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Bond Parameters and Economic Instability

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ABSTRACT

During periods of economic crises, investment activity decreases. The growth of yields on the securities market, typical for such periods, is unprofitable for issuers. Fluctuations in interest rates and general instability in the economy favor mainly short-term investments of investors. Issuers construct bond parameters that help attract investors and reduce risks. **The purpose** of this work is to consider the behavior of some controlled parameters of the bond during periods of instability, to obtain mathematical evidence of the dependence of the duration and price of the bond on the frequency of coupon payments and to justify the possibility of considering the frequency of coupon payments as a parameter that reduces the risks of the investor and the issuer. **Methods** of differential calculus are used to obtain evidence. **The novelty** of the work consists in the fact that the proofs obtained in the work are not available in the literature. The **results** are obtained for bonds that do not have credit risk. It has been established that with an increase in the number of coupon payments per year at fixed values of the main parameters, the duration of the bond decreases, and the price increases. The proven statements about the behavior of the duration and the price of the bond are consistent with market observations. A decrease in the duration of the bond with an increase in the number of coupon payments per year means a decrease in the "real term" and a decrease in the interest rate risk of the bond, which may be of interest to the investor. The price increase indicates an increase in demand for bonds with an increase in the number of coupon payments per year and the possibility of increasing the issuer's income. The **relevance** of the work lies in the fact that the conditions for economic instability in Russia and in the world remain and the results of the work may be of interest to participants in the bond market. Conclusions: the paper shows that an increase in the number of coupon payments per year contributes to an increase in the attractiveness of bond issuance for both investors and issuers. **Conclusions**: the paper shows that an increase in the number of coupon payments per year contributes to the growth of the attractiveness of a bond issue for both investors and issuers. **Practical significance** of the work: the results of the work can be useful for investors and issuers, financial engineering specialists in the design of bond parameters, as well as in theoretical studies of the investment properties of bonds.

Keywords: mathematical methods; coupon bond; frequency of coupon payments; bond duration; bond price

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INTRODUCTION

Periods of economic difficulties and crises are characterized by instability, rising interest rates, and inflation. In conditions of stable economic development, the bond market is an important component of the country's economy, where all market participants earn income. However, during periods of instability, the bond market is perceived as risky by both investors and issuers. Activity in the primary bond market is slowing down [1]. After the key rate was raised by the Bank of Russia in 2014 and 2021, previously purchased fixed-income securities significantly lost value, and many investors left the market. First-tier issuers have reduced their presence in the market.[1]

Nevertheless, in conditions of instability, bonds are considered the most reliable instrument for preserving funds and financing the development of the country's economy [2–4]. Indeed, the fixed stream of payments from bonds reduces the level of uncertainty and risk for investors. According to studies [5, 6], bonds can pose good competition to deposits. According to the internet resource,[2] during periods of instability, the growth of interest rates on bank deposits always lags behind the growth of interest rates on bonds, which helps attract a certain segment of investors to the bond market. On the other hand, issuers also show interest in issuing bonds as a more advantageous way to attract borrowed funds compared to loans during such periods [1, 2]. The issuance of government bonds, such as government loan bonds (OFZ —abbreviation for Russian), during periods of instability helps the government address budget deficit coverage issues by attracting the savings of the Russian population, which are generally significant [3]. According to the Ministry of Finance of the Russian Federation, in 2023–2025, domestic borrowings will be the main source of financing the budget deficit.[3] As we can see, during periods of economic instability, bonds remain a sought-after financial instrument.

As already noted, during periods of instability, the bond market is perceived by market participants as risky. For issuers, the problem of attracting investors becomes more complicated. Financial engineering is working on constructing bond parameters that ensure increased issuance attractiveness and reduced risks for both the issuer and the investor. According to [7], the goal of financial engineering in the bond market is to construct bond parameters such that the generated cash flows most closely align with the primary interests of the issuer, while maximizing the investment attractiveness of the product. This goal is achieved through the reasoned selection and careful construction of each individual bond parameter.

As indicated by the works on financial engineering [7, 8], the maturity period of a bond and the coupon rate are the main controllable parameters of a bond. The payment frequency parameter, which is secondary, is also manageable. Let's consider the principles of financial engineering in relation to these parameters.

