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DETERMINATION OF FISCAL PRESSURE TREND IN ROMANIA WITH ANALYTICAL METHODS

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Abstract:

Determining the trend of fiscal pressure in Romania with analytical methods requires calculating the linear trend, the parabolic and the modified exponential one using the least square method. Then, with the help of absolute deviations between empirical and theoretical values will choose the best trend line for which the variation is the smallest. It is noted that the evolution of fiscal pressure in Romania between 2007 – 2010 can be best modelled using linear regression equation.

Keywords: *fiscal pressure, least square method, trend*

1. INTRODUCTION

Given data on the evolution of fiscal pressure in Romania, for a period of seven years, between 2004 and 2010, we will adjust the series by analytical methods. Determining the trend of fiscal pressure in Romania with analytical methods involves calculating the linear trend, the parabolic and the exponential modified by the method of least squares. Then, using coefficients of variation we will choose the best trend line which has the smallest variation.

2. Determining the linear trend for the fiscal pressure

For a linear trend, least squares method leads to the following system of equations:

$$\begin{cases} \sum y_i = n * a + b\sum t_i \\ \sum t_i\, y_i = a\sum t_i + b * \sum t_i^2 \end{cases}$$

Since the time variable is a series of consecutive numbers, origin can be considered the centre of the series and so $\sum t_i = 0$ which makes the system of equations above become:

$$\begin{cases} \sum y_i = n * a \\ \sum t_i\, y_i = b * \sum t_i^2 \end{cases}$$

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Table no. 1

Years	y_i	t_i	$t_i y_i$	t_i^2	$y_t = 28{,}54 - 0{,}03t_i$	$I y_i - y_t I$
1	**2**	**3**	**4**	**5**	**6**	**7**
2004	27,7	-3	-83,10	9,00	28,63	0,93
2005	28,5	-2	-57,00	4,00	28,60	0,10
2006	29,2	-1	-29,20	1,00	28,57	0,63
2007	29,8	0	0,00	0,00	28,54	1,26
2008	28,8	1	28,80	1,00	28,51	0,29
2009	27,7	2	55,40	4,00	28,48	0,78
2010	28,1	3	84,30	9,00	28,45	0,35
Total	199,8	0	-0,80	28,00	199,78	**4,34**
2011 forecast		4		16,00	28,42	
2012 forecast		5		25,00	28,39	
2013 forecast		6		36,00	28,36	
2014 forecast		7		49,00	28,33	
2015 forecast		8		64,00	28,30	
2016 forecast		9		81,00	28,27	
2017 forecast		10		100,00	28,24	

So, according to calculations in Table no. 1 we obtain:

$$\begin{cases} 199{,}8 = 7a \\ -0{,}8 = 28b \end{cases}$$

$$\begin{cases} a = \dfrac{199{,}8}{7} \\ b = \dfrac{-0{,}8}{28} \end{cases}$$

$$\begin{cases} a = 28{,}54 \\ b = -0{,}03 \end{cases}$$

Linear trend equation of fiscal pressure is:

$$y_t = a + bt_i = 28{,}54 - 0{,}03t_i$$

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Linear regression equation for the fiscal pressure is determined in column 6 of Table no.1.

3. Determining the curvilinear regression equation for fiscal pressure

For a curvilinear regression equation, the method of least squares leads to the following system of equations:

$$\begin{cases} \sum y_i = n * a + b\sum t_i + c\sum t_i^2 \\ \sum t_i\, y_i = a\sum t_i + b * \sum t_i^2 + c * \sum t_i^3 \\ \sum t_i^2\, y_i = a\sum t_i^2 + b * \sum t_i^3 + c * \sum t_i^4 \end{cases}$$

Since the time variable is a series of consecutive numbers, origin can be considered the centre of the series and so $\sum t_i = 0$ which makes the system of equations above become:

$$\begin{cases} \sum y_i = n * a + c\sum t_i^2 \\ \sum t_i\, y_i = b * \sum t_i^2 \\ \sum t_i^2\, y_i = a\sum t_i^2 + c * \sum t_i^4 \end{cases}$$

