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Analytical Analysis of the Egyptian Foreign Fish Trade

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ABSTRACT

The research aims to study the interrelationship between fish production, consumption and imports through a three-stage standard model to show the most important factors affecting the quantity consumed, produced and imported of fish for the period (2000-2021). Although Egypt is surrounded by the Mediterranean and the Red Sea and has the Nile River and lakes, the quantity produced is about 1217 thousand tons, while the amount consumed is about 1532 thousand tons, and the Egyptian fish gap is estimated at 215 thousand tons, and the amount of fish exports is 42.7 thousand tons compared to imports of 250.3 thousand tons and knead for the average period (2000-2021).and by using the simultaneous three-stage equations, it is shown that the most important factors affecting the quantity consumed are the quantity produced, the average real per capita income, and the direct relationship. Imports by increasing the quantity consumed and the population, we will increase the amount of low-priced fish imports that are in line with the income level of Egyptians .As for the fish gap in Egypt, it may reach about 527.8 thousand tons in 2025, and it will increase until it reaches about 601.4 thousand tons in 2030, which will be covered by low-value fish imports, as fish imports in 2025 will reach about 554.6 thousand tons, and the increase will continue. In the imported quantity, it will reach about 668 thousand tons in 2030. On the other hand, Egypt exports fish of high value and high quality. The quantity in 2025 is estimated at about 47.3 thousand tons. The exported quantity of Egyptian fish of high value and quality increases, reaching in 2030 to about 57 thousand tons, the study recommends increasing Egyptian fish production by making optimal use of the vast water bodies of the seas, lakes and rivers, then paying attention to increasing fish farming of high-value fish and in the same demand in foreign markets, in addition to trying to bridge the gap by decreasing the quantity imported with increasing the amount of fish exports so that the fish trade balance can be in Egypt's interest.

Keywords: Production, consumption, multi-equation models, economic.

1. Introduction

A statistical estimation of the econometric model of fish demand and supply variables includes during the period (2000-2021) using multi-equation models. Since economic phenomena are often not so simple as to be described and analyzed through a single equation, there has always been a need to describe economic phenomena as complex and containing many overlapping economic relationships. And, on the other hand, multi-equivalent models reflect the interchangeable effect between the models dependent and autonomous variables, it is not the case in single-equation models because it is concerned only with the one-way effect from the independent to the subordinate and does not demonstrate the reverse effect. Consequently, the study statistically assessed the ingredients of food demand and supply for food groups using multi-equation models.

Estimating the standard multi-equation economic model is relatively more difficult compared to those single equation models because of the many stages and main steps needed from the characterization of economic relations (according to economic logic) and then identify the most important variables to be used according to the matrix of simple correlation transactions and then

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determine the best mathematical images that will be used in the statistical analysis and after the finalization of the model transactions, The degree of identification of the model is determined and then the most appropriate methods of estimation are determined. In this regard, the study used the overall image and the medium image of another, as well as the logarithmic images of each. All these variations and alignment between the variables of the model used under certain criteria were economic logic, statistical morale and, as far as possible, econometric problems to ensure that the estimations obtained were as accurate as possible and could be relied upon for later predicting. In order to study an econometric model of the fish market in Egypt, the general timeline of the internal variables of the model must be shown. The amount produced by fish in Egypt is estimated at about 1666 thousand tons, from two main sources, such as the seas, the Nile River and lakes, which produce about 455 thousand tons. Industrial sources, such as fish farms, which produce about 1443.2 thousand tons, the amount consumed is approximately 2108 thousand tons and thus the fish gap is estimated at 440 thousand tons, which is imported from abroad an estimated of 426 2 thousand tons for the average period (2017-2021).

Research problem

Although Egypt possesses water levels of up to 13 million acres, its production is insufficient for its consumer needs. Egypt suffers from a deficit in the fish trade balance and a decrease in the rate of export coverage for imports. The value of the fish trade balance deficit is $593.2 million, representing about 18.3% of the average trade balance deficit of about $3.24 billion. (2015-2021) In addition to confronting the difficulty of fishermen in marketing their production at home because of the greed of intermediaries, the difficulty of financing for fishermen and the weakness of marketing services.

