

IMPACT OF FINTECH ON BANK PERFORMANCE: EVIDENCE FROM EMERGING MARKETS

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**IMPACT OF FINTECH ON BANK PERFORMANCE:
EVIDENCE FROM EMERGING MARKETS**

by

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CERTIFICATE

The thesis entitled, “**Impact of FinTech on Bank Performance: Evidence from Emerging Markets**”, being submitted by **Ms. Radhika Goel** to the Indian Institute of Technology Delhi, for the award of the degree of **Doctor of Philosophy** is a record of bonafide research work carried out by her. She has worked under my guidance and supervision and has fulfilled all the requirements for the submission of this thesis, which has attained the standard required for a Ph.D. degree at this institute. The results presented in this thesis have not been submitted elsewhere for the award of any degree or diploma.

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ABSTRACT

The 2008 Global Financial Crisis marked a watershed moment for the global financial sector, triggering widespread mistrust in traditional banking institutions and exposing the structural vulnerabilities of the financial system. In its aftermath, banks were forced to navigate a rapidly evolving digital landscape while attempting to restore public confidence and comply with more stringent regulatory frameworks. Simultaneously, the accelerated rise of Financial Technology (FinTech) emerged as both a disruptor and a catalyst for transformation, enabling banks to modernize operations, improve customer experience, rebuild their reputation, and meet evolving stakeholder expectations through digital solutions. While FinTech has been widely recognized for its disruptive potential, its implications for key dimensions of bank performance—namely, efficiency, stability, and sustainability—remain underexplored, especially in the heterogeneous banking landscapes of India and other emerging economies. In this backdrop, this study aims to bridge this critical gap by empirically examining (i) the impact of FinTech adoption on cost, technical, and allocative efficiency among scheduled commercial banks in India, (ii) the potentially non-linear relationship between FinTech and bank risk, and (iii) the influence of FinTech on Environmental, Social, and Governance (ESG) performance in emerging markets. In doing so, the study also explores how bank-specific factors such as size, ownership structure, board independence, and financial leverage moderate these relationships, providing a comprehensive understanding the role of FinTech in shaping modern banking performance.

To address these objectives, this study adopts a multi-pronged empirical strategy, combining bank-level and macroeconomic data across multiple geographies and time periods. For the analysis of efficiency and risk (objective 1&2), the study focuses on 96 scheduled commercial banks in India, leveraging their regulatory consistency and systemic importance

to ensure methodological rigor. The dataset spans key operational and financial variables, and excludes cooperative, investment, and non-banking financial entities to maintain comparability. For the investigation into ESG performance (objective 3), the scope expands to include 93 commercial banks from nine emerging economies—India, Argentina, Brazil, Indonesia, Mexico, Poland, Russia, Saudi Arabia, and Turkey—selected based on their global economic significance and FinTech adoption potential. To measure FinTech adoption, a novel FinTech Index is developed using advanced text-mining and factor analysis techniques, capturing multiple dimensions such as risk management, resource allocation, and payment systems. Efficiency scores were estimated using Data Envelopment Analysis (DEA), while the risk model incorporated both linear and non-linear specifications to capture potential U-shaped dynamics. ESG performance is assessed using Bloomberg’s ESG disclosure scores, disaggregated into environmental, social, and governance dimensions. Fixed effects panel regressions and system GMM have been employed, with extensive robustness checks—including models with lagged variables, instrumental variables, and other regression techniques—implemented to address endogeneity and ensure the reliability of results. Bank-level heterogeneity is further explored through interaction terms capturing size, ownership, board independence, and leverage, allowing for a nuanced understanding of how FinTech impacts banking performance across different institutional contexts.

The empirical analysis yields several important insights. First, FinTech adoption significantly enhances cost, technical, and allocative efficiency among Indian scheduled commercial banks, with the most pronounced gains observed post-2017, coinciding with policy reforms and digital acceleration. While larger banks benefit from economies of scale, smaller banks exhibit greater efficiency improvements from FinTech integration due to their agility and simpler structures. Private sector banks, despite lower baseline efficiency, lead in leveraging FinTech for operational gains. Second, the relationship between FinTech and bank risk

follows an inverted U-shape—initial digital investments and regulatory challenges raise risk, but mature adoption improves stability by reducing credit, liquidity, and leverage risk. Private and small banks experience stronger risk-mitigating effects, while public banks face persistent structural barriers. Third, FinTech adoption exhibits a U-shaped relationship with ESG performance in emerging markets: early adoption strains resources and compliance, but advanced digital integration enhances sustainability disclosures and governance. ESG improvements are more substantial among private and small banks, especially those with independent boards and lower leverage. These findings highlight transformative capacity of FinTech to enhance efficiency, reduce risk, and improve sustainability—while also emphasizing the role of bank-specific characteristics in moderating these effects.