According to [7], the maturity period (urgency parameter) is a managed parameter that must ensure the interests of both the issuer and the investor are met. The main requirement for this parameter is that the maturity period must align with market conditions. The term of a bond can be either fixed or variable, where investors or the issuer have the right to demand early redemption of the bond (bonds with embedded call or put options). The more stable the situation, the more widespread fixed-term bonds become.

[1] The bond market in 2021: overcoming instability. URL: https://www.raexpert.ru/docbank/804/304/9a1/b6c6cf48add84b022b4906e.pdf (accessed on 27.08.2024).

[2] The bond market in 2021: overcoming instability. URL: https://www.raexpert.ru/docbank/804/304/9a1/b6c6cf48add84b022b4906e.pdf (accessed on 27.08.2024).

[3] Bond market: high volatility amid significant uncertainty. Overview of the ruble bond market for 2022: RF Ministry of Finance policy on the primary OFZ market. P. 33. URL: https://rusbonds.ru/rb-docs/analytics/240123_2022.pdf?ysclid=lkmovldjp0985661739 (accessed on 27.08.2024).

The coupon rate is the interest rate paid by the issuer to the investor periodically until the bond matures as a reward for the debt. This is a managed parameter that allows for the management of risks for both the investor and the issuer [7, 8]. The main requirement for this parameter is compliance with the current market situation, i.e., the size of the coupon income must correspond to the current yield of similar obligations. The coupon rate can be either fixed or variable, with the rate being adjusted according to changing market conditions. The issuance of fixed-rate bonds is advisable in the case of short- or medium-term issues [7]. The size of the coupon is determined by a number of factors: general market conditions for debt obligations of this term, the creditworthiness of the issuer, the tax status of the issuance, and the cost of collateral to support the issuance [8].

According to [7, 8], the parameter of payment frequency, i.e., the number of coupon payments per year, affects the investment attractiveness of a bond, as it essentially determines the frequency with which investors receive interim payments on the bond. The main principle regarding this parameter is the alignment of the coupon income payment frequency and its period with those accepted in the market. According to [9], as a rule, interest on bonds is paid every six months. In some cases, the interest payment interval is reduced to one month, and very rarely, the payment is made once a year. In bond loans of Russian issuers, the duration of the coupon period most often applied is 3 and 6 months. The author of work [7] notes the importance of this parameter specifically in the Russian bond market: in developed markets, where a significant number of instruments are traded, this factor is not as significant, however, in Russian conditions, with relatively low volumes of bonds in circulation, it can be of great importance [7, p. 57].

BOND PARAMETERS AND RISKS

For an investor, two main types of risks associated with bond investments are identified: credit risk (the risk of the issuer's insolvency) and interest rate risk (the risk of rising interest rates leading to a decrease in bond prices) [10]. According to market research on the risk factors of bond investments [11–14], parameters such as the maturity period and coupon rate of bonds are risk factors for investors. Let's consider what types of risks these parameters are associated with for the investor.

The maturity period is a key characteristic of a bond [15]. This is the period after which the borrower is obliged to fully repay the borrowed amount. According to the results of studies [11–14], the potential for greater risks generally arises with long-term investments. This greater potential risk is due to the exposure of bonds to interest rate risk, i.e., the risk of changes in interest rates and, consequently, the risk of changes in prices. Moreover, the changes in prices are greater the longer the maturity period. In the paper [16], a mathematical proof of the dependence of bond interest rate risk on the maturity period is presented. It has been shown that the interest rate risk of short-term bonds is lower compared to long-term bonds, which is consistent with market observations. According to [11–14], the shorter the maturity period of bonds, the more attractive they will be to investors, as they are considered to have lower risk. Long-term investments are associated with the risk of uncertainty, especially during periods of instability, which exposes the investor not only to interest rate risk but also to default risk, liquidity risk, and reinvestment rate risk [17, 18].

According to [8, 11, 12], the coupon rate serves to determine the level of attractiveness of bonds from the investors' perspective. It is considered that the higher the coupon rate, the more attractive the bond will be for investors. However, as noted in [12], it is often overlooked that a high coupon also indicates relatively low bond quality, which must be compensated by high coupon rates. According to observations [11, 12], bonds that promise higher coupons generally prompt investors to demand a higher yield to maturity, that is, an increase in the risk premium. Thus, a high coupon rate may indicate the presence of default risk. The main adverse factors that a high coupon rate may indicate are a low credit rating of the issuer, a high tax on bond income, the presence of a call option in the bond structure, and reinvestment rate risk [8, 17].

