T.C.

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STATISTICS

ECONOMETRIC ANALYSIS OF MEAT PRICES IN TURKEY

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CONTENTS

Abstract

Beef prices in Turkey is increased for long time. That outcome is caused to find out the reasons which are variables related to beef prices. The target of this study is to clarify relationship of beef price and its independent variables with a regression model. Data analyzed with EViews 12 SV.

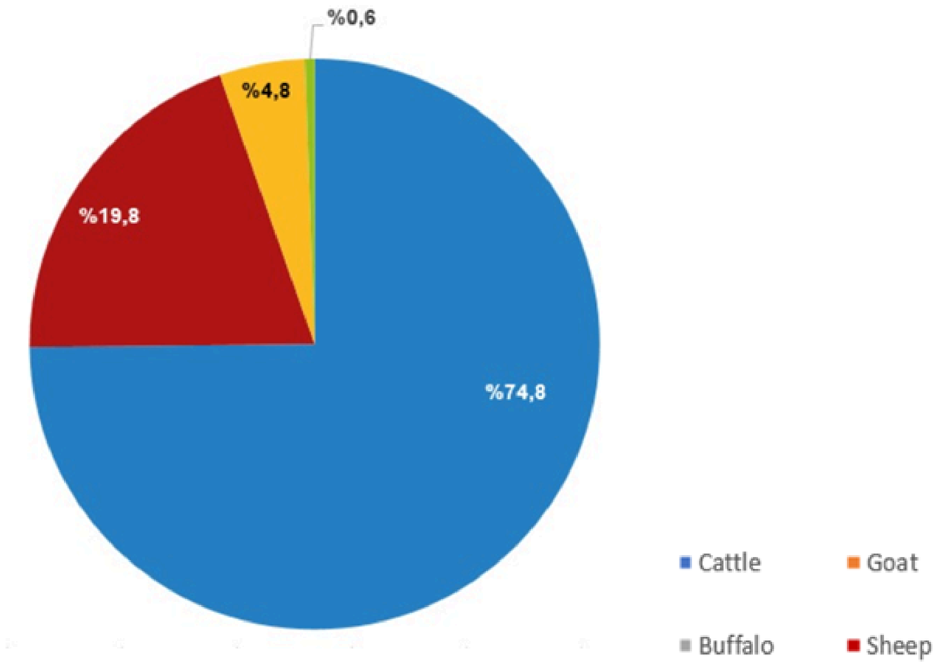
Introduction

According to the World Health Organization, a healthy person should consume 1 g of protein per kilogram of body weight per day, and 50% of this should be of animal origin. The amount of animal protein per child is considered as a criterion in the development systems of countries, and countries with a daily consumption of protein of more than 40% are considered as developed countries.

The demand and welfare level brought by the increasing population in Turkey has made it necessary to increase meat production. The recent increase in food prices has also led to high inflation. According to TUIK data, red meat production increased by 9.3% in 2021 and reached 1 million 952 thousand 38 tons. It is obtained by multiplying the "number of animals slaughtered for import" by the average carcass weight. These developments have revealed the need to determine the status of the factors affecting beef prices, which show a constantly increasing trend. Accordingly, red meat production, which was 1 million 785 thousand 952 tons in 2020, was estimated to be 1 million 952 thousand 38 tons in 2021 with an increase of 9.3%. In this context, beef production increased by 8.9% compared to the previous year to 1 million 460 thousand 719 tons, sheep meat production increased by 11.7% to 385 thousand 933 tons, goat meat production increased by 4.5% to 94 thousand 555 tons, buffalo meat production on the other hand, increased by 28.6% and became 10 thousand 831 tons.

This project includes the prices of beef sold in Turkey between 2002 and 2021. In addition, we have 4 different independent variables: the amount of slaughtered cattle, the amount of meat produced from the cattle, the amount of feed (tons) and inflation.

Distribution of Red Meat Production by Animal Species, 2021



Animal Nutrition Practices of Enterprises In animal production enterprises, animals must be fed with an appropriate ration in order to obtain the desired yield. The use of high quality roughage and mixed feed and the improvement of the environmental conditions of the animals are one of the basic conditions for livestock efficiency. Expenditures related to food in enterprises constitute 60-70% of total operating expenses. Therefore, it is very important for the future of animal husbandry to research and develop new, cheap and high quality feed sources.

It is thought that the enterprises should care about the use of concentrated feed in order to provide more milk production per animal. It is known that the various nutrient needs of high milk yielding cows cannot be met with roughage and dense feeds rich in nutrients and high digestibility are needed (Sevgican, 1996) and for the profitability of dairy cattle farms, animals should be fed with cost-effective, nutrient-balanced and adequate feed. is a fact (Görgülü, 2002).

What is Econometrics?

Economists connect the amount individuals spend on consumer goods to disposable income and wealth, and expect consumption to increase as disposable income and wealth increase (that is, the relationship is positive).

The objective of econometrics is to convert qualitative statements (such as “the relationship between two or more variables is positive”) into quantitative statements (such as “consumption expenditure increases by 95 cents for every one dollar increase in disposable income”).

Instead, econometricians estimate economic relationships using data generated by a complex system of related equations, in which all variables may change at the same time.

The main tool of econometrics is the linear multiple regression model, which provides a formal approach to estimating how a change in one economic variable, the explanatory variable, affects the variable being explained, the dependent variable—taking into account the impact of all the other determinants of the dependent variable.   This qualification is important because a regression seeks to estimate the marginal impact of a particular explanatory variable after taking into account the impact of the other explanatory variables in the model (see “Regressions: Why Are Economists Obsessed with Them?” ... For example, the model may try to isolate the effect of a 1 percentage point increase in taxes on average household consumption expenditure, holding constant other determinants of consumption, such as pretax income, wealth, and interest rates.
By far the most common approach is to assume linearity—meaning that any change in an explanatory variable will always produce the same change in the dependent variable (that is, a straight-line relationship).

Economists usually assume that this “error” term averages to zero and is unpredictable, simply to be consistent with the premise that the statistical model accounts for all the important explanatory variables.

For example, are the signs of the estimated parameters that connect the dependent variable to the explanatory variables consistent with the predictions of the underlying economic theory?

The main tool of the fourth stage is hypothesis testing, a formal statistical procedure during which the researcher makes a specific statement about the true value of an economic parameter, and a statistical test determines whether the estimated parameter is consistent with that hypothesis.

The empirical model may also be used to construct a way to forecast the dependent variable, potentially helping policymakers make decisions about changes in monetary and/or fiscal policy to keep the economy on an even keel.

Even though it is a science, with well-established rules and procedures for fitting models to economic data, in practice econometrics is an art that requires considerable judgment to obtain estimates useful for policymaking.

Methodology

The statistical method used to reveal the relationship between multiple independent variables in a large data pool in finance, investment, econometrics and similar disciplines with a dependent variable is called regression. While a so-called linear method is the most commonly used type of regression, there are many different types of regression that are used to build different models.The main purpose of using the regression method is to determine the correlation between the variables in a large data pool and more importantly to measure whether this correlation is statistically significant. In other words, the answer to the question of whether there is a relationship between the regression and the variables, and if there is, is it useful?

