WORKING PAPER

05 (44) 2013

BANK OF ALBANIA

FISCAL POSITION AND YIELD CURVE IN ALBANIA

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The views expressed herein are of the author and do not necessarily represent the views of the Bank of Albania. This paper has benefited from invaluable comments of Dr. Altin Tanku, Head of Research Department, Bank of Albania and from comments received in the 5th Workshop: "Economic Research in South Eastern Europe", organized by Bank of Albania, in Tirana, on 10-11th November, 2011

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ABSTRACT

This paper tries to investigate the behavior of fiscal policy and the yield curve in Albania, over the period 1999Q1:2012Q2, by employing impulse response functions obtained by Vector Autoregressive (VAR) model and variance decompositions. The yield curve is represented by its two latent factors, level and slope, which are obtained through standard mathematical proxies. The Impulse Response Functions (IRF) analysis shows that fiscal innovations, both to the annual change of domestic debt-to-GDP ratio and to the fiscal balance as percentage of GDP do affect the yield curve, though such effect is transitory. Also, we find that among yield curve factors, annual change of domestic debt-to-GDP ratio affects the most the slope of the yield curve, while fiscal balance as percentage of GDP has more explanatory power on the level of the yield curve. Both, the IRF analysis and variance decompositions suggest that yield curve is more sensitive to movements in the flow fiscal variable, represented by fiscal balance as percentage of GDP rather than by the stock variable, represented by the annual change of domestic debt-to-GDP ratio.

1. INTRODUCTION

Fiscal policy has always been a major area of concern and interest among policy makers in Albania, due to its effects on economic growth, prices, and interest rates. There have been several studies regarding fiscal policy in Albania. Mançellari (2010), employing a Structural Vector Autoregressive model, attempts to estimate the macroeconomic effects of fiscal policy, by differentiating between two different types of fiscal policy: tax decrease and expenditure stimulus. The author finds that a tax cut has the higher multiplier effect on GDP, while among current and capital expenditures, the latter are found to affect more GDP. Also, the author concludes that a tax cut and a 1% increase in current expenditure increases prices, while the capital expenditures do not have a statistical effect on interest rates. Lastly, a tax cut is found to increase interest rates by 0.26 pp after four quarters, as a result of increased consumption and lower saving; while both capital and current expenditures do not significantly affect interest rates, represented by the 12-month T-bills interest rates.

A follow-up study on the Albanian fiscal policy is that of Shijaku and Gjokuta (2012), which adds to the discussion on the ability of fiscal policy to affect economic growth in Albania. The main contribution of this study is to examine the impact of government revenues and expenditure on growth by categorizing tax revenues into distortionary and non-distortionary; and by categorizing expenditures into productive and non-productive. The authors find that both revenue categories affect GDP growth negatively, with distortionary taxation having a much larger and statistically significant effect. Also, the study reveals that growth is positively affected by productive expenditures and negatively by the non-productive expenditures. A second contribution of Shijaku and Gjokuta (2012) is to estimate the impact of public debt on growth and to conclude on a negative relationship between the two. A third research study on fiscal policy issue is that of Shijaku (2012), which evaluated the long-run mean reverting properties of debt-to-GDP ratio by unit root approach and the government reaction function in order to check whether the government pursued policies aiming at avoiding excessive debt accumulation.

As mentioned above, the effect of fiscal policy on interest rate, represented by the 12-month T-bills yields was quite well investigated in Mançellari(2010), but leaves out any possible effect on other maturities of T-bills and on government bonds. It is suggested by economic and empirical theory that short-term interest rates affect mid-term and long-term rates, and that interest rates affect the composition of aggregate demand (through the crowd-out effect, wealth effect or substitution effect); the exchange rate path, and consequently the trade balance. Therefore, it becomes crucial to identify the main forces driving the behavior of interest rates of all maturities, represented by the yield curve. Also, the infantile financial market and the use of the yield curve as an indicator of financial health of the economy, have led to more interest in yield performance. There have been useful statistical and descriptive explanations on the movement of the yield curve (level, slope, and curvature) in monetary policy reports of the Bank of Albania – but there has been no empirical study which focuses on what causes the yield curve to move.[1] Therefore, this study is a first attempt to investigate the dynamics of the whole shape of the yield curve in Albania, and to check whether it is affected by fiscal developments. Also, this study complements the series of research studies on fiscal policies in Albania carried out over the last three years.

Literature on the relationship between fiscal policy and the term structure of interest rates remains quite controversial. Theory does not provide a clear-cut answer to such relationship. According to standard macroeconomic textbooks, in the IS-LM framework, a fiscal expansion (increase in government expenditures or decrease in taxes) increases domestic output, shifts the IS curve to the right, and therefore raises domestic interest rates. But were the Ricardian conditions to be met, in circumstances of increased public spending, consumers would fully anticipate the future tax burden and, therefore, save the increase in disposable income brought by the current tax cut. In turn, total saving remains unchanged, as the fall in public saving (tax cut or increase in public spending) would be fully offset by increase in private saving, and thus leaving interest rates unchanged. However, Faini (2005) argues that even

[1] For more information, refer to Monetary Policy Report for 2010 Q1, Box 7: "An overview on the yield curve", pages 59-60.

when the standard conditions for Ricardian equivalence are met, fiscal policy affects interest rates, if agents are liquidity constrained or have limited horizons, if taxes are distortionary, or if government spending is not a perfect substitute for private goods.

