Cambridge Centre for Alternative Finance

UNIVERSITY OF CAMBRIDGE Judge Business School

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FINTECH AND COVID-19

Impacts, Challenges, and Policy Priorities for Asia

Edited by John Beirne, James Villafuerte, and Bryan Zhang

ASIAN DEVELOPMENT BANK INSTITUTE

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Contents

Tables, Figures and Box v
Abbreviations ix
Contributors xi
Preface xiii

1. Overview 1
John Beirne, James Villafuerte, and Bryan Zhang

PART I: Fintech, Firms, and the Macroeconomy

2. COVID-19, Digital Transactions and Economic Activities: The Puzzling Nexus of Wealth Enhancement, Trade, and Financial Technology 7
Muhammad Ayub Khan Mehar

3. The COVID-19 Pandemic and Indonesia's Fintech Markets 35
Eric Alexander Sugandi

4. COVID-19, Fintech, and the Recovery of Micro, Small, and Medium-Sized Enterprises: Evidence from Bangladesh 63
Monzur Hossain and Tahreen Tahrima Chowdhury

5. Digital Doorstep Banking: Female Banking Agents Lead Digital Financial Inclusion through the Pandemic and Beyond 90
Alreena Renita Pinto and Amit Arora

PART II: Implications for the Post-Pandemic Era

6. The Promise of Fintech: Financial Inclusion in the Post-COVID-19 Era 129
Ratna Sahay, Ulric Eriksson von Allmen, Amina Lahreche, Purva Khera, Sumiko Ogawa, Majid Bazarbash, and Kimberly Beaton

7. Digital Finance, Financial Inclusion, and Sustainable Development: Building Better Financial Systems 176
Douglas Arner, Ross Buckley, Dirk Zetzsche, and Artem Sergeev

8. Toward a Data-Driven Financial System: The Impact of COVID-19 202
Nydia Remolina

9. Sharing Credit Data While Respecting Privacy: A Digital Platform for Fairer Financing of Micro, Small, and Medium-Sized Enterprises 222
Jin-Chuan Duan

Tables, Figures, and Box

Tables

2.1a	Dependent Variable: GDP Growth Rate (GROW) Panel Least Squares (Cross-sectional Random Effects)	20
2.1b	Dependent Variable: GDP Growth Rate (GROW) Panel Least Squares (Cross-sectional Random Effects)	21
2.2a	Dependent Variable: Merchandise Trade as % of GDP (MTGDP) Panel Least Squares (Cross-sectional Random Effects)	22
2.2b	Dependent Variable: Merchandise Trade as % of GDP (MTGDP) Panel Least Squares (Cross-sectional Random Effects)	23
2.3a	Dependent Variable: Trade in Services to GDP Ratio (STGDP) Panel Least Squares (Cross-sectional Random Effects)	24
2.3b	Dependent Variable: Trade in Services to GDP Ratio (STGDP)Panel Least Squares (Cross-sectional Random Effects)	25
2.4a	Dependent Variable: Market Capitalization to GDP Ratio (MCGDP) Panel Least Squares (Cross-sectional Random Effects)	26
2.4b	Dependent Variable: Market Capitalization to GDP Ratio (MCGDP) Panel Least Squares (Cross-sectional Random Effects)	27
A2.1	List of Variables	30
A2.2	Dependent Variable: GDP Growth Rate (GROW) Panel Least Squares (Cross-sectional Random Effects)	31
A2.3	Dependent Variable: Merchandise Trade as % of GDP (MTGDP) Panel Least Squares (Cross-sectional Random Effects)	32
A2.4	Dependent Variable: Trade in Services to GDP Ratio (STGDP) Panel Least Squares (Cross-sectional Random Effects)	33
A2.5	Dependent Variable: Market Capitalization to GDP Ratio (MCGDP) Panel Least Squares (Cross-sectional Random Effects)	34
A3.1.1	Variables, Data, and Data Sources	58
A3.1.2	Stationarity Level-Test Results	58
A3.1.3	Centered Variance Inflation Factors Values	59

A3.2.1	Factors Affecting Fintech Payment Transaction Values in Indonesia	60
A3.2.2	Factors Affecting Fintech Peer-to-Peer Lending in Indonesia	62
4.1	The Distribution of Samples across Divisions/ Districts and Estates	71
4.2	Average Decrease (%) in Production, Sales, and Profit across Firm Size Compared to Pre-COVID-19 Level and Estimated Recovery Rates	72
4.3	Status of Fintech and Online Platform Use among MSMEs	73
4.4	Average Recovery Rate (%) of Firms Using Mobile Financial Services and Online Platforms	75
4.5	Determinants of Use of Mobile Financial Services by MSMEs	78
4.6	Mobile Financial Service Use and Production	81
4.7	Mobile Financial Service Use and Sales	83
4.8	Mobile Financial Service Use and Profit	85
5.1	Financial Inclusion across Indian States, CRISIL Inclusix	92
5.2	RBI Financial Inclusion Plan: Progress Report	94
5.3	Comparison of the Performance of JEEViKA Female Agents vs Non-JEEViKA Male Agents, September 2018–August 2020	102
5.4	Summary of Daily Transactions that the JEEViKA Application Recorded	103
5.5	NRLM-Supported Female Agents, Monthly Progress Reports, 2020	107
5.6	Transaction Trends in Bihar and Odisha between March and July 2020	108
5.7	Transaction Failure Rates	114
9.1	A Non-exhaustive Summary of the SME Financial Assistance Programs in Six of the 10 ASEAN Countries	224
9.2	Summary Statistics on the Four Hypothetical Banks That Lend to Real Exchange-Listed SMEs in Six ASEAN Countries	236

Figures

2.1	Wealth Enhancement, Trade, and Financial Technology	16
3.1	Digital Banking Transaction Values in Indonesia	42
3.2	Shopping Transaction Values by Electronic Money and Payment Cards in Indonesia	43

3.3	New vs. Outstanding Peer-to-Peer Fintech Lending in Indonesia	43
3.4	Outstanding Fintech Peer-to-Peer Lending: Java vs. Outside Java	44
3.5	Quality of Peer-to-Peer Lending Measured Using the 90-Day Success Rate of Return	44
3.6	Bank Lending Rate vs. Fintech New Peer-to-Peer Lending Rate	45
4.1	Month-Wise Salary Disbursement and Merchant Payment through Mobile Financial Services in 2019 and 2020	68
4.2	Month-Wise Average Daily Transactions and Number of Daily Average Transactions through Mobile Financial Service in 2019 and 2020	69
4.3	Point to Point Quarterly Growth of Internet Banking in 2019 and 2020	69
5.1	Different Operational Models of Business Correspondent-Based Banking	92
5.2	Growth in the Value and Volume of AePS Transactions	97
5.3	AePS Transactions, April 2019–April 2021	106
5.4	Daily Withdrawal Transactions	110
5.5	Cash Withdrawal Transactions per BC Agent	112
5.6	Average Transaction Value	113
5.7	Daily Withdrawal Transaction Failure Rate	114
6.1	Scope of the Analysis	138
6.2	Access to Mobile Phones, 2017	143
6.3	Mobile Money Accounts, 2013–2017	145
6.4	Value of Mobile Money Transactions, 2018	145
6.5	Global Fintech Lending by Main Segments, 2015–2017	147
6.6	Fintech Credit Composition by Region, 2017	147
6.7	Use of Digital and Traditional Financial Accounts, 2017	148
6.8	Distribution of Traditional and Digital Financial Inclusion Indices, 2014–2017	149
6.9	Changes in Financial Inclusion Indices, 2014–2017	148
6.10	Gender Gaps: Traditional versus Fintech-Driven Financial Inclusion, 2017	151
B6.1	Financial Inclusion Index	152
B6.2	Digital Financial Inclusion Index, 2014–2017	153
6.11	Impact of Digital Financial Inclusion in Payments on Growth	156
6.12	Tech Spending in Fintech, 2019	158

6.13	Marginal Effect of Digital Infrastructures and Financial Familiarity on Digital Financial Inclusion, 2014–2017	162
9.1	The Schema of the Proposed Federated Credit Model Calibration over Multiple Privacy-Protected Distributed Data Sites along with a User-Support Function	232
9.2a	The 1-Month PDs (Portfolio Average) before and during the COVID-19 Period for the Four Bank Aggregate Portfolio in the Six ASEAN Countries	238
9.2b	The 1-Year PDs (Portfolio Average) before and during the COVID-19 Period for the Four-Bank Aggregate Portfolio in the Six ASEAN Countries	238
9.3	The Impact of the COVID Dummy Variable on the Intercept and the Coefficients of DTD and Two Liquidity Measures (Financial and Nonfinancial Firms) in the 12 Forward PD Functions along with their Corresponding 95% Confidence Intervals	240

Box

6.1	Measuring Fintech-Driven (Digital) Financial Inclusion	152

Abbreviations

AePS	Aadhaar Enabled Payment System
AFI	Alliance for Financial Inclusion
AFPI	Indonesia Fintech Lenders Association
AFTECH	Asosiasi Fintech Indonesia (Indonesia Fintech Association)
ASEAN	Association of Southeast Asian Nations
BC	business correspondent
BCNM	business correspondent network manager
BI	Bank Indonesia
BPS	Badan Pusat Statistik (Statistics Indonesia)
BSBDA	basic savings bank deposit accounts
BSCIC	Bangladesh Small and Cottage Industries Corporation
BST	Bantuan Sosial Tunai
COVID-19	coronavirus disease
CRI	Credit Research Initiative
DAY–NRLM	Deendayal Antayodaya Yojana–National Rural Livelihoods Mission
DFI	digital financial innovation
DFS	Department of Financial Services (India)
DTD	distance-to-default
ECF	equity crowdfunding
EM	electronic money
EMDEs	emerging market and developing economies
ESG	environmental, social, and governance
EU	European Union
FY	fiscal year
G2P	government-to-person
GDP	gross domestic product
IB	internet banking
IBA	Indian Banks' Association
iCASS	intelligent Credit Analytics Sharing System
IIBF	Institute of Banking and Finance
IT	information technology
IV	instrumental variable
JAM	Jan Dhan–Aadhaar–Mobile
JEEViKA	Bihar Rural Livelihoods Promotion Society
MB	mobile banking
MFS	mobile financial services

MSMEs	micro, small, and medium-sized enterprises
NABARD	National Bank for Agriculture and Rural Development
NBFI	nonbank financial institution
NPCI	National Payments Corporation of India
OJK	Otoritas Jasa Keuangan (Financial Services Authority, Indonesia)
P2P	peer-to-peer
PB	phone banking
PD	probability of default
PMGKY	Pradhan Mantri Garib Kalyan Yojana
PMJDY	Pradhan Mantri Jan Dhan Yojana
PRC	People's Republic of China
PSBB	pembatasan sosial berskala besar (large-scale social distancing, Indonesia)
PSU	public sector undertaking
QE	quantitative easing
RBI	Reserve Bank of India
SDGs	Sustainable Development Goals
SHG	self-help group
SMC	sequential Monte Carlo
SMEs	small and medium-sized enterprises
US	United States
VIF	variance inflation factor

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Preface

Set against the context of a growing financial technology (fintech) sector in Asia, this book provides insights on fintech's impacts on economic recovery during the coronavirus disease (COVID-19) pandemic. Helped by the region's smooth adoption of digitalization, notably in the area of digital payments, the backdrop for the continued development of fintech firms in Asia was already favorable. The region benefited from "leapfrogging technology" using mobile and internet-based solutions, with businesses and consumers alike being very accustomed to operating in a digital world. In such an environment, the availability of credit by both fintech and big tech firms in Asia and the Pacific grew significantly. The onset of COVID-19 led to an acceleration in the pace of digitalization, particularly in fintech. Low levels of financial inclusion in Asia also contributed to the growth of fintech in the region, with the proportion of adults having traditional bank accounts being less than 50% in many economies, particularly in Southeast Asia. Insurance and wealth management financial services are also characterized as being low in penetration, which has created a fertile ground for fintech growth. This of course was brought more to the fore due to the pandemic. As a result of COVID-19, firms, as well as governments, were forced to adopt digital solutions in order to carry out their tasks and meet their objectives.

The start-up nature of many fintech firms enabled them to respond rapidly to the pandemic, without the constraints posed by legacy technology. With economies more focused on economic recovery during 2022, fintech firms have been able to benefit from new opportunities provided by the substantial growth in digital financial services and e-commerce. COVID-19 forced fintech firms to rethink their business models in order to progress further going forward. Social distancing also increased demand for neobanks (i.e., internet-only banks) in Asia, while traditional banks are also demonstrating a keenness to collaborate with fintech firms in providing digital financial services.

While COVID-19 has had disproportionate negative economic effects on micro, small, and medium-sized enterprises (MSMEs) and poor households, fintech providers played an important role in mitigating these effects, notably in Asia. The increased use of fintech during the pandemic has been an important aspect in enabling many MSMEs to remain economically viable, with financial services being faster, more efficient, and cheaper than traditional banking. Moreover, peer-to-peer

lending and crowdfunding have been important sources of finance for MSMEs during the pandemic. In addition, digital financial inclusion has helped to provide households with access to financial services in an efficient manner, mitigating the economic ramifications of COVID-19. The important role of fintech during the pandemic in providing respite to vulnerable groups needs to be highlighted, particularly due to its contribution to enhancing digital financial inclusion, lowering inequality, and stimulating more balanced economic growth.

Due to the rapid response of fintech at the onset of the pandemic, communities in remote areas continued to be able to obtain crucial financial services, such as those related to the disbursement of government relief funds. In addition, fintech provided important support to the informal or "gig" economy, which is a sector that is typically underserved by traditional banking. One of the effects of COVID-19 was to spotlight the needs of those who are not part of the traditional financial system. Fintech provides a conduit for these people through effective collaboration with financial institutions and national governments, as well as the retail sector.

The increased use of fintech, particularly during the pandemic, has highlighted a number of key policy areas that should be focused on to maximize its impact on financial inclusion. One of the main hurdles relates to the level of digital literacy and financial literacy across countries. Without having a sufficient level of competence in these areas, economies and communities may be unable to reap the benefits of fintech. In Asia and the Pacific, there is a significant amount of heterogeneity in digital and financial literacy levels, which means that the rate of diffusion and take-up of digital financial services differs across the region. Addressing deficits in digital and financial literacy is therefore of crucial importance. Another factor impeding the financial inclusion impact of fintech relates to insufficient levels of development in digital payments infrastructure, internet connectivity, and broadband penetration. In Asia and the Pacific, some economies are particularly less developed in this respect than others, such as in parts of Southeast Asia. Finally, a lack of trust in digital finance can be a factor, and this is closely related to concerns about data privacy and consumer protection. This book provides insights and empirical work on these issues.

At the time of writing in July 2022, there appears to be an upward growth trajectory for fintech post-pandemic not only in Asia but also globally, with the continued flexibility and innovation of fintech firms enabling efficiency in service provision across a wide range of sectors. There is also a strong feedback loop in Asia as regards fintech adoption driving innovation, and vice versa. Moreover, competition is becoming stronger in Asia in the virtual banking space. There are also potential

risks to sustained growth related to security concerns and addressing potential financial stability risks as regulation of fintech becomes an ever more important policy area. In the case of the latter, many economies in Asia and around the world have created "regulatory sandboxes" to enable digital innovation in the financial sector, while also monitoring and managing the emergence of financial stability risks. It is hoped that this book will stimulate discussions on these issues by policy makers, as well as new avenues of research on fintech impacts.

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1

Overview

John Beirne, James Villafuerte, and Bryan Zhang

This book comprises selected papers presented during the joint Asian Development Bank Institute–Asian Development Bank–Cambridge Centre for Alternative Finance (CCAF), University of Cambridge Judge Business School virtual conference, which took place from 30 March to 1 April 2021. The book examines the role of the novel coronavirus disease (COVID-19) pandemic as a catalyst for the accelerated adoption, use, and trust of digital technology in the financial sector, and the impact of financial technology (fintech) firms in supporting households and businesses during the pandemic. In addition, the book highlights critical structural changes needed from a policy and regulatory perspective to ensure that the post-pandemic fintech environment is efficient and safe, and can minimize risks related to consumer protection, financial stability and cybersecurity.

The book is set against the context of the role of the pandemic as a potential catalyst for an accelerated shift toward digital transformation. A 2020 survey conducted by the CCAF and the World Bank indicated that at the global level, the pandemic led to increase in demand and usage for digital financial services across fintech industry verticals around the world. For instance, costs associated with cross-border remittances are often considerably lower—as compared to traditional channels—via fintech in digital payments. The lower costs of remittance via digital payment channels were particularly important amid the pandemic for consumers during extensive periods of lockdown. For countries subject to strict COVID-19 confinement and lockdown measures, the demand for digital financial services is even higher, from cashless payments, digital banking, and digital wealth management (i.e., wealthtech) to digital asset custody and exchange. In Asia and the Pacific, digital lending and digital capital raising channels have also been highly utilized during the pandemic by start-ups and SMEs. The increasing demand for life and health insurance coverage during the pandemic also created further opportunities for fintech growth in InsurTech. Policy dialogues by central banks globally on issuing central bank digital currencies and regulatory

authorities on regulatory and supervisory innovation initiatives (e.g., suptech) have also progressed further during the pandemic, including in Asia. The book aims to shed light on the development of fintech and related policy as well as regulatory issues in the context of the Asia-Pacific region such as financial inclusion and consumer protection. This book is structured in two parts. Part I focuses on the impact of fintech on consumers, businesses and the macroeconomy during the pandemic. Part II focuses on the policy implications for the post-pandemic era.

Part I comprises four chapters. Chapter 2 provides an empirical assessment across 102 economies on the impact of fintech on gross domestic product (GDP) growth, trade in goods and services, and shareholders' wealth. While the pandemic adversely affected GDP growth, empirical evidence suggests that fintech played an important role in offsetting macroeconomic losses to some extent. Trade and shareholder values were found to be important transmission channels for digital finance, with the overall findings also holding even for a subpanel of 35 Asian economies. Chapter 3 examines the impact of the pandemic and the large-scale social distancing (PSBB) policy on Indonesia's fintech markets, as well as the role of fintech on economic recovery. It is found that Indonesia's fintech markets were relatively resilient during the pandemic, while PSBB increased the quantity of electronic money transactions. The chapter highlights policy lessons on the role of fintech as a stabilizer or shock absorber in the face of the pandemic shocks and as a vehicle for enhancing financial inclusion among poor households and small firms. Chapter 4 focuses on micro, small, and medium-sized enterprises (MSMEs) in Bangladesh during the pandemic and the effect of fintech. Based on survey data from 216 MSMEs, it was shown that mobile financial services were important for driving production, sales, and profitability during the pandemic. In particular, access to digital financial services helped to facilitate the stable supply of raw materials required for production. The chapter highlights the need for greater incentives and policies to further promote the adoption of digital finance and utilization of online platforms by MSMEs, in order to enhance both efficiency and economic recovery for these MSMEs. Chapter 5 examines the role of female banking agents in rural India in facilitating access to social security transfers using fingerprint-based biometric authentication solutions during the pandemic-related lockdown between March 2020 and July 2020. The chapter highlights the importance of further enhancements to the digital infrastructure both for transfers of social security payments and other benefits and for addressing gender-focused financial inclusion through targeted financial products and services.

Part II of the book also consists of four chapters, focusing on implications and lessons for the post-pandemic era. Chapter 6 presents a new index of digital financial inclusion, which demonstrates that digital finance can enhance financial inclusion and promote higher levels of GDP growth. The role of fintech in reducing gender inequality is also outlined in the chapter. Moreover, while fintech firms have demonstrated resilience and flexibility during the pandemic, the chapter shows that collaborative arrangements with traditional banks have further accelerated the digitalization of financial services provision. Chapter 7 focuses on three central themes that are likely to affect finance over the next decade, all of which have been reinforced by the pandemic: sustainable development; technology adoption and tensions between economic, financial, and technological globalization; and fragmentation. The chapter highlights a range of areas where digital finance has been advanced due to the pandemic, including electronic payments and money (including central bank digital currencies); technology for regulatory and supervisory purposes ("regtech" and "suptech"); digital identity and market integrity; and the concentration and dominance of big tech firms and digital finance platforms. The chapter argues for a redesign of existing financial infrastructure and regulatory systems using technology. Chapter 8 assesses the digital transformation of the financial sector in the wake of the pandemic. Data-driven and technology-based solutions to lending programs during the pandemic (e.g. government-backed loan schemes and relief plans) have been adopted by fintech firms and traditional financial institutions. The gradual shift to digitalized financial services has been underway since the aftermath of the global financial crisis of 2008. The chapter stresses the importance for balance in the regulation of fintech to safeguard consumer protection and mitigate financial stability risks, while at the same time support post- pandemic sustainable recovery. Chapter 9 outlines a credit analytics sharing infrastructure that can provide useful information to address the reluctance of financial institutions that lend to MSMEs, an issue which became even more important during the pandemic. The framework addresses information asymmetry by pooling credit information across multiple lending institutions, enabling the construction of a more informative and robust credit model for MSMEs. The chapter presents empirical work based on actual MSME credit data to illustrate the feasibility of a shared credit analytic infrastructure. The impact of the pandemic is also assessed using a portfolio constructed from four hypothetical banks operating in six Association of Southeast Asian Nations member countries.

Overall, the book sheds light on the impact of the pandemic on the digital transformation occurring in financial services and the role

of fintech in enhancing financial inclusion and supporting the post-pandemic recovery. The empirical evidence demonstrated in the book suggested that the pandemic acted as a catalyst to accelerate the use, adoption, and trust of digital technology and finance by households, business, financial institutions, and credit providers. In a global context, Asia and the Pacific is at the forefront of digital financial services and fintech adoption, and developing and shaping the right policies and regulatory frameworks to encourage financial innovation whilst protecting consumers, mitigating financial stability risks and fighting cybersecurity will be crucial in the future. In conjunction with investment in future-proof digital infrastructure and the promotion of digital financial education, fintech and other forms of digital financial services can contribute effectively to economic recovery and sustainable growth.

PART I

Fintech, Firms, and the Macroeconomy

2

COVID-19, Digital Transactions, and Economic Activities: The Puzzling Nexus of Wealth Enhancement, Trade, and Financial Technology

Muhammad Ayub Khan Mehar

2.1 COVID-19, Economic Activities, and Digital Payments

The countermeasures in the state of emergency due to the coronavirus disease (COVID-19) pandemic have restricted the mobility of people, economic activities, entertainment opportunities, and trade in goods and services. The negative and slow growth in the global economy is a natural consequence of such countermeasures and restrictions. Most of the negative growth in the global economy has been transmitted through restrictions and blockages in the trade in goods and services. Educational activities, tourism, travel, entertainment, hospitality, dining in public restaurants, and transportation are included in those services that have been damaged badly because of the COVID-19 pandemic. This shows that trade in services has been badly affected due to countermeasures and restrictions during the pandemic. It is worth noting that the share of trade in services was 13.6% of global gross domestic product (GDP) in 2019, which dropped to 10.8% in 2020 (World Bank 2021). This indicates the impact of the pandemic on global trade in services.

According to one estimate (University of Cambridge 2020), the global economy faces a GDP loss over the next 5 years due to the COVID-19 pandemic ranging from an optimistic loss of $3.3 trillion (0.65% of 5-year GDP) in a rapid recovery scenario to $82.4 trillion

(16.3%) in an economic depression scenario. According to the mid-range consensus of economists in the study (University of Cambridge 2020), the global GDP may drop by $26.8 trillion or 5.3% of 5-year GDP. The economic growth and priorities in development planning in developed and developing countries have been affected by the spread of COVID-19 and the countermeasures adopted by the governments under the state of emergency in different ways. It is mainly the disruption in supply chains, the stoppage of business activities, the interruption to travel and transportation, and the drop in global demand for commodities and services that have steered the economic contractions across the world. However, the different types of businesses are affected by the pandemic in different ways, with a surge of more than $25 billion being recorded in the wealth of the top 100 companies (Mehar 2021). The *Financial Times* (2020) has classified e-commerce, cloud computing, pharmaceuticals, and gaming as the winning sectors.

This uncertainty or declining trend of GDP can also affect the value of financial assets, particularly the value of equities of the companies listed on stock exchanges. The value of equities indicates the wealth of investors, which is an indicator of the investment and business activities in the economies. The investors' wealth, trade, and GDP growth are mutually dependent areas, and their linkages determine the trends of economic progress. How the linkages of shareholders' wealth, GDP growth, and trade activities have been affected due to the COVID-19 pandemic is the core area of this study.

The measures to counter the spread of COVID-19, including lockdowns, the suspension of educational and entertainment activities, the temporary ban on public transport, the suspension of flights and airport operations, and the enforcement of social distancing, have accelerated the use of electronic payments, online buying, and the use of social media for normal business activities. Several strategies for enhancing the use of digital technologies have been attempted during the COVID-19 crisis. The objective of those attempts was to mitigate the adverse effects of the crisis and to provide alternative ways of continuing economic activities during the crisis. Digital technology was rapidly adopted by the public for transferring remittances when remitting cash became a difficult option due to numerous pandemic-related restrictions. The central banks in different countries have encouraged digital payments and mobile money transfers by waiving transaction fees and charges on digital payments. Though it is a common opinion that COVID-19 is a temporary crisis and, like other pandemics, it will become history, the countermeasures will initiate a new era in the use of digital technology. The countermeasures will change business processes

and customers' habits. According to a survey carried out by McKinsey & Company (2020), 75% of people who used digital modes of payment for the first time during the pandemic have indicated that they will continue to use these modes even after things have returned to normal. According to the World Trade Organization (2020), online e-commerce platforms have registered significant growth since the start of the pandemic. A rapid growth in the businesses of e-commerce companies has been reported. Amazon announced revenues of $75 billion in the first 3 months of 2020, MercadoLibre reported more than a 70% increase in net revenue in the first quarter of 2020, and Alibaba reported a 22% growth in sales in the first 3 months of 2020. All these indicators predict that a speedy shift to electronic payments and e-commerce is likely.

Organizations and enterprises in developed and developing countries have invested in digital transformation to enable their business activities to continue successfully. Educational institutions; banks and financial service providers; home delivery of foods, groceries, clothes, and medicines; and other such services are among those businesses where heavy capital has been invested in digital transformation. Their workers, consumers, and clients have also learned to use collaborative software and participate in virtual meetings. The flourishing of information technology (IT) and its peripheral businesses due to the crisis is quite obvious.

Here, it is notable that maximization of shareholders' wealth is the ultimate objective of the changes in business and economic policies and processes. In this context, the increasing share of capital gain in the total return on investment, risk-return trade-offs, long-term strategies and planning in assets management, and venture capital industries have led to the "wealth maximization hypothesis" in financial economics. Contrary to well-accepted "profit maximization theories" in economics, financial economists have adopted the wealth maximization hypothesis to develop their models and theoretical advancement. Modern economic thought is dominated by the financial markets' mechanism, which is primarily based on this hypothesis. To achieve the maximization of the "end of period wealth" as the "core objective" of firms and investors—both individual and institutional—is the fundamental principle in all financial theories and models established under the wealth maximization hypothesis. This concept favors all those actions that can improve the end-of-period shareholders' wealth. The provision for health insurance, spending on corporate social responsibility, use of digital currency, adoption of e-commerce, use of cryptocurrency, mobile banking, and investment in IT to enhance or continue existing business operations are

included in those actions and policies that can be considered for wealth maximization. One of the premises in this reasoning is that growing use of financial technology (fintech) will lead the growth in shareholders' wealth (or market capitalization), or it will reduce the magnitude of the expected decline in shareholders' wealth due to COVID-19.

The World Economic Forum (2021) has pointed out that interrupted social interactions, job losses, a growing digital divide, and abrupt shifts in markets due to the pandemic can lead to severe concerns and lost prospects for large parts of the global population. Climate change, infectious diseases, weapons of mass destruction, debt crises, and the possibility of the IT infrastructure breaking down are risk factors for the global economy, while in the post-COVID-19 world, the digital power concentration, digital inequality, and cybersecurity failure may create further risks.

A consistent erosion of institutions as shown by declining or stalling checks and balances and transparency indicators, high levels of debt in selected economies, widening inequalities, eroding tax bases, and dispersion in information and communication technology access were identified global issues before COVID-19. Moreover, the declining trends in fundamental aspects of productivity have been masked by long-standing accommodative monetary policy but have remained bottlenecks for strengthening economic development (World Economic Forum 2020). Now, COVID-19 has accelerated and broadened the Fourth Industrial Revolution with the rapid expansion of e-commerce, online education, digital health, and remote work.

Based on an assessment by business leaders—through an executive opinion survey—the World Economic Forum (2020) has identified some common strategies to counter the adverse effects of COVID-19. Social distancing, economic digitalization, safety nets and financial soundness to support those who could not work through the pandemic, supporting companies with direct subsidies or credit to prevent excessive bankruptcies and job losses, sound governance and planning, and improving the health system and research capacity, are the common strategies that were identified by the executive opinion survey. However, mismatch between the corporate debt risks and required liquidity in the global financial system over the past decade the World Economic Forum (2020) found there was, while access to finance despite increasing financial inclusion by fintech applications is not sufficiently widespread. Krugman (2020), Rogoff (2020), and Mehar (2021) have insisted on debt financing and enhancement in financial inclusion through the use of fintech and digital modes for financial transactions for economic persistence, while the common actions and strategies

that have been adopted by governments in developed and developing countries belong to short-term borrowing. Mehar (2021) has established a mathematical model to devise a standard to measure the sustainability of external financing. Shirai (2020) explained that the liquidity crunch motivated many central banks to use extensive monetary easing along with substantial fiscal incentive measures. As a result of such policies, a large number of central banks have confronted the effective lower bound (or even zero) in their policy rates. Central banks in the eurozone, Japan, and the United States (US) have scaled up quantitative easing (QE) through the large-scale buying of financial assets (e.g., treasury securities). The Bank of England restarted QE as its policy rate declined to approximately 0%. The Bank of England also permitted a delay of the government's existing overdraft facility amid growing financing needs and burdens in the short-term funding markets. The Bank of England advised that the country's unemployment rate will be over 9% even in 2021. The Bank of England advised the commercial banks to keep lending, because a drop in lending will lead to the liquidation of several businesses, which will come back to upset the banks. The central banks in Australia, Canada, and New Zealand also confronted the effective lower bound in March 2020 and introduced QE. Central banks in Brazil, Chile, Colombia, Hungary, Indonesia, the Philippines, Poland, the Republic of Korea, Romania, and South Africa also implemented QE, despite some still continuing with relatively large positive interest rates (Shirai 2020).

It is noteworthy that global economic growth during the last 2 decades was closely associated with globalization, while the components of globalization can be broadly classified into two categories. The first category belongs to digital technology that includes use of the internet, digital payments, e-commerce, and e-money. The second category covers the physical movements of people, goods, and services. The short-term measures to counter the spread of COVID-19 can create a barrier in the way of globalization, while adverse effects of these short-term measures on the global economy are quite obvious. The disruption of tourism activities and international flight operations, and the restriction of trade in goods and services, may hinder global economic growth. However, accelerated use of the components in the first category can compensate for the effects of the second category to some extent. This is one of the areas of concern in this study.

Although GDP losses due to COVID-19 have been estimated by various studies, a growing use of fintech, including digital transfer, e-money, and e-commerce, has been observed worldwide. One of the important questions in this regard relates to the mitigation of GDP and business losses by the growing use of fintech. This question has been

addressed in this study. We have ascertained the extent to which GDP losses can be mitigated by the use of fintech.

One of the important questions concerns the role and effectiveness of the numerous modes of financial inclusion and fintech in perpetuity of economic and business activities. In this study, we have empirically tested the impacts of several elements of the uses of digital payments on GDP growth, trade in goods and services, and shareholders' wealth. The use of credit cards, the use of the internet for shopping and payment of utility bills, and electronic transfer of funds are the components of fintech that have been included in this study.

The core purpose of this analysis is to examine the effects of different means of fintech on economic growth, trade in goods and services, and investors' wealth. This study examines the impacts of various modes of online and digital payments on (i) GDP growth, (ii) trade activities, and (iii) shareholders' wealth. Section 2.2 establishes a model to explain the relations between the instruments of financial inclusion and technology, trade activities, economic growth, and investors' wealth. The methodology and statistical model used to test the impacts of fintech on economic growth, trade activities, and investors' wealth are explained in section 2.3, while section 2.4 describes the empirical proof based on statistical estimates, and section 2.5 presents the deductions and some policy-related inferences.

2.2 Economic Growth and Financial Inclusion and Technology

The magnitude of trade in services was 13.6% in 2019, which dropped to 10.8% after the spread of COVID-19 in 2020 (World Bank 2021). A decline in global GDP growth from 3.4% in 2017 to –3.4% in 2020 was observed. This declining phenomenon is common across regions with different magnitudes. A decline in merchandising trade was also observed (World Bank 2021; IMF 2021), while domestic credit to the private sector was enhanced after the start of the pandemic, which reflects the government support for the private sector through financial institutions to safeguard the economic activities during the crisis period. The growth in domestic credit to the private sector was a common phenomenon all over the world.

A clear change in the patterns of economic growth, investment, and financing of economic activities from 2017 to 2020 has been noted. The hard data show the changes in global and regional positions of economic growth, trade in goods and services, and shareholders' wealth after and

before the spread of COVID-19, while the sources of financing have also been changed. The World Bank (2017) carried out a survey that depicts the financial inclusion and use of fintech in economic transactions before the spread of COVID-19. This study is based on interactions of the hard data and variables that have been shown in this survey, while some control variables to determine the effect of COVID-19 on GDP growth, trade in goods and services, and investors' wealth have also been included. A list of the variables is presented in the Appendix, Table A2.1.

Various studies have discussed the economic changes in the context of the pandemic and recommended some policy measures to counter the adverse effects of COVID-19 (World Bank 2020a; IMF 2020a, 2020b; Krugman 2020; Rogoff 2020; Mehar 2021). Similarly, the links between economic growth and the use of fintech have been established in various studies. Amstad et al. (2019) broadly defined fintech as "advanced technology to improve and automate delivery and use of financial services to consumers and businesses. It covers a broad landscape from digital currencies and payment systems (e.g., mobile phone wallets, cryptoassets, remittance services) to asset management (e.g., internet banking, online brokers, robo-advisors, cryptoasset trading, personal financial management, mobile trading) to alternative finance (e.g., crowdfunding, peer-to-peer lending, online balance sheet lending, invoicing, and supply chain finance)." According to Gormez (2019), electronic money is not a new concept, and technology can enhance the way of dealing, but it does not change the fundamental nature. He claims that central banks that have perfectly addressed all the fundamental glitches of money and financial service provision can issue digital currencies with no reluctance.

Haddad and Hornuf (2019) concluded that more fintech start-up formations are possible when the economy is well developed and venture capital is readily available. Claessens et al. (2018) mentioned that fintech credit offers a substitute funding source for businesses and consumers, and may expand access to credit for underserved fragments. This may improve the efficiency of financial intermediation. However, fintech credit sizes are greater in countries with less rigorous banking regulation. The International Fund for Agricultural Development and the World Bank Group (2015) pointed out that governments and institutions are now realizing the vast potential of mobilizing migrant capital for the development of national and local economies. However, because of the centrality of remittances to development, it is vital to develop policy guidelines to maximize the impact of migrants' funds. Xu and Xu (2019) explained how the Government of the People's Republic of China (PRC) has implemented many regulations for fintech

applications for the prevention and resolution of financial risks. They included peer-to-peer lending, third-party payments, and cryptoassets in those measures, while some additional measures, including financial standardization, fintech infrastructure development, and investor protection, have also been strengthened to promote sustainable fintech development. The government has tried to strike a balance between encouraging fintech innovation and strengthening regulations.

Based on these studies, current observations in global economic trends, the global inclination to use digital instruments for financial transactions, and measures to counter the spread of the coronavirus, we have established an econometric model based on four simultaneous equations. The interconnectivity of the equations is shown in Figure 2.1, which illustrates how the use of digital instruments influences GDP growth, trade in goods and services, and investors' wealth.

We supposed that decision-making by investors will be based on the expected change in their wealth in response to their decisions. Investors' wealth has been measured by the market capitalization to GDP ratio in a country. It is further supposed that investors' wealth, GDP growth, and trade activities are determined simultaneously. It is obvious that trade in goods and services is largely affected by the countermeasures in response to COVID-19 and the growing use of digital technology. Thus, we included the trade in goods and services to GDP ratio in our analysis. In light of these suppositions, we established four equations to identify the determinants of GDP growth (GROW), the merchandise trade to GDP ratio (MTGDP), the trade in services to GDP ratio (STGDP), and the market capitalization to GDP ratio (MCGDP). The fundamental idea in determining these equations is to test the effects of several types of digital instruments for financial transactions and the COVID-19 pandemic on economic growth, investors' wealth, and trade in goods and services. These equations have been estimated by different alternative options (models), with several control variables also included in these equations.

It is hypothesized that GDP growth is determined by trade in services (STGDP), the use of the internet for online buying of goods and services and payment of utility bills (NETBUY), and the use of credit cards (CARDBUY), while the spread of COVID-19 in 2020 and the number of deaths due to this pandemic have adversely affected GDP growth. To determine the magnitude of merchandise trade (MTGDP), we supposed that domestic credit to the private sector (DCPS), receiving payments through digital modes (RCVDGT), and the size of the economy (GDP) are the determinants of merchandise trade (MTGDP), while the COVID-19 pandemic (COVID) has negatively

affected the magnitude of merchandising trade (MTGDP). It is further hypothesized that receiving payments through digital modes (RCVDGT), the size of merchandising trade (MTGDP), and the size of domestic credit to the private sector are the explanatory factors of the trade in services (STGDP). The underlying assumption for considering the merchandising trade (MTGDP) in the determination of trade in services (STGDP) is the strong association between these two types of trade. The trade in merchandizing goods (MTGDP) establishes the relationships between the people and business communities of two countries, which may enhance the trade relations to promote trade in services (STGDP). The relationship between the business communities of two countries boosts their mutual trade in services like banking and insurance, education, tourism, travel, and health facilities. It was also supposed that the COVID-19 pandemic (COVID) has negatively affected the magnitude of trade in services.

In determining shareholders' wealth in terms of the market capitalization to GDP ratio (MCGDP), merchandising trade (MTGDP) and domestic credit to the private sector as a percentage of GDP (DCPS) have been included as independent variables, while the GDP growth rate (GROW), permission to commercial banks for issuance of e-money (BNKEMON), and receiving payments through digital modes (RCVDGT) have been taken as control variables. We have also tested the impact of the COVID-19 pandemic (COVID) on investors' wealth (MCGDP).

The estimated models are based on various theories and justifications in economic literature (Amstad et al. 2019; Gormez 2019; World Bank 2020a; IMF 2020a, 2020b; Krugman 2020; Rogoff 2020; Durrani, Rosmin, and Volz 2020; Sachs et al. 2020; University of Cambridge 2020; Mehar 2021), while the logical reasoning of the determinants of explained variables has been described in the above discussion.

2.3 Methodology to Measure the Impacts of Fintech

The abovementioned theoretical discussion, models, and Figure 2.1 have been summarized in the following mathematical expressions, while the Appendix, Table A2.1 provides descriptions of the variables:

$$GROW_{it} = \propto_i + \beta_1 COVID_t + \beta_2 DEATH1MP_{it} + \beta_3 COVID_t * NETBUY_i + \beta_4 NETBUY_i + \beta_5 CARDBUY_i + \beta_6 STGDP_{it} + \beta_7 BNKEMON_i + \beta_8 RCVDGT_i + \beta_9 MTGDP_{it} + \beta_{10} GDP_{it} + \beta_{11} DCPS_{it} + \varepsilon_{it} \quad (1)$$

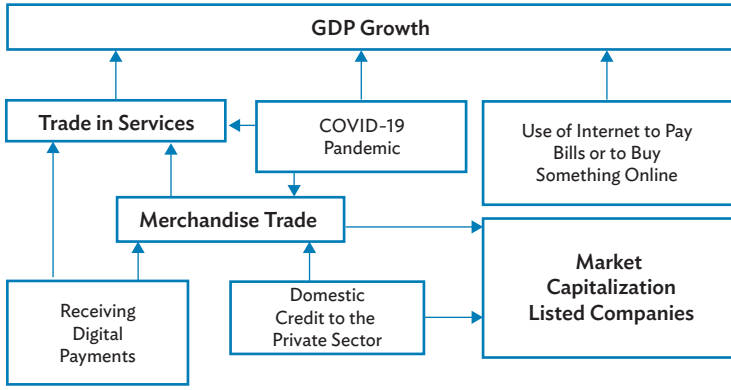
$$MTGDP_{it} = \propto_i + \beta_1 COVID_t + \beta_2 RCVDGT_i + \beta_3 DCPS_{it} + \beta_4 GDP_{it} + \varepsilon_{it} \quad (2)$$

$$STGDP_{it} = \propto_i + \beta_1 COVID_t + \beta_2 RCVDGT_i + \beta_3 COVID_t * RCVDGT_i + \beta_4 MTGDP_{it} + \beta_5 DCPS_{it} + \beta_6 COVID_t * DCPS_{it} + \varepsilon_{it} \quad (3)$$

$$MCGDP_{it} = \propto_i + \beta_1 DCPS_{it} + \beta_2 MTGDP_{it} + \beta_3 GROW_{it} + \beta_4 COVID_t + \beta_5 RCVDGT_i + \beta_6 BNKEMON_i + \varepsilon_{it} \quad (4)$$

Equations (1) to (4) have been estimated through panel data. The data for this study were obtained from the World Development Indicators DataBank (World Bank 2020b, 2021). In this analysis, we employed data on 102 countries for 4 years (from 2017 to 2020). To compare Asian economies with the global conditions, we estimated the same equations for 35 Asian countries. The inclusion of Asian countries in this study is based on the World Bank classification of countries by region (World Bank 2021). The data on further economies could not be incorporated in the model because of the absence of data on some indicators that are included in the study. The cross-sectional random-effects panel least squares (PLS) technique was applied to estimate the effects of explanatory variables. Gross domestic product (GDP) data are in $ billion, while merchandise trade (MTGDP), trade in services

Figure 2.1: Wealth Enhancement, Trade, and Fintech



GDP = gross domestic product.

Source: Author's depiction.

(STGDP), market capitalization (MCGDP), and domestic credit to the private sector (DCPS) are shown as a percentage of GDP. The data on GDP growth were measured in annual percentage change.

The *Global Financial Development Report 2019/2020* (World Bank 2019) provides the details of countries where commercial banks are permitted to issue e-money (BNKEMON). These data have been incorporated through a dummy variable, which is equal to "1" if commercial banks in a country are allowed to issue e-money (plus prepaid e-money cards) and "0" otherwise. The data on the use of a debit or credit card to make a purchase in the past year (CARDBUY), use of the internet to pay bills or to buy something online in the past year (NETBUY), receiving digital payments in the past year (RCVDGT), receiving payments from self-employment through a mobile phone (RCVMBL), and sending domestic remittances through a mobile phone (RMTMBL) have been extracted from the *Global Financial Inclusion and Consumer Protection Survey* report (World Bank 2017).

2.4 Results and Empirical Findings

The outcomes of regression testing are shown in Tables 2.1 to 2.4. Tables 2.1a to 2.4a show the estimated parameters in the global context, while Tables 2.1b to 2.4b depict the picture in Asian countries. The significance of parameters and overall goodness of fit in the equations have also been reported in the abovementioned tables. The parameters associated with the betas show quantifications of the impacts of explanatory variables, though some outcomes are shocking and contradict common opinions. The adjusted R-squares and F-statistics demonstrate goodness of fit in all estimated equations, which shows that independent variables included in the models significantly include the effects of explanatory variables.

The robustness in assessed parameters has also been tested by using the replacements of control variables, where some falsification tests have also been performed. For this intention, some control variables have been incorporated in the regression analysis.

To estimate GDP growth (GROW), we incorporated two dummy variables: COVID (equal to "1" for 2020 to represent the COVID-19 pandemic and "0" otherwise) and BNKEMON (equal to "1" if commercial banks are allowed to issue e-money—including prepaid e-money cards—in the economy and "0" otherwise). The effect of COVID-19 was significantly negative and robust in all alternative scenarios. To evaluate these important results, we tested this model using four alternative scenarios. But the negative and significant effect of COVID-19 was not falsified. However, the issuance of e-money by commercial banks was

not significant. The impact of the use of the internet for paying utility bills or buying something (NETBUY) was significant in all scenarios, which indicates that the use of e-money or electronic transactions may improve the economic situation. However, the negative impact of paying with debit and credit cards is not understandable. It may well be because of high multicollinearity between the use of credit and debit cards and e-money. To capture the effects of the use of buying through the internet during the COVID-19 pandemic (COVID), we created an interaction variable by multiplying the dummy variable of the COVID-19 pandemic (COVID) by the dummy variable of the use of the internet for buying something and for paying bills (NETBUY). The significant parameters associated with this interaction variable indicate the positive effects of using the internet for buying something and paying utility bills during the pandemic on GDP growth. The effect of the number of deaths due to COVID-19 in a country on GDP growth was also tested and significant results show that the higher number of deaths because of the pandemic have significantly affected GDP growth. This provides additional information that as well as the existence of the COVID-19 pandemic (COVID), its severity (DEATH1MP) in a country also affects economic activities. The results for Asian countries depict the same conclusions. The results of the Asian sample are not statistically different from those of the global sample, though the magnitude of betas is different.

The effects of the COVID-19 pandemic and receiving payments through digital modes of financing on merchandising trade are shown in Tables 2.1a and 2.1b. It is thought that the COVID-19 pandemic has significantly affected the merchandise trade to GDP ratio; however, the use of digital modes for receiving money provided some compensation, as the role of digital modes for receiving money is significantly positive for determining the magnitude of merchandising trade. The negative betas associated with GDP indicate that the trade to GDP ratio is relatively lower in large-sized economies. Another important conclusion is the significant role of domestic credit to the private sector in improving the merchandise trade to GDP ratio. It justifies the role of monetary policy in ensuring the growth and sustainability of the merchandising trade. The sample from Asian countries shows consistency with global findings.

Tables 2.2a and 2.2b show that the use of digital modes for receiving payments (RCVDGT) positively affects trade in services. The positive effects of receiving digital payments (RCVDGT) on international trade in services are significant and robust in all alternative scenarios. Similarly, the impact of the magnitude of merchandise trade (MTGDP) is also

positive. However, domestic credit to the private sector (DCPS) is not significant for enhancing trade in services (TSGDP). This last finding is contrary to the common opinion, as it is a common intuition that enhancing domestic credit helps the services sector to promote its trade and production. This opinion was not supported by the current study. The negative impact of the COVID-19 pandemic on trade in services is confirmed in this analysis. The results are significant and robust in all alternative scenarios, including global and Asian samples. However, in the case of Asian economies, the effect of the use of digital modes for receiving payments (RCVDGT) is not significant.

Tables 2.3a and 2.3b show the significant impacts of domestic credit to the private sector (DCPS) and merchandising trade (MTGDP) on shareholders' wealth (MCGDP). The results are statistically significant and consistent in all scenarios. The impacts of the use of digital technology for financial transactions and growth in GDP have not been proved significant explanatory variables for the determination of investors' wealth. However, these variables affect shareholders' wealth indirectly through growth in merchandising trade.

It is believed, in regard to the results (Tables 2.1a to 2.4b), that in the absence of fintech, including buying something through the internet and using digital modes for receiving money, the GDP losses due to the COVID-19 pandemic might be much higher. The use of fintech has significantly mitigated the GDP losses. The inferences are the same for trade in goods and services. In the absence of fintech, the adverse effects of COVID-19 on trade in goods and services might be higher.

It has been concluded that from the statistical significance point of view, Asian economies are not different from other economies. Although it is contrary to common intuition, the results show that the COVID-19 crisis has affected the Asian economies in the same way, though the magnitudes of parameters are slightly different.

To compare the Asian economies with the global sample, we have also adopted an alternative technique. To reconfirm the results, we re-estimated the equations in the global scenario by introducing a dummy variable (equal to "1" for Asian economies and "0" otherwise). The results of these estimations are shown in the Appendix (Tables A2.2 to A5.5). It has been consistently noted that the dummy variable (for Asian economies) was statistically insignificant in all cases, which shows that Asian economies have no significant difference. The COVID-19 pandemic and the growing use of fintech have affected the Asian economies in the same way, though the magnitudes are slightly different.

Table 2.1a: Dependent Variable: GDP Growth Rate (GROW) Panel Least Squares (Cross-sectional Random Effects) No. of Countries: 90; No. of Years: 4 (2017–2020); Total Observations: 344

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	3.083***	6.007	2.883***	5.407	3.453***	6.591	4.019***	4.503
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	–7.685***	–16.947	–7.674***	–16.890	–7.375***	–14.976	–8.817***	–12.945
Death due to COVID-19 against 1 million population: DEATH1MP	–0.004***	–6.184	–0.004***	–6.166	–0.004***	–6.435	–0.002**	–2.174
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Used the internet to pay bills or to buy something online in the past year (% of population aged 15+): NETBUY	0.038***	4.379	0.038***	4.353	0.035***	3.727	0.048***	3.290
Used the internet to pay bills or to buy something online in the past year (% of population aged 15+): NETBUY	0.058**	2.514	0.050*	2.134	0.053**	2.426	0.067**	2.229
Used a debit or credit card to make a purchase in the past year (% of population aged 15+): CARDBUY	–0.083***	–3.741	–0.084***	–3.754	–0.072	–3.347	–0.084***	–3.035
Received digital payments in the past year (% of population aged 15+): RCVDGT	0.028	1.430	0.033	1.682	0.017	0.905	0.006	0.245
Trade in services as % of GDP: STGDP	0.012	1.427	0.013	1.587	0.0159**	2.055	0.015*	1.776
Merchandise trade as % of GDP: MTGDP	–0.001	–0.177	0.001	0.105	0.003	0.744	–0.0004	–0.058
GDP in $ billion: GDP			0.0001	1.373	0.0002**	2.049	0.0002	1.381
Domestic credit to private sector as % of GDP: DCPS					–0.009*	–1.763	0.001	0.173
Dummy variable equal to "1" if commercial banks are allowed to issue e-money (plus prepaid e-money cards) and "0" otherwise: BNKEMON							–0.516	–0.983
Adjusted R-square	0.7785		0.7788		0.7654		0.7420	
F-statistic	151.6968		135.1951		100.4964		43.6222	
Durbin-Watson stat	1.5125		1.3273		1.1662		1.0282	

GDP = gross domestic product.

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

Table 2.1b: Dependent Variable: GDP Growth Rate (GROW) Panel Least Squares (Cross-sectional Random Effects) No. of Asian Countries: 29; No. of Years: 4 (2017–2020); Total Observations: 107

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	4.131***	3.624	3.901***	3.297	4.476***	3.798	2.357*	1.817
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	−8.799***	−8.857	−8.821***	−8.814	−8.253***	−8.725	−10.431***	−9.796
Death due to COVID-19 against 1 million population: DEATH1MP	−0.005**	−2.272	−0.005**	−2.203	−0.006**	−2.438	−0.003	−1.177
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Used the internet to pay bills or to buy something online in the past year (% of population aged 15+): NETBUY	0.073***	3.524	0.073***	3.517	0.070***	3.243	0.113***	5.002
Used the internet to pay bills or to buy something online in the past year (% of population aged 15+): NETBUY	0.086	1.470	0.069	1.095	0.118*	1.903	0.121**	2.123
Used a debit or credit card to make a purchase in the past year (% of population aged 15+): CARDBUY	−0.120**	−2.060	−0.112*	−1.889	−0.115**	−1.989	−0.106*	−1.886
Received digital payments in the past year (% of population aged 15+): RCVDGT	0.038	0.827	0.042	0.917	0.040	0.845	0.010	0.238
Trade in services as % of GDP: STGDP	−0.028	−1.206	−0.026	−1.129	−0.029	−1.237	0.005	0.141
Merchandise trade as % of GDP: MTGDP	0.005	0.658	0.006	0.797	0.023**	2.403	0.015*	1.836
GDP in $ billion: GDP			0.001	0.798	0.001**	2.111	0.001***	3.023
Domestic credit to private sector as % of GDP: DCPS					−0.038***	−2.978	−0.033***	−2.764
Dummy variable equal to "1" if commercial banks are allowed to issue e-money (plus prepaid e-money cards) and "0" otherwise: BNKEMON							2.552**	2.420
Adjusted R-square	0.6622		0.6607		0.6806		0.7394	
F-statistic	26.9724		23.9340		21.0268		22.1456	
Durbin-Watson stat	1.3967		1.4027		1.5157		1.6764	

GDP = gross domestic product.

