

Econometric Models for the Analysis of Tax Revenues

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Abstract: The study analyzes tax revenues by assessing their significance and influence factors. The largest share in State budget revenues is owned by tax revenues. Their importance is reflected both in the leadership - the government and the taxpayer, both being concerned about the ability to cover budget expenditure and investing in the quality of social life. Thus, at the end we tried to answer the question "How can we increase tax revenues?".

Keywords: taxes, tax evasion, State budget, influencing factors

JEL Classification: G20, G28

1. Introduction

The presence of the government in economic and social life is and will be indispensable, with a strong importance on all hierarchical levels. Since most of the services needed to people are sponsored by the state (health, education, culture, etc.), the importance of state revenues is amplified exponentially. The development of the society is highly conditional on the public sector and good management applied in the use of the state budget for the needs of taxpayers.

The need of tax is justified by existing primary costs in any society, even that of a free society, that needs to be covered.

Joseph Garnier defined tax as "the price of services rendered and, in particular, the price of the security services, universal service interest or the premium paid for the guarantee of security, the security word being taken in its general sense of security protection, law justice, order, property, individual freedom, national independence, the enforcement of fair laws or contracts".

The most important role of taxes is manifested financially because it is the primary means of procuring financial resources necessary to cover public spending. Also, one could see an increase in taxes on the economic role embodied in the state's attempts to use taxes as a means of intervention in economic activity. Thus, the taxes can be used as a means of encouraging (as exoneration for example) or discourage (via over taxing for example) certain economic activities. Petre Brezeanu, Iulian Marinescu (1998).

2. The general budget and tax revenues

The general budget is set each year by law, with a specific orientation of each financial year, i.e. 2014 state budget had as orientation the investments.

The largest share in the revenues of the state budget is given by tax revenues. Determining factors of influence on tax revenues is paramount in order to increase the amounts collected by the State.