Multiple linear regression formula:

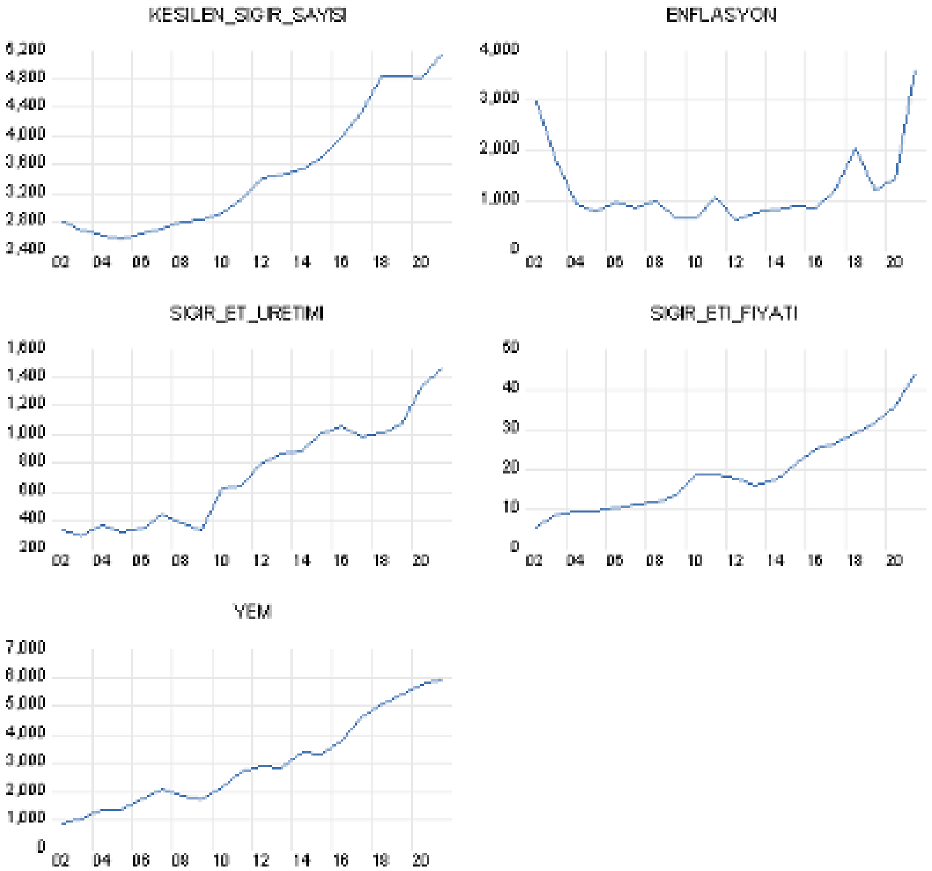
$$Y=\beta_1 + \beta_2 X_2 + \beta_3 X_3 +...+ \beta_k X_k + u$$

In the multiple regression model, the H_0 hypothesis is that all regression coefficients are equal.

H_0: $\beta_1 = \beta_2 =... = \beta_p$

H_1: at least one of them is different.

Graphical Analysis

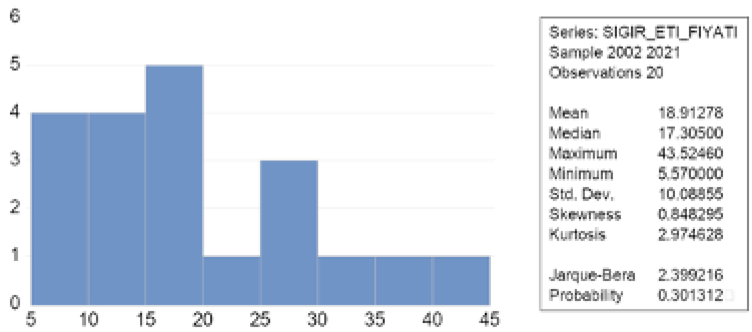


In the table above, the names of the variables we have discussed and what they have shown over the years.

	KESILEN_SI...	ENFLASYON	SIGIR__BES...	SIGIR_ET_U...	SIGIR_ETI_...
Mean	3486.822	1252.200	2957.496	726.5505	18.91278
Median	3274.169	948.5000	2686.728	722.1250	17.30500
Maximum	5134.441	3608.000	5961.009	1460.719	43.52460
Minimum	2558.207	616.0000	898.9440	290.4540	5.570000
Std. Dev.	879.5555	797.7748	1644.809	370.8358	10.08855
Skewness	0.660828	1.868621	0.608866	0.342200	0.848295
Kurtosis	1.983473	5.577750	2.038281	1.922633	2.974628
Jarque-Bera	2.316752	17.17648	1.906154	1.357602	2.399216
Probability	0.313996	0.000186	0.385553	0.507225	0.301312
Sum	69736.44	25044.00	56192.43	14531.01	378.2557
Sum Sq. Dev.	14698741	12092447	48697168	2612865.	1933.797
Observations	20	20	19	20	20

In the table above, there are mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera, Probability, sum, sum of square deviations and observations values of all variables. We will perform our analysis according to these values.

Is the Data Normally Distributed?



H_0: Errors are normally distributed.
H_1: Errors are not distributed normally.

Since the p value is less than 0.05, the H_0 hypothesis cannot be rejected. Also, since the Jargue-Bera value is less than 5.99, we can say that the errors are normally distributed.

ECONOMIC EVALUATION

Estimating Equations

$$Y_i^k = \alpha^k + \beta_1^k X_{i1}^k + \beta_2^k X_{i2}^k + \beta_3^k X_{i3}^k + \beta_3^k X_{i3}^k + \beta_4^k X_{i4}^k$$

Burada;

Y = Sığır Eti Üretim Fiyatı

X_1 = Enflasyon

X_2 = Kesilen Sığır Sayısı

X_3 = Sığır Besi Yem Tonu

X_4 = Sığır Eti Üretim Tonu

SET UP A MODEL

<table>
<tr><td></td><td></td><td colspan="2">X</td></tr>
<tr><td></td><td></td><td>X</td><td>$\log X$</td></tr>
<tr><td rowspan="2">Y</td><td>Y</td><td>Doğrusal
(dog-dog)
$Y = \alpha + \beta x + \varepsilon$</td><td>Doğrusal-log
(dog-log)
$Y = \alpha + \beta(\log x) + \varepsilon$</td></tr>
<tr><td>$\log Y$</td><td>Log-doğrusal
(log-dog)
$\log Y = \alpha + \beta x + \varepsilon$</td><td>Çift logaritmik
(log-log)
$\log Y = \alpha + \beta(\log x) + \varepsilon$</td></tr>
</table>

Log-Lin Model

Model like are called semilog models because only one variable (in this case the regressand) appears in the logarithmic form. For descriptive purposes a model in which the regressand is logarithmic will be called a log-lin model.

It is known as a growth model in econometrics.

$$Y_t = Y_0(1+r)^t$$

step 1

$$\ln Y_t = \ln Y_0 + t \ln(1+r)$$

Now letting

$$\beta_1 = \ln Y_0$$
$$\beta_2 = \ln(1+r)$$

We can write as

$$\ln Y_t = \beta_1 + \beta_2 t$$

Adding the disturbance term to we obtain

$$\ln Y_t = \beta_1 + \beta_2 t + u_t$$

Dependent Variable: LOG(SIGIR_ETI_FIYATI)
Method: Least Squares
Date: 01/03/23 Time: 20:07
Sample: 2002 2021
Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIGIR_ET_URETIMI__TON_	0.000367	0.000499	0.735694	0.4733
SIGIR__BESI_YEMI__TON_	-0.000269	0.000117	-2.297370	0.0364
ENFLASYON	-0.000244	7.80E-05	-3.123576	0.0070
KESILEN_SIGIR_SAYISI	0.001046	7.44E-05	14.05570	0.0000

R-squared	0.840711	Mean dependent var	2.783357
Adjusted R-squared	0.808853	S.D. dependent var	0.545805
S.E. of regression	0.238628	Akaike info criterion	0.156842
Sum squared resid	0.854150	Schwarz criterion	0.355672
Log likelihood	2.509998	Hannan-Quinn criter.	0.190492
Durbin-Watson stat	0.829974		

R^2 Analysis

$$r = \frac{N \Sigma xy - \Sigma x \Sigma y}{[[N \Sigma x^2 - (\Sigma x)^2]\ [N \Sigma y^2 - (\Sigma y)^2]]^{1/2}}$$

The more data points there are, the more R^2 of the higher the reliability.