Table no. 2

Years	y_i	t_i	$t_i\, y_i$	t_i^2	t_i^3	t_i^4	$y_i\, t_i^2$	$y_t = a + bt_i + ct_i^2$	$I\, y_i - y_t I$
1	2	3	4	5	6	7	8	9	10
2004	27,7	-3	-83,10	9,00	-27,00	81,00	249,30	27,79	0,09
2005	28,5	-2	-57,00	4,00	-8,00	16,00	114,00	28,61	0,11
2006	29,2	-1	-29,20	1,00	-1,00	1,00	29,20	29,09	0,11
2007	29,8	0	0,00	0,00	0,00	0,00	0,00	29,23	0,57
2008	28,8	1	28,80	1,00	1,00	1,00	28,80	29,03	0,23
2009	27,7	2	55,40	4,00	8,00	16,00	110,80	28,49	0,79
2010	28,1	3	84,30	9,00	27,00	81,00	252,90	27,61	0,49
	199,8	0	-0,80	28,00	0,00	196,00	785,00	199,85	**2,39**
2011 forecast		4		16,00				26,39	
2012 forecast		5		25,00				24,83	
2013 forecast		6		36,00				22,93	

2014 forecast		7		49,00				20,69	
2015 forecast		8		64,00				18,11	
2016 forecast		9		81,00				15,19	
2017 forecast		10		100,00				11,93	

So, according to calculations in Table no. 2 we get:

$$\begin{cases} 199{,}8 = 7a + 28c \\ -0{,}8 = 28b \\ 785 = 28a + 196c \end{cases}$$

As a result:

$$\begin{cases} b = \frac{-0{,}8}{28} \\ 199{,}8 = 7a + 28c \ |(-4) \\ 785 = 28a + 196c \end{cases} \rightarrow \begin{cases} b = -0{,}03 \\ -799{,}2 = -28a - 112c \\ 785 = 28a + 196c \end{cases}$$

$$-14{,}2 = 0 + 84c$$

$$c = \frac{-14{,}2}{84} = -0{,}17$$

$$\begin{cases} b = -0{,}03 \\ c = -0{,}17 \\ 785 = 28a - 196 * 0{,}17 \end{cases} \rightarrow \begin{cases} b = -0{,}03 \\ c = -0{,}17 \\ 785 = 28a - 196 * 0{,}17 \end{cases} \rightarrow \begin{cases} b = -0{,}03 \\ c = -0{,}17 \\ a = 29{,}23 \end{cases}$$

Curvilinear regression equation of fiscal pressure is:

$$y_t = a + bt_i + ct_i^2 = 29{,}23 - 0{,}03t_i - 0{,}17t_i^2$$

Curvilinear regression equation for the fiscal pressure is determined in column 9 of Table no.2

4. Determining the modified exponential regression equation type $y_t = a * b^{ti}$ for fiscal pressure

For a modified exponential regression equation type $y_t = a * b^{ti}$ method of least squares leads to the following system of equations:

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$$\begin{cases} \log a = \dfrac{\sum \log y_i}{n} \\ \log b = \dfrac{\sum t_i \log y_i}{\sum t_i^2} \end{cases}$$

Since the time variable is a series of consecutive numbers, origin can be considered the centre of the series and so $\sum t_i = 0$ which makes the system of equations above become:

