



ORIGINAL PAPER

ESG-Integrated Lending and Credit Allocation to Underserved Populations

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Abstract:

The integration of Environmental, Social, and Governance (ESG) criteria into financial systems is fundamentally transforming traditional credit risk assessment. While this shift promotes sustainable economic practices, its direct impact on financial inclusion remains complex and insufficiently explored. This paper investigates the evolution of ESG-integrated lending, examining its implications for macroeconomic credit allocation and the financial accessibility of underserved populations. By analyzing recent market trends, the study contrasts the approaches of traditional banking institutions with agile Fintech platforms to understand how ESG metrics influence capital distribution. The analysis reveals a significant dichotomy: traditional banks often apply ESG mandates as rigid risk-mitigation filters that inadvertently restrict credit for marginalized demographics lacking formal green footprints, whereas Fintech companies increasingly leverage alternative data to balance ESG compliance with broader financial access. Ultimately, the findings suggest that Fintech-driven models are more adept at addressing the Social pillar of ESG, effectively reallocating credit toward underserved groups. The research concludes that the pursuit of environmental and governance targets must not compromise social equity and advocates for a calibrated lending framework that harmonizes robust ESG objectives with the imperative of financial inclusion.

Keywords: *ESG Integration, Financial Inclusion, Fintech, Credit Allocation, Sustainability, Credit Risk Assessment.*

JEL Classification: G21, G23, Q56, E58, O16.

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1. Introduction

The global financial architecture is undergoing a deep structural transformation from the traditional model of shareholder primacy to a sustainability-oriented model that explicitly incorporates environmental resilience, social responsibility, and corporate governance. Over the past two decades, the incorporation of Environmental, Social, and Governance (ESG) criteria has evolved from a voluntary set of corporate social responsibility guidelines into a mandatory normative standard reshaping capital markets globally. In this new paradigm, capital is no longer treated as a neutral factor of production, but as a strategic lever to accelerate the transition toward a sustainable, low-carbon economy and to mitigate systemic long-term risks.

Traditional financial institutions have historically evaluated credit risk through a retrospective lens focused almost exclusively on audited financial statements, historical debt-repayment records, and physical collateral. The compulsory inclusion of ESG metrics in lending practices radically alters this calculus. Financial institutions must now assess a borrower's long-term sustainability in relation to climate transition risks, environmental regulations, and shifting market preferences. This integration has been effective in channeling substantial volumes of capital toward green infrastructure and low-polluting industries, thereby protecting financial portfolios from potential future climate shocks. However, it has also generated a complex and unexpected socioeconomic paradox, the paradox of green exclusion.

A critical analysis of current lending practices reveals a clear structural imbalance among the three pillars of the ESG framework. The Environmental (E) pillar has dominated both analysis and regulation, driven by relatively easily quantifiable metrics such as carbon emissions, renewable energy use, and resource efficiency. By contrast, the Social (S) pillar – encompassing financial inclusion, poverty reduction, community resilience, and fair access to capital – is notoriously difficult to standardize and therefore often relegated to a secondary role in formal credit assessments. When lending institutions employ environmental mandates as rigid, defensive risk-reduction filters, they inadvertently create systemic barriers for borrowers who lack the financial and administrative capacity to produce formal, audited sustainability reports. As a result, developing countries are witnessing a growing exclusion of micro-enterprises, informal entrepreneurs, and low-income groups from formal credit markets, since these actors typically lack a documented green footprint. In this dynamic, policies designed to save the planet can inadvertently penalize economic vulnerability, pitting environmental sustainability against social equity.

This article examines the growing operational and philosophical differences between traditional banks and Fintech platforms in order to understand the macroeconomic and social consequences of this shift. Traditional banks are heavily regulated and constrained by legacy infrastructure and, as a result, tend to interpret ESG compliance as a binary risk-mitigation mechanism. In their standard models, the absence of formal environmental compliance or traditional collateral often translates into automatic credit rejection, effectively capping capital allocation to large, mature corporations that can afford the cost of compliance.

