

INTEGRAL ASSESSMENT OF BORROWER CREDITWORTHINESS IN DECENTRALIZED FINANCE BASED ON ON-CHAIN DATA: MODEL AND EMPIRICAL VALIDATION

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Abstract. *This article examines the problem of assessing borrowers' creditworthiness in decentralized finance (DeFi), taking into account the limitations of the traditional approach, which relies primarily on the Loan-to-Value (LTV) ratio. It is argued that liquidation risk in DeFi is multifactorial in nature and is shaped not only by position parameters but also by the borrower's behavioral characteristics, network exposures, and market conditions. An integrated approach to creditworthiness assessment based on on-chain data is proposed, which allows for the consideration of transparent and real-time indicators of user activity and market conditions.*

A mathematical model of the integrated creditworthiness index (IC) has been developed, which involves normalization, hybrid weighting (using the entropy method and an expert approach), and the aggregation of indicators across five risk domains. An empirical test based on a simulation sample parameterized according to DeFi protocols confirmed the superior discriminatory power of the IC index compared to traditional models. The results obtained demonstrate the feasibility of using integrated multifactor models to improve the effectiveness of credit risk management, as well as their potential for implementation in smart contract logic and the risk management practices of DeFi protocols.

Keywords: *decentralized finance (DeFi), creditworthiness, on-chain data, liquidation risk, Loan-to-Value (LTV), composite index, scoring, risk management, smart contracts, financial analytics.*

Liquidation risk in decentralized finance is commonly assessed through collateral ratios, most notably the loan-to-value (LTV) metric. While operationally convenient, this approach captures only a narrow dimension of credit risk and overlooks behavioral patterns of borrowers, market liquidity conditions, and network interdependencies inherent to composable DeFi protocols. As a result, risk differentiation based solely on LTV may remain incomplete under volatile market regimes.

This study introduces a multidimensional framework for assessing borrower creditworthiness using observable on-chain data. The proposed Integral Creditworthiness Index (IC) combines five analytically distinct components: collateral structure and diversification, buffer to liquidation (health factor dynamics), borrower repayment discipline, exposure to interconnected protocols, and execution frictions affecting liquidation outcomes (including collateral volatility, DEX liquidity depth, and transaction costs). Indicators are normalized and aggregated through a hybrid weighting scheme that integrates expert

calibration with entropy-based adjustments, allowing the index to retain economic interpretability while reflecting data-driven variability.

Empirical assessment is performed on a structured simulation panel ($n = 600$) calibrated to the mechanics of Aave and Compound lending protocols. Out-of-sample results indicate that the IC index improves discrimination of liquidation events relative to the baseline LTV specification ($AUC = 0.764$ versus 0.683). Logistic estimation shows a stable inverse association between index values and realized liquidation probability. Under stress scenarios involving collateral price shocks (-10% , -20% , -30%), the index produces consistent stratification of risk groups, supporting its internal coherence.

The contribution of the study lies in formalizing behavioral and network determinants within a composite metric compatible with smart-contract implementation. The framework may be applied to risk-based borrowing constraints, dynamic collateral adjustments, and early-warning mechanisms embedded directly into DeFi protocol logic.

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