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Algorithmic Credit, Digital Financial Literacy, and Institutional Safeguards: Evidence from Digital Lending Adoption in an Emerging Market

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Abstract

The rapid expansion of digital lending platforms and algorithmic credit scoring systems has reshaped access to credit in emerging market economies. While algorithmic credit is widely promoted as a driver of financial inclusion, growing evidence suggests that expanded access does not necessarily translate into improved borrower welfare. This study examines how algorithmic credit adoption influences borrower financial outcomes and investigates the moderating roles of digital financial literacy and institutional safeguards in an emerging market context. Guided by financial inclusion theory, behavioral finance, and institutional governance perspectives, the study employs a quantitative, cross-sectional research design using primary survey data from adult users of digital lending platforms. Descriptive statistics, correlation analysis, multiple regression, and moderation analysis were applied to examine the effects of algorithmic credit adoption on repayment behavior, perceived financial stress, and financial resilience, as well as the conditional roles of borrower capability and governance mechanisms. The results revealed that algorithmic credit adoption is significantly associated with improved repayment behavior and enhanced short-term financial resilience, but also with increased perceived financial stress among borrowers. Importantly, digital financial literacy significantly strengthened positive financial outcomes and mitigates stress-related effects, while institutional safeguards further moderate these relationships by enhancing transparency, accountability, and consumer protection. These findings indicate that the welfare effects of algorithmic credit are conditional rather than uniform. The study contributes to the digital finance and financial inclusion literature by demonstrating that algorithmic credit systems are neither inherently inclusive nor inherently harmful. Instead, their impact depends critically on the interaction between technological adoption, borrower capability, and institutional governance. The findings underscore the importance of integrating digital financial education and robust regulatory safeguards into fintech-driven financial inclusion strategies to promote sustainable and responsible digital lending in emerging markets.

Keywords: algorithmic credit; digital lending; digital financial literacy; financial inclusion; institutional safeguards; fintech governance; borrower financial outcomes; financial resilience; consumer protection; emerging markets

INTRODUCTION

The rapid expansion of digital financial services has fundamentally transformed credit markets in emerging economies. Advances in artificial intelligence (AI), machine learning, and big data analytics have enabled digital lending platforms to deploy algorithmic credit scoring systems that rely on alternative data sources, automated decision-making, and real-time behavioral information (Berg et al., 2020; Kou et al., 2021; Li et al., 2024). These technologies are widely promoted as tools for advancing financial inclusion by reducing information asymmetries and lowering the cost of credit provision for individuals who lack formal credit histories (Demirgüç-Kunt et al., 2022; World Bank Group, 2024).

In recent years, digital lending adoption has accelerated sharply in emerging markets, driven by high mobile phone penetration, widespread use of electronic wallets, and policy initiatives encouraging fintech innovation (World Bank, 2020; BSP, 2023). Central banks and financial regulators increasingly frame algorithmic credit as a mechanism to expand access to formal finance, particularly for

informal workers, micro-entrepreneurs, and first-time borrowers (Ozili, 2023). Empirical studies indicate that AI-enabled credit scoring can improve loan approval rates and repayment prediction accuracy, thereby increasing credit availability at scale (Berg et al., 2020; Li et al., 2024).

Despite these potential benefits, a growing body of literature cautions that expanded access to algorithmic credit does not necessarily translate into improved borrower welfare. While digital lending platforms offer speed and convenience, they are also associated with short repayment cycles, repeated borrowing, and limited transparency in credit decision-making (Gabor & Brooks, 2017; Ozili, 2023). Evidence from emerging markets suggests that such features may exacerbate borrower over-indebtedness and financial stress, particularly among users with limited financial capability or weak consumer protection (Demirgüç-Kunt et al., 2022; World Bank Group, 2024).

Contemporary financial inclusion scholarship increasingly emphasizes that access alone is an inadequate measure of inclusion quality. Rather than focusing solely on account ownership or credit availability, recent frameworks stress the importance of financial well-being, resilience, and consumer protection as core outcomes of inclusive finance (Demirgüç-Kunt et al., 2022). Within this perspective, digital financial literacy has emerged as a critical determinant of how individuals engage with fintech products. Digital financial literacy extends traditional financial knowledge to include competencies related to digital interfaces, electronic contracts, interest calculation, data privacy, cybersecurity, and awareness of algorithmic decision-making (Lusardi et al., 2021; OECD, 2023).

Empirical evidence consistently shows that individuals with higher levels of financial and digital literacy exhibit more prudent borrowing behavior, stronger repayment discipline, and greater financial resilience (Morgan et al., 2020; Hasan et al., 2022). In digital lending contexts, borrowers with limited digital financial literacy may underestimate repayment obligations, misunderstand loan pricing, or engage in repeated borrowing that amplifies financial stress (Ozili, 2023). These findings suggest that borrower capability is a central mediating condition in determining whether algorithmic credit contributes to financial inclusion or financial precarity.

Beyond individual capability, the institutional environment in which digital lending operates plays a decisive role in shaping borrower outcomes. Institutional safeguards, including transparency requirements, standardized disclosures, grievance redress mechanisms, and regulatory oversight, are essential in mitigating information asymmetries and power imbalances inherent in algorithmic credit systems (OECD, 2023; World Bank Group, 2024). The opacity of AI-driven credit models and the limited explainability of automated decisions raise concerns regarding fairness, accountability, and consumer protection (Kleinberg et al., 2018). Weak institutional safeguards may expose borrowers to predatory practices and restrict their ability to contest unfavorable credit decisions.

