THE FISCAL REVENUES AND PUBLIC EXPENDITURES: IS THEIR EVOLUTION SUSTENABLE? THE ROMANIAN CASE

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ABSTRACT: Depending on the specific stage of economic cycle, different types of fiscal policies, expansionist (incentive) or restrictive (prohibition), are use in specific state of the economy, for a certain period of time. Thus, in times of recession, the state use of tax incentive measures and in times of economic boom are applied, in particular, prohibitive taxation policies in order to avoid, where possible, the large economic shocks. Starting from the idea that taxation, as any other financial leverage, is displayed while operated in influencing capacity and rebalancing the economic situation in growth, we believe, that the adjustments made by fiscal policy, it should be comprehensive, immediate and lasting, therefore, this paper is focused on aspects regarding fiscal policy sustainability in Romania. The objective is to provide some empirical evidencies of sustainability of fiscal revenues and expenditure flows. The main output consist in this thesis that some support could be found for the sustainability.

Keywords: fiscal policy, sustainability, cointegration tests, budget revenues and expenditures

JEL codes: H20, H63, C22, C32

Introduction

Changes, in time, of the proportions in which are tax system, is a logical process, objectivity of these structural changes are determined, as revealed in the literature, by more rapid development of activities to the other, by the different rhythms of increases recorded as a result of differential action of the forces that influence behavior and policy-makers.

The issues of sustainability fiscal policy is an approach widely debated both in the scientific community and especially in decision making, which is due to redistributive nature of fiscal policies that can influence sustainable development, at economic, social, political and environmental level.

In order to test sustainability of fiscal revenues flows and expenditure, the first step taken by our methodology is to testing s stationarity adjusting to them to highlight the existence of a a first-order cointegration relation between those variables.

Theoretical background

Such methodology is based on the proposed approach, for example, in Trehan and Walsh (1988, 1991), Elliot and Kearney (1988), Bohn (2007), Tanner and Liu (1994, 1995), Quintos

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(1995), Haug (1995), Ahmed and Rogers (1995), Owoye (1995), Payne (1997), Papadopoulos and Sidiropoulos (1999), Olekalns (2000), Martin (2000), Hatemi-J (2002), Afonso (2005, 2007), Afonso and Rault (2008) and many others. Note, that all the studies, we referred taken into account consolidated general government budgetary revenues and expenditures in their total amount, using data sets of monthly, quarterly or annual, with supporting the sustainability of fiscal policies, both at a single country and on groups of countries. In this paper we consider only the tax revenue raised, given their overwhelming share of the amount of consolidated general government revenues.

Literature suggests a number of other methodologies to test fiscal policy sustainability, taking account, in addition to testing the existence of a a first-order cointegration relation between consolidated general government budgetary revenues and expenditures, tests for the stationarity of the first differences of public debt stock or budgetary constraint for government authorities. In this regard, relevant papers are those of Hamilton and Flavin (1986), Trehan and Walsh (1988), MacDonald and Speight (1990), Caporale (1995), Vanhorebeek and van Rompuy (1995), Getzner, Glatzer and Neck (2001), Greiner, Koeller and Semmler (2004), Talpoş, Dima, Mutaşcu and Enache (2007,2008), works, in witch, the ADF stationary tests - Augmented Dick-Fuller or PP - Phillips Perron highlights sustainability of fiscal policies in a country, or in different groups of countries, with conclusive or inconclusive results, due to sensitivities and peculiarities of each economy examined.

More recent papers, including Cuando, Gil Alana and Perez de Garcia (2002), call into question, after studying the sustainability fiscal policies using the existence of a a first-order cointegration relation between consolidated general government budgetary revenues and expenditures in their total amount, that these variables are integrated of order between 0 and 1, which shows that the budget deficit is a process of *mean reverting*, therefore sustainability will be achieved on long term due to tax adjustments that will take place. Such an approach, which we all agree, operates a number of shortcomings of the method for investigating the sustainability of fiscal policy proposed by Blanchard (1990), methodology used in the papers to which we referred.

