Budget deficit and interest rate developments in Ukraine

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Abstract

Gradual widening of the budget deficit against the backdrop of a steep increase in the real interest rate over the 2010-2013 period has become the most important source of serious macroeconomic vulnerability in Ukraine. By using a VAR/VEC model we estimate the effects of budget deficit and real interest rate shocks on the financial account balance of the balance-of-payments and output for the 2000-2013 data sample. Our estimates lead to several conclusions: (i) a rise in the budget deficit induces a capital outflow, (ii) the budget balance seems to be neutral in respect to GDP, (iii) real interest rate initially decreases in response to a budget deficit shock and increases after a year, (iv) capital inflows and output growth are important factors behind a decrease in the real interest rate, (v) a higher real interest rate is associated with worsening of both budget balance and output. Regarding recent macroeconomic developments in Ukraine, it is realistic to assume that expansionary fiscal policy has led to a decrease in capital inflows, which in turn has brought about an increase in the real interest rate and subsequent worsening of budget balance and output to follow.

Keywords: *budget deficit, interest rate, capital flows, Ukraine, VAR/VEC model*
***JEL Classification*:** E43, E62, F37, P20

1. Introduction

A symmetry between the budget deficit and the real interest rate is a distinct feature of the 2011-2013 period in Ukraine, though this kind of relationship has not been prevailing over previous years. For example, the same high budget deficit of the 2009-2011 period had been observed against the backdrop of a relatively stable (and much lower) real interest rate (Fig. 1). On the other hand, a low budget deficit in 2000-2004 had been coinciding with extremely high real interest rates. Although a traditional view assumes that fiscal expansion raises interest rates and thus 'crowds out' private investment, empirical support for that kind of relationship is not overwhelming (Laubach, 2004; Perotti, 2002). Among explanations, such factors as the Ricardian Equivalence, capital flow openness or financial integration used to be mentioned (Claeys, Moreno & Suriñach, 2008). Regardless of the perfect foresight assumption and other stringent preconditions, easier access to external financing should be helpful in moderating the 'crowding out' effect, as it is implied by the well-known Mundell–Fleming model, the open economy version of the Keynesian IS–LM model.

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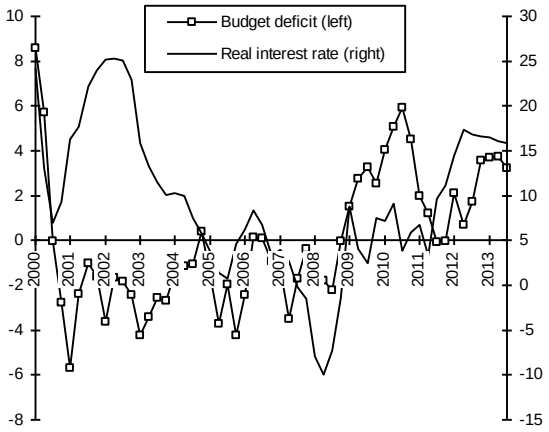

Fig. 1. The budget balance (% of GDP) and interest rates (%) in Ukraine, 2000─2013

Our study reviews some of the main potential relationships between the budget balance and real interest rates and develops an empirical model for estimating their macroeconomic effects in Ukraine. The paper structure proceeds as follows. In Section 2, general explanations of the relationship between the budget deficit and real interest rate are presented. The data and modelling framework are outlined in Section 3. Then empirical results are discussed in Section 4. The last section is the conclusion.

2. Theoretical framework

According to a traditional view, the fiscal expansion raises interest rates through the so-called 'crowding out' effect. Following an increase in the budget deficit, the additional demand for financial resources pushes up interest rates, and thus crowds out the interest-sensitive components of private sector spending, such as business outlays on new plants and equipment or new home construction[3]. Empirical support for this hypothesis is found for the U.S. (Chen, 2007; Cebula, 1998), France (Laubach, 2004), Poland (Hsing, 2010), as well in several pooled and panel time-series studies for OECD Member countries (Ardagna, 2009; Bussière et al., 2009; Orr et al., 1995) or EU-25 countries (Debrun and Joshi, 2008). The relationship between the budget deficit and real interest rate is amplified by accumulation of public debt (Ardagna, 2004).

[3] A rise in interest is smaller if budget deficit is money-financed, while a wealth effect where agents now feel "wealthier" as a result of holding government bonds and thus consume more has an opposite effect, creating an additional interest rate rise (Ussher, 1998).

