

# Corporate Lending in Overdraft Mode: Determination of Limit and Criteria for Economic Justification

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**Abstract:** For a lending institution, overdrafts to corporate customers are attractive in terms of maintaining bank liquidity and increasing revenues from operating activities. The introduction of this credit service and expansion of its application does not require additional capital investments from the bank, but at the same time enhances its competitive position, since this service can not be provided by non-bank financial services operators, but exclusively by banks, because they act as financial intermediaries and settlement centers. When lending in overdraft mode, the bank has two specific tasks - determining the overdraft limit and assessing the economic soundness of lending in this mode. The problem of the current moment is that the lending banks solve these tasks, based on the administrative approach, often subjective, which does not have a unified economic justification, characterized by the length of the decision-making process for the loan application. This problem does not allow the bank to "put on stream" making decisions on lending in overdraft mode and thus, to give this service speed and mass character. As a solution to this problem, the article proposes a unified methodology for determining the limit and criteria for the correspondence of the corporate client's cash flow to the overdraft regime, which allows the bank to standardize the decision-making process for applications for lending in the form of an overdraft.

**Keywords:** Overdraft, overdraft mode, determination of limit, economic justification, corporate lending, overdraft criteria.

## 1. INTRODUCTION

Overdraft crediting is a loan by a bank to a bank account of a borrower with insufficient or no money on it by paying settlement documents from the borrower's bank account. Bank crediting of the bank account of the borrower in case of insufficiency or lack of money on it is carried out at the established limit (ie the maximum amount for which the specified transaction can be performed) and the period during which the arising credit obligations of the bank customer must be repaid. In the mode of overdraft, both legal entities and individuals can be credited if the relevant condition is provided for by a concluded bank account agreement or a deposit agreement. This article considers an overdraft provided to borrowers - legal entities.

The role of corporate governance in the lending bank is significant. This role includes the procedures for making an economically sound decision (Hsiao-Jung Chen, Kuan-Ting Lin, 2016). They note that even new measure of distance in lending technologies has been introduced: the hierarchical distance calculated as the distance between the branch that originates the loan and the location of the hierarchical level responsible for financing decision.

The lending in overdraft mode, provided to corporate clients of the bank, does not lose its relevance in the domestic market of banking services. Overdraft meets the specific needs of most Russian corporate borrowers. It attracts the customer with ease of use (the client uses overdraft within the usual cash-settlement service), relative cheapness (overdraft interest rate is lower than the rates for urgent loans) and the property of unlimited renewal of the credit limit.

For a lending institution, overdrafts to corporate customers are attractive in terms of maintaining bank liquidity and increasing revenues from operating activities. The introduction of this credit service and the expansion of its application does not require additional capital investments from the bank, but it also increases its competitive position, as this service can not be provided by non-bank financial services operators, but exclusively by banks, because banks function as financial intermediaries and settlement centers.

In the context of unification of decision-making on overdraft crediting, the bank can delegate authority to provide this credit product to its branches and internal structural units, which will increase the efficiency of the bank's work in promoting its services in the market.

## 2. CORPORATE OVERDRAFT: CREDIT PRODUCT CHARACTERISTICS

Overdraft is a kind of a short-term loan provided by a bank to a client to cover a temporary shortage of

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money from a customer by paying payment documents from his settlement account in excess of the actual balance of the account (crediting of the account). In the Chart of Accounts for Accounting in Credit Institutions of the Russian Federation (since 1998), an overdraft means a loan provided with a shortage of funds at the settlement (current) account of the borrower. To account for the balance of credit operations in overdraft mode, the client opens a loan account, which reflects the customer's outstanding debts to the bank. When lending in the form of an overdraft, the amount of the borrower's current debt (debt limit) is limited, the amount of the borrower's total turnover in obtaining cash is not limited. The balance takes into account the amount of the unused overdraft limit.

Leo Onyiriuba (2016) believes that banks have institutionalized the practice of making lending decisions based on cash flow strength of borrowers over time. The recognition that most borrowing causes originate from the borrowers' cash flow timing differences informs the practice. This is especially the case in lending to corporate borrowers. The appeal of cash flow lies in its ability to provide a dependable source of loan repayment. When borrowers are deficient of cash, they tend to default on loans and vice versa. It is therefore essential that credit analysts accurately assess cash flow strength of prospective borrowers as part of their credit analysis memorandum.

