MANAGEMENT MODEL OF THE CORRELATION BETWEEN THE TAX BITES AND THE GDP

Assist. Radu Cătălin Criveanu Ph.D
Mirela Ganea Ph.D. Student
University of Craiova,
Faculty of Economics and Business Administration, Craiova, Romania

Abstract: The existence of a causality relation between the GDP and the amount of Inland Revenue leads to the necessity of creating a model which, based on the analysis of the intensity of connections between the phenomena, will allow a proper management of the correlative pair tax bites/GDP, with benefic effects at the level of national economy. The research reveals the hypothesis that stimulating the GDP growth, with the state involvement will inevitably lead through the redistribution process to an economic development with positive implications on the national capital.

Key words: correlation, tax bites, variables, correlative pair, redistribution.

The deep analysis of the level of taxation in a country inevitably leads to the approach on the problems related to the necessity of the GDP growth and to dealing with these aspects by following this indicator in a correlative manner, at macroeconomic level and based on the statistic instruments.

Considering the fact that an increase of the gross national product under the circumstances where no important differences would be recorded at the level of taxation, would implicitly draw an increase in the amount of Inland Revenue for the budget, we start with the hypothesis that there is a dependency relation between the GP and the amount of Inland Revenue. Therefore, starting from the premise of the existence of a causality relation between the two variables it is necessary to determine the intensity of connections between the phenomena.

As far as the analysis of the correlation between the tax bites and the GDP, the correlative pair includes two variables:

GDP – the factorial variable x;

Tax bites – the resultant variable y.

The existence of the interdependence relation between the two variables is evident, in the sense that an increase of the GDP will generate an increase of the level of tax bites.

For the analysis of the correlation between the tax bites and the GDP, we will refer to the same analyzed period (1999-2005) and we will use the values transformed in euros at the annual medium rate of exchange.

The calculation modality will be based on the Data Analysis program in Excel.

For the analysis of the correlation, two essential aspects will be taken into consideration:

The regression helping to determine the contribution of decisive factors to the variability of the effect phenomena;

The intensity of the correlation: it shows how intense the interdependence between the variables is.

Table no.1 The evolution of the GDP and of the compulsory tax bites

Year	Compulsory tax bites -billion EUR-	GDP -billion EUR-
1999	11,348662	33,488598
2000	11,900531	40,277265
2001	12,735044	44,864448
2002	13,354356	48,464275
2003	14,262674	52,605392
2004	16,684003	60,784479
2005	21,811641	79,258790

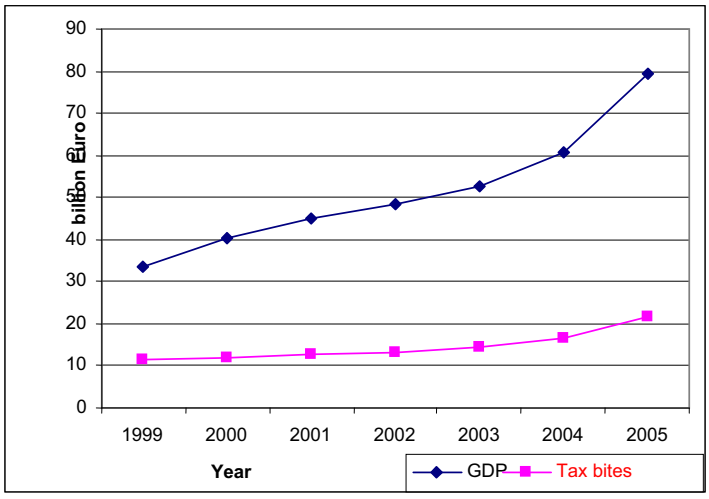

Figure no. 1 The evolution of the GDP and of the compulsory tax bites

The non-linear regression

Analyzing the values of the resultant Y (tax bites) and the determination coefficient we ascertain a non-linear tendency, respectively of parabolic type (see chapter 4.3.1.).

$$y = \beta_0 + \beta_1 \cdot x + \beta_2 \cdot x^2 \qquad (1)$$

Table 2 The correlation between the compulsory tax bites and the GDP

Year	Compulsory tax bites (y_i) -billion EUR-	GDP (x_i) -billion EUR-	$(x_i)^2$
1999	11,348662	33,488598	1.121,486225
2000	11,900531	40,27725	1.622,258075
2001	12,735044	44,864448	2.012,818735
2002	13,354356	48,464275	2.348,785904
2003	14,262674	52,605392	2.767,327262
2004	16,684003	60,784479	3.694,752879
2005	21,811641	79,258790	6.281,955806
Total	102,096912	359,743247	19.849,384886