Let's consider how market participants manage bond parameters to mitigate risks during periods of instability. As already noted, periods of economic instability are characterized by inflation, an increase in the key interest rate, and bond market yields, which means that bonds are exposed to interest rate risk. The rise in rates in the bond market increases the default risks for some companies, which leads to an increase in credit risk in the bond market. For an investor, both types of risk, credit and interest rate, become real during periods of instability, which is why investors prefer short-term investments. According to [17], bonds with an embedded put option may be of interest to investors in a rising interest rate environment.

From the issuers' side, strategies in this situation are formulated approximately as follows:[4] regularly make small-volume issues for a term of 1.5–3 years, now, when rates have increased, we are making shorter issues. As we can see, the strategies of issuers during periods of instability correspond to the principle of financial engineering in forming the maturity parameter — aligning the bond's maturity with market conditions. According to [7, p. 43], in the context of general instability, long-term instruments will either not be redeemed at all or will be acquired at a deep discount.

As we can see, in periods of instability, market participants prefer short-term borrowings and investments. According to the study,[5] in 2021, during the period of rising key interest rates by the Bank of Russia and yields in the bond market, issuers sharply reduced their activity in the long-term bond market. Long-term placements are postponed in case of an unstable market situation [1, p. 104]. A similar conclusion was made in the work [18] based on the results of studies of the U.S. Treasury bond market during two major crises — the global financial crisis of 2007–2009 and the onset of the COVID-19 pandemic in early 2020: in times of crisis, the demand for short-term U.S. Treasury bonds increases, and there is a sharp rise in short-term portfolio debt.

Let's consider how the issuer manages the coupon size to attract investors. According to [8], any factor that increases financial losses and the level of investor uncertainty raises the coupon size. Conversely, the more secure the position of bondholders, the lower the coupon rate can be for the issuance to be successful. The presence of collateral and the convertibility of the bond can attract investors, which reduces the coupon rate required to sell the instrument. The callability of a bond is unattractive to investors, and therefore, to sell the instrument, the issuer increases the coupon yield.

As already noted, when constructing a bond, the coupon size is set according to the principle of adequacy of coupon income to market conditions for comparable debt securities. Therefore, the size of the coupon rate characterizes not only the issuer but also the market. Bonds issued during periods of instability may have an increased coupon rate in line with market yields during such periods, which is advisable for short-term issues to attract investors. In the case of long-term bond placements with a higher coupon rate, the issuer bears the risk of paying larger amounts relative to market rates [7]. Moreover, a high coupon rate

[4] The bond market in 2021: overcoming instability. URL: https://www.raexpert.ru/docbank/804/304/9a1/b6c6cf48add84b022b4906e.pdf (accessed on 27.08.2024).

[5] See ibid.

reduces the interest rate risk of the bond, which can also attract investors during periods of instability.

As we can see, the bond's maturity period and coupon rate are managed parameters that the bond issuer uses to attract investors and reduce risks.

It can be assumed that during periods of instability, the frequency of coupon payments becomes another risk factor for bonds with unreliable credit ratings, alongside the maturity period and coupon rate. The authors [7, 8, 19, 20] note the importance of this parameter in constructing issues that are attractive to investors, including in conditions of economic instability [4]. According to [4, 7], to attract investors in conditions of instability, it is more justified to issue bonds with a coupon period of 3 months, which is the shortest period accepted in the Russian market.

This article examines the issues related to the impact of the frequency of coupon payments, i.e., the number of coupon payments per year, on the values of duration and the price of a risk-free bond. These are OFZ bonds on the Russian bond market or Treasury bonds on the US market. The price and duration of a bond are the most important indicators of its investment properties, which are of primary interest to the investor alongside the yield to maturity [21–23]. Differential calculus methods are used to solve the problems. The yield to maturity of a bond is considered in the form of an effective interest rate, as it is more accurate in these studies [24]. Based on the obtained results, the frequency of coupon payments is proposed to be considered as a parameter that allows reducing the risks for both the investor and the issuer.

MATERIALS AND METHODS

The tasks concerning the impact of coupon payment frequency on the values of duration and bond price are being considered. The bond has no embedded options, is fairly valued, and has no credit risk.