Although prior studies have examined algorithmic credit, digital financial literacy, and fintech governance independently, empirical research integrating these dimensions within a single analytical framework remains limited, particularly in emerging market contexts. Much of the existing literature focuses either on the predictive performance of algorithmic models or on descriptive patterns of fintech adoption, without systematically examining how borrower capability and institutional safeguards condition financial outcomes (Kou et al., 2021; Ozili, 2023). This fragmentation constrains the development of evidence-based policies that align technological innovation with consumer protection and financial capability development.

Addressing this gap, the present study examines the relationship between algorithmic credit adoption and borrower financial outcomes, specifically repayment behavior,

perceived financial stress, and financial resilience, within an emerging market context. Building on financial inclusion theory, behavioral finance, and institutional governance perspectives, the study further investigates whether this relationship is conditioned by borrowers' levels of digital financial literacy and the strength of institutional safeguards governing digital lending platforms. By adopting this integrated analytical perspective, the study seeks to provide empirical evidence on the conditions under which algorithmic credit contributes to sustainable and responsible financial outcomes, rather than merely expanding access to credit.

By integrating technological, behavioral, and institutional perspectives, this study contributes to the financial inclusion and digital finance literature by moving beyond access-based evaluations and providing empirical evidence on the conditions under which algorithmic credit promotes sustainable and responsible financial outcomes.

Research Questions. The rapid expansion of digital lending platforms and algorithmic credit scoring systems has intensified scholarly and policy debates regarding their implications for borrower welfare in emerging market economies. While algorithmic credit is often promoted as a mechanism for expanding financial inclusion, empirical evidence suggests that its outcomes are highly contingent on borrower capability and the institutional environment in which digital lending operates. In response to these concerns, this study seeks to systematically examine the effects of algorithmic credit adoption on borrower financial outcomes, while explicitly accounting for the roles of digital financial literacy and institutional safeguards. Guided by this objective, the study addresses the following research questions:

1. How does algorithmic credit adoption influence borrower financial outcomes in terms of repayment behavior, perceived financial stress, and financial resilience in an emerging market context?
2. What is the level of digital financial literacy among digital loan users, and how is it associated with borrower financial outcomes?
3. How do institutional safeguards in digital lending platforms relate to borrower financial outcomes?
4. Does digital financial literacy significantly moderate the relationship between algorithmic credit adoption and borrower financial outcomes?
5. Do institutional safeguards significantly moderate the relationship between algorithmic credit adoption and borrower financial outcomes?

By addressing these research questions, the study advances existing financial inclusion and digital finance literature by moving beyond access-based evaluations of fintech adoption. The questions provide a coherent analytical structure that links algorithmic credit adoption to borrower financial outcomes through the dual lenses of individual capability and institutional governance. In doing so, the study offers empirically grounded insights that are relevant to scholars, policymakers, and practitioners concerned with the design of inclusive, responsible, and sustainable digital lending ecosystems in emerging markets.

LITERATURE REVIEW

Algorithmic Credit and Digital Lending Systems. Algorithmic credit refers to the application of artificial intelligence (AI), machine learning, and advanced data analytics in evaluating borrower creditworthiness through automated decision-making processes. Unlike traditional credit assessment models that rely heavily on formal credit histories and collateral, algorithmic credit systems integrate alternative data sources such as mobile phone usage, e-wallet transactions, online behavioral patterns, and digital footprints (Berg et al., 2020; Kou et al., 2021). This technological shift has enabled digital lending platforms to rapidly scale credit

provision, particularly in emerging market economies characterized by large unbanked and underbanked populations.

A growing body of empirical research highlights the efficiency gains associated with algorithmic credit adoption. Studies demonstrate that AI-enabled credit scoring improves predictive accuracy, reduces default risk, and lowers operational costs relative to conventional lending models (Berg et al., 2020; Li et al., 2024). These advantages have positioned algorithmic credit as a central instrument in fintech-driven financial inclusion strategies. However, scholars caution that efficiency gains and access expansion do not necessarily equate to positive borrower welfare outcomes (Gabor & Brooks, 2017; Ozili, 2023).

Recent literature increasingly interrogates the distributional and behavioral consequences of digital lending. While algorithmic credit may facilitate short-term liquidity and smoother consumption, evidence suggests that rapid loan disbursement, frequent borrowing cycles, and automated repayment mechanisms may exacerbate over-indebtedness and psychological stress among borrowers (Demirgüç-Kunt et al., 2022). Furthermore, the opaque nature of many algorithmic decision systems raises concerns regarding fairness, accountability, and explainability, particularly when borrowers lack the capacity to contest or understand automated credit decisions (Kleinberg et al., 2018; Trotta & Gnan, 2024).

Digital Financial Literacy and Borrower Capability. Digital financial literacy has emerged as a critical extension of traditional financial literacy in increasingly digitized financial ecosystems. It encompasses not only knowledge of basic financial concepts such as interest rates and repayment schedules, but also competencies related to digital interfaces, electronic contracts, data privacy, cybersecurity, and algorithmic awareness (Lusardi et al., 2021; OECD, 2023). As financial services migrate to digital platforms, the ability to navigate and interpret digital financial products has become central to effective financial decision-making.

Empirical studies consistently find that higher levels of financial and digital literacy are associated with improved borrowing behavior, stronger repayment discipline, and enhanced financial resilience (Lusardi & Mitchell, 2017; Morgan et al., 2020; Hasan et al., 2022). In digital lending contexts, borrowers with greater digital financial literacy are better equipped to evaluate loan affordability, compare alternative credit offers, and anticipate cumulative debt obligations. Conversely, limited digital financial literacy has been linked to misunderstandings of loan terms, repeated borrowing, and heightened vulnerability to exploitative lending practices (Ozili, 2023).

