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THE PROFITABILITY OF THE GOVERNMENT SECURITIES: INTEREST RATE vs. YIELD

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Abstract: *The profitability of the financial instruments is in tandem with the managerial investment decision. To take right decisions the investors must have practical skills. Thus besides the general notions of government securities, investors must be familiar with the main calculation formulas applied to determine their profitability. In this context, the author shows how the price and the interest rate/yield of the government securities issued through the auctions by the government are determined. Based on this, investors can easily appreciate which government securities to buy: treasury bills or government bonds. The results indicate that the same debt instrument has a different interest rate and yield. Also, the paper highlights the yield curve' importance and use.*

Key words: *government securities, price, interest rate, yield, auction*

JEL CLASSIFICATION: G12, G23, H63.

INTRODUCTION

The government securities market is a reliable source of income. Investors who purchase government securities for profit have consider various aspects, such as country risk, usually the higher the country risk, the higher the yield for the sovereign debt, macroeconomic forecast, debt management strategy, etc. Another aspect that has to be taken into consideration is the evaluation of the profitability of the government securities. For this purpose, each country establishes its convention that is applied in formulas related to the government securities. In this context, the author highlights the input data that is necessary to evaluate the government securities' profitability. Additionally, based on practical examples of the Republic of Moldova it is shown the calculations used at the determination of the interest rate, yield and price of the government securities.

Even in the Republic of Moldova the government securities market was launched in 1995, the main investors in government securities are banks, non-banks investors are not so active in buying these instruments. This can be explained by the low level of financial education. The population are more involved in putting their savings in deposits instead of investing in government securities, where they need to be familiar with not only interest rate but with yield, price of the government securities.

Interest rate and yield does not represent one and the same think, the main differences of them are represented. The fluctuation of the interest rate it is explained by four theories. Also it is mentioned how to design the yield curve, and what are its functions.

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THE MOLDOVAN GOVERNMENT SECURITIES MARKET

The National Bank of Moldova, for the first time in the history of the country, on March 14, 1995 launched the government securities auctions (Radziwiłł et al., 1999). Ministry of Finance, on behalf of the Government, issues government securities according to the auction calendar. There are two types of the government securities:

Treasury bills – for the short term, up to one year;

Government bonds – for the long term, one year and more.

In 27 years since the government securities market's foundation, many actions have been taken to develop the government securities market (Figure 1).