In contrast, the paper explores how Fintech platforms are redefining credit allocation by using big data, machine learning, and alternative data sources to assess creditworthiness. Fintech models can accurately evaluate risk without relying on rigid green audits or conventional property collateral, instead using dynamic, non-traditional behavioral metrics such as utility and telecommunication payment regularities, digital

transaction flows, mobile commerce patterns, and real-time cash-flow analytics. This technological agility enables decentralized lending platforms to reach populations that have historically been invisible to the formal banking sector.

The analysis investigates Fintech's lending paradigm and its capacity to reinforce and revitalize the Social pillar of ESG, thereby democratizing access to capital and redistributing financial resources to previously underserved groups. It also considers how alternative data can serve as a crucial bridge between environmental compliance and financial inclusion, allowing institutions to assess a borrower's trajectory and potential, not only their historical documentation. Furthermore, the study analyzes how this dual financial system shapes the macroeconomy by contrasting the risk-averse, centralized capital allocation of legacy banks with the decentralized, inclusion-driven models of Fintech platforms.

Finally, the study argues that a truly sustainable global economy cannot be built on financial exclusion. The necessary push toward net-zero emissions and robust corporate governance must not come at the expense of social fairness and economic upward mobility. On this basis, the paper outlines the basic principles of a calibrated lending framework, grounded in current market trends and institutional arrangements, that combines rigorous environmental targets with the moral and economic imperative of universal financial inclusion, ensuring that no community is left behind in the global transition to sustainability.

2. Literature review

Over the past decade, sustainable finance has moved to the forefront of economic research, driven by the growing consensus that financial systems must actively support climate mitigation. While existing literature provides a robust foundation for the macroeconomic models, green instruments, and risk-management frameworks of sustainable finance, it exhibits a clear thematic imbalance. Researchers have extensively theorized the environmental mechanics of green finance, yet the intersection between these frameworks, social equity, and financial inclusion remains significantly understudied.

Tracing the evolution from macroeconomic mandates to commercial banking practices, this review summarizes the dominant strands in the green finance literature and identifies the research gap that the present study seeks to address.

An examination of the theoretical foundations and top-down macroprudential mandates governing sustainable finance shows that the integration of environmental criteria into financial systems is fundamentally rooted in the economic need to internalize environmental externalities. In their foundational theoretical study, Ağırman and Osman (2018) argue that traditional financial markets inherently fail to account for the long-term social and ecological costs of environmental degradation. Green finance emerges in this context as a corrective mechanism designed to realign capital flows with sustainable development objectives, ensuring that financial returns do not come at the expense of ecological stability. This theoretical foundation is further reinforced by comprehensive literature syntheses, such as the review conducted by Fathihani et al. (2021), which highlights how sustainable green finance has rapidly evolved from a niche academic concept into a dominant research paradigm in global economic literature.

Recent bibliometric evidence confirms that, over the 2001–2025 period, green finance research has expanded rapidly in volume but remains heavily concentrated on climate change mitigation and environmental risk, with only a limited share of studies analysing distributional and inclusion effects (Spulbar & Dupir, 2026).

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The operationalization of these theoretical concepts has been driven primarily by top-down regulatory frameworks and macroprudential policies. A significant portion of contemporary research focuses on the pivotal role of central banks and monetary authorities in steering the green transition. Volz (2017) contends that central banks can no longer remain neutral spectators in the face of environmental degradation, but have an institutional responsibility to enhance green finance by incorporating sustainability criteria into macroprudential supervision and monetary frameworks.

This perspective is expanded by Dikau and Volz (2018), who show that climate change poses direct, systemic threats to financial stability. Their research demonstrates that central banks worldwide are increasingly mandated to treat physical and transition climate risks as core financial risks, compelling commercial financial institutions to adapt their lending and investment strategies accordingly. As monetary authorities have assumed a more proactive stance, scholars have sought to classify and systematize the diverse policy instruments deployed across jurisdictions. Dziwok and Jäger (2021) provide a critical taxonomy of these approaches, distinguishing between passive regulatory adjustments and more assertive green monetary policies. Their classification indicates that, while regulatory frameworks are becoming increasingly sophisticated, they often rely on rigid, standardized criteria designed primarily to safeguard institutional portfolios against climate-related financial depreciation.

