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Optimal taxation and budget deficits: Evidence for the EU's New Member States

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Abstract

The tax smoothing hypothesis (TSH) is tested for the New Member States of the European Union. Our results show that the TSH holds for five countries, the introduction of the Maastricht 3%-deficit rule, however, had very little effect with regard to the validity of the TSH.

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1 Introduction

As of May 2004 the European Union (EU) has been enlarged by ten Eastern European countries, as of January 2007 by two more. With entry into the EU, these New Member States (NMS) became subject to the Maastricht Treaty, which comprises two fiscal criteria, namely government deficit (debt), as a percentage of GDP, must not be higher than 3% (60%). The tax smoothing hypothesis (TSH), based on the premise that governments smooth tax rates over time in order to minimize the implied distortionary welfare costs from taxation, states that future expectations of changes in government expenditure determine whether it is optimal to run either budget surpluses or deficits. This raises the question whether the Maastricht fiscal rule inhibited tax smoothing such that the NMS were not able to let deficits grow as much as implied by expected decreases in government expenditure.

Empirical evidence following the seminal paper by Barro (1979) is relatively mixed, with some papers rejecting the TSH (Huang and Lin, 1993, for the US; Olekalns and Crosby, 1998, for Australia and the UK, Cashin et al., 1999, for Sri Lanka) and others which cannot reject the TSH (Ghosh, 1995, for Canada and the US, Olekalns and Crosby, 1998 for the US; Cashin et al., 1998, 1999, for Pakistan and India). As far as the evidence for Europe is concerned, the only paper, to the knowledge of the authors, is the one by Adler (2006), which tests the TSH for Sweden.

The focus of this paper is on the investigation of the validity of the TSH for the NMS and the existence of a structural break which may have occurred due to the introduction of the 3%-deficit rule. Thus we want to evaluate whether this fiscal rule has indeed prevented countries from smoothing taxes.

2 The theoretical model

In testing the basic premises of the TSH we closely follow Ghosh (1995), Olekalns (1997) and Adler (2006). Postulating that output grows at a fixed rate equal to n, the dynamic government budget constraint is represented by

$$(1+n)d_{t+1} = (1+r)d_t + g_t - \tau_t \tag{1}$$

where d_t is government debt; g_t is government expenditure; τ_t is government tax receipts (all expressed as ratio to output) and r is the (fixed) real interest rate. Substituting (1) forward and imposing the transversality condition gives the intertemporal budget constraint

$$\sum_{j=t}^{\infty}\left(\frac{1}{1+R}\right)^{j-t}E_t\tau_j=\sum_{j=t}^{\infty}\left(\frac{1}{1+R}\right)^{j-t}E_tg_j+(1+r)d_t \tag{2}$$

where j is the index variable for time, $R=(r-n)/(1+n)$ is the effective net interest rate faced by the government, and E_t is the expectations operator, conditional on the government's information set at time t.

Defining the budget balance as $bal_t=(1+n)(d_t-d_{t+1})$, the TSH can be stated as

$$bal_t=\sum_{j=t+1}^{\infty}\left(\frac{1}{1+R}\right)^{j-t}E_t\Delta g_j^{tot} \tag{3}$$

where g_t^{tot} is total government expenditure, i.e. the sum of current expenditure, g_t, and effective interest payment on government debt. According to (3), optimal budget policy requires that the budget balance must always be equal to the discounted sum of all future expected changes in government expenditure.

Besides tax smoothing, there is another motivation to run budget deficits, namely tax tilting (see Ghosh, 1995, Cashin et al, 1998, 1999). The main reason for tax tilting is that the government's discount rate, β, differs from the effective interest rate, R, i.e. tax tilting creates a tendency towards either deficits or surpluses. Thus, it is essential that the optimal balance given by (3) refers only to the budget component that relates to tax smoothing. This can be achieved by filtering the tax tilting component from the budget balance according to

$$bal_t^{sm}=\gamma^{-1}\tau_t-(g_t+(r-n)d_t)=\gamma^{-1}\tau_t-g_t^{tot} \tag{4}$$

where $\gamma=[(1-(R/\beta)R)/(1-R)]$ is the tilting parameter. Given that τ_t and g_t^{tot} are I(1), γ^{-1} is the cointegrating parameter from the regression of g_t^{tot} on τ_t.