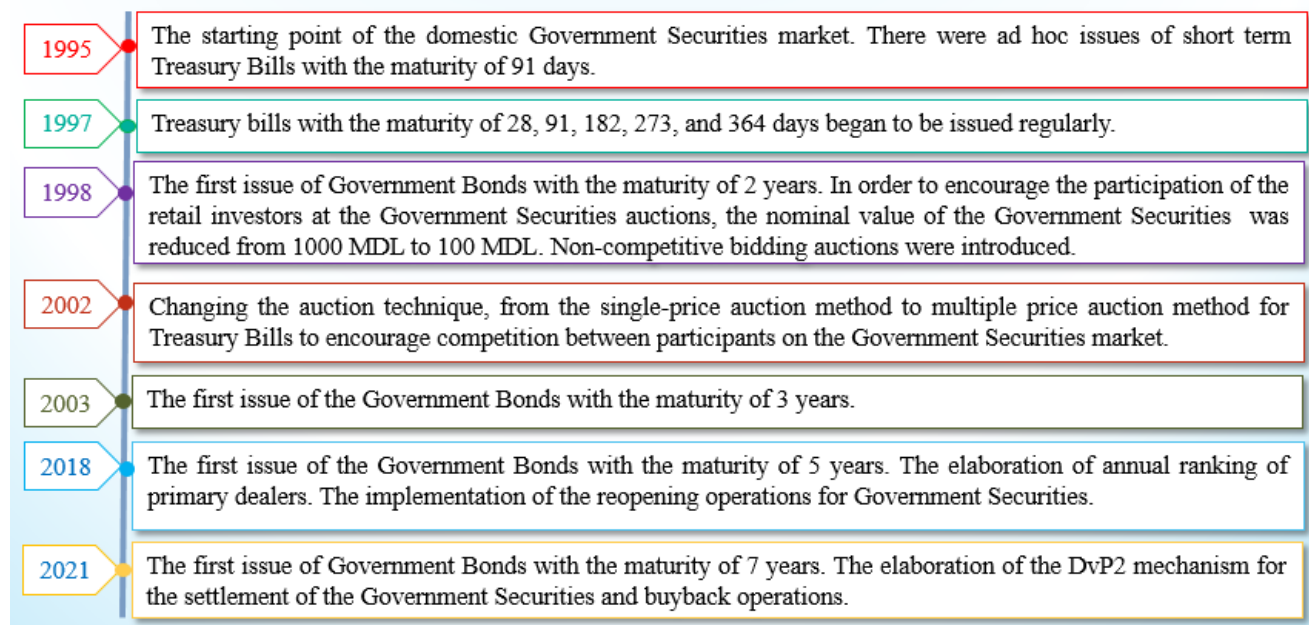


Figure 1. The main events on the government securities market of the Republic of Moldova

Source: Speian, 2021

Every year in the Medium-Term Debt Management Program (2022) are mentioned actions for developing the government securities market. One main action is to extend the maturity of the government securities issued in the primary market to decrease the rollover risk. Another important action is to extend the investor bases and the channels of the selling government securities.

Five days before the auctions, the Ministry of Finance announces the conditions for the government securities placement:

- auction date;
- type of government securities;
- ISIN code;
- nominal value of the government securities;
- indicative volume of the issue;
- circulation term of the government securities;
- conditions for sale;
- settlement date;
- maturity date of the government securities;
- limit for submission of competitive bids, if any.
- annual interest rate for the government bonds, etc.

Investors can participate in the government securities auctions only through the primary dealers. Nine banks from the banking sectors are primary dealers (Table 1).

Table 1. List of the primary dealers

No.	Primary Dealer
1	BC „MOLDOVA – AGROINDBANK” S.A.
2	BC „VICTORIABANK” S.A.
3	BC „Moldindconbank” S.A.
4	OTP Bank S.A.
5	BC „ENERGBANK” S.A.
6	BC „EXIMBANK” S.A.
7	„Banca de Finanțe și Comerț” S.A.
8	Banca Comercială Română Chișinău S.A.
9	BC „EuroCreditBank” S.A.

Source: author’s own elaboration

For participation in the government securities auctions, the investors have to go to one of the primary dealers mentioned in Table 1 to complete the government securities purchase order. There are two options for participation in the auctions:

- at the competitive biddings – it is indicated the amount to be paid and the offered price;
- at the non-competitive biddings – it is indicated only the amount to be paid. The bids are allotted at the weighted average price of the bids satisfied in the competitive bidding.

At the auction date, there are published the auction results, where the investors can find out if they won the auction or any other information that can help them make the decisions for the participation in the future auctions. In the last period of time the share of non-bank sector that invest in government securities is increasing (Figure 2).

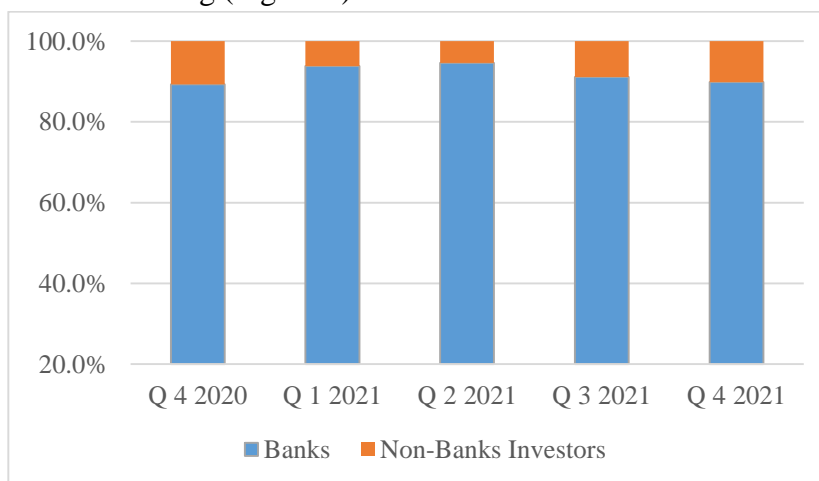


Figure 2. Structure by type of investors buying government securities

Source: author’s own elaboration based on source www.mf.gov.md

According to Figure 2, the share of the non-banking sector in 2021 is almost the same as in 2020. Starting in the first quarter 2021 it has decreased by 6,2% and gradually increased to 10.1%.