As top-down macroprudential mandates have reshaped the regulatory landscape, academic inquiry has increasingly shifted toward their institutional implementation and commercial banking realities. Altunina and Alieva (2021) examine current global and regional trends in the development of green finance systems, focusing on the methodological tools and practical frameworks adopted by lending institutions. Their analysis reveals that methodological rigor in assessing environmental impact has improved significantly, particularly within developed European markets, but that practical application frequently requires complex auditing processes, standardized ESG reporting, and substantial compliance infrastructure.

The macroeconomic efficacy of these green financing mechanisms in driving regional sustainable development is well documented. Empirical evidence from the European market shows a strong, positive correlation between the expansion of green finance and sustainable economic growth (Afzal et al., 2022). Their findings confirm that dedicated green capital allocation effectively channels resources toward renewable energy, clean infrastructure, and eco-efficient industrial projects, thereby accelerating progress toward regional environmental targets.

At the microeconomic and organizational level, researchers have investigated how the adoption of green lending practices influences the internal performance and risk profiles of commercial banks. Zhang et al. (2022) analyze the mediating effect of green financing on banking operations and conclude that active engagement in green banking activities significantly improves a bank's overall environmental performance and sustainability rating.

3. Comparative Analysis: Traditional Banks vs. Fintech and Alternative Green Finance Models

An examination of the macroeconomic shift and the divergence of intermediation models shows that the accelerated global transition toward sustainable economic practices has triggered a fundamental transformation in how credit is evaluated and allocated across markets. As sustainability metrics evolve from optional corporate disclosures into

mandatory components of macro-financial stability, a sharp institutional divergence has emerged between legacy banking systems and alternative financial platforms (Dziwok and Jäger, 2021). While both organizational architectures ultimately aim to channel capital toward eco-efficient activities, their operational methodologies, risk-tolerance criteria, and target demographics differ significantly. Traditional banking institutions tend to approach green finance through a centralized, regulatory-driven lens that prioritizes institutional stability and portfolio risk mitigation, whereas alternative financial platforms rely on decentralized, market-driven mechanisms that emphasize accessibility and technological agility (Fathihani et al., 2021). This systemic discrepancy in credit scoring goes beyond a simple technical distinction and represents a profound macroeconomic shift that directly determines which segments of the real economy gain access to the capital required for sustainable development.

A focus on traditional banking, risk mitigation, and spread optimization shows that commercial banks primarily integrate Environmental, Social, and Governance (ESG) criteria into their lending frameworks as a defensive mechanism designed to shield asset portfolios from transition risks and supervisory penalties. Credit risk reduction and profitability optimization are closely tied to environmental compliance for legacy lending institutions (Chen et al., 2022). Evidence from the commercial banking industry indicates that actively increasing a bank's exposure to green lending significantly reduces its overall default probability while also improving the intermediation spread and the profitability margin between borrowing and lending rates (Chen et al., 2022). Furthermore, participation in structured green banking activities generates a positive feedback loop that improves banks' internal environmental performance and sustainability ratings, enabling them to align with global sustainability targets and institutional investor expectations (Zhang et al., 2022). Consequently, traditional banks are strongly incentivized to expand their green loan portfolios, provided that the underlying assets conform to rigorous institutional risk parameters.

However, a critical reading of the exclusionary mechanics of legacy green finance reveals the major structural barriers created by this traditional banking approach. To comply with regulations and minimize financial risk, traditional banks rely on standard balance-sheet instruments, syndicated loans, and dedicated special-purpose vehicles (SPVs) designed for large-scale renewable energy installations, industrial retrofits, and major green infrastructure projects (Schäfer, 2017). These sophisticated financial engineering tools are highly effective for deploying large amounts of capital to mature, compliance-ready corporations, but they paradoxically create prohibitive barriers for micro-enterprises, small businesses, and marginalized borrowers (Schäfer, 2017). These smaller economic actors frequently lack the financial resources, administrative capacity, and formal documentation required to obtain standardized green certifications or third-party environmental audits. When legacy banks apply rigid green screening tools universally, borrowers operating in the informal economy or rural sectors are systematically categorized as high-risk, resulting in widespread financial exclusion under the banner of environmental sustainability.

