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The revenues-spending nexus in Romania: a TAR and MTAR approach

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ABSTRACT

This study is an attempt to test the relationship between revenues and government spending, in the case of Romania, over the 1999Q1–2012Q1 period. For this purpose, we have chosen the Threshold Autoregressive (TAR) and Momentum-TAR (MTAR) approaches. The main results obtained through the TAR and MTAR models offer support for the spend-tax hypothesis, with long-run asymmetric adjustment for Romania. Considering this case, whenever dealing with budgetary disequilibrium, it is recommended the Romanian government prioritises the spending component of fiscal policy, with adjustments in the level and structure of public expenditures.

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1. Introduction

Over the last few years, Romania has been confronted with serious budgetary deficit problems, especially as a result of the international financial crisis. Being a member of EU since 1997, Romania is an ex-communist country that restructured its economy in the spirit of the free competitive market starting from the Revolution of 1989. After a prosperous economic period between 2003 and 2007, characterised by a high level of foreign direct investment inputs, low unemployment and consistent economic growth, the Romanian government exhibited persistent and complex budgetary liquidity goals, as result of financial crisis. In order to ensure the equilibrium, the public authority contracted a loan of €19.95 billion from the International Monetary Fund (IMF), European Commission (EC), World Bank (WB) and European Bank for Reconstruction and Development (EBRD). Figure 1 shows that, for the period 1995–2011, there are three main periods in the case of Romanian's budgetary activity: first, with a large deficit (1995–2001); second, with a moderate budget deficit (2002–2007), and third, with a very high deficit (2007–2011).

In the first interval, the budgetary deficit increases from 2% of GDP in 1995 to over 4.5% in 2000, while for the second period, the disequilibrium is easily absorbed, from 2% on

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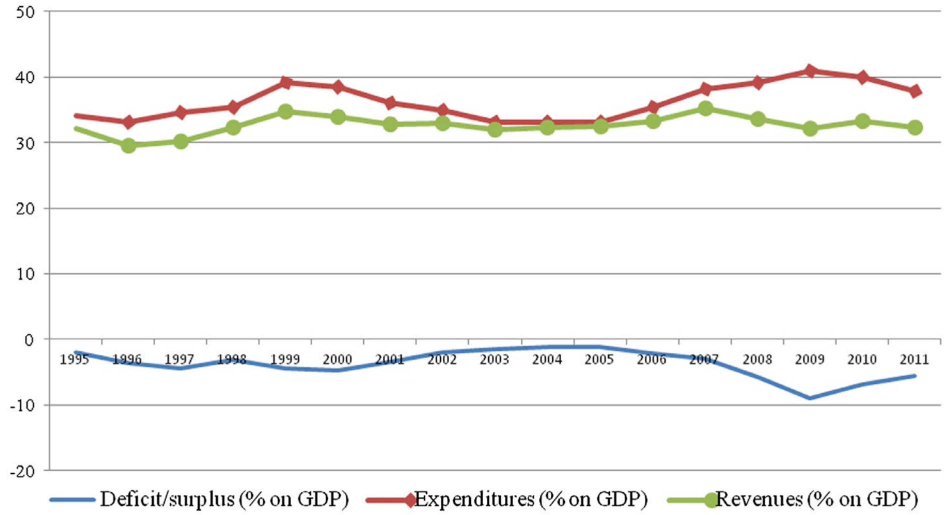

Figure 1. Revenues, expenditures and budgetary disequilibrium in Romania for the period 1995–2011.

GDP in 2002 to 1.2% of GDP in 2004 and 2005. Starting with the international financial crisis, the deficit increases, from 2.9% of GDP in 2007 to 5.5% in 2011, with a maximum level of 9% of GDP in the year 2009. In this case, at least two aspects capture the interest for research in the case of Romania's budget disequilibrium: first, the existence of a long-run relationship between government revenues and expenditures, and second, the evidence of asymmetry in the budgetary adjustment process.

According to Payne (2003), the literature in the field reveals four directions of investigation regarding the 'revenues-expenditures nexus'. Actually, four hypotheses can be tested: the tax-spend hypothesis, the spend-tax hypothesis, fiscal synchronisation and finally, institutional separation.