The outstanding of the government securities issued in the primary market as of December 31, 2021 was 18,8 billion MDL, with 4,2 billion MDL higher than in 2020.

MATHEMATICS OF THE FIXED INCOME MARKET

The price of the government securities can be easily calculated if the rate/yield is known and vice versa. If the price increases then the interest rate decreases, and if the price decreases, then the interest rate increases (Figure 3).

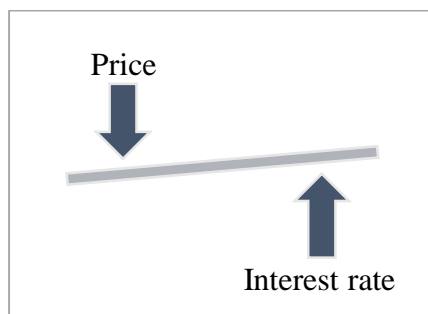


Figure 3. Price vs Interest rate
Source: author's own elaboration

For applying the government securities' formulas, it is important to consider the convention for the calculation chosen by the country (Table 2).

Table 2. Types of the convention calculation

Convention	Rule
Actual/Actual	It is used the actual number of days between two dates. For leap years, 366 days are taken into account, and for the others, 365 days are taken into account.
Actual/365	It is used the actual number of days between two dates. For all types of years 365 days are taken into account.
Actual/360	It is used the actual number of days between two dates. For all types of years, 360 days are taken into account.
30/360	It is assumed that all months have 30 days and the year has 360 days. If the first date is 31, then it changes into 30. If the second date is 31, then it changes into 30 only if the first dates are 30 or 31.
30E/360	It is assumed that all months have 30 days and the year has 360 days. If the first date is 31, then it changes into 30. If the second date is 31, then it changes to 30.

Source: author's own elaboration

In the Republic of Moldova, the convention Actual/365 it is taken for the calculations.

According to the Regulation on Placement, Transaction and Redemption of State Securities in Book-Entry Form no. 170 (2018), the main indicators for guiding investment decisions are based on the following formulas:

– Nominal interest rate for the treasury bills.

$$r = \frac{N-P}{P} * \frac{365}{t} * 100 \quad (1)$$

where:

r – annual nominal interest/yield rate;

N – nominal value of a treasury bill;

P – price of a treasury bill;

t – number of days to maturity.

Table 3. Government Securities auctions results, January 4, 2022

Type of Government Security	Days to maturity	ISIN Code	Amount offered (thous. MDL)	Amount of bids received		Num. of participants	Lowest price and highest price allocated		Weighted average price (MDL)	Total amount allocated		Nominal yield			Effective yield			Maturity date
				Total (thous. MDL)	incl. non competitive bids (thous. MDL)		min (MDL)	max (MDL)		Total (thous. MDL)	incl. non competitive bids (thous. MDL)	min (%)	max (%)	Weighted average (%)	min (%)	max (%)	Weighted average (%)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Treasury Bill	91 days	MD4003001576	100,000.00	343,666.30	6,137.10	9	97.81	97.88	97.81	65,000.00	3,000.00	8.69	8.98	8.98	8.97	9.29	9.29	07.04.2022
Treasury Bill	182 days	MD4003001584	600,000.00	562,892.60	21,794.80	11	95.34	95.46	95.37	361,845.30	21,794.80	9.54	9.80	9.74	9.77	10.04	9.97	07.07.2022
Treasury Bill	364 days	MD4003001592	600,000.00	432,838.00	26,329.50	9	90.97	91.36	91.03	300,512.70	26,329.50	9.48	9.95	9.88	9.48	9.95	9.88	05.01.2023

Source: National Bank of Moldova

Applying formula 1 it is calculating the weighted average yield based on the weighted average price for the treasury bill with the maturity of 91 days.

$$8.98 = \frac{100 - 97.81}{97.81} * \frac{365}{91} * 100 \quad (2)$$

– The effective interest rate of the treasury bills.

$$y = \left(\left(\frac{N}{P} \right)^{\frac{365}{t}} - 1 \right) * 100 \quad (3)$$

where:

y – annual effective interest rate;

N – nominal value of a treasury bill;

P – price of a treasury bill;

t – number of days to maturity.