Method and results

The most common test for determining the sustainability of fiscal policy is a first-order cointegration relation between the first differences of total public expenditures (including debt's interest) an total fiscal revenues, in order to determine the existence of mecaniscm leading to long-term restoration of budgetary balance, implies the following cointegration relation between these variable of the following kind:

$$VF = a + b \times CH + u_t \tag{1}$$

where:

VF = consolidated general government fiscal revenues % GDP;

CH = consolidated general government expenditures % GDP;

a, b = constants, $b \in (0,1]$;

u_t = stochastic variable with zero mean, constant variance and non-self-correlated.

In these conditions, we will test if the time series of public revenues and public expenditures are cointegrated, this means that there is an error-correction mechanism that determines proximity to the required level of intertemporal budget constraint (relation 1).

In order to be cointegrate of order 1, both time series, must be integrated order 1 (exists a long-term (equilibrium) relation), whereas, if one of the series would be stationary, then the two series would become divergent. This feature first difference stationary series of tax revenue and expenditure reduced as they may deviate from one another in time. For the cointegration test, we used annual data for public fiscal revenues and public expenditures, for a period between 1993-

2013, data is the observed values and expected values, and in order to identify the stationarity test we used the *ADF (Augmented Dickey-Fuller)* procedure, and *Kwiatkowski-Phillips-Schmidt-Shin* procedure, data source used is represented by IMF Country Report No. 06/169/2006 for 1993-2005 period and IMF Country Report No. 09/183/2009 for 2005-2011 peroid.

The results of the ADF test for the time series of consolidated general government fiscal revenues, for Romania is:

Table no. 1.

The results of the ADF test for the time series of public fiscal revenues

Null Hypothesis: VF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on Modified HQ, MAXLAG=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.551992	0.0607
Test critical values:	1% level	-4.498307	
	5% level	-3.658446	
	10% level	-3.268973	

*MacKinnon (1996) one-sided p-values.

As we can see, the test confirm the stationarity hypothesis with 0,06 percent probability that consolidated general government fiscal revenues time series has a unit root. An additional test KPSS suggests that the series is nonstationary in levels. The same test was applied for the first differences of the public expenditures time series and the obtained results were the following

Null Hypothesis: VF is stationary
Exogenous: Constant, Linear Trend
Lag length: 0 (Spectral GLS-detrended AR based on Modified HQ, MAXLAG=4)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.357964
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	1.623063
HAC corrected variance (Spectral GLS-detrended AR)	0.957223

Table no. 2.

The results of the ADF test for the time series of public expenditures

Null Hypothesis: CH has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on Modified HQ, MAXLAG=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.464957	0.8074
Test critical values:	1% level	-4.498307	
	5% level	-3.658446	
	10% level	-3.268973	

*MacKinnon (1996) one-sided p-values.

As we can see, the test confirm the stationarity hypothesis with 80.07 percent probability that consolidated general government fiscal expenditures time series has a unit root. An additional test KPSS suggests that the series is nonstationary in levels.

Null Hypothesis: CH is stationary
Exogenous: Constant, Linear Trend
Lag length: 0 (Spectral GLS-detrended AR based on Modified HQ, MAXLAG=4)

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.756523
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

The stationarity tests *Augmented Dickey-Fuller* and *Kwiatkowski-Phillips-Schmidt-Shin* suggest that the two series can be treated as processes of type I (1) (stationary on the differences of 1 order), so, in these conditions, we will test if the time series of public fiscal revenues and public expenditures are cointegrated. We can used the cointegration JOHANSEN test (linear deterministic trend in data, consistent with no trend in cointegration relation and VAR). EViews program implement VAR based on cointegration tests using methodology developed in Johansen (1991, 1995a).