The Aim of the Study

The research aims to examine the interrelationship between production, consumption and fish imports through a three-phase standard model to show the most important factors affecting the quantity consumed, produced and imported fish for the period (2000-2021).

Data Sources

In achieving its objectives, the study relied on a quantitative and descriptive data analysis method, such as statistical analysis using simple regression equations, by examining the overall direction of both production, consumption and fishery imports, as well as the estimation of factors affecting the quantity consumed and the quantity of fish imports using the German equations of a three-stage model for the period (2000-2021).

On the sources of access to research data, published and unpublished secondary data were obtained from a number of entities, including the Central Agency for Public Mobilization and Statistics, the Ministry of Agriculture and Land Reclamation, the Central Department of Agricultural Economy and the General Authority for Fisheries Development.

Results and Discussion

Estimating the overall equations of the quantity of fish produced in the Egyptian market shows the annual significance increase statistically at a rate of 52.6 thousand tons representing about 4.6% of the average production amount of 1217 thousand tons for the average period (2000-2021) The determination factor is about 0.97 and the value (F) is about 757.8 which confirms the significance of the estimated model. The State is currently interested in fish farms, which are estimated to produce about 79.2% of total fish production in Egypt. The rate of annual statistically significance increase in the amount produced from fish farms is about 64.9 thousand tons, representing about 5.7% from the average production of about 1066 thousand tons for the study period, the coefficient of determination is 0.83 and the value (F) is about 74.8, which confirms the significance of the estimated model.

The annual increase in the amount of fish consumed in the Egyptian market is about 67.3 thousand, representing about 4.4% of its average consumption of about 1532 thousand tons for the study period. The determination factor is 0.95 and the value (F) is about 475. The Gap fish The rate of annual statistically significance increase in the amount fish gap from fish farms is about 14.7 thousand tons, representing about 4.7% from the average fish gap of about 315 thousand tons for the study period, the coefficient of determination is 0.53 and the value (F) is about 22.6 which confirms the significance of the estimated model.

As for the quantity of Egyptian fish exports, this has been shown to be small, accounting for about 6.4% of the amount of fish imports for the period of the study. This is due to the fact that Egyptian exports of high-value fish required in European markets. The rate of increase in the quantity of Egyptian fish exports is about 1.9 tons, representing about 4.6% of the average amount of Egyptian fish exports of about 42.7 tons as for the coefficient of determination, it reached about 0.28, and its value (F) was estimated at 7.9, which confirms the significance of the estimated model. The average annual statistically significant increase of the imported quantity is about 11.3 thousand tons, which represents about 4.2% of the average imported quantity of fish, which is about 269.3 thousand tons, and the coefficient of determination is about 0.45 and the value of (F) is about 16.5 for the period (2000-2021), as shown in the Table (1).

The available data on Egyptian exports and imports of fish showed that the quality of exported fish is the expensive and good quality species that are preferred in foreign markets. As for the imported quantities, they are fish of cheap price or of low value, which are compatible with the possibility of the Egyptian consumer with low incomes.

Table 1: Time series analysis equations of production, production of fish farms, consumption and quantity of fish imports during the period (2000-2021).

