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# Budget Constraint Fulfilment in Some EU Candidate Countries

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ABSTRACT

One of the crucial fiscal sustainability preconditions is fulfilment of budget constraint. We applied the approach of budget revenue and expenditure cointegration in some EU candidate countries, because of the reliability of this method for the observed countries. This is the first research of this topic in the majority of these countries based on the above-mentioned methodological set. We showed that weak fiscal sustainability is immanent to Serbia. In Albania and Turkey, we could not find budget sustainability evidence. Our results are very important to economic policy makers in these countries, but also are of special concern to EU bodies in the European integration process. This is emphasised because of reported public debt crisis and macroeconomic spillovers in the European Union.

## 1. INTRODUCTION

Due to the public debt crisis that has been present in many European countries in recent years, the issue of fiscal sustainability has reemerged in the economic literature as one of the most interesting topics for research. Marking the fiscal policy of a country as fiscally sustainable requires the fulfilment of certain preconditions. However, in the economic literature, there is no agreement on which preconditions exactly have to be met. M. Jesic (2013, pp. 113-116) states that signals of fiscal irresponsibility could be systematic violation of fiscal rules, conduction of fiscal policy based on permanent budget deficits, not respecting the numerous goals of public debt management, the budget structure which is favorable towards consumption and at the investment's expense and political budget cycles which are inherent to the economy.

One of the most important preconditions is to fulfill the intertemporal budget constraint. However, although this is often recognized as the sole precondition of fiscal sustainability, we believe that the justification of such an approach is reasonable only in strictly defined circumstances. We are more inclined to think that budget constraint fulfilment implies only a necessary condition of fiscal sustainability. Indisputably, there is a long-term close connection between budget constraint fulfilment and fiscal sustainability. However, in terms of uncertainty

and without rational justification in the movements of macroeconomic indicators, a saturation point for government bonds could result.

The empirical testing of budget constraint fulfilment has been experiencing its momentum since the 1980s. This type of research, however, has been carried out mainly in developed countries. Insufficiently long time series for reliable statistical inference and inadequate data quality are the main obstacles to such research in developing countries.

The present paper aims to examine the budget constraint fulfilment in the EU candidates, but only for these where we could find necessary data. The movement of macroeconomic variables in these countries in recent times has been closely linked to negative tendencies in the fiscal domain. There is a reversible connection between macroeconomic stability and fiscal stability, and this connection is one of the rationales for research in this area.

Therefore, one of the most significant contributions of the current study is the testing, for the first time for the majority of these countries, of the budget constraint fulfilment through the approach of cointegration between budget revenues and expenditures. This work will serve as an incentive for further research on this issue through the prism of this or some other methodology. Economic policy makers in these countries, especially in the fiscal domain, will be able to interpret the results of this work from their own perspective and, based on the main conclusions and recommendations of this study, make fiscal policy in their own country more accountable. This is especially important because of the process of integration into the EU that is more pressing issue in the macroeconomic sense, than it was for the old members (Brada and Kutan, 2002, p. 32). The research results provide a foundation for further analysis of the concept of fiscal responsibility, which, as stated above, requires a deeper analysis of many other indicators.

The remainder of this paper is organized as follows. An overview of the research literature on fiscal sustainability carried out from a methodological viewpoint close to that used in the study is presented first. A theoretical approach to the problem, which is the basis for the empirical part of the work, is in the focus of the next section. Then, we discuss the methodology used in the research, and after that, we provide basic information about the data used in the analysis. Finally, we present the research results, with special emphasis on their economic interpretation, and provide basic recommendations to policy makers in the observed EU candidate countries.

## 2. LITERATURE REVIEW

In the literature, there are, roughly speaking, two different approaches to testing fiscal sustainability. One is the accounting approach, and the other is based on testing the budget constraint fulfilment. The first approach has its advantages; however, given the objective and methodology of our study, we focused only on those studies that empirically tested the budget constraint fulfilment. Special attention was given to works that applied cointegration approach as the basis in their methodological set. Although several studies have addressed this issue in developed countries, as previously explained, the backbone of all other research is formed by a number of works that paved the way for modern testing of the budget constraint fulfilment.

One of the first studies that dealt with the cointegration of budget revenues and expenditures was done by Trehan and Walsh (1988), who tried to determine the conditions necessary to meet the budget constraint. These authors showed that stationarity of the primary budget deficit is neither a necessary nor a sufficient condition but that the budget deficit is, including interest payments. They empirically presented the cointegration between revenues and expenditures in the United States for the period of 1890 to 1986.

Hakkio and Rush (1991) also applied the cointegration approach to the problem of fiscal sustainability. They assumed the possibility of interest rate variations, unlike many authors who dealt with this topic. In addition to the usual way of defining the variables for which they investigated the presence of cointegration, these authors carried out their analysis in a different manner, applying a modified version of the government revenue series. By using quarterly data for the period 1950 (Q2) to 1988 (Q4), they pointed to a potential issue regarding the possibility of marketing the debt.

