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National University of Life and Environmental  
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Conference materials may be of interest to researchers, teachers, researchers, students of higher educational institutions.

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## **VOLATILITY OF YIELD FOR DG BONDS ON THE UKRAINIAN FINANCIAL MARKET**

**Introduction.** The Government of Ukraine uses various sources of loans to cover the budget deficit. These are bonds of the domestic government loan (DG bonds), bonds of the foreign government loan (FG bonds), loans from the National Bank of Ukraine, loans from the international financial organizations (NEFCO, IBRD, EIB, IMF, EBRD, *etc.*), loans from foreign governments (UK, Germany, Poland, Russia, USA, France, Japan, *etc.*). The DG bonds *is the largest in the structure of the government debt of Ukraine. The DG bonds share in the debt structure ranged from 40 to 47% in the last decade [1]. The problem of formation of yield for DG bonds is relevant because of its importance of DG bonds in financing the budget deficit.*

**Analysis of recent researches and publications.** Many studies investigate the issue of yield of government bonds. Heryan, Ziegelbauer investigate volatility of yields of government bonds among GIIPS countries during the sovereign debt crisis in the Euro Area [2]. Trinh, Nguyen, Ngo investigate of Vietnam government bond yield volatility using the GARCH approach [3]. Volatility spillover effect of government bonds and stock market are investigated M. Faniband and T. Faniband [4]. Umar, Manel, Riaz, Gubareva use a TVP-VAR approach to investigate the dynamic spillovers of risk and volatility of US bonds during the Covid-19 pandemic [5]. Regarding the problems of volatility of pricing on the Ukrainian financial market, there is a scientific discussion, which is reflected in the writings of Ukrainian scientists (Burtniak and Suduk [6], Liubkina [7], Yastremskyi [8]).

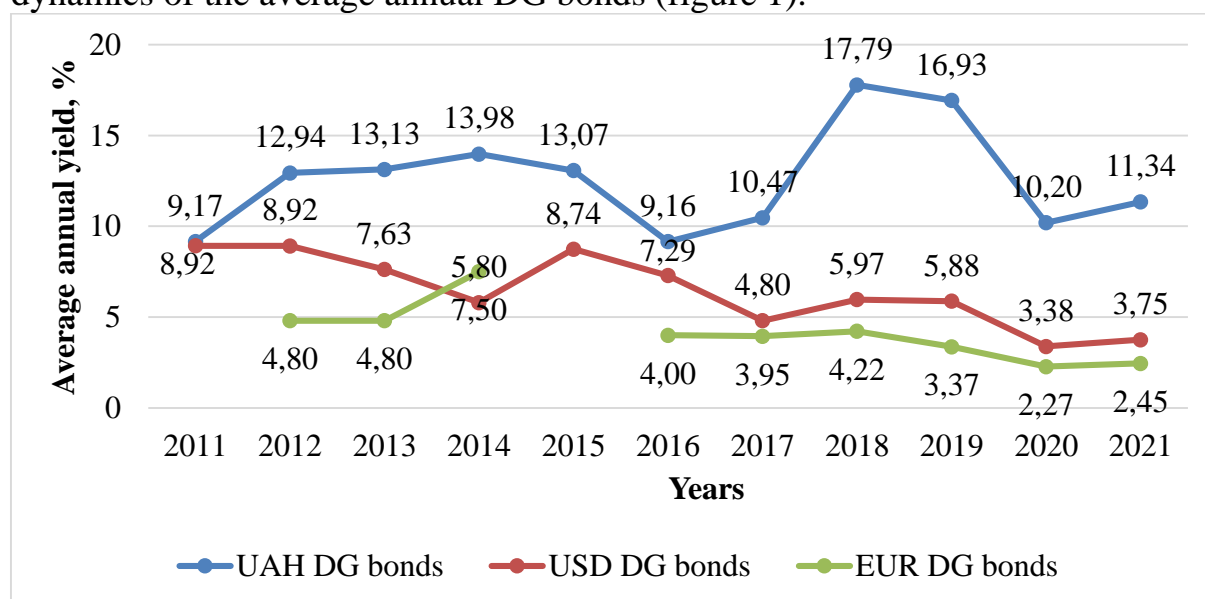
**Purpose** of the study is to investigate the volatility of yield for DG bonds on the Ukrainian financial market.