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

Table 2.2a: Dependent Variable: Merchandise Trade as % of GDP (MTGDP) Panel Least Squares (Cross-sectional Random Effects) No. of Countries: 99; No. of Years: 4 (2017–2020); Total Observations: 355

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	47.565***	5.312	46.880***	5.241	47.676***	5.386	48.277***	3.969
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	−3.614***	−6.149	−2.954***	−3.340	−3.625***	−5.647	−3.737***	−6.572
Received digital payments in the past year (% of population aged 15+): RCVDGT	0.416**	2.211	0.391**	2.065	0.358*	1.916	0.338*	1.724
Domestic credit to private sector as % of GDP: DCPS	0.086*	1.888	0.113**	2.145	0.112**	2.341	0.056	1.213
GDP in $ billion: GDP	−0.003**	−2.447	−0.003**	−2.454	−0.003**	−2.568	−0.003**	−1.968
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Domestic credit to private sector as % of GDP: DCPS			−0.011	−1.003				
Foreign direct investment in $ billion: FDIBIL					−0.007	−0.721		
Dummy variable equal to "1" if commercial banks are allowed to issue e-money (plus prepaid e-money cards) and "0" otherwise: BNKEMON							3.775	0.307
Adjusted R-square	0.1157		0.1157		0.0980		0.1335	
F-statistic	12.5814		10.2653		8.2339		11.2016	
Durbin-Watson stat	1.2844		1.2920		1.2137		1.2590	

GDP = gross domestic product.

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

Table 2.2b: Dependent Variable: Merchandise Trade as % of GDP (MTGDP) Panel Least Squares (Cross-sectional Random Effects) No. of Asian Countries: 35; No. of Years: 4 (2017–2020); Total Observations: 121

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	53.021***	3.518	50.219***	3.438	53.733***	3.963	49.129***	3.003
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	−5.008***	−3.744	−3.262*	−1.845	−4.996***	−3.442	−5.922***	−4.6114
Received digital payments in the past year (% of population aged 15+): RCVDGT	0.118	0.330	−0.013	−0.038	−0.056	−0.168	−0.355	−1.053
Domestic credit to private sector as % of GDP: DCPS	0.261***	2.996	0.364***	3.517	0.324***	3.708	0.243***	2.957
GDP in $ billion: GDP	−0.004*	−1.926	−0.004**	−2.049	−0.006**	−2.606	−0.003	−1.583
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Domestic credit to private sector as % of GDP: DCPS			−0.033	−1.598				
Foreign direct investment in $ billion: FDIBIL					−0.066	−1.414		
Dummy variable equal to "1" if commercial banks are allowed to issue e-money (plus prepaid e-money cards) and "0" otherwise: BNKEMON							21.427	1.220
Adjusted R-square	0.0944		0.1086		0.0992		0.1287	
F-statistic	4.1267		3.9237		3.5111		4.1032	
Durbin-Watson stat	1.3820		1.5150		1.3482		1.4334	

GDP = gross domestic product.

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

Table 2.3a: Dependent Variable: Trade in Services to GDP Ratio (STGDP) Panel Least Squares (Cross-sectional Random Effects) No. of Countries: 102; No. of Years: 4 (2017–2020); Total Observations: 376

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	6.961	1.494	6.848	1.465	6.576	1.324	6.241	1.248
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	–4.266***	–12.921	–5.316***	–7.222	–3.939***	–4.763	–2.809***	–4.431
Merchandise trade as % of GDP: MTGDP	0.053***	1.775	0.058*	1.945	0.092***	2.849	0.088***	2.706
Received digital payments in the past year (% of population aged 15+): RCVDGT	0.278***	3.071	0.272***	2.993	0.324***	3.213	0.308***	3.010
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Received digital payments in the past year (% of population aged 15+): RCVDGT			0.023	1.594	0.011	0.727		
Domestic credit to private sector as % of GDP: DCPS					–0.065**	–2.325	–0.045	–1.423
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Domestic credit to private sector as % of GDP: DCPS							–0.009	–1.262
Adjusted R-square	0.3423		0.3454		0.3238		0.3266	
F-statistic	66.0647		50.4662		32.8880		33.2965	
Durbin-Watson stat	1.3885		1.3863		0.9629		0.9371	

GDP = gross domestic product.

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

Table 2.3b: Dependent Variable: Trade in Services to GDP Ratio (STGDP)Panel Least Squares (Cross-sectional Random Effects) No. of Asian Countries: 35; No. of Years: 4 (2017–2020); Total Observations: 129

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	8.027	1.441	8.120	1.437	6.332	1.174	6.424	1.175
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	−5.517***	−7.631	−5.917***	−4.059	−2.011	−1.429	−2.218	−1.611
Merchandise trade as % of GDP: MTGDP	0.104***	2.772	0.103***	2.727	0.187***	4.885	0.162***	4.110
Received digital payments in the past year (% of population aged 15+): RCVDGT	0.184	1.573	0.182	1.535	0.297**	2.306	0.219	1.635
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Received digital payments in the past year (% of population aged 15+): RCVDGT			0.010	0.316	−0.029	−0.836	0.047	1.042
Domestic credit to private sector as % of GDP: DCPS					−0.118***	−2.713	−0.059	−1.201
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Domestic credit to private sector as % of GDP: DCPS							−0.038**	−2.503
Adjusted R-square	0.3385		0.3338		0.3624		0.3913	
F-statistic	22.8287		17.0315		13.9564		13.2139	
Durbin-Watson stat	1.3545		1.3667		1.3714		1.3092	

GDP = gross domestic product.

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

Table 2.4a: Dependent Variable: Market Capitalization to GDP Ratio (MCGDP) Panel Least Squares (Cross-sectional Random Effects) No. of Countries: 54; No. of Years: 4 (2017–2020); Total Observations: 177

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**B**	**T**	**β**	**T**
Constant	–178.995***	–3.231	–138.862***	–2.943	–161.224***	–2.810	–137.953***	–2.993
Merchandise trade as % of GDP: MTGDP	1.929***	5.438	1.662***	5.130	1.813***	4.807	1.555***	4.385
Domestic credit to private sector as % of GDP: DCPS	1.748***	4.478	1.954***	4.968	1.945***	4.378	2.128***	4.687
GDP growth (annual %): GROW	0.140	0.051	0.210	0.076				
GDP in $ billion: GDP					–0.009	–0.912	–0.005	–0.762
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	18.401	0.650	15.278	0.545	15.508	1.018	11.750	0.787
Dummy variable equal to "1" if commercial banks are allowed to issue e-money (plus prepaid e-money cards) and "0" otherwise: BNKEMON	–14.659	–0.286			–34.478	–0.617		
Received digital payments in the past year (% of population aged 15+): RCVDGT			–1.205	–1.397			–1.231	–1.410
Adjusted R-square	0.2910		0.2751		0.2911		0.2737	
F-statistic	15.4473		14.7367		15.4547		14.6391	
Durbin-Watson stat	1.6523		1.6417		1.6359		1.6231	

GDP = gross domestic product.

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's Estimations.

Table 2.4b: Dependent Variable: Market Capitalization to GDP Ratio (MCGDP) Panel Least Squares (Cross-sectional Random Effects) No. of Asian Countries: 22; No. of Years: 4 (2017–2020); Total Observations: 75

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	−168.567**	−2.141	−209.096**	−2.354	−140.027	−1.432	−209.659**	−2.244
Merchandise trade as % of GDP: MTGDP	2.436***	5.055	1.487***	2.802	1.515**	2.529	0.796	1.318
Domestic credit to private sector as % of GDP: DCPS	2.0492***	3.643	3.2570***	4.399	3.624***	4.743	4.447***	5.171
GDP growth (annual %): GROW	−5.923	−1.598	−3.872	−1.054				
GDP in $ billion: GDP					−0.033**	−2.299	−0.029**	−2.088
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	1.634	0.053	−6.907	−0.221	24.256	1.273	7.060	0.373
Dummy variable equal to "1" if commercial banks are allowed to issue e-money (plus prepaid e-money cards) and "0" otherwise: BNKEMON	−83.022	−1.106			−193.932*	−1.877		
Received digital payments in the past year (% of population aged 15+): RCVDGT			−2.152	−1.256			−2.923	−1.591
Adjusted R-square	0.4434		0.3555		0.4092		0.3650	
F-statistic	12.7908		9.6045		11.2504		9.9681	
Durbin-Watson stat	1.1953		1.2249		1.2373		1.2404	

GDP = gross domestic product.

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's Estimations.

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Appendix

Table A2.1: List of Variables

Variable	Description
BNKEMON	Dummy variable equal to "1" if commercial banks are allowed to issue e-money (plus prepaid e-money cards) and "0" otherwise
CARDBUY	Used a debit or credit card to make a purchase in the past year (% of population aged 15+)
COVID	Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise
DEATH1MP	Death due to COVID-19 against 1 million population as on 20th December 2020
DCPS	Domestic credit to private sector as % of GDP
FDIBIL	Foreign direct investment in $ billion
FDIGDP	Net inflow of foreign direct investment as % of GDP
GDP	GDP in $ billion
GROW	GDP growth (annual %)
MCBIL	Market capitalization of listed domestic companies in $ billion
MCGDP	Market capitalization of listed domestic companies as % of GDP
MTGDP	Merchandise trade as % of GDP
NETBUY	Used the internet to pay bills or to buy something online in the past year (% of population aged 15+)
RCVDGT	Received digital payments in the past year (% of population aged 15+)
RCVMBL	Received payments from self-employment through a mobile phone (% of population aged 15+)
RMTMBL	Sent domestic remittances through a mobile phone (% of population aged 15+)
STDB	Short-term debt as % of total external debt
STGDP	Trade in services as % of GDP
XDBT	External outstanding debt in $ billion

Source: Author's compilation.

Table A2.2: Dependent Variable: GDP Growth Rate (GROW) Panel Least Squares (Cross-sectional Random Effects) No. of Countries: 90; No. of Years: 4 (2017–2020); Total Observations: 344

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	2.827****	5.383	2.668***	4.921	3.218***	6.195	2.686***	4.187
Dummy variable equal to "1" for Asian countries: ASIA	0.694*	1.800	0.647*	1.669	1.032***	2.672	0.725*	1.774
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	–7.739***	–17.040	–7.726***	–16.974	–7.459***	–15.128	–7.930***	–15.064
Death due to COVID-19 against 1 million population: DEATH1MP	–0.004***	–5.939	–0.004***	–5.934	–0.004***	–6.156	–0.004***	–5.680
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Used the internet to pay bills or to buy something online in the past year (% of population aged 15+): NETBUY	0.038***	4.367	0.038***	4.343	0.035***	3.803	0.040***	4.233
Used the internet to pay bills or to buy something online in the past year (% of population age 15+): NETBUY	0.056**	2.476	0.050**	2.132	0.050***	2.344	0.049**	2.254
Used a debit or credit card to make a purchase in the past year (% of population aged 15+): CARDBUY	–0.083***	–3.767	–0.083***	–3.771	–0.066***	–3.095	–0.068***	–3.157
Received digital payments in the past year (% of population aged 15+): RCVDGT	0.030	1.586	0.035*	1.793	0.018	1.009	0.021	1.158
Trade in services as % of GDP: STGDP	0.011	1.410	0.013	1.551	0.016**	2.063	0.020***	2.617
Merchandise trade as % of GDP: MTGDP	–0.001	–0.346	–0.001	–0.079	0.003	0.686	0.003	0.847
GDP in $ billion: GDP			9.07E-05	1.217	0.001**	2.198	0.001**	2.124
Domestic credit to private sector as % of GDP: DCPS					–0.013**	–2.548	–0.011*	–1.995
Dummy variable equal to "1" if commercial banks are permitted to issue e-money (including prepaid e-money cards) and "0" otherwise: BNKEMON							0.263	0.509
Adjusted R-square	0.7786		0.7789		0.7678		0.7814	
F-statistic	135.0601		121.8318		92.6607		85.8986	
Durbin-Watson stat	1.5152		1.5200		1.5297		1.5784	

GDP =gross domestic product,

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

Table A2.3: Dependent Variable: Merchandise Trade as % of GDP (MTGDP) Panel Least Squares (Cross-sectional Random Effects) No. of Countries: 99; No. of Years: 4 (2017–2020); Total Observations: 355

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	42.235***	4.206	41.912***	4.197	43.621***	4.366	44.576***	3.290
Dummy variable equal to "1" for Asian countries: ASIA	10.976	1.191	10.344	1.126	8.272	0.896	6.161	0.636
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	−3.565***	−6.053	−2.965***	−3.352	−3.584***	−5.570	−3.708***	−6.503
Received digital payments in the past year (% of population aged 15+): RCVDGT	0.461**	2.396	0.436**	2.250	0.396**	2.056	0.364*	1.808
Domestic credit to private sector as % of GDP: DCPS	0.079*	1.720	0.1042*	1.958	0.105**	2.193	0.052	1.102
GDP in $ billion: GDP	−0.003**	−2.464	−0.003**	−2.474	−0.003**	−2.567	−0.003**	−2.002
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Domestic credit to private sector as % of GDP: DCPS			−0.010	−0.916				
Foreign direct investment in $ billion: FDIBIL					−0.007	−0.703		
Dummy variable equal to "1" if commercial banks are permitted to issue e-money (including prepaid e-money cards) and "0" otherwise: BNKEMON							4.814	0.386
Adjusted R-square	0.1167		0.1164		0.0973		0.1321	
F-statistic	10.3571		8.7690		6.9842		9.3959	
Durbin-Watson stat	1.4690		1.4873		1.5604		1.5212	

GDP =gross domestic product,

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

Table A2.4: Dependent Variable: Trade in Services to GDP Ratio (STGDP) Panel Least Squares (Cross-sectional Random Effects) No. of Countries: 102; No. of Years: 4 (2017–2020); Total Observations: 376

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	6.257	1.211	6.163	1.190	5.549	1.006	5.267	0.954
Dummy variable equal to "1" for Asian countries: ASIA	1.521	0.332	1.478	0.322	2.185	0.443	0.489	0.100
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	−4.269***	−12.926	−5.316***	−7.222	−3.407***	−8.265	−2.737***	−4.316
Merchandise trade as % of GDP: MTGDP	0.052*	1.732	0.057*	1.902	0.090***	2.766	0.082**	2.534
Received digital payments in the past year (% of population aged 15+): RCVDGT	0.284***	3.065	0.278***	2.987	0.336***	3.219	0.266***	2.669
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Received digital payments in the past year (% of population aged 15+): RCVDGT			0.022	1.590				
Domestic credit to private sector as % of GDP: DCPS					−0.065**	−2.325		
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID* Domestic credit to private sector as % of GDP: DCPS							−0.014**	−2.180
Adjusted R-square	0.3412		0.3442		0.3237		0.3222	
F-statistic	49.5496		40.3712		32.8761		32.6658	
Durbin-Watson stat	1.4240		1.4443		1.4592		1.4422	

GDP =gross domestic product,

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

Table A2.5: Dependent Variable: Market Capitalization to GDP Ratio (MCGDP) Panel Least Squares (Cross-sectional Random Effects) No. of Countries: 54; No. of Years: 4 (2017–2020); Total Observations: 177

	Model I		Model II		Model III		Model IV	
Explanatory Variable	**β**	**T**	**β**	**T**	**β**	**T**	**β**	**T**
Constant	–180.396***	–3.198	–133.114***	–2.715	–163.322***	–2.763	–130.814***	–2.700950
Dummy variable equal to "1" for Asian countries: ASIA	4.689	0.127	–18.751	–0.499	6.479	0.173	–20.492	–0.539923
Merchandise trade as % of GDP: MTGDP	1.935***	5.463	1.669***	5.091	1.811***	4.766	1.556***	4.343843
Domestic credit to private sector as % of GDP: DCPS	1.727***	4.196	2.025***	4.856	1.931***	4.175	2.214***	4.618020
GDP growth (annual %): GROW	0.088	0.032	0.3799	0.138				
GDP in $ billion: GDP					–0.009	–0.924	–0.005	–0.801673
Dummy variable equal to "1" for 2020 to represent COVID-19 pandemic and "0" otherwise: COVID	18.143	0.639	16.232	0.578	15.609	1.022	11.077	0.739696
Dummy variable equal to "1" if commercial banks are permitted to issue e-money (including prepaid e-money cards) and "0" otherwise: BNKEMON	–13.627	–0.264			–33.479	0.589		
Received digital payments in the past year (% of population aged 15+): RCVDGT			–1.307	–1.464			–1.347	–1.486029
Adjusted R-square	0.2882		0.2694		0.2851		0.2680	
F-statistic	12.8770		12.1217		12.6960		12.0426	
Durbin-Watson stat	1.5101		1.5156		1.5251		1.5249	

GDP =gross domestic product,

"β" indicates coefficient; "T" indicates T-statistics.

*p < 0.1; **p < 0.05; ***p < 0.01.

Source: Author's estimations.

3

The COVID-19 Pandemic and Indonesia's Fintech Markets

Eric Alexander Sugandi

3.1 Introduction

With a large population, a growing middle-income class, and a high penetration of mobile phones and the internet, Indonesia is a large potential market for the financial technology (fintech) industry. Statistics Indonesia (BPS) estimated Indonesia's population at 270 million in 2020 (BPS 2020a). The World Bank estimated that 52 million Indonesians belonged to the middle class (World Bank 2020). The BPS (2020b) reported that around 65.5% of Indonesian households owned or used cellular (mobile) phones in 2019. Hootsuite estimated that, as of January 2021, there were around 202.6 million internet users in Indonesia, with the country's internet penetration ratio being 73.7% (Kompas 2021a).

The term fintech can be defined broadly or narrowly. Its broad definition includes all technology-based financial products offered by both banks and nonbank financial institutions (NBFIs). Its narrow and colloquial definition refers to the companies that deliver financial services using technology platforms, such as peer-to-peer (P2P) lending, payment transactions, digital financial innovation products, and crowdfunding. In this chapter, we use fintech to refer to its broad definition, and fintech industry and fintech markets, respectively, when referring to the industry and markets of fintech companies that offer technology-based financial service products.

Sahay et al. (2020) defined fintech as a technology-enabled innovation in financial services that could result in new business models, applications, processes, or products with an associated material effect on the provision of financial services. Bank Indonesia defined fintech as the use of technology in a financial system that generates products, services,

technology, and/or new business models and may have an impact on monetary stability, financial system stability, and/or the efficiency, fluency, security, and reliability of payment systems (AFTECH 2020).

Two authorities are responsible for regulating the fintech industry in Indonesia: (i) Bank Indonesia (BI), which regulates fintech companies and products related to payments; and (ii) the Financial Services Authority (OJK), which regulates fintech companies and products related to financial services (e.g., digital banking, P2P lending, crowdfunding, insure-tech, investment, and market aggregators) (Batunanggar 2019). There are two fintech associations in Indonesia: the Indonesia Fintech Association (AFTECH) and the Indonesia Fintech Lenders Association (AFPI). Each association sets ethical codes for its members.

According to the AFTECH, there are four main types of fintech products in Indonesia based on their respective business models: (i) digital payment; (ii) online lending; (iii) digital financial innovation (DFI) products (e.g., market aggregator, blockchain, and credit scoring); and (iv) equity crowdfunding (ECF). The AFTECH reported that by the end of 2020, 362 fintech start-up companies had joined the association. As of the second quarter (Q2) of 2020, 44% of the AFTECH members were online lending providers, 24% were DFI product providers, 17% were digital payment providers, 1% were equity crowdfunders, and the remaining 14% offered different types of fintech products. The OJK reported that there were 149 P2P fintech lending companies by the end of 2019.

Several of Indonesia's fintech start-up companies have obtained unicorn status (i.e., a start-up company with a market value higher than $1 billion) after receiving funding injections from big investors. These companies include Tokopedia, Traveloka, BukaLapak, OVO, and JD.ID. One fintech start-up company, Gojek, has become a decacorn (i.e., its market value is greater than $10 billion). These six fintech start-ups utilize big data and cloud computing technology (Abdillah 2020).

The number of studies on fintech in Indonesia is growing. For example, PwC Indonesia (2019) conducted a survey investigating the behavior of 2,800 fintech customers in Indonesia. The study by Batunanggar (2019) found that, in general, financial institutions in Indonesia have embraced fintech and financial customers have become more familiar with fintech products. Nuryakin et al. (2019) reported that the main users of fintech are urban households, while fintech's penetration among rural households and micro, small, and medium-sized enterprises (MSMEs) is still low. Tritto, He, and Junaedi (2020) found that the largest investment in Indonesia's P2P fintech lending comes from the People's Republic of China (PRC), in part due to the

regulatory tightening in the PRC and the regulatory gap in Indonesia's P2P fintech lending environment. The Indonesian authorities have created various regulations and institutions to cope with the potential risk of illegal business practices from the influx of foreign investment to the P2P fintech lending industry.

The coronavirus disease (COVID-19) outbreak in Indonesia has hit the country's economy. At the beginning of the outbreak, there was concern among Indonesia's fintech companies about the impacts of the pandemic on the industry. However, Indonesia's fintech industry seems to have survived the pandemic. In fact, the revenues for some types of fintech products were higher in 2020 than in 2019. The total values of fintech payment transactions in 2020 reached Rp27,547 trillion, higher than the Rp27,380 trillion in 2019. The P2P outstanding lending position increased from Rp13.2 trillion at the end of 2019 to Rp15.3 trillion at the end of 2020.

Researchers have conducted a growing number of studies to explore the impacts of the ongoing COVID-19 pandemic on the fintech markets. However, the literature investigating the impacts of the pandemic on Indonesia's fintech markets remains scant. This chapter seeks to contribute to the existing literature by examining the impact of the COVID-19 pandemic and the policy of large-scale social distancing (*pembatasan sosial berskala besar,* PSBB) on Indonesia's fintech markets. It also discusses the roles that fintech companies can play in Indonesia's economic recovery. It provides some policy recommendations for BI, the OJK, and the government to utilize fintech companies to support economic recovery.

Some analysts have claimed that the COVID-19 pandemic and the PSBB to contain it have accelerated the development of fintech markets in Indonesia. The rationale is that the pandemic and the PSBB have induced some households to engage in online financial activities rather than conducting them through conventional channels that involve face-to-face interactions with people. This chapter tests the claim and discusses the results.

The chapter proceeds as follows. Section 3.2 discusses related studies on the impacts of the COVID-19 pandemic on the fintech industry and markets in various countries. Section 3.3 examines the dynamics of Indonesia's fintech markets amid the COVID-19 pandemic. Section 3.4 discusses the impacts of the COVID-19 pandemic and the PSBB on Indonesia's fintech payment products and P2P fintech lending. Section 3.5 discusses the utilization of fintech by Indonesia's economic authorities to support the national economic recovery program. Section 3.6 concludes.

3.2 Related Literature

The World Bank and the University of Cambridge (2020) conducted a survey of 118 central banks and other financial regulatory authorities between June and August 2020 to assess these authorities' response to COVID-19 in regulating and supervising fintech activities and other forms of digital financial services. The survey found that the respondent regulators reported increases in the use or offering of many fintech products and services since the outbreak of the pandemic, particularly digital payments and remittances. The majority of regulators have either accelerated their existing regulatory innovation initiatives or introduced new initiatives on fintech during the pandemic.

Fu and Mishra (2020) examined the effects of the COVID-19 pandemic on digital finance and fintech adoption and use in 71 countries. They found that the spread of COVID-19 and related government lockdowns led to significant increases in downloads of finance applications. They reported that traditional incumbent banks have experienced particularly large gains compared with the "big tech" companies and newer fintech providers during the pandemic in terms of increased consumer uptake of their digital offerings. They also found that businesses that are amalgamated with an existing digital payment infrastructure have been better able to offset the adverse economic effects of the pandemic.

Hill (2021) observed that the COVID-19 pandemic has transformed the United States (US) financial services industry. The pandemic has caused consumers to shift to online and mobile financial services. This shift has hastened banks' adoption of fintech and formation of partnerships with nonbank fintech companies. It has encouraged regulators to scrutinize banks' use of technology and bank–fintech partnerships but at the same time encouraged them to use more technology for bank supervision. The pandemic will bring about regulatory changes for fintech companies, and their regulation may become more like that of mainstream financial companies (such as banks).

Moro-Visconti, Cruz Rambaud, and López Pascual (2020) used the Global FinTech Thematic Index, the MSCI World Banks Weighted Equity Index, and the MSCI World (excluding Australia) Information Technology Index to compare the performance of fintech stocks against that of bank stocks and information technology (IT) stocks. They found that fintech stocks are slightly more volatile than IT stocks and much more volatile than bank stocks. Fintech and IT stocks fell further than bank stocks in March 2020 in the initial phase of the COVID-19 pandemic; however, they recovered much faster than bank stocks from April 2020.

Didenko et al. (2020) suggested that stable digital currencies (e.g., LIBRA and the digital yuan) and COVID-19 can revolutionize the global payment system. The government can use stable digital currencies as a vehicle for public procurement and subsidies to bypass commercial banks at critical moments, such as the COVID-19 pandemic. The COVID-19 pandemic has given a boost to the digital yuan, which the People's Bank of China is currently preparing to launch.

Tut (2020) investigated the impact of the COVID-19 pandemic on the fintech payment markets in Kenya. He found that the pandemic initially harmed the mobile banking market but that favorable short-term regulatory changes have reversed some of the negative effects. Meanwhile, the use of all types of electronic payment cards except for charge cards (which are cheaper than other types of cards) declined significantly during the pandemic. The pandemic has reduced both domestic and international electronic fund transfers via real-time gross settlements. It has also reduced remittance inflows via fintech platforms.

The COVID-19 pandemic has not necessarily harmed the fintech markets in other countries and has sometimes even boosted them. It accelerated mobile money growth in West Africa (Reuters 2020). It boosted e-commerce transactions in Peru, where four out of 10 store purchase orders came from new customers, representing more than 5 million new users (PéruRetail 2020). It also promoted e-commerce transactions in Pakistan (Pakistan Today 2020) and boosted fintech lending for small and medium-sized businesses in Japan (*Japan Times* 2020).

Al Nawayseh (2020) examined citizens' intention to use fintech applications to build resilience during the COVID-19 pandemic. His research sample comprised 500 potential fintech service users in Jordan. He found that the perceptions of technological risks did not affect customers' intention to use fintech applications during the pandemic, but it did affect their trust in the service. Consumers are more likely to make fintech transactions when the perceived benefits, social value, and trust are high and at the same time the risk perceptions are low.

Erel and Liebersohn (2020) investigated the impact of fintech on extending the US government's Paycheck Protection Program to regions and borrowers that the traditional banking system does not serve. They found that zip codes with fewer bank branches, lower incomes, and a larger minority share of the population showed disproportionate use of fintech. Fintech's role in the Paycheck Protection Program provision was greater in counties where the economic effects of the COVID-19 pandemic were more severe.

Davidovic et al. (2020) discussed the use of mobile platforms for government-to-person (G2P) transfers in 57 countries during the

COVID-19 pandemic. They stated that governments' ability to reach workers and households with lifeline support differs across countries depending on the availability of three basic delivery components: (i) a universal identification system, (ii) socioeconomic data on households, and (iii) a mode of benefit delivery. They found that some countries, for example, Brazil, Togo, Peru, and Nigeria, have used G2P mobile transfers to overcome delivery infrastructure weaknesses.

Sahay et al. (2020) introduced a digital financial index to examine the role of digital finance in promoting financial inclusion. They found that digital finance increases financial inclusion and is associated with higher gross domestic product (GDP) growth. Based on these findings, they suggested that digital financial inclusion could play an important role in mitigating the economic and social impacts of the COVID-19 pandemic. Compared with conventional financial services, digital financial services are faster, more efficient, and typically cheaper in reaching lower-income households and MSMEs. Digital financial services can and are enabling contactless and cashless transactions during the pandemic.

Benni (2021) conducted a thorough study on digital finance during the COVID-19 pandemic. He found that the pandemic has accelerated the process of financial digitization, caused a surge in the use of digital payment and transfer services, and helped to reduce dependence on cash exchanges. Meanwhile, the digitization of G2P transfers can enable a social safety net. Digital credit can facilitate the provision of short-term loans to pandemic-affected businesses.

The previous studies have shown that the COVID-19 pandemic and the lockdown policies to curb its spread have promoted the use of fintech on a worldwide scale. Nonetheless, the impacts of the pandemic and lockdowns on the fintech industry have differed across countries and market niches of fintech products. Some of the studies and reports have also shown that the authorities in many countries are utilizing their fintech companies to mitigate the negative impacts of the COVID-19 pandemic and to help the economic recovery, such as using fintech payment channels for cash transfers, subsidies, and assistance for MSMEs.

3.3 Indonesia's Fintech Market Dynamics amid the COVID-19 Pandemic

The COVID-19 pandemic had a brief negative impact on fintech payment transactions in Indonesia during the PSBB period, which lasted from April to June 2020 and mostly took its toll on internet

banking transactions. The internet banking channel is the largest fintech payment transaction channel in Indonesia.

The fintech payment transaction values via phone banking (PB), mobile/SMS banking (MB), internet banking (IB), and electronic money (EM) channels fell in February 2020. However, this was more likely a result of the seasonal factor related to the Chinese New Year festival (celebrated on 25 January 2020) than the COVID-19 pandemic (whose outbreak started in March 2020 in Indonesia). After the festival ended, Indonesian Chinese households returned to their normal spending patterns and thus reduced their fintech transactions.

The IB transaction values fell from Rp2,009 trillion in March 2020 to Rp1,773 trillion in June 2020, while the MB transaction values declined from Rp384 trillion to Rp369 trillion. The PB transaction values increased from Rp9.8 trillion in March 2020 to Rp10.8 trillion in April 2020 and to Rp14.4 trillion in May 2020 before falling to Rp11.6 trillion in June 2020 (Figure 3.1). The EM transaction values rose from Rp15 trillion in March 2020 to Rp17.6 trillion in April 2020 before falling again and hovering around Rp15 trillion in May 2020 and June 2020 (Figure 3.2). As the Indonesian government gradually opened up the economy in July 2020, the IB, MB, and overall fintech payment transaction values rapidly recovered.

According to Karaniya Dharmasaputra, the AFTECH Secretary-General, the values of fintech payment transactions surged in April 2020 as consumers temporarily switched their main payment channel from ATM debit cards to fintech payment channels. Nonetheless, he added that the values of fintech payment transactions fell in May 2020 and June 2020 (*Bisnis Indonesia* 2020).

Figure 3.2 shows that the pandemic caused the values of the EM shopping transactions to approach those of credit cards and combined ATM cards and ATM+ debit cards (ATM+ cards). The shopping transaction values of credit cards and ATM+ cards fell sharply from the beginning of the year to May 2020 before rebounding from June 2020. The decline in transaction values of credit cards and ATM+ cards was in part a result of the declining number of face-to-face shopping activities during the PSBB.

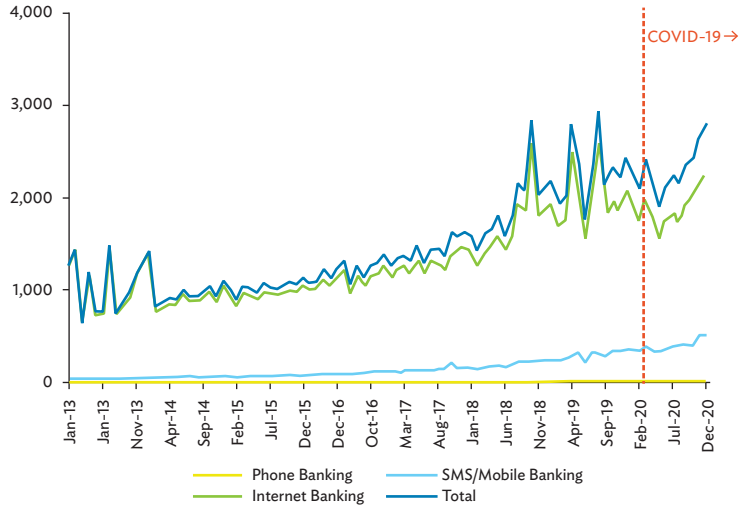
The pandemic also briefly affected the P2P fintech lending from April to July 2020. New P2P lending fell from Rp7.1 trillion in March 2020 to Rp3.5 trillion in July 2020, while outstanding P2P lending declined from Rp14.8 trillion to Rp11.9 trillion (Figure 3.3). The new and outstanding P2P fintech lending started to increase from August 2020 as economic activities gradually resumed with the end of the PSBB.

As the focus of P2P fintech lending is on the island of Java, the decline in Java drove the fall in the outstanding P2P lending from April

to July 2020. While lending in Java still led the P2P lending recovery, the nominal value and the share of P2P lending outside Java have been higher than their pre-pandemic levels (Figure 3.4). The quality of P2P lending (measured using the 90-day success rate of return) had deteriorated before the pandemic and worsened in the early phase of the pandemic and the PSBB. This situation is also apparent from the increasing P2P lending default rate during the same time span (Figure 3.5). The P2P lending quality started to improve in September 2020.

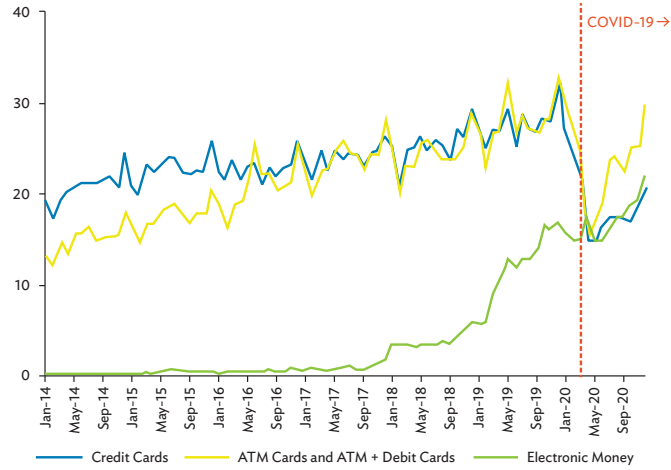
Figure 3.6 shows that fintech P2P lending values tend to move in the opposite direction to the bank lending rates. Except for the PSBB period, the P2P lending increases as the bank lending rates fall. There are no publicly available data on the P2P fintech lending rates, but these rates move in the same direction as the bank lending rates. According to the AFTECH, banks usually benchmark these rates to the lending rates of conventional banks under the "BUKU 1" (banks with core capital less than Rp1 trillion), "BUKU 2" (core capital between Rp1 trillion and Rp5 trillion), or rural bank categories following the OJK and BI classification (*Kompas* 2018).

Figure 3.1: Digital Banking Transaction Values in Indonesia (Rp trillion)



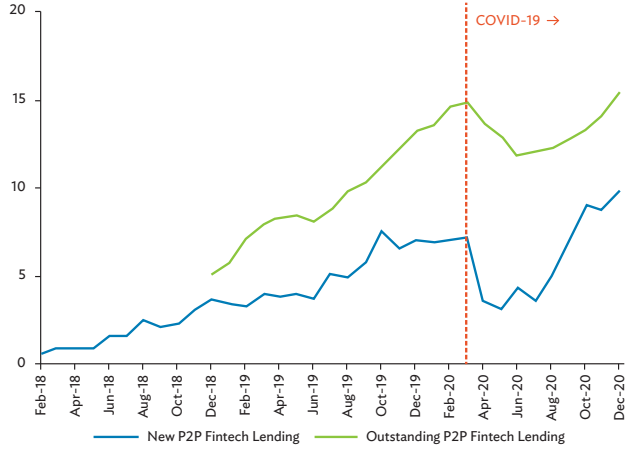
Source: Bank Indonesia.

Figure 3.2: Shopping Transaction Values by Electronic Money and Payment Cards in Indonesia (Rp trillion)



Source: Bank Indonesia.

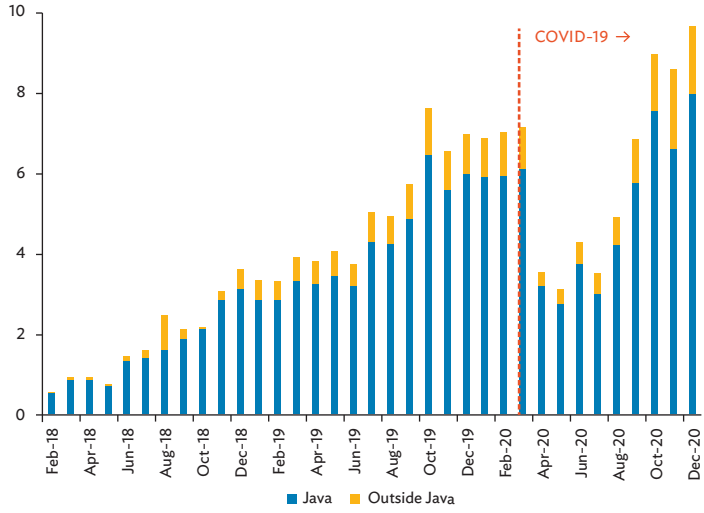
Figure 3.3: New vs. Outstanding Peer-to-Peer Fintech Lending in Indonesia (Rp trillion)



P2P = peer-to-peer.

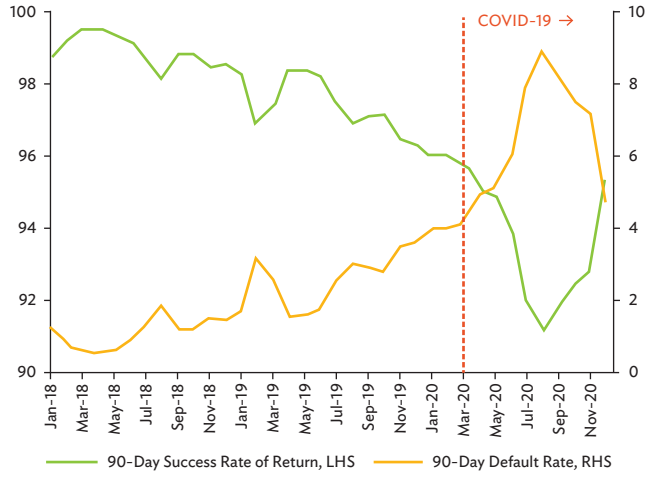
Source: Otoritas Jasa Keuangan.

Figure 3.4: Outstanding Fintech Peer-to-Peer Lending: Java vs. Outside Java
(Rp trillion)



Source: Otoritas Jasa Keuangan.

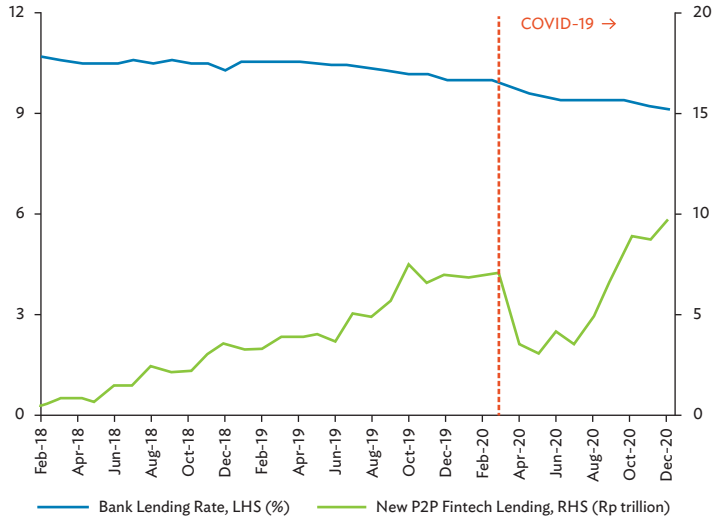
Figure 3.5: Quality of Peer-to-Peer Lending Measured Using the 90-Day Success Rate of Return
(%)



LHS = left-hand side, RHS = right-hand side.

Source: Otoritas Jasa Keuangan.

Figure 3.6: Bank Lending Rate vs. Fintech New Peer-to-Peer Lending Rate



LHS = left-hand side, P2P = peer-to-peer, RHS = right-hand side.

Source: Otoritas Jasa Keuangan.

According to the AFPI, the P2P lending rate for productive business ranges between 16% and 30% (*Kontan* 2019). This rate is higher than banks' average 10.4% working capital and 10.5% investment lending rates in January 2019. The OJK does not impose a limit on P2P lending rates, but the P2P fintech lending companies should advise lenders and borrowers of the lending rate by considering the appropriateness of the rate and the national economic condition (Article 17 of the OJK Regulation No. 77/POJK.01/2016).

Although P2P lending fintech companies seem to have been resilient during the COVID-19 pandemic, the pandemic and the lockdown harmed borrowers' ability to repay their loans. As of April 2020, about 50% of the AFPI members (which represents around 80 P2P lending fintech companies) received requests for lending restructuring from their customers (UOB, PwC, and Singapore Fintech Association 2020).

In December 2020, the OJK issued a new regulation (POJK No. 14/POJK.05/2020) that revised the previous regulation on the countercyclical measure to mitigate the impact of the COVID-19

pandemic on NBFIs. The new regulation included P2P fintech lending as one of the NBFIs, whereas the previous regulation did not. Based on the new regulation, P2P fintech companies can restructure their lending with borrowers whose businesses the pandemic has harmed.

Equity crowdfunding (ECF) also grew strongly during the COVID-19 pandemic. The OJK reported that, as of 30 September 2020, three ECF fintech companies (Santara, Bizhare, and Crowddana) had helped 111 small and medium-sized enterprises (SMEs) to raise Rp154 billion of funding in total from 16,965 investors (*Kontan* 2020). An SME that receives a capital injection through the ECF scheme gives part of its ownership to investors in the form of company shares (stock).

In December 2020, the OJK issued a regulation (POJK No. 57/POJK.04/2020) that allows securities-based fintech crowdfunding. This regulation replaced the previous regulation that only allowed equity-based crowdfunding. Under the new regulation, crowdfunding can use debt securities and Islamic debt securities (*sukuk*). The new regulation also allows MSMEs to engage in fintech crowdfunding. The previous regulation confined the right to conduct crowdfunding to legal limited companies (*Perusahaan Terbatas*). The expectation is that the new OJK regulation will facilitate Indonesia's crowdfunding market growth.

As Indonesia's fintech industry is very dynamic, with more and more new companies, it is rather difficult to know the exact number of existing fintech companies in Indonesia. Many fintech companies have registered with the OJK, but others are awaiting a license to operate as authorized fintech companies. The presence of illegal fintech companies is also an issue that the Indonesian authorities need to resolve.

The AFTECH (2020) reported that 362 fintech companies became members in 2020. Fintech Singapore (2020) stated that there were 322 fintech companies in Indonesia in 2020. The study by UOB, PwC, and Singapore Fintech Association (2020) reported a much higher number of existing fintech companies in Indonesia in 2020: 577. The AFPI noted that, as of June 2020, only 33 out of its 161 members had obtained a license from the OJK to operate as authorized fintech lenders, while the remaining 128 only had a registered status of waiting to obtain a license. The OJK stated that, as of 10 January 2021, there were 149 authorized fintech P2P lending companies (Infobank 2020).

Fintech Singapore (2020) reported that several major acquisitions had taken place in 2020, including Gojek's acquisition of MOKA (amounting to $130 million), Fundtastic's acquisition of Invisee (amounting to $6.5 million), and Gojek's acquisition of MOKA (undisclosed amount). Meanwhile, OVO and DANA are in the process of negotiating their merger. Besides the purpose of raising capital, mergers and acquisitions allow fintech companies to synergize their services

to increase their value added. These corporate actions show that the COVID-19 pandemic did not prevent Indonesia's fintech industry from growing.

MEDICI (2020) reported that more than 77 fintech funding deals, which amounted to $329 million, took place in 2020. The study by UOB, PwC, and Singapore Fintech Association (2020) stated that based on the funding size as a proportion of the total investment deals in Indonesia's fintech industry in 2020, 38% went to insure-tech companies, 32% to payment companies, 5% to finance and accounting tech, and the remaining 25% to alternative lending. The increasing funding (investment) deals for fintech companies during the time of the COVID-19 pandemic shows that investors are still optimistic about the prospect of Indonesia's fintech industry.

3.4 The Impacts of COVID-19 and the PSBB on Indonesia's Fintech Markets

This section discusses the impacts of the COVID-19 pandemic and the PSBB on Indonesia's fintech payment and P2P lending markets. The selection of the two markets was based on data availability considerations. BI releases monthly data on the fintech payment industry, while the OJK publishes data on P2P fintech lending. The OJK and BI do not publish monthly data on ECF and DFI products.

Models 1 to 8 intended to investigate the impacts of the COVID-19 pandemic and the PSBB on the PB, MB, IB, and IM transaction values. Models 9 and 10 aimed to examine the impact of the COVID-19 pandemic and the PSBB on P2P fintech lending.

The generic form of the models is as follows:

$$Y_t = c + \beta_1\, CONTROL_{\,t\ or\ t-1} + \beta_2\, COVID_t + \beta_3\, PSBB_t + \beta_4\, INTERACTION_t + \varepsilon_t$$

where Y is the dependent variable; c is the constant term; *CONTROL* is the control variable(s); *COVID* is the COVID-19 variable (stated as a dummy variable or as the number of daily new cases); *PSBB* is the PSBB dummy variable; *INTERACTION* is the interaction variable; and ε is the error term. Index t is the time index. β_1, β_2, β_3, and β_4 are coefficient vectors (or matrix) for the respective regressors in the models. We introduced the interaction variable to investigate the impact of COVID-19 on the relationship between a particular independent variable and the dependent variable; that is, to determine whether the

pandemic altered the impact magnitude of the respective independent variable on the dependent variable.

The dependent variables for each model are the following: (i) PB transaction values for Models 1 and 5; (ii) MB transaction values for Models 2 and 6; (iii) IB transaction values for Models 3 and 7; (iv) EM transaction values for Models 4 and 8; and (v) new P2P fintech lending values for Models 9 and 10.

The regressors for Models 1 to 8 are the following: (i) the per capita nominal gross domestic product (GDP), which is the control variable; (ii) the COVID-19 dummy variable (for Models 1 to 4) or the number of daily new cases of COVID-19 (Models 5 to 8); (iii) the PSBB variable; and (iv) the interaction variable between the per capita nominal GDP and the COVID-19 dummy variable (Models 1 to 4) or the interaction variable between the per capita GDP and the number of COVID-19 daily new cases (Models 5 to 8).

The regressors for Models 9 and 10 are the following: (i) the real GDP (constant price 2010); (ii) the bank lending rate (1-day lagged); (iii) a COVID-19 dummy variable (for Model 9) or the number of daily new cases of COVID-19 (for Model 10); (iv) a PSBB dummy variable; and (v) the interaction variable between the real GDP and the COVID-19 dummy variable (for Model 9) or the interaction variable between the real GDP and the number of COVID-19 daily new cases (Model 10). The real GDP and the bank lending rate are the control variables for Models 9 and 10.

The COVID-19 dummy variable has a value of 0 for every day from 1 January 2014 to 1 March 2020 and 1 from 2 March 2020 (the first announced case of COVID-19 in Indonesia) to 31 December 2020. The PSBB variable has a value of 0 from 1 January 2014 to 30 March 2020 (the pre-PSBB period), a value of 1 from 1 April 2020 to 2 July 2020, and a value of 2 from 3 July 2020 to 31 December 2020. The Indonesian government initially planned to end the PSBB on 31 May 2020 and begin the "New Normal" phase on 1 June 2020. Nonetheless, it left the decision to end the PSBB to the discretion of local governments, depending on the pandemic situation in their areas. Some local governments ended the PSBB in June 2020, but others (including the special region of Jakarta) ended it in July 2020.

All the data in this study have a daily frequency, covering all the days from 1 January 2014 to 31 December 2020. We selected this period due to the public availability of the data. Appendix 3.1, Table A3.1.1 summarizes the variables, the data, and the data sources. Using the quadratic interpolation method, we interpolated the monthly, quarterly, and annual data to obtain daily data. We interpolated the quarterly nominal GDP data and the annual population data to monthly data to calculate

the monthly per capita GDP. Then, we interpolated the monthly per capita data GDP to daily data.

We detrended the PB, MB, IB, and EM transaction values, the P2P new lending values, and the per capita GDP data from their cyclical trend using the one-sided Hodrick–Prescott (HP) filter and seasonally adjusted them using STL decomposition to obtain stationary series. We detrended the bank lending interest rate using the one-sided HP filter to have a stationary series. We treated the variable of daily new cases of COVID-19 with second-order differencing to obtain a stationary series. The augmented Dickey–Fuller test and the Phillips–Perron test at the 5% significance level confirmed the stationarity of the treated variables (Appendix 3.1, Table A3.1.2).

We use the ordinary least squares method to estimate the models. All the models have a first-order autoregressive term AR(1) to treat the serial correlation problem. We conducted variance inflation factor (VIF) tests to check whether the models encountered the multicollinearity problem. We discarded variables that caused the multicollinearity problem from the final models.

Appendix 3.2, Tables A3.2.1 and A3.2.2 display the results. All the models are fit for the regressions, as the F-test results that reject the null hypothesis of the unfitness of the model show. These models are also free from the serial correlation problem, as the values of the Durbin–Watson statistics indicate having checked them against their critical values. The VIF test results for the final models show no indication of multicollinearity because the centered VIF values for all the variables in each model are lower than 10 (Appendix 3.1, Table A3.1.3). This study set the 5% significance level (α) as the benchmark to test the hypothesis. It based the following analysis on the assumption of other things being equal.

All 10 models show that the COVID-19 variable, either as a dummy variable or as a second-order differenced variable of daily new cases, is not significant in all the models at $\alpha = 5\%$. This finding implies that the pandemic did not significantly affect the transaction values of all types of fintech payment products in Indonesia. The pandemic also did not significantly influence P2P fintech lending. In other words, Indonesia's payment fintech and P2P fintech markets were resilient to shocks from the COVID-19 pandemic. The results also show that the empirical data do not support the claim that the COVID-19 pandemic accelerated fintech's development.

The COVID-19 pandemic did not significantly weaken or strengthen the relationships between the per capita GDP and the PB, IB, or EM transaction values. The interaction variables are not statistically significant in Models 1, 3, 4, 5, 7, and 8. The only significant interaction

variable is in Model 2, in which the presence of the pandemic weakens the impact of the per capita GDP on the MB transaction values. The interaction variable is not significant in Model 6. Considering the speed of change in the number of COVID-19 daily new cases, the impacts of the per capita GDP on the MB transaction values before and during the pandemic are not significantly different.

The interaction variable between the COVID-19 dummy and the real GDP is significant in Model 9. The pandemic weakened the impact of the real GDP on the P2P lending values. However, the coefficient of the interaction variable shows that the influence of the pandemic on the relationship between the real GDP and the P2P lending is marginal, if not negligible. Meanwhile, the interaction variable between the real GDP and the speed of change in the number of COVID-19 daily new cases is not significant in Model 10.

The PSBB dummy variable is statistically significant at $\alpha = 5\%$ in all the models except Model 3 (in which it is significant at $\alpha = 10\%$). The variable has a negative sign in Models 1, 2, 3, 5, 6, 7, 9, and 10. Holding other factors unchanged, the PSBB reduced the PB, MB, and IB transaction values. The PSBB curbed economic activities, decreased the income of most households, and caused households to reduce their online spending. The PSBB also reduced new P2P fintech lending. Because the government allowed fewer economic activities during the PSBB and household consumption weakened, the demand for P2P fintech lending fell.

The PSBB variable has a positive sign in Models 4 and 8, implying that the PSBB increased the use of EM, assuming that other factors remained unchanged. The increasing use of EM during the PSBB was probably because consumers switched their main payment channels from credit cards, debit cards, and ATM+ cards to EM as they reduced their face-to-face transaction activities. The finding that many households switched their payment methods to EM cards is similar to the finding of Tut's study (2020) on the case of Kenya.

3.5 Utilizing Fintech for Economic Recovery

The Indonesian government has included and used fintech companies in the national economic recovery program. The government is using fintech companies to distribute social assistance to people and MSMEs that the COVID-19 pandemic has harmed. Fintech companies are arguably more flexible than conventional financial institutions in providing financial services to MSMEs and households with little or no access to conventional financial services.

The government allocated Rp20 trillion for the pre-employment cards (*Kartu Prakerja*) in the 2020 budget and the same amount in the 2021 budget. It distributes the cards to workers who lost their job due to the COVID-19 pandemic. *Kartu Prakerja* holders receive training or courses to increase their entrepreneurial skills. Cardholders must have a virtual account to receive a fund transfer from the government. They can only use the funds to pay the course tuition fee. From its first launch in March 2020 until February 2021, the number of *Kartu Prakerja* recipients reached 5.5 million people (*Kompas* 2021b).

Different fintech companies play two different roles in the *Kartu Prakerja* scheme: as a fund distributor or as a course provider. The government appointed Bank Negara Indonesia (a state-owned bank) and e-commerce fintech companies (e.g., Gopay, OVO, LinkAja, and DANA) to distribute the funds to cardholders, and it established a partnership with fintech companies that provide courses or training (e.g., Tokopedia, Ruangguru, MauBelajarApa, Bukalapak, Pintaria, Sekolahmu, Pijar Mahir, and dan Sisnaker).