Recent scholarship emphasizes that digital financial literacy plays a moderating role in fintech adoption outcomes. Rather than exerting uniform effects, digital financial literacy conditions how individuals experience and respond to algorithmic credit systems (OECD, 2023). This perspective aligns with financial capability theory, which posits that access to financial services must be complemented by individual knowledge and skills to produce sustainable welfare outcomes (Lusardi et al., 2021). Despite this growing recognition, empirical studies explicitly modeling the moderating role of digital financial literacy in algorithmic credit contexts remain limited, particularly in emerging markets.

Institutional Safeguards and Governance in Digital Finance. Institutional safeguards refer to the regulatory, organizational, and governance mechanisms designed to protect consumers and ensure fairness in financial markets. In digital lending environments, these safeguards include transparency requirements, standardized disclosure of loan terms, grievance redress mechanisms, data protection regulations, and oversight of algorithmic decision-making processes (World Bank Group, 2024). Strong institutional safeguards are essential for mitigating information

asymmetries and power imbalances inherent in digitally mediated credit systems.

Governance-oriented research highlights that weak regulatory frameworks may amplify the risks associated with fintech expansion, particularly in emerging economies where enforcement capacity may be limited (Demirgüç-Kunt et al., 2022; Ozili, 2023). Empirical evidence suggests that robust consumer protection regimes are associated with greater trust in digital financial institutions, improved repayment outcomes, and reduced financial stress among borrowers (OECD, 2023; BSP, 2023). Conversely, inadequate safeguards may expose borrowers to opaque pricing, aggressive collection practices, and limited avenues for dispute resolution.

The rise of AI-driven credit scoring has intensified debates on algorithmic governance. Scholars emphasize the need for explainability, accountability, and ethical oversight in automated credit systems to prevent discriminatory outcomes and protect consumer rights (Kleinberg et al., 2018; Trotta & Gnan, 2024). While policy frameworks increasingly acknowledge these concerns, empirical research examining how institutional safeguards interact with borrower behavior and financial outcomes remains fragmented.

Synthesis of Literature and Research Gap. Taken together, the existing literature underscores the transformative potential of algorithmic credit while simultaneously highlighting its risks. Studies on algorithmic credit primarily emphasize efficiency and access outcomes, research on digital financial literacy focuses on individual capability, and governance literature concentrates on regulatory design. However, these strands of research are often examined in isolation, limiting a comprehensive understanding of how technological adoption, borrower capability, and institutional context shape financial outcomes.

Notably, there is a scarcity of empirical studies that integrate algorithmic credit adoption, digital financial literacy, and institutional safeguards within a single analytical framework, particularly in emerging market settings. This gap constrains the development of evidence-based fintech policies that balance innovation with borrower protection. Addressing this limitation, the present study proposes and empirically tests an integrated framework that examines algorithmic credit adoption as a primary driver of borrower financial outcomes, while explicitly modeling the moderating roles of digital financial literacy and institutional safeguards.

By adopting this integrated approach, the study contributes to the financial inclusion, behavioral finance, and fintech governance literature by advancing a more nuanced understanding of responsible digital lending. It responds directly to calls for research that moves beyond access-based metrics and toward evaluations centered on borrower welfare, resilience, and sustainability (Demirgüç-Kunt et al., 2022; World Bank Group, 2024).

Conceptual Framework of Algorithmic Credit Adoption and Borrower Financial Outcomes. Figure 1 illustrates the conceptual framework of the study, which integrates technological, behavioral, and institutional dimensions to explain borrower financial outcomes in digital lending environments. The framework positions algorithmic credit adoption as the primary independent variable influencing three key borrower financial outcomes: repayment behavior, perceived financial stress, and financial resilience.

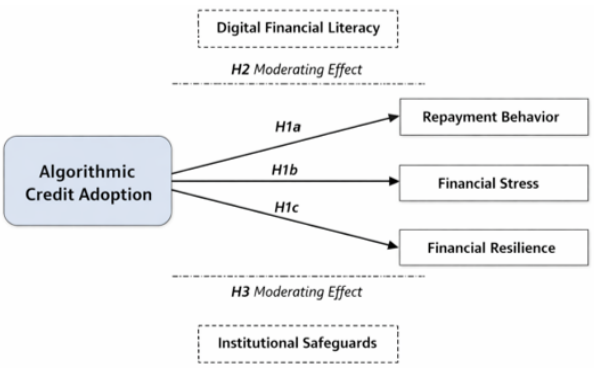

Figure 1
Conceptual Framework of Algorithmic Credit Adoption and Borrower Financial Outcomes

Algorithmic credit adoption refers to the use of artificial intelligence–driven credit scoring systems and digital lending platforms that rely on automated decision-making and alternative data sources. Prior studies suggest that such systems can enhance repayment efficiency and access to credit by reducing information asymmetry and transaction costs (Berg et al., 2020; Li et al., 2024). Accordingly, the framework hypothesizes direct effects of algorithmic credit adoption on borrower financial outcomes, reflecting the dual potential of digital credit to improve repayment performance while simultaneously intensifying financial stress due to rapid loan cycles and increased borrowing frequency (Demirgüç-Kunt et al., 2022; Ozili, 2023).