Thus lets consider Y_t a vector of non-stationary *I(1)* variables, x_t a d – vector of deterministic variables, and ε_t a vector of innovations. Then the data generating process for *t y* y is a *Gaussian vector autoregressive model* of finite order k, *VAR (k)* which could be written as:

$$\Delta Y_t = \prod Y_{t-1} + \sum_{i=1}^{p-1} \Gamma \Delta Y_{t-1} + Bx_t + \varepsilon_t \quad (2)$$

where:

$$\prod = \sum_{i=1}^{p} A_i - I, \Gamma_i = -\sum \quad (3)$$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank $r < k$, then there exist $k \times r$ matrices α and β each with rank such that $\Pi=\alpha\beta$ and $\beta' Y_t$ is I(0). r is the number of cointegrating relations (the *co-integrating rank*) and each column of β is the co-integrating vector.

The elements of α are known as the *adjustment parameters* in the *VEC model*. Johansen's method is to estimate the Π matrix from an unrestricted *VAR* and to test whether one can reject the restrictions implied by the reduced rank of Π. The empirical time series may have nonzero means and deterministic trends as well as stochastic trends. Similarly, the co-integrating equations may have intercepts and deterministic trends. The asymptotic distribution of the LR test statistic for cointegration does not have the usual χ^2 distribution and depends on the assumptions made with respect to deterministic trends. Therefore, in order to carry out the test, one, it needs to make an assumption regarding the trend underlying the analysis data.

Usually, these assumptions imply the following five deterministic trend cases considered by Johansen (1995, p. 80–84):

1. The level data Y_t have no deterministic trends and the co-integrating equations do not have intercepts:
$$\prod Y_{t-1} + Bx_t = \alpha\beta' Y_{t-1} \quad (4)$$

2. The level data Y_t have no deterministic trends and the co-integrating equations have intercepts:
$$\prod Y_{t-1} + Bx_t = \alpha(\beta' Y_{t-1} + \rho_0) \quad (5)$$

3. The level data Y_t have linear trends but the co-integrating equations have only intercepts:
$$\prod Y_{t-1} + Bx_t = \alpha(\beta' Y_{t-1} + \rho_0) + \alpha_\perp \gamma_0 \quad (6)$$

4. The level data Y_t and the co-integrating equations have linear trends:
$$\prod Y_{t-1} + Bx_t = \alpha(\beta' Y_{t-1} + \rho_0 + \rho_1 t) + \alpha_\perp \gamma_0 \quad (7)$$

5. The level data Y_t have quadratic trends and the co-integrating equations have linear trends:
$$\prod Y_{t-1} + Bx_t = \alpha(\beta' Y_{t-1} + \rho_0 + \rho_1 t) + \alpha_\perp(\gamma_0 + \gamma_1 \quad (8)$$

The terms associated with $\alpha_\perp$ are the deterministic terms "outside" the cointegrating relations. When a deterministic term appears both inside and outside the co-integrating relation, the decomposition is not uniquely identified. Johansen (1995) identifies the part that belongs inside the error correction term by
orthogonally projecting the exogenous terms onto the α space so that $\alpha_\perp$ is the null space of α such that $\alpha' \alpha_\perp = 0$.

Two tests could be employed to estimate the number of co-integration relations: The trace statistic tests the null hypothesis of r co-integrating relations against the alternative of k co-integrating relations, where k is the number of endogenous variables, for $r = 0,1,...k-1$. The alternative of k co-integrating relations corresponds to the case where none of the series has a unit root and a stationary VAR may be specified in terms of the levels of all of the series. The trace statistic for the null hypothesis of co-integrating relations is computed as:

$$LR_{tr}(r|k) = -T\sum_{i=r+1}^{k}\log(1-\lambda_i) \quad (9)$$

where:

λ_i = i-th largest eigenvalue of the $\prod$ matrix.

The maximum eigenvalue statistic tests the null hypothesis of r co-integrating relations against the alternative of $r+1$ co-integrating relations. This test statistic is computed as:

$$LR_{\max}(r|r+1) = -T\sum_{i=r+1}^{k}\log(1-\lambda_{r+1}) = LR_{tr}(r|k) - LR_{tr}(r+|k) \quad (10)$$

Table no. 3.