BI Deputy Governor Sugeng stated that 52 fintech companies have launched initiatives to help MSMEs survive the COVID-19 pandemic, including an interest rate reduction, a transfer fee reduction, a merchant discount rate, and training. The recent OJK regulation that allows P2P lending fintech companies to conduct loan restructuring will support these fintech companies' initiatives.

The government can broaden the utilization of fintech companies to support the national economic recovery by introducing other measures, such as direct cash transfers (*Bantuan Sosial Tunai*, BST) for poor households and subsidized loans for MSMEs. In the current BST scheme, the recipient can choose one among three alternatives: (i) receiving the money at home; (ii) visiting a community center to collect the money; or (iii) visiting a post office to collect the money (*Metrotvnews* 2021).The current BST scheme is susceptible to corruption and embezzlement as the disbursement of the fund passes through several bureaucratic levels. Indonesia's anti-corruption agency has pledged its commitment to monitoring the disbursement of the BSTs. That said, fintech payment channels can act as an alternative to bypass the levels of bureaucracy and ensure that the recipient receives the correct amount of money.

The government can also extend loans to MSMEs through the P2P fintech lending channel. It can impose a certain interest rate for the loan (which should be lower than the normal P2P fintech lending rates) and pay the loan transmission fee to the P2P. By utilizing the P2P lending channel for economic recovery, the government can simultaneously help the P2P fintech lending companies to expand their market, particularly

to the MSME segment. The COVID-19 pandemic has shown that P2P lending fintech companies can act as partners rather than disruptors or competitors to banks and the conventional NBFIs. For example, Bank Mandiri (a state-owned bank) allocates funds from the government to Investree to extend to small and medium-sized businesses that the pandemic has affected (*Jakarta Post* 2020).

3.6 Conclusions

This chapter found that the COVID-19 pandemic did not accelerate the development of the fintech payment and P2P fintech lending markets in Indonesia. There was no significant direct impact of the pandemic on the transaction values of phone banking, mobile banking, internet banking, and electronic money. The pandemic also did not have a significant direct impact on P2P fintech lending. As for the indirect impact, the pandemic weakened the impact of the per capita GDP on mobile banking transaction values. It also marginally weakened the impact of the real GDP on P2P lending. The pandemic did not have a significant indirect impact on the relationships between per capita GDP and phone banking, internet banking, or electronic money transaction values.

Therefore, this study concluded that the empirical evidence does not support the claim that the COVID-19 pandemic has accelerated Indonesia's fintech market development. That said, Indonesia's fintech market has been relatively resilient to the COVID-19 pandemic.

The PSBB had a negative direct impact on phone banking, mobile banking, and internet banking transaction values as the restrictions on economic activities harmed the income and purchasing power of many households. The PSBB also adversely affected P2P fintech lending because the demand for lending fell in line with the slowing economic activities. Nevertheless, the PSBB increased electronic money transactions because many households reduced their face-to-face shopping activities and their use of credit cards, debit cards, and ATM+ cards. The relatively short PSBB period prevented the fintech market from receiving too many negative impacts from the restrictions on economic activities.

This chapter considers that the fintech industry can support Indonesia's economic recovery. The Indonesian authorities have involved and utilized the fintech industry as a component of the national economic program, particularly the pre-employment card (*Kartu Prakerja*) program. There are many areas in which the government can utilize the fintech industry further, including direct cash transfers to poor households and the extension of subsidized loans to MSMEs.

Lastly, this chapter suggests that BI, the OJK, and the government develop and maintain a shared database and mapping of Indonesia's fintech industry. There is still a lack of publicly available data on crowdfunding and digital financial innovation products. It would be useful for the public, or at least fintech industry players, to have access to the database. The database will be useful for policy making and business planning, and it should receive regular updates as Indonesia's fintech industry rapidly grows.

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Appendix 3.1

Table A3.1.1: Variables, Data, and Data Sources

Variable	Measurement	Frequency	Data Source
Phone banking transaction value	Rp trillion	Daily (interpolated from monthly)	Bank Indonesia
Mobile banking transaction value	Rp trillion	Daily (interpolated from monthly)	Bank Indonesia
Internet banking transaction value	Rp trillion	Daily (interpolated from monthly)	Bank Indonesia
Electronic money transaction value	Rp trillion	Daily (interpolated from monthly)	Bank Indonesia
P2P lending value	Rp trillion	Daily (interpolated from monthly)	Otoritas Jasa Keuangan
Per capita GDP:	Rp million	Daily:	
– Nominal GDP	Rp trillion	– interpolated from quarterly	CEIC
– Population	Million people	– interpolated from annually	CEIC
Real GDP (constant price 2010)	Rp trillion	Daily (interpolated from quarterly)	CEIC
Bank lending rate	%	Daily (interpolated from monthly)	CEIC
COVID-19 new cases	Unit	Daily	Bloomberg
COVID-19 dummy	0, 1	Daily	Author
PSBB dummy	0, 1, 2	Daily	Author
Interaction variables			
– Per capita GDP × COVID-19 dummy	Rp million	Daily	Author
– Per capita GDP × COVID-19 new cases	Rp million	Daily	Author
– Real GDP × COVID-19 dummy	Rp trillion	Daily	Author
– Real GDP × COVID-19 new cases	Rp trillion	Daily	Author

GDP = gross domestic product, P2P = peer-to-peer.
Source: Author's calculation.

Table A3.1.2: Stationarity Level-Test Results (t-statistics probability)

	Augmented Dickey–Fuller	Phillips–Perron
Phone banking transaction value (detrended, seasonally adjusted)	0.0000***	0.0000***
Mobile banking transaction value (detrended, seasonally adjusted)	0.0000***	0.0000***
Internet banking transaction value (detrended, seasonally adjusted)	0.0000***	0.0000***
Electronic money transaction value (detrended, seasonally adjusted)	0.0000***	0.0002***
P2P lending value (detrended, seasonally adjusted)	0.0463**	0.0018***
Per capita GDP (detrended, seasonally adjusted)	0.0001***	0.0005***
Real GDP (detrended, seasonally adjusted)	0.0005***	0.0056***
Bank lending rate (detrended)	0.0000***	0.0000***
COVID-19 daily new cases (second-order differenced)	0.0000***	0.0001***

GDP = gross domestic product, P2P = peer-to-peer.
Note: * significant at $\alpha = 10\%$; ** significant at $\alpha = 5\%$; *** significant at $\alpha = 1\%$.
Source: Author's calculation.

Table A3.1.3: Centered Variance Inflation Factors Values

	Model 1	Model 2	Model 3	Model 4
Constant	NA	NA	NA	NA
Per capita GDP	1.686333	1.666791	1.195805	1.156588
COVID-19 dummy	1.321420	1.123000	1.103424	1.288043
PSBB dummy	1.013552	1.068858	1.033858	1.116986
Per capita GDP × COVID-19 dummy	2.073073	1.254361	1.121593	1.251998
AR(1)	1.895128	1.232380	1.046480	1.234182
Sigma-square	1.571430	1.277129	1.162382	1.210682
	Model 5	**Model 6**	**Model 7**	**Model 8**
Constant	NA	NA	NA	NA
Per capita GDP	1.120987	1.562117	1.134616	1.004837
d(d(new COVID cases))	2.078139	1.497468	2.547031	3.180102
PSBB dummy	1.014128	1.152120	1.011496	1.245506
Per capita GDP × COVID-19 dummy	2.377271	1.518023	2.570405	3.442086
AR(1)	1.745325	1.324954	1.043802	1.182375
Sigma-square	2.674193	1.354784	1.156065	1.120605
	Model 9	**Model 10**		
Constant	NA	NA		
Real GDP (Rp trillion)	1.100538	1.152583		
Lending rate (%, lag 1)	1.900753	2.265502		
COVID-19 dummy	1.296377	–		
d(d(COVID new cases))	–	4.751354		
PSBB	1.153096	1.087298		
Real GDP × COVID-19 dummy	1.680028	–		
Real GDP × d(d(COVID new cases))	–	2.185456		
AR(1)	3.149984	5.194088		
Sigma-square	2.122129	1.341364		

AR = autoregressive, GDP = gross domestic product, PSBB = *pembatasan sosial berskala besar*, NA = not applicable.

Note: When the variance inflation factor values of all the variables in the model are lower than 10, the model does not encounter the multicollinearity problem.

Source: Author's calculation.

Appendix 3.2

Table A3.2.1: Factors Affecting Fintech Payment Transaction Values in Indonesia (t-statistics probability value in brackets)

Regressors \ Dependent Variable	Model 1 Phone Banking Transaction Value (Rp trillion)	Model 2 Mobile Banking Transaction Value (Rp trillion)	Model 3 Internet Banking Transaction Value (Rp trillion)	Model 4 Electronic Money Transaction Value (Rp trillion)
Constant	−0.246104	3.910686	21.69792	0.015761
	(0.7296)	(0.4334)	(0.6481)	(0.9594)
Per capita GDP (Rp million)	−1.246077	115.9791	276.7875	2.636498
	(0.1816)	(0.0000 ***)	(0.0028 ***)	(0.0000***)
COVID-19 dummy	0.022418	−0.093955	7.174596	0.034300
	(0.9795)	(0.9910)	(0.9698)	(0.9264)
PSBB dummy	−0.186740	−12.48756	−27.82298	0.728008
	(0.0000***)	(0.0000***)	(0.0501 *)	(0.0000***)
Per capita GDP × COVID-19 dummy	0.659750	−229.0943	-10.07293	0.817385
	(0.7712)	(0.0000***)	(0.9809)	(0.2517)
AR(1)	0.993903	0.988770	0.990763	0.995593
	(0.0000***)	(0.0000***)	(0.0000***)	(0.0000***)
Sigma-square	0.018410	6.929109	499.7083	0.003524
	(0.0000***)	(0.0000***)	(0.0000***)	(0.0000***)
Number of observations	2,557	2,557	2,557	2,557
R2	0.978864	0.972659	0.980981	0.990690
Adjusted R2	0.978815	0.972595	0.980936	0.990669
Prob (F-statistic)	0.000000***	0.000000***	0.000000***	0.000000***
Durbin–Watson statistic	1.684226	1.710990	1.621193	1.613300

continued on next page

Table A3.2.1 *continued*

Dependent Variable / Regressors	Model 5 Phone Banking Transaction Value (Rp trillion)	Model 6 Mobile Banking Transaction Value (Rp trillion)	Model 7 Internet Banking Transaction Value (Rp trillion)	Model 8 Electronic Money Transaction Value (Rp trillion)
Constant	−0.241693	3.736738	22.19858	0.020267
	(0.6755)	(0.5055)	(0.6370)	(0.9456)
Per capita GDP (Rp million)	−0.992640	37.15423	269.6548	2.924754
	(0.1941)	(0.0122 **)	(0.0029***)	(0.0000***)
d(d(new COVID cases))	0.000025	−0.000063	0.000524	0.000004
	(0.0640*)	(0.8359)	(0.9303)	(0.6382)
PSBB dummy	−0.187785	−12.46250	−27.27031	0.729588
	(0.0000***)	(0.0000***)	(0.0491**)	(0.0000***)
Per capita GDP × d(d(new COVID case))	0.000418	−0.000761	−0.014569	−0.000037
	(0.1053)	(0.9363)	(0.9008)	(0.8151)
AR(1)	0.993870	0.989601	0.990781	0.995569
	(0.0000***)	(0.0000***)	(0.0000***)	(0.0000***)
Sigma-square	0.018411	7.005137	500.0082	0.003526
	(0.0000***)	(0.0000***)	(0.0000***)	(0.0000***)
Number of observations	2,555	2,555	2,555	2,555
R2	0.978879	0.972380	0.980944	0.990692
Adjusted R2	0.978829	0.972315	0.980899	0.990670
Prob (F-statistic)	0.000000***	0.000000***	0.000000***	0.000000***
Durbin–Watson statistic	1.682498	1.674580	1.619523	1.609239

AR = autoregressive, GDP = gross domestic product, P2P = peer-to-peer, PSBB = *pembatasan sosial berskala besar*

Note: * significant at α = 10%; ** significant at α = 5%; *** significant at α = 1%.

Source: Author's calculation.

Table A3.2.2: Factors Affecting Fintech Peer-to-Peer Lending in Indonesia (t-statistics probability in brackets)

	Model 9	Model 10
Dependent variable		
P2P lending (Rp trillion)		
Regressors		
Constant	0.197320	0.283760
	(0.4865)	(0.4290)
Real GDP (Rp trillion)	−0.000044	−0.000057
	(0.0042***)	(0.0025***)
Lending rate (%, lag 1)	−1.190154	−1.227546
	(0.0000***)	(0.0000***)
COVID-19 dummy	0.222375	–
	(0.3300)	
d(d(COVID new cases))	–	0.000029
		(0.3754)
PSBB	−0.424758	−0.454015
	(0.0000***)	(0.0000***)
Real GDP × COVID-19 dummy	−0.000012	–
	(0.0085***)	
Real GDP × d(d(COVID new cases))	–	0.000000
		(0.7852)
AR(1)	0.966652	0.975917
	0.0000***)	(0.0000***)
Sigma-square	0.038179	0.038166
	(0.0000***)	(0.0000***)
Number of observations	1,064	1,064
R2	0.939871	0.939892
Adjusted R2	0.939472	0.939493
Prob (F-statistic)	0.000000***	0.000000***
Durbin–Watson statistic	2.126561	2.109044

AR = autoregressive, GDP = gross domestic product, P2P = peer-to-peer, PSBB = *pembatasan sosial berskala besar*

Note: * significant at α = 10%; ** significant at α = 5%; *** significant at α = 1%.

Source: Author's calculation.

4

COVID-19, Fintech, and the Recovery of Micro, Small, and Medium-Sized Enterprises: Evidence from Bangladesh

Monzur Hossain and Tahreen Tahrima Chowdhury[1]

4.1 Introduction

A phenomenal surge in the use of financial technology (fintech) and e-commerce during the coronavirus disease (COVID-19) pandemic caused a paradigm shift in digitalized purchases by consumers, and the use of online selling platforms and digital payments by firms. The role of Fintech has been substantially realized after the outbreak of COVID-19, when digital payments became an indispensable mechanism for making financial transactions from a safety perspective. Besides facilitating trade, digital payments also helped governments in disbursing stimulus finance to firms and individuals during the COVID-19 pandemic.

Given the positive role of fintech and digital finance in the pandemic, how and to what extent micro, small, and medium-sized enterprises (MSMEs) have realized the benefits of fintech is of interest for understanding their recovery from the pandemic. During this difficult time of economic stalemate caused by the pandemic, MSMEs are the

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hardest-hit segment among the industrial units and therefore their recovery has an important bearing on their respective economies (Leach et al. 2020). In this chapter, we examine the losses of manufacturing MSMEs in the pandemic and the extent of the use of fintech in their recovery.

Note that MSMEs are quite predominant in the industrial structure of economies, comprising over 95% of all economic units (Yoshino and Taghizadeh-Hesary 2018). The contribution of the MSME sector to gross domestic product (GDP) is over 25% in Bangladesh (ADB 2015), which makes the sector an engine of growth. The contributions of MSMEs in different countries thus confirm the importance of MSMEs worldwide. In the context of a widespread contraction of different economies during the pandemic, smaller firms could be the vehicles of economic recovery by supporting aggregate demand and employment.

Although MSMEs have been affected the most by the pandemic, with necessary but reasonable support, MSMEs could play an important role in economic recovery. They can do so by serving as agents of change through their entrepreneurial undertakings, being sources of considerable innovative activities, including fintech and e-commerce. To this end, for the recovery of the MSME sector as well as the economy, various countries in the world have assembled stimulus packages. For example, the Government of Bangladesh has declared a subsidized credit package worth around $2.5 billion to help MSMEs to recover their loss and maintain the vibrancy of the economy. Similarly, India announced $87 billion in cheap finance for the MSME sector (Hossain 2020; Bhagwati 2020). The central banks in these countries adopted expansionary monetary and fiscal measures to support MSMEs and other sectors of the economy. Considering the opaqueness of MSMEs, the empirical question is, what policy leverage do governments have on their cards to deal with the distress of MSMEs? The traditional approaches of financing MSMEs or providing other business support services to these smaller firms may not be working well in this pandemic (Hossain, Yoshino, and Taghizadeh-Hesary 2021; Hossain 2020). Rather, countries need to find innovative and nontraditional approaches to address the distress of MSMEs during the pandemic.

Therefore, this study examines the impact of COVID-19 on MSMEs in Bangladesh over the span of three quarters in 2020: during lockdown (27 March 2020–30 May 2020); limited lockdown (June–September 2020), and the reopening period (October–December 2020). Although we planned to survey 500 firms based on our earlier survey of 500 firms conducted in 2017 from 25 Bangladesh Small and Cottage Industries

Corporation (BSCIC) estates, we have ultimately been able to survey only 216 MSMEs from 17 BSCIC industrial estates, as we had to stop the survey due to the surge of COVID-19 infections again in Bangladesh at the end of March 2021. We mainly collected data through physical visits, and information on some firms was collected through telephone conversations. A structured questionnaire has been used for the survey. Both descriptive and regression analyses were performed to derive the results. Our instrumental variable (IV) regression results suggest that the use of mobile financial services (MFS) significantly contributed to the recovery of the production, sales, and profit of the firms, indicating that the use of MFS facilitates the stable supply of raw materials and sale of products.

The chapter is structured as follows. Section 4.2 provides an overview of MSMEs and fintech use in Bangladesh. Section 4.3 discusses the firm survey methods and approaches, and section 4.4 discusses the descriptive results. Section 4.5 discusses the methodology and regression results. Section 4.6 concludes the chapter.

4.2 An Overview of MSMEs and Fintech Use amid COVID-19 in Bangladesh

MSMEs are predominant in the industrial structure of Bangladesh, comprising over 97% (including cottage and micro enterprises) of all economic units (BBS 2013). The number of manufacturing units stands at 868,000 in 2013, registering a 75% increase from the 2001/2003 census (BBS 2001/2003), of which 34,000 are MSMEs, employing a total of nearly 7 million workers. While the shares of micro, small, and medium-sized enterprises in manufacturing employment are 7.8%, 16.2%, and 6.5%, respectively, their contribution to manufacturing gross value added was estimated at 5.9%, 23.7%, and 23.3%, respectively (BBS 2012, 2013). The nonfarm sector as a whole has been growing at a rate of 7.9% in the last decade, while the growth of the manufacturing units was about 8.2% (BBS 2013). Only slightly over 10% of all nonfarm units are engaged in manufacturing, while the remaining carry out trading and service-related activities.

The BSCIC estates are the only official estates or clusters that accommodate MSMEs, from where our samples are drawn. Since these estates were especially established for MSMEs, it is of interest how COVID-19 has impacted the firms in these estates and how these firms excel in recovery. There are 76 BSCIC estates in Bangladesh, with 5,822 manufacturing units creating employment for 0.56 million people

with an average employment of 7,626 persons per estate.[2] About 20% firms in these estates are exporting. Among the established units, about 78% are in operation (Hossain 2021). The growth of employment and exporting firms is about 3%. The production of firms grew by 11%, and the value of exports grew by 5%. Access to finance has been identified as the biggest obstacle for SME growth and development, and financial development is considered as one of the solutions for their financial woes (Hossain 2020).

The adoption of fintech has enabled MSMEs to sustain their viability during COVID-19 in terms of continuing production activities through assessing market demand and maintaining the sustainability of the value chain. The findings from a survey by the World Bank, the Cambridge Centre for Alternative Finance, and the World Economic Forum (2020) reveal that the use of fintech has been increased significantly since the outbreak of the pandemic; particularly digital payments and remittances (60% increases), digital banks (22%), and digital savings or deposits (19%). The study found that the priority of fintech has either increased, or remained high after the outbreak of COVID-19. According to a recent Mastercard (2020) survey, around 79% of global consumers, and atleast 91% of consumers in Asia, now transact digitally. The survey also revealed that 6 out of 10 consumers now prefer online transactions in a post-COVID retail market. However, the scenario of SMEs in terms of fintech use is not encouraging, as Sonobe et al. (2021) find that the percentage of MSMEs using online platforms for sales in 2019 was 8.7% and using a digital payment system was 7.1%, based on their telephone survey of MSMEs in eight countries in April–May 2020.

Bangladesh has also experienced rapid change in the fintech and e-commerce industry in recent years, and the effect of COVID-19 resulted in a paradigm shift in terms of digitalized purchases by consumers, online selling platforms, and digital payments. The role of fintech has been substantially realized after the outbreak of COVID-19, during which digital payments became indispensable mechanism to make financial transactions. Besides facilitating trade, digital payments also helped the government in disbursing financial help to the needy populace during the COVID-19 pandemic (LightCastle Partners 2020).

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[2] The BSCIC industrial estates are the estates established for promoting cottage and MSMEs in rural areas to utilize local potential for industrial development. The total land area occupied by the 74 industrial estates is 1,969.2 acres.

The volume of transactions through electronic fund transfers (EFT)[3] substantially increased during the pandemic, and banks have witnessed significant growth in online transactions during the pandemic (BEFTN, Bangladesh Bank 2020).[4] Like other countries, the COVID-19 pandemic has triggered a surge in digital finance in Bangladesh. According to Bangladesh Bank (2021), the amount of average daily MFS transactions increased by 7% in the third quarter of the fiscal year 2019/20 from its previous quarter.

At present, around 2,500 e-commerce sites are operating in Bangladesh selling products worth over $2 billion, making it the 46th largest country globally in terms of e-commerce revenue (*The Daily Star* 2020). Facebook has become an indispensable platform of online business; more than 300,000 Bangladeshi stores are operating through Facebook (IDLC 2019). The social media platform boasts 30 million users and 50,000 business pages in the country. According to the e-Commerce Association of Bangladesh (Hasan 2020), the e-commerce industry in Bangladesh "revolutionized" during the COVID-19 pandemic with an increase in online sales by 70%–80% in July–September 2020 (Sahoo, Hossain, and Hassan 2020). The current market size of e-commerce in Bangladesh is around $1 billion (Tk8,000 crore) and according to Statista, a business data platform, by 2023 the e-commerce market size will become $3 billion in Bangladesh (Islam n.d.).

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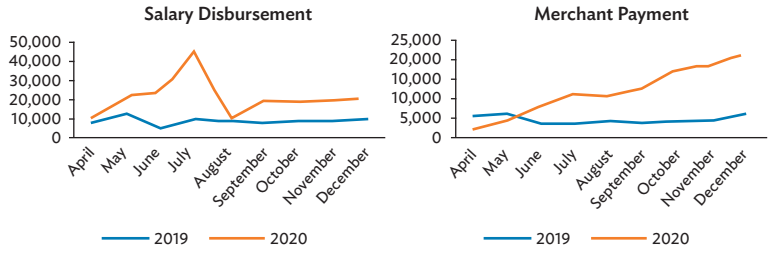
3 Bangladesh Electronic Funds Transfer Network (BEFTN) started its operation on 28 February 2011 and facilitates the transmission of payments between the banks electronically. It allows faster and efficient means of interbank clearing over the existing paper-based system, i.e., BACPS. BEFTN offers a wide variety of credit transfers, such as payroll, foreign and domestic remittances, social security, company dividends, retirement, expense reimbursement, bill payments, corporate payments, government tax payments, social security payments, and person-to-person payments, as well handling debit transfers such as mortgage payments, loan payments, insurance premiums, utility bill payments, government tax payments, and government licenses and fees (See Bangladesh Bank website at https://www.bb.org.bd/fnansys/paymentsys/eft.php).

4 However, only the MFS platform of the fintech industry in Bangladesh gained in popularity. As a result, despite the growing trend of the fintech ecosystem in Bangladesh, the country has been lagging behind its global counterparts. According to the Global Fintech Index 2021, Bangladesh ranked 78th among 83 countries on the index, indicating a poor performance in terms of using technology to automate and digitalize financial activities. Bangladesh ranked the lowest out of 16 countries in Asia and the Pacific.

Figure 4.1: Month-Wise Salary Disbursement and Merchant Payment through Mobile Financial Services in 2019 and 2020 (Tk million)



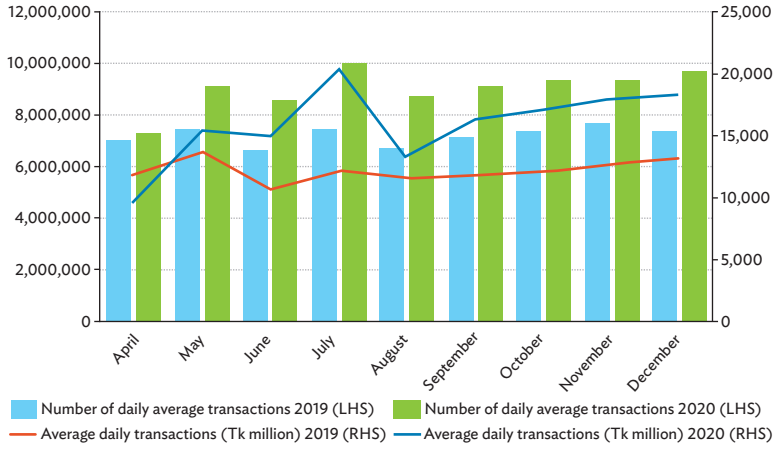
Source: Authors' compilation from data of Bangladesh Bank.

The number of monthly merchant payments through MFS followed a steady trend in 2019, which escalated in 2020 (Figure 4.1). Even though monthly salary disbursement through MFS is higher in each month of 2020 compared to the corresponding month in 2019, the disbursement in 2020 followed a growing trend up to July 2020 and then dropped to a steady trend in the following months. This sudden surge can be explained by the lockdown period up to July when wage payments (especially in the garments industry) were made through mobile transactions.

Figure 4.2 shows the month-wise average daily transactions (in Tk million) and number of daily average transactions made through MFS in 2019 and 2020. The number of average daily transactions was always higher in each month in 2020 compared to 2019. The amount of average daily transactions (in Tk million) followed a stable increase from August 2020.

Internet banking showed a burgeoning trend; the total amount of transactions through internet banking was 3.2%, 15.1%, and 32% higher in the three consecutive periods April–June, July–September, and October–December compared to the corresponding three periods in 2019 (Figure 4.3). On the other hand, in the case of mobile banking, the amounts of transactions in the abovementioned three periods were 11%, 42%, and 41% in 2020 in comparison with the transactions in the respective periods in 2019. Given the impressive increase of

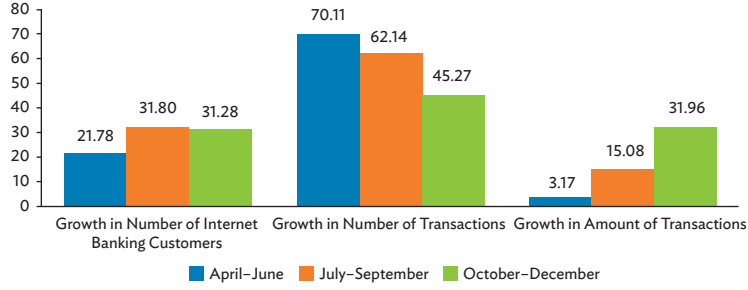
Figure 4.2: Month-Wise Average Daily Transactions (Tk million) and Number of Daily Average Transactions through Mobile Financial Service in 2019 and 2020



LHS = left-hand scale, RHS = right-hand scale.

Source: Authors' compilation from data of Bangladesh Bank.

Figure 4.3: Point to Point Quarterly Growth of Internet Banking in 2019 and 2020



Source: Authors' compilation from data of Bangladesh Bank.

digital finance in Bangladesh during the COVID-19 pandemic, we are particularly interested in the use of fintech by the manufacturing MSMEs and its role in their recovery.

4.3 Firm Survey Methods and Approaches

Our current survey of 216 firms is based on a sampling framework of a recent survey of 500 firms from 25 BSCIC estates in 2017 (BIDS 2017). We revisit the firms to assess the impact of COVID-19 on their production and recovery during March–May 2020. Although the previous survey was conducted among 25 estates, this time we have been able to collect information from 17 estates across the country out of total 76 estates. Since the BSCIC industrial estate accommodates only the cottage and MSMEs, our sample represents MSMEs in industrial estates.[5] The distribution of the surveyed firms across estates is given in Table 4.1. The survey was carried out through a structured questionnaire. We collected information on three quarters: March–May 2020 (strict lockdown), June–September 2020 (limited lockdown), and October–December 2020 (no lockdown), depending on the extent of severity of lockdown and the COVID-19 situation. We collected information in particular on the percentage of production, sales, profit, and employment for the three periods in terms of whether they decrease, increase, or remain the same compared to same pre-COVID-19 period in 2019. We also collected information on the MSMEs' use of fintech and online platform for their business during the COVID-19 pandemic. The survey started at the end of January 2021 and continued until mid-March 2021 before we were compelled to stop the survey due to a surge of COVID-19 infections in the country.

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5 According to the Industrial Policy 2016 of Bangladesh, those firms with fewer than 15 workers (or an asset amount of less than Tk10 lac) are considered cottage firms, firms with 16–30 workers (or an asset amount of Tk10–75 lac) are treated as micro, firms with 31–120 workers (or an asset amount of Tk75 lac–15 crore) are defined as small, and firms with 121–300 workers (or an asset amount of Tk15–50 crore) are defined as medium sized.

Table 4.1: The Distribution of Samples across Divisions, Districts, and Estates

Division	District	Estate Name	Establishment Year	2021 Survey
Chattogram	Chattogram	Patiya	1990	7
Chattogram	Cumilla	Cumilla	1961	39
Chattogram	Cox's bazaar	Cox's bazaar	1975	1
Dhaka	Dhaka	Dhamrai	1990	15
Rangpur	Dinajpur	Dinajpur	1964	1
Chattogram	Feni	Feni (Charipur)	1962	20
Dhaka	Gazipur	Tongi	1964	39
Sylhet	Habigonj	Habigonj	1995	18
Rajshahi	Joypurhat	Joypurhat	1993	2
Khulna	Khulna	Khulna	1961	18
Dhaka	Narayangan	Jamdhani	1999	18
Dhaka	Narayangonj	Narayangonj	1996	22
Chattogram	Nohakhali	Nohakhali	2007	11
Rangpur	Panchagarh	Panchagarh	1994	1
Barishal	Pirojpur	Swarupkathi	1961	1
Khulna	Satkhira	Satkhira	1988	2
Rangpur	Thakurgaon	Thakurgaon	1998	1
Total		25		216

Source: PRISM Survey (2021).

4.4 Descriptive Results

4.4.1 Firm Production, Sales, and Profitability in the COVID-19 Pandemic

In this section, we present the status of firms' production, sales, and profitability across three periods—period 1 (P1) is lockdown (27 March 2020–30 May 2020), period 2 (P2) is during limited lockdown (June–September 2020), and period 3 (P3) is the lockdown-free quarter (October–December 2020)—and compare them with that of the pre-COVID-19 period. We asked the firms at what percentage their output, sales, and profit had decreased or increased compared to the same

period before COVID-19 in 2019. The results are reported in Table 4.2. The results suggest that during the first lockdown in 2020 (March–May), firms were heavily affected as their production had decreased more than 50%, and among the firms, small firms were affected the most. It appears that firms started recovering as the government relaxed the lockdown over time. By the end of December 2020, when the lockdown was lifted, firms' production was only 20% lower than the pre-COVID-19 level, indicating that they had recovered substantially. A similar pattern is observed in cases of sales and profit (Table 4.2).

At the same time, based on their reported loss of outputs (in %: production, sales, and profit) in P1, P2, and P3, we estimated the recovery

Table 4.2: Average Decrease (%) in Production, Sales, and Profit across Firm Size Compared to Pre-COVID-19 Level and Estimated Recovery Rates (N=216)

	% Decrease in Lockdown (March 2020-May 2020)	% Recovery at Pre-COVID-19 Level	% Decrease in Limited Lockdown (June 2020–September 2020)	% Recovery at Pre-COVID-19 Level	% Decrease in Lockdown-Free Period (October 2020–December 2020)	% Recovery at Pre-COVID-19 Level
	P1	R1 (100-P1)	P2	R2 (100-P2)	P3	R3 (100-P3)
Production (%)						
Micro	53.3	46.7	32.33	67.67	21.28	78.72
Small	62.48	37.52	36.38	63.62	25.83	74.17
Medium	54.62	45.38	28.73	71.27	20.87	79.13
All firms	57.04	42.96	33.26	66.74	22.92	77.08
Sales						
Micro	52.67	47.33	31.47	68.53	20.81	79.19
Small	61.82	38.18	35.85	64.15	25.6	74.4
Medium	55.13	44.87	27.57	72.43	18.48	81.52
All firms	56.61	43.39	32.46	67.54	22.23	77.77
Profit						
Micro	40.1	59.9	28.95	71.05	23.71	76.29
Small	58.2	41.8	34.58	65.42	24.1	75.9
Medium	57.23	42.77	24.31	75.69	21.18	78.82
All firms	49.97	50.03	30.6	69.4	23.48	76.52

P1 = Period 1, P2 = Period 2, P3 = Period 3, R = recovery of output rate.

Source: PRISM Survey (2021).

rates through a simple method by subtracting the decreased percentage of output (P1, P2, and P3) from 100, which are denoted as R1, R2, and R3, respectively. Thus, R1, R2, and R3 represent the percentage of recovery of outputs at periods 1, 2, and 3, respectively. The results are reported in Table 4.2. By the end of December 2020, the recovery of production, sales, and profit was about 77%.

4.4.2 Fintech Use in the COVID-19 Pandemic

We make an attempt to explore the techniques and mechanisms MSMEs have used for recovery during the pandemic. Since the use of fintech and online platforms had a big impact worldwide on business recovery during the pandemic, we collected specific information in regard to these aspects of business and financial transactions. Table 4.3 provides the status of use of fintech and online business platforms by the surveyed firms and their role in the pandemic-induced business environment. For fintech, we only collected information on the use of MFS.

About 31% of the surveyed manufacturing firms are found to use MFS for their business transactions. Among the MFS users, about 74% reported that their transactions through MFS have increased during the pandemic, and over 60% agreed that MFS use has facilitated their business in the COVID-19 pandemic. MFS user firms also reported that their sales have increased over 60% during the pandemic, indicating a positive role of MFS in facilitating businesses in this pandemic. Similarly, a small number of firms (15%) have an e-commerce website, and only 13.6% of the firms sell products online. However, only 15% of their total sales were completed using an online platform, and they reported that online sales have increased by about 29% during the pandemic.

Table 4.3: Status of Fintech and Online Platform Use among MSMEs

	Yes	No	Same as Before	N
Mobile financial services (MFS)				
Whether use MFS for business (%)	30.56	69.44		216
Has MFS transaction increased during COVID-19 (%)	74.24	25.76	–	66
Has MFS facilitate business during COVID-19 (%)	61.05	30.53	8.42	95
% of sales increased due to MFS? (mean)		30.56		50

continued on next page

Table 4.3 *continued*

	Yes	No	Same as Before	N
E-commerce and online sales				
Have e-commerce website (%)	14.81	85.19		216
Sell product online (%)	13.64	86.36		110
% of total products sold online (mean)		15.47		15
Whether online sales have increased during pandemic (%)	13.11	86.9		61
What % of online sales increased during pandemic? (mean)		28.88		8
Bank loan (stimulus)				
Stimulus credit received from bank	13.89	86.11		216
BSCIC Loan				
Loan from BSCIC received	0.93	99.07		216

BSCIC = Bangladesh Small and Cottage Industries Corporation; MSMEs = micro, small, and medium-sized enterprises.

Source: PRISM Survey (2021).

4.4.3 Recovery Rates with the Use of Fintech and Online Platforms

It can be observed from Table 4.4 that the use of MFS helped firms recover faster over time. For example, for those who reported that the use of MFS had increased their production, their recovery rate jumped from 42% in P1 to 86% in P3, while the increase is only 8% for those who thought that the use of MFS had actually contributed to a decrease in their production. For the group of firms that thought the use of MFS had not made any change in their production, their recovery is also relatively slower. On the other hand, the recovery of firms that have been using e-commerce and online business is also substantial compared to P1, although both user and non-user groups' recovery were almost the same in P3. The descriptive analysis in Table 4.4 provides an indication that the use of digital finance might have a positive impact on firms' recovery.

Table 4.4: Average Recovery Rate (%) of Firms Using Mobile Financial Services and Online Platforms

	Recovery in Production in P1 Compared to 2019 (%)	Recovery in Production in P2 Compared to 2019 (%)	Recovery in Production in P3 Compared to 2019 (%)
Reported business transaction through MFS:			
Increase	42	72	86
Decrease	88	93	96
Unchanged	67	86	93
Has e-commerce website			
Yes	45	68	86
No	53	79	87
Has online sales increased			
Yes	33	58	76
No	66	82	92

MFS = mobile financial services, P1 = Period 1, P2 = Period 2, P3 = Period 3.

Note: Recovery rate is the percentage change of production in any one period of 2020 compared to production in 2019.

Source: PRISM Survey (2021).

4.5 Methodology and Regression Results

MSMEs were unsparingly affected the most out of all the industrial units worldwide in the COVID-19 pandemic, yet they suffered the most in developing countries. It is also true that MSMEs could recover at a faster rate than larger firms because of their flexibility in adjusting to any sudden changes or crisis because of the dynamics of small firm taxonomy. Governments worldwide, including Bangladesh, provided various types of stimulus packages that might contribute to their recovery. On the other hand, digital platforms also contributed greatly to the recovery of these firms' production and profitability. Therefore, in this section, we particularly examine the role of fintech, particularly the use of MFS on the recovery of MSMEs. In addition, we attempt to understand which type of firm and industrial sector gained most from

these strategies and interventions. In addition, we also assess the role of government stimulus credit on their recovery.

4.5.1 Determinants of the Use of Mobile Financial Services, E-Commerce Websites, and Online Sale Platforms

In order to understand the role of MFS on firms' recovery, it is first important to identify the determinants of MFS use by the firms. The study attempted to explore the determinants of usage of MFS by firms using the probit regression model. The dependent variable is a binary choice; taking a value of 1 if a firm uses the respective financial service and 0 otherwise. There are two vectors of regressors including firm characteristics and individual characteristics of owners. X_i is a vector of firm characteristics and Z_i is a vector of individual characteristics of owners (Equation 1).

The firm characteristics used in the regression are firm size, type of industry (food, textile, jute, leather, paper, chemical and pharmaceutical, engineering, metal, agro-food), distance between firms and some other entities (nearest agent of MFS provider, nearest local market, subdistrict [Upazilla Sadar], district, nearest bank), and firms' source of collecting raw material (binary variable if firm collects raw material from the home district or another district).

The individual characteristics of firms' owners used in the regression are years of education and years of experience of the owner at the current enterprise.

$$\text{MFS}_i = \beta_0 + \beta_i X_i + \beta_i Z_i + €_i \qquad (1)$$

Results: Determinants of Use of MFS, E-Commerce Website, and Online Sale Platforms by Firms

Table 4.5 depicts the results with the determinants of MFS use (Equation 1) where the dependent variable "use of MFS" is a binary variable that takes a value of 1 if a firm uses MFS and 0 otherwise. Whenever firm characteristics were taken into account, "distance to nearest MFS agent" came up negatively significant, delineating the fact that the firms with a smaller distance to the nearest MFS agent are more likely to use MFS. This is expected, as getting access to an MFS agent

without difficulties is the key factor that induces firms to use MFS, and a shorter distance to an MFS agent actually mitigates such difficulties of accessibility.

On the other hand, the distance to the subdistrict (Upazilla Sadar) and the use of MFS are positively and significantly associated; the firms located far away from subdistricts are more prone to the usage of MFS. This is not surprising either as a greater distance to subdistricts means a larger distance to financial institutions located in subdistricts and, therefore, leads to higher costs if financial transactions are executed through physical visits. In such cases, MFS provides a useful mechanism for minimizing the cost of financial transactions.

The results show that small and micro firms are less likely to use MFS compared to medium-sized firms. It is also evident that the firms that collect raw materials from their own or home district are expected to use MFS more than firms that collect raw materials from other districts. This can be explained by the limitations of the MFS policy in terms of the small number of transactions as imposed by the central bank of the country[6] and deferred transactions might be an obvious outcome due to this limited scope of a transaction. Suppliers of raw materials who are located in the same district are probably more willing to receive deferred payments compared to the suppliers of other districts considering the issue of "business trust accompanied with distance." Therefore, the firms which collect raw materials from the home district enjoy the convenience of deferred payments and are willing to use MFS. The industry dummies came up positively significant across all sectors, showing that the firms of each sector are more likely to use MFS.

On the other hand, when individual characteristics of firms' owners are considered, their years of experience of working at the current enterprise turned out to be positively significant, which depicts that firms with a longer period of involvement with their current owners are more likely to use MFS. This finding can be explained in terms of owners' ability and experience acquired through long-term engagements with current business operations that ultimately affect owners' choice of using MFS.

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[6] At present, the ceiling of mobile money transfer is set at Tk100,000 for cash in and Tk50,000 for cash out only (see Bangladesh Bank webpage at https://www.bb.org.bd/fnansys/paymentsys/mobilefin.php).

Table 4.5: Determinants of Use of Mobile Financial Services by MSMEs

Variables	(1) Model 1: Use of MFS
Distance to nearest MFS agent	−6.276***
	(2.387)
Distance to bank	0.014
	(0.130)
Distance to district	0.023
	(0.018)
Distance to Upazilla Sadar (subdistrict)	0.072***
	(0.025)
Distance to the local market	0.098
	(0.105)
Firm size: micro (base = medium)	−0.796**
	(0.385)
Firm size: small (base = medium)	−0.726**
	(0.351)
1 if firms collect raw material from the home district	0.492*
	(0.290)
Years of education of firm's owner	−0.179
	(0.111)
Work experience (years) of firm's owner at current enterprise	0.068***
	(0.018)
Sector: Food	2.686***
	(0.549)
Sector: Textile	2.912***
	(0.410)
Sector: Jute	2.242***
	(0.729)
Sector: Paper	2.723***
	(0.540)
Sector: Leather	3.398***
	(0.527)
Sector: Chemical and Pharmaceutical	2.144***
	(0.673)
Sector: Engineering	2.997***
	(0.535)
Sector: Metal	3.553***
	(0.747)
Sector: Agro-Food	2.382***
	(0.792)
Constant	−2.075**
	(0.958)
Observations	197

MFS = mobile financial services; MSMEs = micro, small, and medium-sized enterprises.
Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Source: Authors' estimates using the data from the PRISM Survey (2021).

4.6 Effect of Mobile Financial Service Use on Production, Sales, and Profit

The study attempted to explore the effect of use of MFS on production, sales, and profit of firms at different time intervals in 2020. The following regression model has been used to estimate the determinants of production, sales, and profit in 2020:

$$Y_{it} = \alpha_0 + \alpha_1 MFS_{use\,it} + \alpha_2 firm_{size\,it} + \alpha_3 skill_{ratio\,it} + \alpha_4 plot_{type_{it}} + \alpha_5 raw_{material_{home_{district\,it}}} + \alpha_6 ownership_{it} + \alpha_7 stimulus_{credit\,it} + \alpha_8 sector\_dummy_{it} + \mu_{it} \quad (2)$$

where Y_{it} is the outcome variable (production, sales, or profit); i stands as subscripts for firm (i = 1,2,3,....., 216); and t stands as subscripts for time intervals (t = 1,2,3,4).

Y_{it} refers to the amount of production, sales, or profit in period t in 2020 expressed as a percentage of production, sales, or profit in period t in 2019. We asked the firms if production, sales, and profit increased, decreased, or remained the same in three different periods—strict lockdown period (April–May 2020), limited lockdown period (June–September 2020), and the reopening of the economy (October–December 2020)—compared to production, sales, and profit in each of these periods in 2019. We also asked if overall production, sales, and profit were increased, decreased, or remained the same throughout 2020 (January–December 2020) compared to overall production, sales, and profit throughout 2019 (January–December 2019). Therefore, the production, sales, and profit in 2020 were reported in relative terms in comparison with the production, sales, and profit in 2019. The reported percentage of production, sales, and profit in 2020, in other words, represents the percentage of recovery of production, sales, and profit.

Considering the base production, sales, and profit in 2019 as 100, the series production, sales, and profit in 2020 used in regressions were computed by subtracting (adding) the reported decreased (increased) percentage of production, sales, and profit from 100. For instance, if firms reported that production, sales, and profit decreased by x% at period t in 2020; then the corresponding value of production, sales, and profit at period t used in the series was (100-x). In the case of increased production, sales, and profit, if firms reported that production, sales, and profit increased by y% in period t 2020; then the corresponding value of production, sales, and profit at period t used in the series was (100+y). On the other hand, if firms reported that production, sales, and

profit remained the same at period *t* in 2020; the corresponding value of production, sales, and profit used in the series was 100.

MFS_use_{it} is a binary variable that takes a value of 1 if the firm uses MFS and 0 if the firm does not use MFS, and this variable is the variable of our key interest in order to find if firms with MFS usage performed better than their counterparts who did not use MFS. The firm characteristics used as explanatory variables in regressions are firm size; skill ratio (proportion of skilled labor to total labor of a firm); the type of plot where a firm is located (according to size: for example, Type A is the largest plot); firm's source of collecting raw material (binary variable taking a value of 1 if firm collects raw material from own/home district and 0 otherwise); type of ownership of firm; receipt of loan by firms as stimulus (binary variable taking a value of 1 if firm received stimulus and 0 otherwise); and type of industry (food, textile, jute, paper, leather, chemical and pharmaceutical, engineering, metal, agro-food).

However, considering the possibility of endogeneity embedded into the "use of MFS," we used a defensible approach of estimating the model through the IV technique instead of the ordinary least squares method. Distance to the nearest MFS agent and work experience of the firm's owner at the current enterprise have been used as IVs for MFS use. We found these variables reasonable to be used as they are unlikely to affect outcome variables independently (any effect will be indirect and transmitted through the effect of MFS use) as well as to be correlated with the unobservable of the model. Furthermore, in the MFS literature, the distance to an agent is a widely used instrument (Munyegera and Matsumoto 2016; Murshid et al. 2020).

Results: MFS Use and Production of Firms in Different Periods

Columns 1, 2, and 3 in Table 4.6 represent the results with MFS use and production of firms in four different periods; t_1 (April–May 2020), t_2 (June–September 2020), t_3 (October–December 2020), and t_4 (January–December 2020).

The IV estimates of MFS use came out positively significant, which shows that the firms that used MFS had higher production compared to the firms that did not use MFS in all the three intervals in 2020 (strict lockdown period, limited lockdown period, and reopening of the economy), and this holds the same when total production in 2020 (column 4) is considered. Medium firms performed significantly better compared to micro firms in terms of higher production in periods t_2, t_3 and t_4. Skill ratio turned out to be positively significant in all four periods, revealing that the firms with a higher number of skilled workers experienced higher production. However, the findings suggest that the

Table 4.6: Mobile Financial Service Use and Production (Production in 2020 as % of Production in 2019)

	(1)	(2)	(3)	(4)
Variables	***Prod_2020_ t_1***	***Prod_2020_t_2***	***Prod_2020_t_3***	***Prod_2020_t_4***
1 if a firm uses MFS	69.903***	37.033***	33.721**	35.144**
	(17.616)	(13.522)	(16.853)	(14.513)
Firm size: micro (base = medium)	−3.835	−17.102**	−18.145**	−15.403*
	(9.352)	(8.595)	(9.245)	(8.397)
Firm size: small (base = medium)	11.064	−5.320	−7.864	−7.502
	(8.600)	(7.762)	(8.329)	(7.965)
Skill ratio	22.662**	19.437**	22.241**	22.110**
	(10.808)	(8.532)	(9.932)	(9.296)
Plot type B (Base: A)	10.963	15.493***	11.788	6.948
	(7.199)	(5.575)	(7.233)	(5.873)
Plot type C (Base: A)	16.524*	6.413	19.338**	9.192
	(9.651)	(7.702)	(8.581)	(8.371)
Plot type D (Base: A)	18.683*	15.851*	17.551	8.836
	(11.100)	(9.308)	(11.327)	(8.440)
Plot type S (Base: A)	7.076	3.220	13.348	−1.525
	(11.323)	(8.699)	(11.235)	(10.231)
1 if firms collect raw material from home district	4.496	11.232*	15.318**	8.350
	(7.046)	(6.160)	(6.841)	(6.315)
Ownership: joint (base: single)	3.193	10.780	19.813**	16.822**
	(8.668)	(7.909)	(7.916)	(8.218)
Ownership: limited (base: single)	−0.620	0.701	20.000**	9.852
	(8.460)	(7.232)	(7.895)	(6.918)
1 if firms received stimulus	−16.806*	−21.312***	−20.907**	−20.522**
	(9.172)	(6.874)	(8.977)	(7.993)
Sector: Food	−40.959**	5.367	7.236	−6.942
	(17.310)	(9.275)	(14.453)	(15.358)
Sector: Textile	−21.426	6.360	8.055	−4.198
	(17.260)	(9.113)	(14.423)	(15.778)
Sector: Jute	−16.583	1.333	−3.487	−12.591
	(22.880)	(13.916)	(18.294)	(19.033)
Sector: Paper	−28.019	5.215	6.241	−12.824
	(19.064)	(11.338)	(15.573)	(16.328)
Sector: Leather	−41.042**	−13.781	−9.206	−19.219
	(19.092)	(9.464)	(16.276)	(15.929)
Sector: Chemical and Pharmaceutical	−40.656**	2.793	10.850	−8.717
	(17.673)	(10.645)	(15.986)	(16.175)
Sector: Engineering	−7.423	20.436**	25.086*	16.768
	(18.444)	(9.195)	(15.243)	(16.436)
Sector: Metal	−31.226	5.399	−1.771	−15.634
	(23.307)	(17.385)	(22.269)	(22.139)
Sector: Agro-Food	−46.689**	15.840	17.739	8.494
	(21.845)	(11.182)	(16.905)	(17.150)

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Table 4.6 *continued*

Variables	(1) *Prod_2020_ t_1*	(2) *Prod_2020_ t_2*	(3) *Prod_2020_ t_3*	(4) *Prod_2020_ t_4*
Constant	42.262**	16.150	9.520	24.199
	(19.554)	(12.944)	(16.746)	(17.482)
Observations	214	214	216	216
R-squared	−0.143	0.036	0.116	0.024
Diagnostics test[a]				
F-statistics	F(21,192) = 4.51	F(21,192) = 3.56	F(21, 194) = 3.03	F(21,194) = 3.22
	p > F = 0.00	p > F = 0.00	p > F = 0.00	p > F = 0.00
Over-identification test	Sargan: 0.116 Chi-sq(1) p-val = 0.7331	Sargan Statistics: 0.256 Chi-sq(1) p-val = 0.6128	Sargan Statistics: 0.213 Chi-sq(1) p-val = 0.6444	Sargan Statistics: 0.910 Chi-sq(1) p-val = 0.3402
Endogeneity test	Chi-sq(1) = 24.346 p-val = 0.0000	Chi-sq(1) = 8.958 p-val = 0.0028	Chi-sq(1) = 3.515 p-val = 0.0608	Chi-sq(1) = 8.748 p-val = 0.0031

MFS = mobile financial services.

Notes: [a] Coefficients are jointly significant with a high F-value (p-value is 0.00), implying the fact that the model is strongly identified. The p-value is insignificant in over-identification, which means that null hypothesis "the instruments are exogenous" is not rejected. Therefore, the over-identification assumption is satisfied. The p-value of the endogeneity test is significant, implying that the null hypothesis "the treatment variables are exogenous" is rejected. Hence, the endogeneity test is also satisfied.

Robust standard errors in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.

Details of time intervals: t_1: April–May 2020; t_2: June–September 2020; t_3: October–December 2020; and t_4: January–December 2020.

Source: Authors' estimates using the PRISM Survey data (2021).

firms that did not receive a loan as a stimulus had higher production, which delineates the fact that the stimulus provided by the government did not work properly for the firms' recovery, perhaps due to loan distribution problems.

Results: MFS Use and Sales of Firms in Different Periods

Columns 1, 2, and 3 in Table 4.7 represent the results with MFS use and sales of firms in four different periods; t_1 (April–May 2020), t_2 (June–September 2020), t_3 (October–December 2020), and t_4 (January–December 2020).