Table no. 3

Years	y_i	t_i	$t_i y_i$	t_i^2	log y_i	t_i log y_i	**log y_t = log a + t_i log b**	**y_t=a*b^{ti}**	I y_i - y_tI
1	2	3	4	5	6	7	8	9	10
2004	27,7	-3	-83,10	9,00	1,44	-4,33	1,46	28,64	0,94
2005	28,5	-2	-57,00	4,00	1,45	-2,91	1,46	28,61	0,11
2006	29,2	-1	-29,20	1,00	1,47	-1,47	1,46	28,58	0,62
2007	29,8	0	0,00	0,00	1,47	0,00	1,46	28,55	1,25
2008	28,8	1	28,80	1,00	1,46	1,46	1,46	28,52	0,28
2009	27,7	2	55,40	4,00	1,44	2,88	1,46	28,49	0,79
2010	28,1	3	84,30	9,00	1,45	4,35	1,46	28,47	0,37
Total	**199,8**	**0**	**-0,80**	**28,00**	**10,19**	**-0,01**	**10,22**	199,86	**4,35**
2011 forecast		4		16,00				28,44	
2012 forecast		5		25,00				28,41	
2013 forecast		6		36,00				28,38	
2014 forecast		7		49,00				28,35	
2015 forecast		8		64,00				28,32	
2016 forecast		9		81,00				28,30	
2017		10		100,00				28,27	

forecast									

So, according to calculations in Table no. 3 we get:

$$\begin{cases} \log a = \dfrac{\sum \log y_i}{n} = \dfrac{10{,}19}{7} = 1{,}46 \\ \log b = \dfrac{\sum t_i \log y_i}{\sum t_i^2} = \dfrac{-0{,}01}{28} = -0{,}0004 \end{cases} \rightarrow \begin{cases} a = 28{,}55157 \\ b = 0{,}999 \end{cases} \rightarrow$$

Results that the exponential trend equation is:

$\log y_t = \log a + t_i \log b = 1{,}46 - 0{,}0004 t_i$ or

$y_t = 28{,}55157 * 0{,}999^{ti}$

Modified exponential regression equation for the fiscal pressure is determined in column 9 of Table no.3

5. Conclusions

The best trend model for fiscal pressure in Romania for the period 2004 - 2010 by the method of least squares is what leads to minimum value for $\sum(y_i - y_t)^2$ or for$\sum|y_i - y_t|$.

Summarizing the data obtained so far in a summary table like Table no. 4 we obtain:

Tabel no. 4

Years	Linear regression equation		Curvilinear regression equation		Modified exponential regression equation	
	$y_t = a + bt_i$	**I y_i - y_tI**	$\boldsymbol{y_t = a + bt_i + ct_i^2}$	I y_i - y_tI	**y_t=a*b^{ti}**	I y_i - y_tI
2004	28,63	0,93	27,79	0,09	28,64	0,94
2005	28,60	0,10	28,61	0,11	28,61	0,11
2006	28,57	0,63	29,09	0,11	28,58	0,62
2007	28,54	1,26	29,23	0,57	28,55	1,25
2008	28,51	0,29	29,03	0,23	28,52	0,28
2009	28,48	0,78	28,49	0,79	28,49	0,79
2010	28,45	0,35	27,61	0,49	28,47	0,37
Total	199,78	**4,34**	199,85	**2,39**	199,86	**4,35**

Comparing the results summarized in Table no. 4 it is shown that the values for the linear trend and modified exponential regression equation are very close, but still the lowest value is recorded for the curvilinear regression equation, so this is the best way to model the evolution of the indicator „Fiscal pressure" in the analyzed period.

Bibliography

- Elisabeta, J. - Statistica, 3-rd edition, Ed. Economica, Bucharest, 2002;
- Pripoaie, R – Statistica economica, EDP, Bucharest, 2008;
- Pripoaie R., Pripoaie S., T*he statistical analysis of GDP, tax pressure and tax revenue with Eviews 7 between 2000 – 2009*, Acta Universitatis Danubius Oeconomica, No. 2/2011, pp.5-17
- Pripoaie S., Pripoaie R., Evolution of taxation in Romania between 2001 – 2010, Acta Universitatis Danubius Oeconomica, No. 5/2011, pp.106-115
- Şarpe, Daniela & Gavrilă, Emil (2002). *Microeconomie – Teorii şi aplicaţii*/*Microeconomics - Theory and applications.* Bucharest: Economică.