Chapter 9

Linear Regression Model[*]

Sometimes, for estimating parameters using other techniques of estimation, which cannot be incremental transformations, linear estimation of parameters is made by numerical methods. Linear regression model is based on the series of data for the two features. This requires completion of the methods used for the estimation of the two parameters; specify the methods to be used for testing the properties of the estimators of regression model and setting the framework for the use of the regression model in making predictions.

In defining the function of linear regression are considered, most commonly, four hypotheses:

- data series are not affected by the errors.
- for each fixed value of the characteristic factorial, residual variable is zero, i.e. on average:

$E[\varepsilon_i|X = x_i] = 0$

for all i,

- the lack of correlation between residues expressed that the terms do not exhibit the phenomenon of covariance, which means the variable correlation hypothesis;
- residuals with the independent, which means that $cov(X, \varepsilon_j) = 0$ for any j, showing an increase in the value of the variable factorial does not automatically lead to an increase of the values of the variable.

On the basis of the four assumptions define the linear regression model through the function: :$y_i = \beta + \alpha \cdot x_i + \varepsilon_i$, $\mathrm{i} = \overline{1, \mathrm{n}}$.

Linear regression model involves the identification of variables for defining specification for variable and model residuals; the context in which the regression model is used. Analysis of chronological

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[*] This chapter includes elements presented in the article *Model based on Linear Regression Function*, RRS Supplement no. 1/2014, authors prof. Constantin Anghelache PhD, prof. Radu Titus Marinescu PhD, assoc. prof. Emanuela Ionescu PhD, Ligia Prodan PhD Student, Alexandru Ursache PhD Student

(time) using a temporal function which, in essence, is also a regression, with a variable time (t). Uni-factorial nonlinear models are linearized transformations that are applied to the variables, the regression model. Sometimes, for estimating parameters using other techniques of estimation, which cannot be incremental transformations, linear estimation of parameters is made by numerical methods. Linear regression model is based on the series of data for the two features. They are represented by vectors x (the variable factor) and y (variable score). Simple regression aim is to highlight the relationship between a dependent variable explained (endogeneous, score) and an independent variable (explanatory note, exogenous factor predictors). To be able to build a linear regression model we defined agriculture, forestry and fisheries as the independent variable, while the total production was considered to be a dependent variable.

To determine the parameters of the linear regression model we have considered a variety of data on the evolution of the macroeconomic indicators of outcomes in the period 1990-2014.

Correlation analysis of Total production and Agriculture, forestry and fisheries

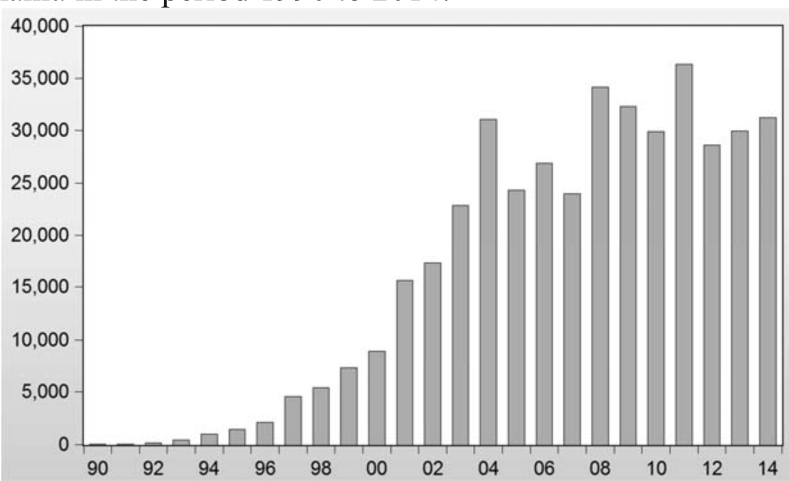
-milions-

Year	**Agriculture, forestry and fisheries**	**Total production**
	x	y
1990	18.7	79.1
1991	41.6	206.4
1992	114.8	606.9
1993	420.6	1906.5
1994	989.8	4700.1
1995	1426.9	6746.9
1996	2094.9	10197.1
1997	4553.3	23036.5
1998	5377.3	33711.2
1999	7280.5	48888.2
2000	8901.5	71990.9
2001	15617.9	106082.2
2002	17289.3	136922.3
2003	22847.5	166602.3