In order to derive the optimal budget balance (equation (3)), a measure of anticipated future changes of government expenditure is needed. Following Campbell (1987) and Campbell and Shiller (1987), under the null hypothesis that tax smoothing holds, the budget balance contains all information about future changes in government expenditure, hence the former should Granger-cause the latter. Since bal_t^{sm} responds to expected future changes in government expenditure, it is a relevant information variable in forecasting the latter. Thus, this forecast can be obtained from a bivariate autoregressive model of $\triangle g_t^{tot}$ and bal_t^{sm}. Hence, we estimate the following first-order unrestricted vector autoregression (VAR)

$$\begin{bmatrix}\triangle g_t^{tot}\\ bal_t^{sm}\end{bmatrix}=\begin{bmatrix}a_{11} & a_{12}\\ a_{21} & a_{22}\end{bmatrix}\begin{bmatrix}\triangle g_{t-1}^{tot}\\ bal_{t-1}^{sm}\end{bmatrix}+\begin{bmatrix}\varepsilon_{\triangle g_t^{tot}}\\ \varepsilon_{bal_t^{sm}}\end{bmatrix} \tag{5}$$

or, rewriting (5) in matrix form

$$X_t = AX_{t-1} + \varepsilon_t \tag{6}$$

where A is a 2×2 matrix of coefficients and $X_t = (\triangle g_t^{tot}, bal_t^{sm})$. The forecast of a one-period change in government expenditure is given by

$$E_t \Delta g_j = \begin{bmatrix} 1 & 0 \end{bmatrix} A^{j-t} X_t \tag{7}$$

In order to obtain the optimal budget balance, substitute (7) into (3)

$$\widehat{bal}_t^{ts} = \sum_{j=t+1}^{\infty} \left(\frac{1}{1+R}\right)^{j-t} \begin{bmatrix} 1 & 0 \end{bmatrix} A^{j-t} X_t$$

$$= \begin{bmatrix} 1 & 0 \end{bmatrix} \frac{1}{1+R} A \left(I - \frac{1}{1+R} A\right)^{-1} X_t$$

$$= \Lambda_1 \Delta g_t^{tot} + \Lambda_2 bal_t^{sm} = \Lambda X_t \tag{8}$$

If the TSH is true, the predicted budget balance, $\widehat{bal}_t^{ts}$, is equal to bal_t^{sm}, i.e., $\Lambda_1 = 0$ and $\Lambda_2 = 1$. Accordingly, the following restrictions must hold for (8), which can be tested using Wald or LR-tests:

$$\Lambda = \begin{bmatrix} 1 & 0 \end{bmatrix} \frac{1}{1+R} A \left(I - \frac{1}{1+R} A\right)^{-1} = \begin{bmatrix} 0 & 1 \end{bmatrix} \tag{9}$$

3 Empirical results[1]

Our first goal is to verify that τ_t and g_t^{tot} are I(1) and cointegrated such that $\tau - g_t^{tot} = bal_t^{sm}$ is I(0). Table 1 displays results from the Dickey–Fuller tests; the null of a unit root of τ_t and g_t^{tot} cannot be rejected except for Estonia, the Slovak Republic and Slovenia which will hence be excluded from the subsequent analysis.

Insert Table 1 around here

The next step is to obtain an estimate of the tilting parameter γ^{-1} as described above. Given that g_t^{tot} and τ_t are I(1), this should be done using the Phillips-Hansen (1990) fully

[1] The data source for all time series used here is the AMECO database of the European Commission. We use quartely data for the NMS from 1998:4-2007:3.

modified OLS (FM-OLS) method, which yields an asymptotically correct variance-covariance estimator in the presence of serial correlation and endogeneity; bal_t^{sm} is then given by the residuals of the FM-OLS estimation of (4).[2] As to the DF-test of bal_t^{sm}, the null of a unit root can be rejected for all countries except for Malta and Slovenia.
The results from the Granger-causality tests (Table 1, column 7) show that the null (i.e. bal_{t-1}^{sm} non-Granger causes $\triangle g_t^{tot}$) can be rejected for all countries except for Latvia and Malta. Hence, the DF- and Granger-causality tests imply that for Latvia and Malta as well as Estonia, the Slovak Republic and Slovenia the data is not consistent with the most basic implications of tax-smoothing behaviour.