Quintos (1995) introduced the concept of weak sustainability. According to her, cointegration is the only sufficient condition for budget sustainability, whereas the value of the parameter from the cointegration vector, which is between 0 and 1, is a necessary and sufficient condition. By using quarterly data from 1947 (Q2) to 1992 (Q3), she showed that the US federal budget was sustainable; i.e., it fulfilled the intertemporal budget constraint.

In addition to these works, a few more studies deserve attention. By using quarterly data on the United States from 1950 to 1990, Haug (1995) showed that the parameter in the cointegration equation of revenues and expenditures is close to one absolute data are observed, whereas the value is significantly less than one for normalized data. He also found, based on tests of parameter instability in cointegrated systems, that there were no changes in the way fiscal policy was carried out under Ronald Reagan. Payne (1997) tested the existence of cointegration between revenues and expenditures in seven developed countries during different periods of time. The results of his research confirmed the revenue and expenditure cointegration in four countries, of which only Germany had a cointegration vector of [1,-1]. Bravo and Silvestre (2002), by using annual data on 11 EU countries for the period 1960 to 2000, showed that the revenues and expenditures were cointegrated only in 5 countries, often with a cointegration vector other than [1,-1]. Afonso (2004) studied fiscal policy sustainability in 15 EU countries for the period 1970 to 2003 and concluded that a few countries have no problem fulfilling the budgetary constraints. More importantly, he found that the parameter in the cointegration vector indicated a potential problem in future borrowings for all countries. Bohn (2005) showed that, to find a comprehensive approach to testing fiscal sustainability, we need to go beyond testing what he called *ad hoc* sustainability, which requires only budget constraint fulfilment. He emphasized the assessment of the so-called fiscal reaction function as the best way to achieve such purpose. Neaime (2015) showed that fiscal policy was viable in Germany and France in the period from 1977 to 2013, whereas it was viable in Ireland, Italy, Spain, and Portugal in the 1970s and 1980s; in Greece, fiscal policy was not sustainable in the observed period.

Very few empirical scientific papers apply a similar methodology of budget revenue and expenditure cointegration in developing countries, which are similar to the EU candidate countries in terms of economic system characteristics. Barna and Mura (2011) reported fiscal sustainability based on monthly data on Romania for the period 2003 to 2009. Based on data in the period from January 1999 to June 2013, Dornean and Oanea (2015) showed that the fiscal system in Romania tended toward sustainability in the long term. Finaly, the research interest in this topic has not been developed for the EU candidates. Up to our knowledge, there is no scientific paper that covers this topic for any of the EU candidates, with exception of Turkey. Kustepeli and Onel (2005) analyzed the sustainability of budget deficit in Turkey for the period 1970 to 2003. They found the week sustainability of budget deficits. Ucal and Alici (2010) by using monthly data showed that fiscal policy was weakly sustainable for the period 1989 to 2000. Based on the data from the following period 2001 to 2008, they showed strong sustainability of budget deficits. The lack of research in this scientific area for potential EU members has been our main motive for this study.

## 3. THEORETICAL BACKGROUND

The intertemporal budget constraint of a state can easily be deduced from an equation that represents the budget constraint of the state in a given period, as shown in Eq. 1.

$$D_t = (1+i)D_{t-1} + ex_t^* - rev_t \quad (1)$$

where *D* is the public debt; *i* is the interest rate; *ex** are expenditures, excluding interest; and *rev* are revenues. If we include *n* periods into the model, we can transform the equation into:

$$D_{t-1} = \sum_{m=0}^{n} \frac{rev_{t+m}}{(1+i)^{m+1}} - \sum_{m=0}^{n} \frac{ex_{t+m}^*}{(1+i)^{m+1}} + \frac{D_{n+1}}{(1+i)^{n+1}} \quad (2)$$

The literature provides numerous variations of this equation depending on whether the *n* periods are viewed as a finite number or assumed to tend to infinity, whether the interest rate is constant or varies, whether the values are nominal or real.

Hakkio and Rush (1991) and Bohn (2007) explained that the interest rate applied in discounting depends on how the state revenues and expenditures are measured. If they are measured in absolute nominal amounts, then the nominal interest rate is applied. If they are measured in absolute real amounts, then the real interest rate is applied. The normalization of state revenues and expenditures according to the *GDP*, or the population, implies the need to subtract the *GDP* growth rate or population growth rate from the corresponding interest rate.