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0,99826							
R Square	0,99653							
Adjusted R Square	0,99480							
Standard Error	0,26218							
Observations	7							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	2	79,07616	39,53808	575,1715	0,000012			
Residual	4	0,27497	0,06874					
Total	6	79,35112	Total	6	79,351121			
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	9,93334	1,49334	6,65176	0,00265	5,78716	14,07951	5,78716	14,07951
X Variable 1	-0,04828	0,05501	-0,87767	0,42968	-0,20101	0,10445	-0,20101	0,10445
X Variable 2	0,00252	0,00048	5,24997	0,00629	0,00119	0,00385	0,00119	0,00385

RESIDUAL OUTPUT		
Observation	*Predicted Y*	*Residuals*
1	11,137668	0,210995
2	12,069621	-0,169089
3	12,830620	-0,095576
4	13,501957	-0,147601
5	14,354879	-0,092204
6	16,292961	0,391042
7	21,909207	-0,097566
TOTAL	**102,096912**	**0,000000**

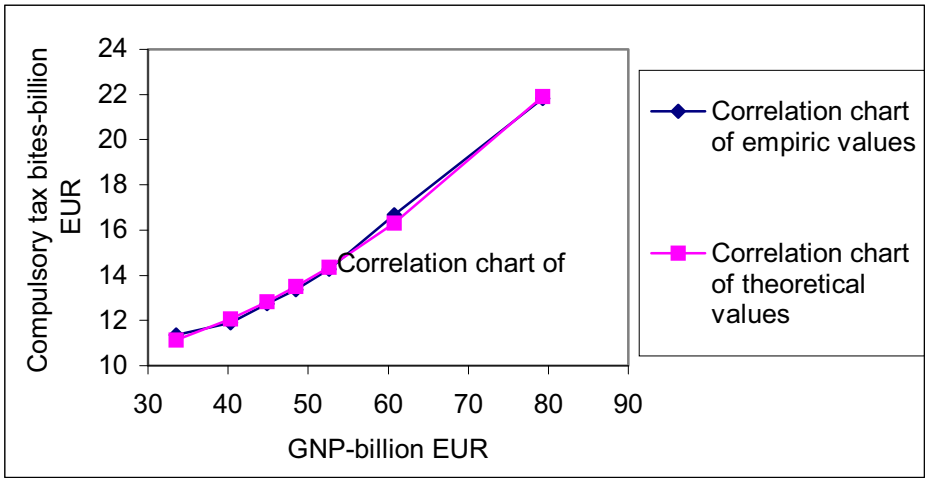

Figure no. 2 The correlation chart of the GDP – Compulsory tax bites

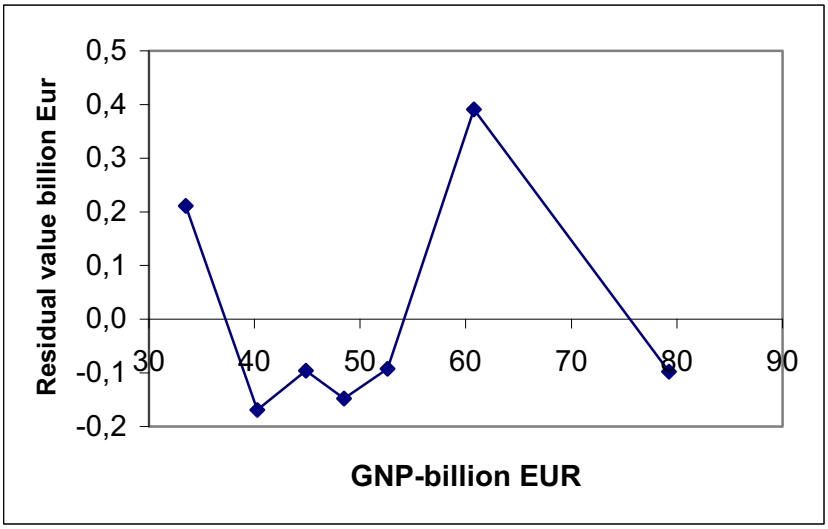

Figure no. 3 The tendency of the residual value

The following parabolic function of the second order will be obtained as a result of this analysis:

$$Y_x = 9{,}933338 - 0{,}048279 \cdot x + 0{,}002516 \cdot x^2$$

Therefore, the theoretic values for the period 1999 – 2005 are:

1999: $Y_{x_1} = 11{,}137668$ billion EUR
2000: $Y_{x_2} = 12{,}069621$ billion EUR
2001: $Y_{x_3} = 12{,}830620$ billion EUR
2002: $Y_{x_4} = 13{,}501957$ billion EUR
2003: $Y_{x_5} = 14{,}354879$ billion EUR
2004: $Y_{x_6} = 16{,}292961$ billion EUR
2005: $Y_{x_7} = 21{,}909207$ billion EUR

The equality $\sum y_i = \sum Y_i;\ \bar{y} = \bar{Y}_i$ is verified.

