ECONOMETRIC MODELLING FOR SIMULATING THE ECONOMIC IMPACT OF STRUCTURAL REFORMS IN ROMANIA: A PILOT PROJECT

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Abstract:

The aim of this research to set up a system which helps to estimate the impact of public funding from projects. The impact depends on all factors affecting demand for the good or service provided under the structural intervention at stake. Thus, the present research provides a pilot econometric model for simulating the main mechanisms that lead to public investment impact from the perspective of 42 counties for the year 2006. The importance of this time span is due to the fact that it represents the end of the second programming period for European Union funds and it reveals the impact of economic structural measures at microeconomic level. Data observed to estimate the linear regression model contain at least 50 observations and the t test, the F test and the coefficients of determination are used to analyse the worthiness of the model after prior estimation of the parameters. Findings showed that the independent element of the model is unbiased, whilst the regression coefficient is biased.

Keywords: econometric modeling, public spending, evaluation, monitoring, pilot project, micoreconomics

JEL Classification: C40, D61, D63, D7, E20

I. Introduction

Budgetary policy modelling is a must in the current state of affairs of the member states in the Community. The present paper provides a pilot econometric model as a specific instrument for replicating and simulating the main mechanisms of a the regional and national Romanian economic system from the perspective of 42 counties for the year 2006. The importance of this timespan is due to the fact that it represents the end of the second programming period for European Union funds of 2000-2006 and results reveal important benchmarks for evaluating the impact of structural interventions made by the Union in Romania on welfare distribution, having in mind the overall expenditures and revenues of the population in that specific year. Data observed to estimate the linear regression model contain at least 50 observations and the *t* test, the *F* test and the coefficients of determination are used to analyse the worthiness of the model after prior estimation of the parameters.

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1.1 Characteristics of OLS estimators

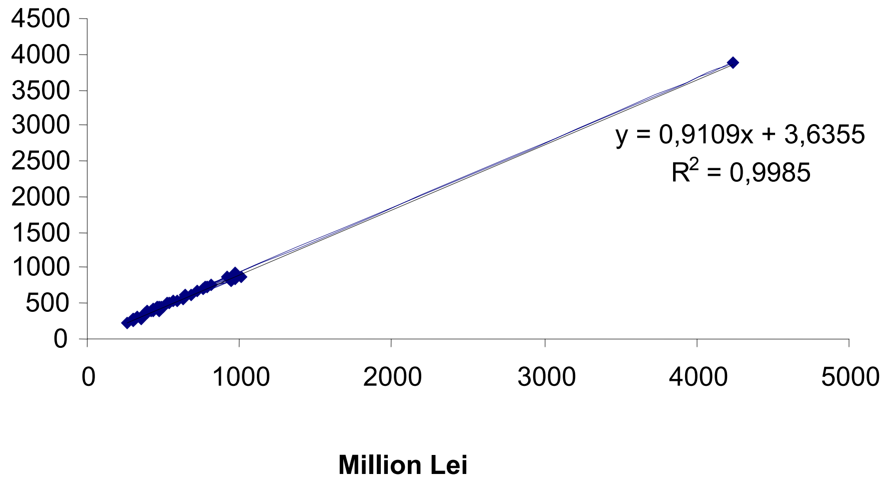
Relevant data of the total revenues and expenditures in the 42 Romanian counties in 2006 are as follows:

Counties	Total revenue (million lei)	Total expenditures (million lei)
Alba	457,4	422,6
Arad	626,8	548,7
Arges	785,4	739,2
Bacau	781,5	733,8
Bihor	938,9	804,6
Bistrita-Nasaud	382,9	354,3
Botosani	476,2	456,2
Braila	388,4	357,9
Brasov	811,5	756,1
Bucuresti	4238,7	3870,1
Buzau	521,8	494,7
Calarasi	301,1	282,2
Caras-Severin	389,1	385,9
Cluj	965,8	848
Constanta	1016,7	866,9
Covasna	258	235,3
Dambovita	536,7	507,6
Dolj	765,5	709,7
Galati	718,3	667,3
Giurgiu	306,3	288,8
Gorj	456	422,3
Harghita	399,5	355,4
Hunedoara	626,4	574,9
Ialomita	296,4	256,4
Iasi	928,9	835,6
Ilfov	478,3	398,3
Maramures	590,9	543,5
Mehedinti	322,5	303,7
Mures	678,7	621,4
Neamt	568,1	523,5
Olt	462	436
Prahova	913	864,1
Salaj	312,1	272,2
Satu Mare	426,7	409,5
Sibiu	648,2	607,9