The framework further incorporates digital financial literacy as a moderating variable that conditions the relationship between algorithmic credit adoption and borrower outcomes. Digital financial literacy encompasses borrowers' ability to understand digital loan terms, manage electronic payments, interpret interest and repayment structures, and recognize risks associated with algorithmic decision-making. Consistent with financial capability theory, borrowers with higher levels of digital financial literacy are expected to derive greater benefits from algorithmic credit while experiencing lower financial stress (Lusardi et al., 2021; OECD, 2023). This moderating role reflects the premise that technological access alone is insufficient without adequate user capability.

In addition, institutional safeguards are modeled as a second moderating variable in the framework. Institutional safeguards include transparency requirements, disclosure standards, grievance redress mechanisms, and regulatory oversight governing digital lending platforms. Governance and consumer protection literature emphasizes that strong institutional safeguards mitigate power imbalances between lenders and borrowers, particularly in automated and opaque credit systems (World Bank Group, 2024). Within the framework, institutional safeguards are expected to strengthen positive financial outcomes and reduce adverse effects such as financial stress by enhancing trust, accountability, and fairness in algorithmic credit processes.

Overall, the conceptual framework presented in Figure 1 reflects an integrated perspective in which the effects of algorithmic credit adoption on borrower financial outcomes are conditional upon both individual capability and institutional context. By explicitly modeling the moderating roles of digital financial literacy and institutional safeguards, the framework advances existing financial inclusion research beyond access-based approaches and provides a theoretical foundation for examining responsible and sustainable digital finance in emerging markets.

METHODOLOGY

Research Design. This study employed a quantitative, cross-sectional, explanatory research design to examine the effects of algorithmic credit adoption on borrower financial outcomes and to test the moderating roles of digital financial literacy and institutional safeguards. A quantitative design is appropriate for theory testing and hypothesis validation where relationships among constructs are examined using statistical inference (Creswell & Creswell, 2018; Hair et al., 2019). The cross-sectional approach allows for the systematic analysis of borrower perceptions and behaviors at a specific point in time, which is consistent with prior empirical studies in digital finance and financial inclusion research (Demirgüç-Kunt et al., 2022; Ozili).

The explanatory nature of the design enables the assessment of both direct effects and conditional (moderating) effects, which is essential for understanding how borrower capability and institutional context shape the outcomes of algorithmic credit adoption. Moderation analysis is particularly suitable in fintech studies where the impact of technological adoption is contingent upon individual and institutional factors (Hayes, 2018; OECD, 2023).

Population, Respondents, and Sampling Technique. The target population of the study consisted of adult users of digital lending platforms who had obtained at least one loan through a fintech-based digital lender utilizing automated or algorithmic credit assessment. They were selected as direct user experience with algorithmic credit systems is necessary to validly assess borrower outcomes, financial stress, and perceptions of institutional safeguards (Berg et al., 2020; Li et al., 2024).

A purposive sampling technique was employed to ensure that all respondents met the inclusion criteria relevant to the study objectives. Purposive sampling is widely used in fintech and consumer finance research where access to specific user groups is required and random sampling is impractical (Etikan et al., 2016; Ozili, 2023). To ensure adequate statistical power for multiple regression and moderation analyses, a minimum sample size of 400 respondents was targeted, consistent with recommendations for multivariate analysis in behavioral and social science research (Hair et al., 2019).

Eligibility criteria included: (a) being at least 18 years of age; (b) prior use of a digital lending platform employing algorithmic credit assessment; and (c) voluntary consent to participate in the study.

Research Instrument. Data were collected using a structured, self-administered questionnaire designed to capture respondents' demographic characteristics, digital financial behavior, and perceptions related to algorithmic credit adoption. The instrument comprised four major sections:

1. ***Demographic and Digital Usage Profile***. This captures the age, employment status, income level, and frequency of digital payment usage.

2. ***Algorithmic Credit Adoption***. This measured through items assessing frequency of digital loan use, reliance on automated approval processes, and engagement with alternative data-driven lending platforms.

3. ***Digital Financial Literacy***. This measured using adapted indicators reflecting respondents' understanding of digital loan terms, interest computation, electronic contracts, data privacy, and online financial risks. These items were grounded in established digital financial literacy frameworks (Lusardi et al., 2021; OECD, 2023).

4. ***Institutional Safeguards and Borrower Financial Outcomes***. This captured perceptions of transparency, consumer protection mechanisms, grievance redress, repayment behavior, perceived financial stress, and financial resilience. Measures of financial stress and resilience were informed by prior financial well-being research (Demirgüç-Kunt et al., 2022; Hasan et al., 2022).

All perceptual items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), a scaling approach commonly adopted in behavioral finance and fintech studies due to its reliability and interpretability (Hair et al., 2019).

Validity and Reliability of the Instrument. To establish content validity, the questionnaire was subjected to expert review by academics and practitioners with expertise in finance, fintech, and quantitative research methods. Feedback focused on item clarity, construct relevance, and alignment with the study's conceptual framework. Revisions were made accordingly to ensure theoretical and contextual appropriateness (Creswell & Creswell, 2018).

A pilot test was conducted prior to full-scale data collection to assess the internal consistency of the research instrument. Reliability was evaluated using Cronbach's alpha coefficients for each multi-item construct. The results indicate satisfactory internal consistency, with Cronbach's alpha values of 0.83 for algorithmic credit adoption, 0.86 for digital financial literacy, 0.81 for institutional safeguards, 0.79 for repayment behavior, 0.84 for perceived financial stress,

and 0.88 for financial resilience. All values exceed the recommended threshold of 0.70, indicating acceptable to high reliability (Nunnally & Bernstein, 1994; Hair et al., 2019). These results confirm that the instrument reliably captures the latent constructs under investigation.