Matteo Cotugno, Stefano Monferrà, Gabriele Sampagnaro (2013) note that a strong bank–firm relationship mitigates the degree of financial constraints and, consequently, reduces the probability of bankruptcy.

### 2.1. Provision of Overdraft Services

Providing an overdraft service, the bank credits a gap in the payment turnover of the corporate client. Upon receipt of payment orders from the client within the period agreed upon with the bank for the debiting of amounts exceeding the balance of the funds on the client's settlement account, the bank, not later than the current business day (the day of receipt of the client's payment order), makes payment from customer's account from own funds, i.e. makes crediting of the client's account. At the same time the bank carries out client payments at the expense of the loan provided to the client.

The Bank grants the client a loan in accordance with the procedure and on terms and conditions

stipulated in the special agreement to the client's bank account agreement, within the limit set by the bank - the overdraft limit.

The date of granting the loan is the date the bank makes payment from the customer's account at the expense of its own funds. The bank can make crediting of the client's account within the established limit of debt repeatedly, providing loan amounts - tranches of the loan.

The client is obliged to repay tranches of the loan, observing the following, simultaneously acting, conditions for the urgency of their repayment, which are stipulated in the agreement on lending in overdraft mode:

- 1) not later than the period specified in the agreement (calculated in banking days) from the date of granting the tranche of the loan;
- 2) not later than the expiration of the agreement.

The assessment of the customer's cash flow to the overdraft mode (its economic feasibility), as well as the determination of the debt limit or the overdraft limit, is made by the bank in accordance with the methodology for determining the overdraft limit given below.

### 2.2. Conditions for Granting a Loan in the Mode of Overdraft

When an overdraft is provided, the bank provides for observance of certain basic conditions that may have individual features in different banks (see Table 1):

## 3. CONDUCTING AN ANALYSIS OF THE APPLICATION FOR A LOAN IN OVERDRAFT MODE

Credit records management is carried out in accordance with procedures approved by the creditor bank. The primary procedure can be considered the receipt in the bank of the application form for the provision of this loan product from the client - the potential borrower, as well as other participants in the transaction (guarantors).

Classification of loans by quality categories for the purpose of reservation is carried out in accordance with the internal regulations of the bank assessing the level of financial position of legal entities and the procedure for determining the amount of the reserve for possible losses on loans, as well as in accordance with the

**Table 1: Basic Conditions for Lending in the Mode of Overdraft and the Criteria for their Compliance (for a Conditional Bank)**

| №  | The basic condition                                                                                          | Compliance Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Level of financial position of the client                                                                    | The financial position of the client is defined by the bank as "average" or "good" in accordance with the methodology for assessing the financial status of legal entities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2  | Correspondence of the client's cash flow to his overdraft account in the bank                                | Evaluation of criteria in accordance with the methodology for determining the overdraft limit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3  | The duration of the client's work in the bank until the conclusion of the Agreement on crediting the account | At least 3 calendar months                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 4  | Maximum term of the Agreement                                                                                | - For customers who receive an overdraft for the first time in a bank - not more than 3 months;<br>- In other cases - no more than 6 months                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 5  | Maximum period of use of the loan tranche                                                                    | Not more than 22 banking days.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 6  | Currency of credit                                                                                           | Russian ruble.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 7  | Minimum amount of debt limit                                                                                 | 100 000 (One hundred thousand) rubles                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 8  | Fee for the provision of crediting of the account                                                            | <p>The cost of the service for the client consists of the following main components:</p> <ol style="list-style-type: none"> <li>1. Interest for using the loan: <ul style="list-style-type: none"> <li>- are charged daily as a percentage of the annual on the actual balance of the debt (accounting for all tranches of the loan) for the principal debt at the beginning of the day;</li> <li>- are paid by the client monthly, not later than the last working day of the current calendar month for the entire reporting period (current calendar month). Payment of interest for the last calendar month is made by the Customer no later than the expiration date of the Agreement;</li> </ul> </li> <li>2. Fee for opening a loan account: <ul style="list-style-type: none"> <li>- in the Agreement is indicated in absolute value;</li> <li>- the payment term - at a time within the period established by the Agreement (as a rule, up to 2 working days from the date of signing the Agreement);</li> <li>- the order of payment: is paid by the client with his payment order.</li> </ul> </li> <li>3. Penalty for late fulfillment of obligations by the client (delay in repayment of the principal (tranche of the loan), delay in payment of interest for using the loan, delay in payment of interest for opening a loan account): <ul style="list-style-type: none"> <li>- is charged as a percentage of the amount of overdue debt for each day of delay in payment,</li> <li>- the order of payment - a direct debit.</li> </ul> </li> </ol> |
| 9  | Termination of credit granting                                                                               | <p>The Bank is entitled to terminate the granting of a loan if it reveals:</p> <ul style="list-style-type: none"> <li>- delay in any payment under the Agreement;</li> <li>- delinquency of any payment on another client's credit commitment to the bank;</li> <li>- suspension of operations on the client's account on the basis of a document authorized by the law of the Russian Federation;</li> <li>- availability of a card file of unpaid settlement documents to the account.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 10 | Security                                                                                                     | <p>Conclusion of Surety Agreements:</p> <ul style="list-style-type: none"> <li>- with individuals - the main owners of the client's business, in aggregate being the owners of a controlling stake or a share of the client;</li> <li>- with legal entities - the main owners of the client's business, in aggregate being the owners of the controlling block of shares or the stake of the client.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 11 | Direct debiting of money from customer accounts in the bank                                                  | The client authorizes the bank to independently debit the monetary sums in order to reimburse any overdue debts by agreement from their accounts with the bank. In case of cancellation of debt from a foreign currency account, conversion into Russian rubles is made at the rate of the bank.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 12 | Direct debiting of money from guarantor accounts in a bank                                                   | According to the concluded guarantee contracts, the guarantors authorize the bank to independently write off the monetary sums from their accounts in the bank without further authorization. In case of cancellation of debt from a foreign currency account, conversion into Russian rubles is made at the rate of the bank.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

