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Business model of creating digital platform for tokenization of assets on financial markets

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Abstract. The article is devoted to the characterization of a business model for creating a digital platform for tokenization of assets on financial markets. The areas of application of tokenization of assets for financial market participants are considered. The legal framework is given, and the financial model using tokenization of the credit portfolio of a commercial bank is described. A method for calculating the interest rate of a package of tokens composed of tokens of various credits as well as an algorithm for calculating the size of a token for a loan with given PD and LGD parameters is given. It is shown that resulting from application of the proposed financial model, the role of banks in the financial market is changing. The bank emerges as the organizer of the P2P lending market from a traditional credit institution. As a result of this transformation the P2P market receives an additional impetus for development, and the bank increases its level of profitability. A comparison of the levels of profitability, liquidity and reliability of the proposed tools with the traditional instruments for attracting and placing funds is made.

1. Introduction

The traditional financial scheme, according to which all financial institutions operate today, consists of two main actions: attracting funds and placing funds [1, 2]. The margin between the percentage of attraction and the percentage of placement is the income of the financial agent (bank, financial company, fund, etc.). Margin is a source of coverage of the internal cost of a financial institution, which consists of operating costs, and also covers the costs of guaranteed return of attracted funds without any reference to the repayment of funds placed by the financial institution.

Thus, the reduction of the operating expenses and the expenditures of guaranteed return on invested funds represent two main areas that will allow a financial institution to beat its competitors [3]. The traditional (extensive) way to solve these problems is realized through consolidation of financial institutions, automation of all internal and external processes, as well as universalization of services provided to customers. By reducing the cost of expenses, financial institutions cannot reduce it to zero, since the expenses of servicing the portfolio of attracted and placed funds are inextricably linked to the presence of these assets on the balance sheet of the financial institution, and most importantly, losses in lending. The methods of handling bad debts [4] reduce bank losses, but cannot reduce them to zero.

The intensive way of solving these problems is associated with the rejection of the traditional approach to attracting and placing funds. In the new paradigm, the financial institution initiates the P2P lending market [5], organizing it at the initial stage and receiving a certain commission for this service from market participants. The second function of the financial institution in the new model is the implementation of settlements between the participants of the P2P lending market, as well as the resale of requirements in the secondary market.

Analysis of P2P lending platforms.

The most famous platforms include:

Blockchain platform for P2P lending Loanbit [6];

Ethereum-based international P2P lending platform Home Loans [7];

Berlin-based P2P lending platform Bitbond [8];

Russian global decentralized blockchain-platform Karma [9].

The business models of all the listed platforms are generally similar, and imply that the borrower and the lender come together on the platform to conclude a loan. This reduces the expenses at the conclusion of the transaction, but does not solve the investor's problems with the repayment risks, and does not provide the investor with high liquidity of investments.

Relevance of the research topic

The development of a global P2P lending market is inextricably linked with distributed registry technology [10, 11] which provides market participants (banks, investors, borrowers) with the necessary transparency, reliability and security. Experts predict that this market volume can reach $286,000,000,000 by 2020. The widespread introduction of distributed registry technology in financial markets will soon lead to the emergence of a number of platforms that will fundamentally change the rules of the game and lead to the emergence of fundamentally new opportunities. In this regard, today it is important to offer a new business model to the market participants that is qualitatively different from the existing ones and will allow the P2P lending market to move to higher levels of reliability and liquidity.

Purpose of the study

The purpose of this article is to develop a business model of a financial institution based on the universal platform for the tokenization of financial assets. Such a platform should provide a wide range of potential investors with not only an attractive return with high investment reliability, but also a fundamentally new level of liquidity.

Research objectives

The main task is to describe the mechanism of tokenization of the bank's loan portfolio, in which investors in the P2P lending market receive a guaranteed income with a predetermined probability. Of practical interest is the determination of the dependence of the token size on the quality indicators of the tokenized portfolio, as well as the rate of return on the token package.

