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Business model of creating a digital platform for tokenization of assets in financial markets

Abstract: The possible areas of application of tokenization of assets for financial market participants are considered. The legal construction 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 is given, as well as an algorithm for calculating the size of a token for a loan with given parameters PD and LGD. It is shown that as a result of applying the proposed financial model, the role of the bank in the financial market is changing. A bank from a traditional credit institution is becoming the organizer of the P2P lending market. As a result of this transformation, the P2P market receives an additional impetus to development, and the bank increases its level of profitability. A comparison is made of the levels of profitability, liquidity and reliability of the proposed tools compared with traditional instruments for attracting and placing funds.

Keywords: Distributed registry, Tokenization of assets, Investments, P2P lending, loan portfolio, Basel standard 2-3

Key words.

Distributed ledger, Tokenization of assets, Investments, P2P lending, Debt Instruments.

1. Введение. The traditional financial scheme, according to which all financial institutions work today, consists of two main actions: raising funds and investment of funds [1], [2]. Margin between the percentage of attraction and the percentage of investment is the income of a financial agent (bank, financial company, fund, etc.). Margin is the source of coverage of the internal cost of a financial institution, which consists of transaction expenses, and also covers the costs of guaranteed return of raised funds without reference to the repayment of funds placed by a financial institution.
Thus, the decrease of transaction expenses and costs for guaranteed return of investments are two main areas that will allow the financial institution to leave its competitors behind [13]. The traditional (extensive) way of solving these problems is carried out by consolidating financial institutions, automating all internal and external processes, as well as universalizing the services rendered to clients. Reducing the cost of expenses, financial institutions cannot reduce it to zero, since the costs of servicing the portfolio of raised and invested funds are inextricably

linked with the presence of these assets on the balance sheet of the financial institution, and most importantly - losses in lending. Methods of dealing with troubled debts [14] reduce bank losses, but cannot reduce such losses to zero.

The intensive way to solve these problems is the rejection of the traditional approach to raising and investment of funds. In the new paradigm, a financial institution is the initiator of the P2P lending market [15], organizing it at the initial stage and receiving a certain commission from market participants for this service. The second function of the financial institution in the new model is the implementation of settlements between participants in the P2P lending market, as well as the resale of claims in the secondary market.

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

1. The rate of return is higher than with the traditional deposit.
2. Higher liquidity of funds than with traditional placement to deposits.
3. Reliability of investments at the level of investments to banks with the Deposit Insurance System (DIS).

The development of the global P2P lending market is inextricably linked to distributed ledger technology [16], [17] which provides market participants (banks, investors, borrowers) with the necessary transparency, reliability and security. According to experts' forecasts, by 2020 the volume of this market can reach \$ 286,000,000,000. The widespread introduction of distributed ledger technology in the financial markets will lead in the very near future to the emergence of a number of platforms that will radically change the rules of the game and lead to the emergence of radically new opportunities. Already today, in the market, there are a number of P2P lending platforms in the launch phase. Such platforms include:

- Block-chain platform for P2P lending Loanbit [6];
- International platform of P2P lending Home Loans on the base of Ethereum [7];
- Platform of P2P lending Bitbond based in Berlin [8];
- Russian global decentralized block-chain platform "Karma" [9].

The business models of all these platforms are similar in general and consist in the fact that the borrower and the creditor meet on a platform for concluding a loan. This reduces the transaction costs, but does not solve the investor's problems with the risks of non-return, and also does not provide the investor with high liquidity of investments.

Let us consider the technology of the new proposed platform, which we will call the Credit Exchange. The platform consists of two main blocks: a block of tokenization of the loan portfolio and a trading platform.

The tokenization block allows to generate packages consisting of tokens (parts of the loan agreement) of various borrowers from the loan portfolio. The example of one of the Russian platforms of tokenization is Investore [18].

According to the requirements adopted in Basel standard 2-3 [1], [2], as well as in International Financial Reporting Standard (IFRS) [3], which became mandatory from 01/01/2018, each loan in the Bank's portfolio must have its own indicators *PD*, *LGD*, *EAD*, as well as interest rate *D*.

For many assets classes [4], the Basel Committee on Banking Supervision suggests the banks to use the foundation and advanced approaches when calculating LGD. In the framework of the advanced approach, banks have the right to use their own estimates of LGD, while in the foundation approach the LGD value is fixed [BIS, 2006]. The applicability and accuracy of

mathematical models for estimating the credit risk of Basel II, including the share of losses under default, are discussed in [1], [10].

Let us introduce the notations.