Data Gathering Procedure. Data collection was conducted through online survey administration, which is appropriate for research involving digitally active populations and fintech users (Bethlehem, 2010). Respondents were informed of the study's purpose, assured of confidentiality and anonymity, and required to provide informed consent prior to participation. To enhance data quality, measures were implemented to prevent duplicate responses and incomplete submissions.

The use of online data collection is consistent with best practices in digital finance research and enables efficient access to respondents who actively engage with digital lending platforms (World Bank, 2020; Ozili, 2023).

Data Analysis Techniques. Data analysis was performed using descriptive and inferential statistical techniques. Descriptive statistics were used to summarize respondent characteristics and examine the distribution of key variables. Pearson correlation analysis was conducted to assess preliminary relationships and diagnose potential multicollinearity issues. To test the study hypotheses, multiple regression analysis was employed to estimate the direct effects of algorithmic credit adoption on borrower financial outcomes. Moderation analysis was conducted by introducing interaction terms between algorithmic credit adoption and (a) digital financial literacy and (b) institutional safeguards, following established procedures for conditional process analysis (Hayes, 2018). Statistical significance was evaluated at the 0.05 level, consistent with conventions in social science research.

Ethical Considerations. The study adhered to established ethical standards for social science research. Participation was voluntary, informed consent was obtained, and no personally identifiable information was collected. Data were stored securely and used solely for academic purposes, in accordance with ethical research guidelines (American Psychological Association, 2020).

RESULTS

Respondent Profile and Digital Usage Characteristics. Table 1 presents the demographic and digital usage profile of the respondents, providing essential context for interpreting borrower behavior in digital lending environments. The results indicate that the majority of respondents are concentrated in the 25–44 age group, representing economically active individuals who are more likely to engage in digital financial services.

Table 1
Demographic and Digital Usage Profile of Respondents (N = 400)

Variable	Category	Frequency	Percentage (%)
Age	18–24 years	56	14.0
	25–34 years	**148**	**37.0**
	35–44 years	**126**	**31.5**
	45–54 years	52	13.0
	55 years and above	18	4.5
Sex	Male	198	49.5
	Female	202	50.5
Employment Status	Employed	272	68.0
	Self-employed	78	19.5
	Unemployed	50	12.5
Monthly Income	Below PHP 15,000	94	23.5
	PHP 15,001–30,000	168	42.0
	Above PHP 30,000	138	34.5
Primary Digital Payment Used	Mobile wallet	284	71.0
	Online banking	82	20.5
	Debit/Credit card apps	34	8.5
Frequency of Digital Payment Use	Daily	176	44.0
	Several times a week	154	38.5
	Occasionally	70	17.5

This demographic pattern is consistent with global evidence showing that digital lending adoption is highest among working-age adults who face regular liquidity needs and possess higher exposure to mobile and internet technologies (Demirgüç-Kunt et al., 2022; World

Bank, 2020). The relatively balanced distribution of male and female respondents further suggests that digital lending platforms have achieved broad gender penetration, supporting claims that fintech can reduce traditional access barriers in credit markets.

In terms of digital behavior, most respondents reported frequent use of mobile wallets and digital payment applications, with a large proportion engaging in digital transactions on a daily or weekly basis. This high level of digital engagement is particularly relevant for studies on algorithmic credit, as the effectiveness of AI-driven credit scoring systems depends on consistent digital data generation (Berg et al., 2020; Li et al., 2024). Prior studies note that borrowers embedded in digital payment ecosystems are more likely to be assessed using alternative data and automated credit decision processes (Ozili, 2023). Thus, the profile of respondents in Table 1 confirms the suitability of the sample for examining algorithmic credit adoption and its implications for borrower financial outcomes.

Descriptive Statistics of Key Study Variables. Table 2 summarizes the descriptive statistics of the core constructs examined in the study, including algorithmic credit adoption, digital financial literacy, institutional safeguards, and borrower financial outcomes. The results show a high mean score for algorithmic credit adoption, indicating that respondents frequently engage with digital lending platforms that employ automated credit assessment and approval mechanisms. This finding aligns with prior empirical research documenting the rapid diffusion of algorithmic credit systems in emerging markets, where fintech platforms have become a primary source of short-term credit (Kou et al., 2021; Li et al., 2024).

By contrast, digital financial literacy and institutional safeguards registered only moderate mean scores, suggesting that borrower capability and perceived governance protections have not advanced at the same pace as technological adoption. This gap echoes concerns raised in the financial inclusion literature that fintech expansion often outstrips investments in consumer education and regulatory oversight (Lusardi et al., 2021; OECD, 2023). Regarding borrower outcomes, respondents demonstrated generally positive repayment behavior alongside moderate levels of financial stress and resilience. These patterns reinforce the argument that access to digital credit may improve transactional performance without necessarily alleviating financial pressure or strengthening long-term financial stability (Demirgüç-Kunt et al., 2022; Ozili, 2023).

Table 2
Descriptive Statistics of Key Study Variables (N = 400)

Variable	Mean	Standard Deviation	Interpretation
Algorithmic Credit Adoption	3.68	0.71	High
Digital Financial Literacy	3.42	0.64	Moderate
Institutional Safeguards	3.36	0.69	Moderate
Repayment Behavior	3.51	0.66	Good
Perceived Financial Stress	3.14	0.72	Moderate
Financial Resilience	3.47	0.61	Moderate–High

Correlation Analysis of Study Variables. Table 3a presents the Pearson correlation matrix, offering preliminary insights into the relationships among algorithmic credit adoption, digital financial literacy, institutional safeguards, and borrower financial outcomes. The results reveal statistically significant positive correlations between algorithmic credit adoption and both repayment behavior and financial resilience, suggesting that increased engagement with digital lending platforms is associated with improved repayment discipline and short-term coping capacity. Similar associations have been reported in studies demonstrating that AI-enabled credit scoring enhances monitoring efficiency and repayment performance (Berg et al., 2020; Li et al., 2024).

