Creation of New Forms of Bond Taxonomies, Allowing to Obtain the Required Quality of Guarantees and Profitability

N V Gryzunova[1], D S Zakharova[1], V I Pyatanova[1]

[1]Plekhanov Russian University of Economics, Moscow, 117997 Russia

E-mail: Gryzunova.NV@rea.ru

Abstract. The purpose of this article is to consider the debt market, namely the management of the market for interest-bearing instruments, the yield and risk of securities based on taxonomies of bonds. The existing problem is caused by the lack of sources of investment, which is acutely felt at the meso level. Regional companies and credit organizations have less financial entropy compared to market entities in the central region. Due to ongoing structural changes in the global and national economy and the uncertainty of the future, sources of investment are transformed and factors that determine profitability and risks change. The problem of achieving the required quality of borrowers is constantly exacerbated, despite the ever-improving scoring technology. One of the tools to estimate future risk and return is the zero-coupon yield curve (ZCYC) curve. Benchmarking of this tool traditionally is government securities, which allows you to set goals and restrictions on investments. When analyzing the need for a loan, regional organizations should be able to choose among the sources and conditions of financing. A good option would be a structured product, the price of which should "push off" from the yield of the respective bonds and which should be traded in the stock exchange of corporate and municipal bonds. Such structured products will create opportunities for regional banking organizations to manage credit risk. The main method of studying the pricing issues of structured products is based on taxonomies, G-curve factors and clustering processes. To overcome the financial contradictions, the shortage of working capital and risks for credit organizations, the authors propose to supplement the investment portfolio with structured products, with pricing based on ZCYC. The clustering of organizations and the inclusion of bond taxonomies in the cluster will expand the boundaries of organizations' cash management models and improve risk management. The proposed approach allows to solve the current problem situations in the field of lending, which affect the investment demand of companies.

1. Introduction
The debt market is the oldest of financial institutions, which today is represented by a variety of price instruments. The term interest rate structure underlying the theory of fixed-income asset valuation and one of the most problematic aspects of achieving the effectiveness of monetary policy for over 40 years. The Russian bond market is no exception. The regional segment of bonds is changing most intensively now. The development of financial engineering has ensured the expansion of retail structured financial products combining conservative and risky components, in the structure of which, on the regional market, they prefer bonds, as they ensure the fulfillment of risk limits. The use of financial engineering allows the investor to save capital and generate additional income.

1.1. Actuality, the scientific significance of the issue with a brief review of the literature

The authors understand the financial structure "structured product" as a result of financial engineering, as a tool with predetermined risk parameters and variable terms of payments and profitability. In the definition, the focus is shifted to the meso level. Payments on a structured product depend on the conditions for issuing bonds included in it. The predominant task of creating a structured product is the change in investment demand and the impact on the dynamics of interest rates. Therefore, institutional financial organizations are testing methodologies for creating a structured product. The goal of the development is the creation of a transparent pricing mechanism that guarantees profitability to both the investor and its developers at a fixed amount of risk, as well as protection from the miselling of investors. Modeling products with predetermined properties and different types of payouts based on a well-known evaluation mechanism should be based on the life stages of the products. The main benchmark benchmarks are base bonds.

One can find similar definitions in the authors: R. Knop, G. Kat, V.V. Omelchenko, A. Belinsky and others, [2,9,10,13,15] but the definition is constantly evolving undergoing damping (correction). So Glukhov M.Yu. [7,8] focuses attention on the redistribution of risks. A. B. Feldman draws analogies with derivatives [4]. J. Hal, P. Wilmot, J. F. Marshall, V. K. Bansala [9,13] pay attention to the system analysis of the properties of bonds in the modeling of structural products.

2. Statement of the problem

The regional structured product, according to the authors, should have the main purpose- investment and capital protection. To do this, you must have an accurate idea of risk and return. Usually this is achieved, the binding characteristics of the product being created to the market indicator. One of the tools to evaluate future risk and return is the zero-coupon yield curve (ZCYC). [6.20] This tool is a generally accepted way of describing the temporal structure of interest rates for homogeneous financial instruments (debt securities) with the same quality characteristics , including similar credit quality.