Table 4.7: Mobile Financial Service Use and Sales (Sales in 2020 as % of Sales in 2019)

	(1)	(2)	(3)	(5)
Variables	***Sales_2020_ t_1***	***Sales _2020_ t_2***	***Sales _2020_ t_3***	***Sales _2020_ t_4***
1 if a firm uses MFS	67.436***	40.326***	26.728	31.912**
	(17.319)	(13.770)	(16.661)	(14.873)
Firm size: micro (base = medium)	−4.347	−16.600*	−21.810**	−17.242*
	(9.191)	(8.654)	(10.392)	(9.368)
Firm size: small (base = medium)	9.330	−5.109	−12.329	−10.463
	(8.395)	(7.839)	(9.460)	(8.831)
Skill ratio	25.655**	17.095*	24.081**	25.401***
	(10.738)	(8.752)	(9.712)	(9.299)
Plot type B (Base: A)	12.996*	16.226***	9.571	9.745
	(7.388)	(5.827)	(7.571)	(6.173)
Plot type C (Base: A)	15.890*	5.974	12.528	6.607
	(9.274)	(7.917)	(9.057)	(8.411)
Plot type D (Base: A)	18.312	12.616	9.578	6.705
	(11.638)	(10.471)	(11.155)	(8.748)
Plot type S (Base: A)	7.928	6.238	9.646	−2.505
	(11.020)	(9.232)	(11.111)	(10.299)
1 if firms collect raw material from the home district	3.181	10.966*	15.317**	6.868
	(7.048)	(6.327)	(6.662)	(6.211)
Ownership: joint (base: single)	3.998	12.195	18.772**	15.262*
	(8.578)	(8.011)	(7.928)	(8.201)
Ownership: limited (base: single)	−0.347	0.576	16.627*	6.966
	(8.333)	(7.387)	(8.599)	(7.565)
1 if firms received stimulus	−17.968**	−23.281***	−21.147**	−21.793***
	(8.925)	(7.255)	(8.993)	(7.904)
Sector: Food	−42.056**	4.883	6.374	−6.235
	(17.307)	(9.657)	(15.015)	(15.879)
Sector: Textile	−22.612	6.279	8.406	−4.007
	(17.088)	(9.416)	(15.018)	(16.167)
Sector: Jute	−19.817	2.463	−12.206	−16.406
	(22.645)	(14.053)	(18.873)	(19.573)
Sector: Paper	−30.147	3.573	4.675	−15.003
	(18.802)	(11.596)	(16.186)	(16.593)
Sector: Leather	−43.068**	−16.212*	−10.784	−21.568
	(18.961)	(9.765)	(16.562)	(16.042)
Sector: Chemical and Pharmaceutical	−41.229**	2.859	16.701	−9.144
	(17.424)	(10.742)	(17.193)	(16.576)
Sector: Engineering	−8.964	20.558**	22.634	14.191
	(18.254)	(9.574)	(15.799)	(16.741)
Sector: Metal	−32.344	−10.744	−14.470	−18.893
	(23.135)	(18.093)	(22.289)	(22.443)
Sector: Agro-Food	−48.481**	15.479	14.347	5.490
	(21.472)	(11.725)	(17.920)	(17.894)

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Table 4.7 *continued*

	(1)	(2)	(3)	(5)
Variables	***Sales_2020_ t_1***	***Sales _2020_t_2***	***Sales _2020_t_3***	***Sales _2020_t_4***
Constant	43.159**	16.332	18.936	28.131
	(19.166)	(12.950)	(18.064)	(18.381)
Observations	213	213	215	215
R-squared	−0.101	−0.018	0.135	0.066
Diagnostics Test[a]				
F-statistics	F(21,191) = 4.71	F(21,191) = 3.61	F(21, 193) = 3.22	F(21,194) = 3.39
	p > F = 0.00	p > F = 0.00	p > F = 0.00	p > F = 0.00
Over-identification test	Sargan: 0.104 Chi-sq(1) p-val = 0.7472	Sargan Statistics: 0.593 Chi-sq(1) p-val = 0.4413	Sargan Statistics: 0.069 Chi-sq(1) p-val = 0.7929	Sargan Statistics: 0.650 Chi-sq(1) p-val = 0.4200
Endogeneity test	Chi-sq(1) = 22.372 p-val = 0.0000	Chi-sq(1) = 11.219 p-val = 0. 0.0008	Chi-sq(1) = 2.241 p-val = 0.1344	Chi-sq(1) = 6.759 p-val = 0.0093

MFS = mobile financial services.

Notes: [a] Coefficients are jointly significant with high F-value (the p-value is 0.00), implying the fact that the model is strongly identified. The p-value is insignificant in the over-identification in the model, which means that the null hypothesis "the instruments are exogenous" is not rejected. Therefore, the over-identification assumption is satisfied. The p-value of the endogeneity test is significant in models 1, 2, and 4, implying the fact that the null hypothesis "the treatment variables are exogenous" is rejected. Hence, the endogeneity test is also satisfied.

Robust standard errors in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.

Details of time intervals: t_1: April–May 2020; t_2: June–September 2020; t_3: October–December 2020; and t_4: January–December 2020.

Source: Authors' estimates using the PRISM Survey data (2021).

The IV estimates of MFS use came out positively significant in t_1, t_2, and t_4 but not in t_3, which shows that the firms that used MFS had higher sales compared to the firms that did not use MFS during strict lockdown and limited lockdown but not during the period of the reopening of the economy. However, the positive and significant coefficient in t_4 reveals that usage of MFS actually facilitated the overall sales of firms in 2020. Medium-sized firms performed significantly better compared to micro firms in terms of higher sales in periods t_2, t_3, and t_4. Skill ratio turned out to be positively significant in all the four periods, revealing that the firms with a higher number of skilled workers experienced higher sales. However, when the receipt of stimulus is considered, the findings are the same as found in production; the firms that received a loan as stimulus had a decrease in sales, describing the fact that the stimulus provided by the government did not facilitate higher sales.

Results: MFS Use and Profit of Firms in Different Periods

Columns 1, 2, and 3 in Table 4.8 represent the results with MFS use and profit of firms in four different periods: t_1 (April–May 2020), t_2 (June–September 2020), t_3 (October–December 2020), and t_4 (January–December 2020).

The IV estimates of MFS_use came out positively significant in t_2 and t_4 only, which shows that the firms that used MFS earned a higher profit compared to the firms that did not use MFS during the limited lockdown and throughout 2020. For specifications in periods t_1 and t_3, the endogeneity test is also insignificant. Medium-sized firms performed significantly better compared to micro firms in terms of a higher profit in period t_1 only, and the skill ratio turned out to be positively significant in periods t_1 and t_4.

Table 4.8: Mobile Financial Service Use and Profit (Profit in 2020 as % of Profit in 2019)

	(1)	(2)	(3)	(4)
Variables	*Profit_2020_t_1*	*Profit _2020_t_2*	*Profit _2020_t_3*	*Profit _2020_t_4*
1 if a firm uses MFS	−7.586	−42.045***	−20.808	−72.033***
	(18.052)	(15.653)	(16.139)	(17.423)
Firm size: micro (base = medium)	−17.686*	−12.764	−3.416	−16.993
	(9.767)	(9.696)	(8.902)	(13.034)
Firm size: small (base = medium)	−1.206	−13.335	−6.782	−14.314
	(9.078)	(9.001)	(8.413)	(12.268)
Skill ratio	22.796*	1.327	−0.870	29.779**
	(11.827)	(11.532)	(12.009)	(14.119)
Plot type B (Base: A)	7.333	12.204	6.455	9.991
	(8.823)	(7.865)	(7.615)	(9.930)
Plot type C (Base: A)	12.977	3.925	9.562	10.258
	(10.526)	(9.002)	(9.355)	(10.331)
Plot type D (Base: A)	−3.702	−24.378*	−3.967	−24.271*
	(12.206)	(13.285)	(13.403)	(13.783)
Plot type S (Base: A)	16.128	−10.506	−2.534	−1.368
	(11.779)	(10.858)	(12.005)	(11.996)
1 if firms collect raw material from the home district	11.552*	4.676	3.810	0.109
	(6.681)	(6.561)	(6.427)	(8.148)
Ownership: joint (base: single)	−2.615	−0.591	1.955	0.145
	(8.923)	(8.904)	(8.369)	(12.051)
Ownership: limited (base: single)	8.985	−8.359	3.131	−1.977
	(9.070)	(8.455)	(7.868)	(12.305)

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Table 4.8 *continued*

	(1)	(2)	(3)	(4)
Variables	***Profit_2020_t_1***	***Profit _2020_t_2***	***Profit _2020_t_3***	***Profit _2020_t_4***
1 if firms received stimulus	−11.341	−13.798	−16.474*	−10.904
	(8.932)	(9.682)	(9.951)	(12.458)
Sector: Food	−18.145	31.844**	48.255***	24.244
	(14.873)	(14.144)	(15.213)	(16.771)
Sector: Textile	−18.025	16.170	43.209***	4.073
	(14.751)	(14.732)	(16.197)	(16.476)
Sector: Jute	−10.630	16.540	41.632**	2.551
	(17.516)	(16.617)	(18.187)	(19.687)
Sector: Paper	−33.747*	29.274*	53.594***	5.828
	(17.699)	(17.423)	(17.811)	(22.791)
Sector: Leather	−35.795**	11.919	32.179*	13.893
	(17.693)	(17.710)	(18.269)	(20.483)
Sector: Chemical and Pharmaceutical	−30.677*	5.121	28.133	−5.687
	(17.836)	(16.833)	(18.272)	(19.422)
Sector: Engineering	9.220	12.875	33.405**	2.711
	(14.789)	(15.317)	(16.549)	(19.036)
Sector: Metal	−2.003	21.742	30.591	27.533
	(24.585)	(21.229)	(22.238)	(20.364)
Sector: Agro-Food	−48.062**	9.561	59.199***	12.231
	(22.254)	(22.225)	(18.656)	(29.991)
Constant	74.046***	73.723***	41.351**	63.374***
	(19.126)	(17.552)	(17.990)	(21.389)
Observations	200	204	205	163
R-squared	0.177	0.060	0.083	0.021
Diagnostic Test[a]				
F-statistics	F(21,178) = 2.71	F(21,182) = 2.88	F(21, 183) = 1.73	F(21,141) = 3.65
	p > F = 0.00	p > F = 0.00	p > F = 0.00	p > F = 0.00
Over-identification test	Sargan: 0.417 Chi-sq(1) p-val = 0.5187	Sargan Statistics: 2.826 Chi-sq(1) p-val = 0.0927	Sargan Statistics: 1.073 Chi-sq(1) p-val = 0.3002	Sargan Statistics: 0.001 Chi-sq(1) p-val = 0.9712
Endogeneity test	Chi-sq(1) = 0.001 p-val = 0.9812	Chi-sq(1) = 4.813 p-val = 0. 0.0283	Chi-sq(1) = 1.194 p-val = 0.2745	Chi-sq(1) = 9.649 p-val = 0.0019

MFS = mobile financial services.

Notes: [a] The coefficients are jointly significant, with a high F-value (p-value is 0.00), implying the fact that the model is strongly identified. The p-value is insignificant in over-identification in models 1, 3, and 4, which means that the null hypothesis "the instruments are exogenous" is not rejected. Therefore, the over-identification assumption is satisfied. The p-value of the endogeneity test is significant in models 2 and 4, implying the fact that the null hypothesis "the treatment variables are exogenous" is rejected. Hence, the endogeneity test is also satisfied.

Robust standard errors in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1.

Note: Details of time intervals: t_1: April–May 2020; t_2: June–September 2020; t_3: October–December 2020; and t_4: January–December 2020.

Source: Authors' estimates using the PRISM Survey data (2021).

4.7 Conclusions

This chapter assesses the impact of the COVID-19 pandemic on MSMEs and the subsequent recovery of the firms during the second half of 2020 after the outbreak of COVID-19 in Bangladesh. The study uses data from a survey of 216 manufacturing MSMEs from BSCIC industrial estates in Bangladesh. Our results based on 216 firms suggest that firms have been recovering gradually after the withdrawal of lockdown from June 2020. So far, firms had recovered 80% of their output at pre-COVID-19 levels by the end of December 2020. Small firms appear to be affected more than medium-sized and micro firms. We observe that firms that have used fintech (we consider only MFS here) and e-commerce platforms perform better than others as their recovery is relatively faster, indicating that MFS might have helped them maintain local product value chains. Moreover, as a mode of payment transfer, MFS might have allowed them to receive money from various sources to continue their business.

However, the percentage of firms using MFS for business is about 31% in our sample, which is relatively low compared to the widespread use of MFS by individuals. On the other hand, only about 15% of the firms have an e-commerce website and 14% sell online, indicating a low demand for digital finance by these firms as well. Considering the widespread surge of e-commerce and digital finance worldwide by firms, including in the trading and service sectors, manufacturing MSMEs appear to be lagging in this venture. Although our surveyed firms irrespective of MFS users and non-users have recovered substantially in a lockdown-free (and low COVID-19 infection rates) environment, still there is scope for them to adopt digital finance and online business strategies to perform better in their business in the coming days.

The findings in this chapter highlight the importance of digital finance and e-commerce in the highly contagious COVID-19 pandemic in maintaining business and firm production. The use of fintech helped owners of firms maintain health protocols and run their businesses in a safer environment. Therefore, favorable policies and regulations on fintech and digital platforms are essential for providing easy access to finance for smaller firms to overcome distress caused by pandemic-type shocks or disasters due to natural hazards. Furthermore, as access to finance for MSMEs has been a perennial problem, particularly in developing countries, the adoption of fintech during the pandemic might have been instrumental for the recovery of the firms. Proper training on fintech, e-commerce, and related skills development is thus crucial for the growth and development of MSMEs, particularly in this pandemic, which is also important for overall economic recovery.

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5

Digital Doorstep Banking: Female Banking Agents Lead Digital Financial Inclusion through the Pandemic and Beyond

Alreena Renita Pinto and Amit Arora

5.1 Introduction

5.1.1 State of Financial Inclusion in India

Research has recognized financial inclusion as a key driver of welfare and poverty reduction. Access to safe, easy, affordable credit, savings, insurance, and other financial services is critical to mitigate risk, provide a buffer against economic shocks, provide social security, create opportunities for economic and social inclusion, and accelerate growth. Further, several studies have shown that empowering women via financial inclusion programs leads to positive effects on women's mobility, family health and planning, children's education, and women's political empowerment (Brody et al. 2015; Chliova, Brinckmann, and Rosenbusch 2015; Gopalaswamy, Babu, and Dash 2016). Despite the broad international consensus regarding the importance of access to financial services as a crucial poverty alleviation tool, rural Indian women remain a critically underserved demographic, especially if we look beyond group-based microcredit delivery models.

While the move toward digital financial services in recent years has improved access to basic financial services for households through the use of mobile money and digital wallets, payment cards, and other financial technology (fintech) applications, there remains a gap in

access to basic banking services, especially in rural India. According to the World Bank's 2019 estimates, 52,489 rural bank branches, just one-third of the 150,000 bank branches across the country, serve 66% of rural Indians,[1] spread across more than 650,000 villages (Reserve Bank of India, RBI).[2] Spatial analysis of RBI bank branch data and population census 2011 data has shown that nearly 596,000 villages remained unbanked (without a bank branch) as of October 2019, with only 45,675 unique villages having a bank branch. However, there has been a drastic improvement in rural bank access in terms of the average distance of unbanked villages to a bank branch in the nearest village or town, which declined from 43.5 kilometers in 1951 to 4.3 kilometers in 2019 (Garg and Gupta 2020).

India's financial inclusion score, according to the CRISIL Inclusix index,[3] is 58.0 on a scale from 1 to 100, and only 14 districts out of 666 score a full 100. The report indicated significant regional variation in the extent of bank penetration between states, as Table 5.1 shows.

Recognizing this lacuna, the Reserve Bank of India (RBI) has endeavored to expand the organized financial system (RBI 2006) to serve unbanked/under-banked areas, encourage the establishment of physical rural bank branches, open no-frills basic savings bank deposit accounts (BSBDA), and provide coverage via banking agents, known as business correspondents (BCs). In this context, the BC or banking agent[4] network model has proven to be a low-cost, innovative solution to address financial inclusion in rural India.

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1 World Bank staff estimates based on the United Nations Population Division's World Urbanization Prospects: 2018 Revision. https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS

2 Database on Indian Economy. RBI's Data Warehouse. https://dbie.rbi.org.in/DBIE/dbie.rbi?site=publications#!17

3 The CRISIL Inclusix score relies on four tangible, measurable dimensions: bank penetration, credit penetration, deposit penetration, and insurance penetration. For more information, see CRISIL (2018).

4 In subsequent sections, we use business correspondent (BC) and banking agent interchangeably.

Table 5.1: Financial Inclusion across Indian States, CRISIL Inclusix

	CRISIL Inclusix Scores			CRISIL Inclusix Ranks		
State	2016	2015	2014	2016	2015	2014
Kerala	90.9	92.1	90.3	1	2	2
Andhra Pradesh	78.4	80.3	78.5	7	8	8
Odisha	63	60.6	54.4	16	17	22
Maharashtra	62.7	58.9	54.6	17	21	21
Jharkhand	48.2	44.2	40.3	26	28	30
Bihar	38.5	33.2	30.6	32	35	35
All India	58	56.2	53.2			

Source: CRISIL Inclusix.

Figure 5.1: Different Operational Models of Business Correspondent-Based Banking

Banking agents deployed by network managers have diverse business models, cost structures and revenue drivers, agent typology, products, and processess.

Traditional BCNMs

Types of Agents: Kiosk based, dedicated, more prevalent in rural areas

- Most BCNMs are traditional BCNMs
- Usually partner with multiple banks in multiple geographies
- May have their own technology platform or ride on bank's technology for agent banking
- Train BC agents to offer complex financial services that involve customer education and sales

New age BCNMs

Types of Agents: Existing merchants, nondedicated, more prevalent in urban areas

- Emerging and few in number
- Narrow product focus, particularly technology-enabled products like AePS and UPIs
- Typically have their own technology that can be integrated with bank's technology
- Agents are better suited to tackle simple financial services that do not require significant sales push or time

Payment banks

Types of Agents: Existing merchants, nondedicated, more prevalent in urban areas or rural marketplaces

- Directly manage BC networks and have regulatory permissions to offer financial products (including third-party products) other than credit
- Agents typically are those related through their primary business (e.g., payments banks promoted by MNOs typically have airtime retailers as agents)

State Rural Livelihood Missions (SRLM)

Types of Agents: Existing women's self-help group (SHG) members, mostly dedicated and in rural areas

- SRLMs in partnership with banks and other BCNMs deploy SHG members as BC agents offering similar products as traditional BCNMs
- Offer training and one-time grants to SHG members to cover setup cost
- Offer a fixed salary for 6 months to augment commission of their agents

Key Characteristics

AePS = Aadhaar Enabled Payment System, BC = business correspondent, BCNM = business correspondent network manager, MNO = mobile network operator, UPI = unified payments interface.

Source: CGAP and MicroSave Consulting (2020).

The RBI propounded the BC model in 2006, following the recommendations of the Khan Committee report (RBI 2005),[5] allowing banks to appoint third-party individual agents, either directly or through aggregators (called business correspondent network managers—BCNMs) to provide banking services on their behalf. Thereafter, in December 2013, the Nachiket Mor Committee advocated a detailed set of design principles for building the requisite architecture to move toward universal financial inclusion by 2016 (RBI 2013). The major recommendations included the provision of universal electronic bank accounts to all adults, universal access to payment and deposit services at reasonable charges, sufficient access to formal credit, universal access to deposit and investment products at reasonable charges, universal access to risk and insurance management products at reasonable charges, and, lastly, the right to suitability.

5.1.2 Leveraging Digital Technology to Expand BC Services across Rural India

The RBI Financial Inclusion Plan progress report in March 2020 (Table 5.2) showed that 94.4% of the 8,687 villages across the country with a population of more than 5,000 have access to banking services (RBI 2020). Further, as of 30 September 2019, 99.2% of the 491,490 villages with a population of fewer than 2,000 have banking service coverage, mostly through the BC channel via different operational models (Figure 5.1). This progress is remarkable when compared with the figures from the previous year, when only 75.5% of villages with a population of more than 5,000 and 97.8% of villages with a population of fewer than 2,000 had coverage (Table 5.2).

While coverage has certainly improved, it is notable that the report deemed a village to be "covered" if it is mapped to at least one banking outlet (including a BC agent) providing basic banking services. In several cases, the BC agent services a cluster of villages, known as a sub-service area, and is therefore available to each village by rotation on a part-time basis, often at irregular intervals.

The RBI 2020 Financial Inclusion Plan revealed that, while there was a 14% increase in the BC agent-serviced bank outlets (BC outlets) in villages with a population of fewer than 2,000 between March 2019 and March 2020, there was a 4% decrease in BC outlets in villages

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[5] Subsequently, recommendations to improve operations were made by the Committee on Financial Inclusion, which C. Rangarajan chaired (RBI 2008) as well as by the Mor Committee (RBI 2014).

Table 5.2: RBI Financial Inclusion Plan: Progress Report

Particulars	March 2010	March 2019	March 2020*	December 2020*
Banking Outlets in Villages—Branches	33,378	52,489	54,561	55,073
Banking Outlets in Villages>2,000—BCs	8,390	130,687	149,106	851,272
Banking Outlets in Villages<2,000—BCs	25,784	410,442	392,069	385,537
Total Banking Outlets in Villages—BCs	34,174	541,129	541,175	1,236,809
Banking Outlets in Villages—Other Modes	142	3,537	3,481	3,440
Banking Outlets in Villages—Total	67,694	597,155	599,217	1,295,322
Basic Savings Bank Deposit Accounts (BSBDAs)—Through BCs (no. in lac)	130 (13 million)	3,195 (319.5 million)	3,388 (338.8 million)	3,601 (360.1 million)
Basic Savings Bank Deposit Accounts (BSBDAs)—Through BCs (amount in $ crore)[a]	1,100 ($57.1 million)[a]	53,195 ($7,599.2 million)[a]	72,581 ($10,368.7 million)[a]	77,163 ($11,023.3 million)[a]

BC = business correspondent.

* Provisional numbers.

[a] $1 = ₹70.

Source: RBI Annual Reports (https://m.rbi.org.in/Scripts/AnnualReportPublications.aspx?Id=1288).

with populations greater than 2,000. Notably, while the number of BSBDAs has grown by 6%, the corresponding value of transactions that customers have performed via BCs in these accounts has grown by an impressive 36%, indicating existing customers' progressively higher usage of the BC channel (Table 5.2). We also noted a fivefold increase in the number of BC outlets in villages with a population of fewer than 2,000 between March 2020 and December 2020, which the RBI attributed to the reclassification of a particular bank's business activity (RBI 2021).

Although the RBI does not provide data on the exact number of deployed BC agents, according to the Pradhan Mantri Jan Dhan Yojana (PMJDY) website of the Department of Financial Services (DFS, Ministry of Finance, Government of India), 126,000 BC agents (also

known as bank *mitras*) are operating across the country, divided into sub-service areas. The BC registry, which the Indian Banks' Association (IBA)[6] maintains, pegs this number at about 160,000, while other reports and estimates, such as the one that the Business Correspondent Federation of India[7] and its members provide, indicate that this number could be anywhere between 1 million and 2 million, including urban agents. Notably, a gender breakdown of BCs operating across the country is not available publicly. The disparate reporting of BC agent numbers across agencies highlights the need for a more comprehensive centralized registry and systematic tracking of banking agents.

Financial inclusion in India received a fillip with the launch of the PMJDY, which led to the opening of 420 million bank accounts, on 10 March 2021. This was possible through the linking of no-frills or basic "Jan Dhan" bank accounts with unique biometric identification and mobile numbers or the Jan Dhan–Aadhaar–Mobile (JAM) trinity with the backing of the India Stack platform.[8] The banking agent platform played a critical role in the opening of basic bank accounts through the use of the Aadhaar-based paperless Know Your Customer (e-KYC) service, which leverages the same agent banking channel to link the new bank account to the customer's unique Aadhaar and associated demographic and biometric data at the backend. This unique innovation of biometric-based e-KYC resulted in the opening of more bank accounts using the BC agent platform than the traditional bank branch channel (ACCESS 2021).

A bank account for every household became a reality in rural India, such that 65.83% (276.5 million) of the total bank accounts that customers opened under the PMJDY belonged to rural and/or semi-urban centers and 53.26% of them belonged to women (232.7 million).[9] Further, while stand-alone state and bank data are available on the PMJDY website, a state-wide breakdown of data with a bank and gender ratio is not available in the public domain.

The JAM trinity boosted the quantity of direct benefit transfers to beneficiary bank accounts by reducing the leakage in the system. Government estimates suggested that the institutionalization of direct benefit transfers for social security schemes and governance reforms, including the removal of duplicate or fake beneficiaries and fraudulent

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6 IBA Registry. https://www.iba.org.in/iba/home/HomeAction.do?doBCPortal=yes

7 Business Correspondent Federation of India. https://bcfi.org.in/

8 India Stack. https://indiastack.org/ (accessed 9 May 2022).

9 As of 10 March 2021. https://pmjdy.gov.in/account

transactions, has resulted in cumulative savings of ₹1,78,396.65 crore ($25,485.2 million) across all schemes as of March 2020.[10]

The Aadhaar Enabled Payment System: Biometric Authentication-Based Interoperable Payment System for Banking Transactions

The National Payments Corporation of India (NPCI) introduced the Aadhaar Enabled Payment System (AePS) in 2016 to facilitate digital transactions linked to the JAM trinity. The AePS allows customers of Aadhaar-linked bank accounts to conduct financial transactions—namely, fund transfers, payments, cash deposits, withdrawals, and bank balance enquiries—through Aadhaar-based biometric authentication.

Most often, AePS transactions take place via a BC using a micro-ATM device, which could be a smartphone, tablet, laptop, or desktop attached to a biometric fingerprint scanner. This BC-assisted AePS-based transaction service, which allows cash-in cash-out and fund transfers, is particularly useful for rural cash-driven geographies where customers lack the technological know-how and smartphones necessary to conduct digital transactions independently and the physical bank branch network is hard to access.

Harnessing digital technology has helped to resolve an age-old malaise whereby a single, simple hand-held device is able to allow transactions to/from and between multiple banks. The AePS platform supports interoperable, interbank or "OFF-US" transactions, for which the customer account may be at a different bank (issuing bank) from the BC's banking partner (acquiring bank). By allowing OFF-US transactions and eliminating the dependence on a particular bank's agent, this seemingly straightforward system has been a game changer in promoting financial inclusion.

In these cases, the issuing bank must pay an interchange fee to the acquiring bank for servicing its customers. ON-US transactions, on the other hand, are those for which both the issuing and the acquirer bank are the same (i.e., the agent and the customer belong to the same bank). This "interchange fee"-based revenue model provides an initial business case for banks to sustain investments in establishing and managing a distribution network of BCs. Several private sector banks, such as ICICI Bank, IDFC First Bank, FINO Payment Bank, Yes Bank, RBL, and so on, have collectively deployed thousands of BC agents in rural un(der)-banked villages to generate revenue through the interchange fee and allied incomes.

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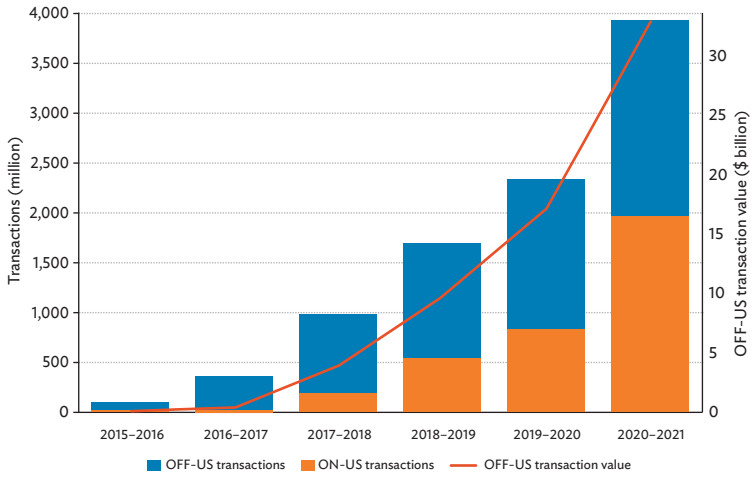
10 Government of India. Direct Benefit Transfer. https://dbtbharat.gov.in/estimatedgain

The AePS platform is the world's largest payment integrated biometric system and has achieved astounding year-on-year growth since its launch in 2016 owing to exponential growth in OFF-US AePS transactions in the recent years despite the discontinuation of interbank AePS-based cash deposit facilities in 2018–19 (Figure 5.2). During fiscal year 2020–21, 1,946.3 million interbank transactions,[11] with a value of $32.29 billion (₹2,260.5 billion), took place over the AePS Micro-ATM platform.

Figure 5.2: Growth in the Value and Volume of AePS Transactions



AePS = Aadhaar Enabled Payment System.

Note: Rural/urban disaggregated data are not available for both regular business correspondent transactions and AePS transactions.

Source: National Payments Corporation of India, AePS product statistics.

In comparison, public sector undertaking (PSU) banks have been slower to capitalize on this business potential and have deployed fewer agents of their own beyond the mandated numbers under

[11] Between April 2020 and March 2021, these included nonfinancial transactions like balance enquiries, mini statements, and so on.

government-led initiatives. While the BC model has unlocked a revenue stream and increased banking points for the acquiring banks (mostly private sector) in un(der)-banked areas, it has resulted in a larger outflow of funds from issuer banks (mostly PSU banks) in the form of "interchange fees" plus "switching costs" paid to the NPCI (n.d.). This has adversely affected some of the larger PSU banks that were already struggling to scale up their business operations due to their fragile financial health.

Research has documented well the resistance from some PSU banks to allowing and encouraging rural OFF-US AePS transactions due to their high cost. Several news reports have also linked this to unfair practices on the part of BC agents, who often resort to "round-tripping" of transactions, which drives up the costs and outflows from PSU banks (Bhakta and Ray 2018). To combat this, PSU banks have also tried to impose limits on the number of OFF-US transactions that a customer and a BC agent can perform, a practice that has been a point of friction between PSU and private banks. The RBI and DFS have reviewed this practice through the IBA and the NPCI (Inventiva 2018). Consequently, the NPCI (2020) has released an advisory statement defining the standardized limits for AePS transactions for all member banks to follow.

Despite the steady growth in both the number and the volume of AePS transactions, the challenge of transaction failures remains significant. Transactions on the AePS can fail for three main reasons—biometric mismatches, technical reasons (internet connectivity and bank system issues), and other reasons (incorrect details entered, insufficient funds, etc.). Previously, official documents and academic studies have reported high transaction failure rates of the AePS in the case of interbank transactions (Bhakta 2017; Balasubramanian et al. 2019). In 2017, the Economic Survey of India, citing data from the NPCI on the AePS, found that transaction failures occurred more frequently for OFF-US transactions. The survey indicated that a possible difference in the failure rates could be that "larger banks are declining transactions originating from smaller remitting banks" and warned banks against untoward interference.

While it is possible to resolve transaction failures related to biometric mismatches, incorrect details, or insufficient funds through financial literacy training, technical and systemic issues require higher-level interventions. Overall, failures of interoperable transactions are a cognizable obstacle in moving toward an economy that relies less on cash. AePS transaction failures are explored in detail in subsequent sections of this chapter.

5.2 The Gender Gap in Banking Services and Financial Inclusion

There has been a substantial increase in the number of female account holders following the success of the PMJDY. However, women continue to lag behind in the use of banking services (Kohli 2018), despite accounting for 53.26% of PMJDY accounts.[12] Several other studies have documented the gender-based disparity in the access to and use of financial services. The financial inclusion insights "Wave 5" report highlighted that, of the total increase in the number of active basic account users since 2015, only 9% were women and almost 55% women surveyed were registered inactive users (FII 2018). The Global Findex report of 2017 (World Bank 2017) estimated that the gender gap in terms of inactive accounts was about 12%. Similarly, in terms of access to credit, bank loans to women comprised only 7%, compared with 30% to men (Chavan 2020). Ghosh and Vinod (2016) documented that households with a woman as the head of the family have 10% lower access to formal finance than households with a male head.

Further, for women in rural geographies, the barrier to accessing financial services increases substantially. The physical distance from bank branches causes time and cost trade-offs and prevents women from completing transactions along with other caregiving responsibilities and sociocultural factors that limit mobility. Another hindrance is the lack of identification and other necessary documents to open bank accounts. Lastly, attitudes and mindsets within the community and summary treatment from bankers can preclude financial inclusion for women (Murata and Sioson 2018). Women are even more underrepresented in business banking; their share in the business loan portfolio declines as the size of the business increases (Deléchat et al. 2018).

These traditional barriers arise even in new domains, where anecdotal evidence and the studies that MicroSave Consulting, GIZ, and NABARD conducted have indicated that sociocultural barriers prevent women from transacting with male BC agents (Thakur et al. 2016; Mehta and Lahiri 2015) and relying on digital financial technology. As a corollary, field experience has validated the assertion that the appointment of female banking agents is a firm step toward bridging the gender gap in financial inclusion. While no official gender-disaggregated data are available in the public domain in spite of having a BC registry, discussions with industry experts have indicated that female banking

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[12] As of 10 March 2021. https://pmjdy.gov.in/account

agents account for no more than 15% of agents in the country; sample surveys that indicated that female banking agents comprise only about 8%–12% of the total number have corroborated this (Chatterjee, Khanna, and Srivastava 2018).

5.2.1 Experiences from Deploying Women as Banking Agents

NABARD–GIZ Pilot and NRLM Scaling Up: Female Self-Help Group Members as Banking Agents

NABARD and GIZ made the first structured attempt at deploying and mainstreaming women as banking agents in 2013–14 under the Rural Financial Institutions Programme.[13] Part of this initiative involved a pilot of the Bank *Sakhi* (female banker friend) model—an approach that deployed female self-help group (SHG) members as banking agents. The pilot successfully demonstrated that female SHG members as BC agents effectively delivered basic banking services in their communities and encouraged women to engage in financial transactions. An assessment of the program in Uttar Pradesh and Madhya Pradesh (Mehta and Lahiri 2015; Lahiri and Mehta 2015) revealed that female customers in rural areas regarded female banking agents as more approachable. The report also highlighted that, with appropriate support and training, female banking agents performed as well as or even better than their male counterparts.

The Bihar Rural Livelihoods Promotion Society (JEEViKA), an autonomous body under the Department of Rural Development, Bihar, which has been instrumental in deploying female community members as banking agents, reported similar findings (Pinto, Arora, and Roy 2020). In February 2021, about 1,700 female banking agents with support from JEEViKA in Bihar completed approximately 440,900 financial transactions, with a total value of $24.5 million (₹1.72 billion). Female BCs were more inclusive in their business approach and encouraged a higher number of female customers to conduct transactions in addition to supporting low-value transactions (which generate lower commission).

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[13] A bilateral cooperation program with joint implementation of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) on behalf of the Government of Germany and the National Bank for Agriculture and Rural Development (NABARD) on behalf of the Government of India. https://gender-works.giz.de/?wpfb_dl=181 (accessed 9 May 2022).

Building on this experience, the Deendayal Antayodaya Yojana–National Rural Livelihoods Mission (DAY–NRLM),[14] under the financial inclusion fund of the World Bank-supported National Rural Livelihoods Project, modified and adopted the SHG-BC model to deploy it at scale across the country. The DAY–NRLM supports 6.9 million SHGs across the country through capacity-building initiatives, initial capitalization, and the establishment of credit linkages with the formal banking sector. These SHGs have a cumulative membership of 75.2 million women, who have successfully leveraged approximately $56 billion as loans from banks since 2013/14 (Kumar et al. 2020). However, to date, most of these loans have been in cash, which SHG office bearers have withdrawn at bank branches to distribute further to the members during group meetings.

To expand access to banking services, some female members of this extensive network of active rural women's SHGs are undergoing training as Bank *Sakhis* to serve as BCs in rural communities. Under the Bank *Sakhi* program of the DAY–NRLM, State Rural Livelihoods Missions (SRLMs) help to identify and train women as BC agents for banks and their BCNM partners. They facilitate the training, examination, certification, and accreditation of female BCs following the established norms of the Indian Institute of Banking and Finance in partnership with Rural Self Employment Training Institutes. The DAY–NRLM finances this, while also providing female BCs with financial assistance in the form of soft loans and grants to purchase hardware and cover other establishment costs. The program also offers basic honorariums ranging between $28.57 (₹2,000) and $57.14 (₹4,000) for the first 6 to 12 months on the job, assuming that these female BCs will earn sufficient commission thereafter. Banks and BCNMs therefore need to liaise with the SRLMs to access a trained cadre of agents, whom they may co-opt and who provide ongoing supervision and technical support services to begin field operations. In the past 18 months, the Indian Institute of Banking and Finance has trained and certified over 35,000 women as BC agents, which is a remarkable feat by industry standards.

As a result of this collaboration, 21,790 female SHG members are working as banking agents with several public and private sector banks in over 20 states. In January 2021, close to 20,000 female BCs carried out approximately 2.4 million transactions worth ₹10.08 billion ($144 million). Through its Financial Inclusion Fund, NABARD has

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14 Government of India. Deendayal Antodya Yojana-NRLM website. https://aajeevika.gov.in/

been providing banks with additional financial assistance since January 2016 to support[15] and boost the impacts of this intervention.

Female Business Correspondents Providing Banking Services for Women

Emerging data indicate that the concerted effort to deploy women as banking agents has helped to bridge the rural gender divide in financial inclusion as female banking agents are able to serve a higher number of female customers in their area of operations, overcoming some of the social and cultural barriers that prevent women from performing financial transactions. A study of female BCs that the Centre for Digital Financial Inclusion conducted found that more than half of the customers of female agents were women (CDFI 2019). These agents also provided banking services to the elderly and differently abled members within their communities.

Table 5.3: Comparison of the Performance of JEEViKA Female Agents vs Non-JEEViKA Male Agents, September 2018–August 2020

Parameters	JEEViKA Female Agents	Non-JEEViKA Male Agents
Total number of transacted BCs	4,497	7,593
Average number of agents	214	362
Number of total transactions (cumulative)	2.25 million	3.46 million
Amount of total transactions (₹)	8,524,923,097 ($121.8 million)	12,428,568,088 ($177.6 million)
Average ticket size (total transactions) (₹)	3,792 ($54.2)	3,597 ($51.4)
Number of accounts opened	75,198	140,913
Total commission earned (₹)	33,907,369 ($484,391)	53,192,239 ($759,889)
Average number of transactions (total) per BC	500	455
Average amount of transactions (total) per BC (₹)	1,895,691 ($27,081)	1,636,846 ($23,384)
Average number of accounts opened per BC	17	19
Average commission per BC (₹)	7,540 ($108)	7,005 ($100)

BC = business correspondent, JEEViKA = Bihar Rural Livelihoods Promotion Society.
Sources: Authors, JEEViKA data.

15 NABARD Circulars. https://www.nabard.org/circulars.aspx?cid=504&id=24

Sample data from a partner PSU bank in Bihar show that female agents, with the support of JEEViKA, performed better than their male counterparts (*within the same state and bank*) in terms of conducting a higher number of transactions and earning higher commission (Table 5.3). While there is a need for more data on the operations and reach of male banking agents to make a suitable comparison, the initial insights from this small sample suggest that, with the right support, female agents can perform on a par with, or better than, their male counterparts.

To understand the nature of banking operations and the customer profiles of female banking agents, a pilot of a digital application to track transactions took place between December 2019 and December 2020 in Bihar. An average of 18 BC agents participated on a monthly basis and shared summaries of their daily transaction data during this period (see Table 5.4 for a summary). The data reveal that 71%

Table 5.4: Summary of Daily Transactions that the JEEViKA Application Recorded (December 2019 to December 2020)

	Male		Female	
	No.	Volume (₹)	No.	Volume (₹)
Account opening		123		627
Deposit	2,158	15,807,177 ($225,817)	4,306	23,197,433 ($331,392)
Withdrawal	12,288	34,775,801 ($4,96,797)	35,072	81,909,061 ($1.2 million)
Immediate payment service	1,031	5,315,919 ($5.3 million)	1,141	7,327,310 ($7.3 million)
Fund transfer	242	3,076,394 ($43,948)	291	3,333,030 ($47,615)
Total	15,719	58,975,291 ($842,504)	40,810	115,766,834 ($1.65 million)

	Total		%	
	No.	Volume (₹)	Female %	Male %
Account opening		750	84%	16%
Deposit	7,016	42,727,272 ($610,390)	61%	31%
Withdrawal	47,364	116,685,472 ($1.7 million)	74%	26%
Immediate payment service	2,335	14,161,034 ($14.2 million)	49%	44%
Fund transfer	537	6,435,434 ($91,315)	54%	45%
Total	57,252	180,009,212 ($2.57 million)	71%	27%

JEEViKA = Bihar Rural Livelihoods Promotion Society.

Source: Authors, JEEViKA data.

of the total transactions that these BCs performed were for female customers.

While we lack comparable data for male agents, these data also provide important insights into the financial transactions that women favor. Poor women have limited underlying banking use cases in a cash-dominated rural economy with the exception of the withdrawal of government cash transfers. Table 5.4 confirms that cash withdrawals occur five times more frequently than deposits and are the dominant transaction type.

Further, SHGs and their female members have been dependent on brick-and-mortar banking structures to withdraw loans, deposit savings, and make repayments. Therefore, the presence of female agents in areas with high SHG penetration is a compelling motivator for female members to use this facility as well as a step toward promoting digital transactions in an ecosystem that is largely cash dependent. Access to a female banking agent can support female SHG members in conducting their regular group transactions in a more convenient, secure, and transparent manner and encourage other women (non-group members) in the vicinity to use formal banking services.

The digitization of these cash flows, especially loan repayments, within SHGs not only allows the tracking of transactions but also produces a significant complementary effect in that individual members are able to build credit histories that may help them to access higher-value individual loans in the future. For banks, this could improve transparency in operations by providing a digital trail for the current outstanding group loans of approximately $17 billion[16] as well as ensuring compliance with the RBI regulatory requirements for lending banks to report group member-level borrowing to credit bureaus.[17] However, the pace of progress toward the digitization of loan disbursements and repayments has yet to accelerate.

Lastly, the deployment of women as BC agents has broader implications for the rural economy as it encourages women to play a more entrepreneurial role as barefoot bankers. In addition to a sustainable business opportunity, the platform has contributed to women's empowerment, especially as banking in rural areas has traditionally been a male bastion.

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16 As of March 2021.

17 See the respective RBI circulars for more details: https://www.rbi.org.in/Scripts/BS_CircularIndexDisplay.aspx?Id=10227 and https://www.rbi.org.in/Scripts/NotificationUser.aspx?Id=10449&Mode=0

5.3 Business Correspondents and Banking during the COVID-19 Lockdown

When the COVID-19 crisis hit India, the Government of India announced a 3-week nationwide lockdown starting on 25 March 2020 to contain transmission. It implemented restrictions on movement and economic activity as well as strict enforcement of social distancing norms under the lockdown, which was originally to end on 17 May 2020. It eased the lockdown on 8 June 2020 after several extensions; however, individual states continued to impose state-level and local restrictions in response to local conditions.

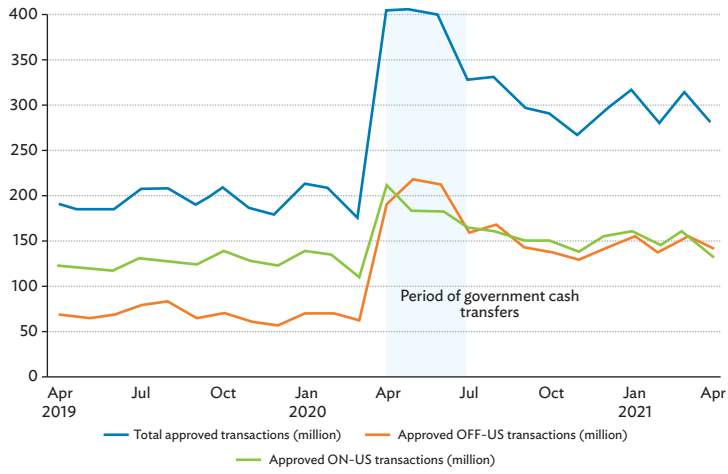
On 26 May 2020, the government announced the ₹1.70 lac crore ($24,285.7 million) Pradhan Mantri Garib Kalyan Yojana (PMGKY) relief package to provide a social safety net for the poor, whom the lockdown had affected the most (Ministry of Finance 2020). It announced cash transfers of ₹500 ($7.1) per month for 3 months to approximately 204 million PMJDY female account holders as part of this package, along with other social security transfers to vulnerable sections of society. Recipients could withdraw these cash transfers in a staggered manner from the nearest bank branch, ATM, or BC agent in compliance with social distancing norms.

When the lockdown restrictions severely curtailed access to financial services and cash flows in the rural economy, the government allowed the BC network freedom of movement and declared it to be an "essential service." BCs proved to be a crucial link in enabling access to the critical PMGKY transfers (Pinto and Arora 2020). This is evident from the 133% jump in the recorded number of AePS transactions in April 2020 (over the previous month) corresponding to the release of the first tranche of the government cash transfers (Figure 5.3).

During the lockdown, in several low-income states, female banking agents worked tirelessly to provide cash flows in their villages together with their male counterparts and were a critical link in the chain to support last-mile service delivery (Ministry of Rural Development 2020). Given the paucity of available structured data, records that different ecosystem partners maintained are presented below to highlight the coverage and reach of the female banking agents with the support of the DAY–NRLM.

Aligned with the spike in AePS transactions that we described above, the field and MIS reports that the Ministry of Rural Development maintains exhibit similar trends. The Bank *Sakhi* program recorded a 46% increase in the number of female agents that it deployed between April and June 2020, despite prevalent lockdown restrictions at that

Figure 5.3: AePS Transactions, April 2019–April 2021



AePS = Aadhaar Enabled Payment System.

Source: National Payments Corporation of India, AePS product statistics.

time. However, while new BCs joined the network and dormant female agents were encouraged to restart operations, the pandemic negatively affected the transaction volumes that these female agents processed, much like those of other BC agents across the country.

Overall, despite an increase in the total number of transactions between May and June 2020, the data reveal a decline in the volume of transactions over the same period. In April 2020, 9,071 female BCs (Table 5.5), with the support of the DAY–NRLM, completed 2.3 million transactions amounting to ₹38,441 lac ($54.9 million). The average transaction values of these female banking agents continued to remain significantly lower than their pre-lockdown activity in February and March, which is perhaps indicative of the slowdown in the overall economic activity.

Table 5.5: NRLM-Supported Female Agents, Monthly Progress Reports, 2020

	February	March	April	May	June
Female SHG members as banking agents	6,217	6,958	9,071	10,497	13,270
Number of transactions	767,801	909,729	2.3 million	2.2 million	2.6 million
Volume of transactions (₹ lac)	27,501 ($39.3 million)	32,325 ($46.2 million)	38,441 ($54.9 million)	45,345 ($64.8 million)	42,702 ($61 million)
Average transactions per BC	124	130	253	208	193
Average ticket size of transactions (₹)	3,582 ($51.2)	3,553 ($50.8)	1,676 ($24.0)	2,081 ($29.7)	1,660 ($23.7)

BC = bank correspondent, NRLM = National Rural Livelihoods Mission, SHG = self-help group.
Source: Authors from Deendayal Antayodaya Yojana–NRLM progress reports.

5.3.1 Banking during COVID-19: A Case Study of Bihar and Odisha[18]

Interactions with female banking agents and project staff showed that, while there was a spike in transaction volumes during the COVID-19 lockdown, especially in the form of cash-out transactions immediately after the announcement of the relief package, a corresponding rise in AePS OFF-US transaction failures occurred. Dvara Research (Raghavan 2020) published a report indicating that, in April 2020, the average failure rate of AePS transactions was 39%, ranging from 10% to 62% across providers (Mint 2020).

To understand these trends, we reviewed a small data sample of female banking agents from a private sector bank in Bihar and a PSU bank in Odisha. While they operate in similar rural settings, there are notable differences in the financial inclusion parameters of the two states, primarily because Odisha has higher bank branch penetration. Industry experts have suggested that the number of private sector BC agents is higher in Bihar than in Odisha perhaps because Bihar is an

[18] In 2011, the Government of India approved the name change of the State of Orissa to Odisha. This publication reflects this change.

active inward-domestic-remittance corridor with a higher population density.

Owing to the difference in the number of agents for whom data are available across both states, our analysis focused on trends and averages across states. In subsequent sections, transactions broadly refer to cash withdrawals that the AePS platform supports. The available data do not allow for causal attribution of cash withdrawal activities and amounts to specific government cash transfers or to the gender of the customer.

For Bihar, the data that we used are from March to July 2020 and draw from the transactions of 40 rural female BC agents of a private sector bank, for which an average of 33 BCs were active[19] on a daily basis. The BC agents mostly performed OFF-US withdrawal transactions as an acquirer, such that they served customers of other banks, mostly PSUs. For Odisha, the data follow the same period and include 126 rural female BC agents of a public sector bank, for which an average of 90 BC agents were active. They performed mostly ON-US withdrawal transactions as an issuer, such that they served customers of the same public sector bank. Sample data from the two states also revealed that the average transaction numbers per BC agent were higher in Bihar than in Odisha.

To understand the implications of the lockdown for BC transactions, we describe the trends over nine time periods (T0–T8) of varying durations, linked to the COVID-19 lockdown and associated government announcements (Table 5.6).

Table 5.6: Transaction Trends in Bihar and Odisha between March and July 2020

#	Dates	Notes
T0: Pre-lockdown	1–21 March 2020	In the pre-COVID-19 lockdown period, we assume normal transactions. The announcement of the Janta curfew occurred on 19 March and its observation on 22 March. No transactions took place on 22 March.
T1: Lockdown announced	23–30 March 2020	Lockdown from 25 March; announcement of the PMGKY relief package on 26 March. As per government directives, crediting of PMGKY transfers would take place on 2 April 2020.

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[19] Perform at least one transaction during the day.

Table 5.6 *continued*

#	Dates	Notes
T2: Cash transfers (PMJDY account holders)	3–10 April 2020	It was possible to withdraw PMGKY cash transfers in a staggered manner between 3 and 9 April 2020.
T3: Continued transactions, withdrawals	11 April–3 May 2020	Regular transactions took place while observing the restrictions associated with the COVID-19 lockdown.
T4: Cash transfers 2.0	4–11 May 2020	Period for staggered withdrawal of the second cash transfer.
T5: Continued transactions, withdrawals	12 May–4 June 2020	Regular transactions while observing the restrictions associated with the COVID-19 lockdown.
T6: Cash transfers 3.0	5–10 June 2020	Period for staggered withdrawal of the third cash transfer.
T7: Continued transactions, withdrawal	11–30 June 2020	Regular transactions with the easing of restrictions associated with the first phase of "unlocking" to begin on 8 June.
T8: Continued transactions, withdrawals	1–31 July 2020	Regular transactions with the easing of restrictions associated with "unlocking."

PMGKY= Pradhan Mantri Garib Kalyan Yojana, PMJDY = Pradhan Mantri Jan Dhan Yojana.
Source: Authors.

To understand the implications of the lockdown for the transaction volumes, we calculated the average number of daily transactions that all the BC agents in our sample attempted (both successful and failed transactions), for each of the reference periods, and plotted this for both private and public sector banks.

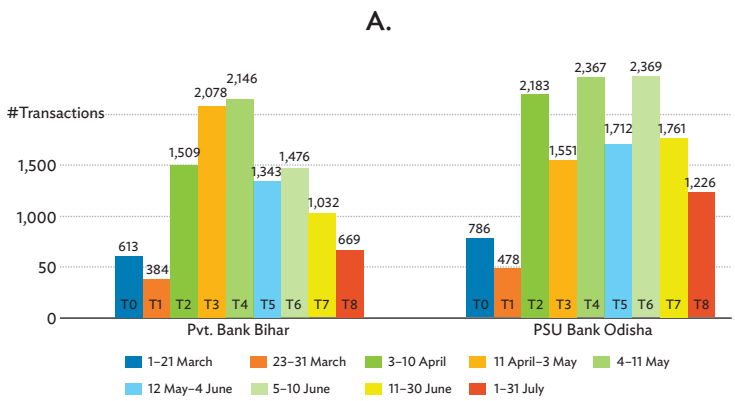
For both banks, we observed an initial drop in transaction volumes immediately after the lockdown (in T1: 23–31 March) linked to the restrictions on economic activity and movement. However, a spike in the number of transactions in the following periods corresponds to the announcement of the PMGKY cash transfers to the beneficiaries' bank accounts.

The staggered withdrawal that the government announced and the daily limits on volumes that BC agents were able to handle resulted in spillover transaction activity, as evident in the surge in transactions reported in T3 (11 April–3 May), T5 (12 May–4 June), and T7 (11–30 June) (post-cash transfer periods). However, the transaction activity remained higher in T8 (associated with the unlocking of the economy) than in pre-lockdown levels.

In the case of the private sector bank in Bihar, it is possible to link some of the spillover in the periods after cash transfers to failed transactions—all OFF-US in nature—which required the beneficiary to visit the BC point again after a few days to reattempt the transaction. A 37% drop in the number of transactions occurred during the week immediately after the announcement of the lockdown (T1: 23–31 March), following which growth of almost 211% took place until June.

Similarly, in Odisha, a 39% drop in the number of transactions was apparent during the same period (T1: 23–31 March). The growth in transactions during subsequent periods was approximately 137% until June. This suggests greater reliance on the BC agent network in Bihar than in Odisha, perhaps due to the lower bank penetration in Bihar. While the absolute numbers of transactions performed (partly because of the difference in the BC sample size) vary between the private sector BCs in Bihar and the PSU BCs in Odisha, the overall trends in transactions are almost identical.