The R^2 value of the explainable variation (SSR) as a ratio to total variation (SST) defined (R^2 = SSR / SST).

Both R^2 and the adjusted R^2 give you an idea of how many data points fall within the line of the regression equation. However, there is one main difference between R^2 and the adjusted R^2: R^2 assumes that every single variable explains the variation in the dependent variable. The adjusted R^2 tells you the percentage of variation explained by only the independent variables that actually affect the dependent variable.

In the log lin model, the rate of explaining the dependent variables of the independent variables is 84%.

In this table, we see the independent variables and some of their results. We want to normalize these values in order to process them. One way to do this is to take the logarithm of the variables.

Lin-Log Model

$$Y_i = \beta_1 + \beta_2 \ln X_i + u_i$$

For descriptive purposes we call such a model a lin–log model. Let us interpret the slope coefficient β_2

$$\beta_2 = \frac{\text{change in } Y}{\text{change in} \ln X} = \frac{\text{change in } Y}{\text{relative change in } X}$$

The second step follows from the fact that a change in the log of a number is a relative change.Again, using differential calculus, we have

$$\frac{dY}{dX} = \beta_2\left(\frac{1}{X}\right)$$

$$\beta_2 = \frac{dY}{\frac{dX}{X}} = (6.6.12)$$

Symbolically, we have

$$\beta_2 = \frac{\Delta Y}{\Delta X / X}$$

$$\Delta Y = \beta_2(\Delta X / X)$$

Dependent Variable: SIGIR_ETI_FIYATI
Method: Least Squares
Date: 01/03/23 Time: 20:36
Sample: 2002 2021
Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-61.09452	35.80930	-1.706108	0.1117
LNENFLASYON	4.653669	1.248047	3.728762	0.0025
LNKESILEN_SIGIR_SAYISI	1.862331	7.465343	0.249464	0.8069
LNSIGIR__BESI_YEMI__TON_	-2.893812	3.764789	-0.768652	0.4558
LNSIGIR_ET_URETIMI__TON_	0.035360	2.268346	0.015588	0.9878
LNSIGIR_ETI_FIYATI	19.54562	2.840398	6.881295	0.0000

R-squared	0.983453	Mean dependent var	18.59082
Adjusted R-squared	0.977088	S.D. dependent var	10.25889
S.E. of regression	1.552855	Akaike info criterion	3.970157
Sum squared resid	31.34766	Schwarz criterion	4.268401
Log likelihood	-31.71649	Hannan-Quinn criter.	4.020631
F-statistic	154.5236	Durbin-Watson stat	1.600127
Prob(F-statistic)	0.000000		

In the lin log model, the rate of explaining the dependent variables of the independent variables is 98%.

As you can see, we took the logarithm of the independent variables in the above table and the values changed accordingly. Now, the operations we will do on our data will give us more accurate results. This method is available in the system as "lin log". Let's also try the "log log" method.

Log-Log Model

Dependent Variable: LNSIGIR_ETI_FIYATI
Method: Least Squares
Date: 01/03/23 Time: 20:38
Sample: 2002 2021
Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.12E-13	8.50E-13	0.248952	0.8073
LNENFLASYON	-4.62E-15	2.96E-14	-0.155925	0.8785
LNKESILEN_SIGIR_SAYISI	4.91E-14	1.77E-13	0.277008	0.7861
LNSIGIR__BESI_YEMI__TON_	-2.25E-13	8.93E-14	-2.523327	0.0254
LNSIGIR_ET_URETIMI__TON_	1.60E-13	5.38E-14	2.970921	0.0108
LNSIGIR_ETI_FIYATI	1.000000	6.74E-14	1.48E+13	0.0000

R-squared	1.000000	Mean dependent var	2.783357
Adjusted R-squared	1.000000	S.D. dependent var	0.545805
S.E. of regression	3.68E-14	Sum squared resid	1.76E-26
F-statistic	7.90E+26	Durbin-Watson stat	0.893726
Prob(F-statistic)	0.000000		

H_0: The variable is meaningless.
H_1: Variable is significant.

Examined with 95% confidence interval.

In this model, a model is created by taking only the log of our dependent variable.

Our model is significant since the probability value of F is p = > 0.05.

Since the P values are greater than 0.05, a single hypothesis is established and the null hypothesis can be accepted.

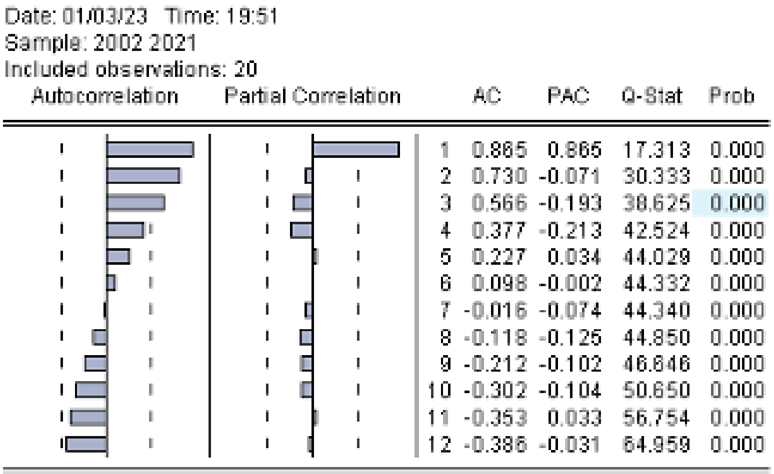
So variables are meaningless.

This time we applied the "log log" method to the same values. The values of the independent variables also changed accordingly.

Correlogram

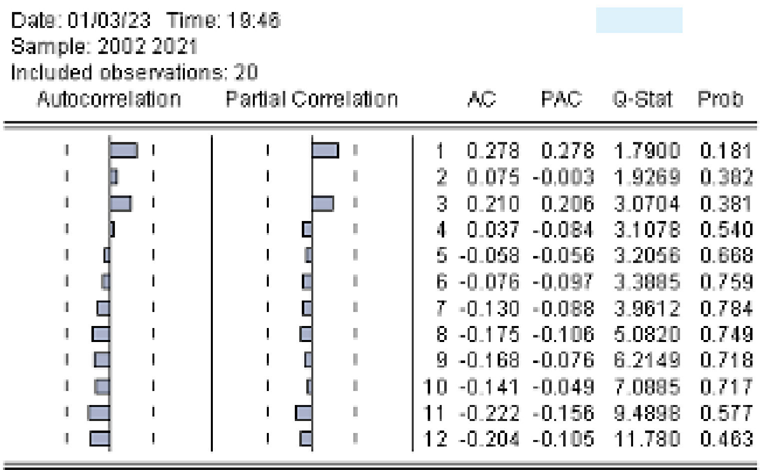
A correlogram, also known as Auto Correlation Function (ACF) plot, is a graphic way to demonstrate serial correlation in data that doesn't remain constant with time. A correlogram gives a fair idea of auto-correlation between data pairs at different time periods. It's used as a tool to check randomness in a data set which is done by computing auto-correlations for data values at different time lags.