Thus, the weighted average effective yield for the treasury bill with the maturity of 182 days equals 9.97% (formula 4).

$$9.97 = \left(\left(\frac{100}{95.37} \right)^{\frac{365}{182}} - 1 \right) * 100 \quad (4)$$

– The price of the government bond.

$$P = \frac{C_1}{(1+r)^{\frac{t_1}{365}}} + \frac{C_2}{(1+r)^{\frac{t_2}{365}}} + \dots + \frac{C_n + N}{(1+r)^{\frac{t_n}{365}}} \quad (5)$$

where:

P – price of a government bond (including the accrued coupon);

n – number of coupons to be paid;

C_n – size of coupon “n”;

N – nominal value of a government bond;

r – yield of a government bond;

t_n – number of days to coupon “n” payment.

– The coupon of the government bond.

$$C = N * \frac{r}{100} * \frac{t}{365} \quad (6)$$

where:

C – size of the coupon;

N – nominal value of a government bond;

r – interest rate of a government bond;

t – coupon term.

Table 4. Government Securities auctions results, January 19, 2022

Government Bond circulation term	Annual interest rate (%)	ISIN Code	Amount offered (thous. MDL)	Amount of bids received		Num. of participants	Lowest price and highest price allocated		Weighted average price (MDL)	Total amount allocated		Effective yield			Coupon frequency	Maturity date
				total (thous. MDL)	incl. non competitive bids (thous. MDL)		min (MDL)	max (MDL)		total (thous. MDL)	incl. non competitive bids (thous. MDL)	min (%)	max (%)	weighted average (%)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
2 years	6.50	MD4004000742	10,000.00	599.80	0.00	3	100.00	100.00	100.00	599.80	0.00	6.61	6.61	6.61	Semi-annual	21.01.2024
3 years	7.00	MD4004000759	10,000.00	300.00	0.00	3	100.00	100.00	100.00	300.00	0.00	7.12	7.12	7.12	Semi-annual	21.01.2025
4.83 years	7.50	MD4004000692	10,000.00	200.00	0.00	2	100.00	100.00	100.00	200.00	0.00	7.64	7.64	7.64	Semi-annual	19.11.2026

Source: National Bank of Moldova

First coupon of the government bond with maturity of 2 years is equal with 3.24 (Formula 7).

$$3.24 = 100 * \frac{6.50}{100} * \frac{182}{365} \quad (7)$$

Using formula 6, the second, the third, and the fourth coupon are calculated. Thus, the price of the coupon with the maturity of 2 years is 100.

$$100 = \frac{3.24}{(1+6.61\%)^{\frac{182}{365}}} + \frac{3.28}{(1+6.61\%)^{\frac{366}{365}}} + \frac{3.22}{(1+6.61\%)^{\frac{547}{365}}} + \frac{3.28+100}{(1+6.61\%)^{\frac{731}{365}}} \quad (8)$$

It is worth mentioning that the interest rate and the yield do not represent the same result. The differences between the interest rate and the yield are represented in Table 5.

Table 5. Yield vs Interest rate

Yield	Interest rate
It can be expressed as amount or percentage	It is expressed as a percentage
Annual bases	It can be determined annually, quarterly, monthly or daily
It is higher than the interest rate	It is less than the yield

Source: author's own elaboration

Investors understanding how to apply the bases formulas and the difference between the yield and interest rate can easily take managerial decisions to obtain a higher return investing in the government securities.

THE CONSTRUCTION OF THE YIELD CURVE

The yield curve is a graphical representation of the relationship between the yield and maturity of the debt instrument (Melicher and Norton, 2017). It performs the following functions:

- It is used as a reference to determine the yields of debt instruments. The yield curve indicates the cost of money for different maturities of financial instruments. The issuer uses the yield curve for pricing the bonds. Generally, the yield curve for zero-coupon bonds is used for new lines of issuing rather than the redemption yield curve.
- It represents an indicator for forecasting yields. The shape of the yield curve is an indicator for forecasting interest rates. This is the most important function of the yield curve. It can also serve as a forecast of inflationary expectations.
- Measuring and comparing returns depending on the maturity of financial instruments. Portfolio managers analyze which point on the curve is less profitable for investment.
- It represents the relative value of the yield for similar instruments. Thus it is determined the price of new bonds to be sold or bought.

