








“Prior credit assessment of long-term SME projects with non-standard cash flows”

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PRIOR CREDIT ASSESSMENT OF LONG-TERM SME PROJECTS WITH NON-STANDARD CASH FLOWS

Abstract

Over the past three decades, the relative bank loan demand has changed due to the arising small and medium-sized enterprises (SMEs). Therefore, banks in their operations face the problem of processing an ever-increasing number of loan applications.

The aim of this paper is to develop an auxiliary approach to assessing the prior creditworthiness of long-term SME projects with nonstandard cash flows.

This study reveals how the principles of value-based management can be incorporated into the process of borrower's creditworthiness assessment to improve the process of screening loan applications. For this, the internal rate of return was used as a criterion for loan granting decision at the initial stage of loan underwriting.

An algorithm for the preliminary evaluation of loan applications is proposed and is based on the principle of maximizing the shareholder value of banks. This algorithm helps to define the credit terms taking into consideration the distribution of positive cash flows throughout the project's expected economic life, calculate the possible real effective interest rate concerning the borrower's nonstandard cash flow schedule, make a rough analysis on the economic efficiency of lending and state the necessary criterion to initiate the procedure of loan underwriting for the projects with nonstandard cash flow schedules.

The proposed estimation algorithm stemming from the IRR-approach for the cash flow analysis can also be initially used by a borrower as a tool for credit solvency self-testing via screening of periods with corresponding cash flows that can be used for loan servicing.

Keywords

loan underwriting, credit solvency, value-based management, credit terms

JEL Classification

G21, E51, H81

INTRODUCTION

In the history of economics, SMEs' access to a source of funds such as bank loans has been considered a key factor in economic development (Mills & McCarthy, 2014).

Credit programs launched by commercial banks and other financial institutions right from the outset were designed as an unsecured line of credit to gain access to short-term funding for SMEs. Most businesses are expected to use these funds to support financing for operational expenses like supplies and payroll or increasing inventory. An unsecured line of credit can be used for cyclical businesses as a source of off-season working capital. Such perception of SMEs' financial needs has been prevailing on the credit market for the last three decades. At present, this simplified model cannot

satisfy either an enterprise as a potential borrower, or a bank as a lender just because the nature of the small and medium-sized enterprise has changed significantly (Jagtiani & Lemeux, 2016).

The ever-increasing role of SMEs in the maintaining of sustained growth has transformed the relatively small specific niche of SMEs on the credit market into the proper target group for banks. Nowadays, SMEs need banks not only for short-term credit funding to support financing of operational expenses, as was the case in the past, but also for long-term financing for capital expenses (OECD, 2019). Banks, to meet market requirements, have to adopt standard processes and procedures of corporate lending to the real needs of SMEs taking a cue from the special features of such businesses (Cusmano & Koreen, 2015). In the vast majority of cases, lenders face the problem of the preliminary assessment of the borrower's creditworthiness, based on the analysis of the borrower's projected financial reports (Wasiuzzaman et al., 2019; Caner & Karan, 2012; Polishchuk et al., 2020; Khovrak & Petchenko, 2015; Dubyna et al., 2021) and try to find cash-flows eligible for loan servicing. One of the problems is that in some cases, an SME, as a potential borrower, does not have the indiscrete series of positive cash flows dedicated to loan servicing. The absence of indiscrete series of positive cash flows excludes the possibility of using traditional credit lending models assuming the uninterrupted series of payments related to loan servicing throughout the credit.

The central thesis of this paper is that the problem of the loan underwriting for SME projects with a nonstandard schedule of cash flows can be solved by including the value-based approach in the standard procedure of loan underwriting enabling to design the original credit facilities ensuring the positive economic effect. It was proposed to use the IRR criteria calculated based on the projected expected cash flows reserved by the borrower for the loan servicing in comparison with the lender's cost of capital as a criterion for the loan decision.