The first hypothesis is formulated by Friedman (1978) and states that a rise in the level of revenues determines an increase of expenditures, without any possibility of deficit reduction. In this case, the author recommends the reduction of expenditures, because the high level of revenues leads to additional inputs. Other researchers, such as Buchanan and Wagner (1977), consider that the increase of revenues reduces the government outputs through the fiscal illusion. The indirect taxation is a good channel to finance the expenditures in this situation, the taxpayers considering this technique to be much cheaper than other methods.

The second hypothesis belongs to Barro (1979) and emphasises that the first corrections should be made on expenditures and after that on the level of tax revenues. Based on the author argument, any additional expenditures will be financed by higher future taxes. As a consequence, the budgetary deficit will be controlled through the reduction of public expenditures. Similar thoughts are offered by Peacock and Wiseman (1979). They demonstrate that, under the effects of crisis, each increase in the level of expenditure will be accompanied by an increase in the level of taxes.

The third hypothesis introduces the fiscal synchronisation concept. As Musgrave (1966) notes, the voters evaluate the marginal benefits related to the marginal government cost. After that, they decide the appropriate levels of expenditures and revenues. Meltzer and

Richard (1981) also postulate that the voters' choice determines the concurrent adjustments in tax revenues and expenditures and, as a result, the so-called fiscal synchronisation.

The final hypothesis is strongly defended by Wildavsky (1988) and Baghestani and McNown (1994) and claims that the decisions regarding the tax revenues and government expenditures are made by separate institutions. In other words, the estimations of revenues and expenditures derive from the collapse of consensus between different institutions that participate in the budgetary process.

The literature reveals two kinds of empirical approaches: the first one is built on the linear assumption of the relationship between tax revenues and spending (e.g., Trehan & Walsh, 1988, 1991; Hakkio & Rush, 1991; Haug, 1991; Smith & Zin, 1991; Quintos, 1995), while the second is focused on the nonlinear tax revenues-spending nexus (Bertola & Drazen, 1993; Arestis, Cipollini, & Fattouh, 2004; Bajo-Rubio, Diaz-Roldan, & Esteve, 2004, 2006; Ewing, Payne, Thompson, & Al-Zoubi, 2006; Arghyrou & Luintel, 2007; Cipollini, Fattouh, & Mouratidis, 2009; Apergis, Payne, & Saunoris, 2012; Paleologou, 2013).

In the first approach, Trehan and Walsh (1988, 1991), Haug (1991), and Smith and Zin (1991) test the cointegration between public revenues and expenditures, and claim a linear long-run relationship. The targeted countries are the US and Canada. The second group of authors investigates the linearity between revenues and spending, assuming structural breaks in cointegration. The break point is considered exogenous by Hakkio and Rush (1991), while Haug (1995), Quintos (1995) and Martin (2000) take into account an endogenous one.

The second approach considers the relationship between tax revenues and spending as nonlinear and follows asymmetric error correction models (i.e. threshold autoregressive models – TAR). Ewing et al. (2006) offers different arguments in the favour of such asymmetric modelling, for both the budget and its response components to equilibrium. The main reason is associated with the deviation of the deficit and surplus from its long run tendency, which can generate different responses from the policymakers. Secondly, budgetary asymmetries can be related to the asymmetries in the business cycle, as Neftçi (1984), Potter (1995), and Hansen and Prescott (2005) note. Thirdly, according to Bertola and Drazen (1993), and Giavazzi, Jappelli, and Pagano (2000), the tax revenues are the result of effective tax rates, because the 'hard' fiscal policy adjustments can have nonlinear effects in the fiscal area.

Bertola and Drazen (1993) show that the rise of current government expenditures increases the current budgetary deficit, having a nonlinear impact on expected future spending. Modelling the US budget deficit as a threshold autoregressive process, Arestis et al. (2004) find that the budgetary deficit is sustainable in the long run. In this case, the fiscal adjustments should be done only when the level of deficit exceeds a certain threshold. Bajo-Rubio et al. (2004, 2006) focus on Spain and identify a non-linear relationship between government expenditures and revenues. Thus, in this context, the Spanish government should cut the deficit when this is 'large', assuring the return of its long-run sustainability. The EMU group of countries (i.e., Greece, Ireland, Italy and the Netherlands) is the main target for Arghyrou and Luintel's (2007) study, which reveals that the fiscal disequilibrium is non-linearly adjusted. Similar non-linear connection between government revenues and spending is obtained by Cipollini et al. (2009) in the case of the US, by Apergis et al. (2012) in the case of Greece, and Paleologou (2013) in the case of three EU countries (i.e., Sweden, Greece and Germany).