Also, empirical evidence does not turn out to be very helpful in resolving such theoretical ambiguities. Conclusions derived from the extensive literature on the relationship between fiscal policy and term structure of interest rates can be grouped into four main blocks.

The first one includes those studies that fail to find any significant effect of fiscal variables on interest rates. In an attempt to explain why real interest rates were quite high in the 1980s, Barro and Sala-i-Martin (1990) estimate the main determinants of interest rates in nine OECD countries over the period 1959 to 1988. Regressing the expected real interest rate on its own lagged value, past value of stock returns, of oil prices, of investment-to-GNP ratio, of world money growth rate, and on the actual values of two fiscal variables (debt-to-GDP ratio / cyclically adjusted real deficit-real GDP ratio), authors find that world interest rates do not significantly respond to fiscal developments.[2]

Studies in the second block find significant impact of fiscal variables (either budget deficits or government debt) on long-term interest rates, especially when employing projections of fiscal variables rather than their current values (Canzoneri, Cumby and Diba 2002; Gale and Orszag, 2003; and Laubach, 2003). Using a panel data set of OECD countries, Gruber and Kamin (2010), find a robust and significant effect of fiscal performance - represented by two years ahead projections of fiscal positions from the OECD's Economic Outlook - on long-term bond yields. The use of forward projections for fiscal variables is justified on the grounds that long-term interest rates are affected more by prospective fiscal policy rather than current one. To test such assumption, Gruber and Kamin (2010) re-run the baseline regressions with current values of fiscal variables rather than projected ones. Their findings show

[2] In Barro and Sala-i-Martin, all variables (explanatory and the dependent ones) are expressed as weighted average over the countries in the sample.

that current levels of debt lose their significance in affecting interest rates; current fiscal variables on the other hand remain significant, though their affect is smaller than in the baseline regressions.

Third, literature suggests that there is a higher elasticity of interest rates to budget deficit than to government debt. Gale and Orszag(2003) finds that forward rates (five years ahead or more) rise by 20 to 30 basis points in response to one percentage point increase in the projected deficit-to-GDP ratio and about 3 to 4 basis points to a percentage point increase in the projected debt-to-GDP ratio. As Faini (2005) suggests, when attempting to investigate the relationship between fiscal policy and interest rates, the choice of fiscal policy indicator is of high importance. Both indicators, flow variable (fiscal balance) and stock variable (debt), theoretically should matter in determining the behavior of interest rates. In a non-Ricardian world, a higher level of public debt adds to household wealth, decreasing, therefore, savings and raising interest rates. The fiscal balance also matters, because it provides a link between debt stocks at different points of time. Also, expected future deficits are important in determining debt dynamics, given that forward-looking households adapt their saving behavior in response to anticipation of future tax burden associated with a higher stock of debt. Futher, Faini (2005) argues that debt dynamics is linked to long-run sustainability and is a better indicator in explaining long-term interest rates.

Fourth, a quick comparative analysis of US literature on fiscal behavior – interest rates nexus with that of Europe reveals that the elasticity of interest rates to fiscal variables is higher in the US than in Europe. Gruber and Kamin (2010), in the their panel data approach for OECD countries find that by 2010, yields could be 60 basis point higher due to a projected deterioration of fiscal positions associated with the recent financial crisis; while in other G7 countries, bond yields would increase by a lesser amount.

Literature on yield curve and especially on the relationship between yield curve and fiscal policy for countries of the region (South Eastern Europe) is quite limited, mostly due to their infantile bond markets and their institutional defects. So, Hanousek, Kocenda,

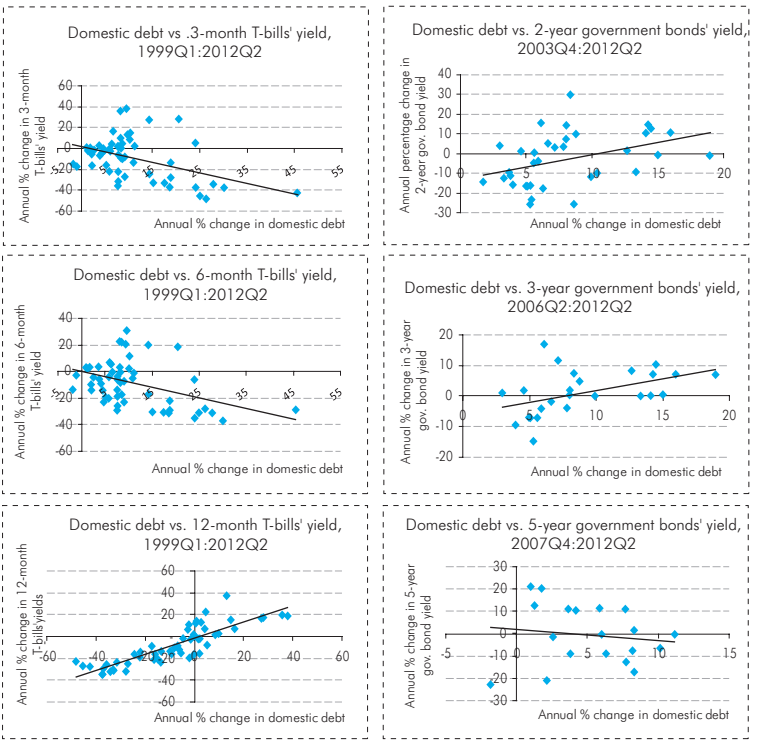
and Zemcik (2006) analyze the Serbian bond market by modeling its terms structure through Nelson and Siegel (1987) approach, and estimating its relationship to several macroeconomic variables (inflation, exchange rate, and industrial production). However, there is no investigation of the effects that fiscal policy indicators might have on the behavior of term structure of interest rates.