– Can be used as a reference price for derivatives. The „risk-free” interest rate of the treasury bills is used to price options.

The shape of the curve is changing in dependence on economic expectations:

– when interest rates are high and the economy seems to be entering a recession;
– investors sell short-term government securities, and buy long term in order to lock high yields;

– The prices for the long-term government securities increase, and yields decrease etc.

Generally, the yield curve has three shapes (Figure 4).

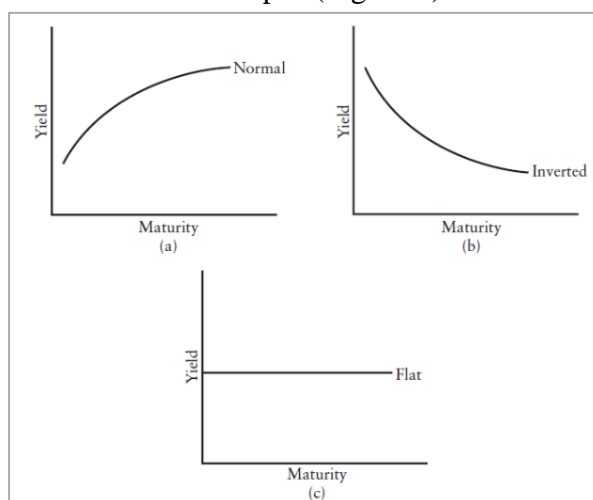


Figure 4. The shapes of the yield curve

Source: Fabozzi and Drake, 2009

For the normal yield curve the short-term yields are lower than the long-term yields. In the case of the inverted yield curve and vice versa, the short-term yields are higher than long-term yields. If the yields for the short-term and long-term are almost equal, the yield curve is flat.

There are four theories that can explain the fluctuation of the interest rates:

– *The expectation theory.* The yield curve indicates the expectations of the investor regarding the inflation rate. If the yield curve is flat, then the inflation will remain essentially unchanged. If it is downward sloping then the inflation rate will decrease.

– *The liquidity preference theory.* The instruments with longer maturity are riskier than those with shorter maturity. The borrower would like to borrow for a longer period, whereas the lender would like to lend for a shorter period (Prameswaran, 2020). The interest rates for long-term government bonds include a premium for long-term holding. This premium compensates investors for the additional risk associated with the longer period of time.

– *The market segmentation theory.* In the financial market, a wide range of issuers have different requirements. Thus, the shape of the yield curve is determined by the supply and demand for the specific debt instruments. Certain types of investors prefer short-term government securities, and other – long-term. The theory argues that there are no interrelationships between these instruments.

– *The preferred habitat theory.* This theory is a slight modification of the market segmentation theory. Investors, in exchange for risk premiums, can change their preferences regarding the terms and structure of the debt instruments.

For liquid financial markets, there are a lot of theoretical and practical examples for modelling the yield curve (Bringio and Mercurio, 2006). In the case of illiquid markets, it is not easy to construct the yield curve, especially since the mechanism for determining the prices of financial

instruments is not credible. Thus, Nelson and Siegel (1987) proposed a model for determining the yield curve for illiquid markets. This model is used in the case of the Republic of Moldova.