The auto-correlations are near zero for any time lag separation if it is random but if not, one or more of the auto-correlations will be non-zero.



Date: 01/03/23 Time: 19:51
Sample: 2002 2021
Included observations: 20

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.865	0.865	17.313	0.000
		2	0.730	-0.071	30.333	0.000
		3	0.566	-0.193	38.625	0.000
		4	0.377	-0.213	42.524	0.000
		5	0.227	0.034	44.029	0.000
		6	0.098	-0.002	44.332	0.000
		7	-0.016	-0.074	44.340	0.000
		8	-0.118	-0.125	44.850	0.000
		9	-0.212	-0.102	46.646	0.000
		10	-0.302	-0.104	50.650	0.000
		11	-0.353	0.033	56.754	0.000
		12	-0.386	-0.031	64.959	0.000



Date: 01/03/23 Time: 19:46
Sample: 2002 2021
Included observations: 20

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.278	0.278	1.7900	0.181
		2	0.075	-0.003	1.9269	0.382
		3	0.210	0.206	3.0704	0.381
		4	0.037	-0.084	3.1078	0.540
		5	-0.058	-0.056	3.2056	0.668
		6	-0.076	-0.097	3.3885	0.759
		7	-0.130	-0.088	3.9612	0.784
		8	-0.175	-0.106	5.0820	0.749
		9	-0.168	-0.076	6.2149	0.718
		10	-0.141	-0.049	7.0885	0.717
		11	-0.222	-0.156	9.4898	0.577
		12	-0.204	-0.105	11.780	0.463

Correlation Analysis

Correlation analysis in research is a statistical method used to measure the strength of the linear relationship between two variables and compute their association. Simply put - correlation analysis calculates the level of change in one variable due to the change in the other.

Cases Observations Weights	ESILEN_SI...	ENFLASYON	GIR_ET_U...	SIGIR_ETI_...	YEM
KESILEN_SIGIR_S...	734936.3				
	1.000000				
	14698726				

	20				
	20				
	20.00000				
ENFLASYON	271756.9	604322.4			
	0.407675	1.000000			
	5435137.	12092447			
	1.894168	-----			
	0.0744	-----			
	20	20			
	20	20			
	20.00000	20.00000			
SIGIR_ET_URETIMI	290700.5	90910.65	130643.9		
	0.938417	0.287913	1.000000		
	5015610.	1818073.	2612878.		
	11.53334	1.279934	-----		
	0.0000	0.2163	-----		
	20	20	20		
	20	20	20		
	20.00000	20.00000	20.00000		
SIGIR_ETI_FIYATI	8022.631	2873.067	3341.651	96.68985	
	0.951703	0.375785	0.940213	1.000000	
	160452.6	57461.74	66833.01	1933.797	
	13.19139	1.720308	11.71204	-----	
	0.0000	0.1025	0.0000	-----	
	20	20	20	20	
	20	20	20	20	
	20.00000	20.00000	20.00000	20.00000	
YEM	1322550.	366456.7	539677.4	14964.13	2470777.
	0.981466	0.299830	0.949889	0.968154	1.000000
	26451004	7329335.	10793547	299282.7	49415540
	21.72229	1.333420	12.89262	16.40674	-----
	0.0000	0.1990	0.0000	0.0000	-----
	20	20	20	20	20
	20	20	20	20	20
	20.00000	20.00000	20.00000	20.00000	20.00000

In the table above, correlation was used to examine the relationship between independent variables.

Multicollinearity Test

Multicollinearity is the occurrence of high intercorrelations among two or more independent variables in a multiple regression model. Multicollinearity can lead to skewed or misleading results when a researcher or analyst attempts to determine how well each independent variable can be used most effectively to predict or understand the dependent variable in a statistical model.

In general, multicollinearity can lead to wider confidence interval that produce less reliable probabilities in terms of the effect of independent variables in a model.

Dependent Variable: SIGIR_ETI_FIYATI
Method: Least Squares
Date: 01/03/23 Time: 20:44
Sample: 2002 2021
Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.942518	7.915221	1.256128	0.2296
ENFLASYON	0.002093	0.000989	2.116326	0.0527
KESILEN_SIGIR_SAYISI	-0.005995	0.004428	-1.353987	0.1972
SIGIR__BESI_YEMI__TON_	0.007756	0.002500	3.102450	0.0078
SIGIR_ET_URETIMI__TON_	0.005345	0.005161	1.035489	0.3180

R-squared	0.954905	Mean dependent var	18.59082
Adjusted R-squared	0.942020	S.D. dependent var	10.25889
S.E. of regression	2.470239	Akaike info criterion	4.867441
Sum squared resid	85.42914	Schwarz criterion	5.115978
Log likelihood	-41.24069	Hannan-Quinn criter.	4.909503
F-statistic	74.11316	Durbin-Watson stat	1.258947
Prob(F-statistic)	0.000000		

R squared 95% of the independent variables had a high rate of explanation for the dependent variable.

Durbin Watson value is 1.25 so D.W test value shows no autocorrelation.

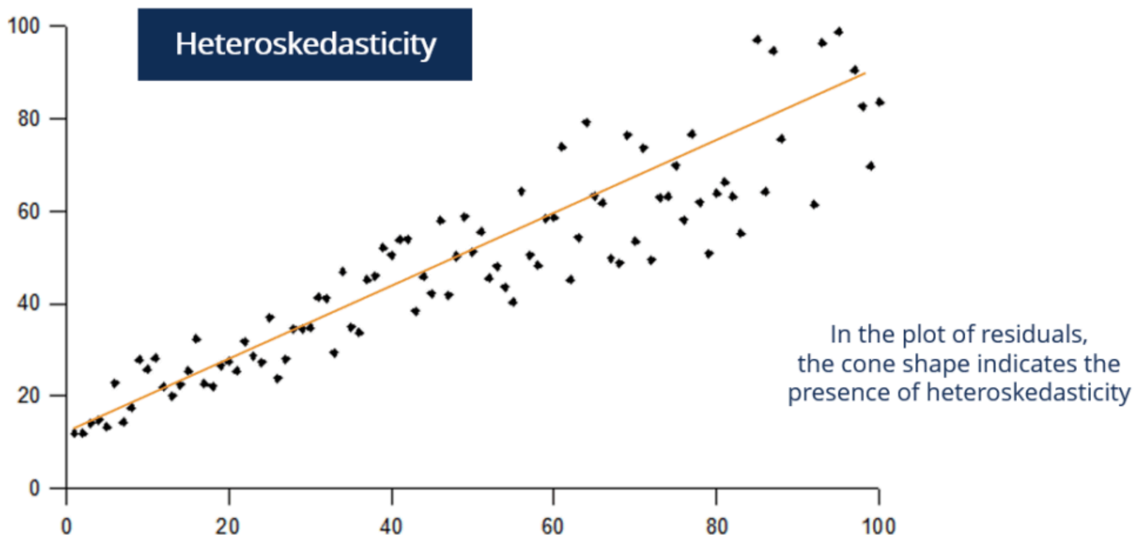
Variance Inflation Factors
Date: 01/03/23 Time: 20:47
Sample: 2002 2021
Included observations: 19

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	62.65073	195.0751	NA
ENFLASYON	9.78E-07	6.849178	1.911633
KESILEN_SIGIR_SAY...	1.96E-05	777.2355	46.35692
SIGIR__BESI_YEMI_...	6.25E-06	220.0837	49.87504
SIGIR_ET_URETIMI_...	2.66E-05	52.59947	10.89836

Considering the VIF values, the number of slaughtered cattle and cattle feed are high figures. Therefore, it can be said that there are multiple linear connections. This means that there are no multiple linear connections.