The plan of this paper is as follows. The next section offers a quick glance at the data and on the relationship between T-bill and government bond yields and fiscal indicators (domestic debt and fiscal balance) and highlights some econometric issues, which might blur such relationship. The third section describes the data and the recursive VAR methodology. In section four, results derived from impulse response functions and variance decompositions are presented. The final section concludes and points out possible areas for further research.

2. A FIRST GLANCE AT THE DATA AND ECONOMETRIC ISSUES

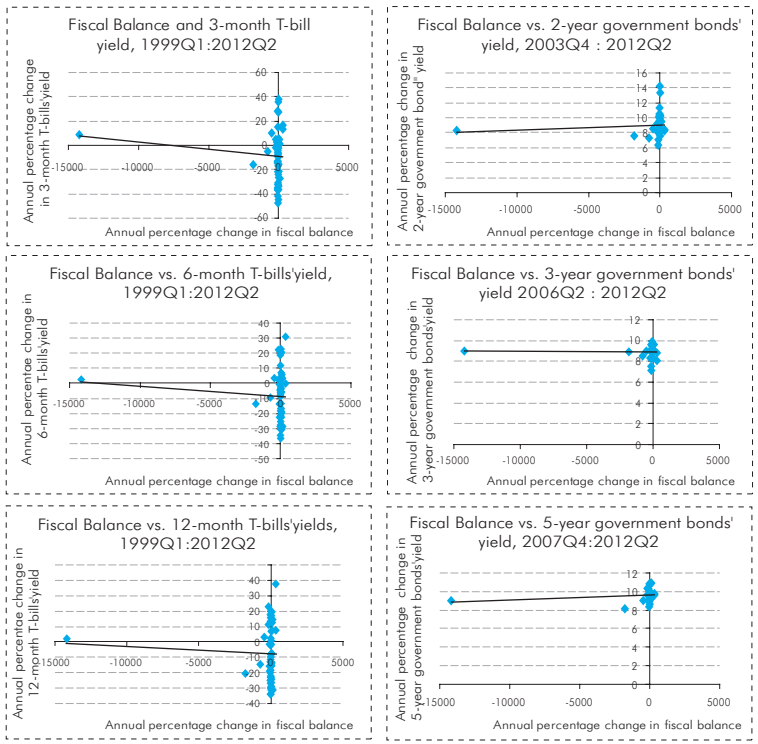
Figure 1 shows the correlation between domestic debt and yields of T-bills (3, 6 and 12-month) and of government bonds (2, 3 and 5-year) - all expressed in annual percentage change - for the case of Albania The relationship does not seem particularly strong. As shown, the annual percentage change of domestic debt is negatively correlated with the performance of yields of 3 and 6-month T-bills, and of 5-year government bonds – contrary to what is expected; while it is positively correlated with the performance of yields of 12-month T-bills, and of 2 and 3-year government bonds – as expected. Similarly, Figure 2 presents simple correlations between annual percentage change of fiscal balance and yields of all maturities. The relationship seems a bit more blurring than

Figure 1: Annual percentage change of domestic debt vs. annual percentage change of T-bills' and government bonds' yields



in the case of public debt stock. Almost all yields do not seem to associate much with yearly changes in fiscal balance.

Figure 2: Annual percentage change of fiscal balance vs. annual percentage change of T-bills and government bonds' yields



Simple correlations between fiscal variables and yields do not provide clear hints on the sign of the relationship between them two. This does not mean we should conclude that fiscal policy does not affect the yield curve, since there might be many confounding factors that might blur such relationship.

Faini (2005) shows that the way the current deficits affect interest rates, depends highly on the initial level of debt. He argues that an increase in deficit in a low debt economy does not raise excessive concerns about the long-run sustainability, and, therefore, does not necessarily lead to higher interest rates as it might do in countries with high debt-to-GDP ratios.

A second and most plausible factor which might distort estimation of fiscal impact on interest rates relates to their respective endogeneity to the business cycle. A cyclical downturn in GDP is associated with higher fiscal expenditures (and further widening of fiscal deficit) due to automatic stabilizers and erosion in tax revenues. At the same time, the monetary authorities loosen the policy to counter the deceleration in economic activity and as a consequence the disinflationary pressures. This introduces a negative relationship between fiscal deficit and the interest rates behavior, which might obscure the underlying positive link. Empirical literature has employed several methods to tackle such endogeneity issue. Gruber and Kamin (2010) provide a comprehensive set of methods in order to isolate the effects of fiscal policy from effects of business cycle on interest rates. First, they employ OECD's two years ahead projections of fiscal indicators based on the rationale that future fiscal behavior is less likely to be affected by current economic conditions. Second, Gruber and Kamin (2010) employ several control variables to account for the current cyclical conditions, like: short-term interest rate represented by the three-month interbank rate, inflation and real GDP growth. And third, in addition to standard fiscal balance, they introduce two additional variables into the regression: the primary fiscal balance aiming to reduce endogeneity with respect to interest rates; and structural balance aiming to exclude the effects of deviations of output from potential.