The intensity of the non-linear correlation

In order to determine the intensity of the non-linear correlation, we will determine the correlation ratio, which is based on the decomposition of the general dispersion into factorial dispersions. The general dispersion synthesizes the total

variation of the resultant variable Y, determined by the simultaneous action of all the influencing factors. $\left(\sigma_y^2 = \frac{\sum (y_i - \bar{y})^2}{n} \right)$ (2)

The general dispersion is decomposed into:

The dispersion of the factor in the correlative pair, which synthesizes the variation of the resultant Y, determined by the influence of the factorial x, when the influences of other factors are considered as constant. It is also known as the dispersion of the explained variation.

$$\sigma_{Y_x}^2 = \frac{\sum (Y_{x_i} - \bar{Y}_x)^2}{n} = \frac{\sum (Y_{x_i} - \bar{y})^2}{n} \quad (3)$$

The dispersion of the factors which are not included in the correlative pair, which synthesizes the variation of the resultant Y determined by the influences of other factors not included in the respective pair. It is known as the dispersion of the unexplained variation.

$$\sigma_{y,Y_x}^2 = \frac{\sum (y_i - Y_x)^2}{n} \quad (4)$$

Comparing the three dispersions we may notice that:

$$\sigma_y^2 = \sigma_{Y_x}^2 + \sigma_{y,Y_x}^2 \quad (5)$$

Table no. 3 Necessary data for the calculation of the non-linear simple correlation

Year	y_i -billion EUR-	x_i -billion EUR-	Y_x	$y - \bar{y}$	$Y - \bar{y}$	$y - Y$
1999	11,348662	33,488598	11,137668	-3,236611	-3,447606	0,210995
2000	11,900531	40,277265	12,069621	-2,684742	-2,515653	-0,169089
2001	12,735044	44,864448	12,830620	-1,850229	-1,754653	-0,095576
2002	13,354356	48,464275	13,501957	-1,230917	-1,083316	-0,147601
2003	14,262674	52,605392	14,354879	-0,322599	-0,230394	-0,092204
2004	16,684003	60,784479	16,292961	2,098730	1,707688	0,391042
2005	21,811641	79,258790	21,909207	7,226368	7,323934	-0,097566
Total	102,096912	359,743247	102,096912	0,000000	0,000000	0,000000

Year	$(y-\bar{y})^2$	$(Y-\bar{y})^2$	$(y-Y)^2$
1999	10,475650	11,885985	0,044519
2000	7,207840	6,328508	0,028591
2001	3,423347	3,078807	0,009135
2002	1,515157	1,173573	0,021786
2003	0,104070	0,053082	0,008502
2004	4,404666	2,916197	0,152914
2005	52,220392	53,640005	0,009519
Total	79,351121	79,076156	0,274965

$$\sigma_y^2 = \frac{79,351112}{7} = 11,335874$$

$$\sigma_{Y_x}^2 = \frac{79,076156}{7} = 11,296594$$

$$\sigma_{y,Y_x}^2 = \frac{0,274965}{7} = 0,039281$$

The equality is achieved.

The determination coefficient $\left(R^2 = \frac{\sigma_{Y_x}^2}{\sigma_y^2} = 0,9965 \right)$ reveals the part of the total variation of the resultant Y which belongs to the factor in the correlative pair.

The correlation ratio $R = \sqrt{R^2} = 0,9982$ represents an intense relation of interdependence between the GDP and the tax bites.

If we analyze the GDP – compulsory tax bites based on the simple linear correlation $(Y = \beta_0 + \beta_1 \cdot x)$ and we make a comparison at the result level as well as at charts level with the non-linear correlation using the Data Analysis program we will ascertain the following:

Linear regression:

Table no. 4 The correlation between the compulsory tax bites and the GDP

Year	Compulsory tax bites (y_i) -billion EUR-	GDP (x_i) -billion EUR-
1999	11,348662	33,488598
2000	11,900531	40,277265
2001	12,735044	44,864448
2002	13,354356	48,464275
2003	14,262674	52,605392
2004	16,684003	60,784479
2005	21,811641	79,258790
Total	102,096912	359,743247

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0,986234							
R Square	0,972658							
Adjusted R Square	0,967189							
Standard Error	0,658730							
Observations	7							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	77,181493	77,181493	177,868039	0,000042			
Residual	5	2,169628	0,433926					
Total	6	79,351121						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	2,349185	0,950656	2,471119	0,056453	-0,094555	4,792925	-0,094555	4,792925
X Variable 1	0,238094	0,017852	13,336718	0,000042	0,192202	0,283985	0,192202	0,283985