The results of co-integretion JOHANSEN test

Included observations: 20 after adjustments
Trend assumption: Linear deterministic trend
Series: CH VF
Lags interval (in first differences): No lags
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.568232	17.98568	15.49471	0.0206
At most 1	0.057685	1.188319	3.841466	0.2757

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.568232	16.79736	14.26460	0.0195
At most 1	0.057685	1.188319	3.841466	0.2757

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

CH	VF
-0.407380	1.053045
0.354603	0.084541

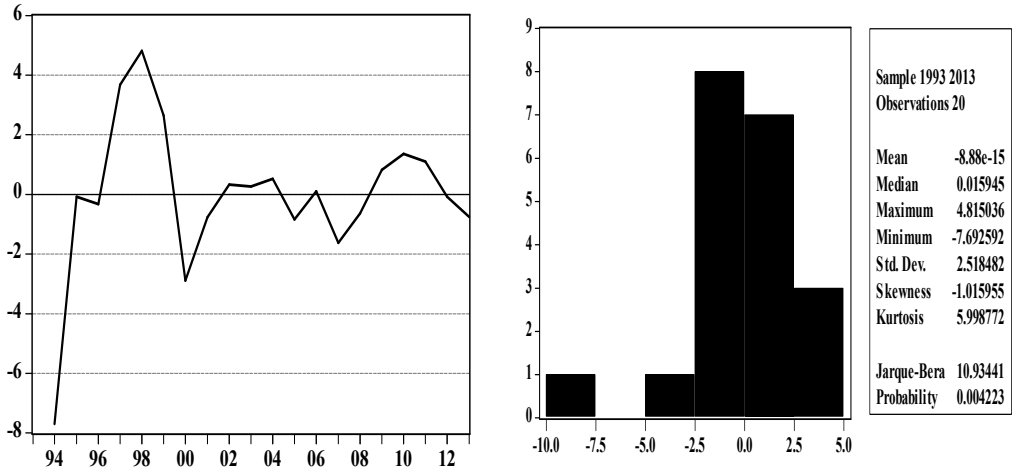
Unrestricted Adjustment Coefficients (alpha):

D(CH)	-0.019941	-0.375799
D(VF)	-0.737468	-0.164709

1 Cointegrating Equation(s): Log likelihood -56.63555

Normalized cointegrating coefficients (standard error in parentheses)	
CH	VF
1.000000	-2.584922
	(0.38086)
Adjustment coefficients (standard error in parentheses)	
D(CH)	0.008123
	(0.15025)
D(VF)	0.300429
	(0.09026)

Cointegration JOHANSEN test, between the current values of the two series, allows highlighting the existence of certain relation Cointegration. Thus, the *Trace* test and *Max-eigenvalue* test highlight a cointegration relation on contemporary values. Of course, one critical issue is that of meaning and stability of such cointegration relation, relation evident in *Graph no. 1*.



Graph no. 1. The evolution of the cointegration relation

Thus, a preliminary analysis, suggest that there may be structural changes in the functional relation between tax revenue and public expenditure, changes in the second period of analysis (2000-2001 period). A possible explanation could be related to lower tax burden by reducing, from January 1, 2000, the corporation tax rate from 38% to 25%, and then, to 16% from January 1, 2005, and reduce all of January 1, 2000, the general VAT rate from 22% to 19%.