3. Theoretical part

You can call the Bank of International Settlements (BIS) [20] a pioneer in creating the ZCYC methodology, and, since 1996, most of the world's central banks almost annually revise their methodology for calculating ZCYC, due to changes in the national financial markets and the emergence of new approaches to determining benchmarks of interest rates. CSC indicators use:

- participants of exchange trade, bank regulator, financial analysts;
- individuals and legal entities, organizations for the purposes of risk management;
- Price Center Exchange to determine the fair value of the bonds;

Market subjects for macro forecasting.Since the main problem of regional organizations is the difference in the level of financial services due to different rates of development of the center and regions, which is manifested primarily in the problems of lending, in 2017, innovations were developed for issuing municipal bonds. Generally, since 1992. The constituent entities of the Russian Federation received the right to create and use various sources of financing and various loan products, but under the control of federal bodies. Many regional entities seized this opportunity and entered the international market with their securities.

Currently, the bond market in Russia is represented by the following types:
• Government bonds: government short-term bonds; federal loan bonds;
• Bonds of constituent entities of the Russian Federation and municipal bonds;
• Corporate bonds;
• Mortgage bonds;
• Eurobonds.

Municipal bonds in the absence of risk are becoming very popular with investors, thanks to tax incentives. Corporate bonds - in terms of profitability and circulation conditions, are among the most attractive for a private investor. The yield of these securities over the past decade has often reached

20%. Since the issuers of bonds are companies from various sectors of the economy, the investor can choose the best combination of profitability and risk. We should recall the latest innovation in 2017 in this market segment — subordinated bonds of corporate issuers that form unprotected debt. Subordinated bonds are more "dangerous" than structured products, the latter provide investors with a choice.

To calculate the risk of a structured product with subordinated bonds, it is necessary to provide for higher risk and profitability, as well as to take into account the wishes of risk-averse investors. The choice of a bond is the choice of the "main unit" in the design, it is he who is the starting basis for pricing.

4. Practical significance

In recent years, market conditions, through the dynamics of interest rates, "prepared" the conditions for the taxonomy of bonds. The development of alternative approaches to the assessment of taxonomies of securities formed a conviction about the need to test models taking into account the specifics of their structure and conditions of circulation and emission. Funding processes are now more important than the key rate. The funding rate, according to the authors, should be defined as:

$$i = LIBOR + CDS\ Spread + \Theta \qquad\qquad (1)$$

where, CDS spread is the spread of the credit default swap on the issuer's debt (a financial swap intended for insurance against counterparty default by the counterparty);

-Θ-profitability of the industry market segment.

The presence of a component (Θ) is due to the fact that the market ceases to be a market one and disproportions are not eliminated. But, the credit risk leveled by a bond loan, will allow "not to burn" borrowers. Corporate and stock exchange bonds of the new model (2017) will also contribute to the repatriation of funds.

One of the most important innovations of the regional financial market is bondation - the development of the debt market in order to reduce borrowing costs for enterprises of the real sector, and attracting "long" money to the economy, expanding the availability of the bond market for small businesses. Despite the high level of liquidity of the banking system, small companies remain cut off from the debt market due to the increased pressure of the risks of such loans on banks' capital. Under these conditions, the market for structural products becomes a compromise resource for business development, especially given the arrival of private investors, for whom bonds are an alternative to bank deposits. You can also recall the "green" and "social" bonds. In 2019, the development of the infrastructure of the organized market will be focused on increasing liquidity in the bond market. For regional subjects, the elements of bookbuilding are "driven around" [1].The performance of the corporate bonds prospectus is formed in accordance with the current market situation and is based on regulatory requirements[1]:

-The authorized capital must be paid at 100%;

-No, the issuer and its satellites have lawsuits of 25% or more of the client's net assets;

-The presence of socially significant positions in the project;

- The fiscal value of the prospectus;

-Lack of overdue debts to the budget, extra-budgetary funds-mi, payroll employees and other payments;

- Lack of bankruptcy procedures and cases of default;

-Experience of management in the market with bonds up to 3 years, the volume of funding and the market segment of at least 5% of the regional market and the presence of the brand;

- Positive dynamics of order portfolios over the past three years;

---

[1] Prospectus of Securities Federal Law of April 22, 1996 No. 39-ФЗ (revised from 08.08.2018) "On the Securities Market" (with amendments by amendments that entered into force on October 16, 2018) http://www.consultant.ru/ law / podborki / prospekt_cennyh_bumag /

- Concentration on one supplier (buyer) - no more than 30%, concentration on three suppliers (buyers) - no more than 70%;

-The presence of the development strategy and mission of the company[2].