**Table 2: Types of Receipts to the Client's Account (for Analysis of Compliance with the Overdraft Mode)**

|          | Cash receipts                                                                                                                          | Non-cash receipts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Included | <ul style="list-style-type: none"> <li>- encashment of proceeds;</li> <li>- the proceeds to the cash department of the Bank</li> </ul> | <ul style="list-style-type: none"> <li>- receipts from final (external) customers and customers (proceeds from sales, payment for services rendered);</li> <li>- receipts from payment of bills received by the client as proceeds from sales or fees for services rendered;</li> <li>- receipts for acquiring;</li> <li>- receipts from conversion operations, if the cash flow is generated by foreign exchange earnings.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Excluded | <ul style="list-style-type: none"> <li>- all other cash receipts</li> </ul>                                                            | <ul style="list-style-type: none"> <li>- income from financial activities (obtaining loans and loans, repayment of loans and interest by third parties, repayment of bonds and bills, repayment of money from deposit accounts and payment of interest on them, targeted financing, sale of shares or shares of the client);</li> <li>- proceeds from conversion operations, if the cash flow is generated not by foreign currency earnings (for example, obtaining a foreign currency loan);</li> <li>- receipts related to the increase of own capital (additional contributions of participants to the authorized capital, additional placement of own shares);</li> <li>- receipts from client's settlement accounts in other banks (replenishment of a current account);</li> <li>- receipts from other client's current accounts opened with the bank</li> </ul> |

Regulation of the Bank of Russia "On the procedure for the formation of reserves by credit institutions possible losses on loans, loan and equated debts" dated June 28, 2017 No. 590-P.

The bank's lending department assesses the economic feasibility of providing the credit service and, if the cash flow is in accordance with the overdraft regime, calculates the debt limit in accordance with the methodology for determining the overdraft limit (the methodology is given below).

### 3.1. Data for Analysis on Compliance with the Overdraft Mode

Employee of the Bank's lending department on the basis of statements on the analyzed customer account forms electronic spreadsheets containing data on receipts with indication of calendar dates of receipts for a period of not less than three calendar months<sup>1</sup> preceding the date of consideration of the application. In this case, the cash flow generated by the client's non-core activities is excluded.

The bank's requirements for the accounted and not taken into account receipts to the client's current account are reflected in Table 2.

The employee of the Credit Department draws up a conclusion (professional judgment) about the level of

the client's financial position and guarantors, the qualitative and quantitative characteristics of the customer's cash flow, and concludes that it is possible / impossible to provide the client with an overdraft crediting service.

The prepared conclusion is submitted to the credit committee of the bank for review by the procedure established by the bank.

### 3.2. Procedures for Granting and Repaying a Loan in Overdraft Mode

Loan granting in the regime of overdraft is carried out by concluding an agreement with the client, which is an integral part of the bank account agreement, on the basis of which operations are performed on the client's settlement account. During the validity period of the agreement, the creditor bank grants the client the right to make payments from the account in the absence of sufficient funds on it.