Heteroskedasticity Test

Heteroskedasticity refers to situations where the variance of the residuals is unequal over a range of measured values. When running a regression analysis, heteroskedasticity results in an unequal scatter of the residuals (also known as the error term).



When observing a plot of the residuals, a fan or cone shape indicates the presence of heteroskedasticity. In statistics, heteroskedasticity is seen as a problem because regressions involving ordinary least squares (OLS) assume that the residuals are drawn from a population with constant variance.

If there is an unequal scatter of residuals, the population used in the regression contains unequal variance, and therefore the analysis results may be invalid.

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.347765	Prob. F(4,14)	0.8412
Obs*R-squared	1.717240	Prob. Chi-Square(4)	0.7876
Scaled explained SS	0.948423	Prob. Chi-Square(4)	0.9175

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/03/23 Time: 20:55
Sample: 2002 2021
Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	25.41589	22.83206	1.113167	0.2844
ENFLASYON	0.001335	0.002853	0.467847	0.6471
KESILEN_SIGIR_SAYISI	-0.011372	0.012772	-0.890359	0.3883
SIGIR__BESI_YEMI__TON_	0.003259	0.007211	0.451968	0.6582
SIGIR_ET_URETIMI__TON_	0.010000	0.014888	0.671678	0.5127

R-squared	0.090381	Mean dependent var	4.496270
Adjusted R-squared	-0.169510	S.D. dependent var	6.588992
S.E. of regression	7.125592	Akaike info criterion	6.986197
Sum squared resid	710.8368	Schwarz criterion	7.234733
Log likelihood	-61.36887	Hannan-Quinn criter.	7.028259
F-statistic	0.347765	Durbin-Watson stat	2.102568
Prob(F-statistic)	0.841229		

H_0 : No heteroscedasticity exists
H_1 : Yes, heteroscedasticity exists

Since the p value is greater than 0.05, the H0 hypothesis cannot be rejected. That is, there is no variance that changes, it has a constant variance.

Arch Test

An uncorrelated time series can still be serially dependent due to a dynamic conditional variance process. A time series exhibiting conditional heteroscedasticity—or autocorrelation in the squared series—is said to have autoregressive conditional heteroscedastic (ARCH) effects. Engle's ARCH test is a Lagrange multiplier test to assess the significance of ARCH effects.

Heteroskedasticity Test: ARCH

F-statistic	0.008138	Prob. F(1,15)	0.9293
Obs*R-squared	0.009218	Prob. Chi-Square(1)	0.9235

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 01/03/23 Time: 20:54
Sample (adjusted): 2003 2021
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.433783	2.103663	2.107649	0.0523
RESID^2(-1)	0.023522	0.260751	0.090209	0.9293

R-squared	0.000542	Mean dependent var	4.541134
Adjusted R-squared	-0.066088	S.D. dependent var	6.927163
S.E. of regression	7.152403	Akaike info criterion	6.882905
Sum squared resid	767.3531	Schwarz criterion	6.980930
Log likelihood	-56.50469	Hannan-Quinn criter.	6.892649
F-statistic	0.008138	Durbin-Watson stat	2.039341
Prob(F-statistic)	0.929315		

Autocorrelation Test

The most common method of test autocorrelation is the Durbin-Watson test. Without getting too technical, the Durbin-Watson is a statistic that detects autocorrelation from a regression analysis.

The Durbin-Watson always produces a test number range from 0 to 4. Values closer to 0 indicate a greater degree of positive correlation, values closer to 4 indicate a greater degree of negative autocorrelation, while values closer to the middle suggest less autocorrelation.

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.791427	Prob. F(2,12)	0.2085
Obs*R-squared	4.368534	Prob. Chi-Square(2)	0.1126

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 01/03/23 Time: 20:59
Sample: 2002 2021
Included observations: 19
Presample and interior missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.896506	7.961782	-0.363801	0.7223
ENFLASYON	-0.000143	0.000948	-0.150873	0.8826
KESILEN_SIGIR_SAYISI	0.001524	0.004444	0.342939	0.7376
SIGIR__BESI_YEMI__TON_	-0.001068	0.002472	-0.432156	0.6733
SIGIR_ET_URETIMI__TON_	0.001557	0.005028	0.309664	0.7621
RESID(-1)	0.563586	0.310669	1.814104	0.0947
RESID(-2)	-0.485114	0.350046	-1.385859	0.1910

R-squared	0.229923	Mean dependent var	-4.91E-16
Adjusted R-squared	-0.155116	S.D. dependent var	2.178546
S.E. of regression	2.341421	Akaike info criterion	4.816703
Sum squared resid	65.78703	Schwarz criterion	5.164654
Log likelihood	-38.75868	Hannan-Quinn criter.	4.875590
F-statistic	0.597142	Durbin-Watson stat	2.015173
Prob(F-statistic)	0.727767		

Since Durbin Watson Test statistic 2.015173 is greater than 2, even if there is negative autocorrelation, we cannot say that there is a strong negative relationship because it is close to 2.

H_0: No autocorrelation.
H_1: There is auto correlation.

Since our p value is greater than 0.05, the H0 hypothesis cannot be rejected. There is no autocorrelation.

Reset Test

$$Y_i = \lambda_1 + \lambda_2 X_i + u_{3i}$$

$$F = \frac{(R^2_{\text{new}} - R^2_{\text{old}})/\text{number of new regressors}}{(1 - R^2_{\text{new}})/(n - \text{number of parameters in the new model})}$$

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: SIGIR_ETI_FIYATI C ENFLASYON KESILEN_SIGIR_SAYISI SIGIR__BESI_YEMI__TON_ SIGIR_ET_URETIMI__TON_

	Value	df	Probability
t-statistic	2.499264	13	0.0266
F-statistic	6.246322	(1, 13)	0.0266
Likelihood ratio	7.455042	1	0.0063

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	27.72571	1	27.72571
Restricted SSR	85.42914	14	6.102081
Unrestricted SSR	57.70343	13	4.438725

LR test summary:

	Value
Restricted LogL	-41.24069
Unrestricted LogL	-37.51317

Unrestricted Test Equation:
Dependent Variable: SIGIR_ETI_FIYATI
Method: Least Squares
Date: 01/03/23 Time: 21:00
Sample: 2002 2021
Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.923324	7.043154	0.699023	0.4969
ENFLASYON	-0.002024	0.001851	-1.093574	0.2940
KESILEN_SIGIR_SAYISI	0.002361	0.005044	0.468010	0.6475
SIGIR__BESI_YEMI__TON_	-0.000948	0.004084	-0.232212	0.8200
SIGIR_ET_URETIMI__TON_	0.002529	0.004544	0.556574	0.5873
FITTED^2	0.020616	0.008249	2.499264	0.0266

R-squared	0.969540	Mean dependent var	18.59082
Adjusted R-squared	0.957825	S.D. dependent var	10.25889
S.E. of regression	2.106828	Akaike info criterion	4.580334
Sum squared resid	57.70343	Schwarz criterion	4.878578
Log likelihood	-37.51317	Hannan-Quinn criter.	4.630808
F-statistic	82.75816	Durbin-Watson stat	1.161562
Prob(F-statistic)	0.000000		

H_0: The model is correct.
H_1: Model is wrong.