Insert Table 2 around here

Based on the results from the VAR-estimation[3] the Λ_1- and Λ_2-parameters and $\widehat{bal}_t^{ts}$ were calculated (see Table 2). The Wald tests for the restrictions set out in (9) show that the null of tax smoothing cannot be rejected for the Czech Republic, Hungary, Lithuania, Poland and Romania, which is also confirmed when graphically comparing bal_t^{sm} to the predicted budget balance $\widehat{bal}_t^{ts}$ (Figure 1), where it can be seen that the two time series correspond quite closely. Interestingly, three of these countries (Czech Republic, Hungary, Poland) had deficits over 3% between 2004 and 2007 which could imply that for these countries smoothing taxes was more important than being subject to the Excessive Deficit Procedure.

Insert Figure 1 around here

As already mentioned, there might be the possibility that the introduction of the Maastricht deficit rule has prohibited countries from tax smoothing. This hypothesis is tested using the methodology by Andrews and Kim (2006), which allows us to test for a structural break at the end of the observation period, where the Maastricht fiscal rule came into force (contrary to usual Chow-type tests, which are only useful if the amount of observations before and after the break is large enough).[4] If a break exists, we calculate the Λ_1 and Λ_2 pre- and

[2] Detailed results from the FM-OLS estimation are available upon request.

[3] Results from the VAR estimations are available upon request.

[4] Andrews and Kim (2006) propose the post-break sum of squared residuals computed with an estimator of the cointegration parameters for data up to the break as a test statistic. The critical values of this test statistic can then be approximated by parametric subsampling. Given that the date of the break is not determined a priori, we estimate the p-values (which correspond to the test statistic P_b in Andrews and Kim, 2006) for the null of no break in the cointegration relationship from 2004 to 2007 (except for Bulgaria and Romania which entered the EU as of 2007), where the break should have occurred.

post break values and test for the validity of the TSH before and after the potential break, rewriting (6) as

$$X_t = \left(A_1 + A_2 \mathcal{I}\left(t > T^*\right)\right) X_{t-1} + \varepsilon_t \quad (10)$$

where T^* will be set equal to the first year for which the P_b test rejects stability at a 5% significance level. $\mathcal{I}(\cdot)$ is a Heavyside function, taking value one if the argument is true, and zero otherwise. The results show that the null of no cointegration breakdown is rejected only for Cyprus (with 2004 as the first year of this break), the Wald test indicates that the TSH is not rejected before but rejected after the break, i.e. tax smoothing may indeed have been inhibited by the Maastricht fiscal rule.[5] Overall, however, the results imply that the introduction of the Maastricht rule had only a small effect on the validity of the TSH.

4 Conclusions

This piece of research presents evidence concerning the tax smoothing hypothesis (TSH) for the New Member States of the European Union. We hypothesized that the introduction of the 3%-deficit rule may have resulted in welfare losses since these countries are no longer capable of smoothing taxes as much as they want. Our basic estimations show that the TSH cannot be rejected for the Czech Republic, Hungary, Lithuania, Poland and Romania.

When we test for a structural break which may have occurred due to the introduction of the Maastricht rule, we find that only Cyprus exhibits a break (with an associated change in the validity of the TSH), which implies that the introduction of this rule has had only a small effect on the relevance of the TSH.

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[5] The values of the Wald test for Cyprus before and after the break are 0.57 and 6.97***, respectively. Detailed results from the end-of-sample cointegration breakdown test are available upon request.

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Economics Bulletin, 2011, Vol. 31 No. 3 pp. 2593-2602