The essence of fulfilling the intertemporal budget constraint is the absence of a Ponzi scheme. That is, if the state acts in accordance with a Ponzi scheme, the debt due will always be replaced with a new debt. This is possible if the equilibrium is dynamically inefficient. In theory, the absence of a Ponzi scheme implies that:

$$\lim_{n\to\infty} \frac{D_{n+1}}{(1+i)^{n+1}} = 0 \quad (3)$$

In this case, the present value of all future primary budget balances will be equal to the current value of the public debt; i.e., subject to the transversality condition, the present value of public debt will converge to 0 in infinity. This can easily be shown to be feasible when the growth rate of the public debt is lower than the interest rate when the data are viewed in absolute terms.

If the data are considered in relation to the *GDP*, it is essential that the *GDP* growth rate is higher than the interest rate because this requires the so-called solvency condition. Then, the budget constraint is given as:

$$d_{t-1} = \sum_{m=0}^{n} \left(\frac{1+y}{1+i}\right)^{m+1} (\tau - \varepsilon) + d_{t+n}\left(\frac{1+y}{1+i}\right)^{n+1} \quad (4)$$

In the previous equation, *d*, *y*, *τ*, and *ε* are the public debt, economic growth, revenues, and expenditures, respectively, normalized to the *GDP*. If the *GDP* growth rate is lower than the interest rate, then the budgetary constraint fulfilment, in which the level of public debt is bounded, requires that the last expression in the formula tends to 0 when *n* tends to infinity.

If, however, the state decides to act on the basis of a Ponzi scheme, that situation will not be possible in terms of the finite number of agents that behave rationally. It can be shown that their welfare declines if they would keep the government debt securities in their portfolios.

Bearing in mind the form of the budget constraint, special emphasis should be placed on the so-called second-round effect. That is, financing the budget deficit by issuing bonds affects the income, which in the next iteration affects the size of the state revenues. Rau (1985) presented this as function: $Y = f(H, B, P, G)$. In the given function, *Y*, *H*, *B*, *P*, and *G* are the income, high-powered money, stock of bonds, prices, and government spending, respectively. The partial derivatives of this function with respect to *H* and *G* are positive, whereas the partial de-

rivative with respect to *P* is negative. Of particular interest is the partial derivative of this function with respect to *B*, the character of which is vague because four effects are present: transfer effect, wealth effect, money market effect, and the Friedman effect. This implies that fiscal responsibility, which is embodied in budget constraint fulfilment, is not a function of one or a few successive periods of time but rather an ongoing process. This also stresses the importance of building and maintaining the credibility of fiscal policy makers.

## 4. METHODOLOGY

Testing the budget constraint fulfilment and the existence of fiscal sustainability in a country can be done in several ways, as reported in the economic literature. These methods primarily test the existence of a unit root in a series of public debt, model the fiscal reaction functions, and test the cointegration between budget revenues and expenditures. Following the methodology presented by Hakkio and Rush (1991) and Quintos (1995), we empirically tested the budgetary balance sustainability, which in theory is derived from the budget constraint fulfilment, based on the test of cointegration between the consolidated revenues and expenditures.

Bohn (2007) showed that, if the expenditure is I(*m*) and the revenue is I(*n*), where the debt is I(*q*), the sufficient condition for budget constraint fulfilment does not have to be the cointegration between revenues and expenditures but only the condition that $q \le \max(m,n)+1$. According to Bohn, most authors neglect cases of revenue and expenditure cointegration of a higher order than 1 and believe that cointegration is the necessary and sufficient condition of fiscal sustainability. Although he proved otherwise, however, similarly to many other authors, he ignored the possibility of financing the budget deficit in the way other than borrowing.

We opted for the cointegration approach for one methodological and one essentially economic reason. The time series from the fiscal domain in the EU candidates are not long enough for reliable statistical inference, and their disaggregation is often not grounded in economic logic. The core reason for selecting this approach lies in the fact that the public debt in these countries, especially in the observed period, changed not only due to borrowing to cover the budget deficit but also because of some other methods that are less frequent in developed countries. That is, the public debt varied depending on the debt relief from international creditors, privatization revenues, and most frequently, the inclusion of certain expenses (those below the line) directly into the public debt. These are all arguments that undermine the economic terms for applying the other two methodological approaches. On the other hand, the cointegration between revenues and expenditures is not an ideal technique, but it is a superior method of testing fiscal sustainability in these countries. More precisely, it tests only one parameter of fiscal sustainability, i.e., budget constraint fulfilment, which is the objective of this paper.

The economic logic behind the approach of budget revenue and expenditure cointegration is simple. If the time series of budget revenues and expenditures are nonstationary, the classical approach to econometric modelling is not applicable because the results of such an analysis are not reliable. Thanks to a Nobel Prize winner, C.W.J. Granger, the cointegration concept has become a very useful instrument for analysing multidimensional nonstationary time series. Even if the time series are individually nonstationary, their linear combination can be stationary. This solves the reliability issue of classic modelling under the conditions of nonstationarity and enables viewing the long-term equilibrium relationship between the observed time series. The approach of budget revenue and expenditure cointegration has a solid foundation in a thesis proven by McCallum (1984). According to that thesis, the budget deficit can be completely financed through borrowing, whereas the primary budget deficit cannot be fully financed through borrowing. This leads to two conclusions. First, if the revenues and expenditures are cointegrated with a cointegration vector of [1,-1], then apart from the budget constraint fulfilment and fiscal deficit sustainability, the public debt is also sustainable; i.e., it is bounded. On the other

hand, the authors that showed public debt sustainability using primary deficit and public debt cointegration approach made a mistake.

