leads to a decrease in Y by 0.0387, provided that other variables remain constant while the statistical significance p (0.0468) indicates that the effect is statistically significant but not very strong, which may mean that X1 has a weak but possible inverse relationship with Y .

X2 represents the quantity of red meat consumed monthly with a coefficient of (-0.2001) where the negative sign indicates a strong inverse relationship between X2 and Y, which means that when X2 increases, Y decreases significantly i.e. every one-unit increase in X2 decreases Y relatively significantly by 0.2001. This makes X2 one of the most influential factors and the strong statistical significance (p-value less than 0.0001) means that this effect is very reliable.

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X3 represents the price of one kilogram of fish with a coefficient of (-1.4505) which indicates a very small effect, meaning that a change in X3 does not cause any noticeable change in Y, while the p-value (0.8582) was very high.

X4 represents the price of one kilogram of chicken with a coefficient of (0.000352), which means that there is a direct relationship and that every one-unit increase in X4 leads to a very small increase in Y by 0.000352. While the p-value of statistical significance (0.0027) indicates that the effect is statistically significant, although small.

X5 represents the price of one kilogram of red meat with a coefficient of (0.000369) which means that every one-unit increase in X5 leads to a slight increase in Y by 0.000369 where the effect was small, but very statistically significant (0.0001) p.

Table (2) Results of Variable Analysis

Variable	Coefficients	R^2_n statistic	P-Value	Adjusted R2	Adjusted R_W^2
C	-3.02745	2294.955	0.0000	71.95%	86.98%
X1	-0.038742				
X2	-0.20007				
X3	-0.0000145				
X4	0.000352				
X5	0.000369				
X6	0.030679				
X7	0.00000155				

every one-unit increase in X6 raises Y by 0.0307 although the effect seems larger than the effects of X4 and X5, it is not statistically significant (p = 0.3137.(

X7 represents the monthly income with a coefficient of (1.5506) where the effect of X7 was very small, but very statistically significant (0.0001) p. This means that small changes in X7 can be slightly related to Y.

Source: Prepared by the researcher based on the outputs of the (Eviews12) program.

X6 represents the number of family members with a coefficient of (0.0307) which indicates that every one-unit increase in X6 raises Y by 0.0307 although the effect seems larger than the effects of X4 and X5, it is not statistically significant (p = 0.3137.(

X7 represents the monthly income with a coefficient of (1.5506) where the effect of X7 was very small, but very statistically significant (0.0001) p. This means that small changes in X7 can be slightly related to Y.

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Conclusions

-1

The study showed that the average annual fish production in Iraq during the period from (1990) to (2022) amounted to about (51540.27) tons, with an annual growth rate of (0.048%). As for the growth rate of fish imports, it reached (0.160%) annually, which means that the quantity of imported fish is increasing by (16%) annually. As for the average quantity of fish meat available for consumption, it amounted to about (53804) tons annually during the same period, with an annual growth rate of (0.050%), which means that the quantity available for consumption increases by (5%) annually. The average annual per capita share of fish meat also amounted to (1.73) kg. Regarding animal protein, calories and fats in fish meat, the average annual per capita share of protein reached (0.44071) kg, while the average calories reached (250.06) calories, while the average per capita share of fat reached (0.138) kg.

-2The fluctuation in the average per capita share of fish meat consumption according to local production and imports on the one hand and the increase in population size on the other hand.

-3The negative sign for fish meat prices confirms the inverse relationship between the price of the commodity and the quantity demanded of it, i.e. the lower the price, the higher the demand for fish meat.

-4The positive sign for the prices of alternative commodities (red meat and poultry meat) indicates that the higher their prices, the higher the demand for fish meat.

-5The income elasticity of demand for the required quantity and the average per capita consumption of fish meat reached (0.612, 0.479) respectively, where the elasticity coefficient was greater than zero and less than one, which means that the commodity is necessary (inelastic) and the level of satisfaction is appropriate for these commodities, while the income elasticity of demand for protein, calories and fat reached (0.859, 1.23, 0.472) respectively.

-6The predicted data indicate a continuous growth in demand for fish meat with a rise in prices and an increase in income, which reflects sustainable economic growth. If these increases continue in parallel, inflation in food prices may not significantly affect consumption.

-7The required and expected quantities for the years (2023-2035) amounted to approximately (105, 108, 110, 113, 115, 118, 123, 126, 128, 131, 134, 136) thousand tons annually, respectively.

In the cross section

-1The relationship was inverse between the quantity of fish consumed on the one hand (fish price, quantity of chicken consumed, quantity of red meat consumed) on the other hand, while the relationship was directly proportional to each of the price of one kilogram of chicken, the price of one kilogram of red meat, the number of family members, and the monthly income.(

-2The income elasticity of the quantities of fish consumed reached (0.43), which means that it is considered a necessary commodity and the level of satisfaction from this commodity is appropriate.

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Recommendations

-1Paying attention to the fish production sector and working to provide all possible means to develop production and increase the quantities available for fish consumption in a manner that matches the increase in population.

-2Granting agricultural loans and supporting the necessary requirements to increase fish production in addition to facilitating the conditions for granting licenses to new producers at the country and governorate levels.

-3Activating the advisory role and directing scientific research and coordinating efforts and working to spread awareness of the importance of the animal production sector in general and the fish production sector in particular as a sustainable national wealth.

-4Following serious development plans and working to direct local investments towards the production of competitive and alternative goods in a balanced manner to meet different consumer patterns.

-5Activating the government role in determining price levels for animal meat in general and fish meat in particular according to scientific foundations and rules that suit the nature of the studied goods and in a manner that makes prices rewarding to producers and at the same time does not constitute a burden on consumers.

-6The necessity of increasing interest in scientific research and studying the elasticities of income demand, which helps to provide clear pictures of the extent of development progress in addition to knowing the level of individual welfare in the country.

-7Increasing production, economic and consumer efficiency in Salah al-Din Governorate through a comprehensive study of the fish market and identifying the necessary needs and requirements and working to meet them, as well as identifying obstacles and addressing them in a way that achieves consumer benefits for the governorate's residents.

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