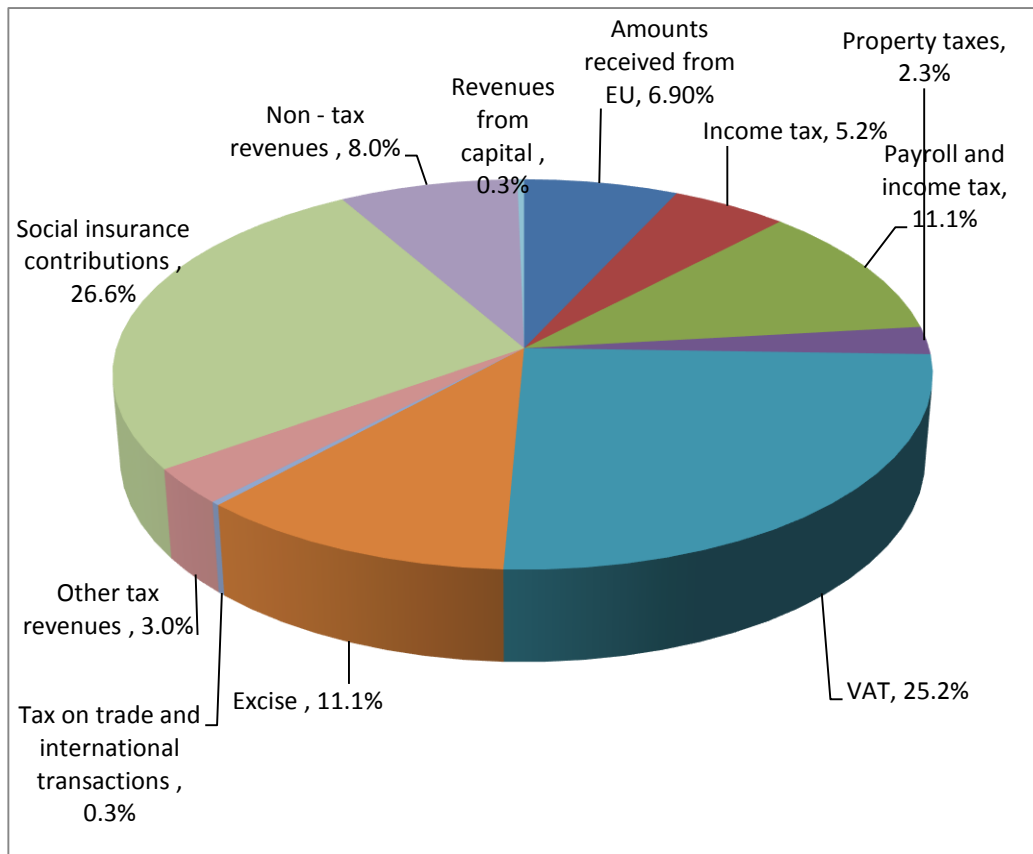


Figure 1. Revenues share, in total budget revenues in 2014

Source: 2014 Budget Report www.mfinante.ro

As shown in Figure 1 the largest share in budget revenues is owned by social insurance contributions, followed by VAT. According to the situation presented, to increase budget revenues level should be taken measures on the man, the taxpayer.

Removal of undeclared work or taxation of daily expenses made by individuals should be the main objectives of the government, being the most important factors generating revenues.

Budget revenues may be influenced by economic developments and fiscal policy decisions taken, e.g. raising the minimum wage, changing the calculation base for social health insurance contributions payable by pensioners, the increase of fees, the change of the amount of excise duty and the decision to block temporarily the repayment of EU funds as a result of deficiencies found in previous years.

Currently, one of the main problems facing Romanians is the low level of tax revenues, due to the weak collection of these.

3. Importance of tax revenues

The importance of analysis of tax revenues is increased as the inability to cover costs and the inability to collect revenues to the state budget in the economy.

A high level of tax evasion, an economy that is not taxed cause great harm

both to the state budget revenues and the level of social life. The failure to fund public services at a level necessary leads to dissatisfaction of the taxpayer and thus also attracts a desire to evade the payment of taxes.

Example:

→ Education: inability to bring all schools to a level of amenities close to international standards;

→ Health: inability to modernize hospitals, polyclinics, dispensaries and medical practices to international standards and especially the inability to finance the supplies needed for the proper medical unit, putting the taxpayer to spend the extra money to treat suffering problems;

→ Public services: transport is an essential service to the taxpayer needs, be it transport, by car, by bike or on foot, the government should provide everything needed for a citizen to be able to move;

→ Social services: social protection (police and welfare) are services that the taxpayer needs daily and which has to rise to its expectations, its safety being the first priority.

4. Tax evasion

According to calculations of Fiscal Council based on NSI data, tax evasion records a very high share in Romania, accounting for 16.2% of GDP in 2013. If Romania would collect the taxes at its maximum, would have budgetary revenues as a percentage of GDP above the European average, while the legal level of the main taxes in Romania is higher than the European average (at European level, Romania has the 3rd highest standard of VAT rate and the 7th high tax burden on labour - generated mainly by CAS; while Romania has one of the lowest statutory corporate tax rate and personal income in the European Union, but they have a low share in the budgetary revenues).

A profound reform of the administration of taxes in Romania targeted towards increasing tax collection is absolutely necessary and likely to create the fiscal space needed to reduce the tax burden on wage labour, which is a very high level today. Fiscal Council of Romania (2013)

The main factors generating the phenomenon of tax evasion can be grouped as follows:

- psycho-social factors - these are based on impulses and intimate beliefs of the taxpayer and also social environment influences where he lives;
- economic factors - they take taxpayer perceptions about opportunities to meet the needs of the income remaining after the payment of contributions to the state budget;
- legal and administrative factors - namely the taxpayer's perception on how establishing tax fairness, on the destinations given by the state to the amounts collected and how the state applies the law.

All these factors do not act independently, with joint action in regard to the phenomenon of tax evasion. Evolution of tax evasion in Romania in the period 2000-2013 recorded explosive growth in this period.

5. Econometric analysis of tax revenues

✓ Data description

The analysis was built on official data published by Eurostat, which were downloaded on May 15th2015. The variables used in the analysis are:

- budget deficit - the indicator was calculated as the relation between the net capacities of financing on the net borrowing. The measurement unit for the indicator budget deficit is millions of euros;
- GDP per capita - the measurement unit of the GDP per capita is EUR per capita;
- Minimum wage - the measurement unit for minimum wage indicator is the EURO;
- Young employees - the indicator comprises people aged between 15 and 24. It is expressed as a percentage of total young people;
- Tax revenues.