The empirical testing of intertemporal budget constraint fulfilment requires the transformation shown in Eq. 5, where *ex* denotes the total budget expenditures (including interest); the variable *G* is derived as $G_t = ex_t^* + (i_t - i)D_{t-1}$ and represents an unconditional mean of the interest rate, whereas $\lambda = \frac{1}{1+i}$.

$$ex_t - rev_t = \sum_{m=0}^{n} \lambda^{m-1}(\Delta rev_{t+m} - \Delta G_{t+m}) + \lim_{n\to\infty} \lambda^{n+1} D_{t+n} \quad (5)$$

Supposing that the last part of the expression in Eq. 5 tends to 0 and that the revenues and expenditures are series with one unit root, then their first differences result in stationary time series. In this case, the fulfilment of the intertemporal budget constraint requires the left side of the equation to be stationary as well; i.e., the linear combination of the revenue and expenditure series should be stationary. The observed cointegration equation has the following form:

$$rev = \alpha + \beta ex + e_t \quad (6)$$

The most comprehensive approach to budget balance sustainability can be found in Afonso (2004). If the revenue and expenditure time series are integrated of order 0, then this is a sufficient condition of sustainability. If both series are I(1), the fiscal sustainability thesis can be confirmed or rejected through the cointegration concept. If one series is I(0) and the other is I(1), then unsustainability is proven.

To obtain reliable conclusions, two types of tests of unit root are used: the Augmented Dickey-Fuller (ADF) test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The ADF test is based on an examination of the significance of parameter *φ* in model 7, where the null hypothesis suggests that there is at least one unit root in a series. A model for the revenue time series is presented. An analogue approach is used in the analysis of the expenditure time series. *k* marks the number of lags required to remove the autocorrelation of residuals by introducing dynamics into the model, and *drev* denotes the first difference in revenues. We use Akaike Information Criterion for determination of above-mentioned optimal lag length. The given model tests the presence of a unit root in the level of series. In the event of non-rejection of the null hypothesis, the testing is continued to examine in an analogous manner the presence of a unit root in the series first difference.

$$drev = \alpha_1 + \alpha_2 t + \varphi rev_{(-1)} + \sum_{i=1}^{k} drev_{(-i)} \quad (7)$$

To ensure the reliability of the conclusions, the analysis also applies the KPSS test, according to the null hypothesis asserts that there is no unit root in the time series. Let us begin with the following model:

$$rev_t = rev_0 + \xi t + u_t,\ t=1,\ldots,T \quad (8)$$

Let us assume that $u_t$ has one unit root. In this case, the model can be presented in the following way:

$$rev_t = rev_0 + \xi t + \sum_{t=1}^{T} v_t \quad (9)$$

In essence, this test is based on the answer to the question of whether the variance of the random error of the model Var($v_t$) is equal to 0. We assumed a linear decline of correlation over time; thus, the Bartlett kernel is used. An analogue approach was used to test the expenditure series.

Because the above-mentioned tests of unit root are extremely sensitive to the existence of deterministic components in the time series movement, it is important to identify which deterministic components should be used in the analysis. This is done based on visual examination and the Stock-Watson test, which is carried out by regressing the first difference in the revenue and expenditure series on the constant. To remove autocorrelation, dynamics are introduced into the model. The purpose of this test is to verify the significance of the constant in that auxiliary regression. The rejection of the null hypothesis in this test justifies the inclusion of the constant and trend as deterministic components when testing series for unit root presence. Otherwise, the trend should be excluded from the model and these tests have to be repeated by using only constant as deterministic component.

Finally, to test the presence of cointegration between the two series previously mentioned, we use the Johansen test of cointegration. This test is of two types: one is based on trace statistics, and the other on the maximum value of eigen statistics. The first type starts from the null hypothesis that the number of cointegration relations is equal to or less than *r*. The alternative hypothesis suggests that this number is different from *r*. The second test starts from the null hypothesis that the number of cointegration relations is equal to *r*, whereas the alternative hypothesis states that the number is equivalent to *r*+1. The number of lags is determined based on a VAR model, considering the multidimensional information criterions (Akaike Information criterion (AIC), Schwarz Information criterion (SC) and Hannan-Quinn Information Criterion (HQ)) and the necessary checking of the autocorrelation of residuals by using the Portmanteau test and multidimensional Breusch-Godfrey test. Deterministic components can be involved in Johansen procedure in five ways, which are sorted by their restrictiveness. First case starts with the assumption of deterministic components nonexistence. Second case assumes restricted constant in the cointegration space, but does not allow trend in the data. Third case allows linear trend in the data, additionally. Forth case assumes linear trend in the cointegration space. Fifth case provides the minimum of restrictiveness, because it allows quadratic trend in the data.