This paper is organized as follows. Section 1 outlines the theoretical aspects of the study, examines the basic approaches to assessing creditworthiness, examines how a loan as a bank's financial instrument can be interpreted in the project terms, and discusses the specific value-based methods used to conduct the research and analysis.

Section 2 presents a decision-making algorithm and the results of testing the use of the proposed approach for assessing the borrower's credit solvency, scheduling lending terms and evaluating the bank's credit economic performance. Section 3 discusses the findings, including limitations, advantages and disadvantages of the proposed approach. A conclusion follows in the last section.

1. THEORETICAL BASIS

In the current environment, for countries with economies in transition, bank loans are still the only one source of long-term extraneous funding, especially when it comes to small and medium-sized enterprises. In most cases, banks so far do not treat such enterprises as eligible for medium or long-term lending, especially at the stage of business formation (Koteshov, 2019). At this stage, long-term loans for SMEs are considered by banks as risk-generating unsecured lending products (Page, 2016).

Among the reasons leading to such a conclusion, there is one applied aspect related to the process

of assessing the borrower's creditworthiness. In practical work, this assessment is complicated by the fact that the potential borrower has the nonstandard (unconventional) schedule of cash flows reserved for credit servicing (Kastro & Kulakov, 2016). It means that the projected cash flows proposed by the borrower are represented by the set of different-sized cash flows' values with uneven distribution over time but not the indiscrete series of the positive cash flows sufficient to service loan.

The nonstandard schedule of potential borrower's cash flows earmarked for loan servicing creates for the lender a problem of non-compli-