Table 1: DF- and Granger causality Tests

Country	$\mathbf{g_t^{tot}}$	$\boldsymbol{\tau_t}$	$\mathbf{bal_t^{sm}}$	$\Delta\mathbf{g_t^{tot}}$	$\Delta\boldsymbol{\tau_t}$	t_{ng}
Bulgaria	-1.49	-1.39	-2.83 ***	-2.72 ***	-2.23 ***	7.80 ***
Cyprus	1.32	3.12	-3.87 ***	-2.79 ***	-6.39 ***	8.54 ***
Czech Rep	0.01	1.02	-2.10 ***	-4.21 ***	-4.55 ***	3.87 **
Estonia	-2.77 ***	-0.69	–	-3.01 ***	-3.36 ***	5.63 ***
Hungary	0.37	0.22	-1.93 **	-3.96 ***	-3.13 ***	3.47 ***
Latvia	-0.67	0.06	-4.29 **	-4.22 ***	-4.17 ***	1.38
Lithuania	-1.78 *	0.99	-2.33 ***	-4.04 ***	-3.10 ***	11.03 ***
Malta	0.18	1.25	-1.25	-2.96 ***	-1.93 **	1.14
Poland	-0.27	0.12	-3.80 ***	-2.46 ***	-2.97 ***	5.82 ***
Romania	-0.29	-1.28	-4.09 ***	-5.08 ***	-8.59 ***	13.53 ***
Slovak Rep	-2.43 ***	-1.25	–	-2.91 ***	-5.13 ***	7.69 ***
Slovenia	-2.30 ***	-2.75 ***	–	-2.80 ***	-3.96 ***	1.81

***(**)[*] indicates rejection at the 1% (5%) [10%] level of significance; bal_t^{sm} is calculated as the residuals of the cointegration equation (4), t_{ng} is the test statistic for the null that $\mathrm{bal}_{\mathbf{t-1}}^{sm}$ non Granger-causes $\Delta \mathrm{g}_{\mathbf{t}}$.

Table 2: Estimated Λ_1 and Λ_2 coefficients

Country	$\widehat{\boldsymbol{\Lambda}}_1$	$\widehat{\boldsymbol{\Lambda}}_2$	Wald test	break
Bulgaria	1.32 (1.03)	3.66 (2.56)	11.97 ***	–
Cyprus	0.47 (0.48)	0.59 (0.32)	5.59 **	2004
Czech Rep	0.15 (0.32)	0.69 (0.60)	0.30	–
Hungary	-0.08 (0.33)	1.12 (0.55)	0.08	–
Lithuania	0.12 (0.45)	2.00 (1.37)	1.93	–
Poland	-0.10 (0.33)	0.71 (0.18)	1.90	–
Romania	0.54 (0.97)	1.39 (1.00)	0.77	–

Notes: The coefficients $\widehat{\Lambda}_1$ and $\widehat{\Lambda}_2$ are the estimated parameters from equation (8) and the numbers in parenthesis are the associated standard errors (calculated as described in Ghosh, 1995). The Wald test statistic (distributed as χ^2_2) tests whether the estimated VAR-coefficients satisfy the restrictions given by (9).

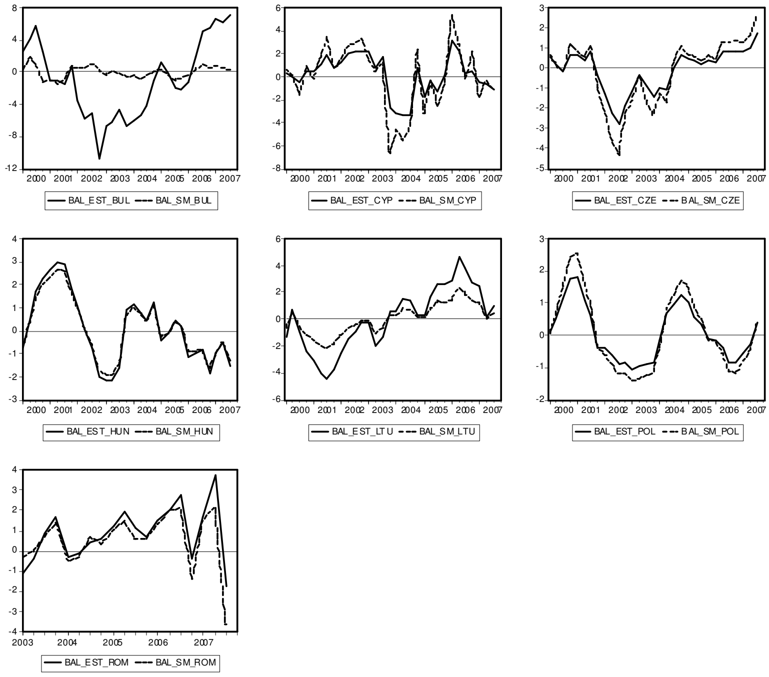

Figure 1: Actual and optimal budget balances