PD - probability of default during the year

LGD - level of losses under default during the year

EAD - amount exposed to credit risk during the year

P - loan amount at the initial moment

CF - expected cash flow for the loan during the year

EL - expected credit losses during the year

Then

$$CF = P \cdot D$$

$$EAD = P + CF = P \cdot (1 + D)$$

$$EL = EAD \cdot PD \cdot LGD = P \cdot (1 + D) \cdot PD \cdot LGD$$

In the process of tokenization, one large loan is divided into many identical tokens possessing the same qualitative characteristics as PD , LGD , D , as for a large loan. The timing of the cancellation of various loans in the Bank's portfolio, from which tokens are selected by the tokenization block to form the same type of packages, the parameters PD , LGD , EAD , D may differ.

We assume that one token from the loan will be sold by the Bank through the trading platform for the amount of I invested by the investor, and the investor expects to receive an annual yield equal to DI for his investment. Then the size p of one token, divided by each tokenized loan with a debt P is determined by the formula

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

Accordingly, the number of tokens of size p in a tokenized loan with a debt P is $N = P/p$. We will answer that when the loan portfolio of the Bank is tokenized, the DI rate is unified for all potential investors. Before the tokenization procedure and investment of received packages of tokens, the Bank must determine the value of DI so as to provide the necessary investor demand for the proposed instrument.

The value of $I - p = \Delta$ is the Bank's income or loss (depending on the sign) for each loan in the process of portfolio tokenization and investment of packages of tokens through the trading platform. If the rates of tokenized loans D are high enough 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 received funds for investment to new loans.

It is not advantageous for the Bank to overestimate the PD , LGD parameters for the tokenized portfolio, because as a result investors can get profitability below the planned DI level, which will reduce the demand for subsequent investment of the Bank's tokenized portfolios and increase the level of the expected DI return on new investments. At the same time, if the assessment is too pessimistic, investors will receive profitability higher than the declared profitability level DI , but will reduce the level of the Bank's income at the initial investment.

The presence in each package of tokens of more than 10.000 different borrowers allows, at a given probability of default of one borrower and a certain interest rate DI of each token included in the same package, to obtain an estimate of the yield of such a package, as well as an

assessment of the probability that the investor who bought the package of tokens will get the expected profitability DI .

A trading platform allows any participant registered in the system to conduct, during trading sessions, the operations of buying and selling packages formed by the tokenization block. The rights to packages are registered in a distributed ledger. At the end of the loan period, the funds transferred by the borrowers to the trading platform are distributed among investors in accordance with the registered rights to the tokens that made up the package.

All income paid to the Bank through tokenized loans during the year is accumulated in the Bank on special accounts, each of which relates to its token. Rights to the balances of these accounts belong to the owners of the tokens. Thus, by the end of the annual period, a certain amount is 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, a new tokenization procedure is carried out on its balance and the newly issued tokens are again placed through the trading platform, and the proceeds go to the owner of the previous token (whose annual expiration date is over). It should be noted that with this investment for each non-repaid and newly tokenized loan, the current value of the PD, LGD, EAD, D parameters is newly determined, which allows to determine the size of the new token p .

Let us compare the offered platform Credit Exchange with existing platforms of P2P lending, as well as with the traditional banking mechanism of raising funds and their further investment to loans. As parameters for comparison we will use: liquidity of investments of the investor, profitableness of investments of the investor, amount reverse to risk of a default, and also reliability of safety and security of the data in system.

The liquidity offered by the Credit Exchange significantly exceeds the traditional banking mechanism, as well as the liquidity of existing P2P lending platforms. This fact is conditioned by the presence in the Credit Exchange of the trading platform block that provides on-line access to all system participants for the purchase and sale of tokens packages.

The second advantage of the Credit Exchange is the high level of profitability provided to investors. This advantage is also associated with the ability to quickly resell assets on short terms.

In terms of security from default, the Credit Exchange is not inferior to the traditional banking mechanism. However, if the bank has this quality provided by the risk management system, the bank's own capital, as well as created reserves, in the case of the Credit Exchange, a low default level is achieved as a result of the work of the tokenization block of the loan portfolio.

The reliability of data security and protection at the Credit Exchange is at the level of other systems using distributed ledger technology. This technology, in case of the global distribution of the system, allows obtaining a higher level of reliability than traditional storage of banking information.