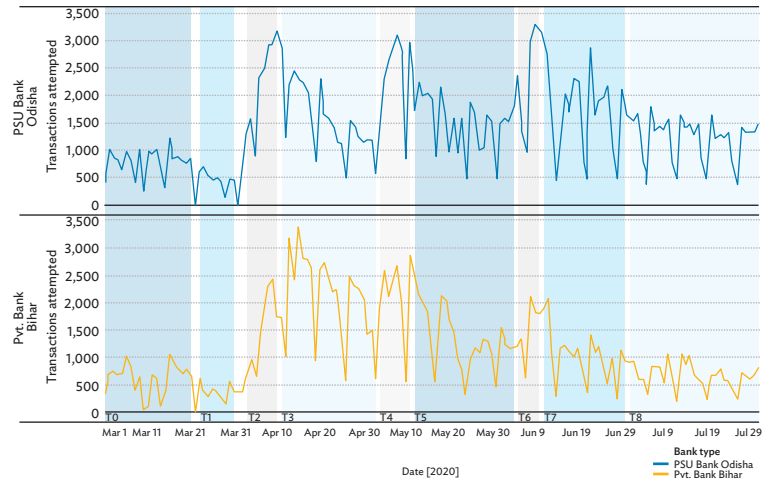
Figure 5.4: Daily Withdrawal Transactions



Notes:
1. The green bars represent periods assigned for staggered withdrawal of government social security transfers.
2. The graph depicts the number of daily transactions attempted (includes both successful and failed transactions) by all sample self-help group business correspondents (female) agents averaged for number of days in the reference period.

continued on next page

Figure 5.4 *continued*



PSU = public sector undertaking.

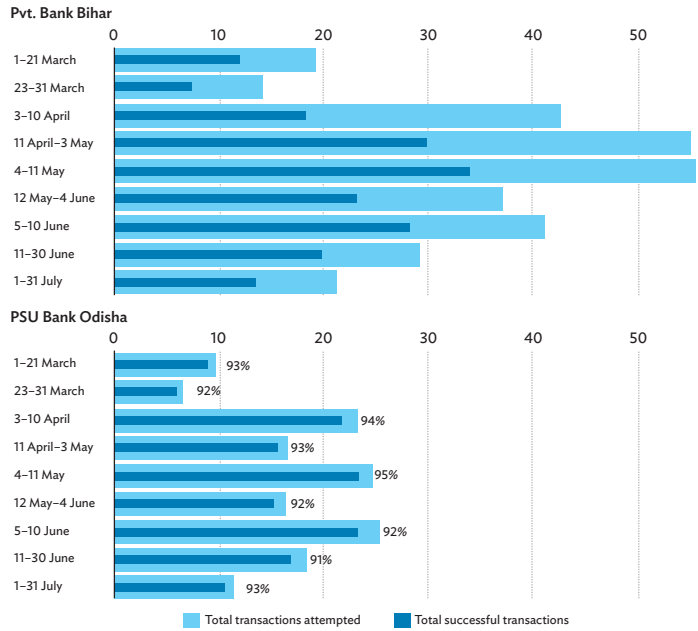
Source: Authors, using partner bank data.

Similarly, at the BC agent level, we noted that, in Bihar, the average daily transactions attempted per BC agent dropped from 19 pre-lockdown (T0: between 1 and 21 March) to 14 in the following period (T1: 23–31 March) and then reached over 50 daily transactions following the initiation of the cash transfers. In Odisha, the number of transactions attempted per BC agent was significantly lower. However, the overall trends in the two states were similar.

BC productivity during and after the lockdown in both states rose by over 100%. This clearly demonstrates that the female BC agents also responded to the critical situation and worked overtime to fulfill the banking needs of the rural community, much like their male counterparts across the country.

However, there are significant differences between private sector BCs in Bihar and PSU BCs in Odisha in the number of successful transactions performed and the total number of transactions attempted, as the chart below shows. This is largely due to the nature of the partner bank—BCs associated with the private sector bank performed only OFF-US transactions (in this case) and experienced a much lower success rate

Figure 5.5: Cash Withdrawal Transactions per BC Agent



BC = business correspondent, PSU = public sector undertaking.

Note: The graph depicts the average transactions per BC agent. The average is calculated based on the daily number of transactions reported per BC agent for the reference period. The percentage of successful transactions to the total is captured for each time period.

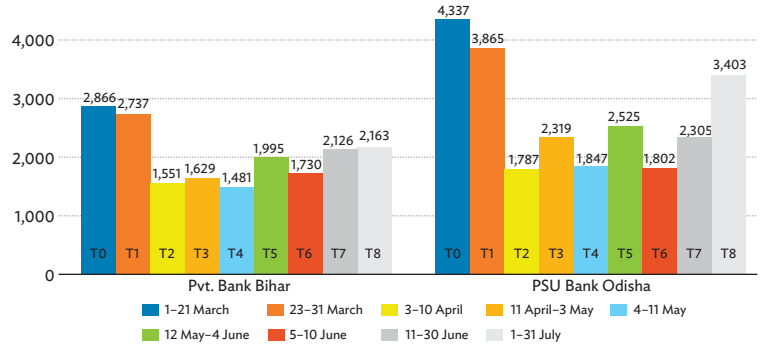
Source: Authors, using partner bank data.

than PSU BCs in Odisha, who performed mainly ON-US transactions and a lower number of transactions overall.

The average transaction value (commonly known as the average ticket size) was much lower than prior to the COVID-19 lockdown (March 2020). This is likely to be because of the reduced economic activity and uncertainty associated with the lockdown and the prevalent situation. The implications of reduced economic activity were more severe in the case of Odisha, where the average transaction value in the pre-lockdown period (T0: 1–21 March) was much higher than that in Bihar. There was a steep drop, comparable to that of Bihar, in the average transaction value in Odisha in the periods after T2 (3–10 April) (with the exception of T8 [1–31 July]).

While it is evident that female BC agents have been successful in ensuring cash flows in the rural economy, a steep rise in transaction

Figure 5.6: Average Transaction Value



PSU = public sector undertaking .

Notes:
1. Cash withdrawals in Indian rupees.
2. The average ticket size charted above refers to the average transaction value of a "successful" withdrawal performed by a business correspondent agent for the reference period.

Source: Authors, using partner bank data.

failure rates for the private sector bank-linked Bank *Sakhis* in Bihar meant lower revenues and a higher cost and effort for them.

5.3.2 Rising AePS Transaction Failures during COVID-19

Transaction failures compounded the challenges that the rural poor faced during testing times, and several news reports documented the two main reasons for these failures, namely biometric mismatches and transaction timeouts, particularly in the case of interbank transactions. Improper Aadhaar linkage, insufficient funds, and blocked or frozen accounts were other common reasons. A single transaction failure may lock out the account holder from conducting further transactions for 24 hours or more.

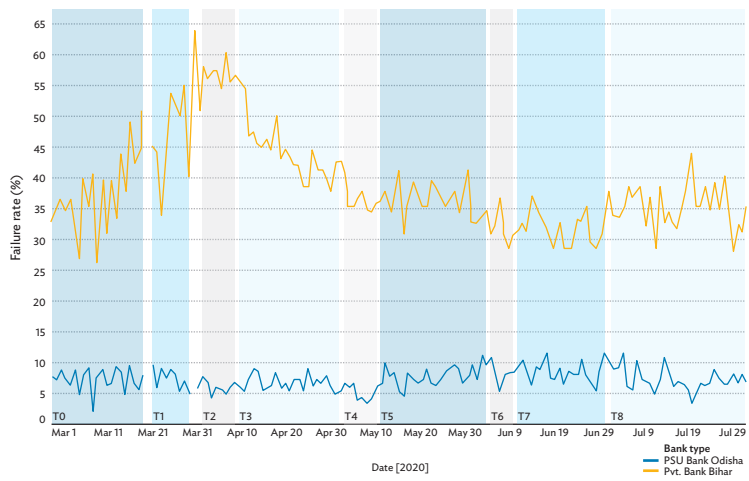
Accordingly, during the first phase of the PMGKY COVID-19 relief package cash transfers, we noted that the transaction failure rates that BC agents operating on behalf of the private bank in Bihar experienced were 57% on average, compared with 38% pre-lockdown (Table 5.7). While the system seems to have stabilized and transaction failure rates reduced to the pre-lockdown levels during the second and third phases of cash transfers, this is a considerably higher total than those experienced by the PSU bank's BC agent sample in Odisha, where the transactions were mostly ON-US. In Odisha, the failure rates remained

Table 5.7: Transaction Failure Rates

Date	Private Bank BCs in Bihar: AePS Transaction Failure Rate (OFF-US Transactions Only)	PSU Bank BCs in Odisha: AePS Transaction Failure Rate (Mostly ON-US Transactions)		
		Overall Failure Rate	ON-US Failure Rate	OFF-US Failure Rate
T0: 1–21 March	38%	7%	0%	10%
T1: 23–31 March	47%	8%	0%	10%
T2: 3–10 April	57%	6%	2%	9%
T3: 11 April–3 May	44%	7%	2%	11%
T4: 4–11 May	37%	5%	2%	8%
T5: 12–4 June	36%	7%	1%	10%
T6: 5–10 June	31%	8%	3%	11%
T7: 11–30 June	32%	9%	1%	11%
T8: 1–31 July	35%	7%	1%	10%

AePS = Aadhaar Enabled Payment System, BC = business correspondent, PSU = public sector undertaking.
Source: Authors, using partner bank data.

Figure 5.7: Daily Withdrawal Transaction Failure Rate



PSU = public sector undertaking.

Source: Authors, using partner bank data.

at similar levels even after the lockdown despite the increased pressure on the banking system and spikes in the daily transaction activity.

We noted that most cash transfers applied to the PMJDY accounts of female beneficiaries, which PSU banks (issuer) opened required an interbank withdrawal transaction in the case of Bihar's sample private bank-affiliated BC agents. However, in Odisha, we found that only 24.54% of the total transactions that BCs completed were OFF-US (interbank) in nature. Here, only 1.7% of the ON-US transactions failed compared with 10.03% of the OFF-US transactions.

The transaction summary of the sample seemed to imply that the success rate of an ON-US transaction that a PSU bank's own BC agent initiated is higher than the success rate of OFF-US interbank transactions that a private sector bank's BC agent initiated. Interactions with key stakeholders also suggested that the increase in transaction failures was largely due to the increased network and bandwidth requirements for a spike in the demand for services, mostly in the case of interbank transactions.

Our assessment of BC transactions during the COVID-19 cash transfers is in line with the findings of previous studies that we discussed earlier. Suffice it to say that, for rural customers, these transaction failures mean the inability to confirm whether a failed transaction has debited their account, and they may to need to wait for an extended period without reversal of debits (sometimes even 14 days). They also incur costs when returning to the banking agent to complete the transaction and lose daily wage hours in the process. This could have serious implications for the push for digital financial inclusion, deterring rural customers who are already hesitant and suffering distress due to the COVID-19 situation.

5.4 Conclusion and Way Forward

Four PSU banks account for a majority of the PMJDY accounts according to data from 24 March 2021.[20] PSBs hold nearly 74% of PMJDY accounts, and regional rural banks hold about 24%, with only about 2% in PSBs. However, private sector banks are increasingly employing the BC channel to leverage this opportunity to serve rural areas sustainably through the interbank transaction fee that they receive for transactions that their acquiring agent network supports.

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[20] Pradhan Mantri Jan Dhan Yojana. 24 March 2021. https://pmjdy.gov.in/BankwiseLatest

Building on lessons from implementation, especially in the light of COVID-19 and the efforts to build back economic growth, this chapter argues for financial inclusion strategies premised on a strong banking agent network and a gender focus. In the following subsections, the chapter covers the structural and technical challenges and possible solutions that require a multi-pronged, multi-stakeholder approach to maintain the positive impact of these initiatives with the aim of furthering financial inclusion.

5.4.1 Building a Resilient Business Correspondent Ecosystem to Further Financial Inclusion as a Business Case

Private sector banks have deployed a large-scale network of BC agents and plugged the gap that PSU banks left, evident from the exponential rise in interbank AePS transactions in recent years. As we discussed earlier, the RBI's annual report of fiscal year (FY) 2019/20 (refer to Table 5.1) also showed that, while the growth in the number of BSBDA accounts that customers opened through the BC channel has plateaued, the number and value of transactions occurring through this channel is continuing to rise steadily, highlighting the critical role of BC agents in facilitating access to banking services. The following institutional and structural mechanisms are necessary to enhance financial inclusion in rural areas.

- Several technological and policy measures are necessary to address the high transaction failure rates of OFF-US AePS transactions. Banks need to upgrade their information technology (IT) system capacities to ensure negligible failure rates for interbank transactions in compliance with a recent NPCI circular that advocated for better management of banks' transaction loads.[21] AePS failures in times of crisis can have adverse effects, adding to the anxiety and uncertainty that beneficiaries experience and deterring them from using the BC channel recurrently (Balasubramanian et al. 2019). There is a need to enforce a prescribed failure rate for banks and to encourage the automation of reconciliation of failed transactions to reduce the turnaround time involved in crediting funds back to customers' account in compliance with the relevant regulations. Regular tracking of bank performance, especially the transaction failure rates and the public disclosure of such

[21] NPCI Circular NPCI/AePS/2020_21/006. 24 August 2020.

performance indicators, including the average turnaround time for redressal/reversal of failed transactions and compensation for customers, could help to improve the performance.[22] Customer protection and grievance redressal mechanisms that are easily accessible and enforceable are critical to build rural customers' faith in the channel's service delivery ability.

- Learning from the additional support that some banks provided agents with during the pandemic and the DAY–NRLM's support for its female banking agents, hiring banks must provide social security benefits and cash-carrying risk cover for BC agents to mitigate or reduce risk and boost morale within the agent network. Further, in accordance with an April 2014 circular of the RBI,[23] banks must meet the working capital needs of BC agents to enable them to expand their operations, and it is necessary to consider the cash that the BC agents handle as the cash in hand of the concerned bank.

Interactions with BC agents indicated that most often the compliance burden of supporting working capital requirements, social security cover, and cash-carrying risks falls on BCNMs. In many cases, BCNMs also do not provide the required working capital or cash-carrying risk cover, which adds to the cost and effort of operations and erodes the revenue margins of banking agents. Providing BC agents with low- or no-cost working capital will make a considerable contribution to strengthening the agent network and will encourage more women to take on the role of BC agents in rural areas. An added incentive for banks is that support for the working capital requirement of BC agents would count toward their priority sector lending targets.

- The pandemic has highlighted the need for alternative and/or additional identity and transaction authentication systems to augment the capacity of the current AePS, which requires biometric authentication linked to fingerprint scans. Field reports have pointed to both the reluctance of users to conduct transactions and the possibilities of transmission in the absence of regular disinfection given the "high-contact" nature of the solution. There is a need to explore alternative backup options and contactless solutions, including a simplified one-time password or OTP system linked to the customer's mobile

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22 RBI Circular. https://rbi.org.in/scripts/NotificationUser.aspx?Mode=0&Id=11693 and https://rbi.org.in/scripts/NotificationUser.aspx?Mode=0&Id=11946.

23 RBI Circular: RPCD.FID.BC.No. 96/12.01.011/2013–14. 22 April 2014.

number or authentication linked to iris and facial recognition technologies connected to the existing Aadhaar database. While instituting these alternative technologies will be a welcomed demand- and supply-side solution, expanding and mainstreaming this solution will require both investments in hardware and a grievance redressal mechanism and systems to secure the privacy of customers.

- Encouraging competition among banks in un(der)-banked rural areas and providing more products and services through the BC channel will help both to deepen financial inclusion and to support sustainable BC operations (Uzma and Pratihari 2019). For example, while some banks allow customers to open small-value recurring or fixed deposits electronically at the BC point, in most cases, the physical paper trail still needs to supplement this action. Banks also restrict the encashment and closure of such deposits for credit into the customers' savings accounts (of small denominations) digitally through the BC channel. This inhibits the mobilization of savings in rural areas, especially among women. While institutional directions to improve the range of micro-banking products and services for delivery through the BC channel could encourage customers to move beyond cash-in–cash-out services, a larger service offering would also improve the earnings stream for BC agents via increased commission.

5.4.2 Female Business Correspondents as a Means to Reduce the Gender Gap in the Provision of Financial Services

The policy focus on the expansion of the number of female BCs, coupled with the PMJDY transfers to women's accounts, is a powerful indicator that the well-being of women and their households is a priority for the government. As section 5.2.1 discussed, the results from earlier assessments of the SHG-BC approach that both the DAY–NRLM and the NABARD–GIZ conducted suggest that female agents serve a larger proportion of female customers, while female customers are more comfortable approaching female BC agents.

- Many of the PMJDY accounts that receive the PMGKY cash transfers may belong to first-time female users of agent banking services. AePS transaction statistics (section 5.3)[24] show

[24] For more details, see https://www.npci.org.in/what-we-do/aeps/product-statistics

sustained usage of the platform beyond the spike in observed volumes during the period of COVID-19 relief transfers (April 2020–June 2020) and a 68% growth in total volumes between FY2019/20 and FY2020/21. The current crisis could present an opportunity to build suitable (micro-banking) financial products for these women based on their cash flows and needs and to expand cashless merchant payments in rural areas. In areas with high penetration of women's bank accounts and usage, for instance in areas with high levels of SHG and other community-based organization activity, the appointment of trained female BC agents can play a critical role in moving from basic financial inclusion to financial deepening for women. Currently, PSU banks have roughly 15,000 rural bank branches with SHG loan portfolios of over ₹50 lac ($71,400) each, which banks could prioritize for engaging female agents.

- There is a need to consolidate the different BC databases that stakeholders maintain into a single, comprehensive national BC registry. The RBI could mandate the IBA to release periodical state- and bank-wise summaries of gender-disaggregated data on BC agents under the BC registry that they already maintain.[25] Alternatively, the feasibility of the NPCI leading this initiative could undergo examination since it provides services to all types of banks for AePS transaction switching and related activities. The RBI and DFS should also release more granular data on state- and bank-wise gender-disaggregated PMJDY–BSBDA account use on the demand side in line with gender-disaggregated BC agent data on the supply side for the sector. This is particularly critical in light of the recent analysis, which suggested that about half of India's poor women may still not have coverage under the PMJDY and were therefore excluded from the recent cash transfers under the COVID-19 assistance package (Pande et al. 2020).
- A recent FinEquity publication highlighted that collecting and analyzing gender-disaggregated data can inform evidence-based financial inclusion policy and regulation as well as enhancing the effectiveness of national-level efforts.[26] Under the Alliance for Financial Inclusion's Denarau Action Plan (AFI 2017, 2018), several member countries have committed

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25 Indian Banks' Association. Business Correspondents (BCs) Registry. https://www.iba.org.in/bcregistry/

26 See more details at FinEquity Brief (2020).

> to building a road map for more gender-focused financial inclusion policies and regulation. While India has been part of the Alliance for Financial Inclusion's network, it has yet to adopt gender-specific targets and reporting. It would be a progressive initiative for India to have specific gender-based financial inclusion targets, not only restricted to the opening of bank accounts but also along various usage metrics.

Drawing on data from Bihar and Odisha, we described how the current COVID-19 crisis has highlighted the need for and role of female BC agents in promoting financial inclusion and easier access to banking facilities in rural economies. Encouraging women to participate as BC agents on a larger scale will require additional institutional support mechanisms to make the BC business sustainable and profitable in the long term. This would require convergence between policy actors, such as the Ministry of Rural Development and NABARD, as well as the DFS and RBI, to encourage and incentivize banks to hire female BC agents and offer suitable, customized products that encourage micro-savings until the benefits of the incremental scale and gender balance start accruing.

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PART II

Implications for the Post-Pandemic Era

6

The Promise of Fintech: Financial Inclusion in the Post-COVID-19 Era

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6.1 Introduction

Somewhere remote in a low-income country, in the early hours of the morning, a woman wakes up and dials her cell phone. She is borrowing a very small amount of money digitally to buy vegetables in the local market. During the day, she will sell her inventory in her shop located in the outskirts of the town. Some customers will pay her using their mobile wallet, others with cash. She will transfer the cash onto her phone at the shop next door, where the merchant is also a mobile money agent. At the end of the day, she will be able to pay back her loan and keep her profit in her mobile wallet. She can use this mobile money to pay for the gas she uses to cook dinner, as the utility company has recently connected its payment system to the mobile money infrastructure. In her daily life, this is huge progress.

Somewhere central in a rich country, just a few weeks before the year-end holiday season, a machine in a chocolate factory breaks down. Without a new device, the profits during the busiest part of the year will vanish. The owner tries frantically to obtain credit from his bank to replace his machine.Even though the factory has operated for several years and has a profitable track record, the bank is just too busy for this small client and schedules an appointment in the new year—way too late. A few years ago, this could have been the end of the business. But a friend told him about an online lender. Within a week, the online lender had assessed the creditworthiness, approved the loan, and disbursed the money. The machine was delivered just in time—two weeks before the holiday season. This is a true story that played out in the city of London.

These anecdotes that preceded the novel coronavirus disease (COVID-19) pandemic illustrate ways in which technological innovations in the financial sector (fintech) has enhanced financial inclusion in countries at different stages of development. Globally 1.7 billion people have no access to a bank account and small- and medium-sized

enterprises (SMEs) (95% of companies worldwide) provide employment to more than 60% of workers, yet struggle to access finance. In this environment, fintech is creating significant opportunities, helped by the growing ownership of mobile phones and access to internet.

The COVID-19 health crisis has created new opportunities for digital financial services to accelerate financial inclusion amid social distancing.[2] The health crisis led to the "Great Lockdown," as country authorities have opted for restrictive containment measures—lockdowns, quarantines, travel restrictions, and other social distancing measures—to bring the contagion of the virus under control. Fintech, including mobile money, can help people and firms to maintain and increase access to financial services during lockdowns and the reopening of businesses, given growing preference for cashless and contactless transactions to mitigate the spread. Many country authorities have encouraged its use by introducing measures to lower cost and increasing the limits on transactions for digital transactions (e.g., Ghana, Kenya, among others). These developments could help accelerate the shift toward digital financial services from traditional financial services. For instance, the severe acute respiratory syndrome (SARS) epidemic in 2003 accelerated the People's Republic of China's (PRC's) launching of digital payments and e-commerce.[3]

Anecdotal evidence suggests that fintech is already playing an important role in mitigating the economic impact of COVID-19, by facilitating targeted fiscal measures to be deployed efficiently and quickly to their intended beneficiaries, even the unbanked. By reducing or eliminating the need for physical interactions and the need for cash, fintech is helping governments reach—quickly and securely—people and businesses with various forms of income and liquidity support. In countries where access to banking networks is limited, mobile money networks are being used to deliver government transfers (e.g., Namibia, Peru, Uganda, Zambia). Information from data garnered from mobile payments is connecting governments to informal workers outside formal benefits programs. In Togo, for example, a new program was introduced targeting informal workers, in which transfers are made through mobile money and with a top-up for women recipients (IMF 2020b). Tax authorities are encouraging use of online platforms for filing tax returns (Kenya, Namibia, and Nigeria). Some fintech lenders

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2 Agur, Martinez Peria, and Rochon (2020) analyze the opportunities and risks associated with digital financial services in the context of the COVID-19 pandemic.

3 https://www.weforum.org/agenda/2020/05/digital-payments-cash-and-COVID-19-pandemics/

are also responding quickly to the liquidity needs of SMEs affected by the pandemic (e.g., the PRC), taking advantage of the real-time data and online processes. Many fintech companies, big and small, are offering flexibility in loan repayments for impacted borrowers (e.g., India, Kenya, and United Kingdom [UK]). But the scope to improve remains vast, especially in expanding e-government via fintech companies and digital banking.

From a macroeconomic perspective and based on recent empirical evidence, the promise of digital financial inclusion in enhancing economic growth, narrowing income inequalities, and reducing poverty appears to be immense.[4] From poor households to SMEs, fintech has been facilitating access to accounts, transactions, and credit in recent years, thereby opening opportunities for wider sections of the population to participate in formal economic activity. The development of digital savings, cross-border transfer solutions, and insurance also offers promises. Beyond the enhancement of individual opportunities, a broader access to finance has positive macroeconomic effects: International Monetary Fund (IMF) research already shows that financial inclusion supports growth and lowers inequality (Sahay et al. 2015a; Čihák and Sahay 2020); and provided the financial sector is well regulated, it does not hurt financial stability. It also improves the effectiveness of macroeconomic policies, further supporting growth and stability (Loukoianova and Yang 2018). These are important findings for creating income and employment, and for reducing inequalities in financial access following the large COVID-19 shock.

Notwithstanding these opportunities, the COVID-19 crisis has also brought to the fore risks that had been emerging prior to the pandemic. For instance, risks to financial stability—notably as regulatory arbitrage leads financial activities to migrate from the regulated to the less or lightly regulated sector—are one important concern of policy makers. The possible disruption of traditional business models, and the interconnectedness of traditional financial institutions with lightly supervised fintech companies raise similar concerns. There are also risks related to the technology itself, which affect both banks and nonbank financial institutions: for instance, confidential data may leak, including via cyberattacks. Financial service providers could be facing new money laundering/terrorism finance (ML/TF) risks. Regulators warned that cybersecurity risks or inappropriate lending practices by under-regulated institutions could jeopardize trust. The balance of risks

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[4] Financial inclusion enabled by the use of fintech. In this note, the words "digital" and "fintech-driven" financial inclusion are used interchangeably, although the former could be offered by financial institutions as well (see Box 6.1).

may also be affected by the possible changes in the fintech landscape and regulations during and post COVID-19.

Financial inclusion itself could be at risk as digital services accelerate in the post-COVID era, driven by unequal access to digital infrastructure and potential biases amplified by new data sources and data analytics. Lack of access to mobile phones, computers, or the internet could leave us with new forms of exclusion, which could be exacerbated if the shift toward digital financial services accelerates during and post COVID-19. During the COVID-19 crisis, smooth access to government electronic systems that are well integrated with digital financial services platforms such as fintech firms, mobile money companies, and digital banking are proving to be critical in providing wide-reaching policy support promptly and without contact to the public. If they are not easily accessible or not well integrated, fiscal support announcements—no matter how large—will fail to reach the most vulnerable and needy. Fintech companies also highlighted the limited supply of skilled labor and digital infrastructure as major constraints. Data biases or inaccurate and insufficient information could result in greater financial exclusion and feed distrust for new technology, especially among the most vulnerable. Lack of financial and digital literacy could exacerbate these risks. Financial inclusion could be threatened from the possible demise of microfinance institutions, whose operations and clients might be affected more by the economic fallout and who might be struggling to operate digitally during the COVID-19 crisis.

Furthermore, many fintech companies are young and have never experienced an economic downturn before, let alone faced the worst global shock in several decades. The COVID-19 crisis is the first major test of the fintech sector's resilience during a crisis. First, tighter funding conditions will affect fintech companies, big or small, with thinner liquidity buffers. Preliminary data already suggest this is happening: fintech funding activity stalled in the first quarter of 2020, resulting in the worst first quarter for fintech funding since 2017, as investors pulled back investments.[5] Insofar as the funding drought leads to smaller fintech firms being bought up by larger firms, or disappearing altogether, we could see higher market concentration in the fintech sector going forward. Second, the economic crisis, and in particular the collapse in consumption (notably in highly impacted sectors such as hotels, restaurant, airlines, and even retail) will cause a fall in fintech

5 https://www.cbinsights.com/research/report/fintech-trends-q1-2020/

payment firms' revenues.[6] Third, much fintech lending has targeted small borrowers, who are likely to be disproportionately affected in the ongoing crisis, and hence may see a sharp deterioration in loan quality. Major disruptions to services provided by fintech companies could set back the progress that has been made with digital financial inclusion and innovation, and there could also be macroeconomic and financial spillovers.

While fintech's potential to increase financial inclusion is clearly very high, the benefits and risks cannot be easily quantified. The data on digital payments are patchy, even patchier for digital lending, savings, and insurance (the other three components of financial inclusion). Financial inclusion, a key component of United Nations Sustainable Development Goals (SDGs), would remain elusive if policy makers cannot accurately measure the benefits and risks. Hence, a concerted effort is needed to strengthen data collection, and this would be an important early step in the COVID-19 economic recovery phase, once the immediate health risk fades.

Recognizing the data limitations, this chapter uses a two-pronged approach to further our understanding of developments in digital financial inclusion and their macroeconomic effects. It complements quantitative analysis, based on available data from before the COVID-19 crisis, with information from interviews around the world with a broad set of policy makers, regulators, fintech companies, and banks. In a fast-evolving fintech landscape, the interviews allowed us to understand better developments—both prior to and post the COVID-19 pandemic—that are not yet captured in the data.

Our work focuses on two leading aspects of financial inclusion: access to domestic payments and credit. The other dimensions of financial inclusion—savings, insurance, and wealth management—are still nascent, and where they exist, data are lacking. The potential for fintech to support affordable cross-border payments—notably for remittances—is high; the cost of remitting money across border is declining slowly, but at almost 7%, it remains above the 3% target set by the SDGs. Fintech combined with strong digital identification and robust AML/CFT could have a great potential in supporting more affordable and remotely accessible cross-border transactions such as remittances, which have been an important support for families in low-income countries. The latter topic, however, is beyond the scope of this note, which focuses on domestic payments and credit.

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[6] Some payment companies have seen demand for their services take off. For instance, PayPal job slots more than doubled in early 2020, according to the Thinknum job posting database.

We introduce a new index to measure digital financial inclusion. Comparing this index with one of traditional financial inclusion allows us to quantify the relative progress of digital financial inclusion in a sample of 52 emerging market and developing economies (EMDEs) prior to the COVID-19 crisis. We also analyze global developments in marketplace lending, one aspect of digital credit. Finally, we explore the determinants of digital financial inclusion and assess its impact on economic growth.

To complement the empirical analysis, we interviewed representatives of more than 70 fintech companies, central banks, regulatory bodies, and banks around the world in two phases (Sahay et al. 2020, Annex 1). The first phase of interviews was conducted before the COVID-19 crisis, and they provided key insights on the areas where fintech has the greatest potential for financial inclusion, the competitive landscape, the impediments to promoting digital financial inclusion, the role of regulation, and the risks related to digital financial inclusion. The second phase involved follow-up interviews with a subsample of the fintech companies interviewed in the first phase to understand the impact of the COVID-19 pandemic on digital financial inclusion, their own business and clients, their responses and collaboration with governments and traditional banks, and how they see their roles going forward.

Our key findings underscore the impact of digital finance and the factors that may facilitate or inhibit financial inclusion. In particular:

- *Digital finance is increasing financial inclusion, even where traditional financial inclusion is declining.* In all 52 countries covered in our analysis, digital financial inclusion improved between 2014 and 2017, particularly in Africa and Asia, and even where traditional financial inclusion was stalling or declining. In a sample of more than 100 countries, marketplace lending—a subset of digital credit—also grew fast, albeit from a small base. Digital financial inclusion tends to fill a gap: it develops where the traditional delivery of financial services is less present. Interviews point to different effects on digital credit during the COVID-19 crisis—in some countries, fintech lenders participate in the government schemes to support credit extension to SMEs, whereas in other countries many fintech firms are scaling down new lending in response to weak demand and to focus on preserving liquidity and managing credit risks.
- *Digital financial inclusion is associated with higher gross domestic product (GDP) growth.* We find that adoption of digital payments is significantly and positively associated with growth, consistent with the notion that fintech might contribute to

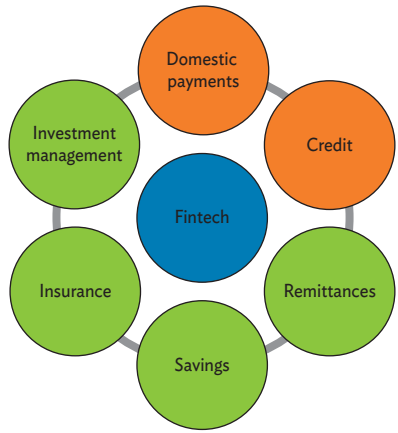
growth. Fintech could thus play an important role in mitigating the economic impact of the COVID-19 pandemic, and support the recovery, as countries with higher digital financial inclusion will find it relatively easier to (i) ensure continued access to financial services, including by maintaining credit flows to households and businesses while keeping people safe; (ii) deliver government support effectively and securely; and (iii) support consumption, innovation, and hence productivity through digital economy developments. However, the impact on growth and income distribution in the post-COVID-19 era may also be affected by the possible changes in the fintech landscape—if the smaller fintech companies that have higher reach to low-income households and small businesses disappear, it may increase the income divide between the rich and poor.

- *Fintech is contributing toward closing gender gaps in financial inclusion in most countries, but there is a concern that they may rise in the post-COVID-19 era*. Stakeholders noted several barriers that may be higher for women: cultural or social norms, financial literacy, safety, and disparity in access to resources. Given these structural barriers, concerns remain that the gender gaps may widen as the shift toward digital financial services accelerates during the COVID-19 crisis.
- *The delivery of digital financial services is evolving, with various models of interaction between incumbents and disruptors*. Fintech companies—frequently the source of the innovation—often compete with banks and other established financial institutions. These established institutions are responding to the competition by investing heavily in fintech. But we also see widespread collaboration between fintech firms and established institutions, based on complementarities. This was confirmed by our data analysis, as well as interviews. While the pandemic could increase both the opportunities for collaboration and competition as traditional institutions accelerate the shift toward digitization, policy measures focused on delivering support related to the COVID-19 through the banking sector could affect the competitive landscape. Consolidation in the fintech industry, driven for example, by tighter funding conditions for smaller fintech firms, could lead to greater concentration in the sector. At the same time, the COVID-19 crisis is also illustrating the opportunities for governments to collaborate more with private digital financial service providers to increase the reach of e-government services to wider sections of the population.

- *The safe development of digital financial inclusion rests on a combination of factors.* Rapid financial inclusion without proper regulation and financial literacy can lead to financial instability, as witnessed during the global financial crisis. Regulators warned that cybersecurity risks or inappropriate lending practices by under-regulated institutions could jeopardize trust—in this context, consumer protection, digital identification, and financial and digital literacy were high on their agenda. Fintech companies highlighted the supply of skilled labor for fintech companies and availability of digital financial infrastructure as major constraints.
- *Digital finance can create new risks to financial inclusion.* Those risks stem from unequal access to digital infrastructure, constraints to financial and digital literacy, and potential biases amplified by new data sources and data analytics. The current model of lightly regulated digital lending could, in turn, threaten financial stability. Indirect risks relate to the possible disruption of financial inclusion through microfinance institutions and to the consequences of a demise in trust in digital technology. All of these risks are even more important in light of the rapid and abrupt shift toward digital financial services amid the COVID-19 crisis, as highlighted above.

Analyses on digital financial inclusion face constraints, many of which originate from lack of comprehensive data on certain aspects of fintech-related financial inclusion. First, the data do not fully capture all financial services, such as savings/wealth management and insurance instruments and many aspects related to credit. They also exclude cross-border payment services (Figure 6.1). Second, detailed data on digital payments are available only for a relatively small sample of countries (52 out of about 190) and exclude the period from the onset of the COVID-19 health crisis as well as developed economies. Third, the databases we use to capture digital services do not identify the provider—in other words, such data could reflect services provided by fintech companies, as well as banks. Fourth, in the empirical analysis on the impact of digital finance on growth, the available time series is short and excludes several components of digital finance and therefore, likely underestimates the impact on growth. Fifth, determining the direction of causality between growth and fintech-related financial inclusion remains a challenge, not unique to the empirical work in this chapter. Even though our analysis attempts to address endogeneity

Figure 6.1: Scope of the Analysis



Note: Of the many dimensions of financial services that are affected by fintech innovations, our work focuses on payments and credit.

Source: Authors.

or reverse causality, the short time span of the data and lack of good instruments remain constraints. Finally, even though we interviewed many stakeholders around the globe, the sample may not be sufficiently representative of the population.

The remainder of the chapter is organized around six broad questions that were covered in the interviews and the empirical work. A short review of the literature sets the stage for those questions. Then, the chapter asks the following: Where was digital financial inclusion emerging prior to the COVID-19 crisis? Is fintech increasing financial inclusion? What are the macroeconomic effects of digital financial inclusion? Are fintech companies disrupting traditional providers, and how could these relationships evolve during the ongoing downturn and the subsequent recovery? What are the impediments to the development of digital financial inclusion? What are the risks of fintech to financial inclusion? The last section offers some open questions on the changing landscape of the fintech sector from the COVID-19 crisis and its implications for financial inclusion.

6.2 Setting the Stage: Recent Global Developments and Literature Review

Three fundamental changes have influenced the development of fintech: massive data generation, advances in computer algorithms, and increases in processing power. These have been facilitated by high-speed broadband internet, cloud computing, and artificial intelligence, which have enabled big data analytics, blockchain technology, and biometric identification.

Fintech is changing the way financial services are delivered to small businesses and low-income households. Traditionally, financial services have been delivered by banks and their agents, microfinance institutions, and informal systems (for instance, relying on relatives, microlending clubs, or moneylenders), with often limited competition. They are predominantly built on cash transactions and face-to-face interactions with the financial service provider. Those interactions are the basis for monitoring creditworthiness; they are also often the way customers become financially educated. The emergence of fintech is changing this landscape: with the development of digital finance tools that are accessible from mobile phones or computers, the need for face-to-face interactions is greatly reduced. The mobility restrictions to contain the current COVID-19 pandemic have amplified these benefits of expanding digital financial services. The development of digital platforms, which can offer a variety of financial products and serve as aggregators for existing financial products or fintech companies' own products, helps maximize the value for customer by facilitating a comparison of the price and suitability of products and services offered by different companies.

Fintech's potential to boost financial inclusion has been on the radar of global leaders and policy makers since long before the COVID-19 crisis. The Alliance for Financial Inclusion (AFI), a global network of policy makers started in 2008, set out its main objectives in the Maya Declaration in 2011. The Group of Twenty (G20) leaders also focused on financial inclusion in the Seoul Summit in 2010, endorsing a Financial Inclusion Action Plan and creating the Global Partnership for Financial Inclusion. In 2015, the United Nations adopted the SDGs for 2030, wherein financial inclusion features prominently. In 2016, the AFI and the Global Partnership for Financial Inclusion identified technology as a core aspect of financial inclusion, creating a new workstream, Fintech for Financial Inclusion. In 2018, at their Annual Meetings in Indonesia, the IMF and World Bank launched the Bali Fintech Agenda, which lays out the broad principles for the safe development of fintech, including

to support financial inclusion. The COVID-19 pandemic has put a bright spotlight on how digital financial inclusion can be harnessed to respond to the crisis and how the crisis in turn would accelerate digital financial inclusion.

The international attention has spurred data collection and analysis on financial inclusion on a cross-country basis. The early literature largely relied on survey work in individual countries, or on single measures of financial inclusion—such as the number of bank branches and ATMs, and bank accounts per capita (e.g., Beck, Demirgüç-Kunt, and Martinez Peria 2007; Honohan 2008). The launch of databases such as the IMF's Financial Access Survey (FAS) and the World Bank's Global Findex database (Demirgüç-Kunt and Klapper 2012) allowed the development and use of more multidimensional, composite measures of financial inclusion, taking into account various aspects of access and usage by households and firms (Amidžić, Massara, and Mialou 2014; Dabla-Norris et al. 2015a; Camara and Tuesta 2017).[7] This, in turn, opened the way for analyzing the macroeconomic impact (Sahay et al. 2015a, 2015b; Svirydzenka 2016, Dabla-Norris et al. 2015b; Loukoianova and Yang 2018) and drivers of financial inclusion (Deléchat et al. 2018; Rojas-Suárez and Amado 2014; Rojas-Suárez 2016).

The empirical literature on *digital* financial inclusion is nascent and mostly focuses on specific countries or regions. It includes work on the development of mobile money in Kenya (Tarazi and Breloff 2010; Jack and Suri 2011, 2014; IMF 2018b), as well as analysis of regional developments in fintech activities (Sy et al. [2019], focus on sub-Saharan Africa; Berkmen et al. [2019], on Latin America and the Caribbean; Loukoianova et al. [2019], on Pacific Islands; and Lukonga [2018], and Blancher et al. [2019], on the Middle East and Central Asia). Heterogeneity in the adoption of mobile money across regions and countries are typically explained by GDP growth, levels of per capita income, the regulatory environment (Tarazi and Breloff 2010; Gutierrez and Singh 2013), and rule of law. The pivotal role of a lead firm, such as the Ant Financial Services Group in the PRC, is also recognized (Hau et al. 2018). Some studies analyze the impact of mobile money and the internet (Loukoianova and Yang 2018; Jahan et al. 2019) and the drivers of mobile money adoption (Lashitew, van Tulder, and Liasse 2019).

Two recent interview-based studies of fintech providers and regulators have enriched our understanding of the role of fintech in financial inclusion. Patwardhan, Singleton, and Schmitz (2018) underscore the importance of mobile and other person-to-person

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[7] There are two parametric approaches used for constructing these composite indices: principal component analysis and common factor analysis.

payment methods, and the development of new ways of complying with customer due diligence. Ghose and Annabale (2020) similarly emphasize the role of identity, mobile money, platform-based services, and microcredit. Their findings are consistent with our findings.

However, to the best of our knowledge, there are no comprehensive global studies on fintech and financial inclusion, reflecting in part the limited availability of cross-country data. Some studies have looked into the role of fintech in supporting access to credit—an important dimension of financial inclusion, which is often cited as a key constraint to activity, especially for SMEs (Ayyagari, Demirgüç-Kunt, and Maksimovic 2017). An important part of the literature has focused on understanding the determinants of digital lending, underscoring the importance of regulation, financial development, digital infrastructure, or market structure (Rau 2019; Claessens et al. 2018). Studies using individual loan data suggest that fintech lenders process mortgage applications faster than traditional lenders (Fuster et al. 2018), do reach underserved customers, and offer lower-cost credit than traditional lenders (Jagtiani and Lemieux 2017; de Roure, Pelizzon, and Thakor 2018).

Finally, the analysis of potential stability and inclusion risks related to fintech is still at an early stage, both in the fintech-related literature and at the level of global standard setters. As the financial sector continues to see disruptions—including from the entry of big tech (large technology firms with a dominant role in online activity)—the discussions are increasingly focused on privacy concerns, ML/TF risks, and the potential macroeconomic impact of digital currencies (Adrian and Mancini-Griffoli 2019; Brunnermeier, Harold, and Landau 2019; G7 2019). The financial stability implications of the increasing interconnectedness between fintech companies and banks, or of the growing digital credit origination, are also on the agenda of regulators. Finally, awareness of the risk that fintech could lead to financial exclusion—e.g., because of lack of access to digital infrastructure, differences in financial and digital illiteracy, or potential biases in algorithms—is yet to gain traction. These risks might increase with the abrupt switch toward digital financial services amid the COVID-19 crisis, including for making government-to-person (G2P) payments.

6.3 Where Is Fintech for Financial Inclusion Emerging?

Fintech-driven financial services are filling a gap left by traditional financial institutions. Across different regions in the world, fintech companies are making their presence felt locally. Some companies,

including in Silicon Valley, the UK, and the PRC, are also expanding into emerging markets, such as India, Kenya, Mexico, Nigeria, and Tanzania. Traditional financial institutions typically provide services through brick-and-mortar establishments and rely on legacy technology that are costly to operate, and even more costly to upgrade and adapt to fast-changing technology. But, as discussed later, these institutions are responding to the competition from fintech companies with large investments in technology. Fintech companies are often better positioned to use the latest technology and data analytics to target niche markets, including lower-income groups, and orient their products to maximize consumer satisfaction. During and after the COVID-19 health crisis, these characteristics can allow them to help governments expand the reach of their emergency responses to those in the informal sector and those who do not have access to bank accounts.

In most countries, fintech for financial inclusion started with "spend" and is fast moving into "lend." The growth of mobile money—one of the early fintech solutions for payments—has been most prevalent in EMDEs. Online digital payments are more common in advanced economies and some emerging markets. In both cases, digital payments generate data, which financial institutions can use to build creditworthiness assessments that do not require long histories, identity, or collateral. These developments in turn enable digital lending. The ability to track payment transaction records could also provide information on which sectors are suffering the largest consumption declines during the ongoing COVID-19 crisis, and therefore allow for targeted credit provisioning, including government assistance to firms and households. Digital lending so far is concentrated in the PRC, the UK, and the United States (US), but is growing rapidly in other parts of the world, such as India and Kenya. Interviews with fintech companies indicate that they are eager to expand into lending to ensure viability, as profitability is low (or even negative) in the payments business.

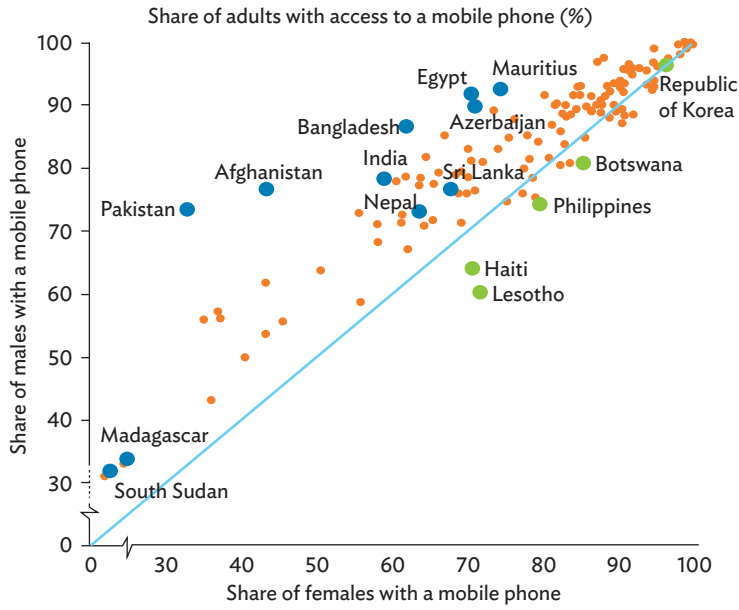
6.3.1 Spend: What We Know about Digital Payments

Digital payments have so far been the most common instrument of financial inclusion and can be expected to accelerate during the post-COVID-19 era. Successful mobile money services require a large enough network of users and an ability to link cash and mobile money transactions. In their simplest form, they use feature phones, allowing individuals and merchants to transact without physical cash. The progress to date is striking is some parts of the world. Stakeholders, especially in Africa, underscored the convenience factor as the most useful aspects of mobile money: the investment cost is low (basic mobile phones can be enough, and smart phones are not essential), it is simple

to use, it is available any time of the day, and it avoids long and costly trips to the nearest town that has a bank or an ATM.[8, 9] It is also safer in comparison to using cash, as it reduces the risk of theft. These benefits may seem rudimentary but are transformational for improving the daily lives of the underprivileged. Moreover, the COVID-19 pandemic has magnified these benefits, and not just for the underprivileged: digital payments allow people and firms to conduct financial services while adhering to the social distancing recommended to reduce contagion.

Africa and Asia have seen the largest increase in digital payments, with East Africa, the PRC, and India taking the lead. In Africa, fintech has taken the form of mobile money—impressively cutting the cost

Figure 6.2: Access to Mobile Phones, 2017



Note: Green (blue) indicate examples of countries with higher female (male) ownership of mobile phones than male (female).

Source: World Bank, G20 Financial Inclusion Indicators.

8 Smartphones are becoming increasingly affordable, with some costing $20 to $30.

9 Even in developed economies, digital payments reduce cash usage (see Fung, Huynh, and Sabetti [2014], on Canada).

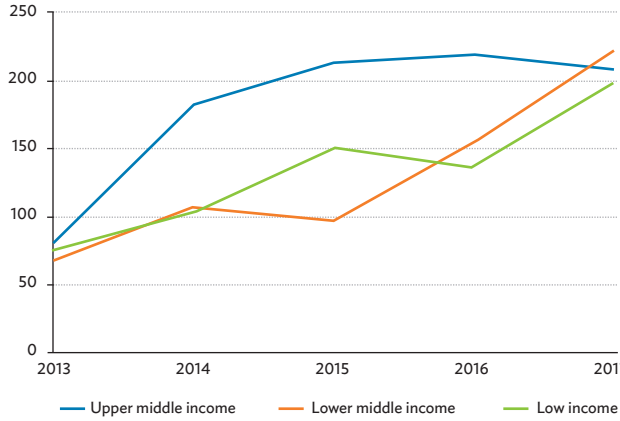
of sending remittances by 50% (GSMA 2016, using the World Bank's Remittance Prices Worldwide database). It originated in Kenya and is rapidly expanding to the rest of the continent. In the PRC and India, online payments and messaging apps prompted the development of fintech services. In all cases, the development of digital money was spurred by systemic actors, such as M-Pesa in Kenya, Alipay and Wechat Pay in the PRC, and Paytm in India. As Figure 6.2 indicates, mobile phone ownership is widespread among both men and women, even though it is less for the latter.

Empirical evidence points to the growing importance of mobile money payment services in low-income countries. Data from the World Bank and the GSMA point to the growing usage of digital payments, using either mobile phones or the internet.

- The number of active mobile money accounts almost tripled, and the use of mobile phone for domestic remittances roughly doubled between 2013 and 2017 in lower-middle-income and low-income countries (Figure 6.3). As a result, in low-income countries, about half of the population received or sent remittances using mobile phones in 2017. The value of mobile money transactions now constitutes a substantial part of the financial system, with transactions in Cambodia, Ghana, and Zimbabwe reaching more than 75% of GDP in 2018 (Figure 6.4).
- A parallel development is observed in online payments (partly made on smartphones): the share of adults making or receiving digital payments increased by 11 percentage points between 2014 and 2017 to reach 52% (Demirgüç-Kunt et al. 2018).
- In 2017, more than 2.9 million mobile money agents operating in 90 countries facilitated cash-in/cash-out transactions, peer-to-peer transfers, and bill payments (GSMA 2018).

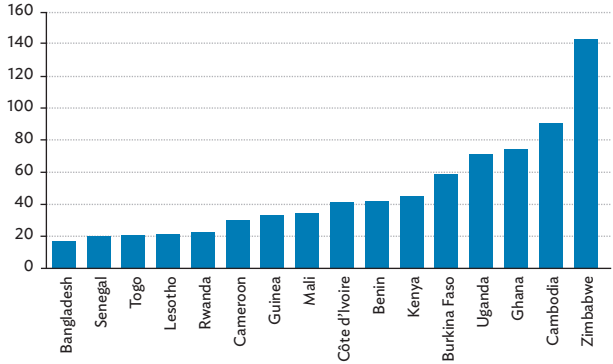
The COVID-19 crisis and related government responses will further stoke growth in digital financial services. Measures introduced by many country authorities—lowering fees and increasing limits on mobile money transactions (e.g., Kenya, Uganda, and Zambia) or to ease know-your-customer (KYC) regulations for small transactions (e.g., Ghana) and to relax interoperability rules (Democratic Republic of the Congo)—could accelerate the shift toward digital financial services, including by traditional financial institutions. Moreover, it could lead to an increase in the collaboration between governments and fintech service providers to expand the reach of governments' support measures. For example, Peruvian authorities are expanding the set of financial service providers to channel G2P—to include private banks and mobile money providers—to reach additional beneficiaries.

Figure 6.3: Mobile Money Accounts, 2013–2017 (active, per 1,000 adults)



Sources: International Monetary Fund (IMF) Financial Access Survey and authors' calculations.

Figure 6.4: Value of Mobile Money Transactions, 2018 (% of GDP)



GDP = gross domestic product.

Source: International Monetary Fund Financial Access Survey.

6.3.2 Lend: From Payment Data to Microcredit

The development of mobile money and online payments, and the expansion of user data that comes with it, has spurred digital lending. Ant Financial in the PRC, a global leader in mobile and online financial services, started as a payment service and expanded into providing digital credit. Digital lenders use "alternative data" (from payment providers and other sources such as the internet) and "loan engines" (e.g., innovative algorithms) to identify creditworthy clients and provide (mostly unsecured) lending. Fintech companies in the US have grown to make up 38% of the unsecured personal loan market in 2018, from only 5% in 2013 (TransUnion 2019). In the UK, SMEs are an obvious target of fintech companies as they receive only 2% of bank loans, even though they contribute to 50% of GDP and 70% of employment.

The role of digital lenders during the COVID-19 crisis appears to vary across countries and by institution. With online platforms and real-time data, some established digital lenders are responding quickly to the liquidity needs of SMEs affected by COVID-19-related lockdowns and containment measures (e.g., in the PRC and the UK). Their technology- and online-focused business models give them an advantage over traditional financial institutions in digital verification and onboarding of new customers, particularly so amid the need for social distancing. On the other hand, some fintech lenders noted having halted new lending during the COVID-19 lockdowns, in response to weak demand and in order to preserve liquidity and focus on managing credit risks of their existing portfolio. Some are taking part in the governments' emergency lending programs, but the extent varies across countries, depending on whether these programs are designed exclusively for banks or are open to nonbank lenders more broadly (e.g., UK and US).