In light of these results, the study offers important implications for bank management, regulators, and investors seeking to navigate the evolving digital banking landscape. Bank management is advised to adopt differentiated FinTech strategies aligned with their size and governance structures, investing in digital infrastructure, cybersecurity, and talent development to optimize performance. Policymakers should foster an enabling regulatory environment that balances innovation with stability—particularly through adaptive frameworks addressing cybersecurity, ESG disclosures, and inclusive growth. Investors, especially those with long-term and ESG-focused mandates, are advised to prioritise banks demonstrating strategic FinTech integration, robust sustainability practices, and digital transparency.

सार

2008 की वैश्विक वित्तीय संकट ने वैश्विक बैंकिंग क्षेत्र के लिए एक निर्णायक मोड़ प्रस्तुत किया, जिसने पारंपरिक बैंकिंग संस्थाओं में व्यापक अविश्वास उत्पन्न किया और वित्तीय प्रणाली की संरचनात्मक कमजोरियों को उजागर किया। इस संकट के बाद, बैंकों को बदलते डिजिटल परिदृश्य में स्वयं को ढालते हुए, सार्वजनिक विश्वास बहाल करने और अधिक कठोर नियामक ढाँचों का पालन करने की आवश्यकता पड़ी। इसी दौरान, वित्तीय प्रौद्योगिकी (FinTech) एक विघटनकारी शक्ति और परिवर्तन के उत्प्रेरक के रूप में उभरी, जिसने बैंकों को संचालन का आधुनिकीकरण करने, ग्राहक अनुभव सुधारने, अपनी साख पुनः स्थापित करने और हितधारकों की बदलती अपेक्षाओं को डिजिटल समाधान के माध्यम से पूरा करने में सक्षम बनाया। यद्यपि FinTech की परिवर्तनकारी क्षमता को व्यापक रूप से स्वीकार किया गया है, परंतु इसकी भूमिका बैंकिंग प्रदर्शन के प्रमुख पहलुओं—जैसे कि दक्षता (Efficiency), स्थिरता (Stability) और सततता (Sustainability)—पर अभी भी सीमित रूप से अध्ययन की गई है, विशेष रूप से भारत और अन्य उभरती अर्थव्यवस्थाओं के विविध बैंकिंग परिदृश्यों में। यह अध्ययन इस महत्वपूर्ण शून्य को भरने का प्रयास करता है और तीन उद्देश्यों की पूर्ति हेतु डिज़ाइन किया गया है: (i) भारत के अनुसूचित वाणिज्यिक बैंकों में FinTech अपनाने का लागत, तकनीकी, और आवंटन दक्षता पर प्रभाव; (ii) FinTech और बैंक जोखिम के बीच संभावित गैर-रेखीय संबंध; और (iii) उभरती अर्थव्यवस्थाओं में FinTech का पर्यावरण, सामाजिक और शासन (ESG) प्रदर्शन पर प्रभाव। इसके अतिरिक्त, अध्ययन बैंक आकार, स्वामित्व संरचना, बोर्ड स्वतंत्रता और वित्तीय उत्तोलन जैसे संस्थागत कारकों की मध्यस्थ भूमिका का भी परीक्षण करता है।

इन उद्देश्यों को प्राप्त करने हेतु, अध्ययन एक बहु-आयामी अनुभवजन्य रणनीति अपनाता है, जिसमें विभिन्न देशों और समय अवधियों के बैंक-स्तरीय एवं मैक्रोइकोनॉमिक डेटा को शामिल किया गया है। दक्षता और जोखिम विश्लेषण के लिए, अध्ययन भारत के 96 अनुसूचित वाणिज्यिक बैंकों (2009–2022)