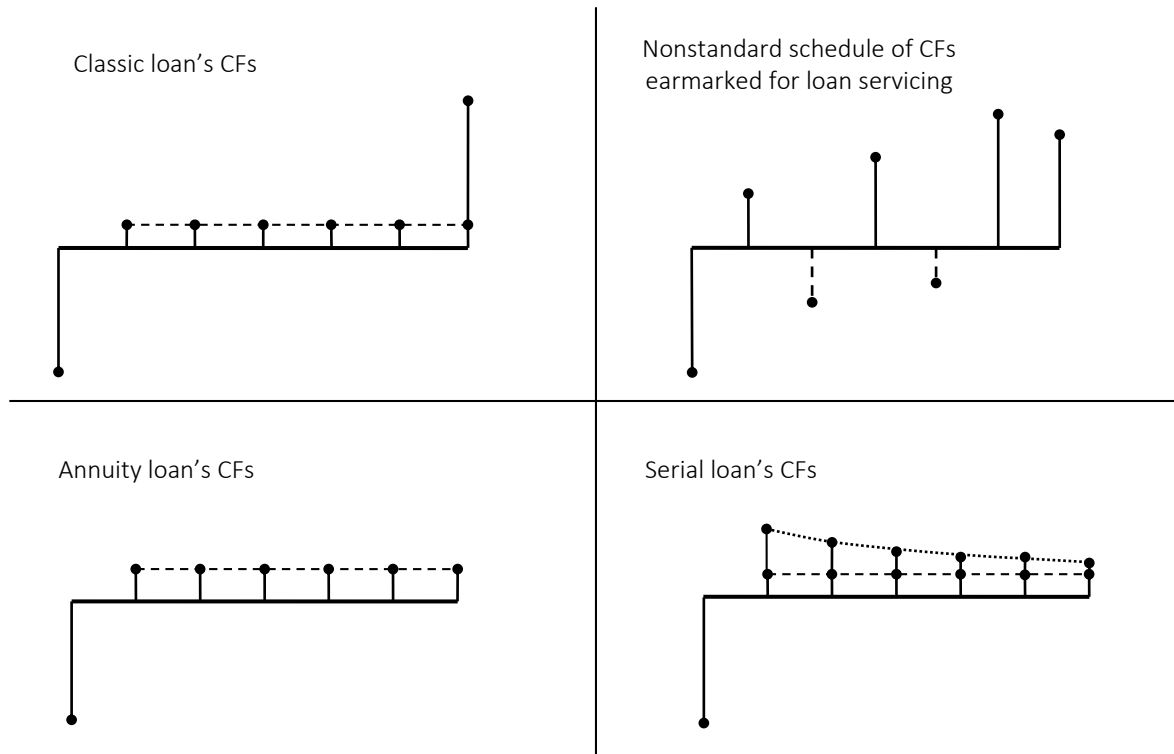


Figure 1. CF schedules

ance of the virtual cash flows with the existing cash flow templates of traditional medium and long-term credit facilities such as an annuity loan, a serial loan or a classic loan with regular interest payments and principal's bullet repayment at the end of the credit term. These traditional long-term credit facilities assume that after receiving a loan, a borrower has to meet debt service obligations on a scheduled basis steadily. Figure 1 shows the discrepancy between the nonstandard schedule of cash flows earmarked for loan servicing and the cash flow templates of traditional long-term credit facilities. Consequently, it can be concluded that traditional medium and long-term credit facilities and standardized credit lending models related to the process of loan underwriting cannot properly work with projects with nonstandard cash flow schedules earmarked for loan servicing.

In response to this problem, this study proposes a new value-based approach to assessing the economic effectiveness of the corporate debt financing with a nonstandard cash flow schedule. This approach is based on the claim that the granting of credit makes economic sense to the lender when this credit generates the positive net present value ($NPV > 0$) as it works for any investment project (Pike & Dobbins, 1988; Koller, 1994).

To transform this educated guess into the applied approach, it is proposed to treat a bank loan as an individual investment project for a lender. Consideration of a bank loan in the context of the investment project analysis showed that a bank loan had all the key features of an investment project (Hurjui & Hurjui, 2008) (Table 1).

The use of value-based analytical tools typical of project evaluation enables to sidestep the

Table 1. Comparison of loan and project terms

Loan terms	Project terms
Principal amount (P) – <i>outflow</i>	Initial costs (IC) – <i>outflow</i>
Loan payments (derivative of credit rate (r) and principal amount (P)) – <i>inflows only</i>	Project CFs – <i>inflows and outflows</i>
Terms of a loan (T)	Terms of a project (T)
Cost of capital for a bank (CoC)	Cost of capital for a project (CoC)

mentioned above institutional limitations of the existing templates of loan servicing and evaluate the economic effect of the corporate debt financing with nonstandard cash flow schedules. It can be done using actual positive cash flows generated by an enterprise over a certain period of its economic life as the cash flows for loan servicing. The projection and evaluation of these expected actual positive cash flows do not distinguish from the procedure that applies to the borrower's solvency and creditworthiness evaluation. In that case, the credit payment schedule is designed by reference to the sequence of enterprise cash flows eligible for credit servicing distributed over a certain period. Such an approach can help determine the loan's terms acceptable to both a lender and a borrower, as well as ensure a positive economic performance for a lender.

The hypothetical case stated below can help analyze the problem. Assume that a commercial bank is intended to start the procedure of loan underwriting. An enterprise as a potential borrower has already supplied the bank with the input data represented by the desired sum of the loan (P) and a nonstandard schedule of cash flows that can be used for loan servicing. This schedule is represented by a set of different-sized (positive, negative and zero value) cash flows with uneven distribution over time but not the indiscrete series of the positive cash flows that are sufficient to service the loan.

Figure 1 shows that the borrower cannot maintain the loan that is typical for the newly established business. Traditional long-term credit facilities and main types of credit lending models related to the process of loan underwriting cannot work with this project just because it has a nonstandard cash flow schedule.

To start the procedure of the loan underwriting, bank has to determine additionally the credit interest rate (r) and the term of credit (T). What is more, both criteria under consideration are interdependent and depend on the proposed potential borrower's schedule of cash flows that are initially earmarked for loan servicing.

Traditionally, a bank establishes the credit interest rate individually for any given loan via adjusting

the basic interest rate previously calculated for traditional *long-term credit facilities* such as an annuity loan, a serial loan or a classic loan (Weth, 2002; Hanweck & Ryu, 2005). In this case, the terms of the loan are initially atypical.