Table 1. Requirements for the debutant issuer are determined on the basis of its financial statements[3].

Accounting system	International Financial Reporting Standards	Russian Accounting Standards
Financial statements	Availability of the issuer's audited statements for the three completed financial years;	Availability of the issuer's audited statements for the three completed financial years;
Financial performance	Availability of semi-annual reporting for the current year (for 3 or 9 months of the current year) 1. Revenue - positive dynamics in the period under review 2.EBITDA - positive, positive dynamics in the period under review 3. Debt / EBITDA - no more than 4.0 (depending on the industry) 4.EBITDA / interest payable - more than 1.5 5. Profitability of activities in the period under review (exception: a one-time loss in one year of the analyzed period, provided that the total profit of the analyzed period	
Credit rating	Availability / receipt of credit rating: • According to the national scale from rating agencies accredited by the Bank of Russia; • On an international scale from agencies: S & P; Moody's; Fitch	

Regional companies and credit organizations have lower financial entropy compared with market entities of the central region. Due to the ongoing structural changes in the global and national economy and the uncertainty of the future, sources of investment are being transformed and the factors determining profitability and risks change. The problem of achieving the required quality of borrowers is constantly exacerbated, despite the constantly improving technology scoring. The competitive status of a non-financial cluster (segment of the economy) is based on an assessment of the quality of investments, mobilization and strategic factors. But, during the period of macroeconomic instability and stock market volatility, the main criterion for competitiveness is the financial stability of cluster enterprises, these requirements are reflected in table 1. For regional companies, the cluster is also a guarantor of stability and a possible source of additional investment.

The construction of ZCYC is based on the parametric Nelson-Siegel model[4] with the addition of terms that provide additional degrees of entropy and, as a consequence, a more accurate fit of the curve to the trading data. For 2019, the MICEX and the regulator will use the following model:

$$G(t) = \beta_0 + (\beta_1 + \beta_2)\frac{\tau}{t}\left[1 - \exp\left(-\frac{t}{\tau}\right)\right] - \beta_2 \exp\left(-\frac{t}{\tau}\right) + \sum_{i=1}^{9} g_i \exp\left(-\frac{(t-a_i)^2}{b_i^2}\right) \tag{2}$$

---

[2] Ibid

[3] Regulations on the standards for issuing securities, the procedure for state registration of an issue (additional issue) of issued securities, state registration of reports on the results of the issue (additional issue) of issued securities and registration of securities prospectuses (approved by the Bank of Russia on August 11, 2014 No. 428-P) (revised from 08/03/2017).

[4] Methodical documents and historical values of the new Curve are available on the Exchange website in the section "Project of the New G-Curve" http://moex.com/a3642

Where, time t is expressed in years;

G (t) - in basis points;

The fixed parameters for 2019 are equal to[5]:

$a_1 = 0$, $a_2 = 0.6$, $a_i + 1 = ai + a^2 k^{i-1}$ i = 2, ..., 8,

$b_1 = a_2$, $b_i + 1 = b_{ik}$, i = 1, ..., 8, k = 1.6

The calculation of the dynamic parameters β0, β1, β2, τ, g1 ÷ g9 is carried out in real time on transactions and bids in the government securities market.

The sums up to the sign corresponding to the Nelson-Siegel model determine the "base block" of the curve used for pricing. Additional members arise only as needed and are calculated for each day. An example of the calculation is shown in (see Fig.1). At each iteration the additional terms are smoothed to avoid accumulation of distortions. The translation of the G-curve value is performed for periods from one year to twenty years. Beginning in 2015, the methodology for estimating the zero-coupon yield curve (ZCYC), carried out by MOEX[6], is updated annually, which allows professional participants of the securities market to level their risks. To date, the entire block of classical models of assessment ZCYC (Nelson - Siegel, Svensson, Vasicek - Fong, Fisher - Nychka - Zervos, etc.) is aimed at overcoming country and situational limitations [3,5,14,17]. The need for a new taxonomy is due to:

Qualitative and quantitative changes in the bond market:

✓ Change in proxy liquidity indicators;

✓ Stimulation of financial market entities for long-term borrowing through tax and institutional incentives;

✓ Changing the sequence of spreads (narrowing).