The indicator represents the sum of tax revenues, taxes and social contributions at the general state budget (including its subunits: central budget, the state budget, local budget and social security funds).

The measurement unit for the indicator of tax revenues is millions of euros.

For the realization of the model were used data for 15 European Union countries: Bulgaria, Czech Republic, Spain, France, Latvia, Lithuania, Luxembourg, Hungary, Poland, Portugal, Romania, Slovenia, Slovakia, England and Malta. The choice of these countries was founded by the lack of data for the indicator of minimum wage for certain countries as those countries have a minimum wage set by law, for example Sweden.

The period analyzed is 1990-2012.

The methodology used is the analysis of panel data models. The object of this study is to determine how the variables influence the budget deficit, GDP per capita, minimum wage and young employees on the tax revenues indicator.

To determine the model we tested whether the chosen indicators meet the following criteria: variables to be stationary (analysis that was performed using Augmented Dickey-Fuller test) errors to be normally distributed (analysis has been done using Jarque Berra test) and uncorrelated.

Modelling was performed using the E-views program.

Augmented Dickey-Fuller test

Unit root test is used to determine the nature of the series (stationary or non-stationary).

The auto-regression equation:

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{j=1}^p (\delta_j \Delta Y_{t-j}) + e_t$$

$$\Delta Y_t = \alpha + \gamma Y_{t-1} + \sum_{j=1}^p (\delta_j \Delta Y_{t-j}) + e_t$$

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \sum_{j=1}^p (\delta_j \Delta Y_{t-j}) + e_t$$

Where:

- t is the time index;
- α is an intercept constant called a drift;
- β is the coefficient on a time trend;
- γ is the coefficient presenting process root, i.e. the focus of testing;
- p is the lag order of the first-differences autoregressive process;

- e_t is an independent identically distributed residual term.

Model assumptions:

$$1) \quad H_0: Y_t \text{ is Random Walk (series is non-stationary)}, \gamma = 0$$

$$H_1: Y_t \text{ is stationary process}, \gamma < 0$$

$$2) \quad H_0: Y_t \text{ is Random Walk around a drift}, \gamma = 0, \alpha \neq 0$$

$$H_1: Y_t \text{ is level stationary process}, \gamma < 0, \alpha \neq 0$$

$$3) \quad H_0: Y_t \text{ is Random Walk around a trend}, \gamma = 0, \beta \neq 0$$

$$H_1: Y_t \text{ is trend stationary process}, \gamma < 0, \beta \neq 0$$

All indicators were tested using Augmented Dickey-Fuller test in E-views and standing when appropriate.

Testing was done by the two models Fixed Effects and Random Effects.

➤ Fixed Effects Model

Fixed Effects Model Equation is:

$$Y_{it} = \beta_1 x_{it} + \alpha_i + u_{it}$$

Where:

Y_{it} – is the dependent variable;

x_{it} – is the independent variable;

β_1 – coefficient;

α – is the intersection of variables;

u_{it} – errors.

As shown in Figure 2, according to this indicator minimum wage model has the strongest correlation with tax revenues, followed by youth employees and budget deficit:

$$\text{Venit}_{\text{fiscal}} = -64771,03 - 2941,313 * \text{PIB} - 0,300920 * \text{deficit}_b + 2671,170 * \text{tineri}_a \\ + 344,6780 * \text{sal}_{\text{min}}$$

Dependent Variable: VENIT_FISCAL?
 Method: Pooled Least Squares
 Date: 05/26/15 Time: 23:37
 Sample: 1999 2012
 Included observations: 14
 Cross-sections included: 13
 Total pool (unbalanced) observations: 177
 Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-64771.03	27269.50	-2.375219	0.0187
PIB?	-2941.313	1260.894	-2.332720	0.0209
DEFICIT_B?	-0.300920	0.108932	-2.762449	0.0064
TINERL_A?	2671.170	643.3554	4.151936	0.0001
SAL_MIN?	344.6780	56.74183	6.074496	0.0000
Fixed Effects (Cross)				
_BULGARIA-C	-5558.706			
_RCEHA-C	-26309.61			
_SPANIA-C	122552.3			
_FRANTA-C	404263.0			
_MALTA-C	-222267.4			
_LETONIA-C	-50191.60			
_LITUANIA-C	-29804.30			
_LUXEMBURG-C	-310599.3			
_UNGARIA-C	-15050.30			
_POLONIA-C	20701.78			
_ROMANIA-C	-4231.204			
_SLOVENIA-C	-148643.5			
_ANGLIA-C	254494.4			
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.987932	Mean dependent var	155016.6	
Adjusted R-squared	0.986725	S.D. dependent var	259918.0	