This paradox is clearly illustrated by the current macroeconomic landscape. The transition to a green economy is inevitable, but empirical data show that climate-relevant sectors still play a systemic role in Romania, contributing 40.6% of gross value added, holding 48.4% of total assets, and accounting for 51.7% of the total corporate loan stock as of September 2024, while green loans represent only 2.9% of bank exposure to non-financial companies (BNR, 2024). Such a divergence highlights the risk that inflexible

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ESG filters may cut off funding to a significant part of the real economy, intensifying the tension between the objectives of environmental sustainability and social equity. Today, Small and Medium Enterprises (SMEs) are at the crossroads of three major transitions – green, digital, and demographic (Slăvoiu, 2025a). Within the traditional banking approach, enforcing strict environmental standards risks turning the green transition into a form of economic elitism, in which SMEs are excluded due to a lack of ESG know-how and high reporting costs. In this context, Fintech models and digitalization act as crucial accelerators, lowering operational costs and enabling the efficient processing of complex ESG data (Slăvoiu, 2025a). Digital financial infrastructure, such as B2B platforms and digital scoring, is essential for making green investments scalable and accessible for SMEs, thereby preventing their marginalization.

These institutional frictions become even more pronounced when analyzing emerging market barriers and commercial bank limitations. Underdeveloped capital markets in developing and transitional economies often make private commercial banks the main, if not the only, drivers of green finance adoption (Zheng et al., 2021). Despite this central role, these institutions face significant structural impediments, including prohibitively high transaction costs for small-scale green lending, entrenched default-averse cultures, and overly complex procedures for verifying environmental impact (Zheng et al., 2021). Private commercial banks in emerging markets typically adopt an overly conservative lending stance to protect their balance sheets from these compounded risks, demanding extensive physical collateral and formal documentation that the average local borrower cannot provide. As a result, even as green finance frameworks expand at the institutional level in developing countries, the practical constraints of legacy banking prevent this capital from reaching the real economy, limiting broad financial access and amplifying socioeconomic disparities (Zheng et al., 2021).

An examination of Fintech agility, alternative data, and the operationalization of the Social pillar shows how technological innovation redefines sustainable credit distribution in sharp contrast to existing institutional limitations. Financial technology platforms and alternative financing models display superior operational agility, positioning them as particularly well suited to address the Social (S) pillar of existing ESG frameworks (Fathihani et al., 2021). Fintech lenders rely on predictive behavioral analytics rather than retrospective, audit-heavy assessment techniques, since they are not constrained by traditional brick-and-mortar overheads or legacy IT infrastructures. By leveraging big data, machine learning algorithms, and alternative data streams – such as real-time cash-flow velocity, mobile payment regularities, and digital supply-chain interactions – these platforms can quantify creditworthiness without demanding formal green certifications or conventional property collateral. This technological capability enables digital lenders to identify creditworthy borrowers within historically excluded demographics, transforming environmental compliance from an exclusionary barrier into an inclusive opportunity for sustainable economic advancement.

Lastly, decentralized crowd-investing models and alternative banking structures accelerate the democratization of sustainable capital. Beyond algorithmic credit scoring, innovative structural models such as peer-to-peer (P2P) lending, equity crowdfunding, and crowd-investing eliminate traditional banking frictions by mobilizing private capital directly toward small-scale sustainable projects (Schäfer, 2017). These alternative financial structures allow retail investors to participate in green project financing with minimal capital thresholds, thereby democratizing both the provision and the receipt of sustainable investment. By using online platforms to connect capital providers directly

with eco-entrepreneurs, community renewable energy initiatives, and rural agricultural projects, alternative financing models bypass the complex assessment procedures and high overhead costs of traditional banks. As Schäfer (2017) notes, these cutting-edge platforms effectively redistribute capital to marginalized groups and foster broad financial inclusion while maintaining a strong commitment to environmental sustainability.