At the same time, algorithmic credit adoption is also positively correlated with perceived financial stress, indicating that greater access to digital credit may intensify financial pressure among borrowers. This finding supports behavioral finance perspectives emphasizing

that ease of access and rapid loan disbursement can increase borrowing frequency and psychological stress, particularly when repayment cycles are short (Gabor & Brooks, 2017; Ozili, 2023). Importantly, digital financial literacy and institutional safeguards show strong negative correlations with financial stress and positive correlations with favorable outcomes, reinforcing their protective roles as documented in prior financial capability and governance research (OECD, 2023; World Bank Group, 2024). None of the correlation coefficients exceed critical thresholds, indicating that multicollinearity is unlikely to bias subsequent regression analyses (Hair et al., 2019).

Table 3a
Correlation Matrix of Key Variables (N = 400)

Variable	1	2	3	4	5	6
1. Algorithmic Credit Adoption	1.00					
2. Digital Financial Literacy	0.41***	1.00				
3. Institutional Safeguards	0.38***	0.46***	1.00			
4. Repayment Behavior	0.49***	0.44***	0.47***	1.00		
5. Financial Stress	0.36***	-0.42***	-0.39***	-0.33***	1.00	
6. Financial Resilience	0.43***	0.48***	0.45***	0.52***	-0.41***	1.00

***p < .001

Regression Analysis of Algorithmic Credit Adoption. Table 3b reports the results of multiple regression analyses examining the direct effects of algorithmic credit adoption on borrower financial outcomes. The results indicate that algorithmic credit adoption has a significant positive effect on repayment behavior, suggesting that automated credit assessment and digital repayment mechanisms may enhance borrowers' ability to meet repayment obligations. This finding is consistent with empirical studies showing that AI-driven credit scoring improves risk classification and repayment monitoring, thereby supporting repayment performance (Berg et al., 2020; Kou et al., 2021).

However, the regression results also show a significant positive association between algorithmic credit adoption and perceived financial stress. This dual effect highlights a critical paradox within digital financial inclusion initiatives: while algorithmic credit may improve observable repayment outcomes, it may simultaneously increase subjective financial strain. Such patterns have been observed in emerging market contexts where repeated borrowing and automated collection mechanisms intensify repayment pressure (Demirgüç-Kunt et al., 2022; Ozili, 2023). The positive effect on financial resilience, although statistically significant, is comparatively smaller, suggesting that resilience gains may be short-term and contingent than structural.

Table 3b
Regression Results on Algorithmic Credit Adoption and Financial Outcomes (N = 400)

Dependent Variable	β	t-value	p-value
Repayment Behavior	0.284	6.93	< .001
Financial Stress	0.217	5.71	< .001
Financial Resilience	0.196	4.45	< .001

**Model Summary: R^2 = 0.31, F = 58.42, p < .001*

Moderating Effect of Digital Financial Literacy. Table 4 presents the results of the moderation analysis examining the role of digital financial literacy in conditioning the relationship between algorithmic credit adoption and borrower financial outcomes. The interaction term between algorithmic credit adoption and digital financial literacy is statistically significant, indicating that the effects of algorithmic credit vary according to borrowers' level of digital financial capability. This finding provides empirical support for financial capability theory, which posits that individual knowledge and skills shape how financial products translate into welfare outcomes (Lusardi & Mitchell, 2017; Morgan et al., 2020).

Table 4
Moderation Analysis: Digital Financial Literacy (N = 400)

Interaction Term	β	t-value	p-value
Algorithmic Credit × Digital Financial Literacy	0.164	5.29	< .001

More specifically, higher levels of digital financial literacy strengthen the positive effects of algorithmic credit on repayment behavior and financial resilience, while mitigating perceived financial stress. This suggests that digitally literate borrowers are better equipped to

interpret loan terms, manage repayment schedules, and avoid excessive borrowing. Prior studies similarly emphasize that digital financial literacy reduces vulnerability to harmful lending practices and improves debt management in fintech environments (Lusardi et al., 2021; OECD, 2023). The results in Table 4 thus underscore digital financial literacy as a critical enabling condition for responsible algorithmic credit use.

Moderating Effect of Institutional Safeguards. Table 5 reports the moderation results for institutional safeguards, examining how governance mechanisms shape the impact of algorithmic credit adoption on borrower financial outcomes. The statistically significant interaction effect indicates that strong institutional safeguards enhance the positive effects of algorithmic credit while reducing its adverse consequences. This finding aligns with governance and consumer protection literature emphasizing that transparency, disclosure, and accountability mechanisms are essential in digitally mediated credit markets (World Bank Group, 2024).

Table 5
Moderation Analysis: Institutional Safeguards (N = 400)

Interaction Term	β	t-value	p-value
Algorithmic Credit × Institutional Safeguards	0.176	5.18	< .001

In contexts where institutional safeguards are perceived to be strong, borrowers experience better repayment outcomes and lower financial stress, even with high levels of algorithmic credit adoption. Conversely, weak safeguards may amplify power imbalances between lenders and borrowers, increasing stress and vulnerability. These results provide empirical support for policy arguments that fintech innovation must be accompanied by adaptive regulation and robust consumer protection to ensure inclusive and sustainable outcomes (OECD, 2023; Demirgüç-Kunt et al., 2022).