**Materials and methods of research.** Our empirical analysis employs a sample consisting of yearly data on DG bonds which are denominated in UAH, USD, EUR for the period from 2011 to 2021. In this study, the data comprise DG bonds with a 1-year, 1-3-years, 3-5-years and more than 5-year maturity range. The DG bonds yield available in the official websites of the National Bank of Ukraine and the Ministry of Finance of Ukraine.

Volatility is a statistical measure of the dispersion of returns for a given security or market index. Volatility is often measured as either the standard deviation ( $S$ ) or variance between returns from that same security or market index [9]. One measure of the relative volatility of a particular stock to the market is its beta ( $\beta$ ). A beta approximates the overall volatility of a security's

returns against the returns of a relevant benchmark (usually the S&P 500 is used) [9]. In this study, A beta approximates the overall volatility of the DG bonds yield against the returns of a relevant benchmark (PFTS Index or UX Index).

**Results of the research and their discussion.** The Government of Ukraine issued DG bonds during all the studied years in UAH and USD. In 2012-2014 and 2016-2021, EUR DG bonds were issued. The average annual UAH DG bonds yield fluctuated from 9.16% to 17.79%; the average annual USD DG bonds yield fluctuated from 3.38% to 8.92%; the average annual EUR DG bonds yield fluctuated from 2.27% to 7.50%. We investigated the dynamics of the average annual DG bonds (figure 1).



**Fig. 1. The Ukrainian DG bonds yield in 2011-2021**

There is no correlation between UAH DG bonds yield and USD DG bonds/EUR DG bonds. Therefore, the dynamics of the average annual UAH DG bonds yield were determined as a wave-like: 2011-2014 was increase of UAH DG bonds yield, 2014-2016 was decrease of UAH DG bonds yield, 2017-2018 was increase of UAH DG bonds yield, 2019-2020 was decrease of UAH DG bonds yield. Also the dynamics of the average annual USD DG bonds yield were determined as a wave-like.

Regression analysis of the average annual Ukrainian DG bonds yield ( $Y_{\text{UAH DG bonds}}$ ,  $Y_{\text{USD DG bonds}}$ ) and coefficient of determination ( $R^2 = 0,76$ ) indicate the reliability of polynomial models (formula 1, formula 2).

$$Y_{\text{UAH DG bonds}} = 0,005x^6 - 0,16x^5 + 2,17x^4 - 13,92x^3 + 43,16x^2 - 57,89x + 36,10 \quad (1)$$

$$Y_{\text{USD DG bonds}} = -0,0003x^6 + 0,01x^5 - 0,18x^4 + 1,25x^3 - 4,28x^2 + 5,93x + 6,30 \quad (2)$$

Standard deviation of the average annual UAH DG bonds yield was 2.89. This is the maximum value of the average annual DG bonds yield by type of currency. Standard deviation of the average annual USD DG bonds yield was 2.00 and the average annual EUR DG bonds yield was 1.55. We have established a relationship between the level of volatility and the currency of the DG bonds. A higher level volatility of the average annual DG bonds bond is inherent in currencies with a higher level volatility of exchange rate.

The average annual UAH DG bonds yield with a 1 year maturity fluctuated from 7.02% to 18.40% (standard deviation was 4.02). The average annual UAH DG bonds yield with 1-3 years maturity fluctuated from 9.32% to 17.85% (standard deviation was 3.22). The average annual UAH DG bonds yield with 3-5 years maturity fluctuated from 8.75% to 16.74% (standard deviation was 2.37). This is the minimum value of the standard deviation of the average annual UAH DG bonds. The average annual UAH DG bonds yield volatility of medium-term bonds was the lowest.