Indicators	Equation	R2	Average	Change rate%
Production quantity(Thousand tons)	Y^ =611.8+52.6Xi (27.5)**	0.97	1217	4.3
Frames production quantity (Thousand tons)	Y^ = 481.8 + 64.9 Xi (8.7-)**	0.83	1066	7.6
consumption quantity (Thousand tons)	Y^ = 757 + 67.3 Xi (17.9)**	0.95	1532	4.4
Fish gap (Thousand tons)	Y^= 145.3 +14.7 Xi (4.8)* *	0.53	215	4.7
Exports quantity (Thousand tons)	Y^ =1.5 +1.9Xi (2.8)* *	0.28	42.7	4.6
Imports quantity (Thousand tons)	Y^ = 139.6 +11.3 Xi (4.1)* *	0.30	250.3	3.47

Where:
Y^ indicates the estimated value of the dependent variable,
Xi denotes the time component as an independent variable where i (1, 2, 3, 4.....22). ** Significant at 1% level * Significant at 5% level.
Source:
1- The Central Agency for Public Mobilization and Statistics, the annual bulletin of the movement of production and foreign trade, and the available consumption of agricultural commodities, in different numbers.
2- Central Agency for Public Mobilization and Statistics Website. WWW.Cpamas.gov.eg
3- Ministry of Agriculture - Central Administration of Agricultural Economy - Food Balance Bulletin - Various Issues
4- Ministry of Agriculture and Land Reclamation, General Authority for Fisheries Development, fish production statistics, various numbers

Description of the standard model of the fish consumption in Egypt

The model consists of three structural plus definition equations

Equation of local consumption of fish: It was assumed that the most important factors affecting the consumed quantity of fish are the quantity produced and the real domestic price of tilapia on the basis that the majority of, and the real per capita income.

Equation of local production of fish: It was assumed that the most important factors affecting the quantity of fish produced are the quantity of fish consumed, the quantity of fish imports, and the quantity of fish produced from fish farms.

Equation of fish imports: It was assumed that the most important factors affecting the quantity of fish imports are the consumption amount of fish, the import price of fish and the population.

Definition equation: in which the consumed quantity of fish = the quantity produced locally and the quantity of imports.

The model consists of Structural-Form Equations that measure the direct effect of the explanatory variable on the dependent variable, while the reduction equations measure the direct and indirect total

effect of the specified variables on the internal variables, which cannot be clarified in the structural formula of the model, and the following is the mathematical description of the behavioral and definition equations of the model.

Consumption Equation
$QCOt = \alpha + \beta 2QPOt + \beta 5RPOt + \beta 8INt$

Production Equation:
$QPOt = \alpha + \beta 1QCO\ t - \beta 3\ QIOt + \beta 4Qpft$

Import Equation:
$QIOt = \alpha + \beta 1\ QCOt + \beta 6Ipot + \beta 7PT$

As for the mathematical description of the definition equation, it is as follows:

Definitional Equation
$QCOt = QPOt + QIOt$

Where:
QCOt = quantity of fish consumed in thousand tons per year t
QPOt = Quantity of fish produced - thousand tons per year t
QIOt = quantity of fish imports in thousand tons per year t
IPOXt = fish import price - in dollars per ton per year t
RPOt = real domestic price of tilapia in pounds per ton per year t
Pt = Population in million people per year t
QPF = Quantity of fish production from fish farms in the year t
INt = real per capita income in pounds per year t

At the beginning of selecting the model, the extent to which the independent factors relate to each other, as well as to the dependent factor, was estimated using the correlation matrix to eliminate the problems of estimation. Next, the three-stage simultaneous model was studied using more than one attempt to reach the estimate, i.e. the influencing and affected factors, which is known as the mutual influence, i.e. the relationship between The dependent factor, the independent factors, and the opposite, and access to the best mathematical images. The Durban-Watson test has been performed, and the existing equations are the results of the estimation using a statistical program on the computer STATA.

Distinguishing or defining behavioral equations Identification

The behavioral equations included in the structural form of the red meat market model were distinguished by applying the order condition and the rank condition. It has been found that non-zero determinants can be obtained for each behavioral equation in the model, and that the total number of endogenous variables and exogenous variables of the proposed model (K) minus the number of internal and external variables in the equation in the definition (L) is greater than or equal to the number of internal variables (M) minus one, that is $(M - 1) \geq (K - L)$ and then the behavioral equations fulfill the conditions of rank or degree, which are over-identified equations, which means the possibility of obtaining a unique solution for the structural parameters of the proposed model for each of the production, consumption and imports of red meat, and therefore the best way to estimate in this case is the Three Stages Least Squares Method (3SLS) This method gives more efficient estimates of a single parameter value, although the estimate remains biased for small samples.