Multicollinearity Diagnostics. Table 6 presents the Variance Inflation Factor (VIF) values used to assess multicollinearity among the independent variables and interaction terms included in the regression models. All VIF values fall well below the commonly accepted threshold of 5.0, indicating that multicollinearity does not pose a significant concern in the estimation of regression coefficients (Hair et al., 2019).

Table 6
Variance Inflation Factor (VIF) Results

Variable	VIF
Algorithmic Credit Adoption	1.82
Digital Financial Literacy	2.06
Institutional Safeguards	1.97

The absence of multicollinearity strengthens confidence in the stability and reliability of the estimated effects reported in Tables 3b, 4, and 5. This diagnostic result supports the robustness of the analytical approach and suggests that the observed relationships among algorithmic credit adoption, digital financial literacy, institutional safeguards, and borrower financial outcomes are not artifacts of overlapping explanatory variables.

Taken together, the results provide consistent empirical evidence that algorithmic credit adoption influences borrower financial outcomes in complex and conditional ways. While digital lending systems contribute to improved repayment behavior and short-term resilience, they also increase perceived financial stress. Crucially, digital financial literacy and institutional safeguards significantly shape these outcomes, highlighting the importance of borrower capability and governance structures in fintech-driven financial inclusion (Demirgüç-Kunt et al., 2022; World Bank Group, 2024).

DISCUSSION

This study examined the effects of algorithmic credit adoption on borrower financial outcomes in an emerging market context, while accounting for the moderating roles of digital financial literacy and institutional safeguards.

Consistent with the results presented in Tables 1–6, the findings demonstrate that the impacts of algorithmic credit are multidimensional and conditional, reinforcing recent critiques of access-only approaches to financial inclusion (Demirgüç-Kunt et al., 2022; Ozili, 2023). Rather than producing uniformly positive outcomes, algorithmic credit adoption generates both benefits and risks that are shaped by borrower capability and governance structures.

Borrower Profile, Digital Engagement, and Algorithmic Credit Context. The respondent profile and digital usage patterns (Table 1) provide an important contextual foundation for interpreting subsequent findings. The concentration of borrowers within the economically active age group and their high engagement with mobile wallets and digital payments indicate that algorithmic credit adoption occurs within a digitally mature segment of the population. This aligns with global evidence that fintech credit primarily targets individuals who are already embedded in digital financial ecosystems (World Bank, 2020; Demirgüç-Kunt et al., 2022). As prior research suggests, algorithmic credit systems rely heavily on continuous digital data generation, making digitally active borrowers more visible and assessable within automated lending models (Berg et al., 2020; Li et al., 2024). However, digital engagement alone does not guarantee positive financial outcomes. The results suggest that even digitally active borrowers may face challenges related to financial stress and resilience, highlighting the distinction between digital access and financial well-being. This finding supports emerging scholarship arguing that fintech-driven inclusion must be evaluated in terms of outcome quality rather than mere participation (Ozili, 2023; OECD, 2023).

Algorithmic Credit Adoption and Financial Outcomes. The descriptive and regression results (Tables 2 and 3b) indicate that algorithmic credit adoption is associated with improved repayment behavior and enhanced short-term financial resilience. These findings corroborate studies demonstrating that AI-enabled credit scoring improves risk assessment accuracy and repayment monitoring, thereby facilitating better observable loan performance (Berg et al., 2020; Kou et al., 2021; Li et al., 2024). From an operational standpoint, automated reminders, digital repayment channels, and real-time monitoring may incentivize timely repayment and improve transactional efficiency.

At the same time, the positive association between algorithmic credit adoption and perceived financial stress underscores a critical paradox. While borrowers may repay loans more consistently, they may also experience heightened psychological pressure due to frequent borrowing cycles, short repayment horizons, and automated collection mechanisms. This dual effect has been documented in prior studies that link rapid digital credit expansion to increased borrower stress and vulnerability, particularly in emerging markets (Gabor & Brooks, 2017; Demirgüç-Kunt et al., 2022). The findings thus reinforce arguments that improved repayment metrics alone are insufficient indicators of borrower welfare.

Moderating Role of Digital Financial Literacy. The moderation results reported in Table 4 provide strong empirical evidence that digital financial literacy significantly conditions the effects of algorithmic credit adoption. Borrowers with higher levels of digital financial literacy experience stronger positive effects on repayment behavior and financial resilience, alongside reduced financial stress. This finding aligns with financial capability theory, which emphasizes that individuals' knowledge and skills shape how financial products translate into welfare outcomes (Lusardi & Mitchell, 2017; Morgan et al., 2020).

In digital lending environments, digital financial literacy enables borrowers to better interpret loan terms, anticipate repayment obligations, and exercise restraint in repeated borrowing. Prior research suggests that digitally literate borrowers are less likely to misjudge loan affordability or underestimate cumulative debt

burdens (Lusardi et al., 2021; OECD, 2023). The present findings extend this literature by empirically demonstrating that digital financial literacy functions as a protective mechanism, mitigating the stress-inducing effects of algorithmic credit while amplifying its benefits.

Moderating Role of Institutional Safeguards. The moderation analysis in Table 5 further demonstrates that institutional safeguards play a decisive role in shaping borrower outcomes. Strong safeguards enhance the positive effects of algorithmic credit adoption on repayment behavior and financial resilience, while reducing perceived financial stress. This result is consistent with governance and consumer protection literature emphasizing that transparency, accountability, and grievance mechanisms are essential in automated credit environments characterized by information asymmetry and algorithmic opacity (OECD, 2023; World Bank Group, 2024).