Let D_m and P_m — be the duration and quoted price of a bond, with coupon payments made m times a year, m = 1, 2,.... The bond is considered at the moment immediately after the coupon payment, when there are T years and n coupon payments ($n = Tm$), remaining until maturity, with $T > 1$ (otherwise if m = 1 the bond is not a coupon bond). We will consider the duration D_m and price of the bond P_m as functions of the number of coupon payments per year m, for a given term to maturity T, the coupon rate f and the yield to maturity r. The influence of the parameter m on the magnitude of the duration D_m and the bond price P_m we will study by differentiating the functions D_m and P_m with respect to the variable m. Differentiation with respect to an integer variable is applied in the study of the investment properties of bonds. For example, in the papers [16, 25, 26].

Let's consider the expressions for the functions D_m and P_m. By definition:

$$D_m = \frac{\sum_{i=1}^{Tm} \frac{i}{m} \cdot \frac{\frac{1}{m} fA}{(1+r)^{\frac{i}{m}}} + T \cdot \frac{A}{(1+r)^T}}{\sum_{i=1}^{Tm} \frac{\frac{1}{m} fA}{(1+r)^{\frac{i}{m}}} + \frac{A}{(1+r)^T},},$$

where A — bond face value. This expression transforms into the form:

$$D_m = \frac{\frac{f}{m^2}(1+r)^{\frac{1}{m}}\left((1+r)^T-1\right) - T\left((1+r)^{\frac{1}{m}}-1\right)\left(\frac{f}{m}-\left((1+r)^{\frac{1}{m}}-1\right)\right)}{\left((1+r)^{\frac{1}{m}}-1\right)\left(\frac{f}{m}\left((1+r)^T-1\right) + (1+r)^{\frac{1}{m}}-1\right)}, \; m=1,2,\ldots. \tag{1}$$

Expression (1) was used to study the dependence of bond duration on the parameter m.
Let's consider the expression for the function P_m. By definition:

$$P_m = \sum_{i=1}^{Tm} \frac{\frac{1}{m} fA}{(1+r)^{\frac{i}{m}}} + \frac{A}{(1+r)^T}.$$

This formula transforms into the form:

$$P_m = Af\left(1-\frac{1}{(1+r)^T}\right)\beta(m) + \frac{A}{(1+r)^T}, \; m=1,2,\ldots, \tag{2}$$

where

$$\beta(m) = \frac{1/m}{(1+r)^{\frac{1}{m}}-1}.$$

Expression (2) was used to study the dependence of the bond price on the parameter m. In formulas (1) and (2), the yield to maturity of the bond r is defined using the effective interest rate method [15, 24].

In the paper of A. Gerard and Cahill[6] an analysis of the yields of U. S. Treasury bonds over nearly 200 years is presented. The author reports: during this period, the country experienced the Civil War, two world wars, the Great Depression, and periods of rapid prosperity. Nevertheless, the average yield of 4.62% appears reasonably close to today's market yield. Thus, in formulas (1) and (2), the bond yield r represents a sufficiently small value, which allows for the use of approximate equalities in obtaining proofs.

RESULTS AND DISCUSSIONS

Theorem. With fixed values of the main parameters of the bond — the term to maturity T, where $T > 1$, the coupon rate f and the yield to maturity r, the following statements are true:

1. The sequence $\{D_m\}$ is decreasing.
2. The sequence $\{P_m\}$ is increasing.

Proof. 1. $\{D_m\}$ — this is a numerical sequence in which the sequence member number m coincides with the number of coupon payments in a year. Let's use the following notation: $a(m) = (1+r)^{\frac{1}{m}} - 1, \quad b = (1+r)^T - 1$. Then formula (1) transforms into the form:

$$D_m = \frac{\frac{f}{m^2} b\left(a(m)+1\right) - Ta(m)\left(\frac{f}{m} - a(m)\right)}{a(m)\left(\frac{f}{m}b + a(m)\right)}.$$

[6] Gerard A. Cahill. Choosing a realistic discount rate. URL: http://www.cfin.ru/finanalysis/invest/realistic_disc.shtml (accessed on 27.08.2024).