Suceava	768,6	734,9
Teleorman	429,1	392,3
Timis	974,3	920,1
Tulcea	351,6	290,5
Valcea	484,3	444,8
Vaslui	500,2	461,6
Vrancea	425,8	394
TOTAL	27708,6	25392,8

The data were sampled from the National Statistics Institute (www.insse.ro) from the TEMPO-Online database which contains time series data.

Dependency between the total revenues and expenditures



The least square method was applied using the using the Excel for all 42 Romanian counties which form the overall population in order to detect the dependency of the total expendtures from the total revenues. Exstimations issued through this model are presumed to be the real values of the parameters associated to the population.

The results of the OLS are presented in the table below:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,999255
R Square	0,99851

Adjusted R Square	0,998473
Standard Error	21,58427
Observations	42

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	12486222,28	12486222,28	26801,31677	3,66124E-58
Residual	40	18635,23704	465,8809261		
Total	41	12504857,52			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	3,635508	4,956548249	0,733475808	0,467545619	-6,382049356	13,65307
Venit total	0,910912	0,005564147	163,7110771	3,66124E-58	0,899666888	0,922158

RESIDUAL OUTPUT

Observation	*Predicted Total Expenditures*	*Residuals*
1	437,412	18,78798407
2	238,6509	-3,350919792
3	358,0715	27,82845829
4	277,9112	4,288753703
5	835,2986	28,80142682
6	459,2739	2,326085322
7	574,5954	-25,89543058
8	3864,72	5,379898782
9	883,3948	-35,39475043
10	391,502	2,497971447
11	929,7602	-62,86019403
12	478,9496	15,75037645
13	521,1249	2,375130109
14	492,5222	15,07778097
15	394,508	-2,208039631
16	439,3249	-41,02493207
17	700,939	8,76101289
18	323,9123	-33,41232492
19	367,545	-12,14503117
20	282,648	6,152008974
21	419,0116	3,28841552
22	420,2869	2,313138093
23	357,4339	0,466097
24	849,7821	-14,1820811
25	273,63	-17,22995779

26	703,7628	31,1371843
27	657,9439	9,356080431
28	719,0661	20,13385518
29	287,9313	-15,73128322
30	891,1375	28,96249376
31	444,7904	0,009593244
32	297,4048	6,295227317
33	392,3218	17,17815024
34	742,841	13,25904029
35	858,8912	-54,29120558
36	715,5136	18,28641372
37	574,2311	0,668934395
38	424,4771	11,52294083
39	352,4239	1,876115463
40	594,089	13,81104303
41	541,8937	1,606326296
42	621,8718	-0,471786631

1.2 Summary output Table

Analysis of the results showed that from the SUMMARY OUTPUT table offering information on the worthiness of the model, R= 0,99925 reveales that there is a strong connection between the model parameters. Moreover, R^2 = 0,998509 shoes that 99,85 % of the variation of total expenditures is determined by the total revenue level, so that it represents a determinative factor of the model. Due to the fact that the average square deviation of errors is s_u = 21,584274, the correlation report and the determination coefficient are close to 1 so that the simple linear regression model can be considered valid.

1.3 Anova table

The ANNOVA Table reveales that F = 26.801,32 which is a big value and Significance F = 3,66E-58, by consequence a very small value, concluding that the model adjusts well the sample data.

1.4 Residual output table

Intercept is the independent element, thus cofficient $\hat{a}$ is 3,6355. The independent element is the point where the exogenous variable equals 0. In conclusion, the total expenditures level is 3,6355, if the total revenue is 0. Because t_{a_0} = 0,7334 and the significance threshold P-value is 0,4675>0,05, the coefficient is not significant. The Confidence Interval for this parameter is -6,38205 $\leq \alpha \leq$ 13,65307.