Since our p value is lower than 0.05, the H0 hypothesis can be rejected. The model is wrong.

The associated p-value is significant, meaning there is a specification error.

Wald Test

The Wald test approximates the LR test, but with the advantage that it only requires estimating one model. The Wald test works by testing the null hypothesis that a set of parameters is equal to some value. In the model being tested here, the null hypothesis is that the two coefficients of interest are simultaneously equal to zero. If the test fails to reject the null hypothesis, this suggests that removing the variables from the model will not substantially harm the fit of that model, since a predictor with a coefficient that is very small relative to its standard error is generally not doing much to help predict the dependent variable.

Dependent Variable: SIGIR_ETI_FIYATI
Method: Least Squares
Date: 01/03/23 Time: 21:03
Sample: 2002 2021
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.757532	7.581383	1.155136	0.2661
ENFLASYON	0.001909	0.000934	2.043844	0.0589
KESILEN_SIGIR_SAYISI	-0.005326	0.004239	-1.256416	0.2282
SIGIR_ET_URETIMI	0.006392	0.004837	1.321405	0.2062
YEM	0.007228	0.002333	3.097690	0.0074

R-squared	0.954364	Mean dependent var	18.91278
Adjusted R-squared	0.942194	S.D. dependent var	10.08855
S.E. of regression	2.425569	Akaike info criterion	4.822327
Sum squared resid	88.25076	Schwarz criterion	5.071260
Log likelihood	-43.22327	Hannan-Quinn criter.	4.870921
F-statistic	78.42197	Durbin-Watson stat	1.208489
Prob(F-statistic)	0.000000		

Since it is a multivariate model, t statistics were not obtained.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.341430	(3, 15)	0.2984
Chi-square	4.024289	3	0.2589

Null Hypothesis: C(1)=C(2)=C(3)=C(4)
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1) - C(4)	8.751140	7.581014
C(2) - C(4)	-0.004482	0.004864
C(3) - C(4)	-0.011718	0.006811

Restrictions are linear in coefficients.

Below the list of constraints we see the chi-squared value generated by the Wald test, as well as the p-value associated with a chi-squared of 4.024289 with two degrees of freedom. The p-value is less than the generally used criterion of 0.05 so we are able to reject the null hypothesis, indicating that the coefficients are not simultaneously equal to zero. Because including statistically significant predictors should lead to better prediction (i.e., better model fit) we can conclude that including math and science results in a statistically significant improvement in the fit of the model.

Granger Causality

Granger causality is a statistical concept of causality that is based on prediction. According to Granger causality, if a signal X_1"Granger-causes" (or "G-causes") a signal X_2, then past values of X_1 should contain information that helps predict X_2 above and beyond the information contained in past values of X_2 alone. Its mathematical formulation is based on linear regression modeling of stochastic processes (Granger 1969). More complex extensions to nonlinear cases exist, however these extensions are often more difficult to apply in practice.

Granger causality (or "G-causality") was developed in 1960s and has been widely used in economics since the 1960s. However it is only within the last few years that applications in neuroscience have become popular.

Pairwise Granger Causality Tests
Date: 01/03/23 Time: 21:04
Sample: 2002 2021
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
KESILEN_SIGIR_SAYISI does not Granger Cause ENFLASYON	18	6.85210	0.0037
ENFLASYON does not Granger Cause KESILEN_SIGIR_SAYISI		2.84610	0.0944
SIGIR__BESI_YEMI__TON_ does not Granger Cause ENFLASYON	15	3.21065	0.0837
ENFLASYON does not Granger Cause SIGIR__BESI_YEMI__TON_		0.09069	0.9140
SIGIR_ET_URETIMI__TON_ does not Granger Cause ENFLASYON	18	4.61110	0.0307
ENFLASYON does not Granger Cause SIGIR_ET_URETIMI__TON_		0.32099	0.7310
SIGIR_ETI_FIYATI does not Granger Cause ENFLASYON	18	5.37761	0.0199
ENFLASYON does not Granger Cause SIGIR_ETI_FIYATI		0.01962	0.9806
SIGIR__BESI_YEMI__TON_ does not Granger Cause KESILEN_SIGIR_SAYISI	15	6.24828	0.0174
KESILEN_SIGIR_SAYISI does not Granger Cause SIGIR__BESI_YEMI__TON_		1.00492	0.4002
SIGIR_ET_URETIMI__TON_ does not Granger Cause KESILEN_SIGIR_SAYISI	18	3.75867	0.0515
KESILEN_SIGIR_SAYISI does not Granger Cause SIGIR_ET_URETIMI__TON_		1.98146	0.1774
SIGIR_ETI_FIYATI does not Granger Cause KESILEN_SIGIR_SAYISI	18	3.49079	0.0612
KESILEN_SIGIR_SAYISI does not Granger Cause SIGIR_ETI_FIYATI		3.99908	0.0443
SIGIR_ET_URETIMI__TON_ does not Granger Cause SIGIR__BESI_YEMI__TON_	15	0.08931	0.9153
SIGIR__BESI_YEMI__TON_ does not Granger Cause SIGIR_ET_URETIMI__TON_		0.36929	0.7003
SIGIR_ETI_FIYATI does not Granger Cause SIGIR__BESI_YEMI__TON_	15	1.48013	0.2735
SIGIR__BESI_YEMI__TON_ does not Granger Cause SIGIR_ETI_FIYATI		4.30836	0.0447
SIGIR_ETI_FIYATI does not Granger Cause SIGIR_ET_URETIMI__TON_	18	1.72871	0.2159
SIGIR_ET_URETIMI__TON_ does not Granger Cause SIGIR_ETI_FIYATI		0.46867	0.6360

H_0: Variable X does not Granger Cause variable Y.
H_1: Variable X Granger Cause variable Y.

Therefore, p-value of less than 0.05 is necessary to conclude that variable X granger causes variable Y. We see that kesilen_sıgır_sayısı and enflasyon, sıgır_et_uretimi and enflasyon, sıgır_et_fiyatı and enflasyon relationship p-value is less than 0.05.

ADF Test

As the name suggest, the ADF test is an ‘augmented’ version of the Dickey Fuller test. The ADF test expands the Dickey-Fuller test equation to include high order regressive process in the model.

$$y_t = c + \beta t + \alpha y_{t-1} + \phi_1 \Delta Y_{t-1} + \phi_2 \Delta Y_{t-2} .. + \phi_p \Delta Y_{t-p} + e_t$$

If you notice, we have only added more differencing terms, while the rest of the equation remains the same. This adds more thoroughness to the test. The null hypothesis however is still the same as the Dickey Fuller test.

A key point to remember here is: Since the null hypothesis assumes the presence of unit root, that is α=1, the p-value obtained should be less than the significance level (say 0.05) in order to reject the null hypothesis. Thereby, inferring that the series is stationary.

Null Hypothesis: Unit root (individual unit root process)
Series: ENFLASYON, KESILEN_SIGIR_SAYISI, SIGIR__BESI_YEMI__TON
_, SIGIR_ET_URETIMI__TON_
Date: 01/03/23 Time: 21:16
Sample: 2002 2021
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Total number of observations: 72
Cross-sections included: 4

Method	Statistic	Prob.**
ADF - Fisher Chi-square	0.10690	1.0000
ADF - Choi Z-stat	4.79795	1.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
ENFLASYON	0.9710	2	4	17
KESILEN_SIGIR...	0.9992	0	4	19
SIGIR__BESI_Y...	0.9877	0	2	17
SIGIR_ET_URE...	0.9893	0	4	19

The p-value is greater than 0.05 significance level, so we can reject the null hypothesis and assume that the series is not stationary

Cointegration Error Correction (ECM)

It is very difficult to predict a stock's future price based only on past prices. You need to incorporate other data into your model to get better prediction accuracy by accounting for shocks to the stock price. An obvious piece of data to start with are market movements. If the market is tanking, your stock could be at risk of tanking as well. You can include lags of market price data to capture the short-term relationship between the market and your security of interest. But what about their long-run relationship? That's where the error-correction model (ECM) is useful. It includes a term for the deviation from the long-run relationship that estimates how much of the disequilibrium will dissipate in the next forecasting period.