A third possible factor which might distort the visual relationship between fiscal performance and interest rates might relate to underlying perceptions of creditworthiness. In principle, a high-fiscal-deficit country is considered less creditworthy and, so is punished with higher interest rates. However, a government's creditworthiness depends on other issues as well, like: economic growth performance, political stability, and established record of timely repayment. All these will be charged with lower interest rates, and as a result will entice governments to further expand their deficits, leading to a negative correlation between deficits and interest rates. In the case of Albania, economic growth has been satisfactory, with real GDP growth around 5.3% over the 2004-2007 period, jumping to 8% in 2008, and then slowing down to 3.4% in the years 2009–2011. Also, Albania scores quite high on terms of timely debt interest payments, but it is lagging behind with regard to political stability, especially over the last year.

3. DEFINING YIELD CURVE IN ALBANIA

A challenging task in estimating the impact of fiscal policy on the yield curve is determining how to introduce the yield curve in the VAR estimation. Literature on yield curve is quite intensive. There have been numerous studies by macroeconomists and financial economists who attempt to extract useful information from the term structure of the yield curve. According to Nielson and Siegel (1987), it can be summarized into three main factors: level, slope and curvature. These approaches differ quite substantially from each other, in terms of fit and form. As Diebold (2005) argues, these differences in yield curve models arise due to different needs and motives of researchers (market surveillance, bond or option pricing, interest rate forecasting, etc.) In broad terms, macroeconomists, when building yield curve models, are more interested in estimating the impact of inflation expectations and expected economic activity on the behavior of yields; while financial economists abstract from any possible influence derived from such factors. There are also studies which build "bridge models", bringing together both, financial and macroeconomic factors.

The approach dominating the finance literature in parsimoniously modeling the yield curve is first proposed by Nelson and Siegel (1987), and further extended by Svensson (1994). Such approach consists in adopting a parametric function, according to which the yield curve is explained by its three time-varying parameters (level, slope and curvature). Nelson and Siegel (1987) approach in modeling yield curve is widely used by central bankers and policy makers of the Bank of England, European Central Bank and Bank of International Settlements.

A second, a more direct and easier approach in extracting information from the yield curve consists in using standard empirical proxies for the latent factors, which are also widely used in yield curve literature. Also, Martin and Afonso (2010); Bianchi, Mumtaz and Surico (2009) and Diebold et al. (2005) compare these standard empirical proxies with estimates obtained from following the Nielson and Siegel (2006) approach, and find that they are highly correlated with each other. Both these estimates provide a rich

history on the evolution of the yield curve, though the Nelson and Siegel (1987) approach shows some advantages at certain periods. Among the three latent factors, curvature is the one to exhibit higher variability, and hence lower correlation with its empirical proxy. In this paper, we choose to represent the yield curve through standard empirical proxies which are calculated as simple functions of yields at different maturities (equations 1, 2 and 3).

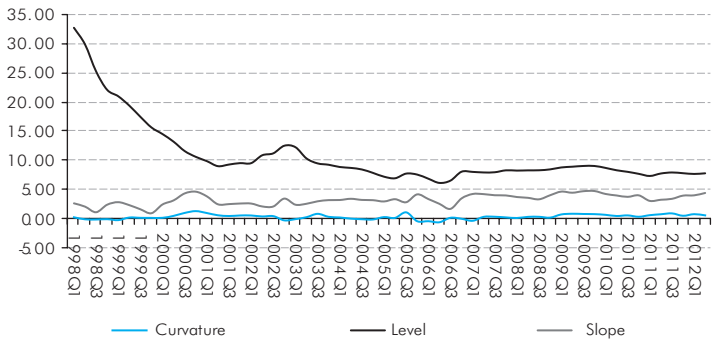
$$\text{Level} = [\, Y_t(3) + Y_t(6) + Y_t(12) + Y_t(24) + Y_t(36) + Y_t(60) \,]/6 \qquad (1)$$

$$\text{Slope} = [Y_t(60) - Y_t(3)] \qquad (2)$$

$$\text{Curvature} = \text{Average}\,[Y_t(36)] - \tfrac{1}{2} * [(\, Y_t(3) + Y_t(60)] \qquad (3)$$

There are two main reasons why it is more appropriate to adopt the second approach rather than the methodology represented by Nielson and Siegel (2006). First, there is not a wide spectrum of maturities forming the yield curve in Albania. There are only seven maturities (3-month T-bill; 6-month T-bill; 12-month T-bill; 2-year government bond; 3-year government bond; 5-year government bond and 7-year government bond). The last one is dropped out of the yield curve due to its quite recent launch, in 2007, and the very small number of auctions held so far (2 in total). Second, time series on yields of government bonds (2, 3, 5-year) are short. They date back in 2002Q4, 2005Q2, and 2006Q4, respectively. Also, the frequency of auctions limits the number of observations on these yields. So, 2-year government bonds auctions are held every month; those of 3-year and 5-year government bonds are held every three months. Due to these two reasons, it would be more appropriate to wait for some time until there are enough observations to allow conducting a pure econometric exercise as proposed by Nelson and Siegel (2006) for estimating the level, slope and curvature factor of the yield curve. Figure 3 shows the time-series of the yield curve latent factors obtained from the standard empirical proxies.

Figure 3: Latent factors of the yield curve, 1998Q1: 2012Q2



4. DATA CHOICE AND SETTING UP THE VAR

The methodology employed in this study consists in analyzing the properties of the VAR model for seasonally-adjusted inflation, real GDP growth, fiscal variable, policy rate, and yield curve, represented by its two latent factors: level and slope. All data are on quarterly terms and cover 1999Q1: 2012Q2. Fiscal policy is represented by annual change of domestic debt-to-GDP ratio and by the fiscal balance as percentage of GDP. To avoid puzzling results, the two fiscal variables enter the model separately. Also, due to limited data (52 observations), we choose to represent the yield curve only by its two main factors, level and slope, and drop out the curvature factor. Our choice to leave the curvature factor out of estimation is mostly guided by literature, which suggests that curvature factor, when estimated by a standard empirical proxy is not very informative and shows high variability with its maximum-likelihood estimate.