The derivative of this function with respect to the variable *m* has the form:

$$D_m{}' = \frac{1}{B^2}\left[-\frac{f^2b^2}{m^4}a(m)\big(a(m)+1\big)-\frac{2fb}{m^3}a^2(m)\big(a(m)+1\big)-\frac{f^2b^2}{m^3}a'(m)-\right.$$

$$\left.-\frac{fb}{m^2}a(m)a'(m)\big(a(m)+2\big)+\frac{Tf}{m^2}a^3(m)(b+1)+\frac{Tf}{m}(b+1)a^2(m)a'(m)\right],$$

where B^2 — the square of the denominator of the function D_m, $a'(m)=-\frac{1}{m^2}(1+r)^{\frac{1}{m}}\ln(1+r)$.

We use approximate equations:

$$a(m)=(1+r)^{\frac{1}{m}}-1\approx\frac{r}{m},\ b=(1+r)^T-1\approx rT,$$

$$\ln(1+r)\approx r,\ a'(m)=-\frac{1}{m^2}(1+r)^{\frac{1}{m}}\ln(1+r)\approx-\frac{r}{m^2}\left(1+\frac{r}{m}\right).$$

Then we will get:

$$D_m{}'\approx\frac{1}{B^2}\cdot\frac{r^5}{m^6}fT\left(\frac{1}{m}-T\right)<0,$$

since $m\geq 1$, $T>1$. This means that the duration of the bond is a decreasing function of the parameter *m*. Then

$$D_m > D_{m+1},\ m=1,2,\dots,$$

— the sequence $\{D_m\}$ is decreasing. Let's note that this result does not depend on the coupon rate. The limit of the sequence $\{D_m\}$ is:

$$\lim_{m\to\infty}D_m=\frac{f\big((1+r)^T-1\big)-T\ln(1+r)\big(f-\ln(1+r)\big)}{\ln(1+r)\Big(f\big((1+r)^T-1\big)\ +\ \ln(1+r)\Big)}. \qquad (3)$$

Since $\lim_{m\to\infty}D_m=\inf\{D_m\}$, then $D_m\geq\lim_{m\to\infty}D_m$, $m=1,2,\dots$. The statement is proven.

2. Let's now consider the problem of the dependence of the quoted bond price P_m on the number of coupon payments per year *m*. Let's show that the sequence $\{P_m\}$ is increasing.

$\{P_m\}$ — this is a numerical sequence in which the sequence member number *m* coincides with the number of coupon payments per year. According to the formula **(**2),

$$P_m=Af\left(1-\frac{1}{(1+r)^T}\right)\beta(m)+\frac{A}{(1+r)^T},\ m=1,2,\dots,$$

where $\beta(m)=\frac{1/m}{(1+r)^{\frac{1}{m}}-1}$. We differentiate the function P_m to the variable *m*:

$$P'_m = Af\left(1-\frac{1}{(1+r)^T}\right)\beta'(m),$$

where

$$\beta'(m) = -\frac{(1+r)^{\frac{1}{m}}}{m^2\left((1+r)^{\frac{1}{m}}-1\right)^2}\left[1-(1+r)^{-\frac{1}{m}}-\frac{1}{m}\ln(1+r)\right].$$

The sign of the derivative $\beta'(m)$ is determined by the sign of the expression in the square brackets. The expression in square brackets is a function of the form $\varphi(u)=1-(1+r)^{-u}-u\ln(1+r)$, where $u=1/m$. Since $m\geq 1$, then $u\in(0,1]$. To determine the sign of the function $\varphi(u)$ on the half-interval $(0,1]$, let's consider the function

$$g(u)=\begin{cases}\varphi(u), & 0<u\leq 1\\ 0, & u=0.\end{cases}$$

The function $g(u)$ is continuous on the segment $[0,1]$ and differentiable on the interval $(0,1)$. Since the derivative is $g'(u)=-\ln(1+r)\left(1-(1+r)^{-u}\right)<0$ on the interval, $0<u<1$, the function $g(u)$ is decreasing on the segment $0\leq u\leq 1$. Then for any $u\in(0,1]$ the inequality holds $g(u)<g(0)$. Since $g(0)=0$, then $g(u)<0$ on the half-interval $0<u\leq 1$. Since $g(u)=\varphi(u)$ in $u\in(0,1]$, then $\varphi(u)<0$. Then the derivative $\beta'(m)>0$, where $m\geq 1$. Hence, the derivative $P'_m>0$ at $m\geq 1$ — the price of the bond P_m is an increasing function of the parameter *m*. Then

$$P_m < P_{m+1},\ m=1,2,\dots,$$

— the sequence $\{P_m\}$ is increasing. Let's note that this result does not depend on the coupon rate. The limit of the sequence $\{P_m\}$ is equal to:

$$\lim_{m\to\infty} P_m = \frac{Af}{\ln(1+r)}\left(1-\frac{1}{(1+r)^T}\right)+\frac{A}{(1+r)^T}. \tag{4}$$