Based on the above-mentioned analysis, we provide the results and their interpretation, taking into account the fact that the EU candidates are developing countries, and thus budget constraint fulfilment does not necessarily imply fiscal sustainability in the previously defined manner. For developing countries with persistent budget deficits, a case of weak fiscal sustainability is especially relevant. If the coefficient $\beta$ in the cointegration vector [1,-$\beta$] is less than 1, then there is no strong sustainability but rather weak fiscal sustainability. Hakkio and Rush (1991) showed that even when the cointegration vector is not [1,-1], the intertemporal constraint can be fulfilled. If $\beta$ moves at the interval (0,1), and $D_{t+n}$ is defined as shown in Eq. 10, then the last expression in this equation tends to 0, where $S_t = (1-\beta)ex_t^* - \alpha$.

$$D_{t+n} = \sum_{k=0}^{n}(1+(1-\beta)i)^{n-k} S_{t+k} + (1+(1-\beta)i)^n D_{t-1} \quad (10)$$

This means that the intertemporal budget constraint is fulfilled, but the undiscounted value of the public debt tends to infinity. Our task is to confirm the hypothesis on fiscal sustainability in the EU candidate countries, with special emphasis on the coefficient $\beta$.

## 5. DATA

The data on the consolidated budget revenues and expenditures for Albania, Serbia and Turkey were taken from the websites of the Central Banks and Ministries of Finance of these countries. Unfortunately, the observed time series in other two candidate countries FYRM and Montenegro are too short for valid statistical inference and conclusions about fiscal responsibil-

ity, so we decided to exclude these countries from the observed panel. Detailed information on the data can be found in the Appendix A of this paper.

The literature cites various approaches regarding the type of data used in the analysis. The data are either in absolute values or in relative values in terms of *GDP* or per capita. In addition, the data may be nominal or real. The decision of the researchers depends on their research objectives. In the case of the observed EU candidates, we believe that the nominal data in absolute values provide the best basis for analysis. However, the lack of reliable data on the *GDP*, changes in the method of calculating the *GDP*, and the relatively short period of observation led us to opt for the absolute values.

On the other hand, by excluding the impact of inflation, we would neglect the influence of monetary policy and the possible coordination between monetary and fiscal policy. In particular, because all the observed countries have their own currency, unlike other countries in which similar research has been done, their central bank has more room to maneuver in managing monetary policy.

We observed the time series on a monthly basis. The samples for the observed countries are not the same length, due to the deficiency of the data. Because the observed time series showed distinctive seasonal variations, we de-seasonalized the data by using the CENSUS X12 method. Hereafter, for the purpose of simplification, we will use the terms revenues and expenditures without the attributes "de-seasonalized" and "consolidated". After this transformation, the foundations for further empirical analysis were set.

## 6. EMPIRICAL FINDINGS AND ECONOMIC INTERPRETATION

To verify empirically the thesis on the fiscal sustainability in the observed EU candidates, we primarily investigated the existence of unit roots in the observed series of revenues and expenditures. The results of the ADF unit root test showed that the revenues and expenditures series are I(1) for all countries.

**Table 1**. Results of the ADF unit root test

| | | Level | | | First difference | | |
|---|---|---|---|---|---|---|---|
| country | variable | estimated ADF(*k*) statistic | lags | critical values (5%) | estimated ADF(*k*) statistic | lags | critical values (5%) |
| Albania | *rev* [c] | -1.9320 | 7 | -2.8906 | -6.1645 | 6 | -2.8906 |
| | *ex* [c] | -2.0052 | 3 | -2.8895 | -7.9676 | 3 | -2.8898 |
| Serbia | *rev* [c, t] | -2.6265 | 5 | -3.4497 | -8.8640 | 4 | -3.4497 |
| | *ex* [c, t] | -3.4029 | 3 | -3.4490 | -8.1571 | 3 | -3.4493 |
| Turkey | *rev* [c, t] | -1.2346 | 8 | -3.4546 | -6.2607 | 7 | -3.4545 |
| | *ex* [c, t] | -1.7004 | 5 | -3.4532 | -10.2462 | 4 | -3.4532 |

*Notes*: Deterministic components are shown in the brackets in the column named variable. These components are c which stands for constant and t which stands for trend; Lag lengths are based on AIC; Critical values are based on MacKinnon (1991).

*Source*: Author's calculation

Similarly to the previous test, the KPSS unit root test also showed that all the variables are I(1). That is, the application of the test on the levels of series indicated that the series have at least one unit root, whereas the use of the LM statistics of this test applied on the first differences of the series showed that there is no sufficient evidence to discard the null hypothesis of unit root nonexistence.