Interpretation of the results of the Egyptian meat market model (2000-2021)
Consumed Quantity Equation

It was found from Table (2) that by studying the relationship between the consumed quantity of fish and the locally produced quantity in thousand tons the real local price of red meat in pounds/kilograms, real per capita income in pounds/year by using the three-stage simultaneous equations, it became clear that the most important factors affecting the consumed quantity of fish are

the produced quantity of fish the consumed quantity increases, meaning that each of them increases by one unit, the consumed quantity increases by about 1.5 thousand tons , while it was found that there was an inverse relationship between the consumed quantity of fish and real per capita income in pounds per year , the consumed quantity increases, meaning that each of increases by one unit, the consumed quantity increases by about 0.006 thousand tons, and the coefficient of determination (R2) is estimated at about 0.96, meaning that 96% of the changes in the quantity consumed of fish are due to the quantity of produced of fish, the real price of fishThe calculated (F) value is 537.3, which confirms the significance of the estimated model.

Produced Quantity Equation:

It is clear from Table (2) that the study of the relationship between the produced quantity of fish in Egypt, and the factors affecting it, namely, the consumed quantity, the imported quantity of fish, the, and the quantity produced from fish farms, where the direct relationship between the produced quantity and the consumed quantity was confirmed. That is, by increasing the consumed quantity by one unit of fish, the produced quantity from it increases by about 0.445 thousand tons , while the inverse relationship between the produced quantity and the imported quantity of fish became clear, as an increase in the imported quantity of fish by one unit leads to a increase in the produced quantity of fish by about 0.427 thousand tons, That is, by increasing the produced quantity one unit of fish, the quantity produced from fish farms, it increases by about 0.240 thousand tons , and the coefficient of determination (R2) is estimated at about 0.97, meaning that 97% of the changes in the produced quantity are due to the consumed quantity, the imported quantity of fish, the, and the quantity produced from fish farms, and the calculated (F) value amounted to 802.7, which confirms the significance of the estimated model.

Table 2: Functions of fish in the Egyptian market during the period (2000-2021)

	Equation	R2	F
Consumption Equation	QCOt =-179.4+1.54QPOt – 2.88RPOt+0.006INt (.9.29) ** (-0.48) (2.59)	0.96	537.3
Production Equation	QPOt =179.5+0.445OCOt+ 0. 427QIOt +0.240QPft (4.23)** (2.03) * (2.6)**	0.97	802.8
Import Equation	QIOt = -1253.9+0.401QCOt-7.02IPOt20.28.0PTt (1.895)** (-..1683) (2.81)**	0.50	29.26

Source: Results of the Egyptian fish market model in the appendix.

Imported Quantity Equation

It is clear from Table (2) that by studying the relationship between the imported quantity of fish, and both the consumed quantity of fish, the import fish price and the population, it was found There is a direct relationship between the number of population and the imported quantity of fish, meaning that by increasing the population by one unit, the quantity of imports increases by about 20,22 thousand tons ,it was found that there is a direct relationship between the consumed quantity of fish and the imported quantity of fish, meaning that by increasing the consumed quantity of fish by one unit, the imported quantity of fish increases by about 0.426 thousand tons .The coefficient of determination (R2)is estimated at 0.50, meaning that 50% of the changes in the imported quantity of fish are due to the the consumed quantity and the population, the calculated (F) value is 29.26, which confirms the significance of the estimated model.