4. The Role of Central Banks and Institutional Frameworks in Credit Allocation

The effective reallocation of credit toward sustainable and inclusive sectors cannot rely solely on market forces and private initiatives; it requires a strong institutional architecture led by central banks. An examination of market failures, carbon underpricing, and institutional intervention shows that, despite their enormous potential for innovation and capital deployment, private financial markets and emerging technologies are structurally constrained by pervasive externalities, most notably the systematic underpricing of carbon emissions and ecological degradation. Consequently, central banking authorities are uniquely positioned to address these market failures and to ensure that environmental risks are accurately reflected in financial markets.

By standing at the apex of the monetary and financial system, central banks possess both the supervisory mandate and the macroprudential leverage needed to internalize environmental costs, transforming climate risk from an ignored external factor into an unavoidable component of institutional capital allocation. As Slăvoiu (2025b) notes, institutions such as the European Central Bank (ECB) and the National Bank of Romania (BNR) increasingly treat environmental degradation as a core threat to price stability and financial security, driven by transition risks that can trigger inflation, cost shifts, and investment uncertainty. At the same time, the European Parliament insists that monetary authorities must respect market neutrality and avoid distorting free markets by exclusively favoring green assets, which reinforces the need for an institutional framework that supports the transition without creating sudden imbalances in carbon-intensive sectors.

An analysis of green macroprudential tools, stress testing, and reserve adjustments illustrates how monetary authorities can actively re-engineer the financial system's risk architecture. To achieve these objectives, central banks can deploy a diverse array of green microprudential and macroprudential policies. In addition to strategically modifying legal reserve requirements to favor portfolios rich in green assets, these supervisory interventions include the implementation of stringent climate-related stress tests designed to assess the financial system's structural resilience to severe environmental shocks. By simulating physical and transition climate scenarios on commercial balance sheets, regulators force lending institutions to recognize the true risk profile of carbon-intensive assets. Recalibrating reserve ratios simultaneously enables central banks to lower the regulatory capital cost of sustainable loans, altering the commercial lending risk-reward calculation in favor of green economic activities.

The operationalization of this supervisory influence extends into targeted monetary policy instruments and preferential refinancing lines. Beyond passive risk monitoring, monetary authorities can establish dedicated refinancing facilities that provide commercial banks with preferential funding terms for sustainable investments or even accept carbon certificates as part of commercial banks' eligible collateral to reduce the funding cost of low-carbon projects. Through these proactive monetary mechanisms, central banks effectively dual-track the cost of capital within the banking sector.

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Institutions that channel credit toward verified sustainable infrastructure or low-carbon transition projects obtain liquidity at subsidized rates, whereas those maintaining carbon-intensive portfolios face progressively higher borrowing costs. This direct intervention in interbank markets accelerates the macroeconomic shift toward sustainability by creating powerful financial incentives for commercial banks to identify and support green projects.

However, an assessment of governance structures, institutional quality, and environmental degradation shows that the surrounding legal and regulatory environment is intrinsically linked to the effectiveness of monetary policy. Beyond central banks, the broader institutional framework plays a critical role in determining the success of green finance. Macroeconomic research on European economies indicates that financial development coupled with high institutional quality significantly reduces environmental degradation, underscoring that strict environmental regulations and effective governance are essential for sustainable policies to take root. Transparent property rights, strong legal enforcement, and robust accounting standards provide the confidence required for long-term green investments. When these institutional pillars are strong, financial markets can distinguish effectively between genuine sustainability and superficial greenwashing, ensuring that funds are allocated to projects that generate real environmental improvements.

Conversely, the paradox of financial deepening in the absence of regulatory supervision reveals the substantial risks associated with market expansion in institutional voids. Without robust institutional monitoring, financial deepening and foreign direct investment can paradoxically lead to higher carbon emissions and accelerated depletion of natural resources. In jurisdictions characterized by weak governance, permissive environmental standards, or regulatory capture, an influx of capital often exacerbates ecological destruction, as investors exploit regulatory loopholes to finance highly profitable, high-emitting industrial activities. A coordinated effort that combines active central bank engagement with strong, transparent governance is therefore essential to create an environment in which green finance can flourish and support sustainable economic development. Ultimately, establishing a truly sustainable and inclusive credit market requires a symbiotic relationship between proactive monetary authorities and high-quality governance frameworks, ensuring that financial innovation remains firmly anchored in regulatory integrity.