The basis for providing the client with a tranche of the loan by agreement - is the client's payment documents that they have transferred to the bank for execution in the absence of sufficient funds in the settlement account. Such customer payment documents are considered a client's application for a tranche of a loan.

The amount of the loan amount granted (the tranche of the loan) is defined as the difference between the amounts indicated in the client's payment

<sup>1</sup>That will be about 66 working days.

documents for the writing-off of funds from the account accepted for execution and the amount of money held in the account at the end of the business day in which payment documents are executed by the bank, but no more than the difference between the limit of debt - the overdraft limit and the amount of the actual debt of the client for all of the given tranches of the loan (for the principal). When determining the amount of the private loan amount - the tranche of the loan, the amount of money, which is seized in accordance with the current legislation, is not taken into account.

The loan is not granted if there are violations by the client of its obligations that caused the termination of the loan. Also, a loan is not provided for the execution of orders of third parties to write off funds from the account in connection with the performance by the client of their obligations to these persons in accordance with Civil Code of the Russian Federation, as well as in other cases established by law (for example, for execution of collection orders, exposed by tax authorities). The loan is discontinued three business days before the expiry date of the agreement.

Repayment of the customer's debt for the amount of the principal debt (tranches of the loan) is carried out by the client in accordance with the terms specified in the agreement, by his payment order and / or by means of a direct debiting by the bank of funds in the account at the end of the trading day, on this account, but not more than the amount of the debt on the principal amount, the maturity of which expires on the current operational day.

The customer has the right to repay the principal debt ahead of schedule in whole or in part by sending funds from the account or any other of his current account with the bank or other banks.

Each granted tranche of the loan must be fully repaid no later than the term of use established by the agreement. In case of excess of the term of using any tranche of the loan, the loan debt for this tranche of the loan is transferred to the accounts of overdue debts.

The software installed in the bank may provide for automatic:

- provision of loan amounts - tranches of credit
- repayment of loan debts (including overdue loans);
- repayment of interest on interest and other payments (including overdue payments);

- Transfer of overdue debt (for principal and interest for use of the loan) to the relevant accounting accounts.

In the event that the software does not ensure the performance of the above procedures, these actions are carried out on the basis of appropriate orders prepared by the Bank's Lending Office.

### **3.3. Features of Credit Monitoring in the Regime of Overdraft**

The bank's lending department on a monthly basis assesses the economic feasibility of providing the service to the client, and also calculates the debt limit in accordance with the methodology for determining the overdraft limit based on historical cash flow data for prior periods. The results of the analysis are placed in the client's credit profile and can be used by the Bank's Credit Department when considering a new client's application for the provision of a loan product - crediting an account in overdraft mode.

The lending department provides monitoring results to the Bank's Risk Analysis Department. In the rest the monitoring of the credit transaction should be carried out in accordance with the procedure for performing lending operations of legal entities and the procedure for determining the level of credit risks and the amount of the reserve for possible losses on loans to legal entities.

### **4. METHODOLOGY FOR DETERMINING THE LIMIT AND CRITERIA FOR THE ECONOMIC JUSTIFICATION OF THE OVERDRAFT MODE**

The purpose of this method is to calculate an economically justified overdraft limit within the overall objective of credit management, understood as minimizing credit risk while maintaining the necessary profitability of loan operations.

The technique makes it possible to solve two applied problems:

- 1) to give a qualitative assessment of the compliance of the client's cash flow with the overdraft regime (to identify the criteria for its economic justification);
- 2) the quantitative task of determining the overdraft limit.

The proposed method of analysis is objective, as it involves the application of a mathematical model of

calculation, which makes it possible to unify the decision-making process regarding the provision of this credit product to the client.

To describe the quantitative characteristics of our methodology, a statistical method of probability theory is used, with the dominant role of the analysis of the economic essence of the operations being studied.

The automated calculation of the overdraft limit proposed in our methodology can be implemented both with the help of Excel spreadsheets (ie not necessarily a professional programmer) or by writing additional programs on the operational day of the bank by the forces of intra-bank IT departments or creating an independent software product professional programmers.

#### 4.1. Criteria for the Economic Justification of the Overdraft Mode

In the process of analyzing an application for a loan in the form of an overdraft, the creditor bank resolves the task of quantifying the credit risk - the risk of the completion of the transaction, i.e. assessment of uncertainty associated with the possible (likely) failure of the client to fulfill its contractual obligations on time. To meet the overdraft regime, a client must have a stable cash flow and a high level of diversification of incoming payments.