**Table 2.** Results of the KPSS unit root test

| | | level | First difference | |
|---|---|---|---|---|
| country | variable | LM statistic | LM statistic | critical values (5%) |
| Albania | *rev* [c] | 0.6603 | 0.1624 | 0.4630 |
| | *ex* [c] | 0.8909 | 0.1753 | 0.4630 |
| Serbia | *rev* [c, t] | 0.1933 | 0.1169 | 0.1460 |
| | *ex* [c, t] | 0.2172 | 0.1174 | 0.1460 |
| Turkey | *rev* [c, t] | 0.5326 | 0.0394 | 0.1460 |
| | *ex* [c, t] | 0.5408 | 0.0434 | 0.1460 |

*Notes*: Deterministic components are shown in the brackets in the column named variable. These components are c which stands for constant and t which stands for trend; The critical values are based on Kwiatkowski et al. (1992)

*Source*: Author's calculation

The justification of the use of the above-presented unit root test modalities, with inclusion of different deterministic components, was investigated by visual examination of the series and with the help of formal test. Table 3 shows a summary of the results of the Stock-Watson test. The free member in the cases of Serbia and Turkey is statistically significant. Therefore, we can conclude that when testing the presence of unit roots in revenue and expenditure series, it is necessary to use both the constant and the trend as deterministic components. In contrast with that, following the results of this test, we used only constant as deterministic component in the case of Albania.

**Table 3.** Test of the adequacy of deterministic components

| country | variable | coefficient c | t value | p value | lags |
|---|---|---|---|---|---|
| Albania | *rev* | 206.5259 | 1.2764 | 0.2047 | 2 |
| | *ex* | 459.9144 | 1.2559 | 0.2121 | 3 |
| Serbia | *rev* | 2428.1200 * | 4.0637 | 0.0001 | 4 |
| | *ex* | 3085.8810 * | 3.8507 | 0.0002 | 5 |
| Turkey | *rev* | 901.3836 * | 3.8384 | 0.0002 | 5 |
| | *ex* | 1120.6440 * | 5.1134 | 0.0000 | 5 |

*Notes*: * Denotes significance at the 5% level;

*Source*: Author's calculation.

We finished the first step of the analysis with the conclusion that all series have exactly one unit root. After determining the integration level of the budget revenue and expenditure series, all the necessary terms for the cointegration test are obtained. Because both the revenue and expenditure series are I(1) in all countries, there is a possibility that their linear combination is I(0). The answer to this question is given by two variants of the Johansen cointegration test. More details about the procedure of lag length choice can be found in Appendix B. In accordance with the data, we will focus on two cases of deterministic component inclusion. In cases where we could not determine the linear trend in data, we used Johansen recommendation to involve only constant in the cointegration space. On the other hand, in cases where we could find the significance of the trend in the data, we allowed linear trend in the data. This case allows linear trends to enter the VECM as drift (Ahking 2002, p. 55).

**Table 4.** Results of the Johansen cointegration test

| | Cointegration Rank Test (Trace) | | | Cointegration Rank Test (Maximum Eigenvalue) | | |
|---|---|---|---|---|---|---|
| country | No. of cointegration eqn(s) | trace statistic | critical value | No. of cointegration eqn(s) | max-eigen statistic | critical value |
| Albania | $H_0$: r≤0; $H_1$: r≠0 | 19.2177 | 20.2618 | $H_0$: r=0; $H_1$: r=1 | 12.8592 | 15.8921 |
| Serbia | $H_0$: r≤0; $H_1$: r≠0 | 26.6670 * | 15.4947 | $H_0$: r=0; $H_1$: r=1 | 24.0915 * | 14.2646 |
| | $H_0$: r≤1; $H_1$: r≠1 | 2.5756 | 3.8415 | $H_0$: r=1; $H_1$: r=2 | 2.5755 | 3.8415 |
| Turkey | $H_0$: r≤0; $H_1$: r≠0 | 12.5623 | 15.4947 | $H_0$: r=0; $H_1$: r=1 | 8.0266 | 14.2646 |

*Notes*: We assume no deterministic trend in the data and restricted constant in the cointegration space for Albania. For Serbia and Turkey, we allow for linear trend in the data, but no trend in the cointegration space; Lag lengths are 6,5 and 5 for Albania, Serbia and Turkey, respectively; * Denotes statistical significance at the 5% level; Lag lengths are chosen based on the VAR model.

*Source*: Author's calculation.

The results of the Johansen cointegration test clearly showed one stationary linear combination of revenues and expenditures in Serbia, thus supporting fiscal sustainability. We could not determine the existence of cointegration between these variables by Johansen test in Albania and Turkey for the observed periods. However, our analysis also aimed to examine which form of budget sustainability is immanent in Serbia. That is, value of the parameter $\beta$ in the cointegration equation should discriminate between the hypothesis of a strong form of sustain-

ability versus the alternative of a weak form of sustainability. The restriction of these coefficients to a value of 1 was statistically tested.