2. Research method

In order to make the work of a new model of the financial institution efficient, it must provide conditions for P2P lending market participants that would be better than with the traditional model. Let us formulate these conditions:

1. Higher than the traditional deposit rate of return.

2. Higher liquidity of funds than with traditional placement in deposits.

3. Reliability of investments at the level of investments in banks with the Deposit Insurance System (DIS).

Let us consider the technology of the new proposed platform, which will be called the Credit Exchange. The platform consists of two main units: a tokenization unit of the loan portfolio and a trading platform.

The tokenization unit allows to form packages consisting of tokens (parts of the loan agreement) of different borrowers from the loan portfolio. Investore can be used as an example of one of the Russian tokenization platforms [12].

We introduce the notation in accordance with Basel 2–3 [13].

$$PD - \text{probability of default during the year}$$
$$LGD - \text{loss rate at default during the year}$$
$$EAD - \text{amount subject to credit risk during the year}$$
$$P - \text{initial loan amount}$$
$$CF - \text{expected cash flow on the loan during the year}$$
$$EL - \text{expected loan losses during the year}$$

then, $EAD = P + CF = P \cdot (1 + D)$ and $EL = EAD \cdot PD \cdot LGD = P \cdot (1 + D) \cdot PD \cdot LGD$.

Every loan in the Bank's portfolio should have its own indicators *PD*, *LGD*, *EAD*, as well as interest rate *D* according to the requirements adopted in Basel Standard 2-3 [14], as well as in the International Financial Reporting Standard (IFRS) [15], which became mandatory for use since 01.01.2018.

The Basel Committee on Banking Supervision suggests for many asset classes [16] that the banks use the foundation and advanced approaches in calculating the LGD value. The banks have the right to use their own LGD estimates in the context of the advanced approach, while with the foundation approach, the LGD value is fixed [BIS, 2006]. The applicability and accuracy of mathematical models for assessing the Basel II credit risk, including the shares of losses due to default are discussed in [13, 17].

During the tokenization procedure in the described business model, one large loan is divided into many identical tokens with the same quality characteristics of *PD, LGD, D* as a large loan. The terms of cancellation of different loans in the Bank's portfolio, from which the tokenization unit selects tokens to form packages of the same type, parameters *PD, LGD, EAD, D* may differ.

An example of the dependence of the rate of return of three packages consisting of 500 tokens, 2,000 tokens and 1,000,000 tokens at the rate of return of each token at *D* = 10%, the loss rate for each token *LGD* = 45.5%, and provided that the probability of default of each token is independent [18] and equal to *PD* = 3%, is shown in figure 1.
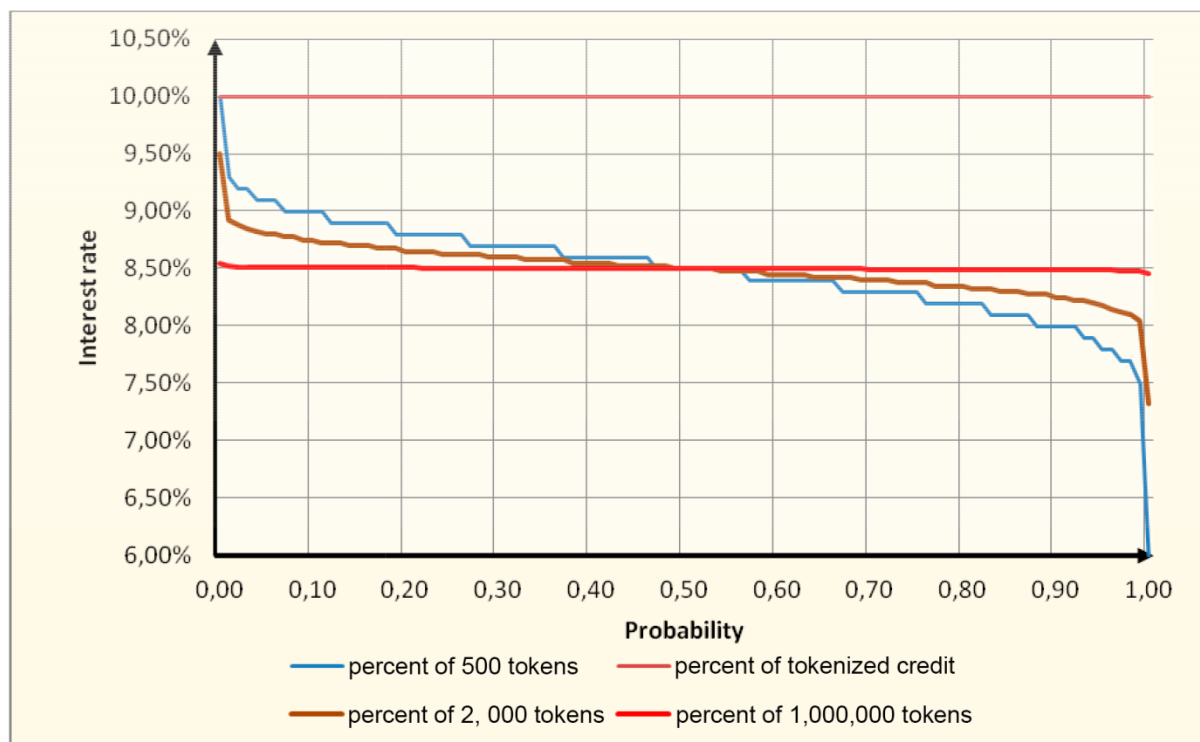