Prior to setting up the VAR, we conduct Augmented Dickey Fuller tests on each of the time series included in VAR estimation, in order to check for their stationarity and therefore decide whether they enter VAR in level or first difference. We find conclusive evidence on the stationarity of all variables at 90% confidence level (Table 1, Appendix A). The VAR is specified in levels for all of them: inflation, real GDP growth, policy rate, fiscal variables, level and slope factor of the yield curve.

In the standard form, the p[th]-order VAR is described as follows:

$$X_t = C + \sum_{i=1}^{p} V_i X_{t-1} + \varepsilon_t$$

where X_t denotes the (5 x 1) vector of the m endogenous variables given by X_t = [growth_real, inf_sa, f, rate, YC]; c is a (5 x 1) vector of intercept terms, V is the matrix of autoregressive coefficients of order (5x5); and ε_t is the vector of random variance disturbances; *growth_real* denotes the real GDP growth; *inf_sa* denotes inflation – seasonally adjusted; f represents the fiscal policy indicator : annual change to domestic debt-to-GDP ratio (*annual_ddebt*) or seasonally adjusted fiscal balance as percentage of GDP (*fdeficit_f_sa*); YC represents the latent factors of the yield curve (*level or slope*).

To identify various shocks in the system, we impose simple contemporary recursive restrictions given by a Choleski triangular factorization of the variance-covariance matrix. Therefore it is important to order endogenous variables in the appropriate way. The rationale of ordering can be supported either by independent empirical evidence or other empirical grounds or expert judgment. Following Martins and Afonso (2010), the VAR is ordered from the most exogenous to the least exogenous variables, as follows. Assuming that yield curve latent factors (*level and slope*) may be affected contemporaneously by shocks to inflation, real GDP growth, fiscal positions, or policy rate, but will not affect them instantaneously, we place *level and slope* in the last position of the system. Right after the yield curve latent factors, we place the monetary policy rate, assuming that it is affected contemporaneously by output, inflation, and fiscal shocks, but it is not able to affect them within a quarter due to already known monetary policy lags. In the third position, we place the fiscal variable (annual change of domestic debt-to-GDP ratio/fiscal balance as percentage of GDP), on the grounds that there is no discretionary response of fiscal policy to changes in prices and output. The first two positions are occupied by shocks to inflation and output, as they are expected to contemporaneously affect fiscal variables, due to automatic stabilizers. So, we estimate two VAR's where fiscal policy is in one case represented by annual change of domestic debt-to-GDP ratio, and in the second VAR by the fiscal balance as percentage of GDP.

Prior to VAR estimations, it is important to determine its appropriate lag lenth, in order to ensure that residuals in our VAR specification do not suffer from serial correlation. Due to the limited number of observations (52) and the number of endogenous variables included in the model, choosing the appropriate lag length becomes quite a challenging task. In this paper, the VAR order is set following the specific-to-general approach while checking for all residual diagnostics rather than utilizing information criteria. We begin the analysis starting from VAR 2, as one quarter is not enough to capture all the dynamics in the model. Based on this approach, the optimal lag length for both specifications is 2 for VAR specification utilizing annual change of domestic debt-to-GDP ratio, and 4 for the one utilizing fiscal balance as percentage of GDP. Both VARs fulfill

tests of stability, residuals' autocorrelation, and heteroskedasticity, while neither of them fulfills the normality test.[3]

In the VAR specification utilizing annual change of domestic debt-to-GDP ratio, 3 dummies and a time trend are introduced to correct for the stability of the system. Dummies account for 2002Q2, 2005Q2, 2006Q4, and 2009Q4, and their use is justified with the first launch of 2-year, 3-year and 5-year government bonds, respectively.

[3] For detailed information on diagnostic tests, refer to Appendix, Table 2

5. VAR ANALYSIS: IMPULSE RESPONSES, VARIANCE DECOMPOSITIONS AND GRANGER CAUSALITY TESTS

i. Impulse Responses

This section provides the accumulated impulse response functions of all variables to a positive innovation to annual change of domestic debt-to-GDP ratio and fiscal balance as percentage of GDP, with magnitude of one standard deviation of the respective errors, together with the usual two-standard error confidence bands (95 percent).

Figure 4 shows that as a response to a positive innovation to annual change of domestic debt-to-GDP ratio, GDP and inflation start falling after the first quarter, though their response is not significant. As a reaction to deteriorating economic activity and deflationary pressures, the monetary policy rate decreases. The level factor of the yield curve decreases, while its slope increases.

The decrease in the level factor– significant only in the first quarter – indicates that average interest rates decrease reflecting the expansionary monetary policy. The increase in the slope factor – insignificant- indicates that either yields at shortest maturities fall, in line with the decrease in monetary policy rate; or yields at longest maturities increase due to expectations hypothesis (according to which long-term interest rates factorize expectations for increase in short-term interest rates) or due to increase in domestic debt reflected in higher government demand in bonds auctions.