To forecast the quantity of fish produced in Egypt, it is clear from Table (3) and the graphic figure that the quantity produced will reach about 1909.7 thousand tons in 2025 and will continue to increase until it reaches about 2146.9 tons in 2030. The Egyptian society is interested in increasing fish production through fish farming. It is estimated The quantity produced from fish farms in Table (4) in 2025 is about 1718 thousand tons, and it continues to increase until the production of fish farms in 2030 reaches about 1996 thousand tons. However, the population increase devours everything that is produced, so the consumption of fish in 2025 reaches about 2507.9 thousand tons. In 2030, it will reach about 2844.6 thousand tons, as shown in Table (5).

Table (3) and the chart shows the forecast of the quantity of fish produced in Egypt for the period (2022-2030)

Table 3: The forecast of the quantity of fish produced in Egypt for the period (2022-2030)

Period	QPO Forecast	Lower 95.0% Limit	Upper 95.0% Limit
2022	1767.43	1671.65	1863.21
2023	1814.86	1679.41	1950.31
2024	1862.29	1696.39	2028.18
2025	1909.71	1718.16	2101.27
2026	1957.14	1742.97	2171.31
2027	2004.57	1769.96	2239.18
2028	2052.0	1798.59	2305.41
2029	2099.43	1828.53	2370.33
2030	2146.86	1859.52	2434.19

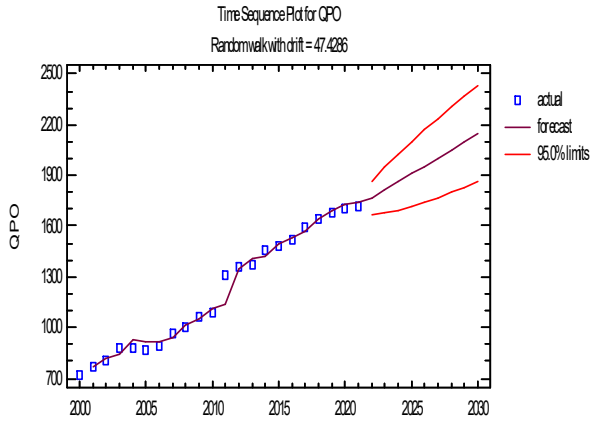


Table (4) and the graphic figure shows the forecast of the quantity produced from fish farming in Egypt for the period (2022-2030)

Table 4: The forecast of the quantity produced from fish farming in Egypt for the period (2022-2030)

Period	ó QPF Forecast	Lower 95.0% Limit	Upper 95.0% Limit
2022	1550.76	1428.59	1672.93
2023	1606.52	1433.75	1779.3
2024	1662.29	1450.68	1873.89
2025	1718.05	1473.71	1962.38
2026	1773.81	1500.63	2046.99
2027	1829.57	1530.32	2128.82
2028	1885.33	1562.11	2208.56
2029	1941.1	1595.55	2286.64
2030	1996.86	1630.35	2363.36

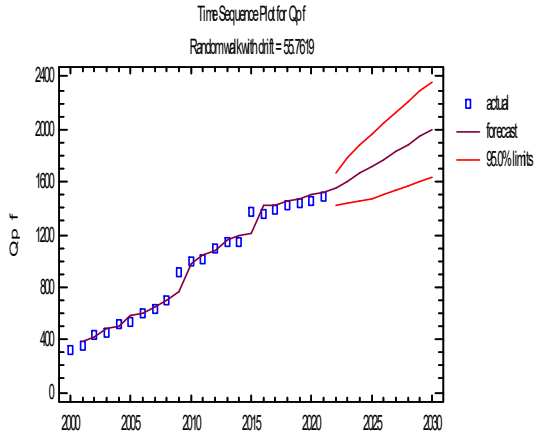
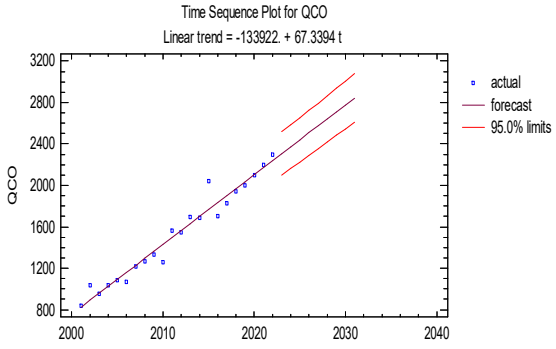