In the absence of robust safeguards, borrowers may face limited recourse in disputing credit decisions or understanding repayment obligations, thereby increasing stress and vulnerability. Conversely, when institutional safeguards are perceived to be strong, borrowers are more likely to trust digital lending platforms and engage with them in ways that support sustainable financial behavior. These findings empirically support calls for adaptive fintech regulation that balances innovation with borrower protection, particularly in emerging market contexts (Demirgüç-Kunt et al., 2022; Ozili, 2023).

Integrated Interpretation and Contribution to the Literature. Taken together, the findings support an integrated interpretation of algorithmic credit as a capability- and governance-contingent innovation. While algorithmic credit systems can enhance repayment performance and short-term resilience, their welfare effects depend critically on borrower digital financial literacy and the strength of institutional safeguards. This integrated perspective advances the financial inclusion literature by moving beyond access-based metrics and emphasizing the quality, sustainability, and ethical dimensions of digital finance (Demirgüç-Kunt et al., 2022; World Bank Group, 2024).

By empirically modeling the joint moderating roles of digital financial literacy and institutional safeguards, this study contributes to fintech governance and behavioral finance research. It provides evidence that algorithmic credit outcomes are not solely determined by technological design, but by the interaction between technology, borrower capability, and institutional context. This contribution is particularly relevant for emerging markets, where rapid fintech adoption often outpaces regulatory capacity and financial education initiatives.

Conclusion. This study investigated the effects of algorithmic credit adoption on borrower financial outcomes in an emerging market context, with particular emphasis on the moderating roles of digital financial literacy and institutional safeguards. Drawing on financial inclusion theory, behavioral finance, and institutional governance perspectives, the findings demonstrate that algorithmic credit adoption yields conditional and multidimensional outcomes rather than uniformly positive effects.

Empirical results indicate that algorithmic credit adoption is associated with improved repayment behavior and enhanced short-term financial resilience, confirming the operational advantages of AI-driven credit scoring and digital lending platforms. However, the study also reveals a significant positive association between algorithmic credit adoption and perceived financial stress, underscoring a critical paradox in fintech-driven financial inclusion initiatives. While digital credit expands access and improves observable repayment performance, it may simultaneously intensify psychological and financial pressure on borrowers, particularly in the absence of capability and governance mechanisms.

Crucially, the study establishes that both digital financial literacy and institutional safeguards

significantly moderate the relationship between algorithmic credit adoption and borrower financial outcomes. Higher levels of digital financial literacy amplify positive effects on repayment behavior and financial resilience while mitigating financial stress. Similarly, robust institutional safeguards enhance borrower protection, reduce information asymmetries, and promote more sustainable engagement with digital lending platforms. These findings reinforce the argument that technological innovation alone is insufficient to ensure inclusive and welfare-enhancing financial outcomes.

By empirically integrating technological, behavioral, and institutional dimensions within a single analytical framework, this study contributes to the growing literature that calls for a shift from access-based measures of financial inclusion toward outcome-oriented and governance-sensitive evaluations. The findings provide robust evidence that algorithmic credit systems are neither inherently inclusive nor inherently harmful; instead, their societal impact depends critically on the interaction between technology, borrower capability, and institutional context.

Policy and Practical Recommendations. Based on the findings, several policy and practical recommendations are advanced to support responsible and sustainable digital lending:

First, digital financial literacy must be embedded as a core pillar of financial inclusion strategies. Policymakers, regulators, and financial institutions should collaborate to develop targeted financial education programs that address not only traditional financial concepts but also the specific risks and features of digital lending, including algorithmic decision-making, interest compounding, data privacy, and borrower rights. Integrating digital financial education into fintech ecosystems can enhance borrower capability and reduce stress-related outcomes.

Second, institutional safeguards governing digital lending platforms should be strengthened and consistently enforced. Regulatory frameworks must prioritize transparency in loan pricing and algorithmic decision processes, standardized disclosure requirements, and accessible grievance redress mechanisms. Given the increasing reliance on automated credit assessments, regulators should also promote principles of algorithmic accountability and explainability to protect borrowers from opaque or discriminatory practices.

Third, digital lending institutions and fintech providers should adopt responsible innovation and ethical design principles. Platforms should incorporate safeguards against excessive borrowing, provide clear and timely repayment information, and design user interfaces that promote informed decision-making. Proactive engagement with consumer protection standards can enhance trust and long-term sustainability in digital credit markets.

Implications for Future Research. While this study provides important insights, several avenues for future research remain. Longitudinal studies are recommended to examine the long-term welfare effects of algorithmic credit adoption and to establish causal relationships more definitively. Future research may also explore heterogeneity across borrower segments, such as income levels, employment types, or degrees of digital engagement, to better understand distributional effects. Additionally, comparative cross-country analyses could illuminate how varying regulatory regimes and institutional capacities shape digital lending outcomes.

Further research may extend the present framework by incorporating dimensions related to algorithmic transparency, explainable AI, and data ethics, thereby deepening understanding of the governance challenges posed by AI-driven financial systems.

Overall, this study underscores that the promise of algorithmic credit as a tool for financial inclusion can only be realized when technological innovation is complemented by

robust borrower capability development and strong institutional governance. Aligning fintech expansion with education, regulation, and ethical design is essential for building inclusive, resilient, and sustainable digital finance ecosystems in emerging markets.

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