In subsequent quarters, due to upward pressures exerted from the decrease in monetary policy rate, the short term interest rates are expected to increase and, subsequently, the long-term interest rates (as expectations hypothesis indicates) as well. In a 10-quarter horizon, the level of the yield curve remains above its original values, thus interest rates of all terms increase due to higher domestic financing. Similarly, the slope remains above the original value till 6th quarter (higher increase in long-term interest rates),

mostly as financial conditions worsen because of deterioration in the fiscal position, though this channel is missing in our VAR setup.

Figure 4: Accumulated Impulse Responses Functions to shock in annual change of domestic debt-to-GDP ratio, 1999Q1: 2012Q2

Accumulated Responses to Cholesky One S.D Innovation± 2 S.E

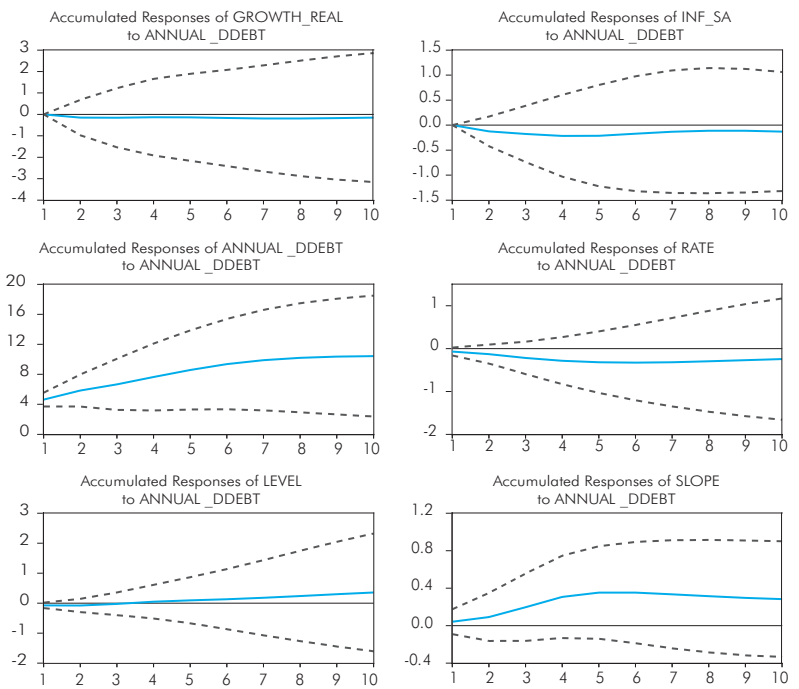
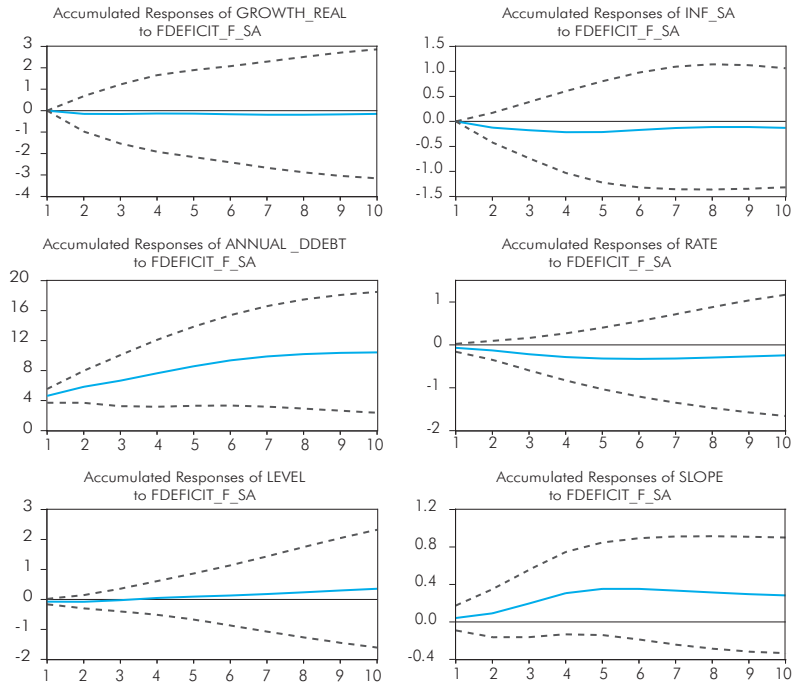


Figure 5 reports the impulse response functions of the variables of the system (together with the two-standard errors confidence bands) to a positive innovation to the fiscal balance[4] as percentage of GDP. We can summarize the results, as follows. An increase in the fiscal balance, as percentage of GDP, leads to an insignificant increase in real economic activity, and to an insignificant decrease in inflation after the first quarter. Also, Mancellari (2010) points to the same conclusion. Employing a SVAR approach, the author finds that the response of prices to a government spending shock (both

[4] A positive innovation to fiscal balance, as percentage of GDP, indicates an improvement of the fiscal position.

Figure 5: Accumulated Impulse Responses Functions to shock in Fiscal Balance as percentage of GDP, 2001Q1: 2010Q4

Accumulated Responses to Cholesky One S.D Innovation ± 2 S.E



current and capital) is insignificant, while that of GDP is significant, though at a very low magnitude, around 0.037% after 4 quarters (in the case of current spending shock) and around 0.032% in three quarters (in the case of capital spending shock). The monetary policy rate decreases, though it is significant only in the first three quarters. The level decreases significantly till the 4th quarter, indicating that average interest rates decrease due to lower demand of domestic government financing. The slope of the yield curve increases in the first quarter, which suggests that - either the short-end of the yield curve decreases as it follows the decrease in policy rate, or the long-end of the yield curve increases because of expectations for an increase in the policy rate in subsequent quarters. However, immediately after the first quarter, the slope decreases and reaches its original value in the second quarter. Combining both the reactions

of the level and slope, we might conclude that long term interest rate decrease more than short-term ones, possibly due to better financial conditions resulting from improvement in fiscal position (this channel is missing in or VAR setup)

ii. Variance Decompositions

This section provides the variance decomposition of the forecast errors of the yield curve latent factors (level and slope) for both specifications of VAR.