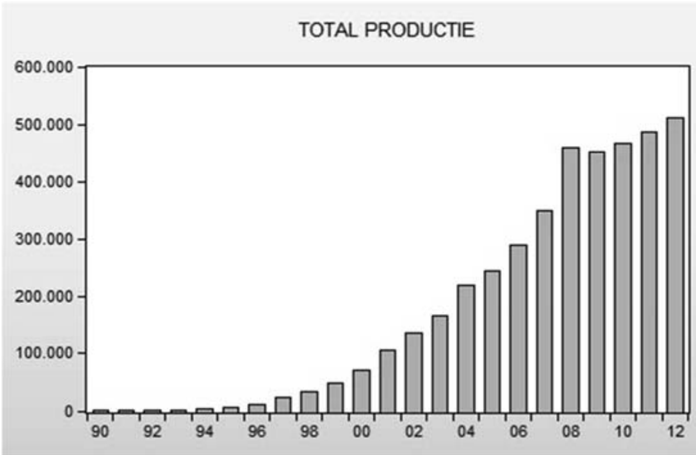
Year	Agriculture, forestry and fisheries	Total production
	x	y
2004	31055.0	220931.3
2005	24291.8	244676.8
2006	26861.9	289695.6
2007	23992.2	350845.6
2008	34126.4	458535.5
2009	32297.8	450979.1
2010	29874.2	466397.0
2011	36341.6	487733.2
2012	28638.1	512112.2
2013	29938.9	535386.4
2014	31239.8	558660,6

From the analysis of correlation between total production and the first branch, namely agriculture, forestry and fisheries, have cost and then unearthed graphic that during the analysis period from 1990 to 2014 as the value of agriculture, forestry and fisheries is stronger. For this, from 2001 onwards and until the year 2014 the correlation between the two factors is significant, and the relationship of interdependence between those two factors.

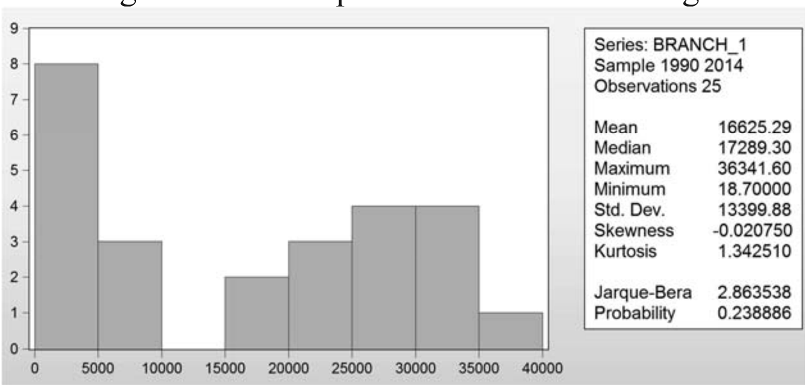
Developments in the field of agriculture, forestry and fisheries in Romania in the period 1990 to 2014:



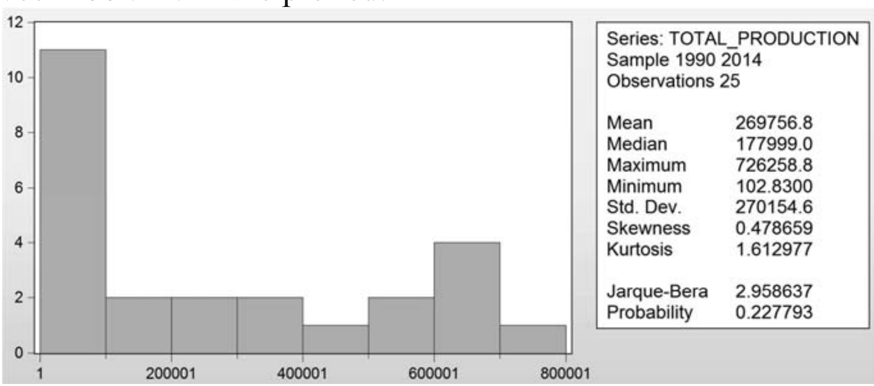
Graphical representation of the total production in Romania during 1990-2014 is as follows:



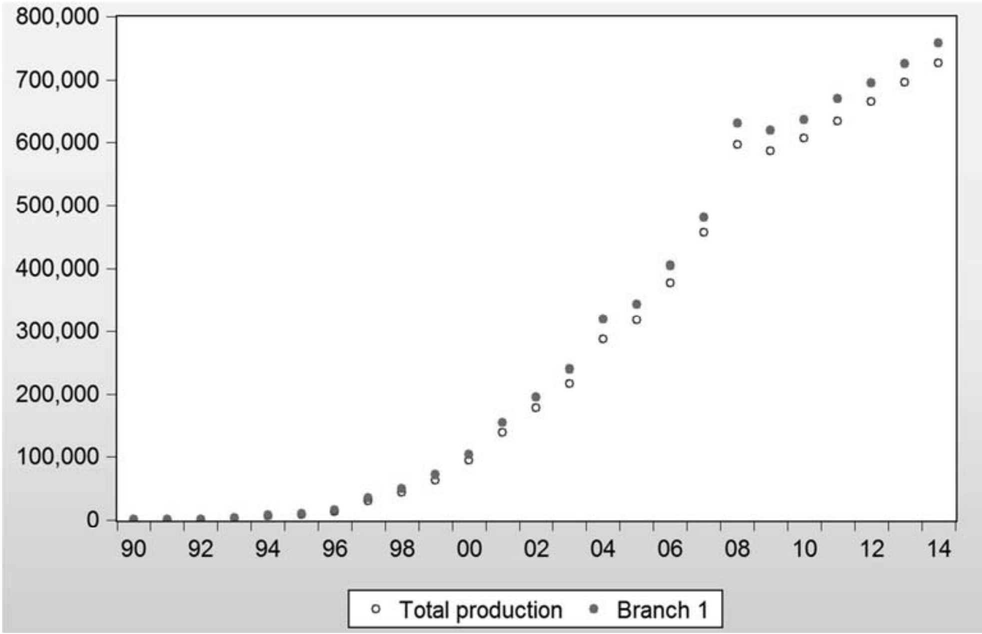
Statistic tests regarding Agriculture, forestry and fisheries of Romania during 1990-2014 is presented in the following chart:



Statistics tests upon the value of Total production of Romania between 1990-2014 are plotted:



Corelation between Agriculture, forestry and fisheries – Total production is represented:



Characteristics of regression model are:

Sample: 1990 2014
Included observations: 25
TOTAL_PRODUCTION=C(1)+C(2)*BRANCH_1

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-40829.78	33484.88	-1.219350	0.2351
C(2)	18.68157	1.580646	11.81895	0.0000

R-squared	0.858625	Mean dependent var	269756.8
Adjusted R-squared	0.852478	S.D. dependent var	270154.6
S.E. of regression	103762.6	Akaike info criterion	26.01422
Sum squared resid	2.48E+11	Schwarz criterion	26.11173
Log likelihood	-323.1777	Hannan-Quinn criter.	26.04126
F-statistic	139.6875	Durbin-Watson stat	0.437902
Prob(F-statistic)	0.000000		