It is important to establish cointegration before estimating an ECM. Cointegration essentially means two time series have a long-run relationship. If there isn't a long-run relationship, an ECM is not appropriate. To test for cointegration, we perform a linear regression of our target variable on our independent variable and test the residuals for stationarity. In our case, our model is:

$$stock\ price_t = \alpha + \beta * market_t + u_t$$

Null Hypothesis: D(SIGIR_ETI_FIYATI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.453444	0.5333
Test critical values:	1% level	-3.857386	
	5% level	-3.040391	
	10% level	-2.660551	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 18

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SIGIR_ETI_FIYATI,2)
Method: Least Squares
Date: 01/03/23 Time: 21:27
Sample (adjusted): 2004 2021
Included observations: 18 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SIGIR_ETI_FIYATI(-1))	-0.407206	0.280167	-1.453444	0.1654
C	0.959195	0.688836	1.392486	0.1828

R-squared	0.116632	Mean dependent var	0.278408
Adjusted R-squared	0.061422	S.D. dependent var	2.211856
S.E. of regression	2.142851	Akaike info criterion	4.466591
Sum squared resid	73.46899	Schwarz criterion	4.565521
Log likelihood	-38.19932	Hannan-Quinn criter.	4.480232
F-statistic	2.112499	Durbin-Watson stat	1.398360
Prob(F-statistic)	0.165433		

When we applied the Augmented Dickey-Fuller test statistic in the table above, our value was -1.45. However, this value is not stable because it is higher than the test critical values. In order to make it static, we must apply the 1st difference option over the Unit Root Test and process it again.

Null Hypothesis: D(SIGIR_ETI_FIYATI) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.686189	0.4210
Test critical values:	1% level	-3.857386	
	5% level	-3.040391	
	10% level	-2.660551	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 18

Residual variance (no correction)	4.081610
HAC corrected variance (Bartlett kernel)	4.689230

Phillips-Perron Test Equation
Dependent Variable: D(SIGIR_ETI_FIYATI,2)
Method: Least Squares
Date: 01/03/23 Time: 21:28
Sample (adjusted): 2004 2021
Included observations: 18 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SIGIR_ETI_FIYATI(-1))	-0.407206	0.280167	-1.453444	0.1654
C	0.959195	0.688836	1.392486	0.1828

R-squared	0.116632	Mean dependent var	0.278408
Adjusted R-squared	0.061422	S.D. dependent var	2.211856
S.E. of regression	2.142851	Akaike info criterion	4.486591
Sum squared resid	73.46899	Schwarz criterion	4.565521
Log likelihood	-38.19932	Hannan-Quinn criter.	4.480232
F-statistic	2.112499	Durbin-Watson stat	1.398360
Prob(F-statistic)	0.165433		

When we apply the Phillips-Perron test statistic in the table above, our value is -1.68. However, this value is not stable because it is higher than the test critical values. In order to make it static, we must apply the 1st difference option over the Unit Root Test and process it again.

Null Hypothesis: ECM has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.933225	0.0611
Test critical values:	1% level	-3.857386	
	5% level	-3.040391	
	10% level	-2.660551	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 18

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ECM)
Method: Least Squares
Date: 01/03/23 Time: 21:32
Sample (adjusted): 2004 2021
Included observations: 18 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	-0.660663	0.225234	-2.933225	0.0103
D(ECM(-1))	0.513542	0.220013	2.334142	0.0339
C	0.096332	0.407761	0.236247	0.8164

R-squared	0.398410	Mean dependent var	0.172578
Adjusted R-squared	0.318198	S.D. dependent var	2.085336
S.E. of regression	1.721889	Akaike info criterion	4.075733
Sum squared resid	44.47354	Schwarz criterion	4.224128
Log likelihood	-33.68160	Hannan-Quinn criter.	4.096195
F-statistic	4.966959	Durbin-Watson stat	1.643006
Prob(F-statistic)	0.022118		

In this table, we observe that our Augmented Dickey-Fuller test statistical result has changed. This time, the test got closer to critical values and became stagnant. In line with these values, the table will give us the correct result.

Null Hypothesis: ECM has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.378457	0.1603
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19

Residual variance (no correction)	3.390124
HAC corrected variance (Bartlett kernel)	3.390124

Phillips-Perron Test Equation
Dependent Variable: D(ECM)
Method: Least Squares
Date: 01/03/23 Time: 21:34
Sample (adjusted): 2003 2021
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	-0.508000	0.213584	-2.378457	0.0294
C	0.288069	0.447566	0.643635	0.5284

R-squared	0.249682	Mean dependent var	0.359270
Adjusted R-squared	0.205546	S.D. dependent var	2.183864
S.E. of regression	1.946526	Akaike info criterion	4.269270
Sum squared resid	64.41236	Schwarz criterion	4.368685
Log likelihood	-38.55807	Hannan-Quinn criter.	4.286095
F-statistic	5.657057	Durbin-Watson stat	1.171032
Prob(F-statistic)	0.029377		

In this table, we observe that our Phillips-Perron test statistical result has changed. This time, the test got closer to critical values and became stagnant. In line with these values, the table will give us the correct result.