✓ Improving the adequacy of the indicator in crisis situations:

✓ Lengthening of the explicit period ~ 5 ÷ 7 years

✓ The emergence of new directions of use, for example, financial engineering, which involves the use of linking coupon rates of corporate bonds to ZCYC, adjustment of credit agreements taking into account additional coverings (obligations, such as interest rate, financial sanctions, commissions), etc. [16,19]
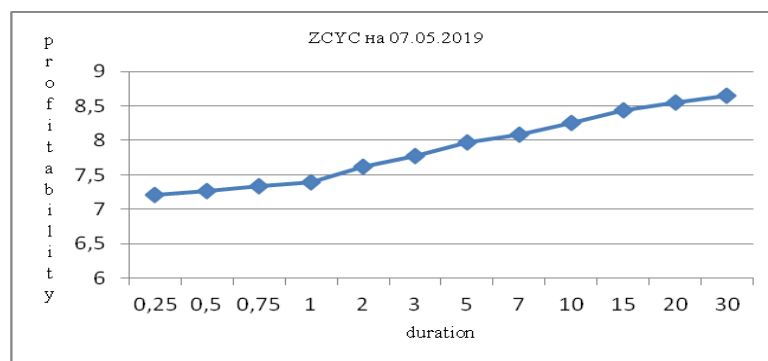

Figure 1. Zero-coupon yield curve in one day.

The properties of the G-curve are:

-in determining the most probable development of the bond market;

-in accumulated "memory" of fluctuations in yield.

- taking into account volatility, liquidity, free-float, repo, etc.

G-curve has several disadvantages:

• prices depend on the state of the "glass" and can be very different from the market;

---

[5] www.crd.ru

[6] The name of the money market indicator "ZCYC Moscow Exchange" is a registered trademark, the copyright holder of which is Moscow Exchange. Certificate for the trademark number 661712

• there are limitations on the calculation of corporate bond z-spreads during trading

The process of creating a regional structured product may include the following procedures [12,16,18]:

- Determination of the need for lending to an organization within the cluster. The key element at this stage is the established credit rate i_k, which is defined as:

$$i_k = m_r + \text{CDS spread}, \tag{3}$$

where, m_r is the market rate in the currency of the instrument being issued. The higher the ik, the higher the profitability of the structural product;

CDS spread is a credit default swap spread defined by a self-regulatory organization (SRO) of the cluster.

- Determination of investor preferences. On the basis of monitoring, the current interest rates, rates, profitability, etc. are determined, and then the product properties are recorded;

- Determination of the product structure, that is, the share and type of bonds used in the structure and the level of capital protection.

-Hedging, selection of a guarantee system;

-Pricing, it is based on the value of the "block" of pledged bonds. The largest share of the market is occupied by notes with capital protection and products with increased income. The estimated product price determined using ZCYC will be:

$$B = \sum_{j=1}^{n} \frac{C_i}{(1+i_r)^{t_i}} + \sum_{i=1}^{N} r_i x_i \tag{4}$$

Where, n - the number of upcoming payments;

t_i- terms before payments;

C_i - the size of payments (coupon, depreciation, and other repayment), expressed in shares of the outstanding part of the nominal value of the bond.

r_i is the return on risky securities invested in the structured product;

x_i - the share of risk securities in the product.

In order to analyze the price behavior and identify its dependence on the main market factors, the authors designed products presented in three categories: products that repeat the underlying bonds; high-yield products with capital protection, see table 2.

Table 2. Fixing prices for structured products.

Indicators	structures that repeat dynamics of the underlying asset	thestructure with high yield	acapital protection structures
changes in the price of the underlying asset	1,14	(-0,51)	0.44
ZCYC	7,27	7,33	7,21
volatility of return on risky securities	(-9,81)	(-9,12)	(-9,83)

Issuers can set certain limit values of indicators for each type of product that will meet the requirements of investors.