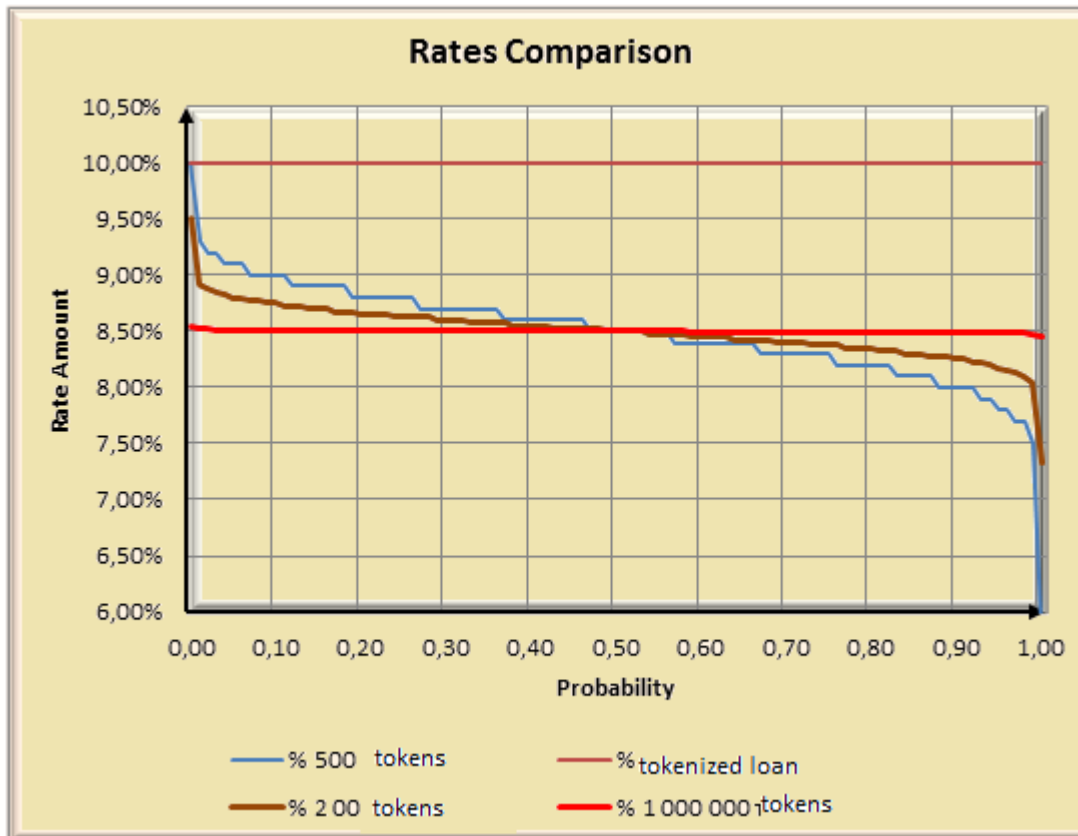
When using the Credit Exchange, the role of banks changes. The banks still have the function of issuing loans and working with the borrower in case of default [20]. After the formation of the loan portfolio and the allocation of borrowers with the same level of default probability, the bank transfers the formed loan portfolio for tokenization. After the realization of the generated packages at the trading platform, the bank returns the funds invested to the credits with the income, which, under the usual mechanism, would only be received after the expiration of the loan agreements.

In case of a borrower whose loan was tokenized, defaulting, the bank will work to return the funds on the basis of a smart contract, to which each credit token of the borrower's credit is associated. After receiving funds from such a borrower, the bank, retaining its commission, transfers funds to the trading platform that distributes them among all investors whose packages contained tokens of the defaulted borrower, in accordance with the information in the distributed ledger.

Conclusions:

1. Distributed ledger technologies radically change the character 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 at the Credit Exchange and works with troubled debts.
2. The bank's profitability under the new scheme significantly increases, which is due to the tight deadline for the implementation of the tokenized portfolio to investors through the trading platform in comparison with the deadlines for the portfolio repayment, as well as the fact that the proceeds from the tokenized loans continue to accumulate on the Bank during the year, creating an additional liquidity cushion.
3. Investors placing their funds through the trading platform receive a higher level of profitability and liquidity in comparison with existing mechanisms at a level of reliability not inferior to the traditional deposit in the bank.
4. The Credit Exchange becomes an independent center for rendering financial services for tokenizing, primary investment and organization of the secondary market, both for the creditor banks and for a wide range of investors.

The example of the dependence of the rate of return on three portfolios consisting of 500 tokens, 2.000 tokens and 1.000.000 tokens with a yield rate of each token of 10% and subject to a probability of a default of a token equal to 3% is shown in the figure.



Comparing rates for portfolios of different numbers of tokens

As the number of tokens in the portfolio increases, the portfolio yield curve tends to a horizontal straight line passing through the point of return equal to 9.25%, corresponding to a probability of 0.5.

According to the Basel 2 standard [1], each loan in the Bank's portfolio should have its *PD*, *LGD*, *EAD* indicators, and interest rate *D*. The probabilistic rate of return of the *S* token portfolio, which was obtained from various loans, depends both on the yield of each of such *D* loans, and from the level of *LGD* and the default probability *PD* and is calculated by the formula $S = D - PD(1 + D)LGD$. For the example in the figure, taking into account $LGD = 45.5\%$, $D = 10\%$, $PD = 3\%$, we get $8.5\% = 10\% - 3\%(1 + 10\%)45.5\%$.

5. Future research directions

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

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