RESIDUAL OUTPUT		
Observation	*Predicted Y*	*Residuals*
1	10,322611	1,026051
2	11,938950	-0,038419
3	13,031130	-0,296085
4	13,888226	-0,533870
5	14,874200	-0,611525
6	16,821589	-0,137586
7	21,220207	0,591434
Total	**102,096912**	**0,000000**

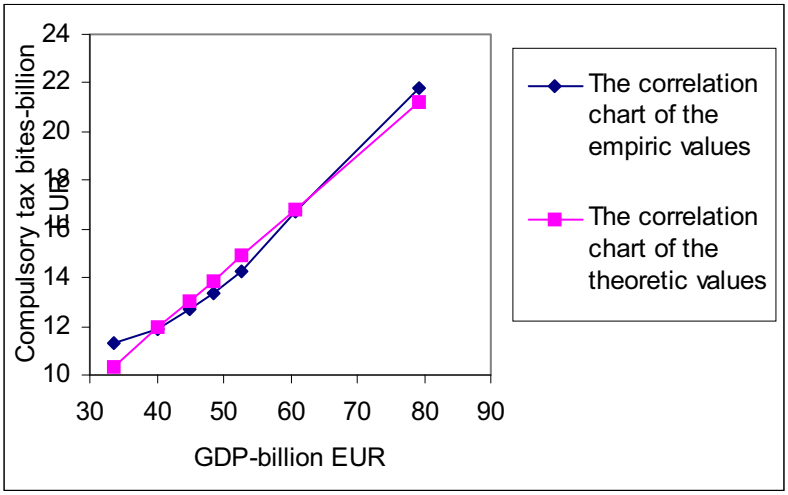

Figure no. 4 The correlation chart of the GDP – Compulsory tax bites

$$Y = \beta_0 + \beta_1 \cdot x, \qquad (4.74)$$

where:

$\beta_0 = 2{,}349185$

$\beta_1 = 0{,}238094$

As far as the linear function, the determination coefficient $R^2 = 0{,}9726$ is inferior to that of the parabolic function. At chart level, as far as the linear function we may ascertain a greater deviation of the theoretic values as opposed to the actual values than for the parabolic function, which leads to the conclusion that the expression of the smallest squares reaches their minimum at the level of the non-linear function.

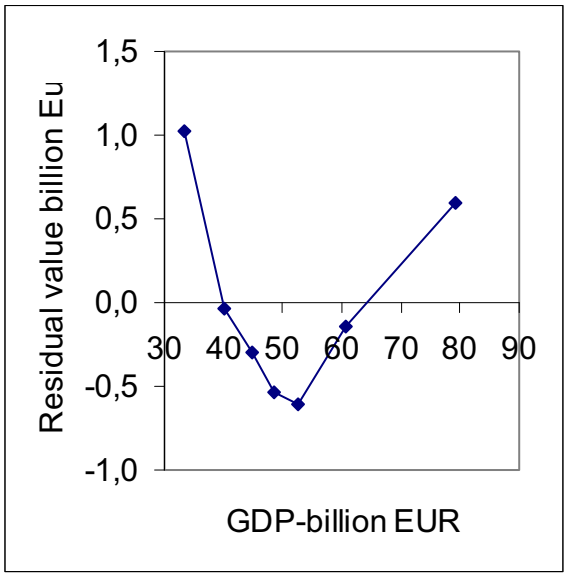

Figure no. 5 The tendency of the residual value

The intensity of the linear correlation

In order to determine the simple linear correlation, Pearson's linear correlation coefficient is being used, which is calculated as simple arithmetic value of the product of fixed deviations of x_i and y_i values. Using the Data Analysis program we will determine a correlation ratio $R = 0{,}9862$, which represents a strong relation of dependency of the tax bites on the GDP, but a relation which is more reduced in intensity than the one resulting in the case of the parable $(R = 0{,}9982)$.

Table 4 Necessary data for the calculation of the coefficient of linear correlation

x_i -billion EUR-	y_i -billion EUR-
33,488598	11,348662
40,277265	11,900531
44,864448	12,735044
48,464275	13,354356
52,605392	14,262674
60,784479	16,684003
79,258790	21,811641

	Column 1	*Column 2*
Column 1	1	
Column 2	0,986234	1

The intense and direct relation of dependency established between the compulsory tax bites and the GDP (R^2 = 0,9982), leads to the hypothesis that a stimulation for increase in the GDP by involving the state will inevitably lead through the redistribution process to an economic development with positive implications on the national capital also.

According to a correlative management approach at macroeconomic level and considering the current stage of the Romanian economy, the increase of the GDP (a significant increase over short periods of time) can not be achieved but through foreign investments, which have a double effect on Romanian economy: the first having short and medium term advantages, represents the engine of the economy in transition, while the second has long term implications and concerns on one hand how the national capital starts having less weight in the creation of the GDP and on the other hand the created plus-value, which will help maintain the discrepancy between states through the repatriation process.

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