In the case of non-regular cash flows, a bank has to establish the term of the credit (in fact, it has to be the consecutive order or set of cash flows distributed in time) in such a way that the credit hurdle rate ($r_{effective}$) outnumber the cost of capital for the bank (CoC_{bank}) (Driver & Temple, 2010):

$$R_{effective} \geq CoC_{bank}. \quad (1)$$

For the cases when the bank has information about the sum of the loan and cash flows that can be used for loan servicing ($CFs_{reserved}$), the projected credit hurdle rate ($r_{effective}$) can be calculated as the internal rate of return (IRR) for this set of cash flows ($CFs_{reserved}$):

$$r_{effective} \equiv IRR_{CFs_{reserved}}. \quad (2)$$

The calculation of IRR is related to the set of standard procedures commonly used for evaluating investment projects (Brunzel et al., 2013). In this case, it indicates the maximum cost of capital that can be used by a bank for financing of this project where the bank treats the loan as an own investment project and where the project is represented by the sum of credit and cash flows earmarked for loan servicing.

Replacing (2) into (1) makes it possible to formulate a necessary criterion for providing a credit for a borrower with a nonstandard cash flow schedule:

$$\begin{aligned} r_{effective} \equiv IRR_{CFs_{reserved}} \geq CoC_{bank} \Rightarrow \\ \Rightarrow NPV_{credit} > 0. \end{aligned} \quad (3)$$

The omission of this criterion results in the negative value of credits' NPV:

$$\begin{aligned} r_{effective} \equiv IRR_{CFs_{reserved}} \leq CoC_{bank} \Rightarrow \\ \Rightarrow NPV_{credit} < 0. \end{aligned} \quad (4)$$

The importance of this criterion is because the fulfillment of this condition has a positive economic effect on a bank. However, the necessity but not sufficiency of this criterion can be explained by

the competitive market environment where the bank operates. On the one hand, in such an environment, the fitted value of $IRR_{CFs_{reserved}}$ as an equivalent of $r_{effective}$ can be treated as acceptable for the selected bank; on the other hand, it can lead to the situation when this bank experiences implicit losses providing loans with the credit interest rate lower than the prevailing market rate (r_{market}). In this context, there is a need to introduce the sufficient criterion for assessing the lending capacity of a potential borrower:

$$r_{effective} \equiv IRR_{CFs_{reserved}} \geq r_{market}. \quad (5)$$

The above criteria help formulate a two-tier approach to assessing the credit solvency of a potential borrower. At the first level, the lender checks loan application for the internal economic effectiveness (the necessary criterion), and at the second level, the lender checks it again for the comparative market effectiveness (the sufficient criterion). The differentiation of these criteria is to some extent conditional, especially concerning the sufficient criterion. In some specific cases, to get the short-term tactical benefits at the credit market, the bank can afford to keep the credit interest rate lower than it is stipulated by the criteria.

2. RESULTS

The above shows that one of the ways to solve the problem of preliminary evaluation of a loan application for both the lender and the borrower can be the use of some principles of value-based management (VBM). In this light, the IRR criterion calculated for the set of cash flows drawn by a lender from the borrower's proposed pool of cash flows is used as the projected loan hurdle rate. This hurdle rate helps in the process of a comparative study to find whether this loan can bring the expected additional value to the lender. The proposed approach assumes that loan applications are vetted for compliance with (1) the necessary criterion such as the internal economic effectiveness of the loan, and with (2) the sufficient criterion such as the comparative market effectiveness. To achieve this, the algorithm has been developed that helps represent the logical flow of the process. The algorithm has a series of steps as shown in Figure 2.

Step-by-step analysis of the proposed algorithm shows that it contains several scenarios (Table 2).

To check the effectiveness and demonstrate how the proposed algorithm can be used in a real-case scenario to define the loan terms, where the potential borrower's cash flows intended for loan servicing are not regular, the data from Table 3 can be used.