पर केंद्रित है, जो नियामकीय समानता और प्रणालीगत महत्व के कारण चयनित किए गए हैं। ESG प्रदर्शन की जाँच हेतु, अध्ययन का क्षेत्र नौ उभरती अर्थव्यवस्थाओं—भारत, अर्जेंटीना, ब्राज़ील, इंडोनेशिया, मैक्सिको, पोलैंड, रूस, सऊदी अरब और तुर्की—के 93 वाणिज्यिक बैंकों (2015–2022) तक विस्तारित किया गया है, जो वैश्विक आर्थिक महत्व और FinTech अपनाने की क्षमता के आधार पर चुने गए हैं। FinTech अपनाने को मापने के लिए, एक नवीन सूचकांक विकसित किया गया, जिसे टेक्स्ट माइनिंग और फैक्टर विश्लेषण की उन्नत तकनीकों से निर्मित किया गया है, और जिसमें जोखिम प्रबंधन, संसाधन आवंटन, और भुगतान प्रणाली जैसे कई आयाम शामिल हैं। दक्षता को डेटा एंवलपमेंट एनालिसिस (DEA) के माध्यम से मापा गया, जबकि जोखिम मॉडल में संभावित यू-आकार (U-shape) संबंधों को पकड़ने के लिए रैखिक और गैर-रेखीय विश्लेषण दोनों सम्मिलित किए गए। ESG प्रदर्शन को ब्लूमबर्ग के ESG प्रकटीकरण स्कोर द्वारा मापा गया, जिसे पर्यावरणीय, सामाजिक, और शासनात्मक घटकों में विभाजित किया गया। परिणामों की विश्वसनीयता सुनिश्चित करने हेतु, स्थिर प्रभाव पैनल प्रतिगमन (Fixed Effects Panel Regression) और सिस्टम सामान्यीकृत क्षण विधि (System GMM) जैसी उन्नत तकनीकों का उपयोग किया गया, तथा एंडोजेनेटी की समस्या को नियंत्रित करने हेतु विभिन्न रिग्रेशन परीक्षणों और मजबूती जांचों का उपयोग किया गया। बैंक-स्तरीय विषमता को समझने के लिए, अध्ययन में आकार, स्वामित्व, बोर्ड स्वतंत्रता और वित्तीय उत्तोलन को दर्शाने वाले इंटरएक्शन टर्म्स का भी विश्लेषण किया गया।

अनुभवजन्य विश्लेषण से कई महत्वपूर्ण निष्कर्ष प्राप्त होते हैं। प्रथम, FinTech अपनाने से भारत के अनुसूचित वाणिज्यिक बैंकों में लागत, तकनीकी और आवंटन दक्षता में महत्वपूर्ण वृद्धि होती है, विशेष रूप से 2017 के बाद, जब डिजिटल प्रगति और नीतिगत सुधारों ने रफ्तार पकड़ी। जहाँ बड़े बैंक पैमाने की अर्थव्यवस्थाओं का लाभ उठाते हैं, वहीं छोटे बैंक अपनी चपलता और सरल संरचनाओं के कारण अधिक दक्षता सुधार प्रदर्शित करते हैं। निजी क्षेत्र के बैंक, भले ही उनकी प्रारंभिक दक्षता कम हो, FinTech को सबसे प्रभावी रूप से अपनाते हैं। द्वितीय, FinTech और बैंक जोखिम के बीच एक उल्टे

यू-आकार (Inverted U-shape) का संबंध पाया गया है—प्रारंभिक चरण में डिजिटल निवेश और नियामकीय जटिलताओं के कारण जोखिम बढ़ता है, किंतु FinTech परिपक्व होने पर, यह क्रेडिट, तरलता, और उत्तोलन जोखिम को कम करके स्थिरता में सुधार लाता है। यह प्रभाव निजी और छोटे बैंकों में अधिक स्पष्ट रूप से देखा गया है। तृतीय, FinTech अपनाने और ESG प्रदर्शन के बीच एक यू-आकार (U-shape) का संबंध पाया गया है: आरंभिक स्तर पर FinTech अपनाने से संसाधनों पर दबाव पड़ता है और अनुपालन चुनौतियाँ उत्पन्न होती हैं, परंतु जैसे-जैसे डिजिटल एकीकरण परिपक्व होता है, ESG प्रकटीकरण और स्थिरता प्रथाओं में सुधार होता है। विशेष रूप से स्वतंत्र बोर्ड और कम वित्तीय उत्तोलन वाले निजी और छोटे बैंकों में ESG सुधार अधिक स्पष्ट हैं। ये निष्कर्ष दर्शाते हैं कि FinTech बैंकिंग क्षेत्र में दक्षता बढ़ाने, जोखिम घटाने, और सतत विकास को बढ़ावा देने की परिवर्तनकारी क्षमता रखता है, साथ ही यह भी स्पष्ट करता है कि संस्थागत विशेषताएँ इन प्रभावों को कैसे आकार देती हैं।