Figure 1. Comparing rates for portfolios with different numbers of tokens.

As the number of tokens in the package increases, the portfolio yield curve tends to a horizontal straight line passing through a yield point of 8.5% corresponding to a probability of 0.5.

The probabilistic rate of return for a package of tokens S, which was obtained from various loans, depends both on the profitability of each of these loans D, and on the LGD level and the probability of default PD and is calculated using the formula $S = D - PD(1 + D)LGD$. For example, taking into account that $LGD = 45.5\%$, $D = 10\%$, $PD = 3\%$, we get $8.5\% = 10\% - 3\%(1 + 10\%)45.5\%$ in figure 1.

We assume that one token from the loan will be sold by the Bank (as part of a package of tokens) through the trading platform for the amount I invested by the investor, and the investor expects to receive an annual yield on his investment equal to DI. Then, the number p of a single token, into which each token credit is divided will be determined by formula (1)

$$p = \frac{I \cdot (1 + DI)}{(1 + D) \cdot (1 - PD) + PD \cdot (1 + D) \cdot (1 - LGD)} = \frac{I \cdot (1 + DI)}{1 + (D - PD \cdot (1 + D) \cdot LGD)}. \tag{1}$$

Accordingly, the number of tokens of size p in a tokenized loan with debt P is $N = P/p$. In case of tokenization of the Bank's loan portfolio, the DI rate is the same for all potential investors. Before the procedure of tokenization and placement of received packages of tokens, the Bank must determine the value of DI so as to ensure the necessary investor demand for the proposed tool.

The value $I - p = \Delta$ is the income or loss of the Bank (depending on the sign) for each loan during the procedure of tokenization of the portfolio and placing packages of tokens through the trading platform. If the rates of tokenized loans D are high compared to the DI rate, and the loans themselves have a low level of PD and LGD, then the Bank receives a positive total value of Δ and can use the funds received to place them in new loans.

It is not profitable for the Bank to be too optimistic about estimating PD, LGD parameters for a tokenized portfolio, as a result, investors can get S profitability below the planned DI level, which will reduce the demand for subsequent allocations of this Bank's tokenized portfolios and increase the level of DI profitability expected by the investor at new placements. In this case, with an unduly pessimistic assessment, investors will receive a return S higher than the one declared at the placement of the level of return DI, which will reduce the level of income of the Bank during the initial offering.

The presence in each package of tokens of more than 10,000 different borrowers allows for a given probability of default PD, a known interest rate D and LGD parameter of each token included in the same type package to get an estimate of the profitability of such S package, as well as an estimate of the probability that the investor who bought the package of tokens will get S yield.

The trading platform allows any participant registered in the system to conduct the operations of buying and selling packages of tokens formed by the tokenization unit during the trading sessions. Registration of rights to packages will be carried out in a distributed registry. The funds transferred by borrowers to the trading platform will be distributed at the end of the term of the credits among investors in accordance with the registered rights to the tokens that made up the package.