Scenario No. 1. The desired sum of the loan (principal) is UAH 625,000.00.

The bank's cost of capital is 12% p.a., and the prevailing rate on the credit market is 20% p.a.

The results of assessing the lending capacity and calculating the loan terms are presented in Table 4.

As can be seen from this case, the internal economic appropriateness of lending for the selected bank will not occur unless the lender accepts the reserved cash flows for the first five years. What is more, to reach the comparative market effectiveness of lending, this bank has to consider the earmarked cash flows for the first seven years.

In this case, it is assumed that the bank is free to choose the limited set of cash flows that could be used for loan servicing and establish the term of credit respectively. An additional point is that the prospective borrower, having studied the bank's credit offer, can change his attitude to the set of cash flows that were initially earmarked for loan servicing and propose new variants. For example, the borrower can bring a proposal either to reduce the sums of payments at the initial stage and in turn to prolong the term of credit by including the additional cash flows following the initially defined set or to increase the reserved sums of the cash flows for the specific periods (where it is possible) or both. In this case, the bank has to reassess the credit hurdle rate ($r_{effective}$) and make sure that the new interest rate remains eligible, i.e., matches necessary and sufficient criteria.

Scenario No. 7. To illustrate this situation, the input data for the initial case was modified by reducing the fourth cash flow from UAH 226,000 to UAH 120,000. The lending capacity assessment represented in Table 5 indicates that the projected