However, in many cases higher budget deficits are either insignificant in respect to the long-term interest rate, as it is found for Australia, the U.S., the U.K., Canada and Germany (Siklos, 1988; Perotti, 2002), Turkey (Bayat et al., 2012), or even bring about a decrease in this macroeconomic indicator, as it is obtained, for example, for Japan and Germany (Laubach, 2004). Corsetti (Corsetti et al., 2009) found for the U.S. that the budget deficit leads to an increase in the interest rate in the short run, but there is a decrease in the interest rate in six quarters. Ussher (Ussher, 1998) remarks that assumption of interest rate-based crowding out of private borrowing and investment is based upon assumptions of resource constraints, exogenous money supply, or government budget constraints. Taking into account multi-asset markets, investment accelerators and the alternative causality – interest rates to budget deficits, it is possible to explain econometric testing incongruities regarding the interaction between deficits and interest rates.

The most popular explanation of the lack of a direct link between the budget deficit and interest rate refers to the Ricardian Equivalence, which implies that private saving fully offsets the effect of higher public consumption or lower taxes, though in the latter case the effect is less convincing[4]. The way the government finances a given level of expenditure does not play any role, as taxing or borrowing have similar effects because people are forward looking. Even if the necessary conditions for Ricardian Equivalence do not hold (rationality of economic agents, perfect capital markets, non-distortive taxation etc.), the interest rate effects of deficits remain ambiguous because observed changes in current and projected deficits usually depend on the timing of the changes in government spending and approaches for achievement of the government's intertemporal budget – by adjusting taxes or spending (Laubach, 2004). Based on the overlapping generations model, budget deficits can be associated with lower interest rates in the case in which the increase in debt caused by a current tax cut is fully repaid by future spending cuts, while any policy that leaves the stock of debt persistently higher leads to higher interest rates.

Another channel is provided with the open-economy loanable funds framework (Cebula, 1998):

$$R_t = f\left(E_t\pi_{t+1}, E_tR^s_{t+1}, g_t, B_t, FA_t\right) \qquad f_\pi, f_R, f_g > 0, \quad f_B, f_{FA} < 0, \tag{1}$$

[4] The concept was first formulated by the 19th century English economist David Ricardo, and it was rediscovered and formalized by Robert Barro (Barro, 1974).

where R is the long-term interest rate, π_t is inflation, R_t^s is the long-term interest rate, g_t is the budget deficit, B_t is the net purchases of government bonds by the central bank, FA_t is the net capital inflow, E is the operator of expectations.

In accord with the assumptions of the loanable funds model, the nominal long-term interest rate is an increasing function of the expected inflation, the expected short-term interest rate and the budget deficit. Central bank purchases of securities and net capital inflows produce downward interest rate pressure. If capital inflows are strong enough, it is likely to compensate for an opposite upward pressure of the budget deficit, all the more that in the case of favourable inflationary expectations used to be associated with capital inflows.

Claeys et al. (2008) found that the crowding out effect on domestic interest rates is still significant, but it is reduced by spillover across borders. As the supply of savings becomes very interest rate elastic, the crowding out effect of budget deficit becomes much weaker, all the more that for economies that are more closely integrated. It is quite natural that the spillover effect is particularly strong among EU countries. As established by Faini (2006), an increase of the budget deficit of EU countries by 1% of GDP contributes to increase of the interest rate by 0.1%, which is much lower as compared to the U.S. While in the past a wider budget deficit had been associated with a higher interest rate and exchange rate depreciation, it is not the case since the formation of the European Currency Union, even despite that there are a risk premium for some countries. Although it is true that in the Mundell–Fleming model the budget deficit results in a higher interest rate (and output), under either fixed or floating exchange rates, as it is noticed by Siklos (1988), there is no link between budget balance and interest rate under a perfect capital mobility, when for a small open economy the interest rate is determined by its international level.

3. Data and modeling framework

Our study makes use of the following variables: BD_t is the seasonally adjusted budget balance (% of GDP), R_t is the real interest rate (%), FA_t is the seasonally adjusted financial account balance of the balance-of-payments (% of GDP), Y_t is the seasonally adjusted gross domestic product (index, 1994 = 100). The data sources are: IMF *International Financial Statistics*, Ministry of Finance of Ukraine (www.minfin.gov.ua), State Committee of Statistics (www.ukrstat.gov.ua). The sample ranges from 2000Q1 to 2013Q3.

Since it is likely that there is a long-run relationship between variables in question, we test for a unit root I(1) in each series and their cointegration. Both the Augmented Dickey–Fuller

(ADF) and Phillips─ Perron (PP) tests are employed to test for I(1). The ADF test implies that output and real interest rate are non-stationary in levels but stationary in first differences. It is not possible to reject the hypothesis of I(1) for the budget balance at the 5% level of statistical significance, which is a conventional feature[5]. According to the ADF test, the financial account balance seems to be I(1), while the PP test does not allow for such a conclusion.