The main statistical indicator of such uncertainty is the coefficient of variation. The coefficient of variation characterizes the relative measure of the deviation of the measured values from the arithmetic mean, and is usually expressed as a percentage. The higher the coefficient of variation, the higher the risk or uncertainty.

Thus, as a criterion for the correspondence of the revenue regime to the customer's settlement account, the overdraft regime considers the actual value of the coefficient of variation ( $v_{\text{fact}}$ ), located in one of two intervals:

- 1)  $v_{\text{fact}} \leq 33\%$  (the collection of receipts to the client's account is uniform, the overdraft limit will be calculated without a correction factor);
- 2)  $33\% \leq v_{\text{fact}} \leq 100\%$  (the aggregate of receipts to the account is not homogeneous, but overdraft crediting is possible within the limit calculated with a decreasing correction coefficient).

As a statistical totality within the framework of the methodology, daily cash flows to the client's settlement account are considered for a period of not less than 60 working days, the variable signs of which are the amounts of daily receipts to the client's settlement account ( $X_i$ ) during this period. The daily amount of proceeds ( $X_i$ ) is determined in accordance with the statement of cash flow statement on the client's current account.

For the quantitative expression of these characteristics, a statistical method is used, with the help of which, according to formula (1), the coefficient of variation of daily receipts of funds to the client's account is determined:

$$v = \sigma / X_{\text{av.}} \times 100\%, \quad (1)$$

where:

$v$  is the coefficient of variation;

$\sigma$  (sigma) - the value of the standard deviation;

$X_{\text{av.}}$  - The average daily value of cash inflow to the client's account.

Within the framework of the present technique, the following iterations are performed (the calculation example is given in Table 3):

1. Determine the amount of daily receipts of funds to the client's current account during the last, for example, 66 working days - ( $X_i$ ) or variants of the characteristic (in statistics, the variant is the value of the feature of the statistical aggregate element) according to the program of the bank's operational day.
2. The value of the average daily cash flow  $X_{\text{av.}}$  is calculated. by the formula of the average arithmetic weighted, where each variant (in this case, the sum of the receipt of funds for each day) is multiplied by its frequency (weight), then the sum of the received products is found and the resulting sum is divided by the volume of the aggregate (the sum of frequencies), which in this case represents the number of working days considered. The calculation formula has the form:

$$X_{\text{av.}} = \sum (X_i \times f) / \sum f, \quad (2)$$

**Table 3: Calculation of the Coefficient of Variation for a Conditional Enterprise Ideal LLC (Criterion  $v_{\text{fact}} \leq 33\%$ )**

| Ideal LLC                                                                                           | Data for 66 working days |     |            | Amount      |
|-----------------------------------------------------------------------------------------------------|--------------------------|-----|------------|-------------|
|                                                                                                     | 20.07.2017               | ... | 19.10.2017 |             |
| Receipts to the current account, $X_i$                                                              | 2 236 000                | ... | 1 705 000  | 114 598 452 |
| $X_{\text{av.}} = 1 736 340$                                                                        | 1 736 340                | ... | 1 736 340  | 114 598 452 |
| $X_{\text{av.}} - \sigma = 1 239 927$                                                               | 1 239 927                | ... | 1 239 927  | 81 835 181  |
| $X_{\text{av.}} + \sigma = 2 232 753$                                                               | 2 232 753                | ... | 2 232 753  | 147 361 723 |
| Mean square deviation $\sigma$ (sigma)                                                              | 496 413                  | ... | 496 413    | XXX         |
| Number of days (frequency), $f$                                                                     | 1                        | ... | 1          | 66          |
| $X_i \times f$                                                                                      | 2 236 000                | ... | 1 705 000  | 114 598 452 |
| $(X_i - X_{\text{av.}})^2$                                                                          | 2,4966E+11               | ... | 9,8221E+08 | 3,1994E+14  |
| $(X_i - X_{\text{av.}})^2 \times f$                                                                 | 2,4966E+11               | ... | 9,8221E+08 | 3,1994E+14  |
| $\sigma^2$                                                                                          | 2,4643E+11               | ... | 2,4643E+11 | XXX         |
| Number of payments per day, $q$                                                                     | 14                       | ... | 16         | 521         |
| $Q_f$                                                                                               | 14                       | ... | 16         | 521         |
| Average daily amount of payments $q$ , pieces                                                       | <b>7,89</b>              |     |            |             |
| Term of using a separate tranche of an overdraft under an agreement $t$ , days                      | <b>10</b>                |     |            |             |
| The coefficient of variation is $v_{\text{fact.}} = \sigma / X_{\text{av.}}$<br>(norm $\leq 33\%$ ) | <b>28,59%</b>            |     |            |             |
| Overdraft calculated limit, rub.                                                                    | <b>5 787 801</b>         |     |            |             |

where:

$X_i$  - daily receipt to the customer's account;

$f$  - number of days of observation (frequency).