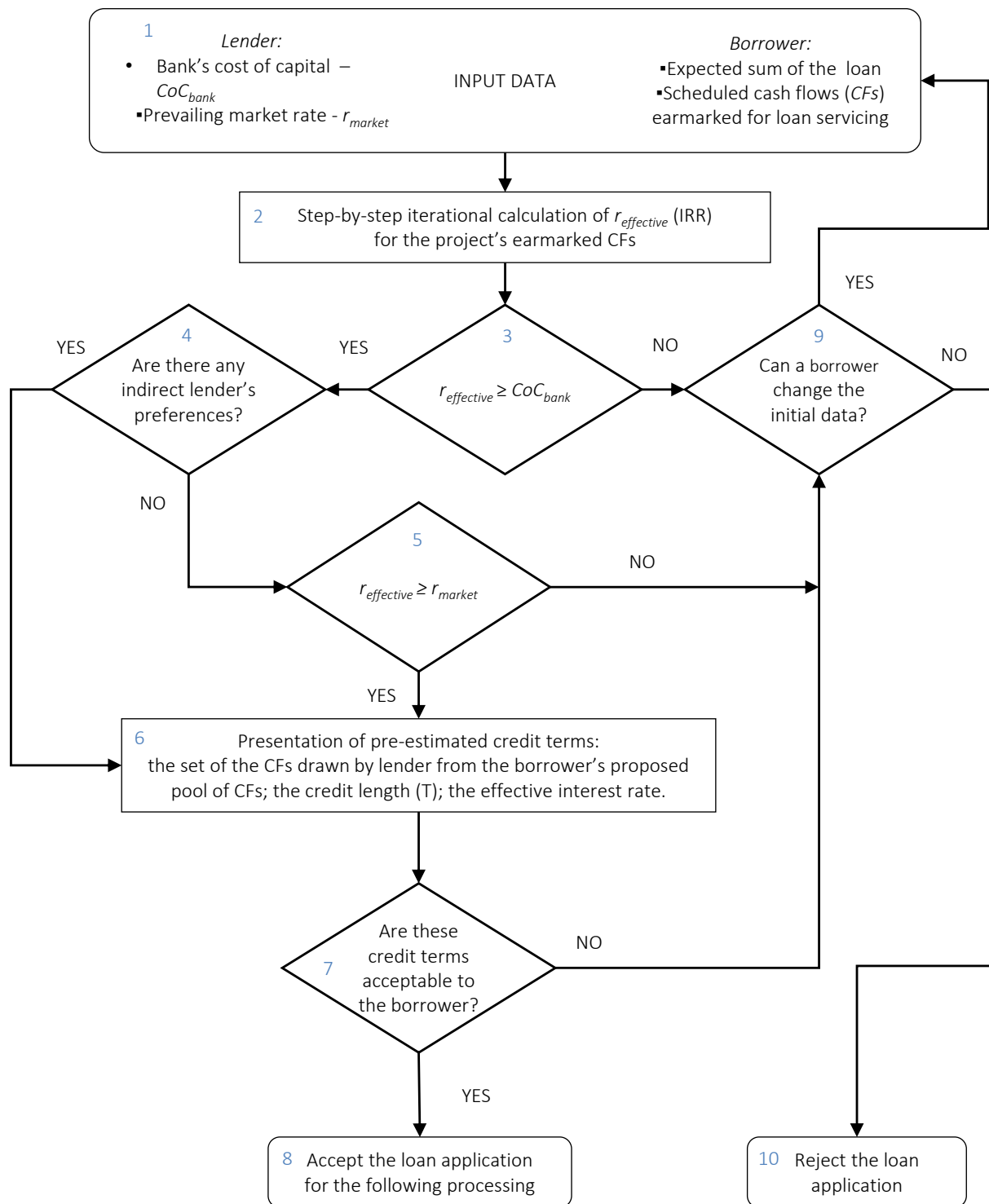


Figure 2. Preliminary evaluation of the loan application

term of credit has to be extended up to the seventh year to grant the internal economic effectiveness of the credit for the bank when the credit hurdle rate (19,92%) outnumbers the cost of capi-

tal for the bank (12%). Besides, the lender can extend the term of credit up to eight years to reach the comparative market effectiveness of the credit (20,04%).

Table 2. Selected scenarios for the realization of the algorithm

No.	Scenario	A sequence of action and interactions
1	1-2-3-4-5-6-7-8	No indirect lender's preferences (4). The potential borrower's data analysis (2) shows that the loan complies with the necessary (3) and sufficient (5) criteria. The preliminary evaluated credit terms (6) are acceptable to the borrower (7). The loan application can be accepted for the following processing (8).
2	1-2-3-4-6-7-8	There are some indirect lender's preferences (4). The potential borrower's data analysis (2) shows that the loan complies with the necessary (3) but not the sufficient (5) criterion. The preliminary evaluated credit terms are acceptable to the borrower (7). A bank experiences implicit losses of value. A loan application can be accepted for the following processing (8) only due to the lender's preferences.
3	1-2-3-9-10	No indirect lender's preferences (4). The potential borrower's data analysis (2) shows that the loan does not comply with the necessary criterion (3). The potential borrower is not ready to change the initial data (9). A bank experiences direct losses of value. The loan application must be rejected (10).
4	1-2-3-4-5-9-10	No indirect lender's preferences (4). The potential borrower's data analysis (2) shows that the loan complies with the necessary (3) but not the sufficient criterion (5) and the potential borrower is not ready to change the initial data (9). A bank experiences direct losses of value. The loan application must be rejected (10).
5	1-2-3-4-5-6-7-9-10	No indirect lender's preferences (4). The potential borrower's data analysis (2) shows that the loan complies with the necessary (3) and sufficient (5) criteria, but the preliminary evaluated credit terms (6) are unacceptable to the borrower (7), and the last one is not ready to change anything (9). A bank experiences direct losses of value. The loan application must be rejected (10).
6	1-2-3-4-6-7-9-10	There are some indirect lender's preferences (4). The potential borrower's data analysis (2) shows that the loan complies with the necessary (3) but not the sufficient criterion (5). The preliminary evaluated credit terms are unacceptable to the borrower (7), and the last one is not ready to change the initial data (9). A bank experiences direct losses of value. The loan application must be rejected (10).
7	1-2-3-4-5-6-7-9-1-2-3-4-5-6-7-8	No indirect lender's preferences (4). The potential borrower's data analysis (2) shows that the loan complies with the necessary (3) and sufficient criteria (5) but the preliminary evaluated credit terms (6) are unacceptable to the borrower (7). The potential borrower is ready to change the initial data (9) and do it (1). The potential borrower's updated data analysis (2) shows that the loan complies with the necessary (3) and sufficient (5) criteria. The preliminary re-evaluated credit terms (7) are acceptable to the borrower (7). The loan application can be accepted for the following processing (8)
8	1-2-3-4-6-7-9-1-2-3-4-6-7-8	There are some indirect lender's preferences (4). The potential borrower's data analysis (2) shows that the loan complies with the necessary (3) but not the sufficient (5) criterion. The preliminary evaluated credit terms are unacceptable to the borrower (7). The potential borrower is ready to change the initial data (9) and do it (1). The potential borrower's updated data (2) analysis shows that the loan complies with the necessary (3) but not the sufficient criterion (5). The preliminary re-evaluated credit terms (7) are acceptable to the borrower (7). Bank experiences implicit losses of value. The loan application can be accepted for the following processing (8) only due to the lender's preferences.