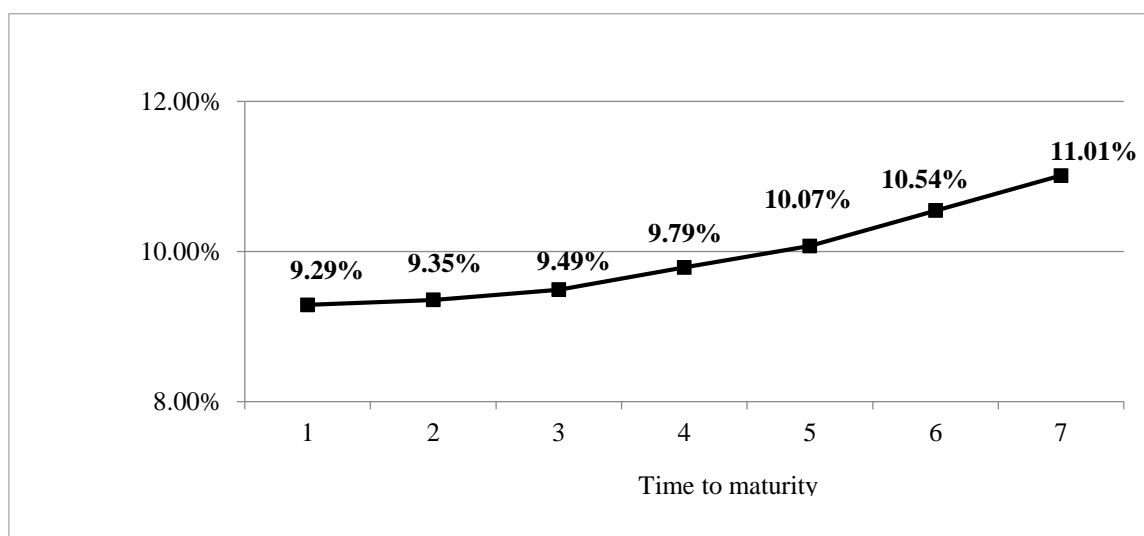


Figure 5. Yield curve, as of December 31, 2021

Source: Source: author's own elaboration based on source www.mf.gov.md

According to Figure 5, the shape of the yield curve represents an upward curve, which assumes that short-term returns are lower than long-term returns. This is also explained by the fact that investors ask higher rate of return for assuming the risk of investing money over a longer period of time. The same, the yield shape indicates that the inflation rate will increase, which came true. In August 2022 the annual inflation rate reached the level 34.3%.

CONCLUSION

Investors must be familiarized with the formulas regarding the government securities' price, yield or interest rate to take an investor decision. In this paper, the author presents practical examples of using the main formulas applied for the government securities issued in the Republic of Moldova.

The yield and the interest rate are not the same thing. Yield is higher than the interest rate and can be expressed in amount and percentage, whereas the interest rate is expressed only in percentage. Also, investors have to take into account the convention used for calculations because different countries have different conventions. In the Republic of Moldova, the convention that is applied at the formulas regarding the government securities is Actual/365.

Taking into consideration the low degree of the liquidity in the government securities market, it is not easy to choose the credible method for determining the prices of financial instruments. In this case, the Nelson-Siegel model is used to construct the yield curve, which is indicative one.

REFERENCES

1. Bringo, B., Mercurio, F. (2006). Interest rate models – Theory and Practice. *Springer Finance*.
2. Fabozzi, F.J., Drake P.P. (2009). *Finance: capital markets, financial management, and investment management*. New Jersey: John Wiley & Sons, Inc.
3. Hotărârea Comitetului Executiv al Băncii Naționale a Moldovei cu privire la aprobarea Regulamentului cu privire la plasarea, tranzacționarea și răscumpărarea valorilor mobiliare de stat în formă de înscrie în cont: nr. 170 din 19 iulie 2018. In: Monitorul Oficial al Republicii Moldova, 2018, nr.277-284, art. 1171.
4. Hotărârea Guvernului cu privire la aprobarea Programului Managementul datoriei de stat pe termen mediu (2022-2024): nr.81 din 16.02.2022. In: Monitorul Oficial al Republicii Moldova, 2022, nr.45-52, art. 111.
5. Melicher, R.W, Norton, E.A. (2017). *Introduction to Finance*. USA: John Wiley & Sons, Inc.
6. Ministry of Finance. (2022). *Monthly statistical bulletins*. <https://mf.gov.md/sites/default/files/Buletin%20Statistic%2012.2021.pdf>
7. National Bank of Moldova. (2022). *Results of Government securities auctions*. <https://www.bnm.md/bdi/pages/reports/dop/DOP10.xhtml>
8. Nelson, C.R, Siegel, A.F. (1987). Parsimonious Modelling of Yield Curves. *The Journal of Business* (60(4)), 473-489.
9. Prameswaran, S.K. (2020). *Fixed Income Securities: Concepts and Applications*. Berlin: Walter de Gruyter Inc. p. 109 ISBN 978-1-5474-1673-8
10. Radziwiłł, A., Șcerbațchi, O., & Zaman, C. (1999). Financial Crisis in Moldova - Causes and Consequences. *Studies & Analyses CASE*, 192. 11 p.
11. Speian, O. (2021). The historical evolution of the Government Securities market in the Republic of Moldova. *International Scientific and Practical Conference „Sustainable development and socio-economic cohesion in the 21st century: trends and challenge”*. Bulgaria: Tsenov Academic Publishing House, pp. 378-385.