Null Hypothesis	Maximum Eigenvalue Tests		Trace Tests	
	Actual statistic	Critical values (95%)	Actual Statistic	Critical values (95%)
$r = 0$	34.02*	27.58	70.76*	47.86
$r \leq 1$	23.95*	21.13	36.74*	29.80
$r \leq 2$	7.60	14.26	12.80	15.49
$r \leq 3$	5.19**	3.84	5.19**	3.84

Notes: r is the number of cointegrating vectors; VAR lag length is chosen at 3;
* the null hypothesis of the presence of a unit root is rejected at the 5% level.

Table 1 Johansen Cointegration Tests.

Johansen's (1988) multivariate cointegration technique is an adequate procedure for studying causal relationships as a simultaneous determination of main macroeconomic indicators is very likely. Results of the Johansen test are presented in Table 1[6]. The null of no cointegrating vector can be rejected at the 1% level of statistical significance. There are at least two cointegrating vectors, and the results are basically robust to increasing lag length of the Johansen test.

As there is the need to account for the dynamic structure jointly with the long-term structure, with the possibility of dealing with multiple cointegration relationships, the vector error-correction (VEC) model is a preferable option. The VAR/VEC specification restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing a wide range of short-run dynamics.

[5] As mentioned by Laubach (2004), the inability to reject a unit root for the deficit-to-GDP ratios implies that the government will ultimately violate its inter-temporal budget constraint. Also, a non-stationary budget balance could be a small-sample problem.

[6] The trace statistic tests whether r cointegrating vectors are present in the system against the alternative hypothesis that the system is already stationary (i.e., n cointegrating vectors are present in the system). Equivalently, the max statistic tests whether the rank is r against the alternative hypothesis that the rank is $(r+1)$.

The VAR/VEC in first differences can be presented as follows:

$$\Delta X_{it} = A_1 \Delta X_{t-1} + ... + A_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \eta_t + \varepsilon_t, \quad t = 1,...T, \tag{2}$$

where A_i is and Π are $n \times n$ matrices, η is a $n \times 1$ vector of constants, ε_t is a $n \times 1$ error vector $(\varepsilon_t \approx N(0, \Omega))$.

For the purposes of our study, $n = 4$ (budget balance, real interest rate, net capital inflows, and output). The Johansen's test determines the number of cointegrating vectors present in the system (r). If $\text{rank}(\Pi) = r < n$, then $\Pi = \alpha\beta'$, where both α and β are $n \times r$ matrices (the former is the loadings matrix and the latter contains the coefficients of the cointegrating vectors). The cointegrating vectors (r) are stationary and represent the long-term relationships between endogenous variables. The adjustment coefficients provide information about the convergence speed of endogenous variables to their long-term values.

4. Empirical results

Estimations of the long-term parameters of the VEC model produced the following results (the values of the standard deviations of the parameter estimates are given in brackets):

$$\begin{matrix} BD_t = & 0.548 K_{t-1} & -1.287 Y_{t-1}, \\ & (0.26) & (-1.07) \end{matrix} \tag{3}$$

$$\begin{matrix} R_t = & 0.479 K_{t-1} & -8.031 Y_{t-1}. \\ & (0.56) & (-2.28) \end{matrix} \tag{4}$$

Both vectors indicate that the net capital inflow is associated with an improvement in the budget balance, though it is neutral in respect to the real interest rate in the long run. Higher output is a factor behind a decrease in the real interest rate, but it is not contributing to fiscal discipline.

Figure 2 presents the impulse-response functions over the twelve-quarter horizon obtained with the Cholesky decomposition. The ordering is $BD \Rightarrow R \Rightarrow FA \Rightarrow Y$. Additional information is provided with the forecast error variance decomposition of the budget balance at different forecast horizons across each of the endogenous shock types (Table 2).