Table (5) and the chart shows the forecast of the amount of fish consumed in Egypt for the period (2022-2030)

Table 5: The forecast of the amount of fish consumed in Egypt for the period (2022-2030)

Period	QCO Forecast	Lower 95.0% Limit	Upper 95.0% Limit
2022	2305.95	2096.27	2515.62
2023	2373.29	2161.25	2585.33
2024	2440.63	2226.05	2655.2
2025	2507.97	2290.7	2725.23
2026	2575.31	2355.19	2795.42
2027	2642.64	2419.53	2865.76
2028	2709.98	2483.72	2936.25
2029	2777.32	2547.78	3006.87
2030	2844.66	2611.71	3077.62



As for the fish gap in Egypt, as in Table (6), it may reach about 527.8 thousand tons in 2025, and it will increase until it reaches about 601.4 thousand tons in 2030, which will be covered by low-value

fish imports, as fish imports in 2025 will reach about 554.6 thousand tons, and the increase will continue. In the imported quantity, it will reach about 668 thousand tons in 2030. On the other hand, Egypt exports fish of high value and high quality. The quantity in 2025 is estimated at about 47.3 thousand tons. The exported quantity of Egyptian fish of high value and quality increases, reaching in 2030 to about 57 thousand tons, as in Table (6).

Table (6) and the graphic figure shows the prediction of the amount of fish gap in Egypt for the period (2022-2030)

Table 6: The prediction of the amount of fish gap in Egypt for the period (2022-2030)

Period	GAP Forecast	Lower 95.0% Limit	Upper 95.0% Limit
2022	483.714	273.781	693.648
2023	498.429	286.127	710.73
2024	513.143	298.306	727.98
2025	527.857	310.323	745.392
2026	542.571	322.183	762.96
2027	557.286	333.894	780.678
2028	572.0	345.46	798.54
2029	586.714	356.888	816.54
2030	601.429	368.184	834.673

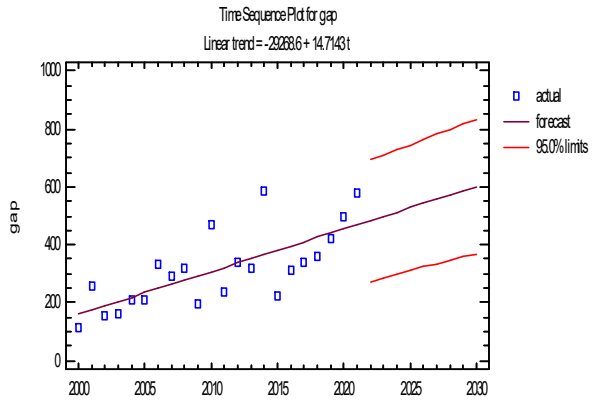


Table (7) and the chart shows the forecast of the exported quantity of fish in Egypt for the period (2022-2030)

Table 7: The forecast of the exported quantity of fish in Egypt for the period (2022-2030)

Period	Export Forecast	Lower 95.0% Limit	Upper 95.0% Limit
23	43.364	-3.7769	90.5048
24	45.3141	-2.35845	92.9866
25	47.2642	-0.977688	95.5061
26	49.2144	0.366696	98.062
27	51.1645	1.67604	100.653
28	53.1146	2.95168	103.278
29	55.0648	4.19497	105.935
30	57.0149	5.40723	108.623