5. Findings

A retrospective analysis of price dynamics made it possible to identify the following patterns of price behavior of each category of structural products. In conditions of stagnation, the cost of products may be higher than the spot price, and during a recession, the economy completely repeats the price. Rising interest rates lead to higher prices for structural products with a lag of about 2 to 6 months. The price behavior of high-yield products is determined by the presence of a fixed income, the fixation predetermines future operations. Usually, a coupon on a product is paid twice a year, which is why a sharp fluctuation in volatility is possible. In conditions of stable interest rates, financial companies almost always practice the price of the "ladder" product. The cost of products with higher returns is

more influenced by interest rates, so it is advisable to use a variable coupon. Creating products with high yield is beneficial at low interest rates and in the short term, for a period of 1-2 years. The price behavior of capital-protected products is based on the return on the underlying asset. Interest rates and the time period remaining until maturity have a significant impact on the value of the product. Volatility affects the cost of products only for short periods of time. As one of the most important features of a structured retail product is its focus on financing the activities of the issuer. In addition, it is advisable to simplify the emission of structured products. As part of the modernization of the bond oscillator system, it is advisable to create a new index, which is the basis for creating exchange-traded bond investment funds that have high credit reliability.

References
[1] Alexander G, Edwards A, Ferri M 2000 "The determinants of high yield corporate bonds" *Journal of Financial Markets* **3** 177-204
[2] Belinsky A 2015 Structural products in the Russian financial market *Stocks and bods market* **7** 3
[3] Chakravarty S, Sarkar A 1999 "Liquidity in the US fixed income markets: a report of the Federal Reserve Bank of New York *Staff Report*
[4] Feldman A B 2003 Derivative financial and commodity instruments: Textbook *Finance and statistics* 304
[5] Fisher M, Nychka D, Zervos D 1995 Fitting the Rates with Smoothing Splines *Federal Reserve Board Working* 95-1
[6] Gambarov G, Shevchuk I, Balabushkin A, Nikitin A 2006 The Zero-coupon yield curve in the GKO-OFZ market MOIX **6**
[7] Glukhov M Yu 2007 Structured financial products: concept and device *Bulletin of the Financial Academy* **3(43)** 124-132
[8] Glukhov M Yu 2007 Structured Products: What's Inside? *Securities market* **15** 32-35
[9] Hull J 2004 Options, futures and other derivative financial instruments *M.: Wil-yam* **2** Structured Products Handbook Oesterreichische Nationalbank
[10] Kat Harry M 2001 Structured equity notes and structured notes *John Wiley & Sons Ltd* 170
[11] Knop Roberto 2002 Structured Products A Complete Toolkit to Face Changing Financial Markets John Wiley & Sons Ltd
[12] Krahmal A 2005 Hybrid Instruments: Jurisdiction Dependent Characteristics " *Houston Business and Tax Law Journal* vol 5 **1** http://ssrn.com/abstract=918325
[13] Marshall J F, Bansala V K Financial Engineering: A Complete Guide to Financial Innovations *M.: INFRA-M*
[14] Nelson-Siegel 1987 Parsimonious Modeling of the Field Curve *The Journal of Business* **60** 473-489
[15] Omelchenko V V 2009 Definition and classification of financial products *Bulletin of the Samara State Economic University* **6(56)** 57-60
[16] Subramanian K 2001 "Term structure assessment in illiquid markets" *Journal of Fixed Income* **11(1)** 77-86
[17] Svensson L E O 1995 Estimating Forward Interest Rates with the Extended Nelson & Siegel Method Sveriges *Riksbank Quarterly Review* **3** 13–26
[18] Vasicek O A, Fong H G 1982 Term Structure Modeling Using Exponential Splines *Journal of Finance* **37** 339–356
[19] Wilmott Paul Wimott on Quantitaive Finance Second Edition John Wiley & Sons Ltd ISBN 13 978-0-470-01870-5
[20] 2005 Zero-coupon yield curve: technical documentation *Bank for International Settlements Working Paper* 25