5. Conclusions

A critical structural change within the global financial architecture is being driven by the incorporation of environmental, social, and governance criteria into credit risk assessment. As financial systems move from traditional, profit-centric models toward holistic sustainability frameworks, capital allocation has become a primary instrument for shaping macroeconomic and ecological stability. This analysis shows that the pursuit of a green economy cannot be understood solely as an environmental imperative, but must be framed as a comprehensive strategy that balances ecological preservation with social equity and financial inclusion. A financial transformation that prioritizes carbon reduction while neglecting socioeconomic accessibility risks creating new structural fractures in the global economy and ultimately undermining the long-term objectives of sustainable development.

Synthesizing the traditional banking dichotomy between profitability and exclusion highlights the operational complexities embedded within legacy financial

institutions. Traditional banks have demonstrated that adopting green lending practices can be financially advantageous, improving profitability spreads and mitigating default risks, yet their rigid compliance filters simultaneously threaten to exclude marginalized populations from accessing essential credit. While commercial banks benefit institutionally from greening their portfolios through enhanced reputation and reduced exposure to transition risks, their heavy reliance on retrospective financial disclosures, formal environmental audits, and standardized collateral often alienates small enterprises, informal entrepreneurs, and developing communities. Without methodological adaptation, standard risk-mitigation strategies applied by legacy banks can inadvertently turn green finance into a mechanism of socioeconomic exclusion.

To bridge this exclusionary gap, the evaluation of technological democratization, alternative data, and peer-to-peer frameworks underscores the transformative potential of digital financial intermediation. Fintech and alternative financing models emerge as indispensable components of the modern financial ecosystem, demonstrating a strong capacity to democratize capital access and address the social dimensions of sustainability through innovative data utilization and decentralized intermediation structures. By leveraging machine learning algorithms, forward-looking behavioral analytics, and alternative data streams, agile technological platforms can assess risk without relying on rigid green certifications or traditional property collateral. In doing so, they operationalize the Social (S) pillar of the ESG paradigm by decentralizing traditional banking services and enabling retail and institutional capital to reach grassroots sustainable projects, micro-entrepreneurs, and underserved demographics.

At the same time, the need for central bank intervention and macroprudential guidance confirms that technological innovation and market forces alone cannot deliver systemic realignments. The transition toward sustainable development requires a proactive approach from state actors and central banks, which must implement calibrated green monetary policies and macroprudential regulations to correct market failures and guide private investment. Monetary authorities have to shape the financial risk architecture by internalizing environmental externalities through climate stress testing, adjusting reserve requirements, and deploying preferential refinancing lines for sustainable lending. In doing so, central banks provide the regulatory incentives needed to align commercial lending strategies with macro-environmental goals while preserving financial stability by dual-tracking the cost of capital within the banking system.

Advancing a calibrated lending framework and an institutional architecture for universal inclusion represents the synthesized normative outcome of this study. Achieving a truly sustainable and inclusive economy requires a harmonized framework in which robust environmental and governance objectives are integrated with the imperative of financial accessibility. To attain this balance, regulatory authorities and financial institutions must adopt a calibrated lending approach that actively compensates for a borrower's initial lack of formal green documentation by evaluating their potential for positive socioeconomic impact and local resilience. This ambitious goal depends on the continuous strengthening of institutional quality, the promotion of environmental education, and close cooperation between traditional and alternative financial institutions. As recent contributions emphasize, a just and sustainable transition in financing should rest on three core principles: proportionality (relative to company size), adequacy (sectoral and geographical), and gradualness (conditionality based on green or digital performance indicators). To avoid the discretionary exclusion of vulnerable firms, the calibrated framework should incorporate hybrid financing products, such as green and transition

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loans backed by public guarantees and cost-sharing mechanisms. Ultimately, inclusive financing must be understood not as a mere compliance cost, but as a strategic investment in which the development of human capital – the Social dimension of ESG – receives at least as much attention as green infrastructure.

Authors' Contributions:

The authors contributed equally to this work.

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