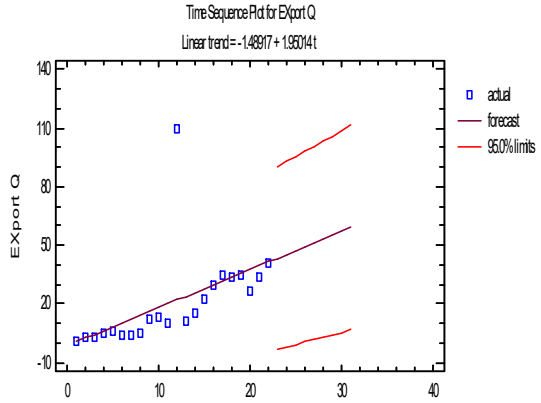
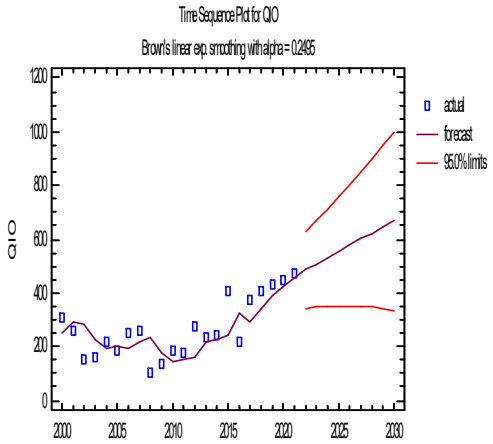


Table (8) and the graphic figure shows the forecast of the imported quantity of fish in Egypt for the period (2022-2030)

Table 8: The forecast of the imported quantity of fish in Egypt for the period (2022-2030)

Period	QIO Forecast	Lower 95.0% Limit	Upper 95.0% Limit
2022	486.498	341.573	631.423
2023	509.219	347.252	671.185
2024	531.939	350.695	713.183
2025	554.659	352.139	757.179
2026	577.38	351.789	802.97
2027	600.1	349.815	850.385
2028	622.82	346.358	899.283
2029	645.541	341.533	949.548
2030	668.261	335.436	1001.09



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Appendix

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import excel "C:\Users\PC\Desktop\fish.xls", sheet firs trow
reg3 (QCO = QPO RPO IN) (QPO = QCO QIO Qpf) (QIO = QCO IPO PT)
Three-stage least-squares regression
------------------------------------------------------------------------------
Equation  Obs Parms RMSE "R-sq" chi2 P
------------------------------------------------------------------------------
QCO   22 3 84.30845 0.9626 537.32 0.0000
QPO   22 3 58.65972 0.9699 802.76 0.0000
QIO   22 3 75.4904 0.4972 29.26 0.0000
------------------------------------------------------------------------------
------------------------------------------------------------------------------
  | Coef. Std. Err. z P>|z| [95% Conf. Interval]
-------------+----------------------------------------------------------------
 QPO | 1.541243 .1659155 9.29 0.000 1.216055 1.866431
QCO    RPO | -2.881673 5.964123 -0.48 0.629 -14.57114 8.807794
  IN | .0066229 .0025601 2.59 0.010 .0116407 .0016052
 _cons | -179.4447 105.4213 -1.70 0.089 -386.0667 27.17727
-------------+---------------------------------------------------------------- .4456918
 QCO | .4456918 156 4.23 0.000 .2392771 .6521066
|QPO    QIO | .4274434 .2108094 2.03 0.043 .0142645 .8406223
 Qpf | .2400211 .0924114 2.60 0.009 .058898 .4211441
 _cons | 179.5488 72.97522 2.46 0.014 36.51997 322.5776
-------------+----------------------------------------------------------------  |
 - QCO.4262692 .2256031 1.89 0.059 -.868443 .0159047
QIO    IPO | -7.018716 4.18143 -1.68 0.093 -15.21417 1.176737
 PT | 28.00881 9.975594 2.81 0.005 8.457006 47.56061
 _cons | -1253.947 459.8929 -2.73 0.006 -2155.32 -352.5731
------------------------------------------------------------------------------
Endogenous variables: QCO QPO QIO
Exogenous variables: RPO IN Qpf IPO PT
------------------------------------------------------------------------------
```