In the case of VAR including the annual change of domestic debt-to-GDP ratio, Table 1 shows that most of the variance of the error in forecasting the change in level of the yield curve is explained by shocks to the level itself, till the 3rd quarter. Afterwards innovation to inflation and policy rate, especially the former, are accountable for explaining sizeable parts of such variance. Surprises to real output growth contribute to a lesser extent than inflation and monetary policy rate, around 6% in a 10-quarter horizon. The immediate contribution of the fiscal variable - the annual change of domestic debt-to-GDP ratio- is around 5%; however, as the horizon widens, its contribution decreases reaching its trough at the 6th quarter (around 1.3%) and then it slightly increases onwards.

Analyzing the decomposition of the forecast errors variance of the slope factor of the yield curve, we notice that innovations to the annual change of the domestic debt-to-GDP ratio explain a bit more than they do in the case of the level forecast error variance, on average 4.3%. Surprises to policy rate also have important explanatory power on the slope factor, almost to a similar extent as in the case of level forecast error variance. Also, shocks to real output growth turn out to be as important as in the level case.

Table 1: Annual change in domestic debt-to-GDP: Forecast Error Variance Decomposition, 1999Q1:2012Q2

Forecasting the level of the yield curve						
Period	GROWTH_REAL	INF_SA	ANNUAL_DDEBT	RATE	LEVEL	SLOPE
1	0.6634	0.1874	5.1260	11.7863	82.2370	0.0000
2	0.7660	17.7538	1.8117	8.6090	69.0171	2.0424
3	4.3513	29.2239	1.6107	11.1412	50.8336	2.8393
4	7.9216	38.4268	1.7296	12.5830	37.3225	2.0165
5	8.6132	45.5778	1.5013	12.8565	29.8805	1.5707
6	8.2759	49.7176	1.3478	12.9775	26.1031	1.5782
7	7.8548	51.5489	1.3554	13.2872	24.1301	1.8237
8	7.5810	51.9682	1.4860	13.7597	23.0797	2.1254
9	7.4547	51.6954	1.6680	14.2692	22.5525	2.3602
10	7.4284	51.2260	1.8460	14.6987	22.3129	2.4880
Forecasting the slope of the yield curve						
Period	GROWTH_REAL	INF_SA	ANNUAL_DDEBT	RATE	LEVEL	SLOPE
1	8.3246	2.7442	0.6639	7.6603	0.0267	80.5803
2	6.7840	2.1964	1.3082	6.1545	3.3490	80.2078
3	5.6596	9.6447	3.8718	9.5728	3.0319	68.2192
4	4.9691	16.9868	5.7442	13.2281	2.5127	56.5593
5	5.5227	20.2014	5.6160	14.3532	2.3063	52.0005
6	6.6505	20.8665	5.3425	14.0543	2.3142	50.7722
7	7.5693	20.4993	5.2762	13.7316	2.3687	50.5549
8	8.0388	20.4659	5.2778	13.5717	2.4009	50.2448
9	8.1248	21.2730	5.2558	13.3794	2.4074	49.5595
10	8.0246	22.5209	5.1936	13.1524	2.4001	48.7085
Cholesky Ordering: GROWTH_REAL INF_SA ANNUAL_DDEBT RATE LEVEL SLOPE						

In the case of VAR including the fiscal balance as percentage of GDP (Table 2), the variance of the errors in forecasting the change in level of the yield curve at a 10-quarter horizon, is mostly explained by innovations to itself. Surprises to real output growth explain sizeable parts of such variance, and accounts by considerably more than in the case of debt variable. The explanatory power of the fiscal balance as percentage of GDP accounts for about 28% in a 10-quarter horizon, while the explanatory power of monetary policy rate accounts for about 10%, which is slightly lower than in the case of the annual change of debt-to-GDP ratio.

Regarding the variance of the forecasting errors of the yield curve slope (apart from innovations to itself), it is mainly explained by surprises to real growth rate. Surprises in the fiscal balance explain

a considerable proportion of the forecast error variance (around 12%), being larger than in the case of VAR employing the debt variable.

Table 2: Fiscal balance as percentage of GDP: Forecast Error Variance Decomposition, 1999Q1:2012Q12