Several studies also explore the connection 'tax revenues-expenditures' in the case of Romania, by using different types of methodological tools. For example, Hye and Jalil (2010) study the relationship between government expenditures and revenues in the case of Romania, for the period 1998:1–2008:3, by using the autoregressive distributive lag approach to cointegration, variance decomposition and rolling regression method. The output reveals a bidirectional long-run relationship between expenditures and revenues, while the variance decomposition method shows that the shocks of government revenue are much stronger than the expenditure ones. Dritsaki and Dritsaki (2010) perform the causality tests of the revenues-expenditures nexus for 12 EU new state members. They find that the results confirm the evidence of Granger causality from national income to government expenditure only for Cyprus, Poland and Romania. Nalban (2010) conducts similar research in the case of Romania, for the interval 1995Q1–2007Q4, and demonstrate no secular tendencies of budgetary imbalances.

On this related literature, our study is an attempt to test the relationship between revenues and government spending, in the case of Romania, for the period 1999Q1–2012Q1.

For this purpose, we choose the Threshold Autoregressive (TAR) and Momentum-TAR (MTAR) approaches. These models allow us to use the residuals to exhibit different degrees of autoregressive decay depending on the behaviour of the lagged residual and its first difference, respectively. The paper extends the literature in the field by focusing on a country with chronic budget deficits and discovers new evidence regarding the 'revenues-expenditures nexus' by using complex models – TAR and MTAR – in the case of Romania. The main results obtained through the TAR and MTAR models offer support for the spend-tax hypothesis, with long-run asymmetric adjustment for Romania.

The paper is organised as follows. Following the literature review, the second section presents the method used, while Section 3 illustrates the data and empirical findings regarding the relationship between revenues and government spending. The paper concludes in Section 4.

2. Methodology

Previous to discussing the methodology utilised to achieve our objectives, we examined the stationarity properties of the considered variables through unit root tests. The augmented Dickey-Fuller (ADF, 1979) and Dickey-Fuller-Generalised-Least-Square (DF-GLS) (proposed by Elliott-Rothenberg-Stock in Elliott, Rothenberg, & Stock, 1996) are the main targeted tests. Both tools tests the null hypothesis of a unit root. As neglecting of structural breaks can be misleading in drawing conclusions, we also used the Zivot-Andrews (ZA, 1992) unit root test, which takes into account the endogenously determined structural breaks. Once we confirmed that the respective variables are integrated of order one, the following Engle and Granger (1987) cointegrating equation is estimated by using the dynamic ordinary least squares (DOLS) approach of Stock and Watson (1993)[1]:

$$GR_t = \alpha + \beta GE_t + \varepsilon_t \tag{1}$$

where α and β are cointegrating parameters with ε_t the residuals reflecting the (budgetary) disequilibrium between GR_t and GE_t. The cointegration test is based on the OLS estimate of $\rho = 0$ as follows:

$$\Delta\hat{\varepsilon}_t = \rho\hat{\varepsilon}_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta\hat{\varepsilon}_{t-i} + \xi_t \tag{2}$$

where $\xi_t \sim I.I.D.(0, \sigma^2)$ and the lagged values of $\Delta\hat{\varepsilon}_t$ provide for uncorrelated residuals. Under the Engle-Granger cointegration test, the alternative hypothesis implicitly assumes that the adjustment process is symmetric around the budgetary disequilibrium, $\varepsilon_t = 0$. However, if the adjustment in revenues and expenditures in response to budgetary disequilibrium is asymmetric, then the symmetric adjustment process assumed in the error correction model represents a misspecification. Accounting for the possibility of an asymmetric adjustment process, Enders and Granger (1998) generalised the Dickey-Fuller test to consider the null hypothesis of a unit root against the alternative hypothesis of a Threshold Autoregressive (TAR) model or Momentum-TAR (M-TAR) model. This Enders-Granger test can be specified as follows:

$$\Delta\hat{\varepsilon}_t = \rho_1\hat{\varepsilon}_{t-1}I_t + \rho_2\hat{\varepsilon}_{t-1}(1 - I_t) + \sum_{i=1}^{k}\alpha_i\Delta\hat{\varepsilon}_{t-i} + \hat{\xi}_t, \tag{3}$$

where $\xi_t \sim i.i.d(0, \sigma^2)$ and lagged values of $\Delta\hat{\varepsilon}_t$ are meant to yield uncorrelated residuals.