Figure 2. Fixed Effects Model. Calculated in the E-views program, Eurostat data

✓ **Random Effects Model**

The Random Effects Model Equation is:

$$Y_{it} = \beta x_{it} + \alpha + u_{it} + \varepsilon$$

Where:

- Y_{it} – is the dependent variable;
- x_{it} – is the independent variable;
- β_1 – coefficient;
- α – is the intersection of variables;
- u_{it} – errors.

As shown in Figure 3, according to this model, GDP indicators, young employees and minimum wage have the strongest correlation with tax revenues, on the lowest places remaining the budget deficit and gross domestic product:

$$\text{Venit}_{\text{fiscal}} = -92174,15 - 11505,11 * \text{PIB} - 0,288080 * \text{deficit}_b \\ + 2544,960 * \text{tineri}_a + 679,7905 * \text{sal}_{\text{min}}$$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-92174.15	19554.46	-4.713716	0.0000
PIB?	-11505.11	965.0969	-11.92120	0.0000
DEFICIT_B?	-0.288080	0.104357	-2.760529	0.0064
TINERL_A?	2544.960	531.3699	4.789432	0.0000
SAL_MIN?	679.7905	39.10350	17.38439	0.0000
Random Effects (Cross)				
_BULGARIA--C	24321.26			
_RCEHA--C	16858.81			
_SPANIA--C	113091.9			
_FRANTA--C	239924.4			
_MALTA--C	-253606.1			
_LETONIA--C	-15356.27			
_LITUANIA--C	5494.542			
_LUXEMBURG--C	-200492.3			
_UNGARIA--C	10048.78			
_POLONIA--C	27616.55			
_ROMANIA--C	28743.09			
_SLOVENIA--C	-154366.2			
_ANGLIA--C	157721.6			
Effects Specification				
		S.D.	Rho	
Cross-section random		29729.41	0.4964	
Idiosyncratic random		29947.05	0.5036	
Weighted Statistics				
R-squared	0.580210	Mean dependent var	40321.69	
Adjusted R-squared	0.570448	S.D. dependent var	76984.64	
S.E. of regression	50618.36	Sum squared resid	4.41E+11	
F-statistic	59.43224	Durbin-Watson stat	0.266209	
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.677048	Mean dependent var	155016.6	
Sum squared resid	3.84E+12	Durbin-Watson stat	0.030552	

Figure 3. Random Effects Model. Calculated in the E-views program, Eurostat data

To determine which of the two models Fixed Effects and Random Effects is more effective, will be calculated the **Hausman test**.

Equation of the model:

$$\hat{\beta}_{RE} - \hat{\beta}_{FE}$$

$$w = (\hat{\beta}_{RE} - \hat{\beta}_{FE})' \sum (\hat{\beta}_{RE} - \hat{\beta}_{FE}) \sim \chi^2(k)$$

Model assumptions:

H_0 : Random Effects model is the closest;

H_1 : Fixed Effects model is the closest.

Applying Hausman test, using the E-views program, we have determined the probability of 0.75. Since it exceeds 5%, the null hypothesis is accepted, Random Effects is the most efficient model.

✓ **Calculation of errors**

To see whether the errors are normally distributed, we apply the Jarque Berra test, Figure 4.

Since kurtosis has a value of over 1, it means that this distribution is platikurtosis. Skewness approaches 0, with a value of -1.845274.

Jarque-Bera tests whether a distribution is normally distributed. The test measures the difference between the asymmetry coefficients and kurtosis of the analyzed distribution with the ones of normal distribution. The test has the null hypothesis: the series is normally distributed. Thus, if the probability associated with the test is superior to the level of relevance chosen (1, 5 or 10 percent), the null hypothesis is accepted.

As shown, in this case associated probability is 11.67% test, the null hypothesis is accepted, and the series is normally distributed.