Table 1

**The Ukrainian DG bonds yield in 2011-2021 by maturity and currency, %**

Years	UAH DG bonds yield, %	including by maturity				USD DG bonds yield, %	including by maturity		
		to 1 year	from 1 to 3 years	from 3 to 5 years	more than 5 years		to 1 year	from 1 to 3 years	from 3 to 5 years
2011	9.17	7.93	9.57	8.75	9.30	8.92	8.92		
2012	12.94	13.55	12.22	14.29	14.22	8.92	9.30	8.87	
2013	13.13	7.02	9.32	14.26	14.19	7.63	5.18	7.90	7.50
2014	13.98	13.11	16.75	13.57	15.50	5.80	5.78	8.10	
2015	13.07	17.00	16.66			8.74	8.74		
2016	9.16	16.64	17.85	16.74	6.50	7.29		7.29	
2017	10.47	15.23	14.89	15.11		4.80	5.00	4.74	
2018	17.79	17.92	16.18	15.87		5.97	5.90	6.13	
2019	16.93	18.40	16.73	13.11	15.31	5.88	6.50	5.16	
2020	10.20	10.05	10.62	10.98	9.80	3.38	3.34	3.54	
2021	11.34	10.68	11.75	12.32	12.95	3.75	3.67	3.81	

The average annual UAH DG bonds yield with more 5 years maturity fluctuated from 6.50% to 15.50% (standard deviation was 3.29). The Ukrainian DG bonds yield in 2011-2021 by maturity and currency are given in table 1.

In such a way, volatility of yield for UAH DG bonds on the Ukrainian financial market was the maximum in the short-term period. Volatility of yield for UAH DG bonds was the minimum in the medium-term period. In the long-term period, volatility of UAH DG bonds yield increased compared to the medium-term period.

The structure of Ukrainian public debt is formed in such a way that long-term borrowing prevails. The share of long-term UAH DG bonds was from 69.5% to 56.7%. Indicators of volatility of yield for UAH DG bonds in the long term are informative for investors.

We made the same conclusions about volatility of yield for USD DG bonds: volatility of yield for USD DG bonds on the Ukrainian financial market was the maximum in the short-term period. Volatility of yield for USD DG bonds was the minimum in the medium-term period.

Further, it requires research on the relationship between volatility of yield for DG bonds and macrofinancial indicators (PFTS Index, government deficit, public debt) and macroeconomic indicators (consumer price indices, deflators of gross domestic product). Correlation statistic (table 2) proves the absence of a connection between yield for DG bonds and macrofinancial indicators, macroeconomic indicators.

Table 2

### Correlation statistic

	UAH DG bonds yield, %	PFTS Index	Consumer price indices, %	Government deficit, % of expenditures	Public debt, billion USD	Deflators of gross domestic product, %
UAH DG bonds yield, %	1,0000					
PFTS Index	0,2641	1,0000				
Consumer price indices, %	0,0008	-0,4327	1,0000			
Government deficit, % of expenditures	-0,0351	0,0215	-0,4364	1,0000		
Public debt, billion USD	0,1469	0,4315	-0,1131	0,2154	1,0000	
Deflators of gross domestic product, %	-0,1548	-0,2746	0,9143	-0,5519	0,0333	1,0000

**Conclusions and future perspectives of the study.** The DG bonds is *the largest in the structure of the government debt of Ukraine*. The Government of Ukraine issued DG bonds during all the studied years in UAH, USD and EUR. The average annual UAH DG bonds yield fluctuated from 9.16% to 17.79%; the average annual USD DG bonds yield fluctuated from 3.38% to 8.92%; the average annual EUR DG bonds yield fluctuated from 2.27% to 7.50%. Standard deviation of the average annual UAH DG bonds yield was 2.89. This is the maximum value of the average annual DG bonds yield by type of currency. Volatility of yield for UAH DG bonds on the Ukrainian financial market was the maximum in the short-term period. But the long-term DG bonds prevails.

Correlation statistic proves the absence of a connection between yield for DG bonds and macrofinancial/macroeconomic indicators.

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