The Heaviside indicator function associated with the TAR model is given by equation (4), while the indicator function associated with the MTAR model is given by equation (5). The TAR model represents the estimation of equations (3) and (4), while the MTAR model is estimated by using equations (3) and (5):

$$I_t = \begin{cases} 1 & if \quad \hat{\varepsilon}_{t-1} \geq \tau \\ 0 & if \quad \hat{\varepsilon}_{t-1} < \tau \end{cases} \tag{4}$$

$$I_t = \begin{cases} 1 & if \quad \Delta\hat{\varepsilon}_{t-1} \geq \tau \\ 0 & if \quad \Delta\hat{\varepsilon}_{t-1} < \tau \end{cases} \tag{5}$$

where the threshold τ is endogenously set by following Chan's (1993) methodology.[2] The MTAR model works with residual series to exhibit more momentum in one direction than the other.

Note that the indicator variable in equation (4) depends on the budgetary disequilibrium $\{\hat{\varepsilon}_{t-1}\}$ in the previous period; therefore, the TAR model given by equations (3) and (4) captures the response of the budgetary disequilibrium to positive versus negative departures from the threshold. If $\{\hat{\varepsilon}_{t-1}\}$ is above the threshold, which accounts for the positive phase of the budgetary disequilibrium, the adjustment is $\{\rho_1\hat{\varepsilon}_{t-1}\}$. If $\{\hat{\varepsilon}_{t-1}\}$ is below the threshold, it represents the negative phase of the budgetary disequilibrium, and the adjustment is $\{\rho_2\hat{\varepsilon}_{t-1}\}$. Thus, under the TAR model, the differential effects of the positive (i.e. surpluses) versus negative (i.e. deficits) phases of budgetary disequilibrium on the behaviour of revenues and expenditures can be examined. On the other hand, the MTAR model given by the equations (3) and (5) permits the adjustment process to depend on the previous period's change in $\{\hat{\varepsilon}_{t-1}\}$. Thus, the MTAR model is useful if the adjustment process exhibits more momentum in one direction than the other. By using the MTAR model, the differential effects of the positive versus the negative phases of changes in budgetary disequilibrium on the behaviour of revenues and expenditures can be explored.

For both models, the Enders-Granger's test principle says that if ρ_1 and ρ_2 are simultaneously equal to zero, the series is non-stationary (random walk). That is, under the null hypothesis of no cointegration tested by the restriction $\rho_1 = \rho_2 = 0$. Thus, implementing the Φ_μ and Φ^*_μ tests statistic for TAR and MTAR models respectively, there is a nonstandard F distribution. The critical values for Φ_μ and Φ^*_μ depend on the number of observations and the number of variables in the cointegrating vector. The critical values for the case of three-variables have been tabulated by Enders and Dibooglu (2001). If the unit root hypothesis (i.e., null hypothesis of no cointegration) is rejected, the series is assumed to be stationary (mean-reverting), implying a long-run relationship between the variables tested. Given that the null hypothesis of no cointegration is rejected, one may proceed to test for the null hypothesis of symmetric adjustment (i.e., $\rho_1 = \rho_2$). If the null hypothesis of symmetric adjustment is rejected and $|\rho_1| > |\rho_2|$ in the TAR model, then the model exhibits more decay for positive (changes in) errors, indicating that the speed of adjustment is faster when the budget is in surplus as opposed to deficit. Similarly, $|\rho_1| > |\rho_2|$ in the MTAR model suggests that when the budget is improving the speed of adjustment is faster than when the budget is worsening.