The average value of a feature has the property that random deviations of individual values from the main type are repaired in it, and is thus a generalizing characteristic of the considered aggregate on the basis of the amount of daily income.

The obtained value of the average value shows the level of the attribute, referred to the unit of the statistical aggregate (to the amount of daily receipt of funds to the client's current account). At the same time, the same mean value of a characteristic can characterize populations in which variations, or changes in the sign of units of the statistical population, can differ substantially from each other. In connection with this, to characterize the statistical population it is not enough to know the average value of the characteristic, it is also necessary to know the degree of its oscillation.

3. Next, you need to measure the variation of the characteristic, i.e. the change in the values of

daily income in the statistical population under consideration. Due to the fact that each individual value of the characteristic deviates from the average value by a certain amount, the average of the deviations of each individual variant from their average serves as a measure of the variation of the statistical aggregate, for which the standard deviation  $\sigma$  (sigma) is calculated:

$$\sigma = \left[ \frac{\sum ((X_i - X_{\text{av.}})^2 \times f)}{(\sum f - 1)} \right]^{1/2} \quad (3)$$

4. Relative indicator of change in the characteristic - coefficient of variation  $v_{\text{fact}}$ , calculated by the actual values of cash inflow to the client's account (Tables 3, 4):

$$v_{\text{fact.}} = \sigma / X_{\text{av.}} \times 100\% \quad (4)$$

This coefficient shows what percentage of deviations in the average value of the trait. The smaller the value of the coefficient of variation, the more homogeneous the population. In economic statistics, there is a criterion for a homogeneous population. A homogeneous set can be recognized if the coefficient of variation of its characteristics is less than 33% ( $v_{\text{crit.}}$ ).

**Table 4: Calculation of the Coefficient of Variation for a Conditional Enterprise Real LLC (Criterion  $33\% \leq v_{\text{fact}} \leq 100\%$ )**

| Real LLC                                     | Data for 66 working days |     |            |            |
|----------------------------------------------|--------------------------|-----|------------|------------|
| Date                                         | 01.08.2017               | ... | 31.10.2017 | Amount     |
| Receipts to the current account, $X_i$       | 0                        | ... | 70 000     | 11 411 372 |
| $X_{\text{av.}} = 172\,900$                  | 172 900                  |     | 172 900    | 11 411 372 |
| $X_{\text{av.}} - \sigma = 55\,646$          | 56 537                   |     | 56 537     | 3 731 456  |
| $X_{\text{av.}} + \sigma = 290\,154$         | 289 262                  |     | 289 262    | 19 091 288 |
| Mean square deviation $\sigma$ (sigma)       | 116 362                  |     | 116 362    | XXX        |
| Number of days (frequency), $f$              | 1                        | ... | 1          | 66         |
| $X_i \times f$                               | 0                        | ... | 70000      | 11 411 372 |
| $(X_i - X_{\text{av.}})^2$                   | 2,9894E+10               | ... | 1,0588E+10 | 8,9365E+11 |
| $(X_i - X_{\text{av.}})^2 \times f$          | 2,9894E+10               | ... | 1,0588E+10 | 8,9365E+11 |
| $\sigma^2$                                   | 1,3540E+10               |     | 1,3540E+10 | XXX        |
| Number of payments per day, $q$              | 0                        | ... | 1          | 80         |
| Coefficient of variation, $v_{\text{fact.}}$ | 67,30%                   |     |            |            |

= 33%, where  $v_{\text{crit.}}$  is the criterion value of the coefficient of variation for a homogeneous statistical population). The higher the value of the coefficient of variation, the greater the spread and the lower alignment of the investigated values. If the coefficient of variation is less than 10%, the variability of the variation series is considered to be insignificant, from 10% to 20% refers to the average, more than 20% and less than 33% refers to significant, and if the coefficient of variation exceeds 33%, this indicates the heterogeneity of the data of the aggregate. In the above calculation example for Ideal LLC, the coefficient of variation turned out to be equal to 28.59%, which is a criterion for a homogeneous cash flow of the client, which fully corresponds to lending in overdraft mode.