Table 3. Cash flows planned by a potential borrower for loan servicing

Period (t)	Cash flow (CF _t), UAH
0	-625,000.00
1	0.00
2	0.00
3	328,356.00
4	226,000.00
5	520,095.00
6	0.00
7	595,020.00
8	12,600.00

Table 4. Numerical illustration: Lending capacity assessment and loan terms calculation for the case when the potential borrower's cash flows intended for loan servicing are not regular

Data			Criteria for loan granting	
			Necessary criterion	Sufficient criterion
			The internal economic effectiveness of the credit	The comparative market effectiveness of the credit
			IRR of project's reserved CFs \geq Bank's CoC?*	IRR of project's reserved CFs \geq $r_{\text{market}}?$ **
Period (t), year	Project's cash flow (CF), UAH	IRR of project's reserved CFs	Eligibility threshold check	
0	-625,000.00	-	-	-
1	0.00	-	-	-
2	0.00	-	-	-
3	328,356.00	-19.31%	NO	NO
4	226,000.00	-3.45%	NO	NO
5	520,095.00	14.03%	YES	NO
6	0.00	14.03%	YES	NO
7	595,020.00	21.93%	YES	YES
8	12,600.00	22.03%	YES	YES

Note: * Bank's cost of capital = 12% p.a. ** Prevailing market rate = 20% p.a.

Table 5. Numerical illustration: Lending capacity assessment and loan terms calculation for rearranged cash flows

Data			Criteria for loan granting	
			Necessary criterion	Sufficient criterion
			The internal economic effectiveness of the credit	The comparative market effectiveness of the credit
			CFs \geq Bank's CoC?*	IRR of project's reserved CFs \geq $r_{\text{market}}?$ **
Period (t), year	Project's cash flow (CFt), UAH	IRR of project's reserved CFs	Eligibility threshold check	
0	-625,000.00	-	-	-
1	0.00	-	-	-
2	0.00	-	-	-
3	328,356.00	-19.31%	NO	NO
4	120,000.00	-9.64%	NO	NO
5	520,095.00	11.12%	NO	NO
6	0.00	11.12%	NO	NO
7	595,020.00	19.92%	YES	NO
8	12,600.00	20.04%	YES	YES

Note: * Bank's cost of capital = 12% p.a. ** Prevailing market rate = 20% p.a.

3. DISCUSSION

The purpose of this study is to develop a new approach to solving the problem of SMEs' loan underwriting, including scheduling loan terms in the case when a potential borrower has a non-standard schedule of cash flows intended for servicing the loan. In response to this problem, an algorithm was developed that helps represent the logical flow of the process when a loan is treated as the bank's investment project and applied the value-based analytical approach typical of project

evaluation to the assessment of credit's economic appropriateness.