Akaike Information Criterion, Schwarz Information Criterion

Vector Autoregression Estimates

Vector Autoregression Estimates
Date: 01/03/23 Time: 21:36
Sample (adjusted): 2004 2021
Included observations: 15 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	ENFLASYON	KESILEN_SI	SIGIR__BESI	SIGIR_ET_U	SIGIR_ETI_F
ENFLASYON(-1)	1.131565	0.079854	0.083949	-0.228393	-0.000312
	(0.46598)	(0.05310)	(0.23211)	(0.11751)	(0.00209)
	[2.42835]	[1.50370]	[0.36167]	[-1.94368]	[-0.14886]
ENFLASYON(-2)	-0.136384	-0.065269	-0.568011	0.063639	-0.000926
	(0.40630)	(0.04630)	(0.20239)	(0.10246)	(0.00183)
	[-0.33567]	[-1.40960]	[-2.80655]	[0.62113]	[-0.50691]
KESILEN_SIGIR_SAYISI	-3.611133	0.407466	0.879734	0.047804	-0.007980
	(1.14655)	(0.13067)	(0.57112)	(0.28912)	(0.00515)
	[-3.14956]	[3.11840]	[1.54036]	[0.16534]	[-1.54883]
KESILEN_SIGIR_SAYISI	1.928418	0.019365	1.783504	0.003530	0.006944
	(1.41598)	(0.16137)	(0.70533)	(0.35706)	(0.00636)
	[1.36190]	[0.12000]	[2.52862]	[0.00989]	[1.09125]
SIGIR BESI YEMI T	0.117717	0.079747	0.142086	-0.013199	-0.000284
	(0.65989)	(0.07520)	(0.32871)	(0.16640)	(0.00297)
	[0.17839]	[1.06041]	[0.43226]	[-0.07932]	[-0.09564]
SIGIR BESI YEMI T	1.025731	-0.053900	-0.662305	-0.168031	0.003387
	(0.74250)	(0.08462)	(0.36985)	(0.18723)	(0.00334)
	[1.38146]	[-0.63698]	[-1.79072]	[-0.89744]	[1.01510]
SIGIR ET URETIMI T	3.308304	-0.012391	-0.394350	-0.048805	-0.007713
	(1.57758)	(0.17979)	(0.78583)	(0.39782)	(0.00709)
	[2.09707]	[-0.06892]	[-0.50183]	[-0.12268]	[-1.08795]
SIGIR ET URETIMI T	-3.285824	0.608614	-0.648558	1.177783	0.009110
	(2.24494)	(0.25584)	(1.11825)	(0.56610)	(0.01009)
	[-1.46366]	[2.37887]	[-0.57997]	[2.08051]	[0.90298]
SIGIR ETI FIYATI(-1)	12.41150	42.28133	12.70243	46.79974	1.672657
	(110.326)	(12.5731)	(54.9554)	(27.8206)	(0.49580)
	[0.11250]	[3.36284]	[0.23114]	[1.68220]	[3.37368]
SIGIR ETI FIYATI(-2)	-9.345131	-7.764244	41.15907	-10.16527	-0.935435
	(117.181)	(13.3543)	(58.3701)	(29.5492)	(0.52660)
	[-0.07975]	[-0.58140]	[0.70514]	[-0.34401]	[-1.77636]
C	2615.179	949.8957	-4104.063	-122.4326	2.317115
	(2549.72)	(290.575)	(1270.07)	(642.958)	(11.4583)
	[1.02567]	[3.26902]	[-3.23137]	[-0.19042]	[0.20222]
R-squared	0.922920	0.999290	0.995713	0.981554	0.991939
Adj. R-squared	0.730219	0.997515	0.984995	0.935439	0.971786
Sum sq. resids	582437.3	7564.518	144516.6	37036.49	11.76261
S.E. equation	381.5879	43.48712	190.0767	96.22433	1.714833
F-statistic	4.789401	562.8913	92.89918	21.28481	49.22130
Log likelihood	-100.5360	-67.95788	-90.08232	-79.87114	-19.46065
Akaike AIC	14.87147	10.52772	13.47764	12.11615	4.061420
Schwarz SC	15.39071	11.04695	13.99688	12.63539	4.580657
Mean dependent	1077.200	3405.943	2970.999	724.1595	18.95647
S.D. dependent	734.6648	872.2945	1551.686	378.7029	10.20921

Determinant resid covariance (dof adj.)	0.000000
Determinant resid covariance	0.000000
Number of coefficients	55

Since the lower the values of Akaike and Schwarz statistics, the better the model. The Akaike information criterion (AIC) is a mathematical method for evaluating how well a model fits the data it was generated from. In statistics, AIC is used to compare different possible models and determine which one is the best fit for the data. AIC is calculated from:

- the number of independent variables used to build the model.

- the maximum likelihood estimate of the model (how well the model reproduces the data).

The best-fit model according to AIC is the one that explains the greatest amount of variation using the fewest possible independent variables.

Restriction Tests

Dependent Variable: LN_SIGIR_ETI_FIYATIENFLASYONRATIO
Method: Least Squares
Date: 01/03/23 Time: 21:51
Sample: 2002 2021
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_YEMENFLASYONRATIO	0.941843	0.042805	22.00296	0.0000
C	-5.004601	0.047316	-105.7697	0.0000

R-squared	0.964153	Mean dependent var	-4.191349
Adjusted R-squared	0.962161	S.D. dependent var	0.679166
S.E. of regression	0.132113	Akaike info criterion	-1.115682
Sum squared resid	0.314168	Schwarz criterion	-1.016109
Log likelihood	13.15682	Hannan-Quinn criter.	-1.096244
F-statistic	484.1302	Durbin-Watson stat	1.235711
Prob(F-statistic)	0.000000		

The rate of explanation of the dependent variables of the independent variables is 96%. When we look at the results in this test, the coefficient was 0.94 and our std error value was 0.04. In addition, our t statistical value has also increased to 22. On the other hand, we can say that the price of beef is affected by inflation.

Elasticities

Scaled Coefficients
Date: 01/05/23 Time: 17:26
Sample: 2002 2021
Included observations: 19

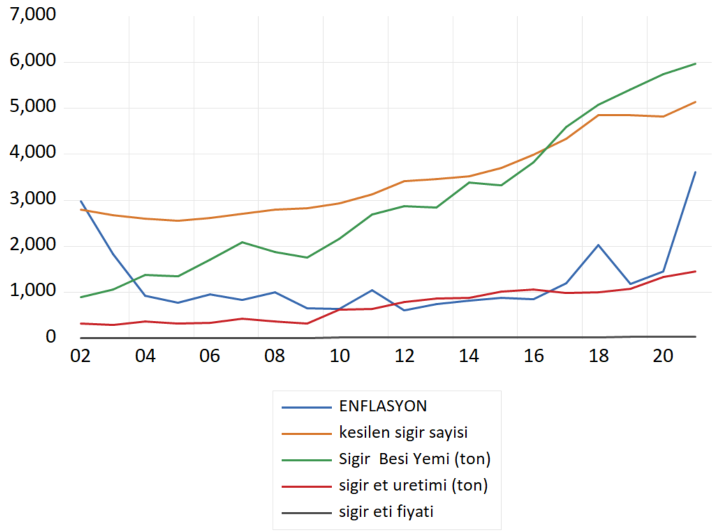
Variable	Coefficient	Standardized Coefficient	Elasticity at Means
C	9.942518	NA	0.534808
ENFLASYON	0.002093	0.166068	0.143351
KESILEN_SIGIR_SAY...	-0.005995	-0.523208	-1.115837
SIGIR__BESI_YEMI_...	0.007756	1.243509	1.233841
SIGIR_ET_URETIMI_...	0.005345	0.194012	0.203837

If elasticity is less than 1, inelastic, if equal to 1, unit elastic, and if greater than 1 elastic explanations are made. Elasticity of supply and demand in the economy is often is used. It is very important for micro and especially macroeconomic policies.

Its elasticity is widely used by governments, firms, courts, etc. decision makers economic decisions they use while giving. In addition, marketers and manufacturers can determine the elasticity of product prices.
They want to use when determining. When governments determine their tax and price policies, they use.

So sığır_besi_yemi production is full elasticity.

ECONOMIC EVALUATION



Meat production and inflation drew a close curve.
We can observe the rise of inflation in the graph.
Along with this, there has been an increase in beef prices.

Economic Interpretation of Coefficients

$$Y_i^k = \alpha^k + \beta_1^k X_{i1}^k + \beta_2^k X_{i2}^k + \beta_3^k X_{i3}^k + \beta_3^k X_{i3}^k + \beta_4^k X_{i4}^k$$

Burada;

$\mathrm{Y} = \text{Sığır Eti Üretim Fiyatı}$

$\mathrm{X}_1 = \text{Enflasyon}$

$\mathrm{X}_2 = \text{Kesilen Sığır Sayısı}$

$\mathrm{X}_3 = \text{Sığır Besi Yem Tonu}$

$\mathrm{X}_4 = \text{Sığır Eti Üretim Tonu}$

LOG(sığır_eti_fiyatı) = 2.12 - 4.62LOG(enflasyon) + 4.91LOG(kesilen_sığır_sayısı) –2.25LOG(sığır_besi_yemi_tonu)+ 1.60LOG(sığır_eti_üretim_tonu)

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