Given the evidence of asymmetries in the budgetary adjustment process, we proceed with an asymmetric error correction model as represented by equations (6) and (7):

$$\Delta GR_t = \eta_0 + \sum_{i=1}^{k} \alpha_i \Delta GR_{t-i} + \sum_{i=1}^{k} \beta_i \Delta GE_{t-i} + I_t \rho_1 \hat{\varepsilon}_{t-1} + (1 - I_t)\rho_2 \hat{\varepsilon}_{t-1} + \varsigma_{1t} \tag{6}$$

$$\Delta GE_t = \tilde{\eta}_0 + \sum_{i=1}^{k} \tilde{\alpha}_i \Delta GR_{t-i} + \sum_{i=1}^{k} \tilde{\beta}_i \Delta GE_{t-i} + I_t \tilde{\rho}_1 \hat{\varepsilon}_{t-1} + (1 - I_t)\tilde{\rho}_2 \hat{\varepsilon}_{t-1} + \varsigma_{2t} \tag{7}$$

where $\varsigma_{1,2t} \sim I.I.I.D(0, \sigma^2)$ and $\hat{\varepsilon}_{t-1} = GR_{t-1} - \hat{\alpha} - \hat{\beta} GE_{t-1}$. The coefficients on the lagged differences for government revenues and government expenditures (expressed as a percentage of GDP) denote the short-run dynamics, whereas the coefficients on the lagged asymmetric error correction terms represent the long-run adjustment back to equilibrium.

3. Data analysis and findings

In order to explore the revenues-spending nexus in the case of Romania, we selected two variables, with quarterly frequency, from 1999Q1 to 2012Q1, representing the government revenues (GR) and government expenditures (GE) (both expressed as a percentage of gross domestic product, GDP). The source of data is the Eurostat online database (Eurostat, 2012).

We report all the unit root results in Panel A in Table 1. The results obtained from ADF and GF-GLS are inconsistent. The ADF test shows both variables as non-stationary in level and first-difference stationary, whereas DF-GLS shows that both variables are level, as well as first difference non-stationary. Therefore, we relied on the ZA test, which confirms the findings obtained from the ADF test.

The cointegration test results, as shown in Panel B of Table 1, reject the null hypothesis of no cointegration at the 1% significance level.

In the next step, we continue the estimation by incorporating the asymmetric adjustment in the cointegration process, in the framework of TAR and MTAR models. The results are reported in Table 2.

Table 1. Unit root and cointegration tests for Romania 1999Q1–2012Q1 for Constant, Linear Trend model.

Panel A: unit root tests[a]				
Variables	ADF	DF-GLS	ZA	Break date
GE	−1.604003	−0.738807	−2.484230	2006Q4
D(*GE*)	−15.80576***	−1.533604	−19.75169***	
GR	−1.958953	−0.765947	−3.420807	2007Q1
D(*GR*)	−31.15785***	−0.999736	−34.89568***	

Panel B: Engle-granger cointegration test[b]	
Cointegrating equation using DOLS	
GR=0.216627 + 0.357337(GE)	ADF
(0.0573)*** (0.13893)**	−6.414333***
Jarque-Bera test for normality: 5.716388	
[0.05737]	

[a]Significant at: ADF critical values are −4.161144, −3.506374 and −3.183002 for 1, 5 and 10% levels respectively; DF-GLS critical values are −3.77, −3.19, and −2.89 for 1, 5 and 10% level respectively; ZA critical values are −5.57, −5.08, and −4.82 for 1%, 5% and 10% levels respectively.
[b]Numbers in parenthesis are standard errors of the coefficients adjusted for long-run variance; *, **, and *** denotes significance at 10, 5 and 1% levels, respectively; DOLS model includes deterministic trend. DOLS is the dynamics OLS regression of *GE* on a constant, a deterministic trend, *GR* and leads and lags of *GR* (we choose lead=4 and lag=0 based on SIC criterion keeping max=4); critical values for the ADF cointegration test at the 1, 5 and 10% significance level are −2.618579, −1.948495 and −1.612135, respectively; brackets indicate probability values corresponding to null hypothesis that the residuals are normally distributed; ADF is the augmented Dickey and Fuller (1979) test; DF-GLS is Elliott-Rothenberg-Stock (1996) test; ZA is the Zivot and Andrews (1992) test allowing for an endogenous structural break in the series; proper lag length for ADF, DF-GLS and ZA test were chosen using SIC.
Source: Authors' calculation.