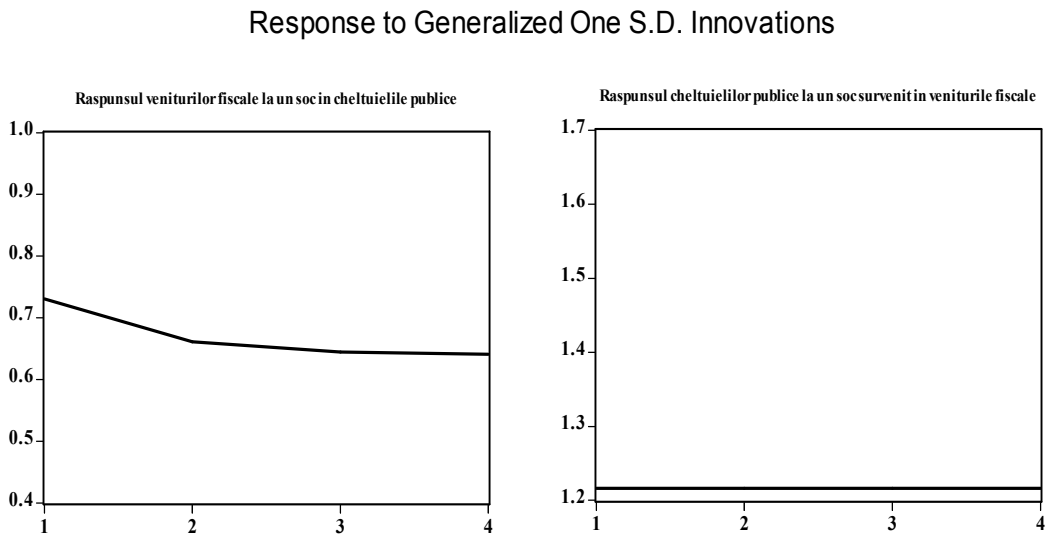
Amid a growth of gross domestic product from 54.573,02 million ron in 1999 to 116.768,7 million ron in 2001, the level of general taxation decreased by 2,1 percentage points in 1999-2001 period.

It is also interesting to note, that the model type VEC (Vector error correction model), which is built by incorporating this cointegration relation, reveals a rigidity of public expenditure in relation to the dynamics of income tax:

Table no. 4.

***The results of* VEC model**

Included observations: 20 after adjustments		
Standard errors in ( ) & t-statistics in [ ]		
Cointegration Restrictions:		
A(1,1)=0		
Convergence achieved after 2 iterations.		
Not all cointegrating vectors are identified		
LR test for binding restrictions (rank = 1):		
Chi-square(1)	0.003097	
Probability	0.955622	
Cointegrating Eq:	CointEq1	
CH(-1)	-0.408249	
VF(-1)	1.052829	
C	-16.02085	
Error Correction:	D(CH)	D(VF)
CointEq1	0.000000	-0.728638
	(0.00000)	(0.14971)
	[NA]	[-4.86684]
C	0.210000	-0.040000
	(0.36882)	(0.22163)
	[0.56938]	[-0.18048]
R-squared	0.000148	0.380593
Adj. R-squared	-0.055400	0.346181
Sum sq. resids	48.97077	17.68283
S.E. equation	1.649424	0.991151
F-statistic	0.002658	11.06005
Log likelihood	-37.33368	-27.14739
Akaike AIC	3.933368	2.914739
Schwarz SC	4.032941	3.014312
Mean dependent	0.210000	-0.040000
S.D. dependent	1.605550	1.225776
Determinant resid covariance (dof adj.)		1.219608
Determinant resid covariance		0.987882
Log likelihood		-56.63710
Akaike information criterion		6.263710
Schwarz criterion		6.562430



Graph no. 2

Conclusions

A possible interpretation of this result is that fiscal policy was based, on a significantly more pronounced way, to the adjustments in the level and structure of tax levels against the reduction of public spending, in order to maintain budgetary balance, in the short time, however, identify which categories of tax revenues were used in adjusting, is difficult. Unfortunately, public authorities have a single goal, to ensure a balance in the short time, to reach the Maastricht convergence criteria and rigid observance of the old Stability and Growth Pact, so, such prerequisites for sustainable development and sustainable by promoting consistent policies tax revenue and expenditure, were ignored.

Of course, an advanced analysis, is too restrictive to fully support such a conclusion. However, the results seem to show a certain rigidity of public expenditure in relation to the active nature of the tax levies, in their depiction of fiscal policy instrument, therefore, the sustainability of fiscal policy in Romania may be questioned, at least on long run.

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