At the same time, the practice of applying this methodology makes it possible to consider the value of  $v_{\text{fact}}$  acceptable for lending, not exceeding 100% with a corresponding proportional reduction in the overdraft limit (see further formula 7). An example of calculating the coefficient of variation and the overdraft limit for this case is considered in Tables 4 and 5 for another conditional borrower Real LLC.

Another mandatory criterion for making a decision to grant an overdraft (giving an indirect confirmation of the maximum value of  $v_{\text{fact.}} \leq 100\%$ ) is a quantitative estimate of the probability of exceeding the amount of daily receipts over the value of the calculated one-day overdraft limit ( $\text{Lim}1$ , in Table 5).

The probability of this event is defined as the value of the integral distribution function with the parameters  $X_{\text{av.}}$  and  $\sigma$ , for all sums of daily receipts large or equal to  $\text{Lim}1$ . (Table 5). In Graph 1, this is the area of the shaded area.

Acceptable values of probabilities greater than 80% can be considered.

As an illustration, Graph 1 shows the probability distribution of daily receipts for the example considered in Table 4.

Applying the above iterations, it is concluded that the mode of payment receipts corresponds to the client's account of the overdraft regime.

Then the practical task of calculating the amount of the overdraft limit is solved.

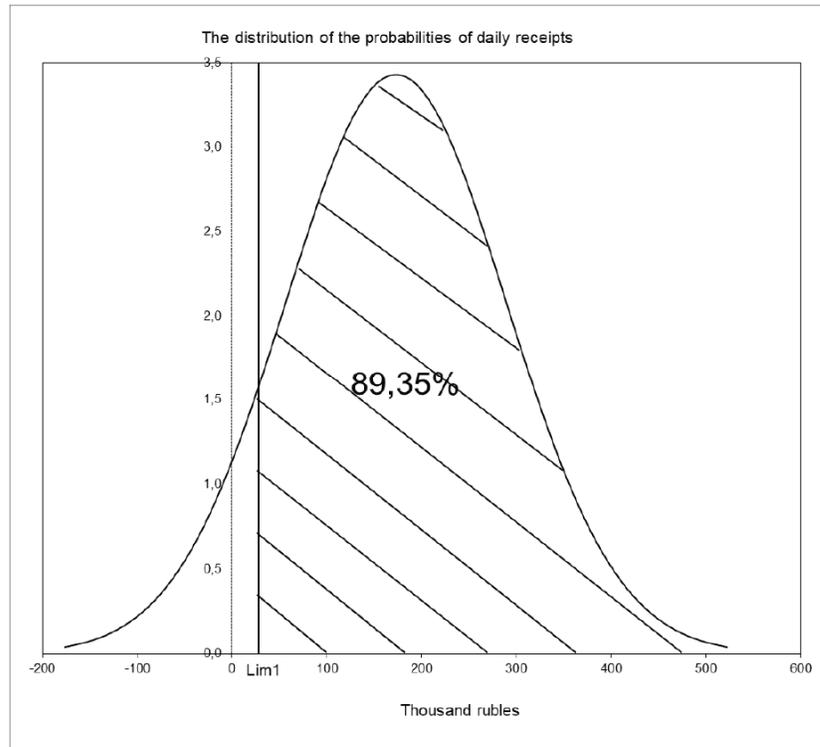
#### 4.2. Determination of the Overdraft Limit

To calculate the overdraft limit, the average amount of the incoming cash flow of the Client is determined during the requested period of use of a separate tranche of the loan:

$$V_{\text{av}} = X_{\text{av.}} \times t, \quad (5)$$

where:

$V_{\text{av.}}$  - average amount of incoming cash flow of the client



**Graph 1:**

$X_{av}$  - average daily value of the receipt of funds to the client's account;

$t$  - the term of using a separate tranche of the loan in days.