Table 2. Tests for cointegration and symmetry.

	TAR [k=1]	MTAR [k=1]
Threshold	0	0
ρ_1	−3.009***	−2.122**
ρ_2	−4.176***	−5.076***
Φ_μ and Φ^*_μ	10.606***	13.172***
$t(\rho_1 = \rho_2)$	0.8727	4.4739**
Threshold	0.031	−0.028
ρ_1	−2.158**	−3.088***
ρ_2	−4.814***	−6.043***
Φ_μ and Φ^*_μ	11.951***	19.317***
$t(\rho_1 = \rho_2)$	2.7604	13.099***

Note: (1) k denotes lag-length which is the number of auxiliary regressors in the TAR and MTAR model and based on SIC and AIC. (2) Φ_μ and Φ^*_μ are the F-statistics for the null hypothesis of no-cointegration or ($\rho_1 = \rho_2 = 0$) under the TAR and MTAR specifications respectively. (3) The 5% critical values of Φ_μ is 7.30 for the TAR model and for Φ^*_μ are 7.96 for the MTAR model (4) $t(\rho_1 = \rho_2)$ is the t-statistics for the test of symmetry. (4) *, ** and *** denotes significance at 10%, 5% and 1% level of significance respectively.
Source: Authors' calculation.

It is evident from Table 2 that the null hypothesis of no cointegration is rejected for both TAR and MTAR models, when either the threshold is assumed zero or it is calculated through Chan's (1993) procedure. Since, the null hypothesis of no cointegration is rejected, we can proceed to testing for the null hypothesis of symmetry (i.e., $t(\rho_1 = \rho_2)$) under the TAR and the MTAR specifications.

We find that the null hypothesis of symmetric adjustment is not rejected for the TAR, but for the MTAR. Since in the MTAR model $|\rho_1| < |\rho_2|$, the speed of adjustment when the budget is improving is less than when the budget is worsening. This means that the attenuation of the negative budgetary balance, which tends to increase, needs more time to

Table 3. Asymmetric error correction model: MTAR.

Independent variables	Dependent variable: GE	Independent variables	Dependent variable: GR
Constant	0.08175*** [3.730]	Constant	0.08905*** [5.476]
GE_{t-1}^{+}	−0.35595 [−0.825]	GE_{t-1}^{+}	−0.48256 [−1.508]
GE_{t-1}^{-}	0.46900 [1.143]	GE_{t-1}^{-}	0.74587** [2.451]
GR_{t-1}^{+}	−0.61987 [−1.643]	GR_{t-1}^{+}	−0.50506 [−1.804]
GR_{t-1}^{-}	1.07094** [2.115]	GR_{t-1}^{-}	1.17792*** [3.135]
Error-correction term		Error-correction term	
$\tilde{\rho}_1$	−0.88707** [−2.408]	ρ_1	−1.20673*** [-4.415]
$\tilde{\rho}_2$	−0.49955 [−0.803]	ρ_2	−1.76592*** [−3.827]
Summary statistics		Summary statistics	
R-squared	0.43		0.72
Adj-R^2	0.35		0.69
F-stat	5.36		18.84
Stat DW	2.23		2.02
AIC/BIC	−135.28/-119.98		−165.14/-149.84
LB(8)	0.00		0.08
LB(12)	0.00		0.08

Source: authors' calculation.

be relaxed, compared with the situation when the budgetary balance tends to be positive (i.e., the deficit tends to reduce). In other words, it is more difficult to adjust a budgetary deficit when it has an accentuated increasing tendency.

Since the long-run relationship (i.e., cointegration) between the test variables holds, an asymmetric error-correction model can be used to investigate the movement of variables to the long-run equilibrium relationship. The asymmetric error-correction models under the MTAR specification, indicating a consistent estimate of thresholds (with threshold = −0.028), are shown in Table 3.