All income paid to the Bank on toned loans during the year will be accumulated in the Bank on special accounts, each of which refers to its own token. The rights to balances on these accounts belong to the owners of tokens. Thus, by the expiration of the annual period, a certain amount will be accumulated on the account of each token, which must be paid to the owner of the token. If the tokenized loan is not fully repaid, then a new procedure of tokenization will be carried out on its balance and the resulting tokens of the new issue placed through the trading platform again, and the proceeds received by the owner of the previous token (whose annual validity period has expired). It should be noted that the current value of the parameters PD, LGD, EAD, D will be re-determined with such an arrangement for each credit that has not been repaid and newly tokenized, which makes it possible to determine the size of the new token p.

3. Results

We will compare this business model based on the proposed Credit Exchange platform with the existing business models based on P2P lending platforms, as well as with the traditional banking business model according to the method of [19, 21]. As parameters for comparison, we will use the liquidity of investor investments, the profitability of investor investments, the amount inverse to the risk of default, as well as the reliability of data integrity and security in the system.

The liquidity offered by the business model of the Credit Exchange greatly exceeds this indicator of both the banking business model and the business model of the existing P2P lending platforms. This fact is due to the presence in the Credit Exchange of a trading platform unit that provides on-line access for all participants in the system for buying and selling token packages.

The second advantage of the business model of the Credit Exchange is a high level of profitability for investors. This advantage is also associated with the possibility of prompt resale of assets for short periods.

With respect to protection from default the business model of the Credit Exchange is not inferior to the traditional banking model. However, if the bank has this quality provided by the risk management system, the bank's own capital, as well as the reserves created, in the case of the Credit Exchange a low level of default is achieved as a result of the operation of the tokenization unit of the loan portfolio.

The reliability of data integrity and security in the business model of the Credit Exchange is at the level of other business models using distributed registry technology. This technology, subject to the global distribution of the system, allows obtaining a higher level of reliability than the traditional storage of banking information.

The role of banks changes when using the business model of the Credit Exchange. Banks are left with the function of issuing loans and working with the borrower in the event of a default [20]. After the formation of the loan portfolio, the bank transfers the formed portfolio for tokenization. Due to the sale of the formed packages on the trading floor, the bank returns the funds placed in the credits with the income that under the usual mechanism would be received only after the expiration of the loan agreements. In the case of a borrower whose loan has been tokenized, in default, the bank carries out work on the return of funds based on a smart contract to which each loan token of such a borrower is attached. After receiving funds from the default borrower, the bank, withholding its commission, transfers the funds to the trading platform that distributes them among all investors whose packages contained default borrower tokens, in accordance with the information in the distributed registry.

4. Findings

1. The proposed business model of the Credit Exchange based on the technology of the distributed registry radically changes the nature of the banking business. The bank becomes an intermediary between the investor and the borrower in the P2P market, prepares a portfolio of borrowers for tokenization on the Credit Exchange and works with bad debts.

2. The profitability of the bank when working on a new business model increases significantly due to the tight implementation period of the tokenized portfolio to investors through the trading platform compared with the deadlines of the portfolio, and also the fact that the income from tokenized loans continues to accumulate over the year, creating additional liquidity cushion.

3. Investors who place their funds in the business model of the Credit Exchange through a trading platform receive a higher level of profitability and liquidity compared with the existing market instruments, at a level of reliability not inferior to the traditional deposit in a bank.

4. The Credit Exchange in the proposed business model becomes an independent center for the provision of financial services for tokenization, initial placement and organization of the secondary market, both for creditor banks and for a wide range of investors.

5. Directions for further research

In the next 2 years it is planned to create a digital platform that will implement the principles described. It is planned to model both the operation of the tokenization unit and the trading system on the basis of the created model of the Credit Exchange, in order to identify their performance and reliability parameters under critical load conditions. After the technical solutions are finalized, the industrial operation of the digital platform is expected to start on the basis of one of the large Russian banks.

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