Marketplace lending—one source of digital lending for which comparable cross-country data exist—remains small but doubled from 2015 to 2017. By 2017, it reached $400 billion, largely driven by consumer credit (Figure 6.5). The volume of marketplace lending remains very small, however, at less than 0.5% of GDP for most countries. In 2017, fintech credit was dominated by the PRC, followed by the US and the UK—together, they made up 98% of the fintech credit market.[10] There are differences across countries according to the type of lending, with consumer credit fairly dominant in Middle Eastern and Central Asian countries and the US, and business lending dominating in the UK, non-US western hemisphere, and Asia (Figure 6.6).

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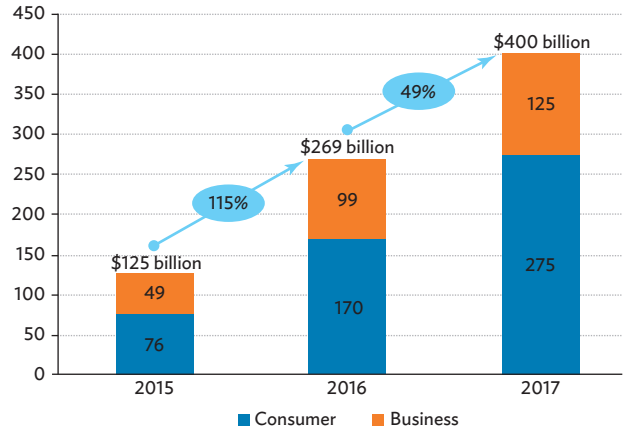
[10] Marketplace lending is likely to have declined substantially in the PRC after 2017, following regulatory changes.

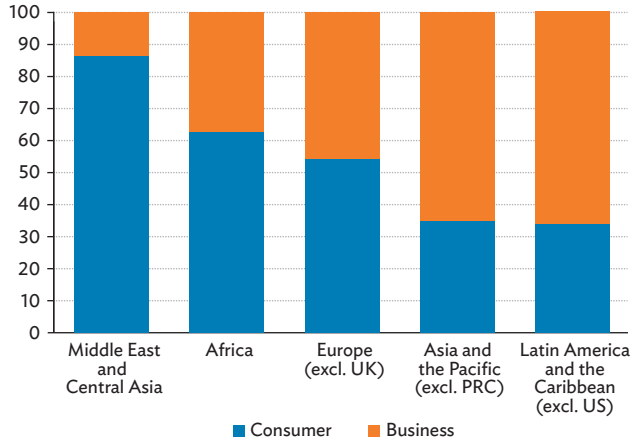
Figure 6.5: Global Fintech Lending by Main Segments, 2015–2017 ($ billion)



Note: Excludes nonsovereign territories. Full data sets for emerging and developing Europe, Middle East and North Africa, and sub-Saharan Africa are not available for 2017.

Sources: Cambridge Centre for Alternative Finance and authors' calculations.

Figure 6.6: Fintech Credit Composition by Region, 2017 (%)



PRC = People's Republic of China, UK = United Kingdom, US = United States.

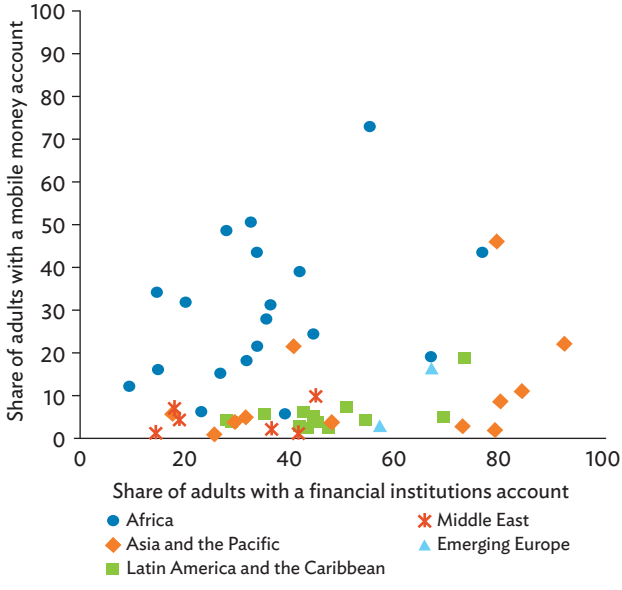
Sources: Cambridge Centre for Alternative Finance and authors' calculations.

6.4 Is Fintech Increasing Financial Inclusion?

There is increasing anecdotal evidence, confirmed through our interviews, that fintech is supporting financial inclusion. Apart from faster speed and higher efficiency that benefits all, we heard from stakeholders that low-income households and SMEs also benefit from lower service cost, little or no collateral requirements for credit extension, and typically better customer experience. Mobile point-of-sale devices are helping SMEs to collect electronic payments, and subsequently use the documented sales as an indicator of creditworthiness to obtain credit. Fintech solutions are also supporting more efficient cash management.

To assess the impact of fintech on financial inclusion beyond the anecdotal evidence, we introduce a new indicator of digital financial inclusion in payments (a description of the methodology is found in Annex 2 of Sahay et al. [2020], and Khera et al. [2021a]). Using recently available data, we construct two indices. The "digital" financial inclusion index aggregates digital payment services provided through mobile phone and the internet using the methodology in Sahay et al. (2015a).

Figure 6.7: Use of Digital and Traditional Financial Accounts, 2017 (%)



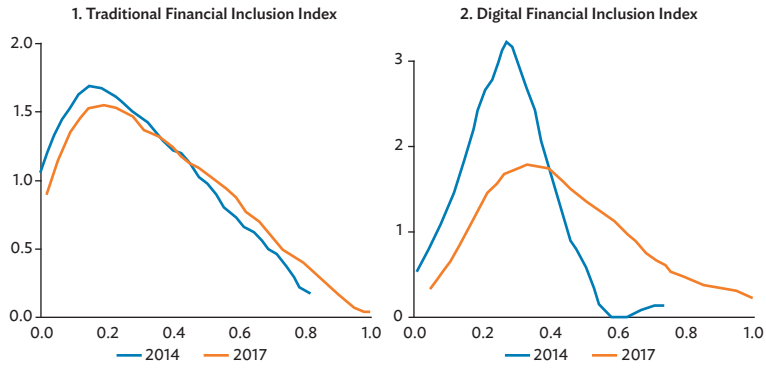
Source: Global Findex.

The "traditional" financial inclusion index is constructed using the same approach, for financial services provided by traditional financial institutions. The sample covers 52 EMDEs and spans the period 2014–2017 for digital financial inclusion and 2011–2017 for traditional financial inclusion (Box 6.1). These indices provide a comprehensive measure of digital financial inclusion across countries before the onset of the COVID-19 crisis.

Digital financial inclusion varies across countries and regions. For instance, the Middle Eastern countries in our sample (asterisks in Figure 6.7) tend to use almost exclusively accounts in financial institutions, while mobile accounts are barely used; conversely, mobile money accounts are generally more present in African countries (blue dots). In some African countries, the share of the adult population with mobile accounts is larger than the share of adults with traditional accounts.

Our index shows that digital financial inclusion has increased significantly in recent years preceding the current crisis. As Figure 6.8 shows, traditional financial inclusion across the countries in our sample remained broadly unchanged during 2014 to 2017. In the same period, an increasing number of countries have benefited from digital financial inclusion, as evidenced by the shift and flattening of the distribution to the right.

Figure 6.8: Distribution of Traditional and Digital Financial Inclusion Indices, 2014–2017 (kernel density)



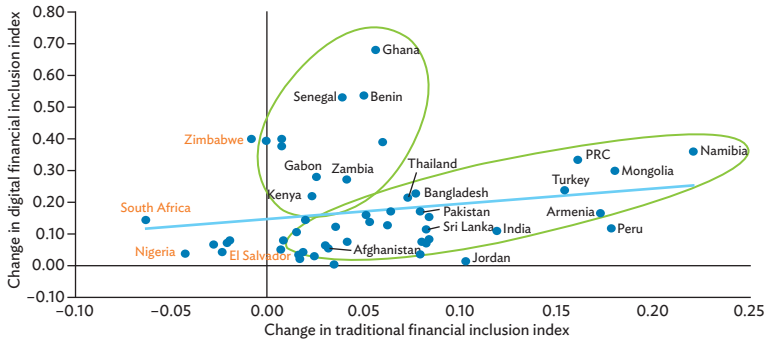
Source: Authors' calculations (see Sahay et al. 2020, Annex 2).

In some countries, digital financial inclusion appears to have been a game changer.

- Comprehensive financial inclusion (that includes digital and traditional) increased in most countries between 2014 and 2017. As Figure 6.9 indicates, some countries saw greater progress in digital inclusion (e.g., Benin, Ghana, Senegal) and others in traditional inclusion (e.g., Mongolia, Namibia, Peru).
- In eight cases, including Zimbabwe (where mobile payments have effectively replaced cash transactions), South Africa, and Nigeria, the progress in financial inclusion is entirely driven by fintech—the increase in digital financial inclusion coincides with a fall in the traditional index.
- From a regional perspective, African and Asian countries maintain an overall lead in digital financial inclusion, while in other regions, such as Europe and Latin America, traditional financial inclusion dominates (Box 6.1).
- There is considerable variation within regions. For instance, in Africa, while Ghana, Kenya, and Uganda are the front-runners in digital financial inclusion, other countries such as Nigeria, Madagascar, and the Republic of the Congo are trailing.

Fintech is contributing toward closing financial inclusion gender gaps, with differences across regions. Gender gaps tend to be slightly lower for fintech-driven financial inclusion than for traditional financial inclusion (Figure 6.10). There is variation across countries, with fintech playing a positive role in closing gender gaps in the Middle East and African countries. Conversely, gaps are lower for traditional financial inclusion in the Asian and Latin American countries of our sample. Variation across countries may be explained by obstacles that fintech cannot address, such as cultural or social norms, and barriers in financial and digital literacy.

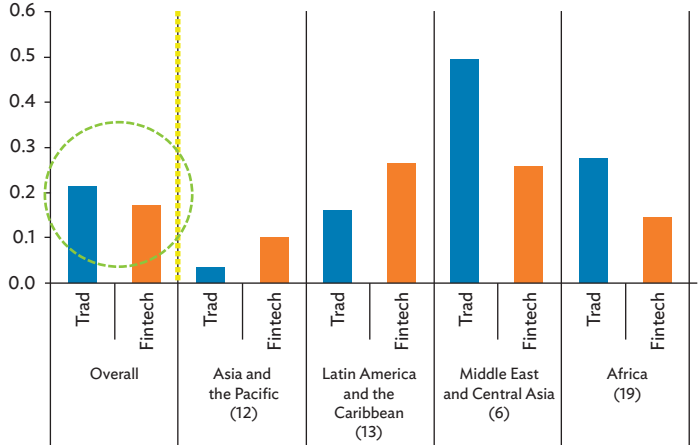
Figure 6.9: Changes in Financial Inclusion Indices, 2014–2017 (level change)



PRC = People's Republic of China.

Source: Authors' calculations (see Sahay et al. 2020, Annex 2).

Figure 6.10: Gender Gaps: Traditional versus Fintech-Driven Financial Inclusion, 2017



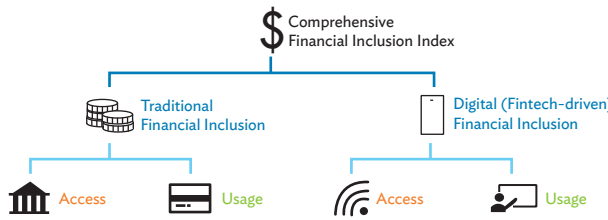
Note: "Trad" is traditional financial inclusion. The gender gap is defined as the percentage difference between the male and female financial inclusion index. Higher values indicate a larger gender gap.

Source: Authors' calculations.

Box 6.1: Measuring Fintech-Driven (Digital) Financial Inclusion

One of the key contributions of this chapter is the introduction of a novel financial inclusion index (Figure B6.1). It combines a traditional (bank-based) and a digital financial inclusion component and covers 52 emerging market and developing economies (EMDEs). The measure combines indicators of access to and usage of traditional and digital payment services, such as ATM and bank branches, mobile and internet access, account holding, and usage of financial institutions and/or mobile accounts for wage and utility payments. A comprehensive financial inclusion index is constructed using a three-stage principal component analysis: the first stage combines various indicators to compute measures of "access" to and "usage" of payment services, separately for both traditional and digital financial inclusion; the second stage computes "traditional financial inclusion" and "digital financial inclusion" indices, combining the respective access and usage indicators from the first stage; and lastly, traditional and digital financial inclusion indices are combined to build comprehensive financial inclusion index of a country.[a]

Figure B6.1: Financial Inclusion Index



Source: Authors.

The addition of indicators related to digital payment services expands the scope of the measurement of financial inclusion in the existing literature. Figure B6.2 displays the index by region.

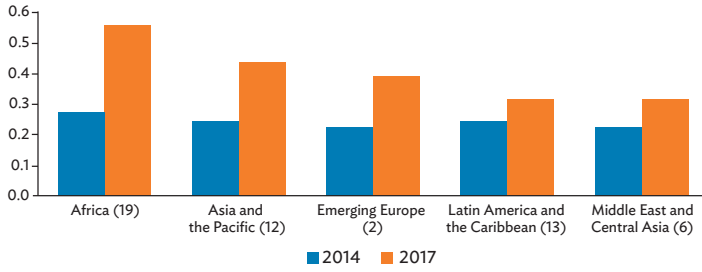
The new financial inclusion index has limitations. Due to lack of comparable data, the index only covers 52 EMDEs. The raw data do not distinguish between digital services provided by fintech companies or banks, which precludes an analysis of whether fintech companies are competing with or complementing the services provided by traditional financial institutions.

[a] See Sahay et al. (2020, Annex 2) for technical detail. Data sources include International Monetary Fund Financial Access Survey, World Bank Global Findex Database, and GSMA.

continued on next page

Box 6.1 *continued*

Figure B6.2: Digital Financial Inclusion Index, 2014–2017



Source: Authors' calculations (see Sahay et al. 2020, Annex 2).

With regard to digital credit, empirical evidence suggests that the quality of infrastructure and the macroeconomic and legal environment help increase access. Using online marketplace lending data for 109 countries over the period 2015–2017, we explore the determinants of digital credit extension (Sahay et al. [2020, Annex 3] describes the methodology and results, with more details in Bazarbash and Beaton [2020]).

- Marketplace lending is small and is provided by a relatively large set of lenders. The average size of loans is not available, but the data on average overall credit origination by lending platforms suggest that marketplace lending consists mostly of very small loans, likely to small borrowers (individuals and businesses).
- Marketplace lending fills a gap: it is higher in countries that have less financial depth. In addition, better credit information, better access to the internet, and stronger legal rights are also associated with larger digital lending: in other words, marketplace lending requires a sufficiently developed environment to thrive.

In the long term, the COVID-19 pandemic has the potential to accelerate progress in digital financial inclusion, and anecdotal evidence suggests it is already happening. The SARS epidemic in 2003

accelerated the PRC's launching of digital payments and e-commerce. Hence, we can expect to see higher digital financial inclusion across the globe post COVID-19. In fact, in many countries, it is already happening. For example, mobile money transactions increased by 450% between January and April 2020 in Rwanda (ranked high in our digital financial inclusion index), and the number of users sending money virtually doubled from 0.6 million in the week before lockdown to 1.2 million in the week after lockdown, and to 1.8 million in the final week of April.[11] This is also corroborated by recent research that shows that the spread of COVID-19 has led to a statistically significant increase in the adoption of fintech, proxied by mobile finance-based application downloads (Fu and Mishra 2020).[12]

In the short term, however, the divide in the progress in digital financial inclusion across and within countries could widen. Developing digital infrastructure takes resources and time, which would make it difficult for countries with low access to digital financial inclusion to scale up quickly given the priority they need to give to spending on health and economic support more broadly. On the other hand, countries with already high access to digital financial services would likely be able to accelerate its adoption even further—both because of the potentially higher demand and related supportive measures implemented by authorities.[13]

6.5 What Are the Macroeconomic Implications?

The positive macroeconomic impact of financial inclusion is well documented, both theoretically and empirically. Sahay et al. (2015a) and Čihák and Sahay (2020) show that both financial access and financial deepening support growth and lower income inequality, with limited negative externalities on financial stability as long as the regulatory environment is sound. Loukoianova and Yang (2018) also point to

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11 See Rwanda Utilities Regulation Authority webpage: https://rura.rw/index.php?id=23

12 The download of finance mobile application is estimated to have increased by 24% on average across 74 countries since the start of the lockdown, compared to prior trends.

13 In the short term, there could be two opposing impacts of COVID-19 on demand for digital payments: on the one hand, it would increase as people favor digital and contactless payments to comply with social distancing measures, in parallel with the shift toward e-commerce; on the other hand, people might curb spending and hence use of digital payments due to staying indoors, fall in incomes, and loss of employment.

growth benefits from financial inclusion. However, financial inclusion of less productive agents can also negatively affect growth (Dabla-Norris et al. 2015b).

Our empirical work finds that in the recent years, payment services have had a stronger association with growth where financial inclusion was driven by fintech. We examine the drivers of real GDP growth over 2014–2018 and 2011–2018 in the sample of 52 countries for which we have computed digital financial inclusion indices, using standard cross-country ordinary least squares regressions (Sahay et al. 2020, Annex 4**;** Khera et al. 2021b). To identify the impact of digital financial inclusion on growth, we relate the initial levels of traditional and digital financial inclusion to subsequent average growth, along with a standard set of country-level control variables. Initial values are used to reduce biases stemming from reverse causation.[14] The results point to the following conclusions:

- Digital financial inclusion is significantly positively associated with growth, consistent with the notion that fintech might contribute to growth, while traditional financial inclusion does not (Figure 6.11). This difference may be that the impact from traditional financial inclusion has already been reaped prior to the period covered in the analysis, whereas the benefits of digital financial inclusion have only just started.
- This result could reflect the positive impact of the use of digital payments on transaction costs, liquidity, and creditworthiness (Islam, Muzi, and Rodriguez Meza 2018). Since our analysis only captures payments and does not cover several components of digital finance (savings, credit, and insurance), it is likely to underestimate the impact on growth. That said, the impact of digital credit on sustainable growth will depend on its ability to finance longer-term investment—which remains an open question.

These findings suggest that digital financial inclusion could play an important role in mitigating the economic impact of the COVID-19 crisis and helping the recovery, provided preconditions for accelerating digital services exist. Some studies have found that digital financial inclusion can help dampen economic shocks and smooth consumption

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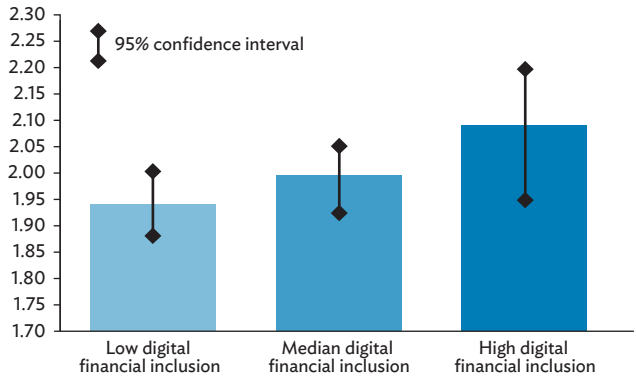
[14] To establish a robust causal link between growth in digital financial inclusion and GDP growth, identifying a valid instrument for change in digital financial inclusion over the time span of GDP growth will help overcome potential biases stemming from endogeneity or reverse causation. This is explored more in detail in Khera et al. (2021b).

(Jack and Suri 2014). While the effect of digital financial inclusion on economic activity during and beyond the COVID-19 shock is yet to be examined, the ability of fintech to help cope with the crisis and in the recovery will likely depend on (i) the extent of digital financial inclusion at the onset of the COVID-19 crisis (see above); (ii) the ability to quickly scale up digital financial inclusion, i.e., availability of enabling factors and policies needed for digital financial services; (iii) pre-existing regulatory and supervisory gaps that could amplify risks; and (iv) the fintech sector's resilience and changes in its landscape during the economic downturn. The latter three factors are explored in the sections that follow.

Figure 6.11: Impact of Digital Financial Inclusion in Payments on Growth (% of annual GDP growth)



GDP = gross domestic product.

Note: Using the coefficient estimates obtained from the regression, annual GDP growth rates for countries with low (25th percentile), median, and high (75th percentile) levels of financial inclusion were calculated, holding other explanatory factors at their median levels.

Source: Authors' calculations (see Sahay et al. 2020, Annexes 2 and 4).

6.6 Are Fintech Companies Disrupting Traditional Providers?

The fintech companies that target the under- and unserved populations have had a limited disruptive impact on traditional bank operations so far. The services that fintech companies are providing (for instance, small loans at short duration or aggregator of services of various companies on

their digital platform) are typically not services that traditional banks provide to small clients. The 24/7 access to online lending platforms is allowing small enterprises to seek financing outside of business hours. In some sense, the fintech companies are complementing the services of traditional providers who focus on big clients and larger loans for longer durations. In advanced economies, for instance, where fintech lenders target the underserved borrowers, fintech companies do not compete with the broad spectrum of services provided by banks, but rather provide "pointed technical solutions" in niche areas.

Interviews with fintech companies suggest that they are increasingly collaborating with banks and creating a variety of business models. Fintech companies are partnering with banks to benefit from their experience and expertise in regulatory compliance and to facilitate scaling up. In turn, fintech companies provide banks with the state-of-the-art platform for reaching out to new customers. In some cases, especially in EMDEs, digital microcredit is operated by fintech companies that manage the lending on behalf of the banks. Big banks are also inviting fintech companies to set up in-house incubator and innovation labs (for example, Barclays and Lloyds). In the Republic of Korea, which has a very high penetration of credit cards, some fintech companies offer platforms that serve as aggregators and connectors to the services provided by credit card companies.

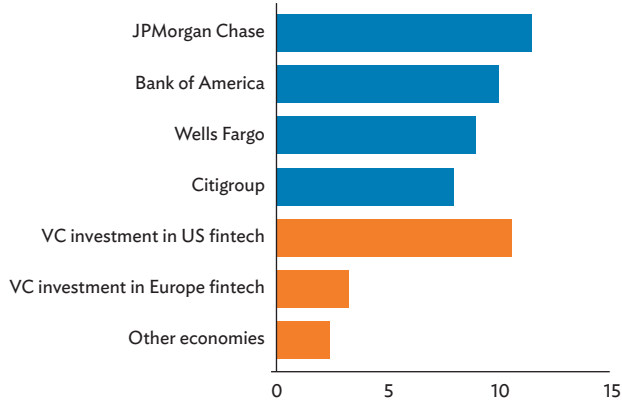
The limited disruption of traditional providers so far, and the complementarity between fintech and banks, are also confirmed in our empirical work. Indeed, digital solutions appear to be "filling the gap" left by traditional financial institutions (Sahay et al. 2020, Annexes 3 and 5).

- Fintech payment services tend to be supplied more, and used more, where traditional access is limited. Our work on digital payments shows that the availability of traditional means of financial inclusion (such as access to bank branches and ATMs) is negatively associated with both the supply and usage of digital payments. While this may in part reflect the shift by banks toward digital means of service provision (e.g., mobile and online banking), it suggests that digital financial inclusion tends to be higher where there is a gap in the existing supply of traditional financial services or when the traditional banking sector is inefficient.
- Fintech credit also tends to emerge where traditional services are limited, i.e., where bank branches are few, and financial depth is lower.

That said, competition between traditional and nontraditional providers, though nascent, is emerging. For instance, purely digital banks are coming up, directly competing for traditional bank customers and

attracting new ones due to their technological advantages and low-cost services. Similarly, fintech lenders now compete directly with informal moneylenders, microfinance institutions, and small banks in both payment and credit. Big banks, too, are beginning to feel the competitive pressure and are responding in different ways. Some are buying up small fintech companies or investing heavily in fintech—their combined investment in 2018 overtook investment by venture capitalists in fintech companies (Figure 6.12). This trend could be further strengthened as they adapt to lockdowns and social distancing measures to contain the COVID-19 pandemic by accelerating the shift toward digital delivery services.

Figure 6.12: Tech Spending in Fintech, 2019 ($ billion)



Note: Venture capital (VC) investment data based on 2018 levels. Other economies include Brazil; Canada; Hong Kong, China; India; and Japan.

Source: Bank disclosures, data compiled by Faux (2020), KPMG Pulse of Fintech Report & Innovate Finance Investment landscape report, based on Pitchbook Data.

6.7 What Are the Factors That Enable and Constrain Digital Financial Inclusion?

The literature and our interviews with stakeholders highlight several enabling factors for financial inclusion. These include customer identification, digital infrastructure, financial literacy, and a supportive regulatory and legal environment for making progress in digital financial inclusion.

Customer identification is a first step for promoting financial inclusion (AFI 2018). Financial services require accurate identification of customers, including to prevent fraudulent activities. Many creative solutions are emerging: in EMDEs, telephone numbers are often used as a source of identification for providing basic services such as payments; countries are developing centralized databases for customer due diligence identification. In some advanced economies, fintech companies are working with regulatory authorities (such as the Financial Conduct Authority in the UK) to set up "digital portable identity" in order to help small businesses expand rapidly. These digital identities can be stored in smartphones and used across institutions and borders. The introduction of the Aadhaar card in India, a national system of biometric identification issued to more than 1 billion people, has been a game changer. Its potential usage is high, ranging from delivering national services (pension, health, insurance, and social welfare payments) to digital financial services to satisfying regulatory requirements on customers' identity.[15] Biometric identification has also been introduced in developing Pacific countries, such as Papua New Guinea or Samoa, allowing unregistered persons to use fintech-based payments. A key regulatory and legal issue in many countries is to balance between information sharing and privacy protection.

Interviews with fintech companies highlighted two major constraints: uncertainty of the regulatory environment and lack of technological expertise—the "coders." Interviewees noted that uncertainty or frequent changes in the regulatory environment was, in some sense, more of a constraint than a clear road map with tighter regulation. In some countries, the regulatory support measures, implemented as a response to the COVID-19 shock, are designed to be channeled mainly through the banking sector, which could further exacerbate these constraints. The shortage of technological expertise, the coders, is also increasingly weighing on their minds, particularly in EMDEs. Further, although many fintech firms rely on alternative data to assess creditworthiness, they thought credit bureaus could help augment their assessments. Fintech firms seeking to expand globally also noted the lack of universal credit scores and legal frameworks for loan recovery as impediments.

Funding constraints, especially to scale up, were also mentioned by many fintech companies, and is even more evident during the COVID-19 crisis. Initial support or funding typically comes through incubators or accelerator programs or from angel investors and crowdfunding. Some are increasingly being funded through private equity, venture capital,

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15 For instance, customer due diligence requirements are critical for correspondent banking purposes, and therefore for remittances.

and hedge funds, while a few successful ones are already being publicly listed on stock exchanges. Both interviews and preliminary data suggest that funding constraints have become increasingly acute during the COVID-19 shock, particularly for those firms with thin liquidity and capital buffers. Fintech funding activity stalled in the first quarter of 2020 across regions: for instance, Asia saw a 69% drop in funding and a 23% drop in deals quarter-over-quarter.[16]

Regulatory authorities we spoke with noted the wide-ranging challenges they are facing. These included catching up with the fast-changing landscape, facing budgetary constraints or lack of expertise, and managing lobbying pressures from traditional financial institutions. Regulators are also responding to the development of fintech by encouraging and adopting regtech (the use of information technology [IT] to enhance regulatory processes) and suptech (the use of IT to enhance supervision). From the financial service providers' perspective, the automation and data-driven analysis of internal control systems and reporting are enhancing cost-efficiency. From the supervisors' perspective, it allows for risk-based supervision of vast amounts of data. According to one regtech company, the cost of compliance for one of their clients went down from £18 million to £0.5 million per annum by switching to their technology.

The lack of financial literacy or non-familiarity with new technology was often mentioned as a constraint on the demand side, which is limiting the outreach of COVID-19-related economic support to the most needy. Interestingly, stakeholders in both developed economies and EMDEs noted the low level of financial literacy of their customers. Several fintech companies have added tutorials on their websites to enable the learning of basic concepts. Singaporean authorities have taken wide-ranging initiatives to educate their population. However, interviews with fintech companies revealed that lack of access to e-government in several countries during the COVID-19 crisis is proving to be a major constraint to reach the most needy.

Our empirical work identifies factors that facilitate or impede digital financial inclusion.

- Our analysis (Sahay et al. 2020, Annex 5) shows that better access to digital infrastructure (measured by the availability of the internet and mobile phones) is associated with higher usage of digital payments and credit (Figure 6.13). In fact, we find a monotonic and positive relationship at all levels of digital infrastructure. Similarly, increasing the number of

16 https://www.cbinsights.com/research/report/fintech-trends-q1-2020/

mobile money agents in the same proportion would also lead to improvements in digital financial inclusion (although the magnitude would be smaller).

- The efficiency of traditional providers also matters. More inefficient banking systems (with higher overhead costs to total assets) are associated with more digital financial inclusion.
- The usage of fintech payment services is higher where there is already a high usage of traditional financial services. This could reflect higher financial literacy, as well as trust in the financial system in general.[17]
- Institutions matter, at least for the development of mobile money agents, and the quality of governance is positively associated with the availability of mobile money agents.
- Finally, a more consumer-friendly environment (i.e., higher mobile money regulation index) is, as expected, associated with greater adoption of mobile money.
- On the credit side, our work on marketplace lending indicates that the availability of borrower information and higher protection of legal rights tend to support the emergence and development of fintech credit (Sahay et al. 2020, Annex 3).

The priorities in promoting digital financial inclusion should depend on country circumstances. For example, for countries where traditional access is low, there is room to improve financial inclusion through fintech, irrespective of the level of usage. Conversely, for countries where traditional usage is low, enhancing financial literacy and, more broadly, familiarity with financial services is essential to support financial inclusion, irrespective of access.

The experience with the COVID-19 crisis underscores the importance of promoting digital services to the most needy. Fiscal policy should include investment in digital infrastructure such as access to electricity, mobile and internet coverage, and digital ID, among others (IMF 2020a). In some countries where digital access is higher, the crisis could provide the needed push to accelerate initiatives already in the pipeline in areas related to building conducive regulatory and institutional frameworks. These efforts should be complemented by the promotion of consumer and data protection, cybersecurity, interoperability, and financial and digital literacy.

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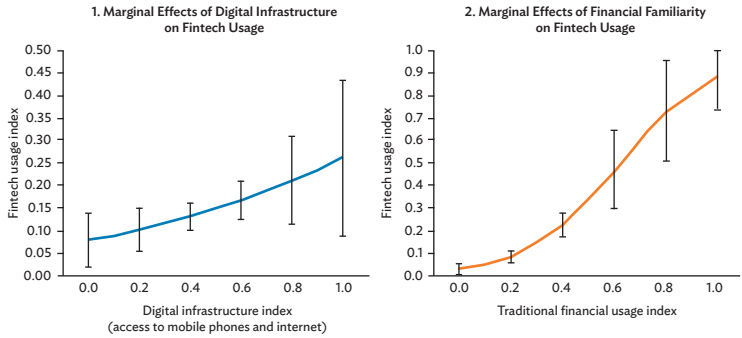
[17] This could also reflect complementarities between mobile banking and formal traditional banking; for instance, in many sub-Saharan African countries mobile financial services have to be backed by a formal bank account.

Figure 6.13: Marginal Effect of Digital Infrastructures and Financial Familiarity on Digital Financial Inclusion, 2014–2017



Note: The charts indicate the expected mean level of digital usage index, conditional on the level of digital infrastructure and traditional financial usage indices. Conditional means are calculated based on pooled regressions using the data for 2014 and 2017, holding other explanatory factors at their mean level.

Source: Authors' calculations (see Sahay et al. 2020, Annexes 2 and 5).

6.8 What Are the Risks of Fintech to Financial Inclusion?

Regulators around the globe have begun to assess the fintech-related risks and formulate policies, and these should be accelerated during and after the COVID-19 crisis. At the international level, the Financial Stability Board (2017, 2019) has concluded that fintech and big tech do not yet present systemic risks. At the same time, it is worth recalling that the push for financial inclusion without proper regulation contributed to the 2008 global financial crisis. The development of digital lending is already raising concerns about predatory lending practices in some countries, which could become even more prevalent in the ongoing COVID-19 crisis (Faux 2020). For instance, fintech borrowers who are unable to make loan repayments due to sudden loss of income, might be subject to aggressive debt collection practices and high late payment and/or default fees. In Indonesia, the Financial Services Authority has identified and closed down more than 1,000 illegal peer-to-peer lenders recently that were offering prohibited financial services or operating without a proper license. Therefore, a sound policy approach at both the global

and domestic level is crucial (IMF 2019a). Global cooperation is needed to mitigate risks related to the possible emergence of global monopolies such as the big tech companies, regulatory arbitrage and race to the bottom, cross-border activities, cybersecurity, and money laundering (IMF 2019b, 2018a). At the domestic level, the list is also long: it includes protecting data; preventing cyber risk (Financial Conduct Authority 2018); facilitating digital infrastructure; strengthening regulatory and supervisory frameworks; upgrading payment and securities settlement systems; ensuring standardization and interoperability; and developing effective user protection and contingency planning.

Risks that fintech might pose to financial inclusion itself—both digital and traditional—have been much less explored. The risks mentioned above were also present in the mind of the stakeholders we interviewed. But, as discussed below, the extent to which fintech could put financial inclusion itself at risk has been much less explored to date.

6.8.1 Could Fintech Create Direct Risks to Financial Inclusion?

Reaping the benefits of fintech requires a minimum level of investment and those who do not have the means may find themselves financially excluded. Investment here includes "tech capital" (e.g., mobile phones, internet access) as well as the human capital required to use digital financial services. As fintech develops and becomes more sophisticated, uneven access to the needed physical infrastructure, or insufficient human capital, could create a new source of financial exclusion, notably among women, the poor, and the elderly, in both EMDEs and advanced economies (G20 2019). The COVID-19 shock has induced a strong shift toward digital financial services, a trend that could exacerbate financial exclusion of those groups left behind. Moreover, "easy" digital credit creates risks for people with limited financial literacy (Kaffenberger, Totolo, and Soursourian 2018).

The use of big data analytics could become a source of financial exclusion if the initial data entry is biased, or if algorithms are imperfectly calibrated. Fintech firms' use of big data and algorithms to profile consumers can allow them to reach customers who, until then, had been excluded from the traditional financial sector because of no or limited credit history (Bazarbash 2019). But there are concerns that it may also entrench biases present in historical data, and this in turn could perpetuate the unfair treatment—and exclusion—of some categories of consumers. While the concern is present everywhere, the issue has been mostly studied in the case of digital lending in the US, where disparate treatment and fair lending violations on the basis of customers'

characteristics has been identified as a risk (Jagtiani and Lemieux 2017; FinRegLab 2019). Furthermore, the unprecedented economic impact brought by the COVID-19 shock will likely test the reliability of existing models and indicators in the downturn, potentially requiring adjustments and recalibrations. The Financial Action Task Force standard on ML/TF promotes a risk-based approach that encourages countries to design measures that meet the national goal of financial inclusion without undermining the measures that exist for fighting ML/TF. However, an improper or disproportionate implementation of the risk-based approach to ML/TF, including through the use of big data analytics, may aggravate financial exclusion (e.g., blanket exclusion of categories of customers associated with higher risks of terrorist financing).

Financial inclusion through fintech could be more procyclical than financial inclusion through traditional means, as is already being observed in some regions following the COVID-19 crisis. The small size of fintech credit limits the potential impact of a fintech credit cycle on the economy. But fintech lending is growing rapidly, in part because the automation of credit decisions makes credit extension more frequent and much faster. Insofar as credit provision based on large and frequently updated data sets allows for a robust evaluation of creditworthiness, such credit could be resilient to the economic cycle. At the same time, automation could also lead to procyclicality—to the extent that algorithms do not substitute for long-term relationship with clients, more automated credit decisions could also lead to faster contraction during a downturn (Carstens 2018). The procyclicality could further be exacerbated by the tightening of funding conditions of fintech lenders, as some are starting to experience during the current health crisis. Many of these firms are new and less established, with less liquidity and balance sheet buffers. They could retrench their operations more sharply in downturns, curtailing access to financial services for SMEs and low-income households disproportionately.[18] If this results in consolidation, the fintech industry could become more concentrated with a few large firms emerging as dominant players. Finally, where fintech (and big tech) companies intermediate small deposits, banks' funding structure may become more dependent on wholesale deposits, which could be more volatile. Swings in bank funding could lead to contraction in credit, which could be particularly detrimental to the marginal borrowers. Altogether, these effects could lead to procyclical swings in financial inclusion.

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[18] There is already some evidence of this happening in some countries, such as in Indonesia. See *Financial Times* article at https://www.ft.com/content/8992491e-8c83-4b02-81a6-b122a0633918?shareType=nongift

6.8.2 Could Fintech Create Indirect Risks to Financial Inclusion?

As fintech develops, the microfinance institutions and small banks that have traditionally catered to the financially vulnerable may suffer. Some of those financial institutions—including, in many cases, the traditional moneylenders in low-income countries—embraced the digital transformation early on, collaborating with fintech companies. But the pressure from fintech could put the business models of the laggards at risk: digital credit and savings solutions, fully online banks, and money transfer solutions are making inroads into some of their business lines. These institutions have fewer resources to respond to competitive pressures they face from nimble fintech companies. If they were to scale back their operations before fintech companies have sufficiently scaled up, the risk of financial exclusion could increase. The COVID-19 crisis could increase this risk: in addition to their clients being likely to be hit harder by the economic fallout of the pandemic, many microfinance institutions lack the expertise and resources to expand digital operations at least in the near term.

A loss of trust in digital technologies could set back progress in financial inclusion. The progress in digital financial inclusion rests on the delicate balance of convenience provided by the technology and trust placed by customers in fintech. For instance, the increased availability of personal data can play an important role in facilitating identification of the people most adversely impacted by the COVID-19 crisis, such as by mobile wallet providers in the PRC and Kenya. However, loopholes or fraud in the handling of private data can erode trust. Data privacy or cybersecurity concerns might prompt consumers to look for ways to reduce fintech companies' access to their data, thereby reducing the ability of fintech to support financial inclusion. Recognizing these risks, some regulators noted that a code-of-conduct directive for fintech firms was in order, especially those dealing with retail customers.

Inadequate user protection could also undermine digital financial inclusion. Households must trust that mobile money or e-wallets are a reliable means of payment. However, risks exist. The mobile money operator could go bankrupt. Alternatively, the bank holding its funds as deposits (which are the aggregation of mobile money users' funds) could fail. In these scenarios, mobile money users may not fully recover their balances. However, some of these risks can be mitigated. Legal structures ensuring the segregation of customer funds from other creditors of the mobile money operator should be explored. Also, customer funds should be invested in highly safe and liquid assets and should be diversified across the safest banks to the extent they are held

as deposits of the mobile money operator. Another option is for central banks to require that mobile money operators hold customer funds as central bank reserves.[19]

6.9 Future Agenda

As fintech develops, policy makers are facing questions relevant for inclusive growth, financial stability, and regulation. The G20 has identified the need to "provide an enabling and proportionate legal and regulatory framework for digital financial inclusion" as one if its High-Level Principles for Digital Financial Inclusion (G20 2016), and there is an active effort by all stakeholders, including think tanks, to think through the contribution of regulation to the safe development of fintech, which preserves financial integrity (Staschen and Meagher 2018). This is an important point, as fintech is often allowing the development of unregulated substitutes to highly regulated activities, such as currency issuance or consumer finance. Currently, there are no internationally agreed regulatory standards, but country authorities around the globe are responding, with the PRC, India, Mexico, Singapore, and the UK, among the countries that are taking a more proactive role. The United Nations Secretary-General's Special Advocate for Inclusive Finance for Development and the Cambridge Centre for Alternative Finance (2019) identify several preconditions for raising digital financial inclusion safely and competitively. These include data privacy, cybersecurity, digital identification, fair competition, physical infrastructure (agents network, connectivity, interoperability), and financial and digital literacy. Although a tall order, it provides a clear set of goals for policy makers to pursue.

In this context, ensuring high-quality supervision and regulation, particularly of nonbank financial institutions, is important. Supervisors have recognized the need to adapt regulatory approaches that strike the right balance between enabling financial innovation and addressing challenges and risks to financial integrity, consumer protection, and financial stability. Examples include the adoption of mechanisms such as innovation hubs and, where appropriate, regulatory sandboxes. Importantly, regulation should remain proportionate to the risks and

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[19] The PRC, Peru, the Philippines, and Thailand require that the e-float be deposited at the central bank. Adrian and Mancini-Griffoli (2019) refer to this scheme more generally as synthetic central bank digital currency (sCBDC for short). sCBDC is a public–private partnership allowing the private sector to interact with customers and innovate on the technological front, while central banks regulate the system and ultimately provide trust.

should support the safe use of innovative technologies (Taylor et al. 2020).

It is becoming imperative that international agreements are needed to address data privacy, cybersecurity, cross-border digital currencies, and digital identification. A valuable benefit of fintech: it offers the ability to conduct transactions securely and cheaply. But it is important to guard against misuse, such as ML/TF. Some progress is in the works: for instance, the Financial Action Task Force has revised its standards to respond to the real risks that the use of virtual assets can pose. But developing other standards will be difficult, given large differences across countries on what such standards should entail (for instance, national preferences regarding information sharing and data privacy can diverge widely).[20]

International agreements are also needed related to anti-trust laws to ensure adequate competition in the fintech and overall financial services sector. Big tech firms such as Alibaba, Amazon, Apple, Facebook, Google, and Tencent bring value in terms of speed, efficiency, and economies of scale. At the same time, with their global footprint and funding advantages, they could easily put smaller companies out of business and be formidable competitors to established financial institutions. With an abundance of cash and business lines that fit well with the COVID-19 demands, big tech companies are doubling down on acquisitions and research and development.[21] With smaller companies being hard-hit by the tighter funding conditions, it is important to ensure that the fintech landscape remains sufficiently competitive after the COVID-19 crisis. Furthermore, the entry of big tech companies is raising questions from a number of perspectives (loss of sovereignty, cost of global monopolies, and others). On the policy side, there is a concern that small countries and their regulatory policies could ultimately be captured by these giants.

Financial and digital literacy is as much of a scarcity in advanced economies as in EMDEs. Emerging markets with younger populations seem to be adapting to fintech much better than aging advanced economies. But common across regions is the fact that few countries mandate courses in financial literacy in high school or college. One country official in an emerging market reported introducing such a course as a high school graduation requirement, but then pointed out

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20 See Carrière-Swallow and Haksar (2019) for a discussion of the risks posed by international fragmentation of data policies, and the need for dialogue and cooperation to avoid such an outcome.

21 In the first quarter of 2020, total research and development spending at five big tech companies—Amazon, Facebook, Apple, Alphabet, and Microsoft—increased by 17% from the first quarter of 2019.

that they quickly ran out of teachers who had the qualifications or experience to teach high school students. Challenges for countries with larger populations, remote regions, or cultural resistance to the use of digital communication means, remain immense. Authorities should undertake measures to increase financial and digital literacy, including through creating incentives for private digital service providers to educate customers.

There are also several macrofinancial risks related to fintech that need to be addressed. Fintech adds to the interconnectedness of the financial system and brings banks and (often unregulated) nonbanks even closer, posing risks for both. Even when fintech companies are unleveraged, they could be affected by spillovers from turbulences in the banking or capital markets. And that, in turn, could put financial inclusion at risk. Finally, fintech could lead to "excessive" financial inclusion (such as the US subprime lending crisis or the more recent rise in default rate to nearly 20% on mobile bank loans in Kenya) when access to credit grows under insufficient regulation and supervision.[22] In crafting new laws, it would be important to ensure proportionality in regulation of small fintech firms (Adrian and Mancini-Griffoli 2019), while being mindful that unsecured digital credit combined with the light regulation of some digital financial service providers may raise complex issues of crisis management. These issues are even more relevant as fintech companies go through the economic downturn triggered by the pandemic. For instance, individuals may seek fast access to credit, including digital credit, to meet immediate living expenses. This practice may expose consumers to less scrupulous credit providers, unfavorable terms and conditions, and increase over-indebtedness.

Fintech's potential to help counter the impact of the COVID-19 pandemic and support the eventual economic recovery is large but cannot be taken for granted. Fintech is proving to be a useful tool in ensuring access to financial services and helping deliver governments' support measures. Its role in the recovery phase, however, will depend on the industry's resilience to the shock and how the fintech landscape evolves post-COVID-19. As more data become available, it would be useful to examine the relationship between the adoption of digital financial services and how well economies are absorbing the COVID-19 shock and recovering post-COVID-19.

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22 Excessive financial deepening is also connected to inequality (Čihák and Sahay (2020). See the IMF managing director's speech in January 2020 at https://www.imf.org/en/News/Articles/2020/01/17/sp01172019-the-financial-sector-in-the-2020s#_edn7.

Are digital financial services closing gender gaps? Women face multiple obstacles in accessing finance, including because of lower literacy and numeracy, lack of documentation, family responsibilities, or social attitudes (Sioson and Kim 2019). Although some of those obstacles may also affect men, they tend to be more important for women. Fintech solutions appear particularly well adapted to the constraints women face—the interfaces are being increasingly designed to be consumer-friendly and digital finance does not require physical presence to access financial services (Jack and Suri 2016). When a face-to-face interaction is needed, e.g., to cash in or cash out, mobile money or bank agents are easily accessible. The AFI (2017) identified leveraging digital financial services as one of the top action points to address gender gaps in financial inclusion. In an IMF study, Khera et al. (2022) look at the evidence on fintech in bridging gender gaps.

A final thought for policy makers is whether fintech for financial inclusion requires additional consideration from a political economy perspective. GDP growth, notwithstanding its limitation, is currently viewed as the leading indicator for measuring the well-being of an economy. But should there be equal concern if new technology, such as fintech, does not serve large segments of the lower-income society, even if the positive impact on GDP is large? Minimizing the risks of fintech to financial exclusion takes a new meaning if the political cost and social implications of ignoring the "small guy" is high, evidenced by the social unrest in many countries during the COVID-19 crisis. Indeed, high or rising inequalities of income and wealth, in part attributed to new technology, is becoming a major source of concern in a number of countries, which will likely exacerbate during the post-COVID-19 era, unless financial exclusion is addressed. The silver lining is that—with careful regulation and supervision, as well as addressing the several constraints that the expansion of financial inclusion faces—countries can attain the promise of fintech to serve greater proportions of the population in realizing their dreams of upward mobility.

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7

Digital Finance, Financial Inclusion, and Sustainable Development: Building Better Financial Systems

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7.1 Introduction

The year 2020 marked the start of a new decade and a new period of evolution for the global financial system and the global economy. It also brought the first global pandemic of the 21st century, and the worst in over 100 years, since the Spanish flu of 1918. The coronavirus disease (COVID-19) pandemic has caused significant social and economic disruption, with developing countries most severely impacted, across Asia and globally. Everywhere, the greatest toll has fallen on those most vulnerable, damaging to human development across the globe. The invasion of Ukraine at the beginning of 2022 is worsening the situation, particularly for the most vulnerable countries.

Finance in the previous decade—the 2010s—was defined by three overarching themes. The first was the global financial crisis that commenced in 2008 and whose impact ran in many different forms throughout the 2010s, particularly the reshaping of finance through internationally coordinated regulatory reforms. Regulatory transformation was thus the second theme of the 2010s, with very

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significant expansion of regulatory scope and scale across the decade. The third was technology: the emergence of a range of new technologies, firms, and business models, which presented opportunities to improve finance but have also brought a range of new risks and challenges. The impact of financial technology (fintech) has been particularly clear in Asia, with finance in the People's Republic of China (PRC) and India experiencing dramatic digital transformations.

Looking forward, we suggest that finance in the next decade will be driven by three central themes: sustainable development, technology, and a continual tension between economic, financial, and technological globalization and fragmentation. These themes will create both new opportunities and new risks as well as new challenges for finance and financial governance in Asia and globally. The COVID-19 pandemic that commenced in 2020 has reinforced all three of these themes.

First, the pandemic is fundamentally a health crisis, which in this case evolved into an economic crisis. As a health crisis, it is also a sustainability crisis, in fact an existential sustainability crisis. Likewise, the Ukraine invasion is being felt most broadly as a food crisis, once again a sustainability crisis, albeit with origins in conflict. While sustainable development (as reflected by the full spectrum of the United Nations Sustainable Development Goals [SDGs]) was a major global focus prior to 2020, the combination of the pandemic and an increasing range of climate, inequality, and other sustainability crises—particularly climate related but also now conflict related—have all come together to drive forward a new consensus in this area. Looking forward, there is a clear need to focus on resilience of finance, financial systems, and financial infrastructure. From the standpoint of resilience, the questions that arise are (i) how can we make our foundational financial and other systems resilient in the face of future crises, and (ii) which tools do we need to develop to respond to sustainability challenges and support sustainable development and transformation? We suggest, in fact, that thinking around these issues has now evolved to the point that the promotion of sustainability has become a core central bank and financial regulatory objective, joining monetary stability, financial stability, consumer protection, and market integrity.

Technology is the second aspect COVID-19 has reinforced, building on and driving forward the pre-existing trends of digitization and datafication of finance, economic activity, and communications, the "digitization of everything" foretold as the Fourth Industrial Revolution. Technology has been central to resilience in the face of the pandemic and particularly its attendant lockdowns around the world; it has also been central to responding to the crisis and seeking to support the recovery. Unlike 2008 when finance was central to the problem, since 2020,

finance—particularly digital finance—has been central to resilience and response.

In looking at experiences since 2020, we identify four major areas where digitalization of finance is moving forward particularly rapidly as a result of COVID-19: electronic payments and money (including central bank digital currencies); use of technology for regulatory and supervisory purposes (regulatory technology or "regtech" and supervisory technology or "suptech"); digital identity and market integrity; and concentration and dominance of the biggest technology companies (big tech) and digital finance platforms.

At the same time, digital financial transformation brings with it new risks, with technological risks ("techrisk") now comprising arguably the most significant financial stability and national security threats. Further, the entry of large technology firms into finance—techfin and big tech—introduces two new problems. The first emerges in the context of new forms of potentially systemic infrastructure (such as data and cloud service providers). The second emerges because data—like finance—benefits from economies of scope and scale and from network effects and—even more than finance—can result in monopolistic or oligopolistic outcomes, increasing the systemic risk from new types of "Too Big to Fail" and "Too Connected to Fail" phenomena.

Going forward, how can we best balance these competing opportunities and risks?

As discussions turn from the immediate crisis response, there is a major opportunity to use the impetus provided by COVID-19 to build better financial systems, which are resilient to future challenges and support and enable future development. From the standpoint of new opportunities, we argue that fintech is the key driver for financial inclusion and sustainable development, as embodied in the SDGs. By enhancing, expanding, and optimizing access to financial services and resources, digital finance can play a fundamental role in the pursuit of sustainable development as envisaged in the SDGs.

The full potential of digital finance to support the SDGs should be based on an ecosystem approach, focusing on three levels: infrastructure, regulation, and the wider environment.

Infrastructure is fundamental, in particular four elements: The first and the foundation of the others is digital inclusion, the key to digital finance. Generally, Asia is characterized by high smartphone penetration levels, providing an important foundation for ongoing and future digitization. The second, drawing on COVID-19 experiences, is open interoperable electronic payment systems. Experiences in the PRC and India, albeit very different, have highlighted the significance of digital payments prior to COVID-19. Experiences across developing

Asia is highlighting the power of electronic payments to enable not only crisis responses but also economic and other activities as well as new business models. The third entails building digital identity, and simplified account opening and electronic know-your-customer (known as e-KYC) systems. This infrastructure underpins the electronic provision of government services and payments as well as private sector activity. India's experience with Aadhar (a system that gives each Indian resident a unique identity number that is linked to their biometric data, which is used to access government services, social benefits, and banking, among other things) has been pathbreaking (Arner et al. 2020), with an increasing range of countries across the region now pursuing sovereign digital identity projects to support financial inclusion, as well as bring people into the formal economy, enable the benefits of digitization, and enhance market integrity protection while reducing de-risking. The fourth—design of digital financial markets and systems—broadens the accessibility of finance and investment.

Implementing the four elements will be a major journey for any economy, but has significant potential to transform not only finance but economies and societies, through fintech, financial inclusion, and sustainable development. This infrastructure in turn requires a balanced proportional graduated approach to financial regulation involving strategic use of technology for regulation and supervision, and an environment that supports research and development and human capital development, and encourages innovation.