For the organization of normal economic turnover, the turnover on credit borrowing should not exceed 1/3 of the customer's total cash flow. Thus, the overdraft debt limit (i.e., the overdraft settlement limit) is determined by the following formula:

$$\text{Estimated Overdraft Limit} = V_{av} \times 1/3 \quad (6)$$

However, this formula (6) is applicable only when the coefficient of variation  $v$  is within the critical value of a homogeneous statistical totality, i.e. is less than 33%. In practice, a loan in the form of an overdraft can be provided even in cases where the aggregate of receipts to the customer's account does not fully correspond to the criterion of a homogeneous totality. This is expressed in the fact that the actually calculated value of the coefficient of variation exceeds the criterion value for a homogeneous totality, i.e. is greater than 33%. Granting an overdraft to a customer whose cash flow can not be considered homogeneous will mean that the creditor bank takes on a higher credit risk.

When a client lends to a client whose aggregate of monetary receipts is not homogeneous by its statistical parameters, the bank must take into account the characteristic of the degree of remoteness of the aggregate of cash receipts to the client's account from the criterion value of the homogeneity of receipts (33%) in order to protect against emerging credit risk. In other words, when an overdraft is provided to a customer whose cash flow is more or less removed from the criterion value of the uniformity of incoming payments, the bank must reduce the limit of the overdraft provided to protect against the credit risk arising in this connection.

The limit of the provided overdraft decreases linearly, where the ratio of the critical value of the homogeneous totality, the coefficient of variation  $v_{crit}$ , equal to 33%, to its actual value  $v_{fact}$ , calculated according to the above method ( $v_{crit}/v_{fact}$ ):

Thus, we obtain the formula (7) for calculating the overdraft limit for the cases when  $33\% \leq v_{fact} \leq 100\%$ :

$$\text{The calculated overdraft limit} = V_{av} \times 1/3 \times v_{crit}/v_{fact}, \quad (7)$$

As an example, Table 5 shows the calculation of the overdraft limit with the repayment period of private loan amounts during the 1 and 22 working days:  $Lim_1$  and  $Lim_{22}$ , respectively.

**Table 5: Calculation of the Overdraft Limit for a Conditional Enterprise Real LLC (Criterion  $33\% \leq v_{\text{fact.}} \leq 100\%$ )**

| Company                                                       | Real LLC                                          |      |
|---------------------------------------------------------------|---------------------------------------------------|------|
| The analyzed period                                           | Data for the period from 01.08.2017 to 31.10.2017 |      |
| Number of working days                                        | 66                                                | days |
| Income to the account for the period                          | 11 411 372,00                                     | rub. |
| Average daily receipt, $X_{\text{av}}$ .                      | 172 899,58                                        | rub. |
| Average daily number of payments, $Q$                         | 1,21                                              | PC.  |
| Standard deviation, $\delta$                                  | 116 362,36                                        | rub. |
| Coefficient of variation, $v_{\text{fact.}}$                  | 67,30%                                            |      |
| Repayment period of the tranche of the loan                   | 1                                                 | days |
| Settlement Limit, $\text{Lim}_1$                              | 28 259,73                                         | rub. |
| Probability (daily receipts > $\text{Lim}_1$ )                | <b>89,35</b>                                      | %    |
| Repayment period of the tranche of the loan                   | 22                                                | days |
| Calculation limit, $\text{Lim}_{22} = \text{Lim}_1 \times 22$ | <b>621 714,05</b>                                 | rub. |

The discrepancy between the statistical characteristics of the client's cash flow to the overdraft mode with sufficient creditworthiness can not be an obstacle for the bank in providing this client with other credit products.

## CONCLUSIONS

When lending in overdraft mode, the bank faces two specific tasks - determining the overdraft limit and assessing the economic soundness of lending in this mode, and not by other methods provided for by domestic banking practice (one-time crediting of funds to the borrower's bank account or opening a credit line).

The problem of the current moment is that the lending banks solve these problems based on the administrative approach, often subjective, which does not have a unified economic justification, and is characterized by the length of the decision on the loan application. This problem does not allow the bank to "put on stream" making decisions on lending in overdraft mode and thus, to give this service speed and mass character.

As a solution to this problem, this article proposes a unified methodology for determining the limit and criteria for the correspondence of the corporate client's cash flow to the overdraft regime, which allows the bank to standardize the decision-making process for applications for lending in the form of an overdraft. To meet the overdraft regime, the customer's cash flow must be stable and characterized by a high level of

diversification of incoming payments. The structure of this article makes it possible to process its text into the internal regulations of the creditor bank that provides the loan product in question.

This methodology can be used by the creditor bank to assess the compliance of the client's cash flow with the overdraft mode and determine the overdraft limit, unless the credit committee of the bank decides on the provision of this service and the amount of the limit individually.

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