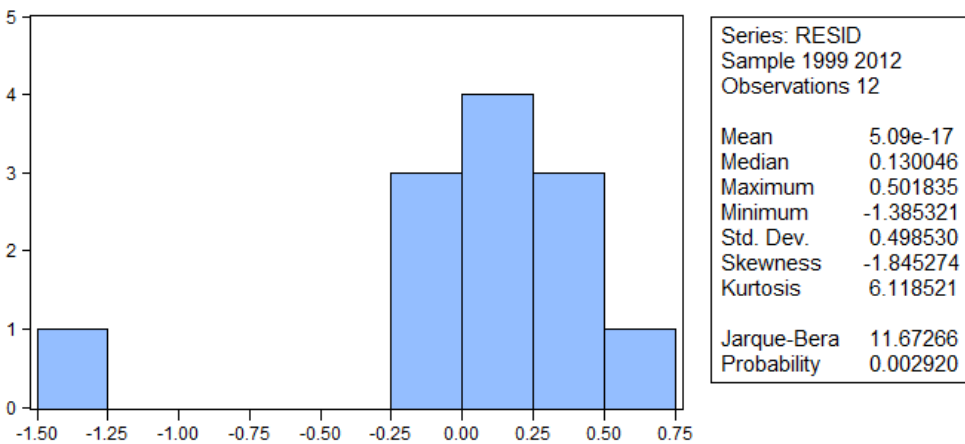


Figure 4 Jarque Berra Test. Calculated in the E-views program, Eurostat data

Correlogram of residues, as shown in Figure 5 does not show significant fluctuations. Autocorrelation coefficients can be equated with zero and coefficients of partial autocorrelation are close to zero.

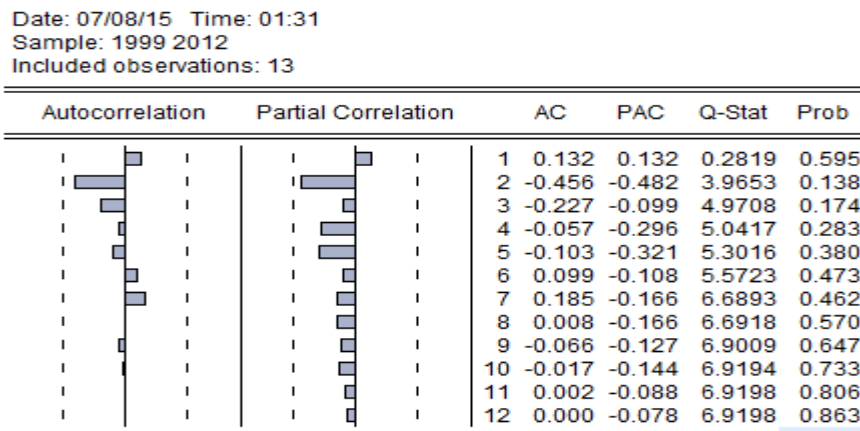


Figure 5. Correlogram of residues. Calculated in the E-views program, Eurostat data

6. Conclusion

Currently, one of the main problems facing Romania is the lower level of tax revenues. The need their increase is accentuated by the need of taxpayers to have quality public services.

Romania is a country with high growth potential but which currently registers very low quality of life indicators.

To increase state budget revenues and therefore costs, we tried to determine the impact on tax revenues for GDP per capita indicators, minimum wage, budget deficit, young employees. As noted the highest correlation was calculated for minimum wage indicator, followed by the indicator of young employees.

This conclusion is reinforced by the fact that in the share of tax revenues, social contributions have the highest percentage. Another indicator may be the answer to "How can we increase tax revenues?" is "young employees." The relatively small values in relation to young people, argues the possibility of increasing revenues and employed population. But it must not lose sight of the fact that their entry into the workforce at the expense of education will in future be no real gain to the state budget, or in society. Thus, for this increase should be implemented projects to encourage and help young people get part-time jobs or seasonal.

Importance of these factors of influence is supported by the significance of tax revenues for both the state budget and for society. Both the government and the taxpayer are concerned about the ability to cover budget spending and investing in the quality of social life. Increasing tax revenues, by means other than raising or creating new taxes, is a major concern of the government.

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