7.2 The Digitalization of Finance

Starting in the 1960s and building on foundations of electrification in the late 19th century, finance has undergone a process of digital transformation, involving digitization and datafication. Today, finance is not only the most globalized segment of the world's economy but also perhaps the most digitized, datafied, and regulated.

This process can be seen across four major axes: global wholesale markets, an explosion of fintech start-ups particularly since 2008, the unprecedented digital financial transformation in developing countries, particularly the PRC, and the increasing role of large technology companies (big tech) in financial services (techfins). This process of digital financial transformation brings with it massive change. These changes have positive aspects, such as greater financial inclusion, and negative aspects, such as new risks. While finance and technology have always developed together and reinforced one another, the changes since the 2008 global financial crisis have been unprecedented, particularly in terms of the speed of technological evolution and of new entrants,

including start-ups, big tech, and new developing country entrants, epitomized by the PRC and India.

This long-term process of digitization and datafication of finance has increasingly been supported by related technologies including big data (Cohen 2013; Barocas and Selbst 2016; Katz 2013, Tene and Polonetsky 2013; Zetzsche et al. 2018) and artificial intelligence,[2] distributed ledgers and blockchain (Catalini and Gans 2018; Zetzsche, Buckley, and Arner 2018), cryptocurrencies (Hacker and Thomale 2018; Zetzsche et al. 2019; Adhami, Giudici, and Martinazzi 2018), smart contracts (Sklaroff 2017; Werbach and Cornell 2017; Raskin 2017), regtech and suptech (Arner, Barberis, and Buckley 2017a; van Liebergen et al. 2016), and digital identity (Arner et al. 2018), in a new era of fintech (Arner, Barberis, and Buckley 2017b). The result is novel services with disruptive effects on existing intermediaries, such as crowdfunding and crowdlending among many others (Armour and Enriques 2018; Zetzsche and Preiner 2018). This process of digitization and datafication combined with new technologies can be seen across developed global markets and emerging and developing markets, where the process of digital financial transformation is, if anything, occurring even faster.

Entering into this environment, COVID-19 has driven digitalization even further and faster, in particular in the context of finance.

7.3 COVID-19 and Digital Financial Transformation

Technology and finance have together been central to resilience in the face of the pandemic and particularly its attendant lockdowns around the world—and to responding to the crisis and seeking to support the recovery. Lockdowns and social distancing have certainly rapidly accelerated digitalization worldwide. If the pandemic had struck a mere decade earlier, the existing technology would have meant the capacity for so many of us to work from home would have been severely constrained, and overall much higher levels of face-to-face interactions between people would have been necessary during lockdowns.

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[2] In computer science, artificial intelligence is defined as devices that perceive their environment and take actions that maximize their chance of successfully achieving their task. The baseline of artificial intelligence is a computer mimicking human "cognitive" functions such as "learning" and "problem solving." Artificial intelligence today can be used to detect unexpected correlations in large data pools, test expected correlations for causation, or determine an empirical probability of a predefined pattern (Poole, Mackworth, and Goebel 1998; Russel and Norvig 2009). From an ethical and/or policy perspective, see Helbing (2018).

Unlike 2008 when finance was central to the problem, since 2020 finance has been central to resilience and response. If we look at the experience since 2020, we can identify four major areas where digitalization of finance is moving forward rapidly as a result of the "digitization of everything": electronic payments, use of technology for regulatory and supervisory purposes, digital identity and market integrity, and big tech and digital finance platforms.

7.3.1 Electronic Money and Payments

The most obvious and immediate impact of COVID-19 on finance has been the dramatic expansion of electronic payments (Committee on Payments and Market Infrastructures 2021). This was a necessity due to lockdowns and increased use of e-commerce (BIS 2021). It also continues the trend of consumers preferring digital payments over cash and of the widespread use of electronic fund transfers by governments around the world to provide financial support. These have been supported by a range of national projects to make digital wallets widely available and the launch of numerous fast payment systems.

COVID-19 has also been marked by dramatic increases in interest and engagement with digital money (Committee on Payments and Market Infrastructures 2021). This can be seen directly in the increase in prices and use of cryptocurrencies and other forms of digital assets and tokens. It can also be seen in the dramatic increase in numbers of jurisdictions working on, experimenting with and, in the case of the Cambodia, the Bahamas, and Nigeria, among a rapidly increasing range of others, launching central bank digital currencies (Committee on Payments and Market Infrastructures 2021). Probably most significant is the impending national rollout of the digital yuan in the PRC.

It has become clear that technologies—both centralized and decentralized—are revolutionizing payments and money. Reflecting these trends, the Group of 20 has launched a payments roadmap (FSB 2021), incentivized by the announcement of the Facebook Libra/Diem project in 2019 and the evolution of cryptocurrencies, reflecting the potential to use technology to build better money and payment systems.

7.3.2 Regulatory Technology and Supervisory Technology

The second dramatic evolution in digital finance has come in the context of regtech and suptech. Faced with the necessity of working from home, financial institutions and their staff—including frontline, trading, compliance, legal, risk management, and management—

have all had to rapidly implement digitized communications and working systems (Arner et al. 2021). Globally, this process has accelerated the digitalization of finance, particularly of incumbents and large financial institutions, which had been lagging. This has driven rapid movement to cloud-based infrastructure to support the full range of processes and activities.

In addition to the financial services industry, COVID-19 has transformed attitudes and approaches of regulators, supervisors and central banks around the world to the use of technology in their own operations and activities (see for example, FSI 2021). Where pre-COVID-19 meetings would have been done face-to-face, they are now done virtually. Supervisory functions have had to move online, in particular what would formerly have been on-site supervisory activities. Interactions with industry compliance staff have also moved online. As a result, central banks, regulators, and supervisors are looking not only at how technological infrastructure can be improved, but also at digitizing and datafying their own operations and systems.

Around the region, central banks and financial regulators including in Singapore; Indonesia; Hong Kong, China; and the Philippines are developing digitization strategies to build better regulatory and financial systems through regtech and suptech.

7.3.3 Market Integrity and Digital Identity

A third major area where COVID-19 has transformed approaches is in the context of market integrity, particularly relating to money laundering and terrorist financing (FSI 2020). Prior to COVID-19, while a range of jurisdictions were implementing sovereign digital identification systems for individuals (with India's Aadhar a particularly high profile and effective example) (Arner et al. 2020), the Financial Action Taskforce (2020) took a long time to recognize that digital identification could be better than traditional paper-based systems. This reflects an increasing understanding among the law enforcement and policy communities of the potential to build better systems for market integrity based on digital identification (for both individuals and entities), combined with systems for tracking and tracing transactions. The European Union (EU) is emerging as a leader in this context, but the trend is clear among major jurisdictions around the world, with efforts through the Asia-Pacific Economic Cooperation forum and the Association of Southeast Asian Nations seeking to support cross-border frameworks for businesses, particularly small and medium-sized enterprises, often based on domestic sovereign digital identity systems.

7.3.4 Big Tech and Digital Finance Platforms

Trends of digitization and datafication over an extended period of time, combined with COVID-19 driven digitalization and the network effects that characterize data and the economies of scope and scale that characterize finance, have led to a global trend toward the emergence of large digital platforms. This is evident in payments (e.g., PayPal, Visa, Mastercard, Alipay, WeChatPay), asset management (e.g., BlackRock, Vanguard), market making (e.g., Citadel, Virtu), and lending (e.g., Ant). Facebook's announcement of its Libra project in 2019 and the decision to halt the Ant initial public offering in 2020 clearly marked the beginning of a new period of digital finance—Fintech 4.0—characterized by dominant platforms and ecosystems, emerging from big tech, incumbents, and fintech and techfin (Arner et al. 2022). Going forward, the challenge is how to balance the benefits of platforms with their risks. The PRC and India have emerged as strategic leaders in seeking to build frameworks to maximize the benefits of data aggregation for balanced sustainable development while seeking to counter forces of concentration and dominance.

7.4 Finance and Sustainable Development: A New Regulatory Paradigm

While sustainable development (as reflected by the full spectrum of the SDGs) was a major global focus prior to 2020, the combination of the COVID-19 pandemic and an increasing range of climate, inequality, and other sustainability crises have together driven forward a new consensus in this area. The pandemic is a health crisis that has led to an economic crisis. It is also a sustainability crisis—in fact, an existential sustainability crisis—and is thus driving forward new approaches to sustainability more generally, particularly in the context of finance. We can see this from the standpoint of resilience in the first instance: how can we make the financial and other systems, which underpin our societies and civilization, resilient in the face of future crises? Second, how can we build better systems going forward, which are not only resilient in the face of future crises but also provide us with tools to respond to sustainability challenges going forward, and which underpin and enable sustainable development and transformation into the future.

We suggest that in fact sustainable development has now become a core central bank and financial regulatory objective, joining monetary stability, financial stability, consumer protection, and market integrity,

as well as bridging and building on existing growth and inclusion objectives.

7.4.1 Central Banks and Sustainable Development

Central banks are primary focal points in any discussion of financial regulation and governance. As highlighted above, three themes have dominated the past decade of finance: the 2008 global financial crisis, financial regulation, and technology. Central banks have been at the center of these discussions.

As highlighted in previous work (Taylor, Arner, and Gibson 2019), from the 1970s until 2008 the central bank consensus focused on monetary stability, i.e., inflation targeting based on price stability. Central banks that were independent and focused on price stability, rather than microprudential supervision, were viewed as the optimum structural design to lower the rate of inflation. This theoretical consensus led to the redesign of central banks in the 1990s, with many jurisdictions introducing a separate microprudential regulator exogenous to the central bank. At this time, central bank independence became statutorily reinforced. Macroprudential financial stability beyond monetary stability was de-emphasized as a role for central banks.

By the 1990s, the theoretically derived consensus was based on three propositions: (i) the central bank focuses on price stability, (ii) financial institution supervision and regulation could be transferred to a specialist non-central bank agency, and (iii) microprudential supervision of individual institutions fully discharged the financial stability function.

The 2008 global financial crisis shattered this consensus by exposing the need for central banks to return to a more traditional yet broader macroprudential stability role. Central banks have taken on pivotal responsibilities to maintain the functioning of the financial system. Mitigating the spread of systemic risks from systemically important financial institutions, other financial institutions, and markets placed new macroprudential stability responsibilities on central banks, forming the basis of a new post-crisis consensus. Macroprudential supervision and systemic risk have been brought to the fore of institutional design, regulation, and financial stability management to establish the new central bank consensus.

Today, central banks are playing increasingly important roles in discussions around sustainable development—in particular, climate change (Park and Kim 2020). Given that such policies are relatively new, the question is whether or not central banks in their current form are an appropriate forum for sustainability discussions and whether they have

the necessary mandates and tools required. We suggest that it is entirely appropriate for central banks to be the focus of such attention, given their economic, monetary, and financial mandates.

Fundamentally, central banking has two objectives: monetary stability and financial stability—often supplemented by economic growth and/or financial development.[3] The first central banks evolved from commercial banks to finance governments in exchange for a legislative monopoly over currency issue. These privileges grew to include monetary management because the central banks' clearinghouse function is important to monetary and financial stability in preventing currency over-issue. The clearing system also extended central banks' financial stability role to include banking supervision, a necessary corollary for the lender of last resort function. These responsibilities led to legislative changes that separated monetary policy from commercial endeavors. To independently fulfill banking sector financial stability responsibilities—crisis management and countercyclical relief measures—central banks were required to be noncompetitive yet monopolistic. Thus the evolution and expansion of responsibilities during the 19th century—the formative period of central bank development—were preeminent in developing core contemporary characteristics: (i) monopolistic note issuance, (ii) responsibility for monetary stability, (iii) a central role in an economy's payment system as the "bankers' bank," (iv) setting a baseline for interest rates, and (v) acting as the lender of last resort.

By the beginning of the 20th century, the classical central banking paradigm was established, focusing on monetary stability via the gold standard, and financial stability in the form of the lender of last resort function. At this time, central banks extended their role as bank supervisors. In some cases, for example the Bank of England, this role evolved from the lender of last resort function. Alternatively, statutory responsibility for banking supervision was imposed on central banks, for example in continental European countries in the aftermath of the Great Depression. Following the outbreak of the Second World War, a model of central banking was established that imposed responsibility for monetary and financial stability. This financial stability function often included bank supervision as a public function, rather than a commercial endeavor.

From this standpoint, it is clear that central banks' core mandate has always focused on economic and financial issues, including in

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[3] For a detailed discussion, see Arner (2007), Lastra (1996), Bagehot (1873), and Thornton (1802).

many cases a developmental focus. As sustainability and technology are risks to these core mandates, there is a clear need for central banks to be involved in finance-related sustainability regulation. The following sections will explore different strategies that central banks can adopt to support sustainable development.

7.4.2 The Global Financial Architecture

Sustainability matters also in the context of the global financial architecture. This argument is relevant in the context of multilateral cooperation. In contrast to many other areas, states tend to be willing to cooperate in the context of sustainable finance and global warming. For example, the EU has placed sustainable development at the center of its strategic priorities, reinforcing its ongoing efforts toward the promotion of green finance and taxonomies of sustainable economic activities (European Commission). The taxonomy will help investors, banks, and insurers to determine the sustainability of different enterprises. In turn, the EU hopes to enhance investments in the green economy and incentivize sustainable economic activities. Other international organizations also focus on the growing importance of sustainability. For example, the International Monetary Fund's research recognized climate change as a source of financial risk (Grippa, Schmittmann, and Suntheim 2019). As a source of risk, climate change and environmental regulations can significantly affect the value of financial assets and, in turn, jeopardize the stability of the international financial system (Carney 2019).

One of the solutions to these risks is to focus on investments in sustainability and sustainable enterprises (Carney 2019). In particular, investments in both environmentally friendly enterprises as well as new sustainable technologies can help to mitigate the risks of climate change. In the context of sustainable investing, regulators can take an extra step to support investors by enhancing sustainability reporting requirements or providing incentives for green investing, e.g., green investment quotas or concessionary loans. Furthermore, international organizations can help states to coordinate their sustainability policies by facilitating the creation of international environmental, social, and governance (ESG) and/or SDG reporting standards, and by prioritizing green investment strategies. One of the relevant debates in the context of international cooperation is the adjustment of capital requirements for banks with green investment portfolios. At the international level, some argued that the Basel Accords should include sustainability risks in

capital requirements calculations (Alexander 2014). While this proposal is not universally supported, there is a strong momentum among international policy makers toward broader regulation of sustainability (Portilla, Gibbs, and Rismanchi 2020). The creation of the International Sustainability Standards Board in 2021 is a major step forward in international standard setting and coordination.

7.4.3 Sustainability and Financial Regulatory Policy

Sustainable development has become a shared objective of vital importance globally. The focus today increasingly centers on the UN SDGs, which provide a framework of detailed objectives and criteria in pursuing sustainable development. The SDGs outline a set of universally agreed goals including the eradication of poverty, elimination of hunger, access to health care, economic growth, and others. Under the SDG framework, all United Nations member states have committed to achieving the SDGs by 2030. The 2020s are thus pivotal. And while progress is being made—building on the earlier Millennium Development Goals—there is a very long way to go, and an increasing range of risks to sustainable development, particularly around climate change, biodiversity loss, and inequality.

Central banks and financial regulators across the globe are considering how to support sustainable development and the SDGs in the context of their wider mandates for financial and economic development, particularly in the context of climate change and related risks. However, these development objectives must also be balanced with the core objectives of financial regulation: financial stability, financial integrity, customer protection, and financial efficiency, development, and inclusion. Financial stability can be seen both negatively (as avoidance of crises) and positively (as appropriate functioning of the financial system). Financial integrity focuses on the prevention of criminal activities, for instance around money laundering and terrorist financing. Customer protection focuses on systems to prevent abuses of consumers. Financial efficiency, development, and inclusion focus on how to support the positive functioning and role of the financial system.

In looking at the SDGs, central banks and financial regulators are increasingly considering them from the perspectives of both risks raised in the context of objectives such as monetary stability, financial stability and consumer protection as well as from the broader standpoint of their role in encouraging a financial sector that supports wider sustainable development.

We thus argue in favor of sustainability as the fifth financial services policy objective, in addition to consumer protection, market integrity, financial stability, and monetary stability.

7.5 Building Better Financial Systems

Coming out of the COVID-19 pandemic, the focus is increasingly on building better financial systems that are not only more resilient to future crises of all forms, including sustainability crises, but that also support sustainable development in the context of the SDGs.

Digital finance and fintech support the achievement of the SDGs in three main ways.

The first is improving the allocation of existing financial resources to support sustainable development. This will occur through business models, incentives, policies, and regulations to redirect financial resources globally and in individual countries to provide SDG-related finance. Examples include ESG and green investment strategies and green investing quotas.

The second involves the expansion of resources in the financial system, which can in turn support the SDGs. This resource expansion takes place through financial sector development that facilitates savings, investment, and inclusion, which can potentially result in large amounts of new money becoming available. This may then increase the availability of financial resources worldwide, and especially in developing markets. The experiences of the PRC and India with digital financial transformation are paradigmatic.

The third involves the use of digital finance and fintech to achieve the SDGs in a direct manner. This takes place through the application of new technologies to design better financial and regulatory systems to achieve policy objectives.

We also need to explore the risks associated with digital finance. While fintech creates a wealth of opportunities for sustainable development, the "digitization of everything" at the center of the Fourth Industrial Revolution also brings with it very significant risks: entirely new in some cases, in others new forms of existing risks (e.g., data monopolization and market concentration). Hence, as with the opportunities of digital financial transformation, the scale and potential for negative outcomes are also significant.

7.5.1 Financial Inclusion and the SDGs

Similar to sustainable finance and fintech, financial inclusion is at the center of current global policy attention, driven, for example, by the Group of 20 (GPFI 2016), the Bank for International Settlements, the World Bank (2018a), and other major international economic, financial, and development organizations.[4]

In a major study with the Alliance for Financial Inclusion (AFI), we focused on this issue: According to the most recent World Bank Global Findex, as of 2017, 1.7 billion adults did not have access to a financial or mobile money account, representing 31% of the global population (Demirgüç-Kunt et al. 2018). However, instead, we focused on those who had gained access to finance in the period from the first Findex in 2010: between 2010 and 2017, 1.2 billion people opened a financial or mobile money account for the first time, concentrated heavily in four countries—Kenya, the PRC, the Russian Federation, and India (World Bank 2018b). Our analysis suggests that much of this progress can be attributed to the impact of technology on finance. For example, mobile money has played a significant role in increasing financial inclusion in Kenya and East Africa (GSMA 2017; Fanta 2016). The PRC has also transformed from an inefficient traditional financial system to perhaps the world's most digitized financial system over a very short period of time (Chien and Randall 2018; Zhou, Arner, and Buckley 2015). India has dramatically increased financial inclusion by developing the infrastructure for a new digital economy ("India Stack"), resulting in hundreds of millions people opening accounts.[5]

Yet in our view neither fintech nor financial inclusion are objectives in themselves. Rather, both are tools to support sustainable development.

Digital financial transformation is one important way regulators and policy makers can support achievement of the SDGs. For those without bank accounts, government-issued identification or other documentation, increased digitization (through digital government-to-person payments and cashless store policies) can represent an additional

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[4] Including the International Monetary Fund, the Organization for Economic Co-operation and Development, and others; nongovernment organizations such as the Alliance for Financial Inclusion, the Toronto Centre, and the Microfinance Centre; as well as the state-sponsored development banks (European Investment Bank, Asian Development Bank, Inter-American Development Bank, Federal Deposit Insurance Corporation, etc.).

[5] India Stack numbers are available on the India Stack website. (https://www.indiastack.org, last accessed 9 May 2022).

barrier. The infrastructure we develop, therefore, must be directed at enabling inclusion.

Based on India's experience and other successful examples mentioned above, including Kenya, the PRC, and the Russian Federation, we argued in our major study for the AFI that countries must focus on four pillars of digital financial infrastructure to support digital financial transformation (Arner, Buckley, and Zetzsche 2018). Prior to COVID-19, it was thus clear that digital finance offered a clear strategy for improving financial inclusion. COVID-19, however, has demonstrated the necessity of digital finance from the standpoint of crisis resilience, response, and recovery.

7.5.2 Digital Finance and Lessons from COVID-19: Building Crisis Resilience

The importance of digital finance has become even more apparent in the face of COVID-19. The pandemic highlighted the need for accelerating the development of digital finance and digital financial infrastructure, particularly in developing countries, to provide timely responses to those in need. Despite the rapid pace of digitalization across the world, most countries were infrastructurally and technologically underequipped to combat the adverse impact of the crisis (see for example, Strusani and Houngbonon 2020). In this light, the existing digital financial infrastructure must be improved, and its development must be accelerated by cooperative acts of governments, international organizations, financial institutions, and tech companies.

The crisis confirmed that digital transformation is key to ensuring consistent functioning of the public and private sectors. To a certain extent, the private sector in developed countries—save for industries such as tourism and airlines—was able to accommodate the needs of individuals in its current state of digitization: mobile payments, e-commerce and delivery apps allowed for online payments and shopping (Strusani and Houngbonon 2020; Okuda and Karazhanova 2020).

As was illustrated by the experience of lockdowns, digital channels may be the most optimal, or even the only, way of providing public services such as health care, immigration, tax, and customs, as well as knowledge sharing for the public (Strusani and Houngbonon 2020; Microsoft 2020). The absence of infrastructure underpinning digital channels poses a huge risk for the continued provision of public services. In this light, governments are urged to implement strategies to support digital financial infrastructure—by working closely with international organizations and tech companies—so they will be able

to pursue the SDGs and opportunities for economic recovery. Such infrastructure will also enable access to financial resources, long-term financing and investments on a global scale. This is not to say traditional finance can or should be ignored in developing such global digital finance infrastructure. Since structural changes cannot be achieved overnight, contingency plans must be made to cater to both developing and developed countries, where the use of cash is still dominant, to deal with any shortage of cashflow in the economy and to redirect resources to the underprivileged and businesses to ensure that they can access necessary financial resources.

In the context of public services, distribution of emergency relief funds could have benefited from the use of fintech (Strusani and Houngbonon 2020).[6] In order to serve the most disadvantaged and reduce the gap between the financially included and excluded, it is essential to provide timely and easy access to relief funds by the public, particularly in developing countries. An effective distribution of such funds was hampered by insufficient digital finance infrastructure and the lack of government experience in enacting large-scale digital financial transactions. This again highlights the inadequacy in existing infrastructure and the need for enhancing all four pillars for responding effectively to crises—to provide quick and easily adopted digital identification tools, to facilitate digitization of traditional payments, to enhance government-to-person payment mechanisms, and to build an infrastructure that allows for inflows of new financial resources into the economy.

Accelerating this global digital financial transformation is imperative for preparing for future crises. The COVID-19 pandemic will have a lasting impact on the global economy and may even reverse previous efforts toward financial inclusion with the diminishing availability of financial resources and cashflow in all countries. In the context of the SDGs, it is crucial that stakeholders participating in digital transformation efforts—governments, international organizations, financial institutions, and tech companies—work together to enhance digital financial infrastructure for a broader use of fintech. In doing so, they must increase collaboration between the public and private sectors to streamline and innovate in the provision of governmental and financial services, as well as to build private sector resilience in preparation for future crises.

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[6] See for example the situation in Indonesia (Eloksari 2020). The example of Indonesia shows that the reliance on digital technology can facilitate access to relief funds only when such reliance is supported by the existing digital infrastructure.

Experience suggests that the best strategic approach is built on three aspects: infrastructure, regulation, and the wider ecosystem.

7.5.3 Digital Financial Infrastructure

The experience of COVID-19 has reinforced the fundamental role of digital infrastructure, not only from the standpoint of financial inclusion but also from the standpoint of crisis resilience, response, and recovery and support for broader sustainable development and achievement of the SDGs.

The four pillars of the AFI fintech for financial inclusion strategy contain the core elements of a robust digital infrastructure policy, based on the fundamental foundation of digital access and inclusion, a metric on which most of Asia has already made significant, even world-leading, progress.[7]

In the context of digital finance, mobile payments have been among the most significant for achieving the SDGs, with the example of M-Pesa in Kenya the best known. Central to their impact is interoperability, with governments across the world increasingly requiring this in order to maximize developmental benefits. Digital payments are essential for the flow of money in developing and developed economies, as well as for government assistance and the development of new business models.

A central enabler for digital payments—in addition to digital inclusion—is access to a financial or mobile money account or digital wallet. Access to these services enables the most basic form of financial inclusion. Most powerful in achieving this are systems of sovereign digital identification.

In addition to supporting transfers, payments, and e-government initiatives, this infrastructure framework also reduces transactions costs and enables the viability of a huge range of commercial activities, new businesses, and opportunities.

7.5.4 Designing Appropriate Regulatory Frameworks

Digital infrastructure needs to be supported by appropriate regulatory frameworks that promote financial stability, market integrity, and consumer protection. Combining global best practice principles around regulations being activity-based, proportional, and technology-neutral, with sequenced regulatory approaches, provides an enabling

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[7] For a more detailed discussion of the mentioned pillars, see Arner, Buckley, and Zetzsche (2018).

framework for innovation but balances it with a continual concern for evolving risks.

In a recent report (Zetzsche et al. 2020), we consider the variety of tools available to support financial innovation and inclusion and how they might best interact with current technologies and regulatory capacities.

Our suggested pathway is as follows.

First, regulators should *identify and modernize unsuitable regulations* based on a regulatory impact assessment that ascertains whether legacy rules remain relevant and useful.

Second, regulators should implement *risk-based graduated proportional regulations*. Provisions for financial stability and integrity should be proportional to the extent of the risks of the regulated activity, with more lenient provisions for less risky activities and increasingly tougher requirements for riskier services. This will encourage the development of new financial products and providers.

Third, regulators should implement a mix of testing and piloting regimes, innovation hubs and/or regulatory sandboxes. Such approaches allow for leniency toward innovative firms through wait-and-see or test-and-learn approaches. By developing specialized licensing and/or revising existing systems to implement a functional approach in major areas of payment, financing, and lending, regulators can better support innovations (Buckley et al. 2020).

Fourth, central to regulatory effectiveness is upgrading supervisory data systems and regulatory technologies, particularly alongside the development of core digital infrastructure: regtech and suptech.

7.5.5 Supporting the Wider Ecosystem

While infrastructure and regulation are fundamental, focusing on the wider ecosystem in which they operate is central to maximizing inclusion.

From the standpoint of digital finance, the wider ecosystem focuses on education, space, and funding, as well as the development of cooperation through related professional and other associations. This wider focus supports the effectiveness of regulatory facilitation arrangements, particularly innovation hubs.

An Innovation Hub with staff knowledgeable about the financial licensing regime will help develop fintech and the local business environment. The Innovation Hub experts should be readily contactable by fintech start-ups and financial institutions and be able to provide guidance about regulatory requirements and dispensations. This approach will also yield valuable insights for regulators.

These measures form an overall strategy to support fintech, innovation and achievement of the SDGs. These goals can be further supported by regional regulatory approaches to support necessary scale.

7.5.6 Cross-Border Harmonization and Market Access

We suggest policy makers and regulators in many countries will need to focus particularly on the advantages of regionally harmonized regulatory frameworks for fintech. The more consistent regulatory approaches are across a region, the more attractive each of the national markets will be to innovative financial service providers. In turn, the greater number of providers in a region will benefit consumers by increasing choice among service providers and promoting more competitive prices, while also increasing the likelihood of firms developing innovative solutions to service the unbanked.

7.6 Balancing Opportunities and Risks Digital Financial Transformation

We here argue that digital finance is fundamental to sustainable development as well as financial inclusion. Looking forward, COVID-19 has not only dramatically accelerated digitalization and its related risks but also provided a significant impetus going forward to build better, more resilient financial systems that can not only serve to address future crises when they occur but also support sustainable development.

Facebook's Libra proposal serves to illustrate the interconnection between financial technology, regulation, sustainable development, and new forms of risk emerging from technology (techrisk).

The proposal highlighted the potential for rethinking finance. Technology now allows the building of entirely new systems which could dramatically enhance the positive scale, scope and impact of finance: a new global currency and payment system to bring those presently excluded into the financial system, potentially limiting the power of individual governments and expanding the resources available for wider economic transformation through the SDGs.

To address the risks of digital financial transformation, an appropriate framework of analysis should consider: (i) new sources of traditional risk; (ii) new forms of risk; and (iii) entirely new markets and systems, including for regulation (such as regulatory technology [regtech]).

In applying this framework, it is helpful to closely consider several key areas of concern that have surfaced during the process of digital financial transformation, including cybersecurity, data security and data privacy, the emergence of new systemically important financial institutions, and the emergence of new financial market infrastructures and dependencies.

These risks are especially relevant in the context of sustainable development and financial inclusion. Both in terms of public infrastructure and the prevention of crime, digitization can exacerbate cybersecurity risks in developed and developing regions. For example, the digitization of government services and public infrastructure can make developing regions vulnerable to new forms of cybercrime or cyberterrorism.[8] Similarly, access to digital financial services can make communities in developing regions more vulnerable to crimes like fraud and cybertheft (Kshetri 2010). Since some of these communities may lack proper knowledge related to cybersecurity, digitization can negatively affect their economic stability in the absence of proper e-education and crime prevention. Lastly, broader access to digital financial services means that developing communities will be exposed to the vulnerabilities of the international financial system. In other words, broader access to financial institutions will make the newly banked customers vulnerable to the general risks associated with financial institutions, e.g. the previously discussed issues of interconnectivity in the financial sector. Naturally, the abovementioned risks do not necessarily overshadow the benefits of the digital financial transformation if they are tackled by appropriate regulatory responses.

While regulators at the national, international, and regional levels are seeking to address these issues, they remain challenging due to the wide range of actors and motivations mentioned previously. Although it is clearly appropriate and necessary for all financial institutions and infrastructure providers to invest in significant resources for cybersecurity, the widespread involvement of state and state-supported actors makes it both difficult and counterintuitive to place the entire burden onto the financial sector.

In addition to cybersecurity, the increasingly central role of data in the financial sector highlights the second major area of concern: data protection. This is in some ways related to cybersecurity, but at the same time, there are a range of underlying policies involved in data protection rules in jurisdictions around the world. Different results are being arrived at in differing economies—with the United States, the PRC, and

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[8] See, for example, the United Nations report on cyberterrorism and critical infrastructure (United Nations Office of Counter-Terrorism 2018).

the EU being the leading examples of differing legal approaches to use and ownership of data resulting from different societal approaches, which in turn result in different market and business structures, with different legal requirements related to data protection and control as a result. Going forward, the ways in which societies address questions about the role of data and the related legal and governance frameworks are likely to be among the most important questions of the 21st century.

While related, data security and privacy risks are separate from those of cybersecurity. In some ways, however, they may be easier to deal with, even in the context of an increasing trend around the world toward data localization rules.

How can regulators respond to this new reality? Central to this approach is risk-based proportional graduated regulation and supervision:

- Prioritize techrisk, both internally and externally.
- Strengthen internal expertise.
- Enhance techrisk reporting requirements.
- Use new technologies themselves, as part of an overall regtech and/or suptech ecosystem strategy, integrating with financial market infrastructures such as digital regulatory reporting systems.

If risks of digitalization are effectively mitigated, digital finance creates a wealth of opportunities for resilience and response to future sustainability crises as well as fundamental to achieving the SDGs.

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8

Toward a Data-Driven Financial System: The Impact of COVID-19

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8.1 Introduction

The coronavirus disease (COVID-19) outbreak has had a growing impact on the global economy and the financial sector. Given the unprecedented macroeconomic nature of the crisis, financial regulators and central banks, along with governments and legislatures, face challenges to maintain financial stability, preserve the core markets, and ensure the flow of credit to the real economy. The financial sector has not only implemented these measures but has also adapted to the new circumstances derived from the pandemic. In this process, the ongoing digital transformation of the financial industry helped to address some of the emerging challenges. Indeed, the digital financial infrastructure that emerged in the wake of the 2008 global financial crisis is being, and can be, leveraged to overcome the immediate challenges presented by the pandemic and manage the impending economic fallout. The first section of the chapter describes the data-driven transformation of the financial services industry, a growing phenomenon within the financial technology (fintech) space.

Even though COVID-19 stopped the operation of many industries, traditional financial institutions and fintechs are trying data-driven solutions to respond to the challenges. For instance, data-driven

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financial companies are participating in lending programs launched by several governments for small businesses, whereas in previous crises such as the global financial crisis, only traditional institutions with traditional credit risk models participated. This response is not unique to the financial sector, since health authorities are also using data to control the spread of the virus (Findlay and Remolina 2020). The second section will present an overview of these data-driven finance initiatives that have been accelerated because of the pandemic.

The third section offers a speculative view of the future of data-driven finance in a post-pandemic world and how, despite its contributions to the recovery of the economy, it also generates consumer protection and financial stability risks. An adequate balance of regulatory objectives will be crucial for a sustainable recovery in a post-pandemic financial industry.

8.2 The Data Revolution in the Financial Services Industry

Data have taken on an immense importance in the last years. Just in 2020, people created 1.7 MB of data every second (Bulao 2021). Studies show that at the beginning of 2020, the number of bytes in the digital universe was 40 times bigger than the number of stars in the observable universe (Vuleta 2021). The financial services industry is not isolated from this trend. This vast sea of data that can now be stored, organized, and made sense of, and a set of emerging tools and approaches is already driving the next wave of financial sector innovation and optimization (Garg et al. 2017). Embracing technology and data use allows incumbent financial institutions to disrupt their own business model, making the most out of the digital transformation.

Financial institutions have access to enormous amounts of data, but, due to multiple constraints, they have not yet sufficiently converted them into useful insights (Lochy 2019). Financial institutions are not native to the digital landscape and have had to undergo a long process of behavioral and technological conversion. Thus, the financial sector is still on the path toward adopting a data-driven approach to become more efficient. Nearly all (97%) of financial services firms are making some sort of inroads on digital transformation, whether by developing a strategy or already implementing one. More than a fifth (21%) list developing a digital transformation strategy as their top digital priority (BDO 2019).

We are also starting to see fully digital banks, also known as "neobanks" that offer internet-only financial services and lack physical branches. Financial regulators in different jurisdictions are

implementing new regulatory regimes for this new way of operation (Matos Rosa 2018). Further, financial companies are establishing a new operating model that relies on technologies such as the Internet of Things (IoT), artificial intelligence, cloud computing, quantum computing, and open architectures such as open finance. The IoT is a catch-all term for the growing number of electronics that are not traditional computing devices, but are connected to the internet to send data, receive instructions, or both. The IoT brings the power of the internet, data processing, and analytics to the real world of physical objects (Fruhlinger 2020).

The term artificial intelligence (AI) was coined in 1956 by John McCarthy and is a development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. AI is defined as the theory and development of computer systems able to perform tasks that have traditionally required human intelligence (Financial Stability Board 2017a). AI applications in the financial sector include algorithmic trading, portfolio composition and optimization, model validation, back testing, robo-advising, virtual customer assistants, market impact analysis, regulatory compliance, and stress testing (Buchanan 2019). Cloud computing is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user (Orban et al. 2018). Quantum computing is a relatively new field of research that studies the algorithms and systems that apply quantum phenomena to complex problems. It can potentially process data at speeds that are impossible for traditional computers (Lopez de Prado 2016). Finally, open banking or open finance is not a technology-based concept; rather, it involves opening up banking systems (functionality and customer data) to third parties to allow them to develop new innovative financial products and services directly to customers. In other words, open banking transforms the relationship between traditional entities and customers. It also provides traditional banks with an ideal opportunity to improve their customer experience through the data they hold and the infrastructure they already built (Remolina 2019).

A broad range of applications in the financial system use these technologies; hence, the term fintech. Indeed, these technologies are impacting the banking and capital markets: for instance, among the use cases of data-driven technologies are credit scoring models using AI or machine learning, AI for stress testing, data analytics for marketing, open banking for integrating in the chain value payment services, chatbots, and capital optimization models are just some of the use cases currently being deployed in the financial services industry (Barnes 2019; Fernandez Naveira et al. 2018; Remolina 2019). In the insurance

industry, machine learning is used for pricing, marketing, and managing insurance policies (Struntz 2017). Regtech, or the use of technologies for regulatory compliance, is another way in which technologies are impacting the industry. For instance, AI and machine learning are used to improve the know-your-customer process, which is often costly, laborious, and highly duplicative across many services and industries (Financial Stability Board 2019). Also, technologies are impacting the regulatory and supervision processes. Suptech is the use of innovative technology by supervisory agencies, and is currently found in data collection and data analytics. Within data collection, applications are used for supervisory reporting, data management, and virtual assistance. Examples include the ability to pull data directly from banks' information and communication technology systems, automated data validation and consolidation, and chatbots to answer consumer complaints while collecting information that could signal potential areas of concern. Within data analytics, applications are used for market surveillance, misconduct analysis, as well as microprudential and macroprudential supervision—for instance, detecting insider trading activities, money laundering identification, monitoring supervised entities' liquidity risks, and forecasting housing market conditions (Broeders and Prenio 2018; Gurrea-Martínez and Remolina 2020).

This intersection of finance and data generates benefits for the financial sector by creating more competition that will ultimately benefit consumers, making the system cheaper, and helping financial service providers to simultaneously meet their customers' needs and enhance their risk management (Arner et al. 2017). However, it also raises major challenges and risks (Financial Stability Board 2017b, 2019) that mostly relate to financial stability due to new systemically important players that could fall outside the regulatory perimeter—such as cloud service providers—cybersecurity, investor protection, consumer protection, competition, fairness, and new and unexpected new forms of interconnectedness. The lack of interpretability or auditability of AI and machine learning methods could also become a macro-level risk. Similarly, a widespread use of opaque AI models may result in unintended consequences (Financial Stability Board 2019). AI governance is also important to mitigate some of these risks, and some financial regulators are debating how to approach this discussion; for instance, the Monetary Authority of Singapore issued "Fairness, Ethics, Accountability, and Transparency (FEAT) in the Use of Artificial Intelligence and Data Analytics in Singapore's Financial Sector" and is working closely with the tech and financial industries to translate these principles into specific recommendations for data-driven applications in the financial sector, (Monetary Authority of Singapore 2019).

Currently, regulators around the world, international setting bodies, and academics discuss what is the appropriate regulatory architecture to help shape the data revolution (Ehrentraud et al 2020). However, it is not an easy task for regulators to address all these challenges and promote financial innovation. While trying to strike the right balance, regulators face unavoidable conflicts between policy objectives (Brummer and Yadav 2019). For example, encouraging innovation through lowering regulatory entry barriers for certain new service providers could undermine to some extent financial stability or consumer protection, for instance, if open banking leads third-party service providers to be under different regulatory standards than traditional service providers (Remolina 2019). Similar tensions of different regulatory objectives arise with digital payment service providers.

Another example of different policy objectives colliding is currently unfolding in AI. For some, regulating AI is necessary, while for others regulating a field in which we still need more research to understand its unintended consequences and ethical issues may harm innovation. The data revolution of the financial services industry, as well as other innovations, exacerbates the trade-offs between different regulatory objectives. Financial services are unbundled because of these innovations, and supply chains and financial intermediation are changing traditional forms and creating new levels of interconnectedness (Brummer and Yadav 2019).

Lastly, these technological developments call for robust financial and personal data protection for consumers. Hence, data protection is becoming increasingly relevant for financial institutions even beyond the compliance risks, with broader opportunities to elevate the customer experience around tools such as privacy by design (Remolina 2019). However, in most jurisdictions, data protection and privacy regulations are designed and enforced by authorities outside the scope of financial regulators. Coordination between authorities, particularly data protection authorities and financial regulators, is crucial in this data-driven finance evolution as never before.

8.3 The Evolution of Data-Driven Finance during the Pandemic

8.3.1 Data-Driven Lending to Help Small and Medium-Sized Enterprises

Small and medium-sized enterprises (SMEs) play a major role in most economies, particularly in developing countries. SMEs represent about 90% of businesses and more than 50% of employment worldwide.

Formal SMEs contribute up to 40% of national income (gross domestic product) in emerging economies, and they create seven out of 10 jobs (World Bank 2020). However, access to finance is a key constraint to SME growth. The International Finance Corporation estimates that 65 million firms, or 40% of formal microenterprises and SMEs in developing countries, have an unmet financing need of $5.2 trillion every year, which is equivalent to 1.4 times the current level of global microenterprise and SME lending. East Asia and the Pacific accounts for the largest share (46%) of the total global finance gap, followed by Latin America and the Caribbean (23%) and Europe and Central Asia (15%) (World Bank 2020).

Additionally, small businesses around the world are facing unprecedented disruption, and are compelled to adapt to new ways of working (OECD Centre for Entrepreneurship 2020). With these unforeseen challenges, governments are offering financial assistance in the form of relief loan packages, most of which are allocated through banks. Regulators have also decided to allow banks to use their capital buffers to provide more liquidity to the economy in the form of loans (Remolina 2020). Consequently, banks get inundated with loan requests from small businesses, all of which must be reviewed and approved in a short time.

Processing of loan application requests involves multiple steps, from loan underwriting to verification checks and approvals (Fuscaldo 2020). There also needs to be a mechanism to authenticate the small businesses. The failure to process loan application requests on time leads to a huge backlog, customer dissatisfaction, and a negative impact in the recovery of economies. In some countries—for example, the People's Republic of China (PRC)—traditional banks have been criticized because of their slow response to COVID-19, particularly in relation to lending issues (Arner et al. 2020).

To address this issue, some countries, such as the United States (US) with the creation of the Paycheck Protection Program (US Small Business Administration 2021), allowed nonbank online lenders that use AI and machine learning models for lending and credit scoring to participate in these programs. For the first time, US regulators approved some fintech companies to help small businesses that may not have an established lending relationship with a large bank, community bank, or credit union. Additionally, the fintech firms believe they will be able to process applications much more quickly through automation and technology. This puts fintech firms, and particularly data-driven lenders, in an unprecedented position. This is the first crisis in which they will be able to demonstrate how beneficial these new business models can be for the economic recovery.

In Asia, even though some young SMEs use crowdlending platforms and other types of online lenders to access finance, fintech has become the main source of credit for many highly vulnerable small businesses. Asian online lenders raised more than $4 billion in 2017 and 2018, with Indian and Indonesian companies most prominent. However, the pandemic has drastically changed the landscape for the online lending industry. Alternative lending companies and platforms across Asia are scrambling to raise funds and stave off bankruptcy as they face a wave of bad loans (Alun, Anand, and Potkin 2020). Online lenders that fall outside the traditional bank regulations have fewer requirements in many markets about how much capital they must have on hand, which makes them more vulnerable to a wave of defaults. Asia-focused banks, as well as most banks in jurisdictions that follow Basel Committee recommendations, have taken greater provisions against nonperforming loans since the global financial crisis, but alternative online lenders are worse off than their traditional competitors.

Another consequence of the pandemic that has accelerated data-driven lending is the creation of new partnerships between banks and fintech companies. Indeed, models are being re-evaluated to make them more flexible and more adaptive to the businesses. For example, some companies are working to promote their QR code contactless payment services, which allow SMEs to conduct sales while mitigating health risks due to COVID-19 (Bteish and Chatain 2020). These transactional data will allow fintechs and other institutions with access to them to enrich their credit risk models, especially in a sector that lacks traditional finance information to apply for a loan. Particularly in Mexico, fintechs are becoming a leading growth partner to SMEs through transactional data that meet the needs and demands of clients. Data are key because they help determine which sector and clients will recover the fastest. This, in return, is important for fintech to prioritize loans provision, although it is important to note that not all jurisdictions have implemented this type of prudential regulatory requirements for fintechs.

Finally, the data-driven finance evolution of the lending landscape is not only related to fintechs, since banks also play an important role. Through partnerships with associations that represent specific industry segments, banks in Asia are understanding the particular problems and needs of that sector and identifying innovative products and services where they could play a meaningful role. For example, DBS[2] partnered with the Restaurant Association of Singapore, since the food industry

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[2] DBS Bank, often known as DBS, is a Singaporean multinational banking and financial services corporation.

was losing 30%–80% of revenues due to quarantine restrictions, yet operating costs remained the same. Compounding those problems was the fact that established food delivery platforms were charging restaurants 30%–33% commission on the total bill. To address this, DBS, along with the Government of Singapore and two homegrown fintech companies, Oddle and FirstCom, rolled out a digital relief package for the food industry. Specifically, they enabled businesses to set up an online ordering site in just 3 days, with much-reduced delivery rates. As a result, DBS enabled SMEs to quickly create additional online channels to increase revenue (Hachem and Conner 2020). Through similar partnerships, banks and fintechs are offering payment solutions for businesses that were not using e-commerce platforms (Rajendran 2020).

8.3.2 Financial Inclusion

Lockdowns and social distancing are accelerating the digitalization of many sectors, including financial services. Just as the SARS epidemic in 2003 expedited the PRC's efforts to launch digital payments and e-commerce (Xiao and Chorzempa 2020), some countries are taking steps to facilitate digital financial services, especially digital payments. Digital payments are now the backbone to the PRC's vibrant digital economy and its development highly influences data-driven initiatives (BIS 2019). Contactless payments to taxi drivers, and vendors are possible through scanning a QR code. Payments for daily essentials, such as mobile phone bills, utilities, rent, or internet fees, can all be made through mobile payments or online banking in the PRC. Governments at all levels also accept mobile payments. Digital payments have almost become a public good in the PRC and are a key factor in data-driven finance (PwC 2018). Data and analytics are becoming the foundation of effective business decision-making.

Many countries, mostly in Africa, Asia, and Latin America, are replicating this model with measures such as lowering fees and increasing limits on mobile money transactions (Eriksson et al. 2020). During COVID-19 lockdowns, digital financial services enabled governments to provide quick and secure financial support to people and businesses, as demonstrated in Namibia, Peru, Colombia, Zambia, and Uganda (Boakye-Adjei 2020). In many of these countries, payment service providers disbursed government subsidies to people who had not previously used a digital financial channel (Narain et al. 2020).

This is expected to mitigate the economic fallout and potentially strengthen the recovery. The pandemic shows that the trend toward greater digitalization of financial services is here to stay.

8.3.3 Going Digital and Customer Experience

Since the pandemic has pushed financial institutions to digitalize, regulatory changes are needed. Accordingly, the Financial Action Task Force (2020) issued a set of measures to combat illicit financing, and encourage the use of the flexibility built into the its risk-based approach to address some COVID-19-related challenges such as digital onboarding and simplified due diligence for know-your-customer processes. As mentioned, some countries have maintained more restrictive regulations on consumer data protection, especially when it comes to cloud acceptance and know-your-customer and anti-money-laundering practices. Dissimilar regulatory regimes have been extremely challenging for digital lenders who have thus tried to promptly implement a uniform action plan across various markets. Thus, the pandemic has driven regulators to rethink their approaches to digital experiences.

Additionally, due to mobility restrictions of quarantines and lockdowns, financial institutions have been pressed to address customer concerns in multiple different channels such as online chats. As a result, digital banking, specifically "conversational banking," seems to have become permanent. A company that partners with financial institutions in Turkey and the US reported that the number of users and messages has increased 5.4 and 3.9 times, respectively, in banking chatbots since the outbreak of COVID-19 (CBOT 2020). The top topics have been loan applications, credit payment delays, and online banking password reset requests.

As more financial institutions turn to data-driven solutions to manage credit risk, they must not forget that numbers alone will not help their most important stakeholders—their customers—to be at peace. By being data-driven while putting human connections first, banks can help the whole economy rise to this historic challenge.

8.3.4 Central Bank Digital Currencies

The debate around central bank digital currencies was surprisingly accelerated by the pandemic in some countries, such as US and the PRC. Millions of US taxpayers waited for weeks for stimulus payments of up to $1,200 per person. While some received direct deposits in mid-April 2020, those without bank accounts or a bank account on file with the Internal Revenue Service, as well as those who have not received a tax refund in recent years or who are married to an immigrant, are still expecting that a check will arrive. Supporters of digital dollars and central bank digital currencies say a digitized monetary system could

quickly disburse large sums to many individuals with varying access to banking services (Meena 2020).

The Bank of China has recently developed a digital YUAN and it has moved one step closer to launch a digital currency in the middle of a global recession. Several PRC-based private companies, including Alibaba, Tencent, Huawei, and China Merchants Bank, have participated in the development of the digital currency. As central banks around the world are cutting interest rates to zero and taking aggressive action against the economic recession, the PRC's central bank is accelerating its central bank digital currency plan, allowing some institutions to turn these challenging times into an opportunity given that a digital asset is seen as the most convenient tool for commercial banks to adopt a central bank's zero and negative interest rate policy (Peng 2020).

According to the Bank for International Settlements, irrespective of whether health concerns are justified or not, perceptions that cash could spread pathogens may change payment behavior by users and firms (Auer, Giulio, and Frost 2020). In any case, and regardless of the motive behind it, digital payments are trending in the pandemic. However, the Bank for International Settlements raised some concerns about the distributional consequences of any move away from cash. If cash is not generally accepted as a means of payment, this could open a "payments divide" between those with access to digital payments and those without. This in turn could have an especially severe impact on unbanked and non-digital consumers (generally the most vulnerable, i.e., those with no access to digital infrastructure and the elderly). Thus, resilient and accessible central-bank-operated payment infrastructures could quickly become more prominent, including retail central bank digital currencies.

8.4 The Challenging, Yet Promising, Future of Data-Driven Finance in a Post-Pandemic World

8.4.1 An Inclusive Recovery through Data Analytics and Artificial Intelligence

Policy makers must promote an inclusive recovery, one that benefits all segments of society. Governments around the world have deployed extraordinary policy measures to save lives and protect livelihoods, including extra efforts to protect the poor, with many countries stepping up food aid and targeted cash transfers. Globally, fiscal actions so far amount to about $10 trillion (Georgieva 2020). Given the severity of the

crisis, however, further efforts are essential. This includes taking the measures needed to avoid a scarring of the economy, including from job losses and higher inequality. Increasing access to opportunities is now more critical than ever to avoid persistent inequality.

Data-driven finance, if adequately deployed, can contribute to this inclusive recovery. A key priority must be to broaden the access of low-income households and small businesses to financial products. However, reaching the most vulnerable can be challenging in developing economies, where nearly 70% of employment is informal (Georgieva 2020). Traditional lending has not solved the problem of lack of access to credit for SMEs and does not fit with their contemporary reality. In Nigeria, for example, less than 7% of SMEs have ever taken out a formal loan, and loan requests under $50,000 are rarely approved (Kehinde and Eksin 2020). The traditional lending model is based on financial systems in which lenders have access to a host of positive and negative data on a credit report, and although the situation is improving, credit scoring is hard to find for some markets and potential debtors. Even if SMEs can produce audited financial statements, tax returns, and 5-year projections, the chance of a traditional loan in some countries remains low (Kehinde and Eksin 2020).

As mentioned, COVID-19 affected SMEs and governments around the world, and enhancing credit risk management through data initiatives will be crucial in the post-pandemic world. In the post-pandemic era, the lending ecosystem will have to work toward four goals that might help enhance credit risk management effectively.

First, building a dynamic credit decisioning framework and credit scores that incorporate the potential impact of the pandemic is key. The traditional credit scoring may need to be remodeled to take into account the potential impacts of the pandemic and to include additional information about those potential lenders that are not yet included in traditional databases, for example by using alternative data. This approach will help AI and machine learning to score the credit risks of borrowers more adequately.

Second, banks and digital lenders will have to deal with the crisis having dramatically increased nonperforming loans, although with temporary relief from strict regulations and with massive liquidity help from central banks. Restructuring in the sector will accelerate. An open question is whether surviving incumbents will move ahead or if powerful new players, such as big tech, will enter the sector with force, transforming the incumbents.

Third, a targeted approach in redesigning loan terms or products for existing borrowers is needed since the potential impact of a

further pandemic would not only be different among sectors but even among borrowers within sectors. In redesigning the terms for existing borrowers, the intervention can be targeted to individual accounts by considering borrower-specific characteristics and circumstances such as age, employment status, industry employed in, credit history, COVID-19 cases in their province, city, etc. A similar approach can be made for corporate clients. For example, a borrower who owns a restaurant is different than a borrower that is a bank. Even borrowers in the same sector might differ a lot considering factors such as the location of the business. Machine learning models used for clustering debtors may enable this targeted redesign.

However, it is important to address the potential challenges that the theoretical benefits of enhancing credit risk management effectively through data analytics and AI represent. The use of AI and machine learning for credit scoring and risk management comes with critical challenges associated with fairness and discrimination that regulators need to rapidly address. These policy conversations are much needed post-pandemic, especially taking into consideration that, outside the technology sector, the financial services industry is the biggest spender on AI and is experiencing very fast growth. This trend has not changed with the COVID-19 crisis (Buchanan 2019).