Since $\lim_{m\to\infty} P_m = \sup\{P_m\}$, then $P_m \leq \lim_{m\to\infty} P_m$, $m=1,2,\dots$. The statement is proven.

DISCUSSION OF RESULTS

It has been established that with fixed values of the main bond parameters, the bond's duration decreases and the price increases with an increase in the number of coupon payments per year. The proven statements about the behavior of bond duration and price are consistent with previous studies [27, 28], where methods of function expansion into power series and operations with series, such as addition and multiplication of series, were used to obtain evidence. The obtained results are confirmed by the data in the table, which presents the characteristics of government bonds (OFZ) with close terms to maturity *T* according to the Moscow Exchange data.[7] As can be seen from the table, with an increase in the number of coupon payments in year *m*, the bond price increases, and the duration decreases. The yield *r* in the table is effective.

Table

Characteristics of Government Bonds (OFZ) According to the Moscow Stock Exchange on 18.12.2023

ISSUE	*T* (days)	*D* (days)	Price	*m*	*f*, %	*r*, %
SU 29016RMFS 1	1101	949	100	4	–	9.47
SU 26207RMFS 9	1143	993	91.75	2	8.15	11.76
SU 29020RMFS 3	1374	1145	99.68	4		9.6
SU 26232RMFS 7	1388	1230	83.40	2	6	11.82
SU 29019RMFS 5	2039	1517	99.05	4		11.74
SU 26242RMFS 6	2081	1597	89.0	2	9	11.85

Source: Compiled by the author according to the Moscow Stock Exchange. URL: http://www.moex.com/ (accessed on 18.12.2023).

A decrease of a bond's duration with an increase in the number of coupon payments per year means a decrease in the "real term" and a reduction in the bond's interest rate risk, which can attract investors in times of crisis and instability. An increase in price may indicate a rise in demand for bonds from investors and, consequently, an increase in the issuer's income with the increase in the number of coupon payments per year. According to economic theory,[8] an increase in demand raises the equilibrium price and the equilibrium quantity of the product, which may interest the issuer during periods of instability.

The interpretation of the results presented in the work aligns with the recommendations of financial engineering specialists for attracting investors: it is advisable to establish a minimum accepted coupon period to enhance the investment attractiveness of the bond through the frequency of periodic payments [7, p. 136]. The interpretation of the results also aligns with market observations. For example[9]: securities with more frequent coupon payments are more valuable.

Let's note that the results were obtained for bonds that have no credit risk, as a company with a low credit rating is unlikely to commit to paying coupons more frequently.

CONCLUSION

The bond's maturity period and coupon rate are the main controllable parameters of the bond that the bond issuer uses to attract investors and reduce risks. Based on the evidence presented in the article on the dependence of the duration and price of a bond on the number of coupon payments per year, it is proposed to consider the frequency of coupon payments as a parameter that allows reducing the risks for both the issuer and the investor. The reduction of the bond's duration with an increase in the number of coupon payments per year contributes to the

[7] Website of the Moscow Exchange. URL: http://www.moex.com/ (accessed on 18.12.2023).

[8] Tumashov A.R., Kotenko S.N., Tumasheva M.V. Economic Theory. Part I. Introduction to Economic Theory. Microeconomics. Kazan: Kazan. Uni., 2011. p. 61.

[9] OFZ Income. URL: https://ofzdohod.ru/bonds/parametry-i-dokhodnost/kuponnyi-dokhod-obligatcii/, (accessed on 27.08.2024).

bond's attractiveness for investors due to the decrease in the «real term» and the reduction of the bond's interest rate risk. The increase in bond prices with an increase in the frequency of coupon payments may indicate a rise in demand for bonds from investors and the potential for increased income for the issuer. The results of the work may be useful for practical investing, when constructing bond parameters in conditions of instability, as well as in theoretical studies of the investment properties of bonds.

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