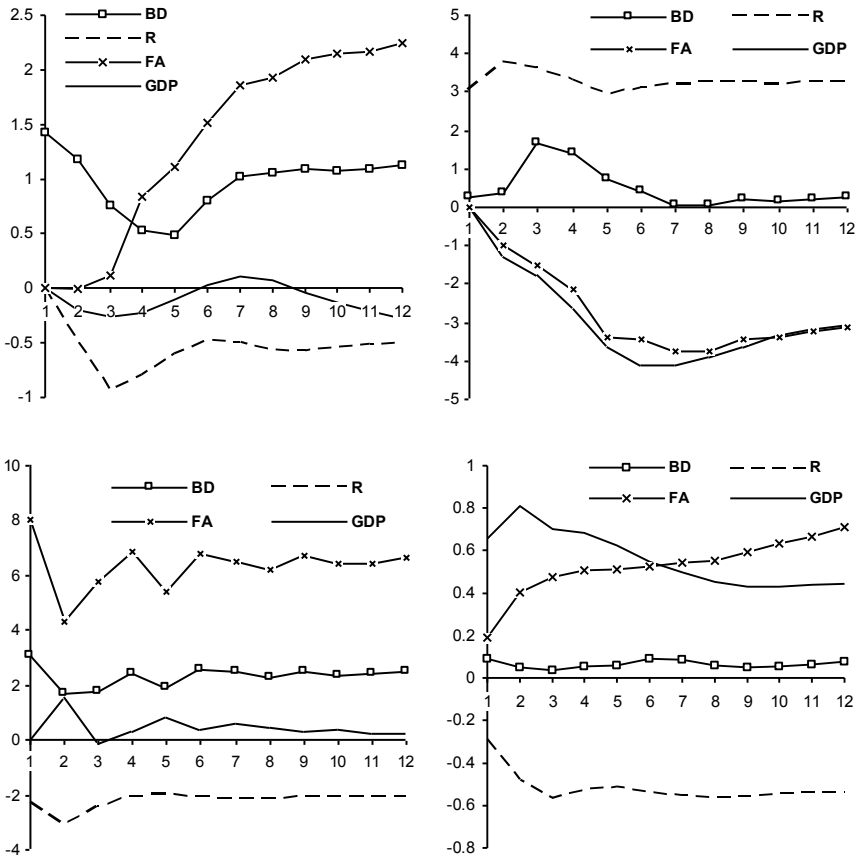

Fig. 2. Effects of VAR shocks on the exchange rate

As shown in Fig. 2a, a one standard deviation shock to the real interest rate tends to worsen the budget balance. Net capital inflows, as measured by the financial account balance, are likely to have a positive effect of substantial amplitude. The variance in the budget balance with a lag of three quarters is explained mainly by its own dynamics (77%) and real interest rate (20%). Then the importance of capital inflows is gaining ground, gradually increasing from 36 to 65% at the end of 12 periods. No significant part of variance in the budget balance is explained by the output, which is a disappointing result.

The results in Fig. 2b do not seem to provide support for the assumption that budget deficits raise real interest rate, at least in the short run. Anyway, the share of the budget balance in the variance decomposition of the real interest rate is marginal (Table 3). Both capital inflows and output are important factors behind a decrease in the real interest rate, determining from 50% to 60% of its changes in the long run. Adjustment of the real interest rate to its own shocks is very slow, suggesting that such shocks have a permanent effect.

Impulses	Responses	Forecast horizons			
		3	**6**	**9**	**12**
Budget balance	*BD*	77	43	30	26
(*BD*)	*R*	20	19	11	8
	FA	0	36	57	65
	Y	3	1	2	1
Real interest rate (*R*)	*BD*	6	4	2	2
	R	77	45	37	36
	FA	7	22	28	29
	Y	10	29	34	33
Financial account	*BD*	10	10	11	11
(*FA*)	*R*	13	11	10	10
	FA	75	78	78	79
	Y	2	1	1	0
Domestic output (*Y*)	*BD*	0	0	1	0
	R	24	27	30	30
	FA	16	22	27	33
	Y	60	50	42	37

Table 2 Forecast error variance decomposition (in percent)

An increase in either budget deficit or real interest rate are detrimental to capital inflows (Fig. 2c). As suggested by the variance decomposition (Table 3), fiscal and interest rate developments are responsible for above 20% of changes in the financial account balance. Output does not play any significant role in shaping capital flows in Ukraine.

In accordance with standard predictions of conventional macroeconomic models, a higher real interest rate has a restrictionary impact (Fig. 2d), with its share in the variance decomposition of output gradually increasing from 24% to 30%. Ukraine's output is strongly associated with capital inflows, which determine about a third of changes in output. As it is suggested by the impulse function and variance decomposition, the budget balance does not exert any impact upon the real sector.

Conclusion

Using the VAR/VEC model for the data sample of 2000Q1─2013Q3, it is established that there is strong evidence of a two-way causality between the budget balance and the capital

flows, with the real interest rate being a by-product of this kind of relationship. As the budget deficit induces a capital outflow, it is followed by an increase in the real interest rate, even though it initially decreases in response to a budget deficit shock. In full accordance with conventional macroeconomics, a higher real interest rate is associated with worsening of both budget balance and output. It is worth noting that changes in the budget balance are neutral in respect to GDP. Regarding recent macroeconomic developments in Ukraine, it is realistic to assume that expansionary fiscal policy has led to a decrease in capital inflows, which in turn has brought about an increase in the real interest rate and subsequent worsening of budget balance and output to follow.

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