इन निष्कर्षों के आलोक में, अध्ययन बैंक प्रबंधन, नियामकों, और निवेशकों के लिए महत्वपूर्ण नीतिगत सुझाव प्रस्तुत करता है, जो बदलते डिजिटल बैंकिंग परिदृश्य में दिशानिर्देश प्रदान कर सकते हैं। बैंक प्रबंधन को सलाह दी जाती है कि वे अपने आकार और शासन संरचना के अनुरूप विशिष्ट FinTech रणनीतियाँ अपनाएँ, तथा डिजिटल अवसंरचना, साइबर सुरक्षा और प्रतिभा विकास में निवेश करें ताकि प्रदर्शन का इष्टतम स्तर प्राप्त किया जा सके। नीति-निर्माताओं को नवाचार और स्थिरता के बीच संतुलन साधते हुए एक सक्षम नियामक वातावरण बनाना चाहिए—विशेष रूप से साइबर सुरक्षा, ESG प्रकटीकरण, और समावेशी डिजिटल विकास को लेकर। निवेशकों, विशेषकर दीर्घकालिक और ESG-उन्मुख मंशा रखने वालों को उन बैंकों को प्राथमिकता देनी चाहिए, जो रणनीतिक रूप से FinTech को अपनाते हैं, मजबूत स्थिरता प्रथाओं का पालन करते हैं, और डिजिटल पारदर्शिता में अग्रणी हैं।

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LIST OF ABBREVIATIONS

ADAM	Adaptive Moment Estimation
AE	Allocative Efficiency
AI	Artificial Intelligence
AML	Anti-money laundering
ANN	Artificial Neural Networks
AQR	Asset Quality Review
AR (2)	Arellano-Bond serial correlation test
ATM	Automated teller machine
BCC	Banker-Charnes-Cooper
BRICS	Brazil, Russia, India, China, and South Africa
CAGR	Compound Annual Growth Rate
CAR	Capital Adequacy Ratio
CBA	Central Bank Assets
CCR	Charnes, Cooper, and Rhodes
CE	Cost Efficiency
CF	Cash Flow
CI	Cost-to-Income ratio
CRS	Constant returns to scale
DEA	Data Envelopment Analysis
DER	Debt-equity ratio
DFA	Distribution-Free Approach
DID	Difference-in-differences
DMUs	Decision-making units
EMDEs	Emerging Market and Developing Economies
ENV	Environmental
ESG	Environmental, Social, and Governance
ETA	Equity-to-asset ratio
FA	Factor Analysis
FCP	Clearing and Payment

FE	Fixed Effects
FI	Financial Technology Index
FIT	Information Transfer
FRA	Resource Allocation
FRM	Risk Management
FSB	Financial Stability Board
FTB	Technical Base
FY	Financial Year
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GOV	Governance
GFC	Global Financial Crisis
GST	Goods and Services Tax
HHI	Herfindahl-Hirschman Index
IFC	International Finance Corporation
IMF	International Monetary Fund
ISSB	International Sustainability Standards Board
KMO	Kaiser-Meyer-Olkin
LA	Loans and advances
LR	Leverage Risk
M&A	Mergers and Acquisitions
MFA	Multi-factor authentication
ML	Machine Learning
MTD	Moving Target Defense
NEFT	National Electronic Funds Transfer
NGFS	Network for Greening the Financial System
NI	Non-interest income
NIM	Net interest margin
NPLs	Non-performing loans
OLS	Ordinary Least Squares
PCA	Principal component analysis
PLS	Partial Least Square
PoS	Point-of-Sale

PSBs	Public sector banks
PSD2	Second Payment Services Directive
R&D	Research and Development
RBI	Reserve Bank of India
RBV	Resource-based view
RE	Random Effects
ROA	Return on assets
ROE	Return on equity
RTGS	Real Time Gross Settlement
SEM	Structural equation modelling
SFA	Stochastic Frontier Approach
SMEs	Small and medium-sized enterprises
SOC	Social
STRBI	Statistical Tables Relating to Banks in India
TA	Total Assets
TCFD	Task Force on Climate-related Financial Disclosures
TD	Total Deposits
TE	Technical Efficiency
TFP	Total Factor Productivity
TI	Total Income
UAE	United Arab Emirates
UK	United Kingdom
UPI	Unified Payments Interface
USA	United States of America
USD	United States Dollar
VIF	Variance Inflation Factor
VRS	Variable returns to scale
WDI	World Development Indicators
2SLS	Two-stage least squares estimator