The findings of this study suggest that the use of the proposed decision-making algorithm, in connection with the internal rate of return as a criterion for loan granting decision at the initial stage of loan underwriting allows: (1) eliminating the limitation, which is common to the main types of credit lending models where the occurrence of the indiscrete series of positive cash flows to serve debt is a must; (2) simplifying the process of credit

pre-screening at the bank using a minimum number of essential parameters.

Although the main object of this study is the process and procedures for assessing the credit solvency of long-term SME projects with nonstandard cash flows, the proposed approach can be widely used for any credit lending models without any of the above stipulations.

Application of the proposed algorithm gives the lender the opportunity:

- to define the credit terms taking into consideration the distribution of positive cash flows throughout the project's expected economic life;
- to calculate the possible real effective interest rate concerning the borrower's nonstandard cash flow schedule;
- to make a rough analysis on the economic efficiency of lending and state the necessary criterion to initiate the procedure of loan underwriting for the projects with nonstandard cash flow schedules where the calculated hurdle rate represented by IRR outnumbers the lender's cost of capital;
- to state the sufficient criterion to perform

the procedure of loan underwriting where the calculated hurdle rate represented by the IRR value outnumbers the market prevailing or corporate recommended credit interest rate.

An additional point is that the proposed estimation algorithm stemming from the IRR-approach for the cash flow analysis can also be initially used by a borrower as a tool for credit solvency self-testing via screening of periods with corresponding cash flows that can be used for loan servicing. Hence, the proposed decision-making algorithm can also be treated as an attempt to use some elements of financial engineering to create distinct credit products that tailor the terms of a loan to the borrower's needs.

The findings in this study are subject to some limitations. First, it is intentionally supposed that a bank as a lender is ready to accept and use the value-based principles of credit management in practical work. Secondly, it is assumed that a borrower can work out the schedule of cash flows earmarked for loan servicing on his own. In this case, the lender has to recheck the borrower's estimates and create its long-time forecast of the borrower's creditworthiness and liquidity based not only on the declared by borrower's cash flows but also on all cash flows adjusted for risk that can be used for loan servicing from the lender's perspective.

CONCLUSION

The main purpose of this study was to modify the existing methodology for assessing the prior credit solvency in relation to long-term SME projects with nonstandard cash flows, which makes it possible to use the standard pre-defined input data for assessing credit solvency and provide the decision rule for making tentative decisions.

The investigation of the standard approach to assessing the credit solvency has shown that in some cases loan application can be rejected by procedural technicalities, since there are inconsistencies between the nonstandard schedule of cash flows earmarked for loan servicing by a prospective borrower and the cash flow templates of traditional long-term credit facilities.

This study shows that credit rating work practices can be improved by including additional assessment criteria related to the principles of value-based management in the process.

The findings of this study suggest that the tools typical of project evaluation can be used for this purpose. Overall, this study strengthens the idea that the use of the internal rate of return as an assessment criterion for the project's expected cash flows earmarked for loan servicing can help banks to improve the process of screening loan applications.

Thus, the paper proposes a new decision-making algorithm, which allows a lender to assess the loan application acceptability for the following processing.

This algorithm aims to determine a borrower's credit solvency, set lending terms and tailor the terms of a loan to the borrower's needs if or when necessary, allowing the achievement of at least a minimum level of economic efficiency for the lender.

AUTHOR CONTRIBUTIONS

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Formal analysis: Serhii Onikiienko, Alla Ivashchenko.

Funding acquisition: Yevheniia Polishchuk.

Investigation: Serhii Onikiienko, Alla Ivashchenko, Anna Kornyliuk.

Methodology: Serhii Onikiienko, Alla Ivashchenko, Anna Kornyliuk.

Project administration: Serhii Onikiienko, Yevheniia Polishchuk.

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Validation: Anna Kornyliuk.

Visualization: Serhii Onikiienko, Alla Ivashchenko, Nazar Demchyshak.

Writing – original draft: Yevheniia Polishchuk, Anna Kornyliuk.

Writing – reviewing & editing: Serhii Onikiienko.

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