**Table 5.** Test results on the strength of budget deficit sustainability

| country | $\beta$ | standard error | t-statistic | critical value |
|---|---|---|---|---|
| Serbia | 0.7520 | 0.0150 | -16.5333 | -1.9808 |

*Source*: Author's calculation.

We conclude that the value of the coefficient $\beta$ is significantly different from 1, which means that in the period from February 2005 to January 2015 in Serbia, budget sustainability was weak. Although the time series of revenues and expenditures are cointegrated, i.e., the budget constraint is fulfilled, the cointegration vector is not [1,-1]; thus, the budget expenditures were growing faster than the budget revenues in the said period. Specifically, for every 1,000,000 Serbian dinars of budget expenditure growth, the budget revenues grew by only 752,000 dinars in average.

This conclusion certainly has significant consequences on the overall fiscal sustainability in countires that are potential EU members. Budget constraint fulfilment is the most important factor, but not the only one, in attaining total fiscal sustainability. The persistent budget deficits, lack of cointegration between revenues and expenditures in Albania and Turkey and the calculated value of the parameter $\beta$ in Serbia, clearly indicate that the public debts of these countries are on a potentially unsustainable path. We suggest the necessity of exploring other factors affecting the sustainability of public debt, most importantly the method of financing the budget deficit; the currency, term, and interest structure of the public debt; the movement of the *GDP*; and the proportion of external debt to the total public debt, among others. If all this is strengthened by pronounced impact of political business cycles in these countries, then there are even more reasons for concern. EU candidate countries are not signatories of European Union treaties that put accent on the fiscal responsibility. Therefore, fiscal responsibility in these countries is dependent on their own fiscal rules. For these reasons, it is important for EU candidates to keep their structural budget deficit within sustainable levels, to ease the burden of interest payments through public debt management, and to apply growth and development strategies to make the deficit and debt less of a burden in relative terms.

## CONCLUSION

Never before has fiscal responsibility been so frequently mentioned in the economic literature as in recent years. The public debt crisis in many countries has raised a number of questions that policy makers, with the help of the scientific community, need to answer. The status of public finance in many countries requires a deep analysis and review of the way fiscal policy is currently carried out, with the goal of putting as much emphasis as possible on long-term fiscal sustainability in the future.

We believe that budget constraint fulfilment is the key factor, but not the only one, in achieving fiscal sustainability. In the short term, many anomalies can break this link. Therefore, we consider the analysis of fiscal sustainability to be much broader than mere examination of the budget constraint fulfilment. In the long run, this relationship becomes stronger in terms of macroeconomic stability. In theory, budget constraint fulfilment implies the absence of a Ponzi

scheme. However, this theoretical concept is not easy to verify empirically, although empirical research on this topic has flourished since the 1980s.

One of the most comprehensive approaches to this problem is the analysis of budget revenue and expenditure cointegration. This approach was used in our analysis of the fiscal responsibility in the EU candidate countries, because it has advantages in comparison with other methods of fiscal sustainability accession. Unfortunaltely, we could not find statistical evidence of cointegration between revenues and expenditures in Albania and Turkey. In contrast with that, we showed the cointegration of budget revenues and expenditures in Serbia. This is an important signal toward fiscal sustainability. However, the signal is not strong enough because the cointegration vector of revenues and expenditures Serbia showed a value of [1,-0.7520]. Therefore, we conclude that there is weak fiscal sustainability in these two countries.

The consequences of this conclusion are numerous and valid for all observed countries. Uncertainty can easily turn small economic shocks into large ones that can affect fiscal and consequently macroeconomic stability. Therefore, it is necessary to implement structural reforms in the public finance area in the coming years. Further, fiscal sustainability should be examined in greater depth. This paper is the starting point for such future works.

## APPENDIX

### A. Data summary

In table A1, we provided information on the raw data.

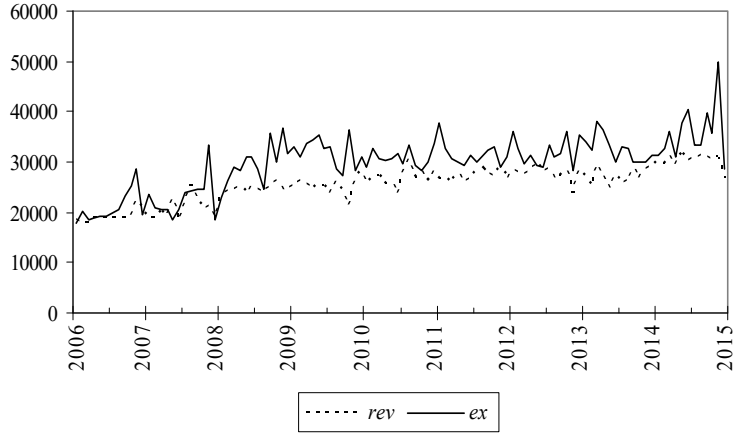
**Table A1.** Basic characteristics of the data