Forecasting the level of the yield curve						
Period	GROWTH_REAL	INF_SA	FDEFICIT_F_SA	RATE	LEVEL	SLOPE
1	10.879	0.761	8.108	12.987	67.265	0.000
2	6.257	10.715	21.595	9.694	51.001	0.738
3	4.917	10.308	41.865	9.842	32.220	0.848
4	10.685	16.287	40.468	9.791	22.206	0.562
5	19.547	22.051	32.787	8.433	16.739	0.443
6	24.280	22.960	28.878	8.895	14.499	0.488
7	26.348	23.143	26.581	10.447	13.044	0.438
8	27.012	22.543	26.137	11.571	12.335	0.403
9	26.578	21.973	26.386	12.129	12.541	0.394
10	26.071	21.575	26.549	12.236	13.148	0.420
Forecasting the slope of the yield curve						
Period	GROWTH_REAL	INF_SA	FDEFICIT_F_SA	RATE	LEVEL	SLOPE
1	27.6747	0.9102	8.2719	3.8862	6.8291	52.4280
2	41.3404	4.9614	6.3288	6.7612	5.7234	34.8847
3	39.5501	9.9708	5.7248	5.4790	4.5857	34.6895
4	38.9101	8.9669	9.6519	5.1250	4.1182	33.2278
5	35.6281	8.7137	8.7851	7.3456	4.1568	35.3708
6	33.9837	7.6740	12.5750	8.2577	5.7443	31.7654
7	31.3513	8.1230	15.0114	7.6535	7.9755	29.8852
8	30.7738	8.0402	15.5516	7.6595	8.6484	29.3265
9	30.6100	7.9760	15.8656	7.6924	8.8726	28.9835
10	30.7227	8.0622	16.1096	7.5632	9.1402	28.4021
Cholesky Ordering: GROWTH_REAL INF_SA FDEFICIT_F_SA RATE LEVEL SLOPE						

6. CONCLUSIONS AND FURTHER AREAS OF RESEARCH

In this study, we investigated the effects of fiscal policy on the term structure of interest rates (yield curve), by employing a VAR methodology. More specifically, the study attempted to estimate the movement of the yield curve (represented by its level and slope factors) in response to shocks in fiscal variables: annual change of domestic debt-to-GDP ratio and fiscal balance as percentage of GDP.

The analysis of impulse response functions showed that both fiscal variables affect the yield curve, though this effect is temporarily significant. Variance decompositions show that among yield curve factors, annual change of domestic debt-to-GDP ratio affects the most the slope of the yield curve, while fiscal balance as percentage of GDP has more explanatory power on the level of the yield curve. Both, the IRF analysis and variance decompositions suggest that yield curve is more sensitive to movements in the flow fiscal variable, represented by fiscal balance as percentage of GDP rather than by the stock fiscal variable, represented by the annual change of domestic debt-to-GDP ratio.

Although our results are grounded on a VAR model and theoretical explanations, we believe there are some other areas which deserve further research:

- It would be interesting to check whether the impact of fiscal variables on interest rates is linear or not. Do fiscal variables exert little effect on yields when fiscal performance is good, but a greater effect when performance is poor? A way to check for such nonlinearity would be by augmenting our baseline regressions with squared terms of the fiscal variables

- In defining the factors of the yield curve, we make use of mathematical proxies to quantify the level and slope of the yield curve. These proxies are frequently used in yield curve literature; however in the future, as the primary market for government bonds of maturities of more than a year further

develops, we might consider to empirically estimate such factors – in order to give more precise estimates of the yield curve in Albania.

- Finally, in estimating the relationship between fiscal indicators and the behavior of yield curve controlling for economic growth, inflation and monetary policy rate, we might also control for financial conditions (for example, level of stress in the financial system), which might provide a link between fiscal developments and long-term interest rates.

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APPENDIX

Table 1: Augmented Dickey Fuller Stationarity tests

Variable	Level		
	Intercept	Trend and Intercept	None
inf_sa	0.0005	0.0049	0.3073
growth_real	0.0062	0.003	0.0239
rate	0.0000	0.0000	0.0177
annual_ddebt	0.0130	0.0151	0.0008
fdeficit_sa	0.0856	0.1074	0.1007
level	0.0000	0.0005	0.0144
slope	0.0549	0.0112	0.5308

DIAGNOSTIC TESTS

Table 2: Autocorrelation, Normality and White Heteroskedasticity

	Diagnostic Tests	
	VAR (annual change of domestic debt-to-GDP ratio)	VAR (fiscal balance as % of GDP)
Autocorrelation LM test Null hypothesis: No serial correlation	p-value	p-value
Lag 1	0.5994	0.4689
Lag 2	0.4453	0.4018
Lag 3	0.4261	0.4704
Lag 4	0.3099	0.1569
Normality Test (Cholesky of covariance) Null hypothesis: Residuals are multivariate normal	0.0806	0.0000

White Heteroskedasticity test Null hypothesis: no HSK	0.5563	0.3400

Table 3: Stability tests

a) VAR (annual change of domestic debt-to-GDP ratio)

b) VAR (fiscal balance as percentage of GDP)

Figure a

Inverse Root of AR Characteristic Polynomial

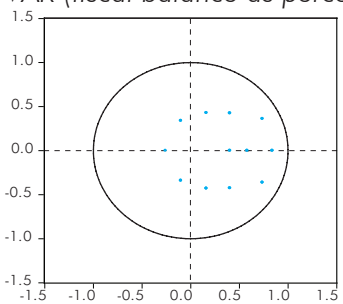
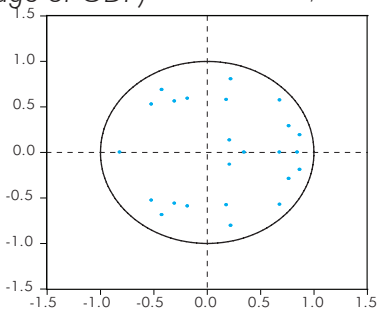


Figure b

Inverse Root of AR Characteristic Polynomial



CIP Katalogimi në botim BK Tiranë

Esida Abazaj
Fiscal Position and Yield Curve in Albania- /
/ Abazaj Esida- Tiranë:
Banka e Shqipërisë, 2013

-32 f; 15.3 x 23 cm.

Bibliogr.
ISBN: 978-99956-42-72-4.

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