Currently, we are starting to witness the first cases of discrimination and unfair lending practices that can not only affect borrowers directly, but also create negative externality and even compromise the stability of the financial system. For instance, the Australian Securities and Investments Commission decided in July 2020 that it will not appeal the dismissal of its case against a fintech called Westpac. Instead, it will review its existing guidance on responsible lending and recommend legislative reforms. Westpac was charged in 2017 for having improperly assessed whether loans were suitable for customers (between 2011 and 2015). The federal court ruled that Westpac's use of the Household Expenditure Measure benchmark was compliant with responsible lending laws, despite its representing a low-end estimate of the spending habits of Australian families (Australian Securities and Investments Commission 2020). This could be a good opportunity for Australian regulators to review how they should target fair lending practices and the use of data and AI in lending.

8.4.2 Online Lenders and Digital Payments Vulnerability

On the one hand, online small business lenders have become the main source of credit for many companies, especially for SMEs and highly vulnerable small businesses. However, online lenders are paralyzed

because they cannot access funding. As a result, they are scaling back just when their services are most needed (Baker and Judge 2020). An online lender is no different than a finance company that needs to borrow in the capital markets and lend that money to customers. When funding in the capital markets is unavailable or very expensive, a finance company will not be able to provide new credit to its customers. The business model of many online lenders exacerbates the crisis funding problem. That means online small business lenders need government help, in the short and medium term, to rescue their customers and then to play a meaningful role in any small business credit and economic recovery (Baker and Judge 2020). This is something to consider in the post-pandemic world: recognize the different approaches that digital lending, especially those provided by small lenders, need to achieve the complicated balance between innovation, financial system stability, and access to finance.

On the other hand, regarding payment service providers, regulators need to think about how, in most countries, they are not regulated under the same rules as traditional financial institutions, and, accordingly, do not have access to liquidity management support. In India, for example, service providers are incurring an additional cost related to liquidity management due to the upsurge in cash-out transactions in rural areas. Several factors have made rebalancing cash difficult. These include the sudden demand for cash, restrictions on movement, and long distances to cover. The distances to bank branches are often as far as 10–12 kilometers, and shutting down of public transport and lack of personal transport options for agents make things even harder. Agents have even reported reducing their investment in liquidity to use the money to feed their families (Narain et al. 2020).

8.4.3 New-Gen Loan Sharks?

Digital lending platforms could help a lot in the post-pandemic world. However, evidence and recent experience in some countries such as India, the Philippines, and some African nations, show that desperate times make people vulnerable. In some countries, digital lenders are known for doing very quick disbursal of loans (Mallikarjunan 2020). However, they are charging high interest rates and making people dependent on these platforms. There are thousands of customers worldwide who have fallen prey to such lending platforms, which are misusing data, overcharging customers, and taking advantage of digital illiteracy (Mallikarjunan 2020). If not adequately addressed, financial inclusion can have a dark side.

8.4.4 From Open Banking to Open Data

As mentioned, COVID-19 has impacted SMEs more than the 2008 financial crisis did. Open banking initiatives use application programming interfaces (APIs) for data sharing, which, in the post-pandemic world, can be crucial to boost lending to the real economy. However, the current regulatory models that target open banking might fail to address the post-pandemic challenges. Hence, moving the conversation from open banking to *open data* and using open APIs to expose data collected not only by banks, but also from other sources (contextual accounting, supply chain, and transactional data) will facilitate sound real-economy lending decisions by developing new products driven by data and built around the SME's dynamic credit requirements after COVID-19 (Remolina 2019).

8.4.5 Data Challenges for Regulatory Agencies

As fintech transforms the financial sector, it also opens up data gaps in central bank statistics. It does so by introducing new financial products, and bringing existing services to a larger market, which reveal a lack of internationally comparable information on fintech. To understand innovation, qualitative information on evolving structures and harmonized time series is needed (IFC Working Group 2020).

In the post-pandemic world, central banks and financial regulators will need to close this gap and develop a comprehensive process to address fintech-related data issues that may arise.

8.4.6 The Role of Standard-Setting Bodies

Fintech and data-driven financial innovations exacerbate the difficulties of setting standards in international financial regulation (Yadav 2020). Reliance on automation and AI, novel types of big data, as well as the use of disintermediating financial supply chains, and the interconnectedness with technology companies and third-party service providers, complicates the balance of different regulatory objectives (Brummer and Yadav 2019).

In the post-pandemic world, this challenge might be further exacerbated. Innovative algorithms will introduce informational uncertainties and complex risks for market integrity, and the ability to impose compliance costs on firms in response to these risks is limited when a preference for innovation favors smaller upstarts and non-traditional players (Yadav 2020). International debate is much needed

in this space in order to prevent a financial crisis stemming from exacerbated risks, especially considering that, in the post-pandemic era, data-driven finance will no longer be an innovation, but a mainstream development.

8.5 Concluding Remarks

The COVID-19 outbreak has a growing impact on the global economy and the financial sector, which plays a critical role in mitigating the unprecedented macroeconomic and financial shocks that result. Financial regulators and supervisors, central banks, along with governments and legislatures, face challenges to maintain financial stability, preserve the well-functioning core markets, and ensure the flow of credit to the real economy. Even though COVID-19 has slowed down our daily lives and stopped the operation of many industries, it did not have the same effect in the data-driven finance world. The digital transformation of the financial services industry and fintech have tempered some of the challenges of the pandemic. Despite the potential benefits of this transformation, the future of data-driven finance in a post-pandemic world looks challenging. An adequate balance of different regulatory objectives will be crucial for a sustainable recovery in a post-pandemic financial industry.

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9

Sharing Credit Data While Respecting Privacy: A Digital Platform for Fairer Financing of Micro, Small, and Medium-Sized Enterprises

Jin-Chuan Duan

9.1 Introduction

Micro, small, and medium-sized enterprises (MSMEs) play a key role in contributing to economic growth and creating employment, yet they face disproportionally large challenges in financing. DiCaprio, Beck, and Daquis (2014), for example, reported that "Gaps in trade finance affect SMEs more negatively than other company respondents. This is a particular problem in Asia where more than 90% of all firms are SMEs." The *Asia-Pacific Trade Facilitation Report 2019* (ADB 2019) stated that "SMEs are most affected as they tend to have higher rejection rates than larger firms. Banks have higher transaction and information costs when dealing with smaller companies." Evidence for the MSME financial gap abounds in the literature and is a repeated theme in numerous studies.

To put it simply, MSMEs worldwide have always faced hardships in financing, but the difficulties are particularly pronounced for those in emerging economies because the national authorities lack the necessary financial resources to help them. This chapter will extend beyond the typical argument to contend that the current way of assisting the financing of MSMEs is ineffective and fails to address the fundamental impediment of informational asymmetry between MSMEs and lending institutions. We will focus the discussion on the Association of Southeast Asian Nations (ASEAN), but the idea and technology that

we will describe are universally applicable to other regions, including developed economies.

According to some estimates, ASEAN is poised to become the world's fourth-largest economy by 2030 (Lee 2018), and its member states view digital transformation as a way of growing their economies. This is an opportune time to help the MSME sector to function more effectively with digital technologies. While many national authorities in ASEAN appreciate the importance of helping MSMEs to access financing, among other policy measures, effective and practical solutions to enable effective flows of capital to the sector are still lacking.

Table 9.1 summarizes the financial assistance programs for MSMEs in six of the 10 ASEAN member countries. The MSME financing program in Singapore serves as a good example. Being a developed economy with solid national finance, the Singapore government is in an enviable fiscal condition to channel substantial resources to the MSME sector. Enterprise Singapore, among many assistance schemes, offers to share risk with lending institutions on working capital loans to eligible SMEs normally at 50% of a loan default loss, rising to 90% during the COVID-19 pandemic period. Also available is a loan insurance scheme that typically co-pays 50% of the commercial insurance premium, which again has increased to 80% to respond to the pandemic. Such proactive and generous assistance programs have no doubt helped many MSMEs to secure financing that they would otherwise be unable to access.

Leveraging the expertise of lending institutions or insurers to facilitate the financing of MSMEs may instinctively appeal to all as an intelligent and effective way of managing assistance. We would contend, however, that it fails to address the fundamental informational asymmetry between lending institutions and MSMEs. In fact, it may disincentivize lending institutions to invest in better credit assessments of their potential borrowers and thus inadvertently create a perverse consequence by widening the information gap.

Governments in both developed and emerging economies worldwide have rolled out special assistance programs for MSMEs in response to the COVID-19 pandemic. These specific financial assistance schemes that the six ASEAN countries and elsewhere have offered, which Table 9.1 describes, will phase out once the outbreak is under control. The improved economies will in a natural course help restore many MSMEs to their pre-pandemic operations.

However, the structural financial difficulties that faced MSMEs in the pre-pandemic period will not simply vanish with the coronavirus unless either government or public and/or private sector efforts put effective structural measures in place. As for the impact of the special COVID-19 policy measures, it is imperative for national authorities to

Table 9.1: A Non-exhaustive Summary of the SME Financial Assistance Programs in Six of the 10 ASEAN Countries

Country	Key Government Policies and Schemes to Help Finance MSMEs
Indonesia	Pre-COVID-19 • Credit for Business (Kredit Usaha Rakyat)—providing credit, working capital, and investment financing schemes dedicated to micro enterprises, SMEs, and co-operatives. • Program for Eastern Indonesian Small and Medium Enterprise Assistance—collaborating with the International Finance Centre to provide financial assistance to SMEs in the poorest areas of Indonesia. Additional policy/stimulus post-COVID-19 • Stimulus for SMEs: Rp123.46 trillion—interest subsidies for microcredit, SME financing, guarantees, and placement of funds in banks.
Malaysia	Pre-COVID-19 • Shariah-compliant SME financing scheme: subsidy rate of 2%, soft loans, grants, and training under SME Corp and insurance coverage credit facility for SME exporters. • Credit Guarantee Corporation (CGC), in collaboration with SME Corp and Credit Bureau Malaysia—offers loan guarantee and financing facilities and advisory, credit information, and credit-rating services. Through the Bureau, the CGC helps SMEs to improve their creditworthiness. Additional policy/stimulus post-COVID-19 • A special grant of RM3,000 for each qualifying microenterprise, which must register with the Malaysian Inland Revenue Board. • Enhanced financing schemes for SMEs as follows: • Abolition of the 2% interest rate for the RM500 million Micro Credit Scheme under Bank Simpanan Nasional. • Extension of the easy financing scheme to the TEKUN Nasional Scheme with a fund of RM200 million at an interest rate of 0%. The maximum loan amount is RM10,000 for each micro company.
Thailand	Pre-COVID-19 • SME Transformation Loan for Thailand 4.0—offering SMEs access to credit of up to B15 million ($0.45 million). SMEs applying for a loan of less than B5 million ($0.15 million) can make fixed interest payments for the first 3 years without collateral, with the Thai Credit Guarantee Corporation acting as guarantor. Additional policy/stimulus post-COVID-19 • SME loan restructuring. • Pre-emptive measure against nonperforming loans (NPL) through interest reduction and an extensive payment period. This is to avoid being classified as troubled debt restructuring with the Credit Bureau, and to be classified as an ordinary loan. • Loan restructuring to promote NPLs to ordinary loans when restructuring loans, with three consecutive installments paid off (from 12 installments). • Measures to support financial institutions and specialized financial institutions in the classification of liquidity loans as ordinary loans (ordinary terms and conditions and a lower interest rate). • Measures to support financial institutions to maintain unused credit lines. • Financial institutions to monitor closely and report monthly milestones according to the measures, including outstanding loans for SMEs, 21 days after the end of each month. • Soft loans not exceeding B3 million per business, with a 3% interest rate for the first 2 years, for affected SME entrepreneurs until 30 December 2020.

continued on next page

Table 9.1 *continued*

Country	Key Government Policies and Schemes to Help Finance MSMEs
Singapore	Pre-COVID-19 • Six categories of loan facilities for Singaporean SMEs: SME working capital loan, SME fixed asset loan, project loan, venture debt loan, trade loan, and mergers and acquisitions loan. • Loans are subject to a cap with a default risk share of at least 50%; for example, the cap for the SME working capital loan is S$300,000 per borrower with a 50% risk share. • Loan insurance schemes co-pay 50% of the premium. Additional policy/stimulus post-COVID-19 • Increased cap and risk share; for example, the SME working capital loan increases the cap to S$1 million, and the government's risk share increases to 90%. SMEs may request deferment of principal repayment for 1 year. • Additionally, financial institutions may apply for low-cost funding through a new Monetary Authority of Singapore dollar facility (extended for another 6 months until September 2021), provided that they pass the savings onto the borrowers. • Loan insurance schemes' premium co-payment has risen to 80%. • Deferment of principal payments on secured term loans.
Philippines	Pre-COVID-19 • Credit Surety Fund—helps cooperatives to manage and administer credit surety funds to enhance access to finance for microenterprise and SME entrepreneurs, cooperatives, and nongovernment organizations. • Pondo Para sa Pagbabago at Pagasenso (P3) (President Duterte's flagship microfinancing initiative)—sets aside $20 million with lower lending rates to eradicate the underground moneylender schemes (56 schemes) and shift to micro businesses and other legal microfinancing facilities. Additional policy/stimulus post-COVID-19 • Non-application of interest, fees, and charges to future payments and/or amortization of individuals, households, microenterprises, SMEs, and corporate borrowers.
Viet Nam	Pre-COVID-19 • Global Company Partnership Grant and Market Readiness Assistance Grant—offer SMEs up to 70% funding support for overseas expansion projects in capability building, market access, and manpower development. The grants support overseas setup, business partner identification, and marketing. Additional policy/stimulus post-COVID-19 • 30% corporate income tax (CIT) reduction—entitling businesses with total revenue in 2020 not exceeding D200 billion (around $8.5 million) to a 30% reduction of CIT payable in 2020.

SMEs = small, and medium-sized enterprises.
Source: Author.

conduct postmortem analyses of these measures' efficacy and learn from the experience to aid future policy formation.

Before proceeding, we contend that not all MSMEs deserve or should receive financial assistance. When a business idea is unsound and the operation is fundamentally nonprofitable, making subsidized financing available not only misallocates capital but also deepens the unnecessary losses that the owner-entrepreneur incurs. Focusing on the

likelihood of success or failure with an evidence-based approach must therefore be a key part of the solution. There should be an incentive for lending institutions to obtain better information on the credit quality of borrowers as opposed to becoming further disengaged due to the government's loss-sharing assistance scheme. In short, our view is that it would be better for the policy objective to focus on building a shared infrastructure to enhance the quality of credit assessments, through which lenders' competition can naturally achieve fairer financing of MSMEs.

With the abundant capital and liquidity in today's financial markets, a lack of information rather than scarce capital lies at the heart of the MSME financing challenge. Building up an MSME information-sharing infrastructure and treating it as a *common good* among lending institutions, in our view, constitute a more productive way to remove the key impediment to channeling much-needed capital to the MSME sector, particularly to those small operations that are in a better position to create jobs and contribute to economic prosperity.

Digital technology enables us to contemplate a new-style soft infrastructure that facilitates the sharing of data across lending institutions and helps to harness alternative data relevant to credit risk assessment. We will elaborate on the idea and its implementation principles later. Such a soft infrastructure has the same spirit as the physical infrastructure, much like a fiber-optic or high-speed train network, which enhances the overall productivity of an economy. When a lending institution can ascertain at a low cost whether the credit quality of an MSME borrower has met its credit standard, it will make business sense to lend without needing a third-party's encouragement. If the credit assessment of a potential borrower is costly, typical MSME loan sizes would not be large enough to justify incurring significant costs to undertake information acquisition.

The central idea underpinning our proposed solution is to create a digital MSME credit analytics platform, a *common good*, for lending institutions to share. Members differing in their risk appetite can compete in loan pricing and services to form, in essence, a *coopetition* business model, which will stand a much better chance of leading to fairer financing of MSMEs.

Defaults are rare events, and therefore data sharing can obviously improve the quality of, say, a probability of default (PD) model. The calibration of a credit model to pooled data from multiple lending institutions needs to respect the data privacy of individual sites. "Federated learning" underlies the technical approach to calibrating a credit model only using the highly aggregated functional values of

the member institutions so that there is no need to transmit privacy-sensitive data to another party.

It is necessary to train the credit models under federated learning on the data residing in a distributed network of multiple lending institutions. The technical design needs to utilize both edge and soft computing to gain operational robustness over network latency and local data site failures in a distributed network. Each data site acts as edge storage and performs edge computing to generate and transmit back highly aggregated functional values to serve as the basis for calibrating a model's parameters. Inversion from these highly aggregated functional values back to the values of the input variables is impossible. This design thus ensures the preservation of total data privacy. It is then possible to share the calibrated model as a *common good* among the member institutions.

The development of the intelligent Credit Analytics Sharing System (*i*CASS)[1] software has already taken place to realize the calibration of large-scale parametric credit models over multiple privacy-protected distributed data sites. The optimization method underpinning this software is the density-tempered sequential Monte Carlo (SMC) technique, which is capable of locating the global optimum for large identifiable parametric models, distinguishing itself from, say, the stochastic gradient descent method that researchers have commonly used for obtaining heuristic solutions for neural network models. The test results show that this new federated learning system is indeed robust to network latency and tolerant of localized data site failures during a calibration session.

We will demonstrate in a shared-data setting how to calibrate a common default prediction model involving four credit portfolios, each corresponding to a hypothetical MSME bank operating in three of the six ASEAN countries. The data, inclusive of the COVID-19 period, come from real exchange-traded SMEs, but the credit portfolios are hypothetical. Each portfolio does not have enough default cases in its own sample to pin down parameter estimates reliably, particularly regarding the COVID-19 impact. This study design intends to show how data sharing can aid policy analysis by emulating the real-world MSME lending market. The special COVID-19 relief measures, such as the concessional loans and deferment of loan payments that Table 9.1

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[1] *i*CASS is a joint effort of the Asian Institute of Digital Finance (AIDF) at the National University of Singapore (NUS) and CriAT, a Singapore-registered fintech firm and an NUS spin-off. This author leads the development team, consisting of members from both AIDF and CriAT. In the interest of full disclosure, this author is a cofounder and the non-executive chairperson of CriAT and concurrently serves as the executive director of the AIDF.

describes, can cause typical MSMEs to experience worsening leverage but improved liquidity. Lowering the short-term default likelihood and raising the longer-term credit risk in effect twist the shape of the term structure of default probabilities for MSMEs. Pooling together the data of the four lending institutions helps to shed light on the issue.

Beyond the privacy-protected data-sharing technology, we lay out some general principles and vital components that can guide the formation of a consortium of lending institutions and the development of the user-support infrastructure. The days of fairer financing of MSMEs in ASEAN or elsewhere through coopetition may become a reality in a not-too-distant future.

9.2 Data Privacy and Federated Credit Model Calibration

Data privacy protection is a typical issue that data usage agreements and/or laws and regulations dictate. How and under what conditions companies can use the credit data pertaining to an obligor, a natural or legal person, are in principle clear. Lending institutions have explicit consent to use a customer's specific information for internal operation purposes. Pooling data falling under different lenders, that is, guardians of the data, without anonymization is obviously impermissible.

When an individual or corporation seeks credit facilities from a bank, they voluntarily provides sensitive information to the lending institution, which in turn must ensure respect of data privacy. Aggregating the credit data of multiple lending institutions into a single database is likely to encounter insurmountable legal complications. We thus need to think of an alternative route through the utilization of digital technology.

A decentralized database may be technologically superior in some contexts, but not for calibrating credit models over many decentralized databases, because doing so involves many network-related issues, such as network latency and occasional individual data site failures. However, facing distributed credit databases in the possession of multiple lending institutions is an operational reality that data privacy concerns dictate.

The main uses of credit models include the prediction of default and recovery rates. The task may also involve developing tools for portfolio credit analysis or pricing credit derivative contracts. Here, we focus on default prediction, that is, estimating the PD, which is the most likely area in which lending institutions would need to share data. This is because default events are rare and data sharing has the obvious advantage of materially affecting the quality of a model.

9.2.1 Federated Model Calibration

The issue and technical challenges that we are facing in essence fall under an increasingly popular term, "federated learning," which Konečný, McMahan, and Ramage (2015) introduced. Federated learning aims to train a model iteratively over multiple distributed data sites without explicitly exchanging data samples. Not exchanging data holds the key to preserving data privacy. Its typical usage is in machine learning models, such as neural networks.

The construction of credit models can take place through various approaches. For example, neural networks and several other machine learning techniques have gained popularity in recent years. It is possible to deploy these machine learning models to classify borrowers into risk categories. Notwithstanding their popularity, neural network credit models are fundamentally deficient, both scientifically and in practical usage in terms of credit modeling. Because a neural network model inherently has numerous local optima and saddle points, its optimization in practice always settles for a heuristic solution.

Research has often shown that such heuristically obtained neural network models are powerful in making predictions in various applications. However, those models are fundamentally uninterpretable and thus ill-suited to managerial usage beyond making simple predictions. It is also well known that these machine learning tools are seriously inadequate for situations that require extrapolation, such as stress testing. In short, predictions in a region that the training data have not previously covered will be entirely unreliable. Risk classification is also insufficient for practical credit risk management because users often need granularity to the level of PD. Real-time usage in banks, for example, also requires the aggregation of individual borrowers into credit portfolios.

For the above reasons, we contend that the preferred credit models should take advantage of conventional parametric approaches building on the accumulated financial and economic knowledge and insights. Naturally, this parametric approach needs to incorporate modern big data techniques to combine the strength of the established theory and/or intuition on credit risk and the information embedded in a large quantity of data.

The credit models that this chapter covers are along the lines of the forward-intensity corporate default prediction approach of Duan, Sun, and Wang (2012), which the Credit Research Initiative (CRI) at the National University of Singapore implemented on exchange-listed firms

globally.[2] The purpose here is to extend the usage of this line of models or others that research has proven to perform robustly in applications to the MSME space through a new federated learning design.

It is possible to view a PD model as a mathematical function linking the chance of seeing the realization of an outcome, which we denote as $Y^{(i)}_{t+\tau,t+\tau+q}$, over a future time period $(t+\tau, t+\tau+q)$, to a borrower's many attributes, $X_{i,t}$, available at the prediction time t. Specifically, it is possible to express borrower i's forward PD at time t for such a future period as

$$\text{Prob}_t\left(Y^{(i)}_{t+\tau,t+\tau+q}=1\right)=f(X_{i,t};\tau,q,\theta)$$

where $Y^{(i)}_{t+\tau,t+\tau+q}=1$ represents a borrower default in the specified time period and $f\left(X_{i,t};\tau,q,\theta\right)$ is a positive nonlinear function. The forward starting time, τ, must enter into the consideration because a future credit event can occur at different points of time, when, for example, a lending contract is for 2 years with 1 month representing a basic time interval. The functional form $f(\cdot;\tau,q,\theta)$ determines the type of model, whereas the multidimensional parameter value θ fixes the model.

Apart from default, an MSME borrower may terminate its banking relationship for various reasons (acquisition by another firm, banking with a different institution, or dissolving to stop losses), which we denote as $Y^{(i)}_{t+\tau,t+\tau+q}=2$, and we need to model this as a different function. An MSME that does not experience either a default or another form of exit over a period is a complementary event, $Y^{(i)}_{t+\tau,t+\tau+q}=0$, which does not require another modeling function simply because the three events must add up to a 100% probability. Hence, we only need a second function,

$$\text{Prob}_t\left(Y^{(i)}_{t+\tau,t+\tau+q}=2\right)=g(X_{i,t};\tau,q,\vartheta)$$

to describe the dynamic system for a firm that may survive multiple periods or default (exit due to other reasons) in one of the periods. These two forward probability functions—$f(X_{i,t};\tau,q,\theta)$ and $g(X_{i,t};\tau,q,\vartheta)$—form the basis for constructing a term structure of PDs to serve various needs in credit risk management.

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[2] See NUS-CRI Staff (2021). The CRI deploys the model of Duan, Sun, and Wang (2012) to generate daily updated PDs on over 80,000 exchange-listed corporations in 133 economies globally and distributes them free of charge through its website (https://www.nuscri.org).

Figure 9.1 depicts conceptually the configuration of this federated calibration system. The Asian Institute of Digital Finance, say, operates the Calibration Central, which interacts with multiple lending institutions, which the schema describes as consortium members. On receiving parameter values θ and ϑ from the Calibration Central, member m computes and submits an aggregated quantity reflective of its contributed credit data pool with N_m borrowers over multiple historical time points $T = \{t_1, t_2, \cdots, t_j\}$. This quantity in the current context is the log-likelihood of the data sample that member m contributes with its pool of borrowers who have survived up to some $t \in T$.

The specific prediction reflects a forward starting time τ and a targeted prediction duration q; that is,

$$\begin{aligned} L_m(\theta, \vartheta; \tau, q) = \sum_{t \in T} \sum_{i=1}^{N_m} \Big(& 1_{\{Y^{(i)}_{t+\tau, t+\tau+q}=1\}} \ln\big[f(X_{i,t}; \tau, q, \theta)\big] \\ & + 1_{\{Y^{(i)}_{t+\tau, t+\tau+q}=2\}} \ln\big[g(X_{i,t}; \tau, q, \vartheta)\big] \\ & + 1_{\{Y^{(i)}_{t+\tau, t+\tau+q}=0\}} \ln\big[1 - f\big(X_{i,t}; \tau, q, \theta\big) \\ & - g(X_{i,t}; \tau, q, \vartheta)\big] \Big) \end{aligned}$$

In the above expression, $1_{\{\cdot\}}$ denotes an indicator function that returns 1 if the condition is true and 0 otherwise. It is evident from the above equation that inverting the process to find an individual $X_{i,t}$ or $Y^{(i)}_{t+\tau, t+\tau+q}$ from $L_m(\theta, \vartheta; \tau, q)$ will be impossible, thus preserving data privacy.

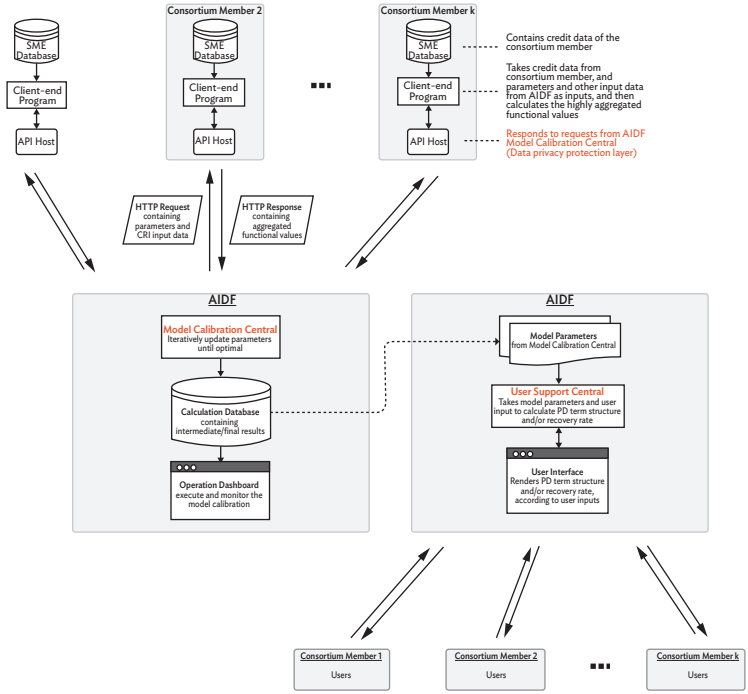
Adding the log-likelihood values from all K member institutions together allows the Calibration Central to compute the overall target function value at the parameter values θ and ϑ, which is

$$L(\theta, \vartheta; \tau, q) = \sum_{m=1}^{K} L_m(\theta, \vartheta; \tau, q)$$

This quantity then serves as the basis on which to update the parameter values.

One must decide on a robust way of finding $\hat{\theta}$ and $\hat{\vartheta}$ that maximizes $L(\theta, \vartheta; \tau, q)$. A key factor in the consideration is the fact that it is necessary to compute $L(\theta, \vartheta; \tau, q)$ repeatedly at different parameter values over a distributed data system that is likely to encounter network latency and some individual data site failures.

Figure 9.1: The Schema of the Proposed Federated Credit Model Calibration over Multiple Privacy-Protected Distributed Data Sites along with a User-Support Function



AIDF = Asian Institute of Digital Finance, API = application programming interface, CRI = Credit Research Initiative, PD =probability of default, SMEs = small and medium-sized enterprises.

Source: Author.

9.2.2 Sequential Monte Carlo Optimization

We rely on the density-tempered SMC technique to perform robust federated optimization over the distributed data sites. Density-tempered SMC is a category of sampling techniques that Del Moral, Doucet, and Jasra (2006), Duan and Fulop (2015), and Duan, Fulop, and Hsieh (2020), among others, advanced. In a nutshell, optimization becomes a sampling problem in which the objective function converts into a density function just short of the norming constant.

It should be clear that exp $[L(\theta, \vartheta; \tau, \mathrm{q})]$ is always a positive function, and its maximizer is exactly the same as the maximizer of $L(\theta, \vartheta; \tau, \mathrm{q})$.

Moreover, exp $[L(\theta, \vartheta; \tau, q)]$ becomes a density function over (θ,ϑ) if we divide it by the norming constant so that it can be integrated to 1. Although this norming constant is unknown and can be highly complex, importance sampling is a way to bypass the need to know it. The density-tempered SMC can be viewed as a sequential way of reliably conducting importance sampling over multiple steps.

Operationally, SMC runs on a sample of (θ, ϑ), say, 1,000 particles. This SMC sample empirically represents the target density function, that is, exp $[L(\theta, \vartheta; \tau, q)]$. Sequentially updating the SMC sample aims to improve the quality of representation. At the end of the self-adaptive SMC run, the particle in the final sample that yields the highest value of exp $[L(\theta, \vartheta; \tau, q)]$ is the Monte Carlo solution to the original optimization problem.

Under the shared-data structure, one may not be able to compute exp $[L(\theta, \vartheta; \tau, q)]$ successfully due to a failure of some data sites to submit their computed results in time for aggregation. Updating the SMC sample of parameters will not be possible without introducing approximation of the missing components. Since the previous round generated the SMC samples corresponding to different data sites, they serve as the natural base on which to perform approximations if necessary.

To make the matter concrete, we use an approximated value, $\hat{L}_m(\theta, \vartheta; \tau, q)$, to replace $L_m(\theta, \vartheta; \tau, q)$ if member m fails to deliver its computed result in time for the next round of parameter updating. Many approximation tools are available when a sample of 1,000 particles is in place, for example the use of the Nadaraya–Watson kernel regression[3] to link $L_m(\theta, \vartheta; \tau, q)$ to (θ,ϑ). Because the parameter may be high dimensional, the initial approximation quality is likely to be poor. As the SMC run progresses, the quality naturally improves. As we mentioned in the introduction, software known as *i*CASS implemented this new federated model calibration.

9.3 Alternative Data

There is a common belief these days that artificial intelligence knows us better than we know ourselves. Digital footprints open new ways for lending institutions to assess the credit quality of MSME borrowers. Utility usage, conventional media coverage, social media chatter, mobile GPS locations, and public records are some examples of alternative data. Harvesting such information solely for the purpose of discriminately

[3] Nadaraya (1964) and Watson (1964) produced this well-known kernel regression technique independently in the same year.

pricing borrowers to enhance a lender's return could put MSME borrowers in an even more disadvantaged position.

When many alternative data become available, naively incorporating them into a shared system will become increasingly difficult for three reasons. First, some lending institutions may have the facilities and/or resources to gather alternative data informative of credit risk, but others may not. Second, individual lenders may place a high value on such data and view them as a way of gaining a competitive edge over others. Finally, the creation of these alternative data is likely to have lacked suitable homogeneity in the variable definition.

It is therefore necessary to modify the credit model for the shared system to accommodate individualities. Thus, we can break up the model parameters into those conventional variables that are common to all lending institutions and those alternative data that are specific to an institution.

Returning to the notation that we introduced earlier, there is a need to partition a borrower's attributes into conventional data, $X_{i,t}^{c}$, and alternative data, $X_{i,t}^{a}$. Hence, we can rewrite the PD model specifically to accommodate alternative data individually for member m; that is, $\text{Prob}_t\left(Y_{t+\tau,t+\tau+q}^{(i)} = 1\right) = f(X_{i,t}^{c}, X_{i,t}^{a}; \tau, q, \theta^{c}, \theta_{m}^{a})$ and $\text{Prob}_t\left(Y_{t+\tau,t+\tau+q}^{(i)} = 2\right) = g(X_{i,t}^{c}, X_{i,t}^{a}; \tau, q, \vartheta^{c}, \vartheta_{m}^{a})$. It is evident that it is possible to modify the federated optimization that we discussed in the preceding section slightly to accommodate institution-specific alternative data; that is,

$$
\begin{aligned}
&L_m(\theta^{c}, \theta_{m}^{a}, \vartheta^{c}, \vartheta_{m}^{a}; \tau, q) \\
&\quad = \sum_{t \in T} \sum_{i=1}^{N_m} \Big(1_{\{Y_{t+\tau,t+\tau+q}^{(i)}=1\}} \ln\left[f\left(X_{i,t}^{c}, X_{i,t}^{a}; \tau, q, \theta^{c}, \theta_{m}^{a}\right)\right] \\
&\quad + 1_{\{Y_{t+\tau,t+\tau+q}^{(i)}=2\}} \ln\left[g(X_{i,t}^{c}, X_{i,t}^{a}; \tau, q, \vartheta^{c}, \vartheta_{m}^{a}) \right] \\
&\quad + 1_{\{Y_{t+\tau,t+\tau+q}^{(i)}=0\}} \ln\left[1 - f(X_{i,t}^{c}, X_{i,t}^{a}; \tau, q, \theta^{c}, \theta_{m}^{a}) \right. \\
&\quad \left. - g(X_{i,t}^{c}, X_{i,t}^{a}; \tau, q, \vartheta^{c}, \vartheta_{m}^{a}) \right] \Big)
\end{aligned}
$$

Again, adding the log-likelihood values from all K member institutions gives rise to the overall target function value at parameter values θ and ϑ, which is

$$L(\theta^c, \vartheta^c, \theta_1^a, \vartheta_1^a, \theta_2^a, \vartheta_2^a, \cdots, \theta_K^a, \vartheta_K^a; \tau, q) = \sum_{m=1}^{K} L_m(\theta^c, \theta_m^a, \vartheta^c, \vartheta_m^a; \tau, q)$$

It is notable that the above expression runs through the index for all member institutions, but not all institutions need to have alternative data because it is easy to switch off alternative data for a member by setting the corresponding parameter values to zero.

In summary, when a member institution has sufficient credit events to support the introduction of its member-specific alternative data, the calibrated credit model can benefit from the sharing of the conventional credit data while retaining its competitive advantage of utilizing the alternative data.

9.4 The Impact of the COVID-19 Pandemic on MSME Defaults

To emulate the real-world MSME lending situation, we conceive four hypothetical financial institutions, which we refer to as Banks A to D. Each operates in three of the six ASEAN countries, as Table 9.1 shows. We assign the three countries randomly. All the MSMEs in the NUS-CRI database appearing in the sample period from January 1996 to May 2021 inclusive in the six ASEAN countries, 2,856 in total, enter the common pool for sampling.[4] We assign each MSME in the pool randomly without replacement to one of the four banks operating in that country until we have exhausted all 2,856 MSMEs. Table 9.2 provides some summary statistics on the emulated data sample.

It is clear from Table 9.2 that any bank alone will fall short of the number of defaults necessary to estimate a default prediction model that has many parameters. Needless to say, pooling all four banks together will still be insufficient to identify the impact of the COVID-19 pandemic on each of the prediction variables. Some simplification in the model specification is necessary, and pooling data is the only practical way to conduct such an analysis.

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[4] The exchange-listed MSMEs in the NUS-CRI database naturally tilt toward relatively larger firms. Micro enterprises are clearly absent from this database. The SME definition varies across jurisdictions. The adopted upper threshold is based on the annual revenue that each authority has defined: Rp50 billion (Indonesia), RM50 million (Malaysia), B500 million (Thailand), S$100 million (Singapore), ₱100 million (Philippines), and D300 billion (Viet Nam).

Table 9.2: Summary Statistics on the Four Hypothetical Banks That Lend to Real Exchange-Listed SMEs in Six ASEAN Countries

	Bank A	Bank B	Bank C	Bank D	Total
Countries	Indonesia, Thailand, Viet Nam	Malaysia, Singapore, Viet Nam	Philippines, Singapore, Thailand	Indonesia, Malaysia, Philippines	Six ASEAN countries
No. of SME borrowers	538	1,062	690	566	2,856
Time period	Jan 1996–May 2021	Jan 1996–May 2021	Jan 1996–May 2021	Jan 1996–May 2021	Jan 1996–May 2021
No. of defaults	14	60	37	51	162
No. of other exits	117	230	140	113	600
No. of defaults—COVID-19 period	1	4	2	0	7
No. of other exits—COVID-19 period	11	14	7	4	36
No. of firm-month observations	27,244	72,099	49,876	34,249	183,468

ASEAN = Association of Southeast Asian Nations, SMEs = small and medium-sized enterprises.
Note: The definition of the COVID-19 period is January 2020 to the end of the sample.
Source: Author.

For simplicity, we deploy the logistic function to model the MSME forward term structure of 1-month PDs from the current time onward: that is, the 1-month PD immediately ahead all the way to the 1-month PD 11 months ahead. We stop at 12 forward months because the COVID-19 period is not long enough to enable a meaningful analysis for longer terms. Using the notation that we described earlier, we treat $f(X_{i,t};\tau,q,\theta)$ as a logistic function at a different month-end, t, where the prediction duration q is always set to 1 month and the forward starting time τ varies from 0 to 11 months. Similarly, $g(X_{i,t};\tau,q,\vartheta)$ is a logistic function for modeling other exits.

With a limited number of default events in the COVID-19 period, we single out its potential impact on $f(X_{i,t};\tau,q,\theta)$ through the intercept and two prediction variables in $X_{i,t}$ because the design of the COVID-19 relief measures aimed to raise liquidity[5] and indebtedness concurrently

[5] We measure liquidity as the ratio of cash and cash equivalent over total assets for financial SMEs and the ratio of current assets over current liabilities for nonfinancial SMEs. This follows the implementation that NUS-CRI Staff (2021) described.

(i.e., lowering distance-to-default, DTD).[6] Furthermore, the relief measures involved default suspension. Hence, one can expect some changes to the parameter values in the COVID-19 period, that is, how defaults react to, say, liquidity. We measure these two variables in terms of the level, that is, their 12-month moving averages. Such incorporation of the COVID dummy variable adds four parameters (intercept, DTD, and two liquidity measures, respectively for financial and nonfinancial SMEs) to each of the 12 PD forward functions.

To avoid introducing too many parameters into the system, we follow the NUS-CRI practice of imposing the Nelson–Siegel function on the forward starting time to smooth the parameters over 12 forward periods on all the variables, including the COVID dummy variable.[7] As a result, the simplified specification only adds 12, instead of 48, parameters to the system.

Ideally, we should treat the COVID dummy variable as country specific, but insufficient data prevent its adoption. Notwithstanding potentially differential intensities across these six ASEAN countries, there is little doubt that their special policy measures all work in the same direction. We do not subject all the other variables in $f(X_{i,t}; \tau, q, \theta)$ to the COVID dummy variable.[8] Neither do we introduce the COVID-19 dummy variable into the probability of other exit function, $g(X_{i,t}; \tau, q, \vartheta)$.

Figure 9.2a depicts the MSME portfolio's averages of 1-month PDs at different month-ends over the sample period for the six ASEAN countries, that is, the four bank portfolios pooled together, whereas Figure 9.2b shows the same overall portfolio's averages of 1-year PDs. We deduce each of the 1-year PDs for an MSME at a month-end with the survival-default formula, using that MSME's 12 estimated forward PDs and probabilities of other exits (POEs) at the time. To these figures,

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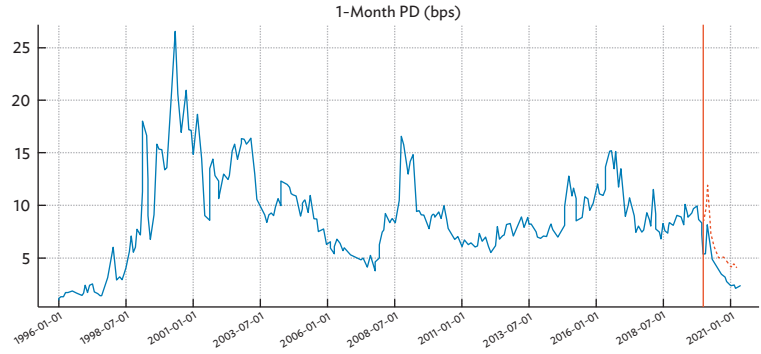
6 We can interpret DTD as the asset volatility adjusted leverage, that is, the ratio of book value of debt over the market value of assets, which we further adjust using asset volatility. The theoretical model of Merton (1974) derived DTD, and we implemented it empirically in accordance with NUS-CRI Staff (2021).

7 Please refer to NUS-CRI Staff (2021) for a discussion on the use of the Nelson–Siegel smoothing function. The NUS-CRI implementation classifies variables into two categories—vanishing vs non-vanishing types. It gives the former type three parameters to characterize the whole forward curve because its impact eventually decays to zero. For the latter, it uses four parameters because the impact does not converge to zero. The COVID dummy variable clearly falls into the vanishing type because the current COVID-19 status should not affect a distant forward period.

8 Other firm-specific prediction variables are the net income over total assets, relative firm size, idiosyncratic equity volatility, and market–book ratio, whereas the common risk drivers are the country-specific interest rate, stock market return, and aggregate DTD.

Figure 9.2a: The 1-Month PDs (Portfolio Average) before and during the COVID-19 Period for the Four Bank Aggregate Portfolio in the Six ASEAN Countries

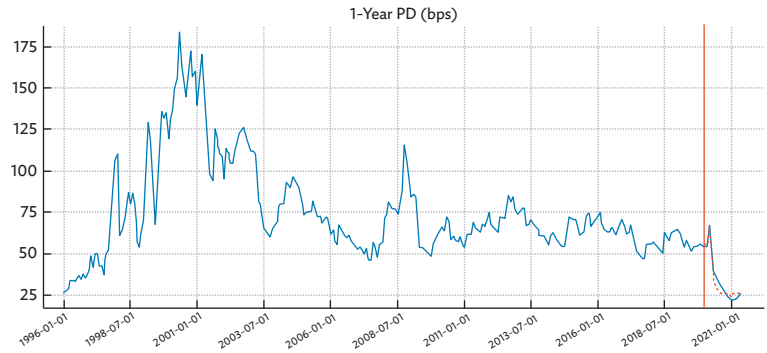


ASEAN = Association of Southeast Asian Nations, bps = basis points, PD = probability of default.

Notes: The graph measures the PDs on the vertical axis in basis points. The dashed line depicts the counterfactual PDs in the COVID-19 period by switching off the COVID dummy variable.

Source: Author.

Figure 9.2b: The 1-Year PDs (Portfolio Average) before and during the COVID-19 Period for the Four-Bank Aggregate Portfolio in the Six ASEAN Countries



ASEAN = Association of Southeast Asian Nations, bps = basis points, PD = probability of default.

Notes: The vertical axis measures the PDs in basis points. The dashed line depicts the counterfactual PDs in the COVID-19 period by switching off the COVID dummy variable.

Source: Author.

we also add the counterfactual PDs as if the COVID-19 pandemic did not affect the parameter values.

At the first glance, these figures reveal a seemingly counterintuitive conclusion that the COVID-19 pandemic has lowered the MSME credit risk, from either a short-run or a longer-term perspective, that is, 1-month versus 1-year PD. Factoring in the special COVID-19 relief measures that the respective national authorities adopted, the results suggest the impact of the policy measures and become quite understandable. Instead of a comparison with the PDs prior to the onset of the COVID-19 pandemic, the counterfactual PDs offer a different angle. They are evidently higher for the short term, signaling the realization of the intended policy outcomes, but the structural impact is likely to fade.

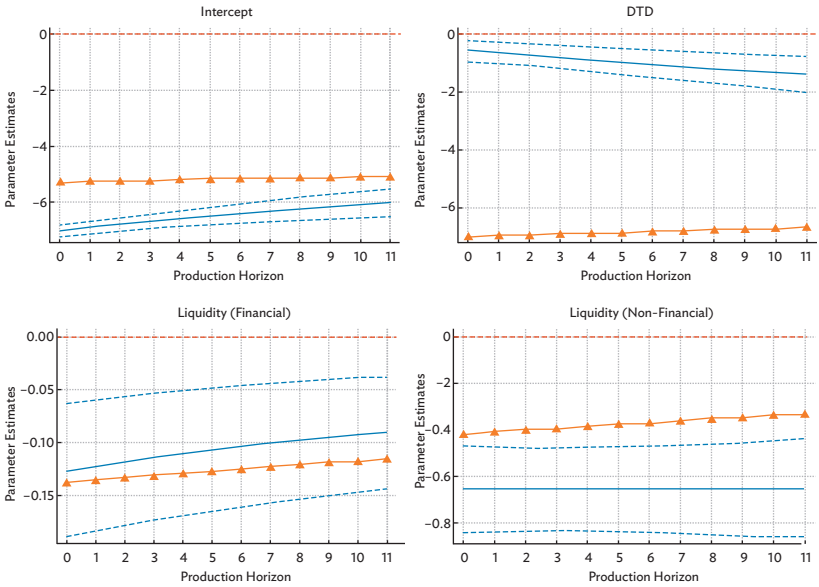
To understand the impact of the special COVID-19 relief measures, we need to recognize two channels. We can understand the direct channel by considering, for example, concessional loans, which directly change the financial variables of MSMEs even if the structural relationship between the default and the financial variables remains unaltered. The indirect channel pertains to the change in the structural relationship via, in a model sense, the coefficients defining the relationship. Mandated default suspension and/or extended grace periods can have an impact on defaults even if financial variables remain unaffected by the relief measures.

Pooling the data of the four banks leads to the finding that the COVID-19 pandemic has influenced the model parameter values. Due to too many model parameters in the system of 24 forward functions—12 for PDs and 12 for POEs—we present the estimation results in Figure 9.3 with four subplots on four selected parameters.

Figure 9.3 succinctly reveals the impact of the COVID-19 pandemic by plotting the four sets of 12 coefficients affected by the COVID dummy variable. We plot their corresponding 95% confidence intervals to assess their statistical significance quickly. Once again, these four sets correspond to the intercept term, DTD, and liquidity (separately for financial and nonfinancial SMEs) in the 12 forward PD functions. The horizon axis shows the forward starting time running from 0 to 11, corresponding to 12 forward periods, each having a 1-month duration.

We add the 12 pre-COVID-19 parameter values (without plotting their corresponding 95% confidence intervals) to each of the above four subplots in Figure 9.3. Evidently, the COVID-19 pandemic has a severe impact on the parameter values, except for liquidity for financial firms. Their directions are sensible considering the knowledge of these COVID-19 policy measures. The lowering of SMEs' default risks, other things being equal, is apparent in the lower intercepts. They also

Figure 9.3: The Impact of the COVID Dummy Variable on the Intercept and the Coefficients of DTD and Two Liquidity Measures (Financial and Nonfinancial Firms) in the 12 Forward PD Functions along with Their Corresponding 95% Confidence Intervals



DTD = distance-to-default, PD = probability of default.

Notes: The horizon axis is the forward starting time running from 0 to 11 corresponding to 12 forward periods of 1-month duration. A triangle marks the pre-COVID-19 coefficients.

Source: Author.

increase the sensitivity to liquidity (nonfinancial), that is, becoming more negative, and lower the sensitivity to DTD, that is, becoming less negative.

In summary, the special COVID-19 measures in the six ASEAN countries have operated in a way that is consistent with the policy intention. Note that the SMEs in the sample exhaust all real exchange-listed SMEs in the six ASEAN countries even though we emulate the four banks with the purpose of illustrating the power of data sharing via modern digital technology. Our conjecture is that the above conclusion would have been stronger if we could have tapped into the closely guarded real banks' SME portfolios comprising many smaller non-exchange-listed SMEs.

9.5 Establishing an MSME Data-Sharing Consortium

Data-sharing technology, such as *i*CASS, enables MSME lenders to form, for example, a consortium. The design of the consortium can benefit its members in two ways—an improved credit model in prediction quality and a shared support service infrastructure to lower the operating costs. The natural consortium members include conventional and/or digital banks, finance companies, peer-to-peer lending platforms, and any fintech companies possessing credit-related data.

Through a consortium, it is possible to treat the improved credit model as a common good. Members still compete with one another via their differences in risk appetite, services, and operational efficiency. In short, the consortium can become a realization in the spirit of *coopetition*.

What incentivizes lending institutions to join a consortium? How can they prevent free riders? Addressing these issues rests with a contract/institution design that extends beyond the technology of data sharing. Here we offer a few thoughts.

As the earlier discussion suggested, the data-sharing platform allows the construction of credit models tailored to individual members if they possess unique alternative data. A lending institution alone may not have sufficient data instances to identify its own credit model when the data features that the prediction uses have expanded to cover alternative data. This member-specific potential may prove to be attractive to some lending institutions. The shared data help to pin down the parameters in the data fields common to all members, which in turn frees a member's own data to work on nailing down those parameters associated with the alternative data. Therefore, the consortium design should encourage members to leverage the shared data and support the infrastructure in deriving member-specific credit models. This benefit may prove to be a strong enough motivator for some lending institutions to join the consortium.

We envision a successful consortium as observing a few guiding principles and key components to address the incentive and other practical issues. Naturally, we expect the variants and refinements to reflect different circumstances and needs. The five general points are as follows:

(1) Set up a governing board to determine policies and a secretariat to support the operation of a consortium.
(2) The governing board determines the formulas for membership fees and query charges to support the operation.
(3) The secretariat maintains the Model Calibration Central and the User Support Central. The former executes the federated learning (initial and subsequent recalibration) of the credit

models. The latter facilitates the members' easy utilization of the calibrated credit model through shared implementation of the calibrated model in response to PD queries based on a member's submission of obligor attributes.

(4) The members contribute credit data on the predefined variables that the governing board has agreed and commit, say, to updating the data quarterly. The contributed data remain at members' own data sites under total privacy protection. The members consent to a third-party audit to ensure the integrity of the contributed data.

(5) A consortium may address free ridership by adopting tiered membership to reflect different levels of data contribution. The privilege that the consortium grants to the highest-tiered members can, for example, be exclusive access to the construction of a member-specific credit model that combines the shared data with the member's own alternative data. A more favorable query fee schedule may also serve as a privilege.

9.6 Concluding Remarks

The COVID-19 pandemic has exacted a toll on many MSMEs worldwide. However painful this might have been, the difficulties arising from the pandemic are only transitory in nature. Those MSMEs that survive the pandemic will continue to face financing challenges with structural roots in the informational asymmetry between themselves and the lending institutions.

Assisting MSMEs with subsidized financing rates and/or risk–share losses, as typical government programs reflect, will not fundamentally alter the pooling equilibrium resulting from the lack of incentives for lending institutions to invest in costly information acquisition on small loans. This chapter advocates building a new-style infrastructure for sharing credit information using digital technology for which the small setup and running costs can in a fundamental way help lending institutions to level their credit information acquisition costs on MSMEs vis-à-vis larger corporations.

With this credit information infrastructure serving as a common good, lending institutions can still compete by offering different loan rates and banking services and/or by specializing in certain market niches. In our view, this *coopetition* model provides a realistic and productive way to achieve fairer financing of MSMEs.

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Fintech and COVID-19

Impacts, Challenges, and Policy Priorities for Asia

Fintech and COVID-19: Impacts, Challenges, and Policy Priorities for Asia describes how the COVID-19 pandemic has accelerated digital technology adoption in the financial sector and the role of financial technology (fintech) firms in supporting households and businesses during the crisis. The book also highlights critical structural policy changes needed to ensure an efficient and safe fintech environment that minimizes risks to consumers and financial stability.

Part I focuses on the impact of fintech on consumers, businesses, and the macroeconomy during the pandemic. Part II discusses the post-pandemic policy implications for enhancing fintech's effect on inclusive growth. Featuring timely new research on developments in Asia and globally, *Fintech and COVID-19: Impacts, Challenges, and Policy Priorities* underscores the importance of fintech, digital infrastructure investment, and digital financial education for driving economic recovery and sustainable development.

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The Asian Development Bank Institute (ADBI) is the Tokyo-based think tank of the Asian Development Bank (ADB). ADBI is focused on delivering demand-driven policy research, capacity building and training, and outreach to help ADB developing member countries practically address sustainability challenges and accelerate socioeconomic change. ADBI seeks to advance timely, innovative evidence-based development solutions that improve the outlook for growth and prosperity across Asia and the Pacific.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members—49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

About the Cambridge Centre for Alternative Finance

The Cambridge Centre for Alternative Finance (CCAF) is a research center at the University of Cambridge Business School with a mission to create and transfer knowledge addressing emergent gaps in the financial sector that supports evidence-based decision-making. It specializes in researching innovative financial instruments, channels and systems that have emerged outside of the traditional finance as well as related regulatory and policy issues.

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