| country | data | series length | total obs. | source of the data |
|---|---|---|---|---|
| Albania | consolidated government revenues and expeditures | 2006 (M2) to 2015 (M1) | 108 | Bank of Albania (according to the Ministry of Finance data) |
| Serbia | consolidated government revenues and expeditures | 2005 (M2) to 2015 (M1) | 120 | National Bank of Serbia (according to the Ministry of Finance data) |
| Turkey | central government consolidated revenues and expeditures | 2006 (M1) to 2015 (M3) | 111 | Ministry of Finance |

*Notes*: Links to the data are presented in the Reference list.

In the following figures, we presented de-seasonalized series of revenues and expenditures across the countries.

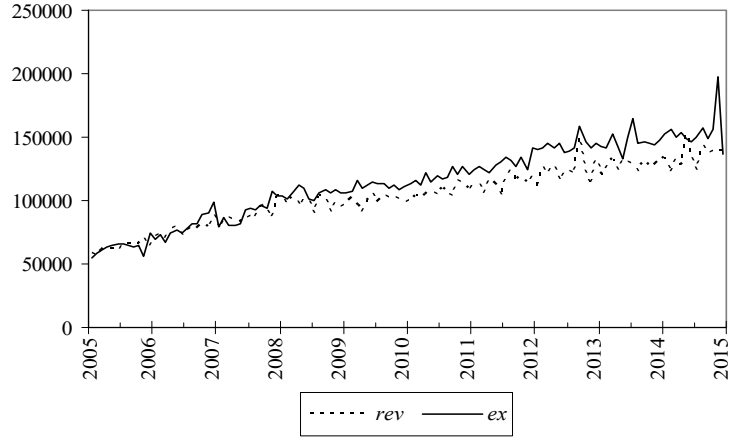
**Figure A1.** De-seasonalized consolidated revenues and expenditures in Albania




*Notes*: Revenues and expenditures are presented in millions of Lek.

*Source*: Author's calculation.

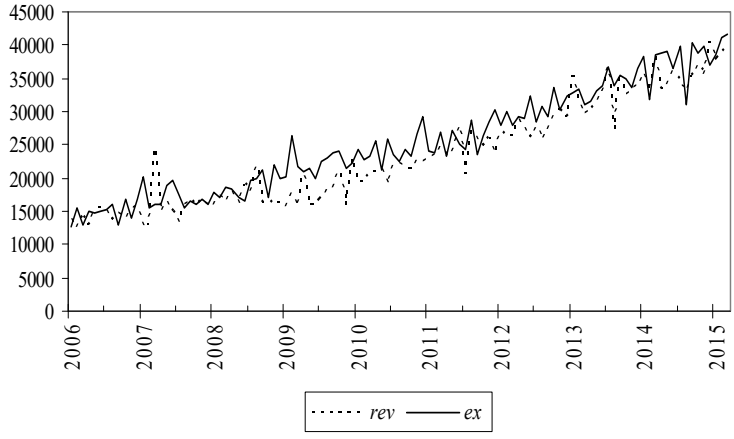
**Figure A2.** De-seasonalized consolidated revenues and expenditures in Serbia




*Notes*: Revenues and expenditures are presented in millions of Dinars.

*Source*: Author's calculation.

**Figure A3.** De-seasonalized consolidated revenues and expenditures in Turkey




*Notes*: Revenues and expenditures are presented in millions of Lira.

*Source*: Author's calculation.

### B. The choice of optimal lag length in Johansen test

Since Johansen test is very sensitive to variations of lag length, we put special attention on the optimal lag length choice. The lag length is primarly based on the information criterions in VAR model. This first step is associated with tests of autocorrelations in order to select the optimal lag length.

Portmanteau test starts from the null hypothesis that there are no residual correlations up to a lag $\eta$. On the other hand, Breusch-Godfrey test is reliable on testing the short lag residual autocorrelations and investigates the presence of autocorrelation at lag of $\eta$ order. The number of lags used in Johansen test is equal to the number of lags for the VAR model minus one, because the model is now based on the first differences.

**Table B1.** The summary of lag length choice procedure

| country | AIC | SC | HQ | optimal lag length |
|---|---|---|---|---|
| Albania | 3 | 3 | 3 | 7 |
| Serbia | 3 | 3 | 3 | 6 |
| Turkey | 6 | 3 | 6 | 6 |

*Notes*: Optimal lag lengths are chosen after the necessary checking for autocorrelation by Portmanteau and Breusch – Godfrey test.

*Source*: Author's calculation.

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