Coefficient $\hat{b}$ is 0,91 which means that the revenue increase by 1% determines an increase in the total revenues by 1%, therefore, the total expenditures level will increase by 0,91. Due to the fact that t_{a1} = 163,711 and the significance threshold P-value is 3,66E-58<0,05 means that this a significant coefficient. The Confidence Interval for this parameter is 0,899667 $\leq \beta \leq$ .0,922158.

For the independent element of the model (Intercept), P-value = 0,4675, concluding that rejecting the hypothesis that the Intercept equals 0, there will be a 46% error. In conclusion, the independent element is no signifficantly different from 0.

Regarding the Confidence Intervals, for the theoretical independent element, the interval is (-6,38205, 13,65307). In addition, for the slope of the regression equation we have the Confidence Interval (0,899667, 0,92215801). It is very important that none of these Confidence Intervals contain 0 in order to make the assumption that the model is valid.

II. Conclusion

In order to finalise the research, the model was checked for any behaviour distortions of the estimation by extracting 30 samples out of 10 counties. For each sample we applied the method of least squares in view of estimating the parameters of the regression models. Results are aggregated in the tale below:

Estimations of the linear regression model for various samples

	Parameter b	**Parameter a**
SAMPLE I	0,913735952	-6,776491812
SAMPLEII	0,896178877	7,34152897
SAMPLEIII	0,922172001	-0,505534353
SAMPLEIV	0,859074039	25,80192753
SAMPLEV	0,802227534	52,61527764
SAMPLEVI	0,854058987	31,82990717
SAMPLEVII	0,913685202	3,106485105
SAMPLEVIII	0,94603653	-17,97586774
SAMPLEIX	0,911004828	11,18535746
SAMPLEX	0,863267446	21,85895454
SAMPLEXI	0,91507055	12,72408929
SAMPLEXII	0,941591495	-4,847258257
SAMPLEXIII	0,980589735	-33,94349337
SAMPLEXIV	0,957452179	-20,42890225
SAMPLEXV	0,913516245	-5,840508736
SAMPLEXVI	0,911856849	-0,990140053

SAMPLEXVII	0,911141139	11,76752161
SAMPLEXVIII	0,930952531	-3,950102424
SAMPLEXIX	0,897929762	14,54030544
SAMPLEXX	0,897929762	14,54030544
SAMPLEXXI	0,86139412	27,7376706
SAMPLEXXII	0,91243849	-2,434070771
SAMPLEXXIII	0,857465912	36,20548307
SAMPLEXXIV	0,928416446	-12,92086762
SAMPLEXXV	0,902045928	12,10271017
SAMPLEXXVI	0,912488083	4,421866955
SAMPLEXXVII	0,840212401	34,58592647
SAMPLEXXVIII	0,839713064	32,53746602
SAMPLEXXIX	0,909279674	13,14017589
SAMPLEXXX	0,879661975	14,55266864
Estimators average	0,89942	9,06608

Values pressumed as valid at population level are:

$y = a + bx + \varepsilon$
a=3,635508(p-value=0,467545619)
b=0,910912(p-value=3,66124E-58)

Following the analysis of the probability p-value for both parameters one can say that, because p-value for the independent element is a is 0, 467545619>5%, parameter a is not signfifficantly different from 0. Nevetheless, for the regression coefficient, p-value is <5%, so we can assume that b is significantly different from 0.

After analysing the unbiased property for the independent element a:

$M(\hat{a}) = a$

$M(\hat{a}) = 9{,}06608 \neq a(=3{,}635508)$ it is not an unbiased estimator and its bias equals the difference $M(\hat{a}) - a = 5{,}430571$.

After analysing the unbiased property for the egression coefficient:

$M(\hat{b}) = b$

$M(\hat{b}) = 0{,}89942 \cong b(0{,}910912)$ it is not an unbiased estimator.

In conclusion, the linear regression model regarding the dependency of total expenditures of total revenues is that the independent element of the model is validated as unbiased, whilst the the biased assumption is validated in the case of the regression coefficient.

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