Table 3 shows that only variable GR_{t-1}^{-} is significant when *GE* is dependent, while when *GR* is the dependent variable, GE_{t-1}^{-} and GR_{t-1}^{-} are significant. Thus, on the short-run, the bidirectional causality is evident. Specifically, the results indicated that the government expenditures respond only to an improving budget ($\tilde{\rho}_1 = |0.88707|$), whereas the response of government revenues to a worsening budget ($\rho_2 = |1.76592|$) is larger than an improving budget ($\rho_1 = |1.20673|$).[3] Thus, for the Romanian economy, our results provide support for the spend-tax hypothesis (as postulated by Payne, 2003), with asymmetric adjustment towards the long-run budgetary equilibrium. In this case, there is a nonlinear connection between government revenues and expenditures in the case of Romania. In other words, the first adjustments should be performed at the expenditures level and after that on revenues, any additional expenditures being financed by higher future taxes. Moreover, the control of government expenditures should take into account a certain threshold of the budgetary balance, which ensures a long-run budgetary equilibrium.

4. Conclusion

Contrasting with previous research, in this study we re-examined the nexus between GR and GE in the case of the Romanian economy, over the 1999Q1–2012Q1 period, allowing for the possibility of asymmetric adjustment towards long-run equilibrium. Distinctively, we utilised the TAR and MTAR models proposed by Enders and Granger (1998) and Enders and Siklos (2001) in order to take into account the asymmetry in the relationship between GR and DE. TAR and MTAR models are utilised to determine whether GR and GE respond asymmetrically to the level as well as to changes in budgetary disequilibrium in Romania. Our unit root test results obtained from the ZA show that both variables were non-stationary in level, but stationary in the first difference. Further, the Engle and Granger (1987) cointegration test, which was applied on the dynamic ordinary least squares (DOLS) approach of Stock and Watson (1993) indicates that both variables are cointegrated in the long-run.

It should be noted that we also found that our TAR and MTAR models confirm the evidence of cointegration between the tested variables, which further discloses asymmetries in the budgetary adjustment process. However, the null hypothesis of symmetric adjustment was not rejected for the TAR, but only for the MTAR model. Therefore, the error-correction model was estimated with MTAR specification. The results from the asymmetric error-correction model, based on the MTAR specification, show bidirectional causality between GR and GE over the short-run. However, in the long-run, GE responds to budgetary disequilibrium, as reflected in the statistical significance of the asymmetric error correction term, corresponding to an improving budget. Moreover, GR responds to budget disequilibrium as reflected in the statistical significance of both asymmetric error-correction terms. Nonetheless, the speed of adjustment is faster for a worsening budget than for an improving budget. To summarise, our findings from TAR and MTAR models offer support for the spend-tax hypothesis with long-run asymmetric adjustment for Romania.

Regarding the policy implications, in this case, it is recommended that the Romanian government focus, with priority, on the output component of fiscal policy whenever dealing with budgetary disequilibrium.

This component should follow two required directions: the reduction of public expenditures and structural adjustments. More precisely, the main corrections should include, on the one hand, a significant reduction of budgetary wages and current government acquisitions of goods and services, and on the other hand, a set of incentives for increasing the government investments and increasing the amount and number of implemented European projects.

Over the long term, considering efficient control of tax evasion, these measures will increase the taxation base and, as a consequence, the level of collected tax revenues.

Notes

1. DOLS estimation includes, as additional regressors, lags and leads of the explanatory variables in first differences to capture the dynamics around the equilibrium.
2. Chan (1993) shows a consistent estimate of the threshold τ. For example, with the M-TAR adjustment mechanism, the consistent estimate of the threshold can be performed by ordering the $\{\hat{\varepsilon}_t\}$sequence in ascending order, such that $\Delta\varepsilon_1^\tau < \Delta\varepsilon_2^\tau < \Delta\varepsilon_3^\tau < \ldots < \Delta\varepsilon_T^\tau$where T denotes the number of usable observations. For each value of $\Delta\varepsilon_j^\tau$, the threshold $\tau = \Delta\varepsilon_j^\tau$ is set and the M-TAR model estimated in the form of equations (4) and (5). The estimated threshold yields the lowest residual sum squares (RSS) which is the consistent estimate of the threshold. To ensure an adequate number of observations in each regime, the standard procedure of using only the middle 80% of the observations as potential thresholds is followed.
3. Generally, the error correction term should be less than zero. In certain cases, this coefficient registers values higher than one in absolute terms, as a result of the econometric tool settings (see similar situation at Enders & Chumrusphonlert, 2004).

Disclosure statement

No potential conflict of interest was reported by the authors.

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